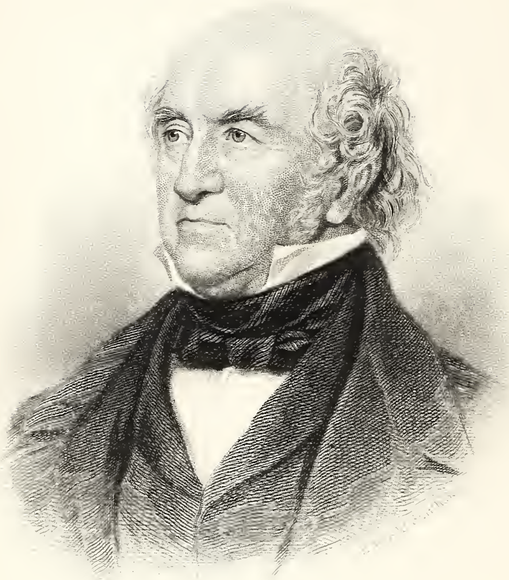

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MILITARY SCHOOLS AND EDUCATION.

An account of the Military and Naval Schools of different countries, with special reference to the extension and improvement, among ourselves, of similar institutions and agencies, both national and state, for the special training of officers and men for the exigencies of war, was promised by the Editor in his original announcement of "*The American Journal and Library of Education.*" Believing that the best preparation for professional and official service of any kind, either of peace or war, is to be made in the thorough culture of all manly qualities, and that all special schools should rest on the basis, and rise naturally out of a general system of education for the whole community, we devoted our first efforts to the fullest exposition of the best principles and methods of elementary instruction, and to improvements in the organization, teaching, and discipline of schools, of different grades, but all designed to give a proportionate culture of all the faculties. We have from time to time introduced the subject of Scientific Schools—or of institutions in which the principles of mathematics, mechanics, physics, and chemistry are thoroughly mastered, and their applications to the more common as well as higher arts of construction, machinery, manufactures, and agriculture, are experimentally taught. In this kind of instruction must we look for the special training of our engineers, both civil and military; and schools of this kind established in every state, should turn out every year a certain number of candidates of suitable age to compete freely in open examinations for admission to a great National School, like the Polytechnic at Paris, or the purely scientific course of the Military Academy at West Point, and then after two years of severe study, and having been found qualified by repeated examinations, semi-annual and final, by a board composed, not of honorary visitors, but of experts in each science, should pass to schools of application or training for the special service for which they have a natural aptitude and particular preparation.

The terrible realities of our present situation as a people—the fact that within a period of twelve months a million of able bodied men have been summoned to arms from the peaceful occupations of the office, the shop, and the field, and are now in hostile array, or in actual conflict, within the limits of the United States, and the no less alarming aspect of the future, arising not only from the delicate position of our own relations with foreign governments, but from the armed interference of the great Military Powers of Europe in the internal affairs of a neighboring republic, have brought up the subject of Military Schools, and Military Education, for consideration and action with an urgency which admits of no delay. Something must and will be done at once. And in reply to numerous letters for information and suggestions, and to enable those who are urging the National, State or Municipal authorities to provide additional facilities for military instruction, or who may propose to establish schools, or engraft on existing schools exercises for this purpose,—to profit by the experience of our own and other countries, in the work of training officers and men for the Art of War, we shall bring together into a single volume, "*Papers on Military Education,*" which it was our intention to publish in successive numbers of the New Series of the "*American Journal of Education.*"

This volume, as will be seen by the Contents, presents a most comprehensive survey of the Institutions and Courses of Instruction, which the chief nations of Europe have matured from their own experience, and the study of each other's improvements, to perfect their officers for every department of military and naval service which the exigences of modern warfare require, and at the same time, furnishes valuable hints for the final organization of our entire military establishments, both national and state.

We shall publish in the Part devoted to the United States, an account of the Military Academy at West Point, the Naval Academy at Newport, and other Institutions and Agencies,—State, Associated, and Individual, for Military instruction, now in existence in this country, together with several communications and suggestions which we have received in advocacy of Military Drill and Gymnastic exercises in Schools. We do not object to a moderate amount of this Drill and these exercises, properly regulated as to time and amount, and given by competent teachers. There is much of great practical value in the military element, in respect both to physical training, and moral and mental discipline. But we do not believe in the physical degeneracy, or the lack of military aptitude and spirit of the American people—at least to the extent asserted to exist by many writers on the subject. And we do not believe that any amount of juvenile military drill, any organization of cadet-corps, any amount of rifle or musket practice, or target shooting, valuable as these are, will be an adequate substitute for the severe scientific study, or the special training which a well organized system of military institutions provides for the training of officers both for the army and navy.

Our old and abiding reliance for industrial progress, social well being, internal peace, and security from foreign aggression rests on:—

I. The better Elementary education of the whole people—through better homes and better schools—through homes, such as Christianity establishes and recognizes, and schools, common because cheap enough for the poorest, and good enough for the best,—made better by a more intelligent public conviction of their necessity, and a more general knowledge among adults of the most direct modes of effecting their improvement, and by the joint action of more intelligent parents, better qualified teachers, and more faithful school officers. This first great point must be secured by the more vigorous prosecution of all the agencies and measures now employed for the advancement of public schools, and a more general appreciation of the enormous amount of stolid ignorance and half education, or mis-education which now prevails, even in states where the most attention has been paid to popular education.

II. The establishment of a System of Public High Schools in every state—far more complete than exists at this time, based on the system of Elementary Schools, into which candidates shall gain admission only after having been found qualified in certain studies by an open examination. The studies of this class of schools should be preparatory both in literature and science for what is now the College Course, and for what is now also the requirements in mathematics in the Second Year's Course at the Military Academy at West Point.

III. A system of Special Schools, either in connection with existing Colleges, or on an independent basis, in which the principles of science shall be taught with special reference to their applications to the Arts of Peace and War. Foremost in this class should stand a National School of Science, organized and conducted on the plan of the Polytechnic School of France, and preparatory to Special Military and Naval Schools.

IV. The Appointment to vacancies, in all higher Public Schools, either among teachers or pupils, and in all departments of the Public Service by Open Competitive Examination. To a diffusion of a knowledge of what has been done, is doing, or is proposed to be done in reference to these great points, the New Series of "*The American Journal of Education*," will be devoted.

THE

American Journal of Education.

[NEW SERIES, NO. 3.]

No. XXVIII—SEPTEMBER, 1862.

CONTENTS.

PART I

MILITARY SYSTEM AND SCHOOLS IN FRANCE.

AUTHORITIES.

The following account of the System of Military Education in France, except in the case of three or four schools, where credit is given to other authorities, is taken from an English Document entitled "*Report of the Commissioners appointed* (by the Secretary of War), *to consider the best mode of reorganizing the system of Training Officers for the Scientific Corps: together with an Account of Foreign and other Military Education.*" Reference has been had, especially in the Programmes and Courses of Instruction to the original authorities referred to by the Commissioners.

I. General Military Organizaton of France.
Vauchelle's Course d' Administration Militaire, 3 vols.

II. The Polytechnic.
1. Fourcy's Histoire de l'Ecole Polytechnique.
2. Décret portant l'Organisation, &c.
3. Règlement pour le Service Interieur.
4. Programme de l'Enseignement Interieur.
5. Programme des Connaissances Exigées pour Admission, &c.
6. Rapport de la Commission Mixte, 1850.
7. Répertoire de l'Ecole Polytechnique; by M. Marielle.
8. Calenders from 1833.
9. Pamphlets—by M. le Marquis de Chambray, 1836; by V. D. Bugnot, 1837; by M. Arago, 1853.

III. School of Application at Metz, and St. Cyr.
Décret Impérial, &c., 1854.

IV. School for the Staff at Paris.
Manuel Réglementaire a l' Usage, &c.

V. Annuaire de l'Instruction Publique, 1860.

MILITARY SYSTEM AND SCHOOLS OF FRANCE.

I. MILITARY SYSTEM.

The French armies are composed of soldiers levied by yearly conscription for a service of seven years. Substitutes are allowed, but in accordance with a recent alteration, they are selected by the state. Private arrangements are no longer permitted; a fixed sum is paid over to the authorities, and the choice of the substitutes made by them.

The troops are officered partly from the military schools and partly by promotion from the ranks. The proportions are established by law. One-third of the commissions are reserved for the military schools, and one-third left for the promotion from the ranks. The disposal of the remaining third part is left to the Emperor.

The promotion is partly by seniority and partly by selection.

The following regulations exist as to the length of service in each rank before promotion can be given, during a period of peace:—

A second Lieutenant	can not	be promoted to	Lieutenant	under	2	years' service.
A Lieutenant	"	"	Captain	"	2	"
A Captain	"	"	Major	"	4	"
A Major	"	"	Lieut-Col.	"	3	"
A Lieutenant-Colonel	"	"	Colonel	"	2	"

But in time of war these regulations are not in force.

Up to the rank of captain, two-thirds of the promotion takes place according to seniority, and the other one-third by selection.

From the rank of captain to that of major (*chef de bataillon ou d'escadron*) half of the promotion is by seniority and the other half by selection, and from major upwards, it is entirely by selection.

The steps which lead to the selection are as follows:—The general officers appointed by the minister at war to make the annual inspections of the several divisions of the army of France, who are called inspectors-general, as soon as they have completed their tours of inspection, return to Paris and assemble together for the purpose of comparing their notes respecting the officers they have each seen, and thus prepare a list arranged in the order in which they recommend that the selection for promotion should be made.

We were informed that the present minister of war almost invariably promoted the officers from the head of this list, or, in other words, followed the recommendation of the inspector-general.

II. MILITARY SCHOOLS.

The principal Military Schools at present existing in France are the following:—

1. The Polytechnic School at Paris (*Ecole Impériale Polytechnique,*) preparatory to—
2. The Artillery and Engineers School of Application at Metz (*Ecole Impériale d'Application de l'Artillerie et du Génie.*)
3. The Military School at St. Cyr (*Ecole Impériale Spéciale Militaire,*) for the Infantry and Cavalry, into which the Officers' Department of the Cavalry School at Saumur has lately been absorbed.
4. The Staff School at Paris (*Ecole Impériale d'Application d'Etat Major.*)
5. The Military Orphan School (*Prytanée Impériale Militaire*) at La Flèche.
6. The Medical School (*Ecole Impériale de Médicine et de Pharmacie Militaires*) recently established in connection with the Hospital of Val-de-Grâce.
7. The School of Musketry (*Ecole Normale de Tir*) at Vincennes, founded in 1842.
8. The Gymnastic School (*Ecole Normale de Gymnastique*) near Vincennes.
9. The Music School (*Gymnase Musical.*)
10. The Regimental Schools (*Ecoles Régimentaires.*)

The military schools are under the charge of the minister of war, with whom the authorities of the schools are in direct communication.

The expenses to the state of the military schools, including the pay of the military men who are employed in connection with them, for the year 1851, are as follows:—

For	Polytechnic School at Paris,	*fr.* 554,911. 91
"	Artillery and Engineers School at Metz,	187,352. 06
"	Infantry and Cavalry School at St. Cyr,	682,187. 35
"	Cavalry School at Saumur,	196,170. 27
"	Staff School at Paris,	145,349. 96
"	Gymnastic School of Musketry at Vincennes,	33,211. 33
"	Regimental Schools,	108,911½,30

From this sum, 2,224,542*fr.*, should be deducted 421,372*fr.* secured from paying pupils, leaving the total cost to the state to be 1,803,308*fr.*, or about $360,000, for about 2,100 pupils. The cost to the state for training an officer of Artillery and Engineers is about $1,500, and that of an officer of the Staff is about $1,400.

SUBJECTS AND METHODS OF INSTRUCTION IN MATHEMATICS,

AS PRESCRIBED FOR ADMISSION TO THE POLYTECHNIC SCHOOL OF PARIS.

BY W. M. GILLESPIE, LL.D.,

Professor of Civil Engineering in Union College.

CONTENTS.

SUBJECTS AND METHODS OF INSTRUCTION

IN MATHEMATICS AS PRESCRIBED FOR ADMISSION TO THE POLYTECHNIC SCHOOL OF FRANCE.

"L'École Polytechnique" is too well known, by name at least, to need eulogy in this journal. Its course of instruction has long been famed for its completeness, precision, and adaptation to its intended objects. But this course had gradually lost somewhat of its symmetrical proportions by the introduction of some new subjects and the excessive development of others. The same defects had crept into the programme of the subjects of examination for admission to the school. Influenced by these considerations, the Legislative Assembly of France, by the law of June 5th, 1850, appointed a "*Commission*" to revise the programmes of admission and of internal instruction. The President of the Commission was Thenard, its "Reporter" was Le Verrier, and the other nine members were worthy to be their colleagues. They were charged to avoid the error of giving to young students, subjects and methods of instruction "too elevated, too abstract, and above their comprehension;" to see that the course prescribed should be "adapted, not merely to a few select spirits, but to average intelligences;" and to correct "the excessive development of the preparatory studies, which had gone far beyond the end desired."

The Commission, by M. Le Verrier, prepared an elaborate report of 440 quarto pages, only two hundred copies of which were printed, and these merely for the use of the authorities. A copy belonging to a deceased member of the Commission (the lamented Professor *Theodore Olivier*), having come into the hands of the present writer, he has thought that some valuable hints for our use in this country might be drawn from it, presenting as it does a precise and thorough course of mathematical instruction, adapted to any latitude, and arranged in the most perfect order by such competent authorities. He has accordingly here presented, in a condensed form, the opinions of the Commission on *the proper subjects for examination in mathematics, preparatory to admission to the Polytechnic School, and the best methods of teaching them.*

The subjects which will be discussed are Arithmetic; Geometry; Algebra; Trigonometry; Analytical Geometry; Descriptive Geometry.

I. ARITHMETIC.

A knowledge of Arithmetic is indispensable to every one. The merchant, the workman, the engineer, all need to know how to calculate with rapidity and precision. The useful character of arithmetic indicates that its methods should admit of great simplicity, and that its teaching should be most carefully freed from all needless complication. When we enter into the spirit of the methods of arithmetic, we perceive that they all flow clearly and simply from the very principles of numeration, from some precise definitions, and from certain ideas of relations between numbers, which all minds easily perceive, and which they even possessed in advance, before their teacher made them recognize them and taught them to class them in a methodical and fruitful order. We therefore believe that there is no one who is not capable of receiving, of understanding, and of enjoying well-arranged and well-digested arithmetical instruction.

But the great majority of those who have received a liberal education do not possess this useful knowledge. Their minds, they say, are not suited to the study of mathematics. They have found it impossible to bend themselves to the study of those abstract sciences whose barrenness and dryness form so striking a contrast to the attractions of history, and the beauties of style and of thought in the great poets ; and so on.

Now, without admitting entirely the justice of this language, we do not hesitate to acknowledge, that the teaching of elementary mathematics has lost its former simplicity, and assumed a complicated and pretentious form, which possesses no advantages and is full of inconveniences. The reproach which is cast upon the sciences in themselves, we out-and-out repulse, and apply it only to the vicious manner in which they are now taught.

Arithmetic especially is only an instrument, a tool, the theory of which we certainly ought to know, but the practice of which it is above all important most thoroughly to possess. The methods of analysis and of mechanics, invariably lead to solutions whose applications require reduction into numbers by arithmetical calculations. We may add that the numerical determination of the final result is almost always indispensable to the clear and complete comprehension of a method ever so little complicated. Such an application, either by the more complete condensation of the ideas which it requires, or by its fixing the mind on the subject more precisely and clearly, develops a crowd of remarks which otherwise would not have been made, and it thus contributes to facilitate the comprehension of theories in such an efficacious manner that the time given to the numerical work is more than regained by its being no longer necessary to return incessantly to new explanations of the same method.

The teaching of arithmetic will therefore have for its essential object, to make the pupils acquire the habit of calculation, so that they may be able to make an easy and continual use of it in the course of their studies. The theory of the operations must be given to them with clearness and precision; not only that they may understand the mechanism of those operations, but because, in almost all questions, the application of the methods calls for great attention and continual discussion, if we would arrive at a result in which we can confide. But at the same time every useless theory must be carefully removed, so as not to distract the attention of the pupil, but to devote it entirely to the essential objects of this instruction.

It may be objected that these theories are excellent exercises to form the mind of the pupils. We answer that such an opinion may be doubted for more than one reason, and that, in any case, exercises on useful subjects not being wanting in the immense field embraced by mathematics, it is quite superfluous to create, for the mere pleasure of it, difficulties which will never have any useful application.

Another remark we think important. It is of no use to arrive at a numerical result, if we cannot answer for its correctness. The teaching of calculation should include, as an essential condition, that the pupils should be shown how every result, deduced from a series of arithmetical operations, may always be controlled in such a way that we may have all desirable certainty of its correctness; so that, though a pupil may and must often make mistakes, he may be able to discover them himself, to correct them himself, and never to present, at last, any other than an exact result.

The *Programme* given below is made very minute to avoid the evils which resulted from the brevity of the old one. In it, the limits of the matter required not being clearly defined, each teacher preferred to extend them excessively, rather than to expose his pupils to the risk of being unable to answer certain questions. The examiners were then naturally led to put the questions thus offered to them, so to say; and thus the preparatory studies grew into excessive and extravagant development. These abuses could be remedied only by the publication of programmes so detailed, that the limits within which the branches required for admission must be restricted should be so apparent to the eyes of all, as to render it impossible for the examiners to go out of them, and thus to permit teachers to confine their instruction within them.

The new programme for arithmetic commences with the words Decimal numeration. This is to indicate that the Duodecimal numeration will not be required.

The only practical verification of Addition and Multiplication, is to recommence these operations in a different order.

The Division of whole numbers is the first question considered at all difficult. This difficulty arises from the complication of the methods by which division is taught. In some books its explanation contains twice as many reasons as is necessary. The mind becomes confused by such instruction, and no longer understands what is a demonstration, when it sees it continued at the moment when it appeared to be finished. In most cases the demonstration is excessively complicated and does not follow the same order as the practical rule, to which it is then necessary to return. There lies the evil, and it is real and profound.

The phrase of the programme, Division of whole numbers, intends that the pupil shall be required to explain the practical rule, and be able to use it in a familiar and rapid manner. We do not present any particular mode of demonstration, but, to explain our views, we will indicate how we would treat the subject if we were making the detailed programme of a *course* of arithmetic, and not merely that of an *examination*. It would be somewhat thus:

"The quotient may be found by addition, subtraction, multiplication;

"Division of a number by a number of one figure, when the quotient is less than 10;

"Division of any number by a number less than 10;

"Division of any two numbers when the quotient has only one figure;

"Division in the most general case.

"*Note.*—The practical rule may be entirely explained by this consideration, that by multiplying the divisor by different numbers, we see if the quotient is greater or less than the multiplier."

The properties of the Divisors of numbers, and the decomposition of a number into prime factors should be known by the student. But here also we recommend simplicity. The theory of the greatest common divisor, for example, has no need to be given with all the details with which it is usually surrounded, for it is of no use in practice.

The calculation of Decimal numbers is especially that in which it is indispensable to exercise students. Such are the numbers on which they will generally have to operate. It is rare that the data of a question are whole numbers; usually they are decimal numbers which are not even known with rigor, but only with a given decimal approximation; and the result which is sought is to deduce from these, other decimal numbers, themselves exact to a certain degree of approximation, fixed by the conditions of the problem. It is thus that this subject should be taught. The pupil should not merely learn how, in one or two cases, he can obtain a result to within $\frac{1}{n}$, n being any number, but how to arrive by a practicable route to results which are exact to within a required decimal, and on the correctness of which they can depend.

Let us take decimal multiplication for an example. Generally the pupils do not know any other rule than "to multiply one factor by the other, without noticing the decimal point, except to cut off on the right of the product as many decimal figures as there are in the two factors." The rule thus enunciated is methodical, simple, and apparently easy. But, in reality, it is practically of a repulsive length, and is most generally inapplicable.

Let us suppose that we have to multiply together two numbers having each six decimals, and that we wish to know the product also to the sixth decimal. The above rule will give twelve decimals, the last six of which, being useless, will have caused by their calculation the loss of precious time. Still farther; when a factor of a product is given with six decimals, it is because we have stopped in its determination at that degree of approximation, neglecting the following decimals; whence it results that several of the decimals situated on the right of the calculated product are not those which would belong to the rigorous product. What then is the use of taking the trouble of determining them?

We will remark lastly that if the factors of the product are incommensurable, and if it is necessary to convert them into decimals before effecting the multiplication, we should not know how far we should carry the approximation of the factors before applying the above rule. It will therefore be necessary to teach the pupils the abridged methods by which we succeed, at the same time, in using fewer figures and in knowing the real approximation of the result at which we arrive.

Periodical decimal fractions are of no use. The two elementary questions of the programme are all that need be known about them.

The Extraction of the square root must be given very carefully, especially that of decimal numbers. It is quite impossible here to observe the rule of having in the square twice as many decimals as are required in the root. That rule is in fact impracticable when a series of operations is to be effected. "When a number N increases by a comparatively small quantity d, the square of that number increases very nearly as $2Nd$." It is thus that we determine the approximation with which a number must be calculated so that its square root may afterwards be obtained with the necessary exactitude. This supposes that before determining the square with all necessary precision, we have a suitable lower limit of the value of the root, which can always be done without difficulty.

The Cube root is included in the programme. The pupils should know this; but while it will be necessary to exercise them on the extraction of the square root by numerous examples, we should be very sparing of this in the cube root, and not go far beyond the mere theory. The calculations become too complicated and waste too much time. Logarithms are useful even for the square root; and quite indispensable for the cube root, and still more so for higher roots.

When a question contains only quantities which vary in the same ratio, or in an inverse ratio, it is immediately resolved by a very simple method, known under the name of *reduction to unity*. The result once obtained, it is indispensable to make the pupils remark that it is composed of the quantity which, among the data, is of the nature of that which is sought, multiplied successively by a series of abstract ratios between other quantities which also, taken two and two, are of the same nature. Hence flows the rule for writing directly the required result, without being obliged to take up again for each question the series of reasonings. This has the advantage, not only of saving time, but of better showing the spirit of the method, of making clearer the meaning of the solution, and of preparing for the subsequent use of formulas. The consideration of "homogeneity" conduces to these results.

We recommend teachers to abandon as much as possible the use of examples in abstract numbers, and of insignificant problems, in which the data, taken at random, have no connection with reality. Let the examples and the exercises presented to students always relate to objects which are found in the arts, in industry, in nature, in physics, in the system of the world. This will have many advantages. The precise meaning of the solutions will be better grasped. The pupils will thus acquire, without any trouble, a stock of precise and precious knowledge of the world which surrounds them. They will also more willingly engage in numerical calculations, when their attention is thus incessantly aroused and sustained, and when the result, instead of being merely a dry number, embodies information which is real, useful, and interesting.

The former arithmetical programme included the theory of *progressions* and *logarithms;* the latter being deduced from the former. But the theory of logarithms is again deduced in algebra from exponents, much the best method. This constitutes an objectionable "*double emploi.*" There is finally no good reason for retaining these theories in arithmetic.

The programme retains the questions which can be solved by making two arbitrary and successive hypotheses on the desired result. It is true that these questions can be directly resolved by means of a simple equation of the first degree; but we have considered that, since the resolution of problems by means of hypotheses, constitutes the most fruitful method really used in practice, it is well to accustom students to it the soonest possible. This is the more necessary, because teachers have generally pursued the opposite course, aiming especially to give their pupils direct solutions, without reflecting that the theory of these is usually much more complicated, and that the mind of the learner thus receives a direction exactly contrary to that which it will have to take in the end.

"Proportions" remain to be noticed.

In most arithmetics problems are resolved first by the method of "reduction to unity," and then by the theory of proportions. But beside the objection of the "*double emploi*," it is very certain that the method of reduction to unity presents, in their true light and in a complete and simple manner, all the questions of ratio which are the bases of arithmetical solutions; so that the subsequent introduction of proportions teaches nothing new to the pupils, and only presents the same thing in a more complicated manner. We therefore exclude from our programme of examination the solution of questions of arithmetic, presented under the special form which constitutes the theory of proportions.

This special form we would be very careful not to invent, if it had not already been employed. Why not say simply "The ratio of M to N is equal to that of P to Q," instead of hunting for this other form of enunciating the same idea, "M *is to* N *as* P *is to* Q"? It is in vain to allege the necessities of geometry; if we consider all the questions in which proportions are used, we shall see that the simple consideration of the equality of ratios is equally well adapted to the simplicity of the enunciation and the clearness of the demonstrations. However, since all the old books of geometry make use of proportions, we retain the properties of proportions at the end of our programme; but with this express reserve, that the examiners shall limit themselves to the simple properties which we indicate, and that they shall not demand any application of proportions to the solution of arithmetical problems.

PROGRAMME OF ARITHMETIC.

Decimal numeration.

Addition and subtraction of whole numbers.

Multiplication of whole numbers.—Table of Pythagoras.—The product of several whole numbers does not change its value, in whatever order the multiplications are effected.—To multiply a number by the product of several factors, it is sufficient to multiply successively by the factors of the product.

Division of whole numbers.—To divide a number by the product of several factors, it is sufficient to divide successively by the factors of the product.

Remainders from dividing a whole number by 2, 3, 5, 9, and 11.—Applications to the characters of divisibility by one of those numbers; to the verification of the product of several factors; and to the verification of the quotient of two numbers.

Prime numbers. Numbers prime to one another.

To find the greatest common divisor of two numbers.—If a number divides a product of two factors, and if it is prime to one of the factors, it divides the other.—To decompose a number into its prime factors.—To determine the smallest number divisible by given numbers.

Vulgar fractions.

A fraction does not alter in value when its two terms are multiplied or divided by the same number. Reduction of a fraction to its simplest expression. Reduction of several fractions to the same denominator. Reduction to the smallest common denominator.—To compare the relative values of several fractions.

Addition and subtraction of fractions.—Multiplication. Fractions of fractions.—Division.

Calculation of numbers composed of an entire part and a fraction.

Decimal numbers.

Addition and subtraction.

Multiplication and division.—How to obtain the product of the quotient to within a unit of any given decimal order.

To reduce a vulgar fraction to a decimal fraction.—When the denominator of an irreducible fraction contains other factors than 2 and 5, the fraction cannot be exactly reduced to decimals; and the quotient, which continues indefinitely, is periodical.

To find the vulgar fraction which generates a periodical decimal fraction: 1° when the decimal fraction is simply periodical; 2° when it contains a part not periodical.

System of the new measures.

Linear Measures.—Measures of surface.—Measures of volume and capacity.—Measures of weight.—Moneys.—Ratios of the principal foreign measures (England, Germany, United States of America) to the measures of France.

Of ratios. Resolution of problems.

General notions on quantities which vary in the same ratio or in an inverse ratio.—Solution, by the method called *Reduction to unity*, of the simplest questions in which such quantities are considered.—To show the homogeneity of the results which are arrived at; thence to deduce the general rule for writing directly the expression of the required solution.

Simple interest.—General formula, the consideration of which furnishes the solution of questions relating to simple interest.—Of discount, as practised in commerce.

To divide a sum into parts proportional to given numbers.

Of questions which can be solved by two arbitrary and successive hypotheses made on the desired result.

Of the square and of the square root. Of the cube and of the cube root.

Formation of the square and the cube of the sum of two numbers.—Rules for extracting the square root and the cube root of a whole number.—If this root is not entire, it cannot be exactly expressed by any number, and is called incommensurable.

Square and cube of a fraction.—Extraction of the square root and cube root of vulgar fractions.

Any number being given, either directly, or by a series of operations which permit only an approximation to its value by means of decimals, how to extract the square root or cube root of that number, to within any decimal unit.

Of the proportions called geometrical.

In every proportion the product of the extremes is equal to the product of the means.—Reciprocal proportion.—Knowing three terms of a proportion to find the fourth.—Geometrical mean of two numbers.—How the order of the terms of a proportion can be inverted without disturbing the proportion.

When two proportions have a common ratio, the two other ratios form a proportion.

In any proportion, each antecedent may be increased or diminished by its consequent without destroying the proportion.

When the corresponding terms of several proportions are multiplied together, the four products form a new proportion.—The same powers or the same roots of four numbers in proportion form a new proportion.

In a series of equal ratios, the sum of any number of antecedents and the sum of their consequents are still in the same ratio.

II. GEOMETRY

Some knowledge of Geometry is, next to arithmetic, most indispensable to every one, and yet very few possess even its first principles. This is the fault of the common system of instruction. We do not pay sufficient regard to the natural notions about straight lines, angles, parallels, circles, etc., which the young have acquired by looking around them, and which their minds have unconsciously considered before making them a regular study. We thus waste time in giving a dogmatic form to truths which the mind seizes directly.

The illustrious *Clairaut* complains of this, and of the instruction commencing always with a great number of definitions, postulates, axioms, and preliminary principles, dry and repulsive, and followed by propositions equally uninteresting. He also condemns the profusion of self-evident propositions, saying, "It is not surprising that Euclid should give himself the trouble to demonstrate that two circles which intersect have not the same centre; that a triangle situated within another has the sum of its sides smaller than that of the sides of the triangle which contains it; and so on. That geometer had to convince obstinate sophists, who gloried in denying the most evident truths. It was therefore necessary that geometry, like logic, should then have the aid of formal reasonings, to close the mouths of cavillers; but in our day things have changed face; all reasoning about what mere good sense decides in advance is now a pure waste of time, and is fitted only to obscure the truth and to disgust the reader."

Bezout also condemns the multiplication of the number of theorems, propositions, and corollaries; an array which makes the student dizzy, and amid which he is lost. All that follows from a principle should be given in natural language as far as possible, avoiding the dogmatic form. It is true that some consider the works of Bezout deficient in rigor, but he knew better than any one what really was a demonstration. Nor do we find in the works of the great old masters less generality of views, less precision, less clearness of conception than in modern treatises. Quite the contrary indeed.

We see this in Bezout's *definition of a right line*—that it tends continually towards one and the same point; and in that of *a curved line*—that it is the trace of a moving point, which turns aside infinitely little at each step of its progress; definitions most fruitful in consequences. When we define a right line as the shortest path from one point to another, we enunciate a property of that line which is of no use for demonstrations. When we define a curved line as one which is neither straight nor composed of straight lines, we enunciate two negations which can lead to no result, and which have no connection with the peculiar nature of the curved line. Bezout's definition, on the contrary, enters into the nature of the object to be defined, seizes its mode of being, its character, and puts the reader immediately in possession of the general idea from which are afterwards deduced the properties of curved lines and the construction of their tangents.

So too when Bezout says that, in order to form an exact idea of an angle, it is necessary to consider the movement of a line turning around one of its points, he gives an idea at once more just and more fruitful in consequences, both mathematical and mechanical, than that which is limited to saying, that the indefinite space comprised between two straight lines which meet in a point, and which may be regarded as prolonged indefinitely, is called an *angle;* a definition not very easily comprehended and absolutely useless for ulterior explanations, while that of Bezout is of continual service.

We therefore urge teachers to return, in their demonstrations, to the simplest ideas, which are also the most general; to consider a demonstration as finished and complete when it has evidently caused the truth to enter into the mind of the pupil, and to add nothing merely for the sake of silencing sophists.

Referring to our Programme of Geometry, given below, our first comments relate to the "Theory of parallels." This is a subject on which all students fear to be examined; and this being a general feeling, it is plain that it is not their fault, but that of the manner in which this subject is taught. The omission of the natural idea of the constant direction of the right line (as defined by Bezout) causes the complication of the first elements; makes it necessary for Legendre to demonstrate that all right angles are equal (a proposition whose meaning is rarely understood); and is the real source of all the pretended difficulties of the theory of parallels. These difficulties are now usually avoided by the admission of a *postulate*, after the example of Euclid, and to regulate the practice in that matter, we have thought proper to prescribe that this proposition—*Through a given point only a single parallel to a right line can be drawn*—should be admitted purely and simply, without demonstration, and as a direct consequence of our idea of the nature of the right line.

We should remark that the order of ideas in our programme supposes the properties of lines established without any use of the properties of surfaces. We think that, in this respect, it is better to follow Lacroix than Legendre.

When we prove thus that three parallels always divide two right lines into proportional parts, this proposition can be extended to the case in which the ratio of the parts is incommensurable, either by the method called *Reductio ad absurdum*, or by the method of *Limits.* We especially recommend the use of the latter method. The former has in fact nothing which satisfies the mind, and we should never have recourse to it, for it is always possible to do without it. When we have proved to the pupil that a desired quantity, X, cannot be either larger or smaller than A, the pupil is indeed forced to admit that X and A are equal; but that does not make him understand or feel why that equality exists. Now those demonstrations which are of such a nature that, once given, they disappear, as it were, so as to leave to the proposition demonstrated the character of a truth evident *à priori*, are those which should be carefully sought for, not only because they make that truth better felt, but because they better prepare the mind for conceptions of a more elevated order. The method of limits, is, for a certain number of questions, the only one which possesses this characteristic—that the demonstration is closely connected with the essential nature of the proposition to be established.

In reference to the relations which exist between the sides of a triangle and the segments formed by perpendiculars let fall from the summits, we will, once for all, recommend to the teacher, to exercise his students in making numerical applications of relations of that kind, as often as they shall present themselves in the course of geometry. This is the way to cause their meaning to be well understood, to fix them in the mind of students, and to give these the exercise in numerical calculation to which we positively require them to be habituated.

The theory of similar figures has a direct application in the art of surveying for plans (*Lever des plans*). We wish that this application should be given to the pupils in detail; that they should be taught to range out and measure a straight line on the ground; that a graphometer should be placed in their hands; and that they should use it and the chain to obtain on the ground, for themselves, all the data necessary for the construction of a map, which they will present to the examiners with the calculations in the margins.

It is true that a more complete study of this subject will have to be subsequently made by means of trigonometry, in which calculation will give more precision than these graphical operations. But some pupils may fail to extend their studies to trigonometry (the course given for the Polytechnic school having become the model for general instruction in France), and those who do will thus learn that trigonometry merely gives means of more precise calculation. This application will also be an encouragement to the study of a science whose utility the pupil will thus begin to comprehend.

It is common to say that an angle is measured by the arc of a circle, described from its summit or centre, and intercepted between its sides. It is true that teachers add, that since a quantity cannot be measured except by one of the same nature, and since the arc of a circle is of a different nature from an angle, the preceding enunciation is only an abridgment of the proposition by which we find the ratio of an angle to a right angle. Despite this precaution, the unqualified enunciation which precedes, causes uncertainty in the mind of the pupil, and produces in it a lamentable confusion. We will say as much of the following enunciations: "A dihedral angle is measured by the plane angle included between its sides;" "The surface of a spherical triangle is measured by the excess of the sum of its three angles above two right angles," etc.; enunciations which have no meaning in themselves, and from which every trace of homogeneity has disappeared. Now that everybody is requiring that the students of the Polytechnic school should better understand the meaning of the formulas which they are taught, which requires that their homogeneity should always be apparent, this should be attended to from the beginning of their studies, in geometry as well as in arithmetic. The examiners must therefore insist that the pupils shall never give them any enunciations in which homogeneity is not preserved.

The proportionality of the circumferences of circles to their radii must be inferred *directly* from the proportionality of the perimeters of regular polygons, of the same number of sides, to their apothems. In like manner, from the area of a regular polygon being measured by half of the product of its perimeter by the radius of the inscribed circle, it must be *directly* inferred that the area of a circle is measured by half of the product of its circumference by its radius. For a long time, these properties of the circle were differently demonstrated by proving, for example, with Legendre, that the measure of the circle could not be either smaller or greater than that which we have just given, whence it had to be inferred that it must be equal to it. The "Council of improvement" finally decided that this method should be abandoned, and that the method of limits should alone be admitted, in the examinations, for demonstrations of this kind. This was a true advance, but it was not sufficient. It did not, as it should, go on to consider the circle, purely and simply, as the limit of a series of regular polygons, the number of whose sides goes on increasing to infinity, and to regard the circle as possessing every property demonstrated for polygons. Instead of this, they inscribed and circumscribed to the circle two polygons of the same number of sides, and proved that, by the multiplication of the number of the sides of these polygons, the difference of their areas might become smaller than any given quantity, and thence, finally, deduced the measure of the area of the circle; that is to say, they took away from the method of limits all its advantage as to simplicity, by not applying it *frankly*.

We now ask that this shall cease; and that we shall no longer reproach for want of rigor, the Lagranges, the Laplaces, the Poissons, and Leibnitz, who has given us this principle: that "A curvilinear figure may be regarded as equivalent to a polygon of an infinite number of sides; whence it follows that whatsoever can be demonstrated of such a polygon, no regard being paid to the number of its sides, the same may be asserted of the curve." This is the principle for *the most simple* application of which to the measure of the circle and of the round bodies we appeal.

Whatever may be the formulas which may be given to the pupils for the determination of the ratio of the circumference to the diameter (the "Method of isoperimeters" is to be recommended for its simplicity), they must be required to perform the calculation, so as to obtain at least two or three exact decimals. These calculations, made with logarithms, must be methodically arranged and presented at the examination. It may be known whether the candidate is really the author of the papers, by calling for explanations on some of the steps, or making him calculate some points afresh.

The enunciations relating to the measurement of areas too often leave indistinctness in the minds of students, doubtless because of their form. We desire to make them better comprehended, by insisting on their application by means of a great number of examples.

As one application, we require the knowledge of the methods of surveying for content (*arpentage*), differing somewhat from the method of triangulation, used in the surveying for plans (*lever des plans*). To make this application more fruitful, the ground should be bounded on one side by an irregular curve. The pupils will not only thus learn how to overcome this practical difficulty, but they will find, in the calculation of the surface by means of trapezoids, the first application of the method of quadratures, with which it is important that they should very early become familiar. This application will constitute a new sheet of drawing and calculations to be presented at the examination.

Most of our remarks on plane geometry apply to geometry of three dimensions. Care should be taken always to leave homogeneity apparent, and to make numerous applications to the measurement of volumes.

The theory of similar polyhedrons often gives rise in the examinations of the students to serious difficulties on their part. These difficulties belong rather to the form than to the substance, and to the manner in which each individual mind seizes relations of position; relations always easier to feel than to express. The examiners should be content with arriving at the results enunciated in our programme, by the shortest and easiest road.

The simplicity desired cannot however be attained unless all have a common starting-point, in the definition of similar polyhedrons. The best course is assuredly to consider that theory in the point of view in which it is employed in the arts, especially in sculpture; i. e. to conceive the given system of points, M, N, P, ... to have lines passing from them through a point S, the *pole of similitude*, and prolonged beyond it to M′, N′, P′, ... so that SM′, SN′, SP′, ... are proportional to SM, SN, SP, ... Then the points M′, N′, P′, ... form a system *similar* to M, N, P, ...

The areas and volumes of the cylinder, of the cone, and of the sphere must be deduced from the areas and from the volumes of the prism, of the pyramid, and of the polygonal sector, with the same simplicity which we have required for the measure of the surface of the circle, and for the same reasons. It is, besides, the only means of easily extending to cones and cylinders with any bases whatever, right or oblique, those properties of cones and cylinders,—right and with circular bases,—which are applicable to them.

Numerical examples of the calculations, by logarithms, of these areas and volumes, including the area of a spherical triangle, will make another sheet to be presented to the examiners.

PROGRAMME OF GEOMETRY.

1. OF PLANE FIGURES.

Measure of the distance of two points.—Two finite right lines being given, to find their common measure, or at least their approximate ratio.

Of angles.—Right, acute, obtuse angles.—Angles vertically opposite are equal.

Of triangles.—Angles and sides.—The simplest cases of equality.—Elementary problems on the construction of angles and of triangles.

Of perpendiculars and of oblique lines.

Among all the lines that can be drawn from a given point to a given right line, the perpendicular is the shortest, and the oblique lines are longer in proportion to their divergence from the foot of the perpendicular.

Properties of the isosceles triangle.—Problems on tracing perpendiculars.—Division of a given straight line into equal parts.

Cases of equality of right-angled triangles.

Of parallel lines.

Properties of the angles formed by two parallels and a secant.—Reciprocally, when these properties exist for two right lines and a common secant, the two lines are parallel.*—Through a given point, to draw a right line parallel to a given right line, or cutting it at a given angle.—Equality of angles having their sides parallel and their openings placed in the same direction.

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* It will be admitted, as a postulate, that only one parallel to a given right line can pass through a given point.

Sum of the angles of a triangle.

The parts of parallels intercepted between parallels are equal, and reciprocally.

Three parallels always divide any two right lines into proportional parts. The ratio of these parts may be incommensurable.—Application to the case in which a right line is drawn, in a triangle, parallel to one of its sides.

To find a fourth proportional to three given lines.

The right line, which bisects one of the angles of a triangle, divides the opposite side into two segments proportional to the adjacent sides.

Of similar triangles.

Conditions of similitude.—To construct on a given right line, a triangle similar to a given triangle.

Any number of right lines, passing through the same point and met by two parallels, are divided by these parallels into proportional parts, and divide them also into proportional parts.—To divide a given right line in the same manner as another is divided.—Division of a right line into equal parts.

If from the right angle of a right-angled triangle a perpendicular is let fall upon the hypothenuse, 1° this perpendicular will divide the triangle into two others which will be similar to it, and therefore to each other; 2° it will divide the hypothenuse into two segments, such that each side of the right angle will be a mean proportional between the adjacent segment and the entire hypothenuse; 3° the perpendicular will be a mean proportional between the two segments of the hypothenuse.

In a right-angled triangle, the square of the number which expresses the length of the hypothenuse is equal to the sum of the squares of the numbers which express the lengths of the other two sides.

The three sides of any triangle being expressed in numbers, if from the extremity of one of the sides a perpendicular is let fall on one of the other sides, the square of the first side will be equal to the sum of the squares of the other two, *minus* twice the product of the side on which the perpendicular is let fall by the distance of that perpendicular from the angle opposite to the first side, if the angle is *acute*, and *plus* twice the same product, if this angle is *obtuse.*

Of polygons.

Parallelograms.—Properties of their angles and of their diagonals.

Division of polygons into triangles.—Sum of their interior angles.—Equality and construction of polygons.

Similar polygons.—Their decomposition into similar triangles.—The right lines similarly situated in the two polygons are proportional to the homologous sides of the polygons.—To construct, on a given line, a polygon similar to a given polygon.—The perimeters of two similar polygons are to each other as the homologous sides of these polygons.

Of the right line and the circumference of the circle.

Simultaneous equality of arcs and chords in the same circle.—The greatest arc has the greatest chord, and reciprocally.—Two arcs being given in the same circle or in equal circles, to find the ratio of their lengths.

Every right line drawn perpendicular to a chord at its middle, passes through the centre of the circle and through the middle of the arc subtended by the chord.—Division of an arc into two equal parts.—To pass the circumference of a circle through three points not in the same right line.

The tangent at any point of a circumference is perpendicular to the radius passing through that point.

The arcs intercepted in the same circle between two parallel chords, or between a tangent and a parallel chord, are equal.

Measure of angles.

If from the summits of two angles two arcs of circles be described with the same radius, the ratio of the arcs included between the sides of each angle will be the same as that of these angles.—Division of the circumference into degrees, minutes, and seconds.—Use of the protractor.

An angle having its summit placed, 1° at the centre of a circle; 2° on the circumference of that circle; 3° within the circle between the centre and the circumference; 4° without the circle, but so that its sides cut the circumference; to determine the ratio of that angle to the right angle, by the consideration of the arc included between its sides.

From a given point without a circle, to draw a tangent to that circle.

To describe, on a given line, a segment of a circle capable of containing a given angle.

To make surveys for plans. (*Lever des plans.*)

Tracing a straight line on the ground.—Measuring that line with the chain.

Measuring angles with the graphometer.—Description of it.

Drawing the plan on paper.—Scale of reduction.—Use of the rule, the triangle, and the protractor.

To determine the distance of an inaccessible object, with or without the graphometer.

Three points, A, B, C, being situated on a smooth surface and represented on a map, to find thereon the point P from which the distances A B and A C have been seen under given angles. "The problem of the three points." "The *Trilinear* problem."

Of the contact and of the intersection of circles.

Two circles which pass through the same point of the right line which joins their centres have in common only that point in which they touch; and reciprocally, if two circles touch, their centres and the point of contact lie in the same right line.

Conditions which must exist in order that two circles may intersect.

Properties of the secants of the circle.

Two secants which start from the same point without the circle, being prolonged to the most distant part of the circumference, are reciprocally proportional to their exterior segments.—The tangent is a mean proportional between the secant and its exterior segment.

Two chords intersecting within a circle divide each other into parts reciprocally proportional.—The line perpendicular to a diameter and terminated by the circumference, is a mean proportional between the two segments of the diameter.

A chord, passing through the extremity of the diameter, is a mean proportional between the diameter and the segment formed by the perpendicular let fall from the other extremity of that chord.—To find a mean proportional between two given lines.

To divide a line in extreme and mean ratio.—The length of the line being given numerically, to calculate the numerical value of each of the segments.

Of polygons inscribed and circumscribed to the circle.

To inscribe or circumscribe a circle to a given triangle.

Every regular polygon can be inscribed and circumscribed to the circle.

A regular polygon being inscribed in a circle, 1° to inscribe in the same circle a polygon of twice as many sides, and to find the length of one of the sides of the second polygon; 2° to circumscribe about the circle a regular polygon of the same number of sides, and to express the side of the circumscribed polygon by means of the side of the corresponding inscribed polygon.

To inscribe in a circle polygons of 4, 8, 16, 32......sides.

To inscribe in a circle polygons of 3, 6, 12, 24, ...sides.

To inscribe in a circle polygons of 5, 10, 20, 40.....sides.

To inscribe in a circle polygons of 15, 30, 60........sides.

Regular polygons of the same number of sides are similar, and their perimeters are to each other as the radii of the circles to which they are inscribed or circumscribed.—The circumferences of circles are to each other as their radii.

To find the approximate ratio of the circumference to the diameter.

Of the area of polygons and of that of the circle.

Two parallelograms of the same base and of the same height are equivalent.—Two triangles of the same base and height are equivalent.

The area of a rectangle and that of a parallelogram are equal to the product of the base by the height.—What must be understood by that enunciation.—The area of a triangle is measured by half of the product of the base by the height.

To transform any polygon into an equivalent square.—Measure of the area of a polygon.—Measure of the area of a trapezoid.

The square constructed on the hypothenuse of a right-angled triangle is equivalent to the sum of the squares constructed on the other two sides.—The squares constructed on the two sides of the right angle of a right-angled triangle and on the hypothenuse are to each other as the adjacent segments and entire hypothenuse.

The areas of similar polygons are to each other as the squares of the homologous sides of the polygons.

Notions on surveying for content (*arpentage*).—Method of decomposition into triangles.—Simpler method of decomposition into trapezoids.—Surveyor's cross.—Practical solution, when the ground is bounded, in one or more parts, by a curved line.

The area of a regular polygon is measured by half of the product of its perimeter by the radius of the inscribed circle.—The area of a circle is measured by half of the product of the circumference by the radius.—The areas of circles are to each other as the squares of the radii.

The area of a sector of a circle is measured by half of the product of the arc by the radius.—Measure of the area of a segment of a circle.

2. OF PLANES AND BODIES TERMINATED BY PLANE SURFACES.

Conditions required to render a right line and a plane respectively perpendicular.
Of all the lines which can be drawn from a given point to a given plane, the perpendicular is the shortest, and the oblique lines are longer in proportion to their divergence from the foot of the perpendicular.
Parallel right lines and planes.—Angles which have their sides parallel, and their openings turned in the same direction, are equal, although situated in different planes.
Dihedral angle.—How to measure the ratio of any dihedral angle to the right dihedral angle.
Planes perpendicular to each other.—The intersection of two planes perpendicular to a third plane, is perpendicular to this third plane.
Parallel planes.—When two parallel planes are cut by a third plane the intersections are parallel.—Two parallel planes have their perpendiculars common to both.
The shortest distance between two right lines, not intersecting and not parallel.
Two right lines comprised between two parallel planes are always divided into proportional parts by a third plane parallel to the first two.
Trihedral angle.—The sum of any two of the plane angles which compose a trihedral angle is always greater than the third.
The sum of the plane angles which form a convex polyhedral angle is always less than four right angles.
If two trihedral angles are formed by the same plane angles, the dihedral angles comprised between the equal plane angles are equal.—There may be absolute equality or simple symmetry between the two trihedral angles.

Of polyhedrons.
If two tetrahedrons have each a trihedral angle composed of equal and similarly arranged triangles, these tetrahedrons are equal. They are also equal if two faces of the one are equal to two faces of the other, are arranged in the same manner, and form with each other the same dihedral angle.
When the triangles which form two homologous trihedral angles of two tetrahedrons are similar, each to each, and similarly disposed, these tetrahedrons are similar. They are also similar if two faces of the one, making with each other the same angle as two faces of the other, are also similar to these latter, and are united by homologous sides and summits.
Similar pyramids.—A plane parallel to the base of a pyramid cuts off from it a pyramid similar to it.—To find the height of a pyramid when we know the dimension of its trunk with parallel bases.
Sections made in any two pyramids at the same distance from these summits are in a constant ratio.
Parallelopipedon.—Its diagonals.
Any polyhedron can always be divided into triangular pyramids.—Two bodies composed of the same number of equal and similarly disposed triangular pyramids, are equal.

Similar polyhedrons.
The homologous edges of similar polyhedrons are proportional; as are also the diagonals of the homologous faces and the interior diagonals of the polyhedrons.—The areas of similar polyhedrons are as the squares of the homologous edges.

Measure of volumes.
Two parallelopipedons of the same base and of the same height are equivalent in volume.
If a parallelogram be constructed on the base of a triangular prism, and on that parallelogram, taken as a base, there be constructed a parallelopipedon of the same height as the triangular prism, the volume of this prism will be half of the volume of the parallelopipedon.—Two triangular prisms of the same base and the same height are equivalent.
Two tetrahedrons of the same base and the same height are equivalent.
A tetrahedron is equivalent to the third of the triangular prism of the same base and the same height.
The volume of any parallelopipedon is equal to the product of its base by its height.—What must be understood by that enunciation.—The volume of any prism is equal to the product of its base by its height.
The volume of a tetrahedron and that of any pyramid are measured by the third of the product of the base by the height.
Volume of the truncated oblique triangular prism.
The volumes of two similar polyhedrons are to each other as the cubes of the homologous edges.

3. OF ROUND BODIES.

Of the right cone with circular base.

Sections parallel to the base.—Having the dimensions of the trunk of a cone with parallel bases, to find the height of the entire cone.

The area of a right cone is measured by half of the product of the circumference of its circular base by its side.—Area of a trunk of a right cone with parallel bases.

Volume of a pyramid inscribed in the cone.—The volume of a cone is measured by the third of the product of the area of its base by its height.*

Which of the preceding properties belong to the cone of any base whatever?

Of the right cylinder with circular base.

Sections parallel to the base.

The area of the convex surface of the right cylinder is measured by the product of the circumference of its base by its height.—This is also true of the right cylinder of any base.

Measure of the volume of a prism inscribed in the cylinder.—The volume of a right cylinder is measured by the product of the area of its base by its height.—This is also true of any cylinder, right or oblique, of any base whatever.

Of the sphere.

Every section of the sphere, made by a plane, is a circle.—Great circles and small circles.

In every spherical triangle any one side is less than the sum of the other two. The shortest path from one point to another, on the surface of the sphere, is the arc of a great circle which joins the two given points.

The sum of the sides of a spherical triangle, or of any spherical polygon, is less than the circumference of a great circle.

Poles of an arc of a great or small circle.—They serve to trace arcs of circles on the sphere.

Every plane perpendicular to the extremity of a radius is tangent to the sphere.

Measure of the angle of two arcs of great circles.

Properties of the polar or supplementary triangle.

Two spherical triangles situated on the same sphere, or on equal spheres, are equal in all their parts, 1° when they have an equal angle included between sides respectively equal; 2° when they have an equal side adjacent to two angles respectively equal; 3° when they are mutually equilateral; 4° when they are mutually equiangular. In these different cases the triangles may be equal, or merely symmetrical.

The sum of the angles of any spherical triangle is less than six, and greater than two, right angles.

The lune is to the surface of the sphere as the angle of that lune is to four right angles.

Two symmetrical spherical triangles are equivalent in surface.

The area of a spherical triangle is to that of the whole sphere as the excess of the sum of its angles above two right angles is to eight right angles.

When a portion of a regular polygon, inscribed in the generating circle of the sphere, turns around the diameter of that circle, the convex area engendered is measured by the product of its height by the circumference of the circle inscribed in the generating polygon.—The volume of the corresponding polygonal sector is measured by the area thus described, multiplied by the third of the radius of the inscribed circle.

The surface of a spherical zone is equal to the height of that zone multiplied by the circumference of a great circle.—The surface of the sphere is quadruple that of a great circle.

Every spherical sector is measured by the zone which forms its base, multiplied by the third of the radius. The whole sphere is measured by its surface multiplied by the third of its radius.†

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* The volume of the cone is derived from that of the pyramid; and it is to be noted that the demonstration applies to the cone with closed base, whatever the figure of that base.

† Numerical examples on the areas and volumes of the round bodies, including the area of a spherical triangle, will be required by the examiners. The calculations will be made by logarithms.

III. ALGEBRA.

Algebra is not, as are Arithmetic and Geometry, indispensable to every one. It should be very sparingly introduced into the general education of youth, and we would there willingly dispense with it entirely, excepting logarithms, if this would benefit the study of arithmetic and geometry. The programme of it which we are now to give, considers it purely in view of its utility to engineers, and we will carefully eliminate every thing not necessary for them.

Algebraical calculation presents no serious difficulty, when its students become well impressed with this idea, that every letter represents a number; and particularly when the consideration of negative quantities is not brought in at the outset and in an absolute manner. These quantities and their properties should not be introduced except as the solution of questions by means of equations causes their necessity to be felt, either for generalizing the rules of calculation, or for extending the meaning of the formulas to which it leads. Clairaut pursues this course. He says, "I treat of the multiplication of negative quantities, that dangerous shoal for both scholars and teachers, only after having shown its necessity to the learner, by giving him a problem in which he has to consider negative quantities independently of any positive quantities from which they are subtracted. When I have arrived at that point in the problem where I have to multiply or divide negative quantities by one another, I take the course which was undoubtedly taken by the first analysts who have had those operations to perform and who have wished to follow a perfectly sure route: I seek for a solution of the problem which does not involve these operations; I thus arrive at the result by reasonings which admit of no doubt, and I thus see what those products or quotients of negative quantities, which had given me the first solution, must be." Bezout proceeds in the same way.

We recommend to teachers to follow these examples; not to speak to their pupils about negative quantities till the necessity of it is felt, and

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* The true distinction between Algebra and Arithmetic is so commonly overlooked that it may be well to present it here, in the words of Comte. "The complete solution of every question of calculation is necessarily composed of two successive parts, which have essentially distinct natures. In the first, the object is to *transform* the proposed equations, so as to make apparent the manner in which the unknown quantities are formed by the known ones; it is this which constitutes the *Algebraic* question. In the second, our object is *to find the value* of the formulas thus obtained; that is, to determine directly the values of the numbers sought, which are already represented by certain explicit functions of given numbers; this is the *Arithmetical* question. Thus the stopping-point of the algebraic part of the solution becomes the starting-point of the arithmetical part.

"Algebra may therefore be defined as having for its object the *resolution of equations;* taking this expression in its full logical meaning, which signifies the transformation of *implicit* functions into equivalent *explicit* ones. In the same way Arithmetic may be defined as intended for *the determination of the values of functions.* Henceforth, therefore, we may call Algebra *the Calculus of Functions*, and Arithmetic *the Calculus of Values.*"

when they have become familiar with algebraic calculation; and above all not to lose precious time in obscure discussions and demonstrations, which the best theory will never teach students so well as numerous applications.

It has been customary to take up again, in algebra, the calculus of fractions, so as to generalize the explanations given in arithmetic, since the terms of literal fractions may be any quantities whatsoever. Rigorously, this may be well, but to save time we omit this, thinking it better to employ this time in advancing and exercising the mind on new truths, rather than in returning continually to rules already given, in order to imprint a new degree of rigor on their demonstration, or to give them an extension of which no one doubts.

The study of numerical equations of the first degree, with one or several unknown quantities, must be made with great care. We have required the solution of these equations to be made by the method of *substitution.* We have done this, not only because this method really comprehends the others, particularly that of *comparison*, but for this farther reason. In treatises on algebra, those equations alone are considered whose numerical coefficients and solutions are very simple numbers. It then makes very little difference what method is used, or in what order the unknown quantities are eliminated. But it is a very different thing in practice, where the coefficients are complicated numbers, given with decimal parts, and where the numerical values of these coefficients may be very different in the same equation, some being very great and some very small. In such cases the method of *substitution* can alone be employed to advantage, and that with the precaution of taking the value of the unknown quantity to be eliminated from that equation in which it has relatively the greatest coefficient. Now the method of *comparison* is only the method of substitution put in a form in which these precautions cannot be observed, so that in practice it will give bad results with much labor.

The candidates must present to the examiners the complete calculations of the resolution of four equations with four unknown quantities, made with all the precision permitted by the logarithmic tables of Callet, and the proof that that precision has been obtained. The coefficients must contain decimals and be very different from one another, and the elimination must be effected with the above precautions.

The teaching of the present day disregards too much the applicability of the methods given, provided only that they be elegant in their form; so that they have to be abandoned and changed when the pupils enter on practice. This disdain of practical utility was not felt by our great mathematicians, who incessantly turned their attention towards applications. Thus the illustrious Lagrange made suggestions like those just given; and Laplace recommended the drawing of curves for solving directly all kinds of numerical equations.

As to literal equations of the first degree, we call for formulas sufficient for the resolution of equations of two or three unknown quantities. Bezout's method of elimination must be given as a first application of that fruitful method of indeterminates. The general discussion of formulas will be confined to the case of two unknown quantities. The discussion of three equations with three unknown quantities, x, y, and z, in which the terms independent of the unknown quantities are null, will be made directly, by this simple consideration that the system then really includes only two unknown quantities, to wit, the ratios of x and y, for example, to z.

The resolution of inequalities of the first degree with one or more unknown quantities, was added to equations of the first degree some years ago. We do not retain that addition.

The equations of the second degree, like the first, must be very carefully given. In dwelling on the case where the coefficient of x^2 converges towards zero, it will be remarked that, when the coefficient is very small, the ordinary formula would give one of the roots by the difference of two numbers almost equal; so that sufficient exactness could not be obtained without much labor. It must be shown how that inconvenience may be avoided.

It is common to meet with expressions of which the maximum or the minimum can be determined by the consideration of an equation of the second degree. We retain the study of them, especially for the benefit of those who will not have the opportunity of advancing to the general theory of maxima and minima.

The theory of the algebraic calculation of imaginary quantities, given *à priori*, may, on the contrary, be set aside without inconvenience. It is enough that the pupils know that the different powers of $\sqrt{-1}$ continually reproduce in turn one of these four values, ± 1, $\pm\sqrt{-1}$. We will say as much of the calculation of the algebraic values of radicals, which is of no use. The calculation of their *arithmetical* values will alone be demanded. In this connection will be taught the notation of fractional exponents and that of negative exponents.

The theory of numbers has taken by degrees a disproportionate development in the examinations for admission; it is of no use in practice, and, besides, constitutes in the pure mathematics a science apart.

The theory of continued fractions at first seems more useful. It is employed in the resolution of algebraic equations, and in that of the exponential equation $a^x = b$. But these methods are entirely unsuited to practice, and we therefore omit this theory.

The theory of series, on the contrary, claims some farther developments. Series are continually met with in practice; they give the best solutions of many questions, and it is indispensable to know in what circumstances they can be safely employed.

We have so often insisted on the necessity of teaching students to calculate, as to justify the extent of the part of the programme relating to logarithms. We have suppressed the inapplicable method of determining logarithms by continued fractions, and have substituted the employment of the series which gives the logarithm of $n+1$, knowing that of n. To exercise the students in the calculation of the series, they should be made to determine the logarithms of the numbers from 1 to 10, from 101 to 110, and from 10,000 to 10,010, the object of these last being to show them with what rapidity the calculation proceeds when the numbers are large; the first term of the series is then sufficient, the variations of the logarithms being sensibly proportional to the variations of the numbers, within the limits of the necessary exactness. In the logarithmic calculations, the pupils will be exercised in judging of the exactness which they may have been able to obtain: the consideration of the numerical values of the proportional parts given in the tables is quite sufficient for this purpose, and is beside the only one which can be employed in practice.

The use of the sliding rule, which is merely an application of logarithms, gives a rapid and portable means of executing approximately a great number of calculations which do not require great exactness. We desire that the use of this little instrument should be made familiar to the candidates. This is asked for by all the professors of the "School of application," particularly those of Topography, of Artillery, of Con struction, and of Applied Mechanics, who have been convinced by experience of the utility of this instrument, which has the greatest possible analogy with tables of logarithms.

Before entering on the subjects of higher algebra, it should be remembered that the reductions of the course which we have found to be so urgent, will be made chiefly on it. The general theory of equations has taken in the examinations an abnormal and improper development, not worth the time which it costs the students. We may add, that it is very rare to meet a numerical equation of a high degree requiring to be resolved, and that those who have to do this, take care not to seek its roots by the methods which they have been taught. These methods moreover are not applicable to transcendental equations, which are much more frequently found in practice.

The theory of the greatest common algebraic divisor, in its entire generality, is of no use, even in pure science, unless in the elimination between equations of any degree whatever. But this last subject being omitted, the greatest common divisor is likewise dispensed with.

It is usual in the general theory of algebraic equations to consider the derived polynomials of entire functions of x. These polynomials are in fact useful in several circumstances, and particularly in the theory of equal roots; and in analytical geometry, they serve for the discussion of curves and the determination of their tangents. But since transcendental curves are very often encountered in practice, we give in our programme the calculation of the derivatives of algebraic and fractional functions, and transcendental functions, logarithmic, exponential, and circular. This has been long called for, not only because it must be of great assistance in the teaching of analytical geometry, but also because it will facilitate the elementary study of the infinitesimal calculus.

We have not retrenched any of the general ideas on the composition of an entire polynomial by means of factors corresponding to its roots. We retain several theorems rather because they contain the germs of useful ideas than because of their practical utility, and therefore wish the examiners to restrict themselves scrupulously to the programme.

The essential point in practice is to be able to determine conveniently an incommensurable root of an algebraic or transcendental equation, when encountered. Let us consider first an algebraic equation.

All the methods which have for their object to separate the roots, or to approximate to them, begin with the substitution of the series of consecutive whole numbers, in the first member of the equation. The direct substitution becomes exceedingly complicated, when the numbers substituted become large. It may be much shortened, however, by deducing the results from one another by means of their differences, and guarding against any possibility of error, by verifying some of those results, those corresponding to the numbers easiest to substitute, such as ± 10, ± 20. The teacher should not fail to explain this to his pupils.

Still farther: let us suppose that we have to resolve an equation of the third degree, and that we have recognized by the preceding calculations the necessity of substituting, between the numbers 2 and 3, numbers differing by a tenth, either for the purpose of continuing to effect the separation of the roots, or to approximate nearer to a root comprised between 2 and 3. If we knew, for the result corresponding to the substitution of 2, the first, second, and third differences of the results of the new substitutions, we could thence deduce those results themselves with as much simplicity, as in the case of the whole numbers. The new third difference, for example, will be simply the thousandth part of the old third difference. We may also remark that there is no possibility of error, since, the numbers being deduced from one another, when we in this way arrive at the result of the substitution of 3, which has already been calculated, the whole work will thus be verified.

Let us suppose again that we have thus recognized that the equation has a root comprised between 2.3 and 2.4; we will approximate still nearer by substituting intermediate numbers, differing by 0.01, and employing the course just prescribed. As soon as the third differences can be neglected, the calculation will be finished at once, by the consideration of an equation of the second degree; or, if it is preferred to continue the approximations till the second differences in their turn may be neglected, the calculation will then be finished by a simple proportion.

When, in a transcendental equation $f(X)=0$, we have substituted in $f(X)$ equidistant numbers, sufficiently near to each other to allow the differences of the results to be neglected, commencing with a certain order, the 4th, for example, we may, within certain limits of x, replace the transcendental function by an algebraic and entire function of x, and thus reduce the search for the roots of $f(X)=0$ to the preceding theory.

Whether the proposed equation be algebraic or transcendental, we can thus, when we have obtained one root of it with a suitable degree of exactness, continue the approximation by the method of Newton.

PROGRAMME OF ALGEBRA.

Algebraic calculation.

Addition and subtraction of polynomials.—Reduction of similar terms.

Multiplication of monomials.—Use of exponents.—Multiplication of polynomials. Rule of the signs.—To arrange a polynomial.—Homogeneous polynomials.

Division of monomials. Exponent *zero*.—Division of polynomials. How to know if the operation will not terminate.—Division of polynomials when the dividend contains a letter which is not found in the divisor.

Equations of the first degree.

Resolution of numerical equations of the first degree with one or several unknown quantities by the method of substitution.—Verification of the values of the unknown quantities and of the degree of their exactness.

Of cases of impossibility or of indetermination.

Interpretation of negative values.—Use and calculation of negative quantities.

Investigation of general formulas for obtaining the values of the unknown quantities in a system of equations of the first degree with two or three unknown quantities.—Method of Bezout.—Complete discussion of these formulas for the case of two unknown quantities.—Symbols $\frac{m}{0}$ and $\frac{0}{0}$.

Discussion of three equations with three unknown quantities, in which the terms independent of the unknown quantities are null.

Equations of the second degree with one unknown quantity.

Calculus of radicals of the second degree.

Resolution of an equation of the second degree with one unknown quantity.—Double solution.—Imaginary values.

When, in the equation $ax^2+bx+c=0$, a converges towards 0, one of the roots increases indefinitely.—Numerical calculation of the two roots, when a is very small.

Decomposition of the trinomial x^2+px+q into factors of the first degree.—Relations between the coefficients and the roots of the equation $x^2+px+q=0$.

Trinomial equations reducible to the second degree.
Of the maxima and minima which can be determined by equations of the second degree.
Calculation of the *arithmetical* values of radicals.
Fractional exponents.—Negative exponents.

Of series.
Geometrical progressions.—Summation of the terms.
What we call a series.—Convergence and divergence.
A geometrical progression is convergent, when the ratio is smaller than unity; diverging, when it is greater.
The terms of a series may decrease indefinitely and the series not be converging.
A series, all the terms of which are positive, is converging, when the ratio of one term to the preceding one tends towards a *limit* smaller than unity, in proportion as the index of the rank of that term increases indefinitely.—The series is diverging when this *limit* is greater than unity. There is uncertainty when it is equal to unity.
In general, when the terms of a series decrease indefinitely, and are alternately positive and negative, the series is converging.

Combinations, arrangements, and permutations of m letters, when each combination must not contain the same letter twice.
Development of the entire and positive powers of a binomial.—General terms.
Development of $(a+b\sqrt{-1})^m$.
Limit towards which $\left(1+\frac{1}{m}\right)^m$ tends, when m increases indefinitely.
Summation of piles of balls.

Of logarithms and of their uses.
All numbers can be produced by forming all the powers of any positive number, greater or less than *one.*
General properties of logarithms.
When numbers are in geometrical progression, their logarithms are in arithmetical progression.
How to pass from one system of logarithms to another system.
Calculation of logarithms by means of the series which gives the logarithm of $n+1$, knowing that of n.—Calculation of Napierian logarithms.—To deduce from them those of Briggs. Modulus.
Use of logarithms whose base is 10.—Characteristics.—Negative characteristics. Logarithms entirely negative are not used in calculation.
A number being given, how to find its logarithm in the tables of Callet. A logarithm being given, how to find the number to which it belongs.—Use of the proportional parts.—Their application to appreciate the exactness for which we can answer.
Employment of the sliding rule.
Resolution of exponential equations by means of logarithms.
Compound interest. Annuities.

Derived functions.
Development of an entire function F $(x+h)$ of the binomial $(x+h)$.—Derivative of an entire function.—To return from the derivative to the function.
The derivative of a function of x is the limit towards which tends the ratio of the increment of the function to the increment h of the variable, in proportion as h tends towards zero.
Derivatives of trigonometric functions.
Derivatives of exponentials and of logarithms.
Rules to find the derivative of a sum, of a product, of a power, of a quotient of functions of x, the derivatives of which are known.

Of the numerical resolution of equations.
Changes experienced by an entire function $f(x)$ when x varies in a continuous manner.—When two numbers a and b substituted in an entire function $f(x)$ give results with contrary signs, the equation $f(x)=0$ has at least one real root not comprised between a and b. This property subsists for every species of function which remains continuous for all the values of x comprised between a and b.
An algebraic equation of uneven degree has at least one real root.—An algebraic equation of even degree, whose last term is negative, has at least two real roots.
Every equation $f(x)=0$, with coefficients either real or imaginary of the form $a+b\sqrt{-1}$, admits of a real or imaginary root of the same form. [Only the enunciation, and not the demonstration of this theorem, is required.]

If a is a root of an algebraic equation, the first member is divisible by $x-a$. An algebraic equation of the m^{th} degree has always m roots real or imaginary, and it cannot admit more.—Decomposition of the first members into factors of the first degree. Relations between the coefficients of an algebraic equation and its roots.

When an algebraic equation whose coefficients are real, admits an imaginary root of the form $a+b\sqrt{-1}$, it has also for a root the conjugate expression $a-b\sqrt{-1}$.

In an algebraic expression, complete or incomplete, the number of the positive roots cannot surpass the number of the variations; consequence, for negative roots.

Investigation of the product of the factors of the first degree common to two entire functions of x.—Determination of the roots common to two equations, the first members of which are entire functions of the unknown quantity.

By what character to recognize that an algebraic equation has equal roots.—How we then bring its resolution to that of several others of lower degree and of unequal roots.

Investigation of the commensurable roots of an algebraic equation with entire coefficients.

When a series of equidistant numbers is substituted in an entire function of the m^{th} degree, and differences of different orders between the results are formed, the differences of the m^{th} order are constant.

Application to the separation of the roots of an equation of the third degree.—Having the results of the substitution of -1, 0, and $+1$, to deduce therefrom, by means of differences, those of all other whole numbers, positive or negative.—The progress of the calculation leads of itself to the limits of the roots.—Graphical representation of this method.

Substitution of numbers equidistant *by a tenth*, between two consecutive whole numbers, when the inspection of the first results has shown its necessity.—This substitution is effected directly, or by means of new differences deduced from the preceding.

How to determine, in continuing the approximation towards a root, at what moment the consideration of the first difference is sufficient to give that root with all desirable exactness, by a simple proportion.

The preceding method becomes applicable to the investigation of the roots of a transcendental equation $X=0$, when there have been substituted in the first member, numbers equidistant and sufficiently near to allow the differences of the results to be considered as constant, starting from a certain order.—Formulas of interpolation.

Having obtained a root of an algebraic or transcendental equation, with a certain degree of approximation, to approximate still farther by the method of Newton.

Resolution of two numerical equations of the second degree with two unknown quantities.

Decomposition of rational fractions into simple fractions.

IV. TRIGONOMETRY.

In explaining the use of trigonometrical tables, the pupil must be able to tell with what degree of exactness an angle can be determined by the logarithms of any of its trigonometrical lines. The consideration of the proportional parts will be sufficient for this. It will thus be seen that if the *sine* determines perfectly a small angle, the degree of exactness, which may be expected from the use of that line, diminishes as the angle increases, and becomes quite insufficient in the neighborhood of 90 degrees. It is the reverse for the *cosine*, which may serve very well to represent an angle near 90 degrees, while it would be very inexact for small angles. We see, then, that in our applications, we should distrust those formulas which give an angle by its sine or cosine. The *tangent* being alone exempt from these difficulties, we should seek, as far as possible, to resolve all questions by means of it. Thus, let us suppose that we know the hypothenuse and one of the sides of a right-angled triangle, the direct determination of the included angle will be given by a cosine, which will be wanting in exactness if the hypothenuse of the triangle does not differ much from the given side. In that case we should begin by calculating the third side, and then use it with the first side to determine the desired angle by means of its tangent. When two sides of a triangle and the included angle are given, the tangent of the half difference of the desired angles may be calculated with advantage; but we may also separately determine the tangent of each of them. When the three sides of a triangle are given, the best formula for calculating an angle, and the only one never at fault, is that which gives the tangent of half of it.

The surveying for plans, taught in the course of Geometry, employing only graphical methods of calculation, did not need any more accurate instruments than the chain and the graphometer; but now that trigonometry furnishes more accurate methods of calculation, the measurements on the ground require more precision. Hence the requirement for the pupil to measure carefully a base, to use telescopes, verniers, etc., and to make the necessary calculations, the ground being still considered as plane. But as these slow and laborious methods can be employed for only the principal points of the survey, the more expeditious means of the plane-table and compass will be used for the details.

In spherical trigonometry, all that will be needed in geodesy should be learned before admission to the school, so that the subject will not need to be again taken up. We have specially inscribed in the programme the relations between the angles and sides of a right-angled triangle, which must be known by the students; they are those which occur in practice. In tracing the course to be pursued in the resolution of the three cases of any triangles, we have indicated that which is in fact employed in the applications, and which is the most convenient. As to the rest, ambiguous cases never occur in practice, and therefore we should take care not to speak of them to learners.

In surveying, spherical trigonometry will now allow us to consider cases in which the signals are not all in the same plane, and to operate on uneven ground, obtain its projection on the plane of the horizon, and at the same time determine differences of level.

It may be remarked that Descriptive Geometry might supply the place of spherical trigonometry by a graphical construction, but the degree of exactitude of the differences of level thus obtained would be insufficient.

PROGRAMME OF TRIGONOMETRY.

1. PLANE TRIGONOMETRY.

Trigonometrical lines.—Their ratios to the radius are alone considered.—Relations of the trigonometric lines of the same angle.—Expressions of the sine and of the cosine in functions of the tangent.

Knowing the sines and the cosines of two arcs a and b, to find the sine and the cosine of their sum and of their difference.—To find the tangent of the sum or of the difference of two arcs, knowing the tangents of those arcs.

Expressions for sin. $2a$ and sin. $3a$; cos. $2a$ and cos. $3a$; tang. $2a$ and tang. $3a$.

Knowing sin. a or cos. a, to calculate sin. $\frac{1}{2}a$ and cos. $\frac{1}{2}a$.

Knowing tang. a, to calculate tang. $\frac{1}{2}a$.

Knowing sin. a, to calculate sin. $\frac{1}{3}a$.—Knowing cos. a, to calculate cos. $\frac{1}{3}a$.

Use of the formula $\cos. p + \cos. q = 2\cos. \frac{1}{2}(p+q)\cos. \frac{1}{2}(p-q)$, to render logarithms applicable to the sum of two trigonometrical lines, sines or cosines.—To render logarithms applicable to the sum of two tangents.

Construction of the trigonometric tables.

Use in detail of the tables of Callet.—Appreciation, by the proportional parts, of the degree of exactness in the calculation of the angles.—Superiority of the tangent formulas.

Resolution of triangles.

Relations between the angles and the sides of a right-angled triangle, or of any triangle whatever.—When the three angles of a triangle are given, these relations determine only the ratios of the sides.

Resolution of right-angled triangles.—Of the case in which the hypothenuse and a side nearly equal to it are given.

Knowing a side and two angles of any triangle, to find the other parts, and also the surface of the triangle.

Knowing two sides a and b of a triangle and the included angle C, to find the other parts and also the surface of the triangle.—The tang. $\frac{1}{2}(A-B)$ may be determined; or tang. A and tang. B directly.

Knowing the three sides a, b, c, to find the angles and the surface of the triangle.—Employment of the formula which gives tang. $\frac{1}{2}A$.

Application to surveying for plans.

Measurement of bases with rods.

Measurement of angles.—Description and use of the circle.—Use of the telescope to render the line of sight more precise.—Division of the circle.—Verniers.

Measurement and calculation of a system of triangles.—Reduction of angles to the centres of stations.

How to connect the secondary points to the principal system.—Use of the plane table and of the compass.

2. SPHERICAL TRIGONOMETRY.

Fundamental relations ($\cos. a = \cos. b \cos. c + \sin. b \sin. c \cos. A$) between the sides and the angles of a spherical triangle.

To deduce thence the relations $\sin. A : \sin. B = \sin. a : \sin. b$; $\cot. a \sin. b - \cot. A \sin. C = \cos. b \cos. C$, and by the consideration of the supplementary triangle $\cos. A = -\cos. B \cos. C + \sin. B \sin. C \cos. a$.

Right-angled triangles.—Formulas $\cos. a = \cos. b \cos. c$; $\sin. b = \sin. a \sin. B$; $\text{tang.}\, c = \text{tang.}\, a \cos. B$, and $\text{tang.}\, b = \sin. c\, \text{tang.}\, B$.

In a right-angled triangle the three sides are less than 90°, or else two of the sides are greater than 90°, and the third is less. An angle and the side opposite to it are both less than 90°, or both greater.

Resolution of any triangles whatever:

1° Having given their three sides a, b, c, or their three angles A, B, C.—Formulas tang. $\frac{1}{2}a$, and tang. $\frac{1}{2}A$, calculable by logarithms:

2° Having given two sides and the included angle, or two angles and the included side.—Formulas of Delambre:

3° Having given two sides and an angle opposite to one of them, or two angles and a side opposite to one of them. Employment of an auxiliary angle to render the formulas calculable by logarithms.

Applications.—Survey of a mountainous country.—Reduction of the base and of the angles to the horizon.—Determination of differences of level.

Knowing the latitude and the longitude of two points on the surface of the earth, to find the distance of those points.

V. ANALYTICAL GEOMETRY.

The important property of homogeneity must be given with clearness and simplicity.

The transformation of co-ordinates must receive some numerical applications, which are indispensable to make the student clearly see the meaning of the formulas.

The determination of tangents will be effected in the most general manner by means of the derivatives of the various functions, which we inserted in the programme of algebra. After having shown that this determination depends on the calculation of the derivative of the ordinate with respect to the abscissa, this will be used to simplify the investigation of the tangent to curves of the second degree and to curves whose equations contain transcendental functions. The discussion of these, formerly pursued by laborious indirect methods, will now become easy; and as curves with transcendental equations are frequently encountered, it will be well to exercise students in their discussion.

The properties of foci and of the directrices of curves of the second degree will be established directly, for each of the three curves, by means of the simplest equations of these curves, and without any consideration of the analytical properties of foci, with respect to the general equation of the second degree. With even greater reason will we dispense with examining whether curves of higher degree have foci, a question whose meaning even is not well defined.

We retained in algebra the elimination between two equations of the second degree with two unknown quantities, a problem which corresponds to the purely analytical investigation of the co-ordinates of the points of intersection of two curves of the second degree. The final equation is in general of the fourth degree, but we may sometimes dispense with calculating that equation. A graphical construction of the curves, carefully made, will in fact be sufficient to make known, approximately, the co-ordinates of each of the points of intersection; and when we shall have thus obtained an approximate solution, we will often be able to give it all the numerical rigor desirable, by successive approximations, deduced from the equations. These considerations will be extended to the investigation of the real roots of equations of any form whatever with one unknown quantity.

Analytical geometry of three dimensions was formerly entirely taught within the Polytechnic school, none of it being reserved for the course of admission. For some years past, however, candidates were required to know the equations of the right line in space, the equation of the plane, the solution of the problems which relate to it and the transformation of co-ordinates. But the consideration of surfaces of the second order was reserved for the interior teaching. We think it well to place this also among the studies to be mastered before admission, in accordance with the general principle now sought to be realized, of classing with them that double instruction which does not exact a previous knowledge of the differential calculus.

We have not, however, inserted here all the properties of surfaces of the second order, but have retained only those which it is indispensable to know and to retain. The transformation of rectilinear co-ordinates, for example, must be executed with simplicity, and the teacher must restrict himself to giving his pupils a succinct explanation of the course to be pursued; this will suffice to them for the very rare cases in which they may happen to have need of them. No questions will be asked relating to the general considerations, which require very complicated theoretical discussions, and especially that of the general reduction of the equation of the second degree with three variables. We have omitted from the problems relating to the right line and to the plane, the determination of the shortest distance of two right lines.

The properties of surfaces of the second order will be deduced from the equations of those surfaces, taken directly in the simplest forms. Among these properties, we place in the first rank, for their valuable applications, those of the surfaces which can be generated by the movement of a right line.

PROGRAMME OF ANALYTICAL GEOMETRY.

1. GEOMETRY OF TWO DIMENSIONS.

Rectilinear co-ordinates.—Position of a point on a plane.
Representation of geometric loci by equations.
Homogeneity of equations and of formulas.—Construction of algebraic expressions.
Transformation of rectilinear co-ordinates.
Construction of equations of the first degree.—Problems on the right line.
Construction of equations of the second degree.—Division of the curves which they represent into three classes.—Reduction of the equation to its simplest form by the change of co-ordinates.*
Problem of tangents.—The coefficient of inclination of the tangent to the curve, to the axis of the abscissas, is equal to the derivative of the ordinate with respect to the abscissa.

Of the ellipse.
Centre and axes.—The squares of the ordinates perpendicular to one of the axes are to each other as the products of the corresponding segments formed on that axis.
The ordinates perpendicular to the major axis are to the corresponding ordinates of the circle described on that axis as a diameter, in the constant ratio of the minor axis to the major.—Construction of the curve by points, by means of this property.
Foci; eccentricity of the ellipse.—The sum of the radii vectors drawn to any point of the ellipse is constant and equal to the major axis.—Description of the ellipse by means of this property.

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* The students will apply these reductions to a numerical equation of the second degree, and will determine the situation of the new axes with respect to the original axes, by means of trigonometrical tables. They will show to the examiner the complete calculations of this reduction and the trace of the two systems of axes and of the curves.

Directrices.—The distance from each point of the ellipse to one of the foci, and to the directrix adjacent to that focus, are to each other as the eccentricity is to the major axis.

Equations of the tangent and of the normal at any point of the ellipse.*—The point in which the tangent meets one of the axes prolonged is independent of the length of the other axis.—Construction of the tangent at any point of the ellipse by means of this property.

The radii vectores, drawn from the foci to any point of the ellipse, make equal angles with the tangent at that point or the same side of it.—The normal bisects the angle made by the radii vectores with each other.—This property may serve to draw a tangent to the ellipse through a point on the curve, or through a point exterior to it.

The diameters of the ellipse are right lines passing through the centre of the curve.—The chords which a diameter bisects are parallel to the tangent drawn through the extremity of that diameter.—Supplementary chords. By means of them a tangent to the ellipse can be drawn through a given point on that curve or parallel to a given right line.

Conjugate diameters.—Two conjugate diameters are always parallel to supplementary chords, and reciprocally.—Limit of the angle of two conjugate diameters.—An ellipse always contains two equal conjugate diameters.—The sum of the squares of two conjugate diameters is constant.—The area of the parallelogram constructed on two conjugate diameters is constant.—To construct an ellipse, knowing two conjugate diameters and the angle which they make with each other.

Expression of the area of an ellipse in function of its axes.

Of the hyperbola.

Centre and axes.—Ratio of the squares of the ordinates perpendicular to the transverse axes.

Of foci and of directrices; of the tangent and of the normal; of diameters and of supplementary chords.—Properties of these points and of these lines, analogous to those which they possess in the ellipse.

Asymptotes of the hyperbola.—The asymptotes coincide with the diagonals of the parallelogram formed on any two conjugate diameters.—The portions of a secant comprised between the hyperbola and its asymptotes are equal.—Application to the tangent and to its construction.

The rectangle of the parts of a secant, comprised between a point of the curve and the asymptotes, is equal to the square of half of the diameter to which the secant is parallel.

Form of the equation of the hyperbola referred to its asymptotes.

Of the parabola.

Axis of the parabola.—Ratio of the squares of the ordinates perpendicular to the axis.

Focus and directrix of the parabola.—Every point of the curve is equally distant from the focus and from the directrix.—Construction of the parabola.

The parabola may be considered as an ellipse, in which the major axis is indefinitely increased while the distance from one focus to the adjacent summit remains constant.

Equations of the tangent and of the normal.—Sub-tangent and sub-normal. They furnish means of drawing a tangent at any point of the curve.

The tangent makes equal angles with the axis and with the radius vector drawn to the point of contact.—To draw, by means of this property, a tangent to the parabola, 1° through a point on the curve; 2° through an exterior point.

All the diameters of the parabola are right lines parallel to the axis, and reciprocally.—The chords which a diameter bisects are parallel to the tangent drawn at the extremity of that diameter.

Expression of the area of a parabolic segment.

Polar co-ordinates.—To pass from a system of rectilinear and rectangular co-ordinates to a system of polar co-ordinates, and reciprocally.

Polar equations of the three curves of the second order, the pole being situated at a focus, and the angles being reckoned from the axis which passes through that focus.

Summary discussion of some transcendental curves.—Determination of the tangent at one of their points.

Construction of the real roots of equations of any form with one unknown quantity.—Investigation of the intersections of two curves of the second degree.—Numerical applications of these formulas.

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* They will be deduced from the property, previously demonstrated, of the derivative of the ordinate with respect to the abscissa.

2. GEOMETRY OF THREE DIMENSIONS.

The sum of the projections of several consecutive right lines upon an axis is equal to the projection of the resulting line.—The sum of the projections of a right line on three rectangular axes is equal to the square of the right line.—The sum of the squares of the cosines of the angles which a right line makes with three rectangular right lines is equal to unity.

The projection of a plane area on a plane is equal to the product of that area by the cosine of the angle of the two planes.

Representation of a point by its co-ordinates.—Equations of lines and of surfaces.

Transformation of rectilinear co-ordinates.

Of the right line and of the plane.

Equations of the right line.—Equation of the plane.

To find the equations of a right line, 1° which passes through two given points, 2° which passes through a given point and which is parallel to a given line.

To determine the point of intersection of two right lines whose equations are known.

To pass a plane, 1° through three given points; 2° through a given point and parallel to a given plane; 3° through a point and through a given right line.

Knowing the equations of two planes, to find the projections of their intersection.

To find the intersection of a right line and of a plane, their equations being known.

Knowing the co-ordinates of two points, to find their distance.

From a given point to let fall a perpendicular on a plane; to find the foot and the length of that perpendicular (rectangular co-ordinates).

Through a given point to pass a plane perpendicular to a given right line (rectangular co-ordinates).

Through a given point, to pass a perpendicular to a given right line; to determine the foot and the length of that perpendicular (rectangular co-ordinates).

Knowing the equations of a right line, to determine the angles which that line makes with the axes of the co-ordinates (rectangular co-ordinates).

To find the angle of two right lines whose equations are known (rectangular co-ordinates).

Knowing the equation of a plane, to find the angles which it makes with the co-ordinate planes (rectangular co-ordinates).

To determine the angle of two planes (rectangular co-ordinates).

To find the angle of a right line and of a plane (rectangular co-ordinates).

Surfaces of the second degree.

They are divided into two classes; one class having a centre, the other not having any. Co-ordinates of the centre.

Of diametric planes.

Simplification of the general equation of the second degree by the transformation of co-ordinates.

The simplest equations of the ellipsoid, of the hyperboloid of one sheet and of two sheets, of the elliptical and the hyperbolic paraboloid, of cones and of cylinders of the second order.

Nature of the plane sections of surfaces of the second order.—Plane sections of the cone, and of the right cylinder with circular base.—Anti-parallel section of the oblique cone with circular base.

Cone asymptote to an hyperboloid.

Right-lined sections of the hyperboloid of one sheet.—Through each point of a hyperboloid of one sheet two right lines can be drawn, whence result two systems of right-lined generatrices of the hyperboloid.—Two right lines taken in the same system do not meet, and two right lines of different systems always meet.—All the right lines situated on the hyperboloid being transported to the centre, remaining parallel to themselves, coincide with the surface of the asymptote cone.—Three right lines of the same system are never parallel to the same plane.—The hyperboloid of one sheet may be generated by a right line which moves along three fixed right lines, not parallel to the same plane; and, reciprocally, when a right line slides on three fixed lines, not parallel to the same plane, it generates a hyperboloid of one sheet.

Right-lined sections of the hyperbolic paraboloid.—Through each point of the surface of the hyperbolic paraboloid two right lines may be traced, whence results the generation of the paraboloid by two systems of right lines.—Two right lines of the same system do not meet, but two right lines of different systems always meet.—All the right lines of the same system are parallel to the same plane.—The hyperbolic paraboloid may be generated by the movement of a right line which slides on three fixed right lines which are parallel to the same plane; or by a right line which slides on two fixed right lines, itself remaining always parallel to a given plane. Reciprocally, every surface resulting from one of these two modes of generation is a hyperbolic paraboloid.

General equations of conical surfaces and of cylindrical surfaces.

VI. DESCRIPTIVE GEOMETRY.

The general methods of Descriptive Geometry,—their uses in Stone-cutting and Carpentry, in Linear Perspective, and in the determination of the Shadows of bodies,—constitute one of the most fruitful branches of the applications of mathematics. The course has always been given at the Polytechnic School with particular care, according to the plans traced by the illustrious *Monge*, but no part of the subject has heretofore been required for admission. The time given to it in the school, being however complained of on all sides as insufficient for its great extent and important applications, the general methods of Descriptive Geometry will henceforth be retrenched from the internal course, and be required of all candidates for admission.

As to the programme itself, it is needless to say any thing, for it was established by *Monge*, and the extent which he gave to it, as well as the methods which he had created, have thus far been maintained. We merely suppress the construction of the shortest distance between two right lines, which presents a disagreeable and useless complication.

Candidates will have to present to the examiner a collection of their graphical constructions (*épurês*) of all the questions of the programme, signed by their teacher. They are farther required to make free-hand sketches of five of their *épures*.

PROGRAMME OF DESCRIPTIVE GEOMETRY.

*Problems relating to the point, to the straight line, and to the plane.**

Through a point given in space, to pass a right line parallel to a given right line, and to find the length of a part of that right line.

Through a given point, to pass a plane parallel to a given plane.

To construct the plane which passes through three points given in space.

Two planes being given, to find the projections of their intersection.

A right line and a plane being given, to find the projections of the point in which the right line meets the plane.

Through a given point, to pass a perpendicular to a given plane, and to construct the projections of the point of meeting of the right line and of the plane.

Through a given point, to pass a right line perpendicular to a given right line, and to construct the projections of the point of meeting of the two right lines.

A plane being given, to find the angles which it forms with the planes of projection.

Two planes being given, to construct the angle which they form between them.

Two right lines which cut each other being given, to construct the angle which they form between them.

To construct the angle formed by a right line and by a plane given in position in space.

Problems relating to tangent planes.

To draw a plane tangent to a cylindrical surface or to a conical surface, 1° through a point taken on the surface; 2° through a point taken out of the surface; 3° parallel to a given right line.

Through a point taken on a surface of revolution, whose meridian is known, to pass a plane tangent to that surface.

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* The method of the change of the planes of projection will be used for the resolution of these problems.

Problems relating to the intersection of surfaces.

To construct the section made, on the surface of a right and vertical cylinder, by a plane perpendicular to one of the planes of projection.—To draw the tangent to the curve of intersection.—To make the development of the cylindrical surface, and to refer to it the curve of intersection, and also the tangent.

To construct the intersection of a right cone by a plane perpendicular to one of the planes of projection. Development and tangent.

To construct the right section of an oblique cylinder.—To draw the tangent to the curve of intersection. To make the development of the cylindrical surface, and to refer to it the curve which served as its base, and also its tangents.

To construct the intersection of a surface of revolution by a plane, and the tangents to the curve of intersection.—To resolve this question, when the generating line is a right line which does not meet the axis.

To construct the intersection of two cylindrical surfaces, and the tangents to that curve.

To construct the intersection of two oblique cones, and the tangents to that curve.

To construct the intersection of two surfaces of revolution whose axes meet.

VII. OTHER REQUIREMENTS.

The preceding six heads complete the outline of the elementary course of mathematical instruction which it was the object of this article to present; but a few more lines may well be given to a mere enumeration of the other requirements for admission to the school.

Mechanics comes next. The programme is arranged under these heads: Simple motion and compound motion; Inertia; Forces applied to a free material point; Work of forces applied to a movable point; Forces applied to a solid body; Machines.

Physics comprises these topics: General properties of bodies; Hydrostatics and hydraulics; Densities of solids and liquids; Properties of gases; Heat; Steam; Electricity; Magnetism; Acoustics; Light.

Chemistry treats of Oxygen; Hydrogen; Combinations of hydrogen with oxygen; Azote or nitrogen; Combinations of azote with oxygen; Combination of azote with hydrogen, or ammonia; Sulphur; Chlorine; Phosphorus; Carbon.

Cosmography describes the Stars; the Earth; the Sun; the Moon; the Planets; Comets; the Tides.

History and Geography treat of Europe from the Roman Empire to the accession of Louis XVI.

German must be known sufficiently for it to be translated, spoken a little, and written in its own characters.

Drawing, besides the *épures* of descriptive geometry, must have been acquired sufficiently for copying an academic study, and shading in pencil and in India ink.

Will not our readers agree with M. Coriolis, that "*There are very few learned mathematicians who could answer perfectly well at an examination for admission to the Polytechnic School*"?

SCHOOLS OF PREPARATION FOR THE POLYTECHNIC SCHOOL.

There are strictly speaking no Junior Military Schools preparatory to the Polytechnic School, or to the Special Military School at St. Cyr. These schools are recruited in general from the *Lycées* and other schools for secondary instruction, upon which they exert a most powerful influence. Until 1852 there was no special provision made in the courses of instruction in the *Lycées* for the mathematical preparation required for admission into the Polytechnic, and the Bachelor's degree in science could not be obtained without being able to meet the requirements in Latin, rhetoric, and logic for graduation in the arts, which was necessary to the profession of law, medicine, and theology. In consequence, young men who prepared to be candidates for the preliminary examinations at the Polytechnic and the St. Cyr, left the *Lycées* before graduation in order to acquire more geometry and less literature in the private schools, or under private tuition.

A new arrangement, popularly called the *Bifurcation*, was introduced by the Decrees of the 10th of April, 1852; and has now come into operation. The conditions demanded for the degree in science were adapted to the requirements of the Military Schools; and in return for this concession it is henceforth to be exacted from candidates for the Military Schools. The diploma of arts is no longer required before the diploma of science can be given. The instruction, which in the upper classes of the *Lycées* had hitherto been mainly preparatory for the former, takes henceforth at a certain point (called that of *Bifurcation*) two different routes, conducting separately, the one to the baccalaureate of arts, the other to that of science. The whole system of teaching has accordingly been altered. Boys wanting to study algebra are no longer carried through a long course of Latin; mathematics are raised to an equality with literature; and thus military pupils—pupils desirous of admission at the Polytechnic and St. Cyr, may henceforth, it is hoped, obtain in the *Lycées* all the preparation which they had latterly sought elsewhere.

Under this new system the usual course for a boy seems to be the following:—

He enters the *Lycée*, in the Elementary Classes; or, a little later, in the Grammar Classes, where he learns Latin and begins Greek. At the age of about fourteen, he is called upon to pass an examination for admission into the Upper Division, and here, in accordance with the new regulations, he makes his choice for mathematics or for literature, the studies henceforth being divided, one course leading to the bachelorship of science, the other to that of arts.

In either case he has before him three yearly courses, three classes—the Third, the Second, and what is called the Rhetoric. At the close of this, or after passing, if he pleases, another year in what is called the Logic, he may go up for his bachelor's degree. The boy who wants to go to St. Cyr or the Polytechnic chooses, of course, the mathematical division leading to the diploma he will want, that of a bachelor of *science.* He accordingly begins algebra, goes on to trigonometry, to conic sections, and to mechanics, and through corresponding stages in natural philosophy, and the like. If he chooses to spend a fourth year in the Logic, he will be chiefly employed in going over his subjects again. He may take his bachelor's degree at any time after finishing his third year; and he may, if he pleases, having taken that, remain during a fifth or even a sixth year, in the class of Special Mathematics.

If he be intended for St. Cyr, he may very well leave at the end of his year in Rhetoric, taking of course his degree. One year in the course of Special Mathematics will be required before he can have a chance for the Polytechnic. Usually the number of students admitted at the latter, who have not passed more than one year in the *mathematiques spéciales* is very small. Very probably the young aspirant would try at the end of his first year in this class, and would learn by practice to do better at the end of the second.

The following are the studies of the mathematical section of the upper division as laid down by the ordinance of 30th August, 1854.

THE THIRD CLASS (*Troisième*,) at fourteen years old.

Arithmetic and first notions of Algebra. Plane Geometry and its applications. First notions of Chemistry and Physics. General notions of Natural History; Principles of classification. Linear and imitative Drawing.

THE SECOND CLASS (*Seconde*,) at fifteen years old.

Algebra; Geometry, figures in space, recapitulation; Applications of Geometry, notions of the geometrical representations of bodies by projections; Rectilineal Trigonometry; Chemistry; Physics; and Drawing.

THE RHETORIC, at sixteen years old.

Exercises in Arithmetic and Algebra; Geometry; notions on some common curves; and general recapitulation; Applications of Geometry; notions of leveling and its processes; recapitulation of Trigonometry; Cosmography; Mechanics; Chemistry concluded and reviewed; Zoölogy and Animal Physiology; Botany and Vegetable Physiology; Geology; Drawing. (The pupil may now be ready for the Degree and for St. Cyr.)

THE LOGIC, at seventeen years old.

Six lessons a week are employed in preparation for the bachelorship of science, and in a methodical recapitulation of the courses of the three preceding years according to the state of the pupil's knowledge.

Two lessons a week are allowed for reviewing the literary instruction; evening lessons in Latin, French, English, and German, and in History and Geography, having been given through the whole previous time.

THE SPECIAL MATHEMATICS, at eighteen and nineteen years old.

Five lessons a week are devoted to these studies; in the other lessons the pupils join those of the Logic class for reviewing all their previous subjects, whether for the bachelorship in science or for competition for admission at the *Ecole Normale* or the Polytechnic.

It will only be necessary to add a few sentences in explanation of the methods pursued in the upper classes of the *Lycées*. The classes are large—from 80 to above 100; the lessons strictly professorial lectures, with occasional questions, as at the Polytechnic itself. In large establishments the class is divided, and two professors are employed, giving two parallel courses on the same subject. To correct and fortify this general teaching, we find, corresponding to the interrogations of the Polytechnic, what are here called conferences. The members of the large class are examined first of all in small detachments of five or six by their own professors once a week; and, secondly, a matter of yet greater importance, by the professor who is conducting the parallel course, and by professors who are engaged for this purpose from other *Lycées* and preparatory schools, and from among the *répétiteurs* of the Polytechnic and the Ecole Normale themselves. It appeared by the table of the examinations of this latter kind which had been passed by the pupils of the class of Special Mathematics at the *Lycée* St. Louis, that the first pupil on the list had in the interval between the opening of the school and the date of our visit (February 16th) gone through as many as twenty-four.

The assistants, who bear the name of *répétiteurs* at the *Lycées*, do not correspond in any sense to those whom we shall hereafter notice at the Ecole Polytechnique. They are in the *Lycées* mere superintendents in the *salles d'étude*, who attend to order and discipline, who give some slight occasional help to the pupils, and may be employed in certain cases, where the parents wish for it, in giving private tuition to the less proficient. The system of *salles d'étude* appears to prevail universally; the number of the pupils placed in each probably varying greatly. At the Polytechnic we found eight or ten pupils in each; at St. Cyr as many as 200. The number considered most desirable at the *Lycée* of St. Louis was stated to be thirty.

It thus appears that in France not only do private establishments succeed in giving preparation for the military schools, but that even in the first-class public schools, which educate for the learned professions, it has been considered possible to conduct a series of military or science classes by the side of the usual literary or arts classes. The common upper schools are not, as they used to be, and as with us they are, *Grammar* schools, they are also *Science* schools. In every *Lycée* there is, so to say, a sort of elementary polytechnic department, giving a kind of instruction which will be useful to the future soldier, and at the same time to others, to those who may have to do with mines, manufactures, or any description of civil engineering. There is thus no occasion for Junior Military Schools in France, for all the schools of this class are more or less of a military character in their studies.

The conditions of admission to the examination for the degree of Bachelor of Science are simply, sixteen years of age, and the payment of fees amounting to about 200 fr. (10*l.*) Examinations are held three times a year by the Faculties at Paris, Besançon, Bordeaux, Caen, Clermont, Dijon, Grenoble, Lille, Lyons, Marseilles, Montpellier, Nancy, Poitiers, Rennes, Strasburg, and Toulouse, and once a year at Ajaccio, Algiers, and nineteen other towns. There is a written examination of six hours, and a vivâ voce examination of an hour and a quarter. It is, of course, only a *pass* examination, and is said to be much less difficult than the competitive examination for admission to St. Cyr.—*Report of English Commissioners*, 1856.

THE POLYTECHNIC SCHOOL OF FRANCE.

CONTENTS.

THE POLYTECHNIC SCHOOL AT PARIS.*

I. FOUNDATION AND HISTORY.

The origin of the *Ecole Polytechnique* dates from a period of disorder and distress in the history of France which might seem alien to all intellectual pursuits, if we did not remember that the general stimulus of a revolutionary period often acts powerfully upon thought and education. It is, perhaps, even more than the Institute, the chief scientic creation of the first French Revolution. It was during the government of the committee of public safety, when Carnot, as war minister, was gradually driving back the invading armies, and reorganizing victory out of defeat and confusion, that the first steps were taken for its establishment. A law, dating the 1st Ventose, year II., the 12th of March 1794, created a "Commission des Travaux Publics," charged with the duty of establishing a regular system for carrying on public works; and this commission ultimately founded a central school for public works, and drew up a plan for the competitive examination of candidates for admission to the service. It was intended at first to give a complete education for some of the public services, but it was soon changed into a preparatory school, to be succeeded by special schools of application. This was the Ecole Polytechnique.

The school and its plan were both owing to an immediate and pressing want. It was to be partly military and partly civil. Military, as well as civil education had been destroyed by the revolutionists. The committee of public safety had, indeed, formed a provisional school for engineers at Metz, to supply the immediate wants of the army on the frontier, and at this school young men were hastily taught the elements of fortification, and were sent direct to the troops, to learn as they best could, the practice of their art. "But such a method," says the report accompanying the law which founded the school, "does not form engineers *in any true sense of the term*, and can only be justified by the emergency of the

* Compiled from "*Report and Appendix of English Commissioners on Military Education.*" 1857.

time. The young men should be recalled to the new school to complete their studies." Indeed no one knew better than Carnot, to use the language of the report, "that patriotism and courage can not "always supply the want of knowledge;" and in the critical campaigns of 1793—4, he must often have felt the need of the institution which he was then contributing to set on foot. Such was the immediate motive for the creation of this school. At first, it only included the engineers amongst its pupils. But the artillery were added within a year.

We must not, however, omit to notice its civil character, the combination of which with its military object forms its peculiar feature, and has greatly contributed to its reputation. Amongst its founders were men, who though ardent revolutionists, were thirsting for the restoration of schools and learning, which for a time had been totally extinguished. The chief of these, besides Carnot, were Monge and Fourcroy, Berthollet and Lagrange. Of Carnot and Lagrange, one amongst the first of war ministers, the other one of the greatest of mathematicians, we need not say more. Berthollet, a man of science and practical skill, first suggested the school; Monge, the founder of Descriptive Geometry, a favorite *savant* of Napoleon though a zealous republican, united to real genius that passion for teaching and for his pupils, which makes the *beau idéal* of the founder of a school; and Fourcroy was a man of equal practical tact and science, who at the time had great influence with the convention, and was afterwards intrusted by Napoleon with much of the reorganization of education in France.

When the school first started there was scarcely another of any description in the country. For nearly three years the revolution had destroyed every kind of teaching. The attack upon the old schools, in France, as elsewhere, chiefly in the hands of the clergy, had been begun by a famous report of Talleyrand's, presented to the legislative assembly in 1791, which recommended to suppress all the existing academies within Paris and the provinces, and to replace them by an entirely new system of national education through the country. In this plan a considerable number of military schools were proposed, where boys were to be educated from a very early age. When the violent revolutionists were in power, they adopted the destructive part of Talleyrand's suggestions without the other. All schools, from the university downwards, were destroyed; the large exhibitions or *Bourses*, numbering nearly 40,000, were confiscated or plundered by individuals, and even the military schools and those for the public works (which were absolutely necessary for the very roads and the defense of the country) were suppressed or disorganized. The school of engineers at Mézières (an excellent one, where Monge had been a professor,) and that of the artillery at La Fère, were both broken up, whilst the murder of Lavoisier, and the well known saying in respect to it, that "the Republic had no need of chemists," gave currency to a belief, which Fourcroy expressed in proposing the Polytechnic, "that the late conspirators had formed a deliberate plan to destroy the arts and sciences, and to establish their tyranny on the ruins of human reason."

Thus it was on the ruin of all the old teaching, that the new institution was erected; a truly *revolutionary* school, as its founders delighted to call it, using the term as it was then commonly used, as a synonym for all that was excellent. And then for the first time avowing the principle of public competition, its founders, Monge and Fourcroy, began their work with an energy and enthusiasm which they seem to have left as a traditional inheritance to their school. It is curious to see the difficulties which the bankruptcy of the country threw in their way, and the vigor with which, assisted by the summary powers of the republican government, they overcame them. They begged the old Palais Bourbon for their building; were supplied with pictures from the Louvre; the fortunate capture of an English ship gave them some uncut diamonds for their first experiments; presents of military instruments were sent from the arsenals of Havre; and even the hospitals contributed some chemical substances In fine, having set their school in motion, the government and its professors worked at it with such zeal and effect, that within five months after their project was announced, they had held their first entrance examination, open to the competition of all France, and started with three hundred and seventy-nine pupils.

The account of one of these first pupils, who is among the most distinguished still surviving ornaments of the Polytechnic, will convey a far better idea of the spirit of the young institution than could be given by a more lengthy description. M. Biot described to us vividly the zeal of the earliest teachers, and the thirst for knowledge which, repressed for awhile by the horrors of the period, burst forth with fresh ardor amongst the French youth of the time. Many of them, he said, like himself, had been carried away by the enthusiasm of the revolution, and had entered the army. "My father had sent me," he added, "to a mercantile house, and indeed I never felt any great vocation to be a soldier, but *Que voulez vous?*

les Prussiens etaient en Champagne." He joined the army, served two years under Dumouriez, and returned to Paris in the reign of terror, " to see from his lodgings in the Rue St. Honore the very generals who had led us to victory, Custine and Biron, carried by in the carts to the guillotine. " Imagine what it was when we heard that Robespierre was dead, and that we might return safely to study after all this misery, and then to have for our teachers La Place, Lagrange, and Monge. We felt like men brought to life again after suffocation. Lagrange said, modestly, "Let me teach them arithmetic." Monge was more like our father than our teacher; he would come to us in the evening, and assist us in our work till midnight, and when he explained a difficulty to one of our *chefs de brigade*, it ran like an electric spark through the party." The pupils were not then, he told us, as they have since been, shut up in barracks, they were left free, but there was no idleness or dissipation amongst them. They were united in zealous work and in good *camaraderie*, and any one known as a bad character was avoided. This account may be a little tinged by enthusiastic recollections, but it agreed almost entirely with that of M. de Barante, who bore similar testimony to the early devotion of the pupils, and the unique excellence of the teaching of Monge.

We are not, however, writing a history of this school, and must confine ourselves to such points as directly illustrate its system of teaching and its organization. These may be roughly enumerated in the following order:

1. Its early history is completed by the law of its organization, given it by La Place in his short ministry of the interior. This occurred in the last month of 1799, a memorable era in French history, for it was immediately after the revolution of the 18th of Brumaire, when Napoleon overthrew the Directory and made himself First Consul. One of his earliest acts was to sign the charter of his great civil and military school. This charter or decree deserves some attention, because it is always referred to as the law of the foundation of the school. It determined the composition of the two councils of instruction and improvement, the bodies to which the direction of the school was to be, and still is, intrusted; some of its marked peculiarities in the mode and subject of teaching. It is important to notice each of the two points.

The direction of the school was at first almost entirely in the hands of its professors, who formed what is still called its Council of Instruction. Each of them presided over the school alternately for one month, a plan copied from the revolutionary government of the Convention. In the course of a few years, however, another body was added, which has now the real management of the school. This is called the "Council of Improvement" (*Conseil de perfectionnement*,) and a part of its business is to see that the studies form a good preparation for those of the more special schools (*écoles d'application*) for the civil and military service. It consists of eminent men belonging to the various public departments supplied by the school, and some of the professors. It has had, as far as we could judge, an useful influence; *first*, as a body not liable to be prejudiced in its proposals by the feelings of the school, and yet interested in its welfare and understanding it; *secondly*, as having shown much skill in the difficult task of making the theoretical teaching of the Polytechnic a good introduction to the practical studies of the public service; *thirdly*, as being sufficiently influential, from the character of its members, to shield the school from occasional ill-judged interference. It should be added that hardly any year has passed without the Council making a full report on the studies of the school, with particular reference to their bearing on the Special Schools of Application.

The method of scientific teaching has been peculiar from the beginning. It is the most energetic form of what may be called the *repetitorial* system, a method of teaching almost peculiar to France, and which may be described as a very able combination of professional and tutorial teaching. The object of the *répétiteur*, or private tutor, is to second every lecture of the professor, to explain and fix it by ocular demonstration, explanations, or examination. This was a peculiarity in the scheme of Monge and Fourcroy. The latter said, in the first programme, "Our pupils must not only learn, they must at once carry out their theory. We must distribute them into small rooms, where they shall practice the plans of descriptive geometry, which the professors have just shown them in their public lectures. And in the same manner they must go over in practice (*répéteront*) in separate laboratories the principal operations of chemistry." To carry out this system the twenty best pupils, of whom M. Biot was one, were selected as *répétiteurs* soon after the school had started. Since then the vacancies have always been filled by young but competent men, aspiring themselves to become in turn professors. They form a class of teachers more like the highest style of private tutors in our universities, or what are called in Germany *Privat-docenten*, than any other body—with this difference, that they do not give their own lectures, but breaking up the professor's large class into small classes of five and six pupils, examine these in *his* lecture. The success of this attempt we shall describe hereafter.

2. A change may be noticed which was effected very early by the Council of Improvement—the union of pupils for artillery and engineers in a single school of application. The first report in December 1800, speaks of the identity in extent and character of the studies required for these two services; and in conformity with its recommendation, the law of the 3rd of October 1802, (12th Vendémiaire, XI.) dissolved the separate artillery school at Châlons, and established the united school for both arms in the form which it still retains at Metz.

3. In 1805 a curious change was made, and one very characteristic of the school. The pupils have always been somewhat turbulent, and generally on the side of opposition. In the earliest times they were constantly charged with *incivisme*, and the aristocracy was said to have "taken refuge within its walls." In fact, one of its earliest and of its few great *literary* pupils, M. de Barante, confirmed this statement, adding, as a reason, that the school gave for a while the only good instruction in France. It was in consequence of some of these changes that the pupils who had hitherto lived in their own private houses or lodgings in Paris, were collected in the school building. This "*casernement*," said to be immediately owing to a burst of anger of Napoleon, naturally tended to give the school a more military character; but it was regarded as an unfortunate change by its chief scientific friends. "*Ah! ma pauvre école!*" M. Biot told us he had exclaimed, when he saw their knapsacks on their beds. He felt, he said, that the enthusiasm of free study was gone, and that now they would chiefly work by routine and compulsion.

4. The year 1809 may be called the epoch at which the school attained its final character. By this time the functions, both of boards and teachers, were accurately fixed, some alterations in the studies had taken place, and the plan of a final examination had been drawn up, according to which the pupils were to obtain their choice of the branch of the public service they preferred. In fact, the school may be said to have preserved ever since the form it then assumed, under a variety of governments and through various revolutions, in most of which, indeed, its pupils have borne some share; and one of which, the restoration of 1816, was attended with its temporary dissolution.

Thus, during the first years after its foundation the Polytechnic grew and flourished in the general dearth of public teaching, being indeed not merely the only great school, but, until the Institute was founded, the only scientific body in France. Working on its first idea of high professorial lectures, practically applied and explained by *répétiteurs*, its success in its own purely scientific line was, and has continued to be, astonishing. Out of its sixteen earliest professors, ten still retain an European name. Lagrange, Monge, Fourcroy, La Place, Guyton de Morveau were connected with it. Malus, Hauy, Biot, Poisson, and De Barante, were among its earliest pupils. Arago, Cauchy, Cavaignac, Lamoricière, with many more modern names, came later. All the great engineers and artillerymen of the empire belonged to it, and the long pages in its calendar of distinguished men are the measure of its influence on the civil and military services of France. In fact its pupils, at a time of enormous demands, supplied all the scientific offices of the army, and directed all the chief public works, fortresses, arsenals, the improvement of cities, the great lines of roads, shipbuilding, mining—carried out, in a word, most of the great improvements of Napoleon. He knew the value of his school, "the hen" as he called it, "that laid him golden eggs"—and perhaps its young pupils were not improved by the excessive official patronage bestowed by him upon "the envy of Europe," "the first school in the world." It can not, however, be matter of surprise, that its vigor and success should have caused Frenchmen, even those who criticise its influence severely, to regard it with pride as an institution unrivaled for scientific purposes.

It is not necessary to give any detailed account of the later history of the school, but we must remark that disputes have frequently arisen with regard to the best mode of harmonizing its teaching with that of the special schools of application to which it conducts. These disputes have been no doubt increased by the union of a civil and military object in the same school. The scientific teaching desirable for some of the higher civil professions has appeared of doubtful advantage to those destined for the more practical work of war. There has been always a desire on the one side to qualify pure mathematics by application, a strong feeling on the other that mathematical study sharpens the mind most keenly for some of the practical pursuits of after life. We should add, perhaps, that there has been some protest in France (though little heard among the scientific men who have been the chief directors of the school) against the *esprit faux*, the exclusive pursuit of mathematics to the utter neglect of literature, and the indifference to moral and historical studies. Some one or other of these complaints any one who studies the *literature*, the pamphlets, and history of the school will find often reproduced in the letters of war ministers, of artillery and engineer officers commanding the school of application at Metz, or of committees from the similar schools for the mines and the roads and bridges. The last of these occasions illustrates the present position of the school.

On the 5th of June 1850, the legislative assembly appointed a mixed commission of military men and civilians, who were charged to revise all the programs of instruction, and to recommend all needful changes in the studies of the pupils, both those preparatory to entrance* and those actually pursued in the school. The commission was composed as follows :—

M. Thenard, Member of the Academy of Sciences, and of the Board of Improvement of the Polytechnic School, President.

Le Verrier, Member of the Academy of Sciences and of the Legislative Assembly, Reporter.

Noizet, General of Brigade of Engineers.

Poncelet, General of Brigade of Engineers, Commandant of the Polytechnic School, Member of the Academy of Sciences.

Piobert, General of Brigade of Artillery, Member of the Academy of Sciences.

Mathieu, Rear Admiral.

Duhamel, Member of the Academy of Sciences, Director of Studies at the Polytechnic School.

Mary, Divisional Inspector of Roads and Bridges.

Morin, Colonel of Artillery, Member of the Academy of Sciences.

Regnault, Engineer of Mines, Member of the Academy of Sciences.

Olivier, Professor at the *Conservatoire des Arts et Metiers.*

Debacq, Secretary for Military Schools at the Ministry of War, Secretary.

A chronic dispute which has gone on from the very first year of the school's existence, between the exclusive study of abstract mathematics on the one hand, and their early practical application on the other, was brought to a head (though it has scarcely been set at rest) by this commission. All the alterations effected have been in the direction of eliminating a portion of the pure mathematics, and of reducing abstract study to the limits within which it was believed to be most directly applicable to practice. The results, however, are still a subject of vehement dispute, in which most of the old scientific pupils of the Polytechnic, and many of what may be styled its most practical members, the officers of the artillery and engineers, are ranged on the side of "early and deep scientific study *versus* early practical applications." It is, indeed, a question which touches the military pupils nearly, since it is in their case particularly that the proposed abstract studies of the Polytechnic might be thought of the most doubtful advantage. We do not try to solve the problem here, though the facts elsewhere stated will afford some materials for judgment. We incline to the opin-

* In an Analysis of the Report of this Commission, see page 97.

ion of those who think that the ancient *genius loci*, the traditional teaching of the school, will be too strong for legislative interference, and that, in spite of recent enactments, abstract science and analysis will reign in the lecture-rooms and halls of study of the Polytechnic, now as in the days of Monge.

II. AN OUTLINE OF THE MANAGEMENT AND OF THE ESTABLISHMENT OF THE SCHOOL, ETC.

The Polytechnic, as we have said, is a preparatory and general scientific school; its studies are not exclusively adapted for any one of the departments to which at the close of its course the scholars will find themselves assigned; and on quitting it they have, before entering on the actual discharge of their duties of whatever kind, to pass through a further term of teaching in some one of the schools of application specially devoted to particular professions.

The public services for which it thus gives a general preparation are the following:

Military: Under the Minister at War.

Artillery (*Artillerie de terre.*)
Engineers (*Génie.*)
The Staff Corps (*Corps d'Etat Major.*)
The Department of Powder and Saltpetre (*Poudres et Salpêtres.*)

Under the Minister of Marine.

Navy, (*Marine.*)
Marine Artillery (*Artillerie de mer.*)
Naval Architects (*Génie maritime.*)
The Hydrographical Department (*Corps des Ingénieurs Hydrographes.*)

Civil: Under the Minister of Public Works.

The Department of Roads and Bridges (*Ponts-et-chaussées.*)
The Department of Mines (*Mines.*)

Under the Minister of the Interior.

The Telegraph Department (*Lignes Télégraphiques.*)

Under the minister of Finance.

The Tobacco Department (*Administration des Tabacs.*)

To these may be added at any time, by a decree on the part of the government, any other departments, the duties of which appear to require an extensive knowledge of mathematics, physics, or chemistry.

Admission to the school is, and has been since its first commencement in 1794, obtained by competition in a general examination, held yearly, and open to all. Every French youth, between the age of sixteen and twenty, (or if in the army up to the age of twenty-five,) may offer himself as a candidate.

A board of examiners passes through France once every year, and examines all who present themselves, that have complied with the conditions, which are fully detailed in the decree given in the appendix. It commences at Paris.

A list of such of the candidates as are found eligible for admittance to the Polytechnic is drawn up from the proceedings of the board, and submitted to the minister at war; the number of places likely to be vacant has already been determined, and the minister fixes the number of admissions accordingly. The candidates admitted are invariably taken in the order of merit.

The annual charge for board and instruction is 40*l.* (1,000 fr.,) payable in advance in four installments. In addition there is the cost of outfit, varying from 20*l.* to 24*l.* Exhibitions, however, for the discharge of the whole or of one-half of the expense (*bourses* and *demi-bourses*,) are awarded by the state in favor of *all* the successful candidates, whose parents can prove themselves to be too poor to maintain their children in the school. Outfits and half outfits (*trousseaux*) and *demi-trousseaux*) are also granted in these cases, on the entrance of the student into the school; and the number of these *boursiers* and *demi-boursiers* amounts at the present time to one-third of the whole.

The course of study is completed in two years. On its successful termination which is preceded by a final examination, the students are distributed into the different services, the choice being offered them in the order of their merit, and laid down in the classified list drawn up after the examination. If it so happen that the number of places or the services which can be offered is not sufficient for the number of qualified students, those at the bottom of the list are offered service in the infantry or cavalry, and those who do not enter the public service, are supplied with certificates of having passed successfully through the school. Students who have been admitted into the school from the army, are abliged to re-enter the army.

All others, as has been said, have the right of choosing, according to their position on the list, the service which they prefer, so far, that is, as the number of vacancies in that service will allow; or they may if they please decline to enter the public service at all.

Such is a general outline of the plan and object of the school. We may add that, besides its military staff, it employs no less than thirty-nine professors and teachers; that it has four boards of management, and that ten scientific men unconnected with the school, and amongst the most distinguished in France, conduct its examinations. The magnitude of this establishment for teaching may be estimated by the fact, that the number of pupils rarely exceeds three hundred and fifty, and is often much less.

A fuller enumeration of these bodies will complete our present sketch.

I. The military establishment consists of:—

The Commandant, a General Officer, usually of the Artillery or the Engineers, at present a General of Artillery.

A Second in Command, a Colonel or Lieutenant-Colonel, chosen from former pupils of school; at present a Colonel of Engineers.

Three Captains of Artillery and Three Captains of Engineers, as Inspectors of Studies, chosen also from former pupils of the school.

Six Adjutants (*adjoints*,) non-commissioned officers, usually such as have been recommended for promotion.

II. The civil establishment consists of:—

1. A Director of Studies, who has generally been a civilian, but is at present a Lieutenant-Colonel of Engineers.

2. Fifteen Professors, viz.:—Two of Mathematical Analysis. Two of Mechanics and Machinery. One of Descriptive Geometry. Two of Physics. Two of Chemistry. One of Military Art and Fortification. One of Geodesy. One of Architecture. One of French Composition. One of German. One of Drawing. Of these one is an officer of the Staff, another of the Artillery, and a third of the Navy; two are Engineers in Chief of the Roads and Bridges; nine are civilians, of whom two are Members of the Academy of Sciences.

3. Three Drawing Masters for Landscape and Figure Drawing; one for Machine Drawing, and one for Topographical Drawing.

4. Nineteen Assistant and Extra Assistant Teachers, (*répétiteurs* and *répétiteurs adjoints*) whose name and functions are both peculiar.

5. Five Examiners for Admission, consisting at present of one Colonel of Artillery, as President, and four civilians.

6. Five Examiners of Students (civilians,) four of them belonging to the Academy of Sciences.

7. There is also a separate Department for the ordinary Management of Administration of the affairs of the school, the charge of the fabric and of the library and museums; and a Medical Staff.

III. The general control or supervision of the school is vested, under the war department, in four great boards of councils, viz.:—

1. A board of administration, composed of the commandant, the second in command, the director of studies, two professors, two captains, and two members of the administrative staff. This board has the superintendence of all the financial business and all the minutiæ of the internal administration of the school.

2. A board of discipline, consisting of the second in command, the director, two professors, three captains (of the school,) and two captains of the army, chosen from former pupils. The duty of this board is to decide upon cases of misconduct.

3. A board of instruction, whose members are, the commandant, the second in command, the director, the examiners of students, and the professors; and whose chief duty is to make recommendations relating to ameliorations in the studies, the programmes of admission and of instruction in the school, to—

4. A board of improvement, charged with the general control of the studies, formed of—

The Commandant, as President.
The Second in Command.
The Director of Studies.
Two Delegates from the Department of Public Works.
One Delegate from the Naval Department.
One Delegate from the Home Department.
Three Delegates from the War Department.
Two Delegates from the Academy of Sciences.
Two Examiners of Students.
Three Professors of the School.

III. CONDITIONS AND EXAMINATIONS FOR ADMISSION.

The entrance examination is held yearly in August; the most important conditions for admission to it are always inserted in the *Moniteur* early in the year, and are—

1st. All candidates must be bachelors of science.

2nd. All candidates (unless they have served in the army) must have been as much as sixteen and not more than twenty years old on the 1st of January preceding.

3rd. Privates and non-commissioned officers of the army must be above twenty and under twenty-five years of age; must have served two years, and have certificates of good conduct.

4th. Candidates who propose to claim pecuniary assistance (a *bourse* or *demi-bourse*) must present formal proofs of their need of it.

The subjects of the entrance examination are the following:—

Arithmetic, including Vulgar and Decimal Fractions, Weights and Measures, Involution and Evolution; Simple Interest.

Geometry of Planes and Solids; application of Geometry to Surveying; Properties of Spherical Triangles.

Algebra, including Quadratic Equations with one unknown quantity, Series and Progressions in general; Binomial Theorem and its applications; Logarithms and their use; on Derived Functions; on the Theory of Equations; on Differences; application of the Theory of Differences to the Numerical Solution of Equations.

Plane and Spherical Trigonometry; Solution of Triangles; application of Trigonometry to Surveying.

Analytical Geometry, including Geometry of two dimensions; Co-ordinates; Equations of the first and second degree, with two variables; Tangents and Asymptotes; on the Ellipse, Hyperbola, and Parabola; Polar Co-ordinates; Curved Lines in general.

Geometry of three dimensions, including the Theory of Projections; Co-ordinates; the Right Line and Plane; Surfaces of the second degree; Conical and Cylindrical Surfaces.

Descriptive Geometry; Problems relative to a Point, Right Line and Plane; Tangent Planes; Intersection of Surfaces.

Mechanics; on the Movement of a Point considered geometrically; on the Effect of Forces applied to points and bodies at rest and moving; on the Mechanical Powers.

Natural Philosophy, including the Equilibrium of Liquids and Gasses; Heat;

Electricity; Magnetism; Galvanism; Electro-magnetism and Light; Cosmography.

Chemistry, the Elements; *French; German; Drawing*, and (optionally) *Latin.*

This examination is partly written and partly oral. It is not public, but conducted in the following manner:—

Five examiners are appointed by the minister of war to examine the candidates at Paris, and at the several towns named for the purpose throughout France.

Two of these examiners conduct what may be called a preliminary examination (*du premier degré*,) and the other three a second examination (*du second degré.*) The preliminary examiners precede by a few days in their journey through France those who conduct the second examination. The written compositions come before either.

The preliminary examination (*du premier degré*) is made solely for the purpose of ascertaining whether the candidates possess sufficient knowledge to warrant their being admitted to the second examination; and the second examination serves, in conjunction with the written compositions, for their classification in the order of merit.

Prior to the examination, each candidate is called upon to give in certain written sheets containing calculations, sketches, plans and drawings, executed by him at school during the year, certified and dated by the professor under whom he has studied. Care is taken to ascertain whether these are the pupils' own work, and any deception in this matter, if discovered, excludes at once from the competition of the school.

This done, the candidates are required to reply in writing to written or printed questions, and to write out French and German exercises; great care being taken to prevent copying. This written examination occupies about twenty-four hours during three and a half separate days, as shown in the following table. It usually takes place in the presence of certain official authorities, the examiners not being present.

First Sitting.	Hours.	*Second Sitting.*	Hours.
Arithmetic, - - - -	1	Algebra, - - - -	1
Geometry, - - - -	1	History, geography, and French, - - -	3
Latin, - - - - -	1		
	3		4
Third Sitting.		*Fourth Sitting.*	
Descriptive geometry, and diagram, or sketch, - -	4	Mechanics, - - - -	1
		Physics, chemistry, and cosmography, - - -	2
			3

Fifth Sitting.	Hours.	*Sixth Sitting.*	Hours.
Applied analysis, - - -	$1\frac{1}{2}$	Solution of a triangle by logarithms, - - - -	3
German exercise, - -	$1\frac{1}{2}$		
	3		

Seventh Sitting.

Drawing, - - - -	4 hours.
Total, - - - - -	24 hours.

Next, each candidate is examined orally for three-quarters of an hour, on two successive days, by each of the two examiners separately, and each examiner makes a note of the admissibility or non-admissibility of the candidate.

At the close of this oral examination, the notes relating to the various candidates are compared, and if the examiners differ as to the admissibility of any candidate, he is recalled, further orally examined, and his written exercises carefully referred to, both examiners being present. A final decision is then made.

The preliminary examiners then supply the others with a list of the candidates who are entitled to be admitted to the second oral examination. On this occasion each candidate is separately examined for one hour and a half by each examiner, but care is taken that in all the principal subjects of study the candidate is examined by at least two out of the three examiners.

Each examiner records his opinion of the merits of every candidate in replying, orally and in writing, by awarding him a credit varying between 0 and 20, the highest number indicating a very superior result.

This scale of merit is employed to express the value of the oral replies, written answers, or drawings. It has the following signification, and appears to be generally in use in the French military schools:—

20	denotes perfect.	8, 7, 6	denotes bad.
19, 18	" very good.	5, 4, 3	" very bad.
17, 16, 15	" good.	2, 1	" almost nothing.
14, 13, 12	" passable.	0	" nothing.
11, 10, 9	" middling		

Considerable latitude is granted to the examiner engaged in deciding upon the amount of credit to be allowed to the student, for the manner in which he replies to the various questions. He is expected to bear in mind the temperament of the candidate, his confidence or timidity, as well as the difficulty of the questions, when judging of the quality of the reply, more value being given for an imperfect answer to a difficult question than for a more perfect reply to an easy one.

The reports of the examiners, together with the various documents belonging to each candidate, are sent from each town to the minister at war, who transmits them to the commandant of the Polytechnic School to make out a classified list.

Very different value of course is attached to the importance of some of the subjects, when compared with others; and the measure of the importance is represented in French examinations by what are termed *co-efficients of influence*, varying for the several subjects of study and kind of examination. The particular co-efficients of influence for each subject in these written and oral examinations, are as follows:—

		Co-efficients of Influence.
Oral examination—analytical mathematics,	20	52
" " geometrical ditto,	14	
" " physics and mechanics,	16	
" " German language,	2	
Written compositions on mathematical subjects,	5	34
" " descriptive geometry, drawing, and description,	5	
" " logarithmic calculations of a triangle,	2	
" " mechanics,	2	
" " physics or chemistry,	4	
German exercise,	1	
French composition,	5	
Latin translation,	5	
Copy of a drawing,	5	
Total,		86

In order to make out the above mentioned classified list, the respective credits awarded by the examiners to each candidate are multiplied by the co-efficients representing the weight or importance attached to each subject; and the sum of their products furnishes a numerical result, representing the degree of merit of each candidate.

A comparison of these numerical results is then made, and a general list of all the candidates is arranged in order of merit.

This list, and the whole of the documents from which it has been drawn up, are then submitted to a jury composed of the

Commandant of the School.
The Second in Command.
The Director of Studies.
Two Members of the Board of Improvement.
The Five Examiners.

It is the special business of this jury carefully to scrutinize the whole of the candidates' documents, drawings, &c., and they further take care that a failure in any one branch of study is duly noted, as such failure is a sufficient reason for the exclusion of the candidate from the general list.

As soon as this general list has been thoroughly verified, it is submitted to the minister of war, who is empowered to add one-tenth to the number actually required for the public services; and thus it may happen that one-tenth of the pupils may annually be disappointed.

IV. THE SCHOOL BUILDINGS AND THE COURSE AND METHOD OF STUDY.

A brief description of the buildings may be a suitable introduction to an account of the studies that are pursued, and the life that is lead in them.

The Polytechnic School stands near the Pantheon, and consists of two main buildings, one for the official rooms and the residence of the commandant and director of studies, the other, and larger one, for the pupils. Detached buildings contain the chemical lecture room and laboratory, the laboratory of natural philosophy, the library, fencing and billiard rooms.

The basement floor of the larger building contains the kitchen and refectories. On the first floor, are the two amphitheaters or great lecture rooms, assigned respectively to the pupils of the two years or divisions, in which the ordinary lectures are given. The rooms are large and well arranged; the seats fixed, the students' names attached to them. The students are admitted by doors behind the upper tier of seats; at the foot of all is a platform for the professor, with a blackboard facing his audience, and with sufficient room for a pupil to stand and work questions beside him. Room also is provided for one of the captains, inspectors of studies, whose duty it is to be present, for the director of studies, whose occasional presence is expected, and for the assistant teachers or *répétiteurs*, who in the first year of their appointment are called upon to attend the course upon which they will have to give their subsequent questions and explanations. On this floor are also the museums, or repositories of models, instruments, machines, &c., needed for use in the amphi theaters, or elsewhere. The museum provided for the lecturer on Physics (or Natural Philosophy) appeared in particular to be well supplied.

The whole of the second floor is taken up with what are called the *salles d'interrogation*, a long series of small cabinets or studies, plainly furnished with six or eight stools and a table, devoted to the *interrogations particulières*, which will presently be described.

The third floor contains the halls of study, *salles d'étude*, or studying rooms, in which the greater part of the student's time during the day is passed—where he studies, draws, keeps his papers and instruments, writes his exercises, and prepares his lectures. These are small chambers, containing eight or, exceptionally, eleven occupants. A double desk runs down the middle from the window to the door, with a little shelf and drawers for each student. There is a blackboard for the common use, and various objects are furnished through the senior student, the sergeant, a selected pupil, more advanced than the rest, who is placed in charge of the room, and is responsible for whatever is handed in for the use of the students. He collects the exercises, and generally gives a great deal of assistance to the less proficient. "When I was sergeant," said an old pupil, "I was always at the board." The spirit of *camaraderie*, said to exist so strongly among the Polytechnic students, displays itself in this particular form very beneficially. Young men of all classes work heartily and zealously together in the *salles d'étude*, and no feeling of rivalry prevents them from assisting one another. The sergeant does not, however, appear to exercise any authority in the way of keeping discipline.

These chambers for study are arranged on each side of a long corridor which runs through the whole length of the building, those of the juniors being separated from those of the seniors by a central chamber or compartment, the *cabinet de service*, where the officers charged with the discipline are posted, and from hence pass up and down the corridor, looking in through the glass doors and seeing that no interruption to order takes place.

The fourth story is that of the dormitories, airy rooms, with twelve beds in each. These rooms are arranged as below, along the two sides of a corridor, and divided in the same manner into the senior and junior side. A non-commissioned officer is lodged at each end of the corridor to see that order is kept.

Such is the building into which at the beginning of November the successful candidates from the *Lycées* and the *Ecoles préparatoires* are introduced, in age resembling the pupils whom the highest classes of English public schools send annually to the universities, and in number equal perhaps to the new under-graduates at one of the largest colleges at Cambridge. There is not, however, in other points much that is common, least of all in the methods and habits of study we are about to describe. This will be best understood by a summary of a day's work.

The students are summoned to rise at half-past five, have to answer the roll-call at six, from six to eight are to occupy themselves in study, and at eight they go to breakfast. On any morning except Wednesday, at half-past eight, we should find the whole of the new admission assembled in an amphitheater, permanent seats in which are assigned to them by lot, and thus placed they receive a lecture from a professor, rough notes of which they are expected to take while it goes on. The first half hour of the hour and a half assigned to each lecture is occupied with questions put by the professor relating to the previous lecture. A name is drawn by lot, the student on whom the lot falls is called up to the blackboard at which the professor stands, and is required to work a problem and answer questions. The lecture concluded, the pupils are conducted to the *salles d'étude*, which have just been described, where they are to study. Here for one hour they devote themselves to completing and writing out in full the notes of the lecture they have just heard. The professor and his assistants, the *répétiteurs*, are expected to follow and make a circuit through the corridors, to give an opportunity to ask for information on any difficult points in the lecture. A lithographed summary of the substance of the lecture, extending perhaps to two octavo pages, is also furnished to each studying room for the use of its pupils.

The lecture, as we have said, commences at half-past eight o'clock; it lasts an hour and a half; the hour of writing up the notes brings us to eleven. The young men are now relieved by a change of occupation, and employ themselves (still in their places in the rooms of study) at drawing. A certain number, detached from the rest, are sent to the physical and chemical laboratories. The rotation is such as to admit each student once a month to two or three hours' work at a furnace for chemistry, and once in two months to make experiments in electricity, or other similar subjects. In this way, either at their drawing or in the laboratories, they spend three hours, and at two o'clock go to their dinner in the refectories below, and after dinner are free to amuse themselves in the court-yard, the library, the fencing and the billiard rooms, till five. At five they return to the studying rooms, and for two hours, on Mondays and Fridays, they may employ themselves on any work they please (*étude libre;*) on Tuesday there is a lecture in French literature, and on Thursday in German; at seven o'clock they commence a lesson, which lasts till nine, in landscape and figure drawing, or they do exercises in French writing or in German ; at nine they go down to supper; at half-past nine they have to answer to a roll-call in their bedrooms, and at ten all the lights are put out.

Wednesday is a half-holiday, and the pupils are allowed to leave the school after two o'clock, and be absent till ten at night. The morning is occupied either in study, at the pleasure of the students, or in set exercises till eleven, when there is a lecture of one hour and a half, followed, as usual, by an hour of special study on the subject of the lecture. On Sunday they are allowed to be absent almost the whole day till ten P. M. There is no chapel, and apparently no common religious observance of any kind in the school.

Such is a general sketch of the ordinary employment of the day; a couple of hours of preparatory study before breakfast, a lecture on the differential calculus, on descriptive geometry, on chemistry, or natural philosophy, followed by an hour's work at notes; scientific drawing till dinner; recreation; and general study, or some lighter lecture in the evening. Were we merely to count the hours, we should find a result of eleven or eleven and a half hours of work for every day but Wednesday, and of seven and a half hours for that day. It is to be presumed, however, that though absolute idleness, sleeping, or reading any book not authorized for purposes of study, is strictly prohibited, and when detected, punished, nevertheless the strain on the attention during the hours of drawing and the lectures of the evening is by no means extreme. Landscape and figure drawing, the lecture in French literature, and probably that in German, may fairly be regarded as something like recreation. Such, at least, was the account given us of the lectures on literary subjects, and it agrees with the indifference to literature which marks the school. Of wholesome out-of-door recreation, there certainly seems to be a considerable want. There is nothing either of the English love of games, or of the skillful athletic gymnastics of the German schools.

The method of teaching is peculiar. The plan by which a vast number of students are collected as auditors of professorial lectures is one pursued in many academical institutions, at the Scotch universities, and in Germany. Large classes attend the lectures in Greek, in Latin, and in mathematics at Glasgow ; they listen to the professor's explanations, take notes, are occasionally questioned, and do all the harder work in their private lodgings. Such a system of course deserves in the fullest sense the epithet of voluntary ; a diligent student may make much of it; but there is nothing to compel an idle one to give any attention.

It seems to have been one especial object pursued in the Polytechnic to give to this plan of instruction, so lax in itself, the utmost possible stringency, and to accumulate upon it every attainable subsidiary appliance, every available safeguard against idleness. Questions are expressly put *vivâ voce* by the professor before his lecture; there is a subsequent hour of study devoted to the subject; there is the opportunity for explanation to individual students; the exaction of notes written out in full form; the professor also gives exercises to the students to write during their hours of general study, which he examines, and marks; general vivâ voce examinations (*interrogations générales*,) conducted by the professors and *répétiteurs*, follow the termination of each course of lectures; and lastly, one of the most important and peculiar parts of the method, we have what are called the *interrogations particulières.* After every five or six lectures in each subject, each student is called up for special questioning by one of the *répétiteurs.* The rooms in which these continual examinations are held have been described. They occupy one entire story of the building; each holds about six or eight pupils, with the *répétiteurs.* Every evening, except Wednesday, they are filled with these little classes, and busy with these close and personal questionings. A brief notice, at the utmost of twenty-four hours, is served upon the students who are thus to be called up. Generally, after they have had a certain number of lectures, they may expect that their time is at hand, but the precise hour of the summons can not be counted upon. The scheme is continually varied, and it defies, we are told, the efforts of the ablest young analysts to detect the law which it follows.

It will be seen at once that such a system, where, though nominally professorial, so little is left to the student's own voluntary action, where the ordinary study and *reading*, as it is called in our English universities (here such an expression is unknown) is subjected to such unceasing superintendence and surveillance, and to so much careful assistance, requires an immense staff of teachers. At the Polytechnic, for a maximum of 350 pupils, a body of fifteen professors and twenty-four *répétiteurs*, are employed, all solely in actual instruction, and in no way burdened with any part of the charge of the discipline or the finance, or even with the great yearly examinations for the passage from the first to the second division, and for the entrance to the public services.

With a provision of one instructor to every eight students, it is probable that in England we should avoid any system of large classes, from the fear of the inferior pupils being unable to keep pace with the more advanced. We should have numerous small classes, and should endeavor, above all things, to obtain the advantage of equality of attainment in the pupils composing them.

The French, on the other hand, make it their first object to secure one able principal teacher in each subject, a professor whom they burden with very few lectures. And to meet the educational difficulty thus created, to keep the whole large class of listeners up to the prescribed point, they call in this numerous and busily employed corps of assistants to *repeat*, to go over the professor's work afresh, to whip in, as it were, the stragglers and hurry up the loiterers. Certainly, one would think, a difficult task with a class of 170 freshmen in such work as the integral and differential calculus. It is one, however, in which they are aided by a stimulus which evidently acts most powerfully on the students of the Polytechnic School. During the two years of their stay, the prospect of their final admission to the public services can rarely be absent from the thoughts even of the least energetic and forethinking of the young men. Upon their place in the last class list will depend their fortune for life. A high position will secure them not only reputation, but the certainty of lucrative employment; will put it in their power to select which service they please, and in whichever they choose will secure them favorable notice. Let it be remembered that fifty-three of these one hundred and seventy are free scholars, born of parents too poor to pay 40*l.* a year for their instruction, to whom industry must be at all times a necessity, and industry during their two years at the Polytechnic the best conceivable expenditure, the most certainly remunerative investment of their pains and labor. The place on the final class list is obviously the prize for which this race of two years' length has to be run. What is it determines that place? Not by any means a final struggle before the winning-post, but steady effort and diligence from first to last throughout the course. For the order of the class list is not solely determined by success in the examination after which it is drawn up, but by the result of previous trials and previous work during the whole stay at the school.

For, during the whole time, every written exercise set by the professor, every drawing, the result of every *interrogation particulière* by the *répétiteurs*, and of each general interrogation by the professors and *répétiteurs*, is carefully marked, and a credit placed according to the name of the student and reserved for his benefit in the last general account. The marks obtained in the examination which closes the first year of study form a large element in this last calculation. It had been found that the work of the first year was often neglected: the evil was quickly remedied by this expedient. The student, it would seem, must feel that he is gaining or losing in his banking account, so to call it, by every day's work; every portion of his studies will tell directly for or against him in the final competition, upon which so much depends.

Such is the powerful mechanism by which the French nation forces out of the mass of boys attending their ordinary schools the talent and the science which they need for their civil and military services. The efforts made for admission to this great scientific school of the public services, the struggle for the first places at the exit from it, must be more than enough, it is thought, to establish the habits of hard work, to accumulate the information and attainment, and almost to create the ability which the nation requires for the general good.

We may now follow the student through his course of two years' study. The first year's work may be mainly divided into three portions of unequal length; two of them of about four months each (with an additional fortnight of private study and examination,) are mainly given to hard lecturing, whilst the third portion of two months is devoted to private study and to the examinations.

In accordance with this arrangement of the year, the four hardest subjects are thus distributed. Analysis and descriptive geometry, the staple work of the school—its Latin, as M. de Barante called it—come in the first four months; there is then a pause for private study and a general examination in these two subjects (*interrogations générales* as distinct from the *interrogations particulières* of the *répétiteurs.*) This brings us to the middle of March. Analysis and geometry are then laid aside for the rest of the year, and for the next portion of four months the pupils work at mechanics and geodesy, private study and a general examination completing this course also. Important lectures on physics and chemistry run on during both these periods, and are similarly closed by private study and a general examination. The less telling evening classes of French literature and German end at the beginning of June, and landscape and figure drawing only last half the year. It may be observed also, that, as a general rule, there is on each day one, and only one, really difficult lecture. This is immediately preceded and followed by private study, but then comes something lighter, as a relief, such as drawing or work in the laboratories.

The chief feature in the third portion of the year is the complete break in the lectures for general private study (*étude libre,*) a month or six weeks before the closing examination at the end of the year. The immediate prospect of this prevents any undue relaxing of the work; and it is curious to observe here how private efforts and enforced system are combined together, for even the private efforts are thus systematized and directed. The closing examination of the first year begins on the 1st and ends on the 25th of September.

The total number of lectures in each branch of study, with the dates when they respectively commence and finish, and the period when the general examinations (*interrogations générales*) take place, are exhibited in the following tables, and we should add that the interval between the close of each course and the commencement of the chief yearly examination is devoted to free study.

TABLE FOR THE SECOND OR LOWER DIVISION, FOLLOWING THE FIRST YEAR'S COURSE OF STUDY.

Subject of Study.	No. of Lectures.	Course of Lectures.		General Examinations. *Interrogations Générales.*		Annual Examination.
		Commenced.	Finished.	Commenced.	Finished.	
Analysis,	48	3rd Nov.	25th Feb.	13th March.	18th March.	Begins on the 1st Sept., and ends on the 25th Sept.
Mechanics and Machines,	40	21st March.	29th June.	24th July.	2nd August.	
Descriptive Geometry,	38	3rd Nov.	3rd March.	13th March.	18th March.	
Physics,	34	2nd "	28th June.	10th July.	19th July.	
Chemistry,	38	5th "	17th "	10th "	19th "	
Goedesy,	35	20th March	30th "	24th "	2nd August.	
French Literature,	30	8th Nov.	6th "			
German,	30	2nd "				
Figure and Landscape Drawing,	50	4th "	15th " 28th April.			
Total,	343					

The work of the second year is almost identical in its general plan with that of the first. A continuation of analysis with mechanics in place of descriptive geometry is the work of the first four months, then comes the private study and the *interrogations générales*, and then again, from the middle of March to the middle of July, work of a more professional character, stereotomy, the art of war and topography, forms the natural completion of the pupil's studies. Chemistry and physics follow the same course as during the first year, and terminate with the private study and the general examination at the beginning of August. The evening lectures in French literature and German end about the middle of June, and those in figure and landscape drawing at the beginning of May. The last portion is again given to private study and the great Final Examination.

TABLE FOR THE FIRST OR UPPER DIVISION, FOLLOWING THE SECOND YEAR'S COURSE OF STUDY.

Subject of Study.	No. of Lectures.	Course of Lectures. Commenced,	Course of Lectures. Finished.	General Examinations. *Interrogations Générales.* Commenced.	General Examinations. *Interrogations Générales.* Finished.	Annual Examination.
Analysis,	32	11th Nov.	3rd March.	13th March.	18th March.	Begins on the 10th Sept. and ends on the 10th Oct.
Mechanics and Machines,	42	10th "	2nd "	13th "	18th "	
Stereotomy,	32	20th March.	26th June.	10th July.	19th July.	
Physics,	36	12 Nov.	29th "	24th "	2nd Aug.	
Chemistry,	38	14th "	28th "	24th July.	2nd "	
Architecture and Construction,	40	10th "	8th "	....	....	
Military Art and Fortification,	20	21st March.	21st "	10th "	19th July.	
Topography,	10	3rd Jan.				
French Literature,	30	11th Nov.	9th "			
German,	30	14th "	19th "			
Figure and Landscape Drawing,	48	12th "	2nd May.			
Total,	358					

V. THE EXAMINATIONS, PARTICULARLY THAT OF THE FIRST YEAR AND THE FINAL ONE.

We have now brought the pupil nearly to the end of his career, but must previously say a few words about his examinations, the chief epochs which mark his progress, and the last of which fixes his position almost for life. For this purpose it is necessary to recapitulate briefly what has been said in different places of the whole examinatorial system of the Polytechnic School.

1. All the professors require the students in their studying rooms, to answer questions in writing on the courses as they go through them: a different question is given to each student, and every third question is of such a nature as to involve a numerical example in the reply.

These questions are given in the proportion of one to about every four lectures, and the replies after being examined by the professor or *répétiteur*, are indorsed with a credit, varying from 0 to 20, and the paper is then given back to the student, to be produced at the close of the year.

2. Credits are assigned to the students for their ordinary manipulations in chemistry and physics, during the first year; and at the close of each year, for their manipulations, in chemistry alone, before the examiners.

3. The *répétiteurs* examine, (in the *interrogations particulières*,) every ten or fourteen days, from six to eight students during a sitting of two hours, on the subject of study lectured on since the previous examination of the same kind. All these students must continue present, and at the close the *répétiteur* assigns to each a

previous examination of the same kind. All these students must continue present, and at the close the *répétiteur* assigns to each a credit entirely dependent on the manner in which each has replied. The professors and captains inspectors are occasionally present at these examinations, which are discontinued at certain periods according to the instructions of the director of studies.

4. At different intervals of time, from a fortnight to a month, as may happen, after the close of the course in each branch of study, general examinations (*interrogations générales*) are made by the professors and *répétiteurs.* From four to six students are examined together for at least two hours, and at the conclusion the professor makes known to the director of studies the credit he has granted to each student for the manner in which he has passed his examination.

Such may be called the minor or ordinary examinations. But there is an annual closing examination at the end of each year, which we will now describe. The first year's annual examination commences on the 1st and ends on the 25th September. It is carried on by special examiners, (a different set from those who conduct the entrance examinations,) and not by the professors. These give to every student a credit between 0 and 20 in each branch of study, according to the manner in which he replies.

The following table shows the co-efficients of influence allowed to the different studies of the first year, subdivided also among the particular classes of examination to which the student has been subjected. The component parts of the co-efficients as well as the co-efficients themselves, slightly vary from year to year, dependent on the number of examinations :—

TABLE I.—FIRST YEAR'S COURSE OF STUDIES: SECOND DIVISION.

Nature of Study.	Total Co-efficients.	Co-efficient of Influence awarded to								
		Written Answers to Professors' Questions.	Examinations by *Répétiteurs. (Int. Part.)*	General Examinations. *(Int. Gén.)*	Manipulations.		Sheets of notes on descriptive Geometry.	Graphical Representations and Drawing.	First Annual Examination.	Total Co-efficients.
					Ordinary.	At Examinations.				
Analysis,	56	9	10	9	..	..	..	..	28	56
Mechanics,	60	7	9	8	..	..	..	14	22	60
Descriptive Geometry,	48	..	7	7	..	..	4	12	18	48
Geodesy,	39	6	5	7	..	..	..	3	18	39
Physics,	45	6	9	7	2	..	..	..	21	45
Chemistry,	45	5	9	7	4	2	..	..	18	45
French Literature,	12	12	..	..	..	..	..	..	..	12
German Language,	10	2	3	..	..	..	..	..	5	10
Drawing,	10	..	..	..	..	..	..	10	..	10
Shading and Tinting Plans,	3	..	..	..	..	..	..	3	..	3

At the conclusion of this examination the director of studies pre pares a statement for each student, exhibiting the credits he has obtained at each of the preceding examinations in each subject, multiplied by the co-efficient of influence, and the sum of the products represents the numerical account of the student's credit in each branch of study.

As the process is somewhat intricate, we append the following example, to show the nature of the calculation performed, in order to ascertain the amount of credits due to each student:—

REPORT OF THE CREDITS GAINED IN THE FIRST YEAR'S COURSE OF STUDY BY M. N., STUDENT AT THE POLYTECHNIC SCHOOL.

Subject of Examination.	Co-efficient of Influence.	Nature of Examination or Proof.	Credit obtained by the Student.	Co-efficients of Influence.	Product.	Sum of Products.	Mean Credit in each Subject of the Course.
Analysis,.........	56	Written answers to Professors' questions,..................	17.16	9	154.44	845.81	15.09
		Examinations by *répétiteurs* (*interrogations particulières*,)	15.47	10	154.70		
		General Examination (*interrogations générales*,)......	13.71	9	123.39		
		Annual Examination,........	14.75	28	413.28		
Mechanics,.......	60	Written answers to Professors' questions, ...	13.45	7	94.15	664.13	11.07
		Examinations by *répétiteurs*,	12.72	9	114.48		
		General examination,........	11.37	8	90.96		
		Graphical representations and drawing, ...	5.61	14	78.54		
		Annual examination,........	13.00	22	286.00		
Descriptive Geometry, ...	48	Examinations by *répétiteurs*,	17.15	7	120.05	633.15	13.19
		General examination,........	11.72	7	82.04		
		Sheets of notes,.............	12.45	4	49.80		
		Graphical rep. and drawing,..	11.88	12	142.76		
		Annual examination,........	13.25	18	238.50		
Geodesy, ...	39	Written answers to Professors' questions,.................	9.16	6	54.96	229.01	5.87
		Examinations by *répétiteurs*,	7.85	5	39.25		
		General examination,........	5.74	7	40.18		
		Graphical rep. and drawing,..	4.36	3	13.08		
		Annual examination,........	4.53	1	81.54		
Physics,..........	45	Written answers to Professors' questions, ...	2.76	6	16.56	112.21	2.49
		Examinations by *répétiteurs*,	3.54	9	31.86		
		General examination,........	3.15	7	22.05		
		Ordinary manipulation,......	1.55	2	3.10		
		Annual examination,........	1.84	21	38.84		
Chemistry, ...	45	Written answers to Professors' questions, ...	2.46	5	12.30	131.16	2.91
		Examinations by *répétiteurs*,	3.25	9	29.95		
		General examination,........	2.47	7	17,29		
		Ordinary manipulation,......	2.26	4	9.04		
		Manipulation at examination,	1.58	2	3.16		
		Annual examination,........	3.34	18	60.12		
French Literature,	12	Written answers to Professors' questions, ...	5.64	12	67.68	67.68	5.64
German Language,	10	Written answers to Professors' questions, ...	6.57	2	13.14	55.92	5.59
		Examinations by *répétiteurs*,	4.86	3	14.58		
		Annual examination,........	5.64	5	28.20		
Drawing, ...	10	Graphical representations and drawing, ...	4,36	10	43.60	43.60	4.36
Shading and Tinting Plans,	3	Graphical representations and drawing, ...	3.86	3	11.58	11.58	3.86

Sum,............10)70.07

General Mean Credit, = (7.00)

It is important to remark that any student whose *mean credit*, given in the eighth column of the preceding table, in any branch of study does not exceed *three*, or whose *general mean credit* for the whole of the studies being the arithmetical mean of all the values recorded in the eighth column, and given at the bottom in the example, does not exceed six, is *considered to possess an insufficient amount of instruction to warrant his being permitted to pass into the first division for the second year's course.* He is accordingly excluded from the school, unless he has been prevented from pursuing his studies by illness, in which case, when the facts are thoroughly established, he will be allowed a second year's study in the second division, comprising the first year's course of study.

We now pass to the second annual or great final examination for admission to the public services, remarking only that in the *interrogations générales* of the second year the principal subjects of both years are included.

The final examinations for admission into the public service commence about the 10th September, and last about one month. They are conducted by the same examiners who examined at the close of the first year. These are five in number, and appointed by the minister of war. One of these takes analysis; a second, mechanics; a third, descriptive geometry and geodesy; the fourth, physics; and the fifth, chemistry.

The examination in military art and topography is conducted by a captain of engineers specially appointed for the purpose; and in the same manner the examination in German is carried on by a professor, usually a civilian, specially but not permanently appointed.

The questions are oral, and extend over the whole course of study pursued during the two years. Each student is taken separately for one hour and a quarter on different days by each of the five examiners; each examiner examines about eight students daily.

A table, very similar to that already given, is prepared under the superintendence of the Director of studies for every student, to ascertain the numerical amount of his credits in each branch of study, the co-efficients of influences for the particular subject of study and nature of examination being extracted from a table similar to that in page 80, and when these tables have all been completed, a general list of all the students is made out, arranged in the order of their merits.

Formerly, conduct was permitted to exercise some slight influence on their position, but that is no longer the case.

The same regulations exist, as regards the minimum amount of credit that will entitle the students to enter into the public service, as have already been stated above in reference to the passage from the first to the second year's course of study.

TABLE II. SECOND YEAR'S COURSE OF STUDY: FIRST DIVISION.

	Total Co-efficients.	Co-efficient of Influence awarded to										Total Co-efficients.
		Result of previous Year's Examination.	Written answers to Professors' Questions.	Examinations by *Répétiteurs.* (*Int. Part.*)	General Examinations. (*Int. Gén.*)	Manipulation. Ordinary.	Manipulation. At Examinations.	Sketches and Notes in Architecture.	Graphical Representations and Drawing.	Examination in Architecture.	Second Annual or Final Examination.	
Analysis, ...	81	28	8	10	9	....	....	......	......	....	26	81
Mechanics, ...	92	25	8	12	9	....	....	......	10	....	28	92
Descriptive Geometry,......	36	36	....	......	......	....	....	......	......	....	......	36
Geodesy, ...	37	......	6	5	7	....	....	......	1	....	18	37
Physics,........	68	23	5	10	8	....	...	......	......	....	22	68
Chemistry,.....	68	20	5	10	8	4	2	......	......	....	19	68
Architecture,...	36	......	....	......	......	....	....	12	14	10	......	36
Military art and Topography,	25	......	....	3	5	....	....	......	9	....	8	25
French Literature, ...	18	6	12	......	......	....	....	......	......	....	......	18
German,.......	15	5	2	3	......	....	....	......	......	....	......	15
Drawing, ...	15	5	....	......	......	....	....	......	10	....	......	15
Shading and Tinting, ...	5	2	....	......	......	....	....	......	3	....	......	5

From the preceding tables and explanations, it will be apparent that, as the whole of the students for each year are compelled to follow precisely the same course of study, the system of professorial instruction, combined with the constant tutelage and supervision exercised by the *répétiteurs*, and the examinations (*interrogations particulières*) of the *répétiteurs*, at short intervals of time, have for their principal object the keeping alive in the minds of the students the information which has been communicated to them. As a stimulus to continuous and unceasing exertion, it will be seen by an inspection of the tables of the co-efficients of influence, that the manner in which the students acquit themselves from day to day, and from week to week, is made an element, and a very important one, in determining their final position in the list arranged according to merit, exceeding as it does in most instances the influence exerted on their classification by their final examination at the close of each year. This principle thus recognizes not only their knowle lge at the end of each year, but also the manner in which they have proved it to the professors and *répétiteurs* in the course of the year; and with referencé to the second year's study, the final result of the first year's classification exercises an influence amounting to about one-third of the whole, in the final classification at the end of the second year.

It follows also, that as the examinations at the end of each year are made by examiners, otherwise unconnected with the school, and not by the professors belonging to it, the positions of the students in the classified list is partly dependent on the judgment of the professors with whom they are constantly in communication, and partly on the public examiners, whom they meet only in the examination rooms.*

The examiners of the students are not frequently changed, and practically the same may be said of the examiners for admission.

The students at the head of the list have generally since the wars of the first Empire entered into the civil rather than into the military services, the former being much better remunerated.

The services are usually selected by preference, nearly in the following order:—

The Roads and Bridges (*Ponts et chaussées*) and Mines (*Mines,*) - - - - } very nearly on an equality.
Powder and Saltpetre (*Poudres et Salpêtres.*)
Naval Architects (*Génie maritime.*)
Engineers (*Génie militaire.*)
The Artillery (*Artillerie de terre,*) and the Staff Corps (*Etat Major,*) } very nearly on an equality.
The Hydographical Corps (*Ingénieurs Hydrographes.*)

Subjects of Study.	Per-centage of influence exercised on the position of the Students.						
	During the 1st Year.		During the 2nd Year.			In the Classified List at the end of 2nd year.	
	By Professors and *Répétiteurs.*	By Examiners.	By the results of the first Year's Examination.	By Professors and *Répétiteurs.*	By Examiners.	By Professors and *Répétiteurs.*	By Examiners.
Analysis,	50.0	50.0	34.5	32.5	33.0	49.75	50.25
Mechanics,	63 2	36.7	27.2	42.4	30.4	59.6	40.40
Descriptive Geometry,	62.5	37.5	100.0	0.0	0.0	62.5	37.5
Geodesy,	53.8	46.2	0.0	51.4	48.6	*51.4	48.6
Physics,	53.3	46.7	33.8	33.8	32.4	51.8	48.2
Chemistry,	60.0	40.0	29.4	43.2	27.4	60.8	39.2
Architecture,	......	......	0.0	100.0	0.0	100.0	100.0
Military Art and Topography,	......	......	0.0	68.0	32.0	68.0	32.0
French Literature,	100.0	0.0	33.3	66.7	0.0	100.0	0.0
German Language,	100.0	0.0	33.3	33.3	33.4	66.7	33.3
Drawing,	100.0	0.0	33.3	66.7	0.0	100.0	0.0
Shading and Tinting Plans,	100.0	0.0	40.0	60.0	0.0	100.0	0.0
					*	* When taught in the 2nd year.	

* The influence exercised in the various branches of study, and consequently in the position of the students in the list classified according to merit, by the professors and *répétiteurs* on the one hand, and by the examiners on the other, as in the table above.

Tobacco Department (*Administration des Tabacs.*)

Telegraph Department (*Lignes Télégraphiques.*)

Navy (*Marine.*)

Marine Artillery (*Artillerie de mer.*)

Such, at least, is the result of a comparison of the selections made by the students during eight different years.

This preference of the civil to the military services has been the subject of frequent complaints on the part of the military authorities to the minister of war.

No steps have, however, been taken by the French government to prevent the *free* choice of a profession being granted to the most successful students.

We have now followed the student at the Polytechnic to the end of his school career. He is then to pass to his particular School of Application, in which (as the name implies) he is taught to apply his science to practice. It is difficult to state precisely the amount of such science which the highest pupils may be thought to possess on leaving; the best idea of it will be gained by reference to the programmes of the most important of the lectures. It is also needless to dwell again on the main features of the school—the emulation called forth, the minute method, the great prizes offered for sustained labor. We must, however, make some remarks on these points before concluding our account, so far as they bear on the subject of military education.

VI. GENERAL REMARKS.

1. Keeping out of sight for the moment some defects both in the principles and details of the education of this school, the method of teaching adopted seems to us excellent, and worthy of careful study. In this remark we allude principally to the skillful combination of two methods which have been generally thought incompatible; for it unites the well-prepared lecture of a German professor, with the close personal questioning of a first-rate English school or college lecture. But besides this, its whole system is admirably adapted for the class of pupils it educates.

These pupils are generally not of the wealthy classes; they are able, and struggling for a position in life. On all these grounds their own assistance in the work may be calculated upon. Yet they are not left to themselves to make the most of their professors' lectures. The aid of *répétiteurs*, even more valuable in its constant "prudent interrogations," than in the explanations afforded, is joined to the stimulus given by marking every step of proficiency, and by making all tell on the last general account. But though the routine and method of the school are so elaborate, play is given to the individual freedom of the pupils in their private work, and this is managed so skillfully that the private work is made immediately to precede the final examination, on which mainly depends the pupil's place for life. Thus from first to last they are carried on by their system without being cramped by it; every circumstance favorable to study is made the most of; rigorous habit, mental readiness, the power of working with others, and the power of working for themselves, the ambition for immediate and permanent success, all the objects and all the methods which students ever have in view, support and stimulate those of the Polytechnic in their two years' career.

2. The mainspring, however, of the school's energy is the competition amongst the pupils themselves, and this could hardly exist without the great prizes offered to the successful. This advantage, added to the general impulse of the early days of the Empire, has no doubt powerfully contributed to the great position of the school. It has made it a kind of university of the *élite* mathematicians, and as in England young men look to the prizes of the universities, and the professions to which they lead, as their best opening in life, so in France, ever since the first revolution, the corresponding class has inclined to the active and chiefly military career which is offered by the great competitive school of the country.

3. A preparatory school of this remarkable character can not but exercise a very powerful influence over those three-fourths of its pupils who leave it to enter the army. The obvious question is whether the attempt is not made to teach more than is either necessary or desirable for military purposes, and to this suspicion may be added the fact that the civil prizes being more in request than the military, many of those who enter the army do so in the first instance reluctantly, and that the pupils at the bottom of the list appear to be often such marked failures as to imply either great superficiality or premature exhaustion.

4. In studying the Polytechnic School we have had these points constantly brought before us, and feeling the difficulty of discussing them fully, we beg to invite attention to the evidence sent us in reply to some questions which we addressed on the subject to some distinguished scientific officers and civilians connected with the school. We will give briefly the result of our own inquiries.

5. The complaint of General Paixhans has been quoted. He urges that a considerable proportion of the army pupils are mere *queues de promotion*, and quite insufficient to form *le corps et surtout la tête* of troops *d'élite.*

Other not inconsistent complaints we heard ourselves, of the mental exhaustion and the excessively abstract tendencies of many of the military pupils of the school.

6. Such are the complaints. There is certainly reason to think that, with regard to the twenty or thirty lowest pupils on the list, those of General Paixhans are well founded. These are the *breaks down*, and we are at first surprised that, entering as they must do,* with high attain-

* The students are selected, by a competitive examination, out of a very large number of candidates, as will be seen from the following table, extracted from the yearly calendars :—

Year.	Candidates who inscribed their Names.	Candidates examined.	Candidates admitted to the Polytechnic.	Year.	Candidates who inscribed their Names.	Candidates examined.	Candidates admitted to the Polytechnic.
1832	567	468	183	1839	530	531	135
1833	367	304	110	......	....	....	....
1834	627	541	150	1842	709	559	137
1835	729	633	154	1843	802	559	166
......	....	....	....	1844	746	531	143
1837	629	508	137	1845	780	559	136
1838	533	410	131				

Giving an average of one student for four candidates *examined*, so that it is impossible to imagine that there is any lack of ability in those selected.

A similar result appears to follow from some other more recent statistics.

ments, they should fall so low as the marks in the tables (with which we are most liberally supplied) prove to be the case.

At the same time, we believe that no teaching ever has provided or will provide against many failures out of one hundred and seventy pupils, even among those who promised well at first: and if the standard of the majority of pupils is high at the Polytechnique, and the point reached by the first few *very* high, it is no reproach that the descent amongst the last few should be very rapid.

With regard to the assertion, that the teaching is excessive and leads too much to abstract pursuits for soldiers, it may be partially true. Perhaps the general passion for science has led to an overstrained teaching for the army, even for its scientific corps; and yet would it be allowed by officers of the highest scientific ability, either in the French or the English army, that less science is required for the greatest emergencies of military than for those of civil engineering, or for the theory of projectiles than for working the department of saltpetre?

It may, however, be true that an attempt is made at the Polytechnic to exact *from all* attainments which can only be reached by *a few.*

7. With this deduction, we must express our opinion strongly in favor of the influence of the Polytechnic on the French army. We admit that in some instances pupils who have failed in their attempt at civil prizes enter the army unwillingly, but they are generally soon penetrated with its *esprit de corps,* and they carry into it talent which it would not otherwise have obtained. Cases of overwork no doubt occur, as in the early training for every profession, but (following the evidence we have received) we have no reason to think them so numerous as to balance the advantage of vigorous, thoughtful study directed early towards a profession which, however practical, is eminently benefited by it. "It can not be said," was the verdict of one well fitted to express an opinion, "that there is too much science in the French army."

8. Assuming, however, the value of the scientific results produced in the French army by the Polytechnic, it by no means follows that a similar institution would be desirable in another country. Without much discussion it may be safely said that the whole history and nature of the institution—the offspring of a national passion for system and of revolutionary excitement—make it thoroughly peculiar to France.

9. Some obvious defects must be noticed. The curious rule of forbidding the use of *all* books whatever is a very exaggerated attempt to make the pupil to rely entirely on the professors and *répétiteurs.* The exclusive practice of *oral* examination also seems to us a defect. Certainly every examination should give a pupil an opportunity of showing such

Year.	Number of Candidates who inscribed their Names.	Number declared admissible to the Second Examination.	Number admitted.
1852	510	216	202
1853	494	222	217
1854	519	238	170
1855	544	232	170

In judging, however, of these numbers, it should be borne in mind that a very large number of the candidates who succeed have tried more than once; the successful of this year have been among the unsuccessful of last year, so that the proportion of individuals who succeed to individuals who fail, is, of course, considerably larger than one to four. Of the 170 candidates admitted in November, 1855, 117 had put down their names for the examination of 1854, and 53 only had not been previously inscribed Of the 117 who put down their names, 19 had withdrawn without being examined at all, 71 had been rejected on the preliminary examination, 27 had been unsuccessful at that of the second degree; 98 of the 170 came up for the second time to the examination.

valuable qualities as readiness and power of expression; but an examination solely oral appears to us an uncertain test of depth or accuracy of knowledge; and however impartial or practiced an examiner may be, it is impossible that questions put orally can present exactly the same amount of difficulty, and so be equally fair, to the several competitors.

At the same time, although in all great competing examinations the chief part of the work (in our opinion) should be *written*, the constant oral cross-questioning of the minor examinations at the Polytechnic, appeared to be one of the most stimulating and effective parts of their system.

10. A more serious objection than any we have named lies against the exclusive use of mathematical and scientific training, to the neglect of all other, as almost the only instrument of education. The spirit of the school, as shown especially by its entrance examinations, is opposed to any literary study. This is a peculiar evil in forming characters for a liberal profession like the army. Such a plan may indeed produce striking results, if the sole object is to create distinguished mathematicians, though even then the acuteness in one direction is often accompanied by an unbalanced and extravagant judgment in another. But a great school should form the whole and not merely a part of the man; and as doing this, as strengthening the whole mind, instead of forcing on one or two of its faculties—as giving, in a word, what is justly called a *liberal* education—we are persuaded that the system of cultivating the taste for historical and other similar studies, as well as for mere science, is based on a sounder principle than that which has produced the brilliant results of the Polytechnic.

11. It may be added, in connection with the above remark, that as the entrance examination at the Polytechnic influences extensively the teaching of the great French schools, and is itself almost solely mathematical, it tends to diffuse a narrow and exclusive pursuit of science, which is very alien from the spirit of English teaching.

12. We may sum up our remarks on the Polytechnic School thus:—

Regarded simply as a great Mathematical and Scientific School, its results in producing eminent men of science have been extraordinary. It has been the great (and a truly great) Mathematical University of France.

Regarded again as a Preparatory School for the public works, it has given a very high scientific education to civil engineers, whose scientific education in other countries (and amongst ourselves) is believed to be much slighter and more accidental.

Regarded as a school for the scientific corps of the army, its peculiar mode of uniting in one course of competition candidates for civil and military services, has probably raised scientific thought to a higher point in the French than in any other army.

Regarded as a system of teaching, the method it pursues in developing the talents of its pupils appears to us the best we have ever studied.

It is in its studies and some of its main principles that the example of the Polytechnic School may be of most value. In forming or improving any military school, we can not shut our eyes to the successful working at the Polytechnic of the principle, which it was the first of all schools to initiate, the making great public prizes the reward and stimulus of the pupil's exertions. We may observe how the state has here encouraged talent by bestowing so largely assistance upon all successful, but poor pupils, during their school career. We may derive some lessons from its method of teaching, though the attempt to imitate it might be unwise. Meanwhile, without emulating the long established scientific prestige of the Polytechnic, we have probably amongst ourselves abundant materials for a military scientific education, at least as sound as that given at this great School.

NOTE.

In addition to the Schools of Application for Artillery and Engineers at Metz, and of Infantry and Cavalry at St. Cyr, of which a pretty full account will be given, the following Public Services are supplied by the Polytechnic School.

GUNPOWDER AND SALTPETRE.—(*Poudres et Salpêtres.*)

In France the manufacture of gunpowder is solely in the hands of the Government. The pupils of the Polytechnic who enter the gunpowder and saltpetre service, are sent in succession to different powder-mills and saltpetre refineries, so as to gain a thorough acquaintance with all the details of the manufacture.

On first entering the service they are named *élèves des poudres.* They afterwards rise successively to the rank of assistant-commissary, commissary of the third, of the second, and of the first class.

NAVY.—(*Marine.*)

A small number of the pupils of the Polytechnic enter the Navy. They receive the rank of *élève de première classe*, from the date of their admission.

They are sent to the ports to serve afloat. After two years' service they may be promoted to the rank of *enseigne de vaisseau*, on passing the necessary examinations, on the same terms precisely as the *élèves de première classe* of the Naval School.

MARINE ARTILLERY.—(*Artillerie de la Marine.*)

The French marine artillery differs from the English corps of the same name, in not serving afloat. Its duties are confined to the ports and to the colonies. It is governed by the same rules and ordinances as the artillery of the army.

The foundries of La Villeneuve, Rochefort, Ruelle, Névers, and Saint Gervais are under its direction.

The officers of the marine artillery are liable to be sent on board ship to study naval gunnery, so as to be in a position to report upon alterations or improvements in this science.

NAVAL ARCHITECTS.—(*Génie Maritime.*)

The naval architects are charged with the construction and repair of vessels of war, and with the manufacture of all the machinery required in the ports and dockyards. The factories of Indret and La Chaussade are under their direction.

The pupils of the Polytechnic enter the corps of naval architects with the rank of *élève du Génie Maritime.* They are sent to the School of Application of Naval Architects at L'Orient. After two years' instruction they undergo an examination, and, if successful, they are promoted to the rank of sub-architect of the third class, so far as vacancies admit. They may be advanced to the second class after a service of two years.

HYDROGRAPHERS.—(*Ingénieurs Hydrographes.*)

The hydrographers are stationed at Paris. They are sent to the coast to make surveys, and the time so spent reckons as a campaign in determining their pension. On their return to Paris they are employed in the construction of maps and charts.

The hydrographers have the same rank and advantage as the naval architects.

On leaving the Polytechnic, the pupils enter the corps of hydrographers with the rank of *élève hydrographe.* After two years' service, and one season employed on the coast, they become sub-hydrographers without further examination.

Roads and Bridges.—Government Civil Engineers.—(*Ponts et Chaussées.*)

The Polytechnic furnishes exclusively the pupils for the Government Civil Engineer Corps. On leaving the Polytechnic, the pupils enter the School of Application in Paris. The course of instruction here extends over a period of three years. It commences each year on the first of November, and lasts till the 1st of April. After the final examination, the pupils are arranged according to the results of the examination and the amount of work performed.

The pupils enter the college with the rank of *élève de troisième classe.* They rise successively to the second and to the first class, on making the requisite progress in their studies.

From the 1st of May to the 1st of November the *élèves* of the second and the third class are sent on duty into the provinces. The *élèves* of the first class who have completed their three years' course of instruction, are employed in the duties of ordinary engineers, or are detached on special missions. In about three years after quitting the college, they may be appointed ordinary engineers of the second class.

The engineers of the *Ponts et Chaussées* prepare the projects and plans, and direct the execution of the works for the construction, preservation, and repair of high roads, and of the bridges and other structures connected with these roads, with navigable rivers, canals, seaports, lighthouses, &c. They are charged with the superintendence of railways, of works for draining marshes, and operations affecting water-courses; they report upon applications to erect factories driven by water. Under certain circumstances, they share with the Mining Engineers the duty of inspecting steam-engines.

Permission is not unfrequently granted to the engineers of the *Ponts et Chaussées* to accept private employment. They receive leave of absence for a certain time, retaining their rank and place in their corps, but without pay.

Mining Engineers.—(*Mines.*)

The Mining School of Application is organized almost exactly on the same plan as that of the *Ponts et Chaussées:* like the latter, it is in Paris.

The course of instruction, which lasts three years, consists of lectures, drawing, chemical manipulation and analysis, visits to manufactories, geological excursions, and the preparation of projects for mines and machines. Journeys are made by the pupils, during the second half of the last two years of the course, into the mineral districts of France or foreign countries for the purpose of studying the practical details of mining. These journeys last one hundred days at least. The pupils are required to examine carefully the railroads and the geological features of the countries they pass through, and to keep a journal of facts and observations. In the final examination, marks are given for every part of their work.

The mining engineers, when stationed in the departments, are charged to see that the laws and ordinances relating to mines, quarries, and factories are properly observed, and to encourage, either directly or by their advice, the extension of all branches of industry connected with the extraction and treatment of minerals.

One of their principal duties is the superintendence of mines and quarries, in the three-fold regard of safety of the workmen, preservation of the soil, and economical extraction of the minerals.

They exercise a special control over all machines designed for the production of steam, and over railways, as far as regards the metal and fuel.

The instructors in the School of Application in Paris, and in the School of Mines at St. Etienne, are exclusively taken from the members of the corps.

Like the engineers of the *Ponts et Chaussées*, the mining engineers obtain permission to undertake private employment.

Tobacco Department.—(*Administration des Tabacs.*)

The pupils who enter the tobacco service, commence, on quitting the Polytechnic, with the rank of *élève de 2^e^ classe.* They study, in the manufactory at

Paris, chemistry, physics, and mechanics, as applied to the preparation of tobacco. They make themselves acquainted at the same time with the details of the manufacture and with the accounts and correspondence.

They are generally promoted to the rank of *élève de 1re classe* in two years. They rise afterwards successively to the rank of sub-inspector, inspector, and director.

After completing their instruction at the manufactory of Paris, the *élèves* are sent to tobacco manufactories in other parts of France.

Promotion in the tobacco service does not follow altogether by seniority. Knowledge of the manufacture and attention to their duties are much considered, as the interests of the treasury are involved in the good management of the service.

TELEGRAPHS.—(*Lignes Télégraphiques.*)

On entering the telegraphic service the pupils of the Polytechnic receive the rank of *élève inspecteur.*

They pass the first year at the central office. During the six winter months they study, under two professors, the composition of signals, and the regulations which insure their correctness and dispatch, the working of telegraphs and the manner of repairing them, the theory of the mode of tracing lines and of determining the height of the towers, electro-magnetism and its application to the electic telegraph. During the summer months they make tours of inspection. They assist in the execution of works, and practice leveling and the laying down of lines.

At the end of the year the *élèves inspecteurs* undergo an examination, and, if there are vacancies, are appointed provisional inspectors. After a year in this rank they may be appointed inspectors either in France or Algeria.

Each inspector has charge of a district containing from twelve to fifteen stations. He is obliged to make a tour of inspection once a month of at least ten days' duration.

After a certain number of years' service the inspector rises to the rank of director. Besides their other duties, the directors exercise a general superintendence over the inspectors.

PROGRAMMES OF THE PRINCIPAL COURSES OF INSTRUCTION

OF THE IMPERIAL POLYTECHNIC SCHOOL DURING THE TWO YEARS OF STUDY.

I. ANALYSIS.—*FIRST YEAR.*

DIFFERENTIAL CALCULUS.

Lessons 1—9. *Derivatives and Differentials of Functions of a Single Variable.*

Indication of the original problems which led geometers to the discovery of the infinitesimal calculus.

Use of infinitesimals; condition, subject to which, two infinitely small quantities may be substituted for one another. Indication in simple cases of the advantage of such substitution.

On the different orders of infinitely small quantities. Infinitely small quantities of a certain order may be neglected in respect of those of an inferior order. The infinitely small increment of a function is in general of the same order as the corresponding increment of the variable, that is to say, their ratio has a finite limit.

Definitions of the derivative and differential of a function of a single variable. Tangents and normals to plane curves, whose equation in linear or polar co-ordinates is given.

A function is increasing or decreasing, according as its derivative is positive or negative. If the derivative is zero for all values of the variable, the function is constant. Concavity and convexity of curves; points of inflection.

Principle of function of functions. Differentiation of inverse functions.

Differentials of the sums, products, quotients, and powers of functions, whose differentials are known. General theorem for the differentiation of functions composed of several functions.

Differentials of exponential and logarithmic functions.

Differentials of direct and inverse circular functions.

Differentiation of implicit functions.

Tangents to curves of double curvature. Normal plane.

Differential of the area and arc of a plane curve, in terms of rectilinear and polar co-ordinates.

Differential of the arc of a curve of double curvature.

Applications to the cycloid, the spiral of Archimedes, the logarithmic spiral, the curve whose normal, sub-normal, or tangent, is constant; the curve whose normal passes through a fixed point; the curve whose arc is proportional to the angle which it subtends at a given point.

Derivatives and differentials of different orders of functions of one variable. Notation adopted.

Remarks upon the singular points of plane curves.

Lessons—10—13. *Derivatives and Differentials of Functions of Several Variables.*

Partial derivatives and differentials of functions of several variables. The order in which two or any number of differentiations is effected does not influence the result.

Total differentials. Symbolical formula for representing the total differential of the n^{th} order of a function of several independent variables.

Total differentials of different orders of a function; several dependent variables. Case where these variables are linear functions of the independent variables.

The infinitesimal increment of a function of several variables may in general be regarded as a linear function of the increments assigned to the variables. Exceptional cases.

Tangent and normal planes to curved surfaces.

LESSONS 14—18. *Analytical Applications of the Differential Calculus.*

Development of F $(x + h,)$ according to ascending powers of h. Limits within which the remainder is confined on stopping at any assigned power of h.

Development of F $(x,)$ according to powers of x or $x—a$; a being a quantity arbitrarily assumed. Application to the functions sin $(x,)$ cos x, a^x, $(1 + x^m)$ and log. $(1 + x.)$ Numerical applications. Representation of cos x and sin x by imaginary exponential quantities.

Developments of $\cos^m x$ and $\sin^m x$ in terms of sines and curves of multiples of x.

Development of F $(x + h, y + k,)$ according to powers of h and k. Development of F (x, y) according to powers of x and y. Expression for the remainder. Theorem on homogeneous functions.

Maxima and minima of functions of a single variable; of functions of several variables, whether independent or connected by given equations. How to discriminate between maxima and minima values in the case of one and two independent variables.

True values of functions, which upon a particular supposition assume one or another of the forms

$$\frac{0}{0}, \frac{\infty}{\infty}, \infty + 0, 0^0, 4^\infty$$

LESSONS 19—23. *Geometrical Applications. Curvature of Plane Curves.*

Definition of the curvature of a plane curve at any point. Circle of curvature. Center of curvature. This center is the point where two infinitely near normals meet.

Radius of curvature with rectilinear and polar co-ordinates. Change of the independent variable.

Contacts of different orders of plane curves. Osculating curves of a given kind. Osculating straight line. Osculating circle. It is identical with the circle of curvature.

Application of the method of infinitesimals to the determination of the radius of curvature of certain curves geometrically defined. Ellipse, cycloid, epicycloid, &c.

Evolutes of plane curves. Value of the arc of the evolute. Equation to the involute of a curve. Application to the circle. Evolutes considered as envelops. On envelops in general. Application to caustics.

LESSONS 14—17. *Geometrical Applications continued. Curvature of Lines of Double Curvature and of Surfaces.*

Osculating plane of a curve of double curvature. It may be considered as passing through three points infinitely near to one another, or as drawn through a tangent parallel to the tangent infinitely near to the former. Center and radius of curvature of a curve of double curvature. Osculating circle. Application to the helix.

Radii of curvature of normal sections of a surface. Maximum and minimum radii. Relations between these and that of any section, normal or oblique.

Use of the indicatrix for the demonstration of the preceding results Conjugate tangents. Definition of the lines of curvature. Lines of curvature of certain simple surfaces. Surface of revolution. Developable surfaces. Differential equation of lines of curvature in general.

LESSON 28. *Cylindrical, Conical, Conoidal surfaces, and Surfaces of Revolution.*

Equations of these surfaces in finite terms. Differential equations of the same deduced from their characteristic geometrical properties.

INTEGRAL CALCULUS.

LESSONS 29—34. *Integration of Functions of a Single Variable.*

Object of the integral calculus. There always exists a function which has a given function for its derivative.

Indefinite integrals. Definite integrals. Notation. Integration by separation, by substitution, by parts.

Integration of rational differentials, integer or fractional, in the several cases which may present themselves. Integration of the algebraical differentials, which contain a radical of the second degree of the form $\sqrt{c+bx+cx^2}$. Different transformations which render the differential rational. Reduction of the radical to one of the forms

$$\sqrt{x^2+x^2},\ \sqrt{a^2-x^2},\ \sqrt{x^2-a^2}.$$

Integration of the algebraical differentials which contain two radicals of the form

$$\sqrt{a+x},\ \sqrt{b+x},$$

or any number of monomials affected with fractional indices. Application to the expressions

$$\frac{x^m dx}{\sqrt{1-x^2}},\ \frac{dx}{x^m\sqrt{1-x^2}},\ \frac{x^m dx}{\sqrt{ax-x}},$$

Integration of the differentials

$$\mathrm{F}\,(\log x)\ \frac{dx}{x},\ \mathrm{F}\,\sin^{-1} x\frac{dx}{\sqrt{1-x^2}},\ x\,(\log x^n)\,dx,\ x^m\,e^{ax}\,dx,\ (\sin^{-1} x^m)\,dx.$$

Integration of the differentials $e^{ax}\sin bxdx$ and $e^{ax}\cos bxdx$.

Integration of $(\sin x^m.)\ (\cos x^n)\ dx$.

Integration by series. Application to the expression

$$\frac{dx}{\sqrt{ax-x^2}\ \sqrt{1-bx.}}$$

Application of integration by series to the development of functions, the development of whose derivatives is given; $\tan^{-1}x$, $\sin^{-1}x$, $\log\,(1+x.)$

LESSONS 35—38. *Geometrical Applications.*

Quadrature of certain curves. Circle, hyperbola, cycloid, logarithmic spiral, &c.

Rectification of curves by rectilinear or polar co-ordinates. Examples. Numerical applications.

Cubic content of solids of revolution. Quadrature of their surfaces.

Cubic content of solids in general, with rectilinear or polar co-ordinates. Numerical applications.

Quadrature of any curved surfaces expressed by rectangular co-ordinates. Application to the sphere.

LESSONS 39—42. *Mechanical Applications.*

General formula for the determination of the center of gravity of solids, curved or plane surfaces, and arcs of curves. Various applications.

Guldin's theorem.

Volume of the truncated cylinder.

General formula which represent the components of the attraction of a body upon a material point, upon the supposition that the action upon each element varies inversely as the square of the distance. Attraction of a spherical shell on an external or internal point.

Definition of moments of inertia. How to calculate the moment of inertia of a body in relation to a straight line, when the moment in relation to a parallel straight line is known. How to represent the moments of inertia of a body relative to the straight lines which pass through a given point by means of the radii vectores of an ellipsoid. What is meant by the *principal axes of inertia.*

Determination of the principal moments of inertia of certain homogeneous bodies, sphere, ellipsoid, prism, &c.

LESSONS 43—45. *Calculus of Differences.*

Calculation of differences of different orders of a function of one variable by means of values of the function corresponding to equidistant values of the variable.

Expression for any one of the values of the function by means of the first, and its differences. Numerical applications; construction of tables representing a function whose differences beyond a certain order may be neglected. Application to the theory of interpolation. Formulæ for approximation by quadratures. Numerical exercises relative to the area of equilateral hyperbola or the calculation of a logarithm.

LESSONS 46—48. *Revision.*

General reflections on the subjects contained in the preceding course.

ANALYSIS.—*SECOND YEAR.*

CONTINUATION OF THE INTEGRAL CALCULUS.

LESSONS 1—2. *Definite Integrals.*

Differentiation of a definite integral with respect to a parameter in it, which is made to vary. Geometrical demostration of the formula. Integration under the sign of integration. Application to the determination of certain definite integrals.

Determination of the integrals $\int \frac{\sin ax}{x} dx$, and $\int \frac{\cos bx \sin ax}{x} dx$, between the limits o and x. Remarkable discontinuity which these integrals present.

Determination of $\int e^{-x^2} dx$ and $\int e^{-x^2} \cos mx dx$ between the limits 0 and ∞.

LESSONS 3. *Integration of Differentials containing several Variables.*

Condition that an expression of the form $M\,dx + N\,dy$ in which M and N are given functions of x and y may be an exact differential of two independent variables x and y. When this condition is satisfied, to find the function.

Extension of this theory to the case of three variables.

LESSONS 4—6. *Integration of Differential Equations of the First Order.*

Differential equations of the first order with two variables. Problem in geometry to which these equations correspond. What is meant by their integral. This integral always exists, and its expression contains an arbitrary constant.

Integration of the equation $M\,d\,x + N\,d\,y = 0$ when its first member is an exact differential. Whatever the functions M and N may be there always exists a factor μ, such that $\mu\,(M\,d\,x + N\,d\,y)$ is an exact differential.

Integration of homogeneous equations. Their general integral represents a system of similar curves. The equation $(a + b\,x + c\,y)\,d\,x + (a' + b'\,x + c'\,y)\,d\,y = c$, may be rendered homogeneous. Particular case where the method fails. How the integration may be effected in such case.

Integration of the linear equation of the first order $\frac{dy}{dx} + P\,y = Q$, where P and Q denote functions of x. Examples.

Remarks on the integration of equations of the first order which contain a higher power than the first of $\frac{dy}{dx}$. Case in which it may be resolved in respect of $\frac{dy}{dx}$. Case in which it may be resolved in respect of x or y.

Integrations of the equation $y = x\,\frac{dy}{dx} + \phi\left(\frac{d\,y}{d\,x}\right)$. Its general integral represents a system of straight lines. A particular solution represents the envelop of this system.

Solution of various problems in geometry which lead to differential equations of the first order.

LESSONS 7—8. *Integration of Differential Equations of Orders superior to the First.*

The general integral of an equation of the m order contains m arbitrary constants.

(*The demonstration is made to depend on the consideration of infinitely small quantities.*)

Integration of the equation $\frac{d^m y}{d\,x^m} = \phi\,(x.)$

Integration of the equation $\frac{d^2\,y}{d\,x^2} = \phi\left(y, \frac{d\,y}{d\,x}\right)$.

How this is reduced to an equation of the first order. Solution of various problems in geometry which conduct to differential equations of the second order.

LESSONS 9—10. *On Linear Equations.*

When a linear equation of the m^{th} order contains no term independent of the unknown function and its derivatives, the sum of any number whatever of particular integrals multiplied by arbitrary constants is also an integral. From this the conclusion is drawn that the general integral of this equation is deducible from the knowledge of m particular integrals.

Application to linear equations with constant co-efficients. Their integration is made to depend on the resolution of an algebraical equation. Case where this equation has imaginary roots. Case where it has equal roots. The general integral of a linear equation of any order, which contains a term independent of the function, may be reduced by the aid of quadratures to the integration of the same equation with this term omitted.

Lesson 11. *Simultaneous Equations.*

General considerations on the integration of simultaneous equations. It may be made to depend on the integrations of a single differential equation. Integration of a system of two simultaneous linear equations of the first order.

Lesson 12. *Integrations of Equations by Series.*

Development of the unknown function of the variable x according to the powers of $x-a$. In certain cases only a particular integral is obtained. If the equation is linear, the general integral may be deduced from it by the variation of constants.

Lessons 13—16. *Partial Differential Equations.*

Elimination of the arbitrary functions which enter into an equation by means of partial derivatives. Integration of an equation of partial differences with two independent variables, in the case where it is linear in respect to the derivatives of the unknown function. The general integral contains an arbitrary function.

Indication of the geometrical problem, of which the partial differential equation expresses analytically the enunciation. Integration of the partial differential equations to cylindrical, conical, conoidal surfaces of revolution. Determination of the arbitrary functions.

Integration of the equation $\frac{d^2 u}{d y^2}=a^2\frac{d^2 u}{d x^2}$. The general integral contains two arbitrary functions. Determination of these functions.

Lessons 17—23. *Applications to Mechanics.*

Equation to the catenary.

Vertical motion of a heavy particle, taking into account the variation of gravity according to the distance from the center of the earth. Vertical motion of a heavy point in a resisting medium, the resistance being supposed proportional to the square of the velocity.

Motion of a heavy point compelled to remain in a circle or cycloid. Simple pendulum. Indication of the analytical problem to which we are led in investigating the motion of a free point.

Motion of projectiles in a vacuum. Calculation of the longitudinal and transversal vibrations of cords. Longitudinal vibrations of elastic rods. Vibration of gases in cylindical tubes.

Lessons 24—26. *Applications to Astronomy.*

Calculation of the force which attracts the planets, deduced from Kepler's laws. Numerical data of the question.

Calculation of the relative motion of two points attracting one another, according to the inverse square of the distance.

Determination of the masses of the earth and of the planets accompanied by satellites. Numerical applications.

LESSONS 27—30.

Elements of the calculus of probabilities and social arithmetic.

General principles of the calculus of chances. Simple probability, compound probability, partial probability, total probability. Repeated trials. Enunciation of Bernouilli's theorem (without proof.)

Mathematical expectation. Applications to various cases, and especially to lotteries.

Tables of population and mortality. Mean life annuities, life interests, assurances, &c.

LESSONS 31—32. *Revision.*

General reflections on the subjects comprised in the course.

II. DESCRIPTIVE GEOMETRY AND STEREOTOMY.

General Arrangements.

The pupils take in the lecture-room notes and sketches upon sheets, which are presented to the professor and the "répétiteurs" at each interrogation. The care with which these notes are taken is determined by "marks," of which account is taken in arranging the pupils in order of merit.

The plans are made according to programmes, of which the conditions are different for different pupils. The drawings are in general acccompanied with decimal scales, expressing a simple ratio to the meter. They carry inscriptions written conformably to the admitted models, and are, when necessary, accompanied with verbal descriptions.

In the graphic exercises of the first part of the course, the principal object is to familiarize the pupils with the different kinds of geometrical drawing, such as elevations and shaded sections, oblique projections and various kinds of perspective. The pupils are also accustomed to different constructions useful in stereotomy.

The subjects for graphic exercises in stereotomy are taken from roofs, vaults, and staircases. Skew and oblique arches are the subject of detailed plans.

FIRST YEAR.

DESCRIPTIVE GEOMETRY.—GEOMETRICAL DRAWING.

LESSONS 1—3 *Revision and Completion of the Subjects of Descriptive Geometry comprised in the Programme for Admission into the School.*

Object of geometrical drawing. Methods of projection. Representation of points, lines, planes, cones, cylinders, and surfaces of revolution. Construction of tangent planes to surfaces, of curves, of intersection of surfaces, of their tangents and their assymplotes.

Osculating plane of a curve of double curvature. A curve in general cuts its osculating plane.

When the generating line of a cylinder or a cone becomes a tangent to the directrix, the cylinder or cone in general has an edge of regression along this generating line. The osculating plane of the directrix at the point of contact touches the surface along this edge.

Projections of curves of double curvature; infinite branches and their assymplotes, inflections, nodes, cusps, &c.

Change of planes of projection.

Reduction of scale; transposition.

Advantage and employment of curves of error; their irrelevant solutions.

Lessons 4—6. *Modes of Representation for the Complete Definition of Objects.*

Pepresentation by plans, sections, and elevation.

Projection by the method of contours. Representation of a point, a line, and a plane; questions relative to the straight line and plane. Representation of cones and cylinders; tangent planes to these surfaces.

Lessons 7—11. *Modes of Representation which are not enough in themselves to define objects completely*

Isometrical and other kinds of perspective.

Oblique projections.

Conical perspective: vanishing points; scales of perspective; method of squares; perspective of curved lines; diverse applications. Choice of the point of sight. Rules for putting an elevation in perspective. Rule for determining the point of sight of a given picture, and for passing from the perspective to the plan as far as that is possible. Perspective of reflected images. Notions on panoramas.

Lessons 12—13. *Representations with Shadows.*

General observations on envelops and characteristics.

A developable surface is the envolop of the position of a movable plane; it is composed of two sheets which meet. It may be considered as generated by a straight line, which moves so as to remain always a tangent to a fixed curve.

Theory of shade and shadow, of the penumbra, of the brilliant point, of curves of equal intensity, of bright and dark edges.

Atmospheric light: direction of the principal atmospheric ray. Notions on the degradation of tints; construction of curves of equal tint.

Influence of light reflected by neighboring bodies.

Received convention in geometrical drawing on the direction of the luminous ray, &c.

Perspective of shadows.

Lessons 14—15. *Construction of Lines of Shadows and of Perspective of Surfaces.*

Use of circumscribed cones and cylinders, and of the normal parallel to a given straight line.

General method of construction of lines of shadow and of perspective of surfaces by plane sections and auxiliary cylindrical or conical surfaces.

Construction of lines of shadow and perspective of a surface of revolution.

The curve of contact of a cone circumscribed about a surface of the second degree is a plane curve. Its plane is parallel to the diametral plane, conjugate to the diameter passing through the summit of the cone. The curve of contact of a cylinder circumscribed about a surface of the second degree is a plane curve, and situated in the diametral plane conjugate to the diameter parallel to the axis of the cylinder.

The plane parallel sections of a surface of the second degree are similar curves. The locus of their centers is the diameter conjugate to that one of the secant planes which passes through the center of the surface.

General study of surfaces with reference to the geometrical constructions to which their use gives rise.

Lesson 16. *Complementary Notions on Developable Surfaces.*

Development of a developable surface; construction of transformed curves and their tangents. Developable surface; an envelop of the osculating planes of a curve. The osculating plane of a curve at a given point may be constructed by considering it as the edge of regression of a developable surface; this construction presents some uncertainty in practice. Notions on the helix and the developable helicoid.

Approximate development of a segment of an undevelopable surface.

Lessons 17—18. *Hyperbolic Paraboloid.*

Double mode of generation of the paraboloid by straight lines; plane-directers; tangent planes, vertex, axis, principal planes; representation of this surface. Construction of the tangent plane parallel to a given plane. Construction of plane sections and of curves of contact, of cones, and circumscribed cylinders.

Scalene paraboloid. Isosceles paraboloid.

Identity of the paraboloid with one of the five surfaces of the second degree studied in analytical geometry.

Re-statement without demonstration of the properties of this surface found by analysis, principally as regards its generation by the conic sections.

Lessons 19—20. *General Properties of Warped or Ruled Surfaces.*

Principal modes of generation of warped surfaces. When two warped surfaces touch in three points of a common generatrix, they touch each other in every point of this straight line. Every plane passing through a generatrix touches the surface at one point in this line. The tangent plane at infinity is the plane-directer to all the paraboloids of "raccordement."

Construction of the tangent planes and curves of contact of circumscribed cones and cylinders. When two infinitely near generatrices of a warped surface are in the same plane, all the curves of contact of the circumscribed cones and cylinders pass through their point of concourse.

The normals to a warped surface along a generatrix form an isosceles paraboloid. The name of central point of a generatrix is given to the point where it is met by the straight line upon which is measured its shortest distance from the adjoining generatrix. The locus of these points forms the line of striction of the surface. The vertex of the normal paraboloid along a generating line is situated at the central point. If the point of contact of a plane touching a warped surface moves along a generatrix, beginning from the central point, the tangent of the angle which the tangent plane makes with its primitive position is proportional to the length described by the point of contact. The tangent plane at the central point is perpendicular to the tangent plane at infinity upon the same generatrix. Construction of the line of striction by aid of this property.

Lessons 21—22. *Ruled Surfaces with plane-divecters Conoids.*

The plane-directer of the surface is also so to all the paraboloids of "raccordement." Construction of the tangent planes and curves of contact of the circumscribed cones and cylinders.

The line of striction of the surface is its curve of contact with a circumscribed cylinder perpendicular to the directer-plane. Determination of the nature of the plane sections.

The lines of striction of the scalene paraboloid are parabolas; those of the isosceles paraboloid are straight lines.

Construction of the tangent plane parallel to a given plane.

Conoid: discussion of the curves of contact of the circumscribed cones and cylinders.

Right conoid. Conoid whose intersection with a torus of the same height, whose axis is its rectilinear directrix, has for its projection upon the directer-plane two arcs of Archimedes' spiral. Construction of the tangents to this curve of intersection.

Lessons 23—25. *Ruled Surfaces which have not a Directer-Plane. Hyperboloid. Surface of the "biais passe."*

Directer-cone: its advantages for constructing the tangent plane parallel to a given plane, and for determining the nature of the plane sections. The tangent planes to the points of the surface, situated at infinity, are respectively parallel to the tangent plane of the directer-cone. Developable surface which is the envelope of these tangent planes at infinity. Construction of a paraboloid of *raccordement* to a ruled surface defined by two directrices and a directrix cone.

Hyperboloid; double mode of generation by straight lines; center; assymptotic cone.

Scalene hyperboloid; hyperboloid of revolution. Identity of the hyperboloid with one of the five surfaces of the second degree studied in analytical geometry.

Re-statement without demonstration of the properties of this surface, found by analysis, principally as to what regards the axis, the vertices, the principal planes, and the generation by conic sections.

Hyperboloid of *raccordement* to a ruled surface along a generatrix; all their centers are in the same plane. Transformation of a hyperboloid of *raccordement.*

Surface of the *biais passé.* Construction of a hyperboloid of *raccordement;* its transformation into a paraboloid.

Construction of the tangent plane at a given point.

Lessons 26—28. *Curvature of Surfaces. Lines of Curvature.*

Re-statement without proof of the formula of Euler given in the course of analysis.

There exists an infinity of surfaces of the second degree, which at one of their vertices osculate any surface whatever at a given point.

In the tangent plane, at a point of a surface, there exists a conic section, whose diameters are proportional to the square roots of the radii of curvature of the normal sections to which they are tangents. This curve is called the indicatrix. It is defined in form and position, but not in magnitude. The normal sections tangential to the axes of the indicatrix are called the principal sections.

The indicatrix an ellipse; convex surfaces; umbilici; line of spherical curvatures.

The indicatrix a hyperbola; surfaces with opposite curvatures.

The assymplotes of the indicatrix have a contact of the second order with the surface, and of the first order with the section of the surface by its tangent plane.

A ruled surface has contrary curvatures at every point. The second assymplotes of the indicatrices of all the points of the same generatrix form a hyperboloid, if the surface has not directer-plane,—a paraboloid, if it have one.

Curvature of developable surfaces.

There exists upon every surface two systems of orthogonal lines, such that every straight line subject to move by gliding over either of them, and remaining normal to the surface, will engender a developable surface. These lines are called lines of curvature.

The two lines of curvature which cross at a point, are tangents to the principal sections of the surface at that point.

Remarks upon the lines of curvature of developable surfaces, and surfaces of revolution.

Determination of the radii of curvature, and assymplotes of the indicatrix at a point of a surface of revolution.

Lessons 29—30. *Division of Curves of Apparent Contour, and of Separation of Light and Shadow into Real and Virtual Parts.*

When a cone is circumscribed about a surface, at any point whatever of the curve of contact, the tangent to this curve and the generatrix of the cone are parallel to two conjugate diameters of the indicatrix.

Surfaces, as they are considered in shadows, envelop opaque bodies, and the curve of contact of a circumscribed cone, only forms a separation of light and shadow, for a luminous point at the summit of the cone, when the generatrices of this cone are exterior. This line is thus sometimes real and sometimes virtual.

Upon a convex surface, the curve of separation of light and shade is either all real or all virtual. Upon a surface with contrary curvatures, this curve presents generally a succession of real and virtual parts: the curve of shadow cast from the surface upon itself presents a like succession. These curves meet tangentially, and the transition from the real to the virtual parts upon one and the other, take place at their points of contact in such a way that the real part of the curve of shadow continues the real part of the curve of separation of light and shade. The circumscribed cones have edges of regression along the generatrices, which correspond to the points of transition.

The lines of visible contour present analogous circumstances.

General method of determining the position of the transition points. Special method for a surface of revolution.

Lessons 31—34. *Ruled Helicoidal Surfaces.*

Surface of the thread of the triangular screw; generation, representation, sections by planes and conical cylinders.

Construction of the tangent plane at a given point, or parallel to a given plane. The axis is the line of striction.

Construction of lines of shadow and perspective: their infinite branches, their assymplotes. Determination of the osculating hyperboloid along a generatrix.

Representation and shading of the screw with a triangular thread and its nut.

Surface of the thread of the square screw; generation, sections by planes and conical cylinders; tangent planes; curve of contact of a circumscribed cone.

The curve of contact of a circumscribed cylinder is a helix whose *step* is half that of the surface. Determination of the osculating paraboloid. At any point whatever of the surface, the absolute lengths of the radii of curvature are equal.

Representation and shading of the screw with a square thread, and of its nut.

Observations on the general ruled helicoidal surface, and on the surface of intrados of the winding staircase.

Lesson 35. *Different Helicoidal Surfaces.*

Saint-Giles screw, worm-shaped screw and helicoidal surfaces to any generatrix. Every tangent to the meridian generatrix describes a screw surface with triangular thread, which is circumscribed about the surface, along a helix, and may be used to resolve the problems of tangent planes, circumscribed cylinders, &c.

Helicoid of the open screw, its generation, tangent planes.

Lessons 36—37. *Topographical Surfaces.*

Approximate representation of a surface by the figured horizontal projections of a series of equidistant horizontal sections. This method of representation is especially adapted to topographical surfaces, that is to say, surfaces which a vertical line can only meet in one point.

Lines of greatest slope. Trace of a line of equal slope between two given points.

Intersection of a plane and a surface, of two surfaces, of a straight line and a surface.

Tangent planes, cones, and cylinders circumscribed about topographical surfaces.

Use of a topographical surface to replace a table of double-entry when the function of two variables, which it represents, is continuous. It is often possible, by a suitable anamorphosis, to make an advantageous transformation in the curves of level.

Lesson 38. *Revision.*

Review of the different methods of geometrical drawing. Advantages and disadvantages of each.

Comparison of the different kinds of surfaces, *résumé* of their general properties.

Object, method, and spirit of descriptive geometry.

SECOND YEAR.

STEREOTOMY.—WOOD-WORK.

LESSONS 1—4. *Generalities.*

Notions on the mode of action of forces in carpentry. Resistance of a piece of wood to a longitudinal effort and to a transversal effort. Distinction between resistance to flexure and resistance to rupture. Beams.

Advantages of the triangular system, St. Andrew's cross.

LESSONS 5—8. *Roofs.*

Ordinary composition of roofs.

Distribution of pressures in the different parts of a girded roof.

Design of the different parts of roofs, &c., &c.

LESSONS 9—10. *Staircases.*

MASONRY.

LESSONS 11—12. *Generalities.*

Notions on the settlement of vaulted roofs. Principal forms of vaults, *en berceau*, &c., &c.

Distribution of the pressures, &c.

Division of the intrados. Nature of the surfaces at the joints, &c., &c.

LESSONS 13—15. *Berceaux and descentes.*

LESSONS 16—22. *Skew Arches.*

Study of the general problem of skew arches.

First solution. Straight arches *en échelon.*

Second solution: Orthogonal *appareil.* True and principal properties of the orthogonal trajectories of the parallel sections of an elliptical or circular cylinder. Right conoid, having for directrices the axis of the circular cylinder and an orthogonal trajectory. The intersection of this conoid by a cylinder about the same axis is an orthogonal trajectory for a series of parallel sections.

Third solution: helicoidal. Determination of the angular elevation at which the surfaces of the beds become normal to the head planes; construction in the orthogonal and helicoidal *appareil* of the curves of junction upon the heads, and the angles which they form with the curves of intrados. Cutting of the stones in these different constructions. Broken helicoidal *appareil*, for very long skew arches.

Helicoidal *trompes* at the angles of straight arches; *voussures* or widenings, which it is necessary to substitute near the heads at the intrados of an arch with a considerable skew; case where the skew is not the same for the two heads. Orthogonal trajectories of the converging sections of a cylinder.

Lessons 23—25. *Conical Intrados—Intrados of Revolution.*

Skew *trompe* in the angle. Suggestions on the general problem of conical skew vaulted roofs.

Spherical domes, &c.

Lessons 26—27. *Intrados, a Ruled Surface.*

Winding staircases, &c., &c.

Lesson 28. *Helicodial Intrados.*

Staircase on the Saint-Giles screw.

Lessons 29—31. *Composite Vaulted Roofs.*

Various descriptions of vaults.

Suggestions on vaulted roofs with polygonal edges and with ogival edges.

Lesson 32. *Revision.*

Spirit and method of stereotomy.

Degree of exactness necessary. Approximate solutions. Case where it is proper to employ calculation in aid of graphical constructions.

Review and comparison of different *appareils.*

MECHANICS AND MACHINES.

GENERAL ARRANGEMENTS.

The pupils execute during the two years of study:—

1. Various drawings or plans of models in relief, representing the essential and internal organs of machines, such as articulations of connecting rods, winch-handles and fly-wheels, grease-boxes, eccentrics worked by cams or circles giving motion to rods; the play of slides, &c.; cylinders of steam-engines, condenser, pistons, and various suckers; Archimedes' screw, and other parts of machines.

The sketches of the plan drawings are traced by hand and figured. The drawings in their finished state are washed and colored according to the table of conventional tints; they all carry a scale suitably divided.

2. A drawing of wheel-work by the method of development, and tracing the curves of teeth by arcs of circles from which they are developed. This drawing represents, of the natural size, or on any other scale of size considered suitable to show the nature of the partial actions only, a small number of teeth either in development or projection; the entire wheel-work is represented by the usual method of projection, where in drawings on a small scale the teeth are replaced by truncated pyramids with a trapezoidal base.

3. Finally, numerical exercises concerning the loss of work due to the prejudicial resistances in various machines, the gauging of holes, orifices, &c.

Models in relief, or drawings on a large scale, of the machines or elements of the machines mentioned in the course, assist in explaining the lessons. They are brought back, as often as found necessary, under the eyes of the students. When possible, lithographic sketches of the machines, or the elements of the machines, which ought to enter into the course, are distributed among the pupils.

The pupils, divided into sections, pay their first visit to the engine factories towards the end of their first year of study; they make one or more additional visits at the end of the second year.

FIRST YEAR.

PART I. KINEMATICS.—PRELIMINARY ELEMENTARY MOVEMENTS OF INVARIABLE POINTS AND SYSTEMS.

LESSONS 1—2.

Object of kinematics, under the geometrical and experimental point of view. Its principal divisions.

Re-statement of the notions relative to the motion of a point, its geometrical representation, and more especially the determination of its velocity.

Simultaneous Velocities of a Point and the Increments of its Velocities.

Ratio of the elementary displacement and the velocity of a point to the displacement, and velocity of its projection upon a straight line or plane. Use of infinitesimals to determine these ratios. Example:—Oscillatory motion of the projection upon a fixed axis of a point moving uniformly upon the circumference of a circle.

Analogous considerations for polar co-ordinates. Relations of the velocity of a point, of its velocity of revolution and its angular velocity about a fixed pole; of its velocity in the direction of the radius vector; of the velocity of increase of the area which this radius describes.

Simple Motions of Solids, or Rigid Systems.

1. Motion of rectilinear or curvilinear translation; simultaneous displacements, and velocities of its different points.

2. Motion of rotation about a fixed axis; relation of the velocities of different points to the angular velocity.

Geometrical notions and theorems relative to the *instantaneous center* of rotation of a body of invariable figure and movable in one plane, or to the *instantaneous axis* of rotation of a rigid system situated in space, and movable parallel to a fixed plane. Relation of the velocities of different points to their common angular velocity. Use of the instantaneous center of rotation for tracing tangents; examples—and amongst others—that of the plane curve described by a point in a straight line of given length, whose extremities slide upon two fixed lines. Rolling of a curve upon another fixed curve in a plane. Descartes' theorems upon the intersection of the normals at the successive points of contact: cycloids, epicycloids, involutes, and evolutes. Extension of the preceding motions to the instantaneous axis of rotation of a rigid system movable about a fixed point.

COMPOSITION OF MOTIONS.

LESSONS 3—6 *Composition of the Velocities of a Point.*

Polygon of velocities. Example of movements observed relatively to the earth. Particular cases; composition of velocities taken along three axes; composition of the velocity of a point round a fixed pole, and its velocity along the radius vector. Method of Roberval for tracing tangents.

Composition of the Simple Motions of a Solid System.

Composition of any number of translatory displacements of a solid. Composition of two rotations about two intersecting axes. Composition of any number of rotations about axes cutting one another at the same point; parallelopiped and polygon of rotations. Composition of two simultaneous rotations about parallel axes; case where the rotations are equal and of opposite kinds. Decomposition of a rotation about an axis into an equal rotation about any axis whatever parallel to the first, and a translation perpendicular to the direction of this axis. Direct and geometrical decomposition of the most general motions of a body into a rotation about, and a translation along, an axis called the *instantaneous axis.* Composition of any two motions whatever. Every movement of an invariable system is at each instant of time decomposable into three movements of rotation, and three movements of tranlation with respect to three axes, which are neither parallel nor lying in the same plane, but otherwise arbitrarily chosen.

Relative or Apparent Motions.

Relative motion of two points whose absolute motions are given graphically *à priori.* Trajectory of the relative motions, relative velocities, and displacements upon curves or upon the direction of the mutual distance of the two points; use of the parallelogram to determine its amount. Relative motion of a point in motion in respect of a body turning about a fixed axis; relative motion of two bodies which turn about parallel or converging axes, and in general of two rigid bodies or systems impelled by any motions whatever. How this problem is immediately reduced to that of the composition of given motions.

The most general continued motion of an invariable figure in a plane is an *epicycloidal* motion, in which the instantaneous center describes a curve fixed in relation to absolute space, and traces relatively to the proposed figure a movable curve, which is rigidly connected with that figure and draws it along with it in its motion of rolling upon the other fixed curve. Case of space or spherical figures.

ON THE ACCELERATED MOTION OF A POINT.

LESSONS 7—9. *Accelerated Rectilinear Motion.*

Re-statement of the motions acquired relatively to the acceleration in the variable rectilinear motion of a point. Brief indication of the solution of six problems arising out of the investigation of the laws of the motion in terms of the space, time, velocity, and accelerating force. For the most part these solutions may be brought to depend on exact or approximate quadratures. Numerical exercises.

Accelerated Curvilinear Motions.

Re-statement of the notions acquired relative to the composition of accelerating forces; the resulting acceleration, the normal and tangential acceleration animating a point in motion on a curve. The total acceleration of a point upon an axis or plane is the projection upon this axis or plane of the acceleration of the moving body in space. In uniform curvilinear motion the total or resultant acceleration becomes normal to the curve. Particular case of the circle; value of the normal acceleration in terms of the velocity of revolution or the angular velocity of the radius vector. Case of any curve whatever; geometrical expression of the total or resultant acceleration.

Accelerated Compound and Relative Motions.

Geometrical investigation of the simple and compound accelerations arising out of the hypothesis in which the motion of any system of points whatever is referred to another system of invariable form, but also in motion, Geometrical and elementary explanations of the results obtained by means of the transformation of co-ordinates.

Examples or Exercises chosen from among the following Questions:—

Projection of circular and uniform motion upon a fixed straight line or plane; motion of a circle which rolls uniformly on a straight line; comparison of the motions of the planets relatively to each other, treating them as circular and uniform; comparison of the accelerating force on the moon with that of bodies which fall to the earth.

GEOMETRICAL THEORY AND APPLICATION OF MECHANISMS OR CONTRIVANCES FOR THE TRANSFORMATION OF MOTION.

LESSONS 10—19.

Succinct notions on the classification of elementary motions and organs for transmission of motion in machines after Monge and Hachette, Lanz and Bétancourt.

The most essential details upon this subject are set forth in the following order, and made clear by outline drawings previously distributed among the pupils.

Organs fitted to regulate the direction of the circular or rectilinear motion of certain pieces.

Axle; trunnions, gudgeons; pivots and bearings; couplings of axes; adjustment of wheels and of their arms. Joints with hinges, &c.; sheaves and pulleys; chains, ropes, and straps; means of securing them to the necks. Grooves and tongue-pieces. Eyelet-holes sliding along rectilinear or curvilinear rods. Advantages and disadvantages of these different systems of guides under the point of view of accuracy.

Rapid indication of some of their applications to drawbridges and to the movable frames or wagons of saw-works and railways.

Transmission at a Distance of Rectilinear Motion in a determinate Direction and Ratio.

Inclined plane or wedge guiding a vertical rod. Wedge applied to presses. Rods, winch-handles, &c. Disposition of drums or pulleys in the same plane or in different planes; geometrical problem on this subject. Fixed and movable pulleys. Blocks to pulleys. Simple and differential wheel and axle moved by cords. Transmission through a liquid. Ratios of velocities in these different organs.

Direct Transformation of circular progressive motion into progressive and intermittent rectilinear motion.

Rod conducted between guides: 1°, by the simple contact of a wheel; 2°, by cross-straps or chains; 3°, by a projecting cam; 4°, by means of a helicoidal groove set upon the cylindrical axis of the wheel. To-and-fro movement, and heart-shaped or continuous cam, waves, and eccentrics. Simple screw and nut. Left and right handed screws; differential screw of Prony, called the micrometric screw. Ratio of the velocities in these different organs.

The example of the cam and pile-driver will be particularly insisted upon; 1°, in the case where this cam and the extremity of the rod have any continuous form given by a simple geometrical drawing; 2°, in the case where this form is defined geometrically by the condition, that the velocity is to be transmitted in an invariable ratio, as takes place for cams in the form of epicycloids or involutes of circles.

Transformation of a circular progressive motion into another similar to the first.

1°, by contact of cylinders or cones, the two axes being situated in the same plane; 2°, by straps, cords, or endless chains, the axes being in the same situation; 3°, by cams, teeth, and grooves, at very slight intervals; 4°, by the Dutch or universal joint. Case, where the axes are not situated in the same plane; use of an intermediate axis with beveled wheels or a train of pulleys; idea of White or Hooke's joint in its improved form. Endless screw specially employed in the case of two axes at right angles to one another. Combinations or groupings of wheels. Idea of differential wheels. Relations of velocities in the most important of these systems of transmission.

Transformation of circular progressive Motion into rectilinear or alternating circular motion.

Ordinary circular eccentric. Eccentrics with closed waves or cams. Examples and graphical exercises in the class-rooms relative to the alternate action of the traveling frames of saw-mills, of the slides or entrance valves of steam-engines. Cams for working hammers and bellows.

Transformation of alternating circular motion into alternating rectilinear motion, or into intermittent and progressive circular motion.

Pump rods with or without circular sectors, &c. Examples taken from large exhausting pumps, fire-engines, and common pumps. Suggestions as to the best arrangement of the parts. Lagarousse's lever, &c. Application of the principle relative to the instantaneous center of rotation to give the relations of the velocities in certain simple cases.

Transformation of alternating circular or rectilinear motions into progressive circular motion.

The knife-grinder's treadle. System of great machines worked with connecting rods, fly-wheel, &c. Watt's parallelogram, and the simplest modifications of it for steamboats, for instance. The most favorable proportions for avoiding the deviation of piston-rods. Simplification of parts in the modern steam-engines of Maudsley, Cavé, &c. Variable ratios of the velocities.

Of organs for effecting a sudden change of motion.

Suspendors or moderators, &c. Dead wheels and pulleys, &c. Mechanisms for stretching cords or straps, and make them change pulleys during the motion. Brakes to windmills, carriages, &c., &c. Case where the axes are rendered movable. Means for changing the directions and velocity of the motions. Coupled and alternate pulleys; alternate cones; castors moving by friction and rotation upon a plate or turning-cone; eccentric and orrery wheels. Means of changing the motion suddenly and by intervals; wheels with a detent pile-drivers; Dobo's escapement for diminishing the shock, &c.

Geometrical Drawing of Wheel-work.

General condition which the teeth of toothed wheels must satisfy. Consequence resulting from this for the determination of the form of the teeth of one of two wheels, when the form of the teeth of the other wheel is given.

Cylindrical action of toothed wheels or toothed wheels with parallel axes. External engagement of the teeth; internal engagement. Particular systems of toothed wheels; lantern wheels, flange wheels, involutes of circles. Reciprocity of action; case where the action can not be rendered reciprocal. Pothook action. Details as to the form and dimensions given in practice to the teeth and the spaces which separate them.

Conical action of toothed wheels, or toothed wheels with converging axes. Practical approximate method of reducing the construction of a conical to that of a cylindrical engagement of toothed wheels.

Means of observation and apparatus proper for discovering experimentally the law of any given movement.

Simple methods practiced by Galileo and Coulomb in their experiments relative to the inclined plane and the motion of bodies sliding down it. Various means of observing and discovering the law of the translatory and rotatory motion of a body according as the motion is slow or rapid. Determination of the angular velocity, &c. The counter in machines. Apparatus of Mattei and Grobert for assigning the initial velocity of projectiles (musket balls.) Colonel Beaufoy's pendulum apparatus. Chronometrical apparatus for continuous indications by means of a pencil. Eytelwein's apparatus with bands, and its simplest modifications. Apparatus with cylinders or revolving disks. Use of the tuning-fork for measuring with precision very small fractions of time.

(The principal sorts of the apparatus above described are made to act under the eyes of the pupils.)

PART II.—EQUILIBRIUM OF FORCES APPLIED TO MATERIAL SYSTEMS.

LESSON 21.

Résumé of the notions acquired upon the subject of forces, and their effects on material points.

Principle of inertia, notion of force, of its direction, of its intensity. Principle of the equality of action and reaction. What is meant by the force of inertia? Principle of the independence and composition of the effects of forces. Forces proportional to the acceleration which they produce on the same body. Composition of forces. Relation between the accelerating force, the pressure, and the mass. Definition of the work done by a force. The work done by the resultant is equal to the sum of the works done by the components. Moment of a force in relation to an axis deduced from the consideration of the work of the force applied to a point turning about a fixed line. The moment of the resultant of several forces applied to a point is equal to the sum of the moments of the components. Corresponding propositions of geometry.

Lessons 22—25.

Succinct Notions upon the Constitution of Solid Bodies.

Every body or system of bodies may be regarded as a combination of material points isolated or at a distance, subject to equal and opposite mutual actions. Interior and exterior forces. Example of two molecules subject to their reciprocal actions alternately, attractive and repulsive, when the forces applied draw them out of their position of natural equilibrium. Different degrees of natural solidity, stability, or elasticity; they can only be appreciated by experience.

Equilibrium of any Systems whatever of Material Points.

General theorem of the virtual work of forces applied to any system whatever of material points. It is applicable to every finite portion of the system, provided regard be had to the actions exercised by the molecules exterior to the part under consideration. Determination of the sum of the virtual works of the equal and reciprocal actions of two material points. Demonstration of the six general equations of equilibrium of any system whatever. They comprise implicitly *every* equation deduced from a virtual movement compatible with the pre-supposed solidification of the system.

Theorem on the virtual work in the case of systems where one supposes ideal connections, such as the invariability of the distance of certain points of the system from one another, and the condition that certain of them are to remain upon curves either fixed or moving without friction.

Equilibrium of Solid Bodies.

The six general equations of equilibrium are sufficient as conditions of the equilibrium of a solid body. Theory of moments and couples.

APPLICATIONS.

Lessons 26—29. *Equilibrium of Heavy Systems.*

Recapitulation of some indispensable notions for the experimental determination of the center of gravity of solids when the law of their densities is unknown. Re-statement of the theorem relative to the work done by gravity upon a system of bodies connected or otherwise. In machines supposed without friction submitted, with the exception of their supports, to the action of gravity alone, the positions of stable or unstable equilibrium correspond to the highest or lowest points of the curve which would be described by the center of gravity of the system when made to move. Influence of defect of centering in its wheels, upon the equilibrium of a machine. Case where the center of gravity always remaining at the same height the equilibrium is neutral. Examples relative to the most simple drawbridges, &c.

Equilibrium of Jointed Systems.

Equilibrium of the funicular polygon deduced from direct geometrical considerations: Varignon's theorem giving the law of the tensions by another polygon whose sides are parallel and proportional to the forces acting upon the vertices of the funicular polygon. Case of suspension bridges; investigation of the curve which defines the boundary of the suspension chain; tensions at the extremities.

Equilibrium of systems of jointed rigid bodies without friction. Determination of the pressure upon the supports and the mutual actions at the joints.

Equilibrium and stability of solid bodies submitted to the action of stretching or compressing forces.

Permanent resistance and limiting resistance of prisms to longitudinal extension and compression. Equilibrium and stability of a heavy solid placed upon a horizontal plane and submitted to the action of forces which tend to overset it. Resultant pressure and mean pressure; hypothetical distribution of the elements of the pressure on the base of support. Conditions of stability, regard being had to the limit of resistance of solid materials, co-efficient of stability deduced from it.

PART III.—ON THE WORK DONE BY FORCES IN MACHINES.

LESSONS 30—39. *General Notions.*

Principle of work in the motion of a material point. Extension of this principle to the case of any material system whatever in motion. Considerations relative to machanical work in various operations, such as the lifting of weights, sawing, planing, &c. It is the true measure of the productive activity of forces in industrial works. It may always be calculated either rigorously or approximately when the mathematical or experimental law which connects the force with the spaces described is given. Uniform work, periodical work, mean work, for the unit of time. Horse-power unit. Examples and various exercises, such as the calculation of the work corresponding to the elasticity of gases on the hypothesis of Mariotte's law, the elongation of a metallic prism, &c.

Dynamometrical Apparatus.

Dynamometer of traction by a band or rotating disc or register. Dynamometer of rotation with simple spring, with band or register. Dynamometer of rotation with multiple springs and with register for the axles of powerful machines. Improved indicator of Watt.

(These pieces of apparatus are made to act under the eyes of the pupils.)

Work of Animal Prime Movers upon Machines.

Results of experience as to the values of the daily work which animal motors can supply under different circumstances without exceeding the fatigue which sleep and nourishment are capable of repairing.

Theory of the Transmission of Work in Machines.

Principal resistance. Secondary resistances. Two manners in which bodies perform the duty of motors. Ratio of work done to work expended always inferior to unity. Different parts of machines; receiver; organs of transmission; tools as machines.

Calculation of the Work due to the passive resistances in machines.

Résumé of the notions previously acquired on friction. Application to the inclined plane, to the printing-press, to guides or grooves, to the screw with a square thread; different cases of uniform motion being impossible under the action of forces of given directions. Friction of trunnions, pivots, eccentrics, and insertions of winch-handles. Prony's dynamometrical brake; conditions of its application. Resistance to rolling; its laws according to experiment. Use of rollers and friction-wheels; their practical inconveniences.

Mixed friction of toothed wheels; the Dobo escapement: friction of the teeth in the endless screw.

Stiffness and friction of cords. Results of experience. Friction of cords and straps running round drums. Different applications; brakes; transmission by cords, endless straps, or chains.

Examples and exercises; effects of passive resistances in the capstan, the crane, pulleys, &c.

Lesson 40. *Revision.*

SECOND YEAR.

PART I.—DYNAMICS.—DYNAMICS OF A MATERIAL POINT.

Lessons 1—2. *Completion of the Notions acquired on this Subject.*

Differential equations of the motion of a material point submitted to the continued action of one or more forces. The acceleration of the projection of a point upon any axis or plane is due to the projection of the forces on this axis or plane. The acceleration along the trajectory is due to the tangential force. Relation of the curvature to the centripetal force. Introduction of the force of inertia into the preceding enunciations.

The increase of the quantity of motion projected upon an axis or taken along the trajectory is equal to the impulsion of the projected resultant, or to that of the tangential force. The total impulsion of a force is got by methods of calculation and of experiment analogous to those which relate to *work.* The increase of the moment of the quantity of motion in relation to any axis is equal to the total moment of the impulsions of the forces during the same interval of time; direct geometrical demonstration of this theorem. In decomposing the velocity of the moving body into a velocity in the plane passing through the axis of the moments, and a velocity of revolution perpendicular to this plane, we may replace the moment of the quantity of motion in space by the quantity of motion of revolution. Particular case known under the name of the principle of areas.

Extension of the preceding theorems to the case of relative motions. Apparent forces which must be combined with the real ones that the relative motion of a point may be assimilated to an absolute motion. Particular case of relative equilibrium. Influence of the motion of the earth upon the accelerating force of gravity.

DYNAMICS OF ANY MATERIAL SYSTEMS.

Lessons 3—8.

Principle or general rule which reduces questions in dynamics to questions in equilibrium by the addition of the forces of inertia to the forces which really act on the system. Equation of virtual work which expresses this equilibrium; it comprises in general the external and internal forces.

General Theorems.

These theorems, four in number, are founded upon the principle of the equality of action and reaction applied to internal forces. They may be deduced from the preceding rule, but the three last are obtained more simply by extending to a system of material points analogous theorems established for isolated material points.

General theorem of the motion of the center of gravity of a system. Particular case called *principle of the conservation of the motion of the center of gravity.*

General theorem on the quantities of motion and impulsions of exterior forces projected on any axis.

General theorems of moments of quantities of motion and impulsions of exterior forces, projected on any axis whatever.

General theorems of the moments of quantities of motion and impulsions of exterior forces about any axis. Analogy of these two theorems with the equations of the equilibrium of a solid, in which the forces are replaced by impulsions and quantities of motion.

Composition of impulsions, of quantities of motion, or the areas which represent them. All the equations which can be obtained by the application of the two theorems relative to quantities of motion and impulsions, reduce themselves to six distinct equations. Particular case called *principle of the conservation of areas.* Fixed plane of the resulting moment of the quantities of motion called *plane of maximum areas.*

General theorem of work and *vis viva.* Part which appertains to the interior forces in this theorem. Particular case called principle of the conservation of *vires vivæ*, where the sum of the elements of work done by the exterior and interior forces is the differential of a function of the co-ordinates of different points of the system. Application of the theorem of work to the stability of the equilibrium of heavy systems.

Extension of the preceding theorems to the case of relative motions. Particular case of relative equilibrium. Motion of any material system relative to axes always passing through the center of gravity, and moving parallel to themselves. Invariable plane of Laplace. Relation between the absolute *vis viva* of a material system, and that which would be due to its motion, referred to the system of movable axes above indicated.

Examples and Applications.

The following examples, amongst others, to be taken as applications or subjects of exercises relative to the general principles which precede.

Walking. Recoil of guns. Eolypile. Flight of rockets.

Pressure of fluid veins, resistance of mediums, &c. Direct collision of bodies more or less hard, elastic, or penetrable. Exchange of quantities of motion. Loss of *vis viva* under different hypotheses. Influence of vibrations and permanent molecular displacements.

Pile driving; advantage of large rammers. Comparison of effects of the shocks and of simple pressures due to the weight of the construction. Oblique collision, and ricochet. Data furnished by experiment.

Oscillations of a vertical elastic prism suspended to a fixed point, and loaded with a weight, neglecting the inertia, and the weight of the material parts of this prism. Case of a sudden blow. What is meant by the "*resistance vive*" of a prism to rupture? Results of experiments.

Work developed by powder upon projectiles, estimated according to the *vis viva* which it impresses on them, as well as upon the gun and the gases upon hypothesis of a mean velocity.

SPECIAL DYNAMICS OF SOLID BODIES.

LESSONS 9—12. *Simple Rotation of an invariable Solid about its Axis.*

In applying to this case the first general rule of dynamics, the theorem of the moments of the quantities of motion, and the theorem of work, we are led to the notion of the moment of inertia; explanation of the origin of this name. The angular acceleration is equal to the sum of the moments of the exterior forces divided by the moment of inertia about the axis of rotation. Sum of the moments of the quantities of motion relative to this axis. *Vis viva* of a solid simply turning about an axis. What is meant by *radius of gyration?*

Remind of the geometrical properties of moments of inertia, of the ellipsoid which represents them, of the principal axes at any point, of those which are referred to the center of gravity.

Pressure which a rotating body exercises on its supports. Reduction of the centrifugal and tangential forces of inertia to a force which is the force of inertia of the entire mass accumulated at the center of gravity, and a couple.

Particular case where the forces of inertia have a single resultant; different examples. Center of percussion. Compound pendulum; length of the corresponding simple pendulum. Center of oscillation; reciprocity of the centers or axes of suspension and oscillation. Pressure upon the axis. Influence of the medium; experience proves that the resistance, varying with the velocity, changes the extent of the oscillations, but does not sensibly affect the time. Experimental determination of the center of oscillation and the moment of inertia about an axis.

Motion of an invariable Solid subject to certain Forces.

General notions on this subject. Motion of the center of gravity; motion of rotation about this point.

LESSONS 13—19. *Various Applications.*

Motion of a homogeneous sphere or cylinder rolling upon an inclined plane, taking friction into account.

Motion of a pulley with its axis horizontal, solicited by two weights suspended vertically to a thread or fine string passing round the neck of the pulley, the axle of which rests upon movable wheels. Atwood's machine serving to demonstrate the laws of the communication of motion.

Motion of a horizontal wheel and axle acted on by a weight suspended vertically to a cord rolled round the axle, or upon a drum with the same axis, and presenting an eccentric mass. To take account of the variable friction of the bearings, and the stiffness of the cord, with recourse, if necessary, to approximation by quadratures. Oscillations of the torsion balance.

Balistic pendulum. Condition that there may be no shock on the axis. Experimental determination of the direction in which the percussion should take place.

Theory of Huyghen's conical pendulum considered as a regulator of machinery. How to take account of the inertia and friction of the jointed rods, as well as of the force necessary to move the regulating lever, &c.; appreciation of the degree of sensibility of the ball apparatus with a given uniform velocity.

Windlass with fly-wheel. Dynamical properties of the fly-wheel. Reduced formulæ for a crank with single or double action. Advantages and disadvantages of eccentric masses. Tendency of the tangential forces of inertia to break the arms. Numerical examples and computations.

Mutual action of rotating bodies connected by straps or toothed wheels in varying motion.

The wedge and punching-press. Stamping screw or lever used in coining, cams, lifting a pile or a hammer. To take account of the friction during the blow, and afterwards to estimate the loss of *vis viva* in cases which admit of it.

PART II.—SPECIAL MECHANICS OF FLUIDS.—HYDROSTATICS.

Lessons 20—22.

Principle of the equality of pressure in all directions. Propagation of the pressures from the surface to the interior of a fluid, and upon the sides of the vessel. Equations of equilibrium for any set of forces. Pressure exerted in the containing orifices. Measure of the pressure upon a plain portion of surface inclined or vertical (sluice-gate, embankments, &c.) Center of push or pressure. Pressure against the surfaces of a cylindrical tube. Effect, and resistance to oppose to the pressure. Manometer and piezometer. Equilibrium of a body plunged in a heavy fluid or floating at its surface. Stability of floating bodies. Metacenter. Laws of the pressure in the different atmospheric strata.

HYDRAULICS.

Lessons 23—27. *Flow of Fluids through small Orifices.*

Study of the phenomena which accompany this flow in the case of a thin envelop and a liquid kept at a constant level. Conditions of this constancy in the level, and the permanence of the motion in general. Motion of the lines of fluid; form; contraction; reversal and discontinuity of liquid veins. Fundamental formulæ for liquids and gases based upon the principle of *vis viva*, and Bernouilli's hypothesis of parallel sections or Borda's of contiguous threads. Torricelli's theorem relative to small orifices. What is called the theoretical expenditure, effective expenditure, and co-efficient of geometrical contraction. Co-efficient deduced from the effective expenditure. Its variations with the volume of the fluid contents, and the form of the inner surfaces of the reservoir. Results of the experiments of Michelotti, Borda, Bossut, &c. Phenomenon of adjutages. Venturi's experiments; influence of atmospheric pressure; loss of *vis viva;* reduction of the velocity and augmentation of the expenditure. Results of experience relative to the co-efficient of expenditure, the form and range of the parabolic jets, showing the initial *vis viva*, and the loss of *vis viva*.

Large orifices.—Sluice holes and floodgates; reservoirs or open orifices; expenditure; practical formulæ and results of experiment. Influence of the proximity of the sides and the walls. Arrangement to avoid the effects of contraction or the losses of *vis viva.*

Flow through conducting Pipes and open Canals.

Practical formulæ relative to the case of uniform sections of great length. Measure of the pressures at different points of a conduit-pipe. Expression for the losses of effect due to corners and obstructions. Flow of gases. Principal methods of measuring the volume consumed adopted in practice. Floats. Pitot's tube. Woltman's mill. Register mill in air or gas. Waste in such instruments. Modulus and scale for water-supply.

PART III.—DIFFERENT MACHINES CONSIDERED IN THE STATE OF MOTION.

LESSON 28. *General Considerations. Résumé of the Notions acquired on this Subject.*

Equation of *vis viva*, and transmission of work in machines, account being taken of the different causes of power and resistance. Physical constitution of machines; *receiver*, *communicators*, and *operator.* Influence of the weights, of frictions, of shocks, and any changes in the *vis viva.* Parts with continuous or uniform motion, with alternating or oscillating motion. Laws of the motion on starting from rest, and when the stationary condition is established. The positions to which the maximum and minimum of the *vis viva* correspond are those in which there is equilibrium between all the forces, exclusive of the forces of inertia. Advantage of uniform or periodic motion. General methods for regulating the motion; symmetrical distribution of the masses and strains; flys and various regulators. Brakes and moderators; their inconveniences. Object and real advantages of machines.

LESSONS 27—35. *Hydraulic Wheels.*

Vertical wheels with float-boards, with curved ladles, and with spouts. Figure of the surface of the fluid in these latter. Horizontal wheels working by float-boards, buckets, and reaction. Turbines. Description, play, and useful effects compared according to the results of experiment. Vertical wheels of windmills and steamboats. Screw propeller.

Windmills.

Description. Result of Coulomb's observations.

On the principal kinds of Pumps.

Special organs of pumps. Valves and pistons, force pump, sucking pump; limit to the rise of the water. Sucking and force pump. Dynamical effects. Indication as to the losses of *vis viva* and the waste in different pumps. Explanation of the hydraulic ram. Air vessel. Fire pumps. Double action pumps.

Various Hydraulic Machines.

Hydraulic press. Water engine. Exhausting machines; *norias;* under and overshot wheels; Archimedes' screw, construction and experimental data.

LESSONS 36—39. *Steam Engines.*

Succinct description of the principal kinds of steam-engine with or without detent. Effects and advantages of the detent. Condenser. Air Pump. Furnace and feeding-pump.

Variable detent. Formulæ and experimental results.

LESSONS 40—42. *Revision.*

Reflections on the totality of the subjects of the course.

IV. PHYSICS.—*FIRST YEAR.*

GENERAL PROPERTIES OF BODIES.—HYDROSTATICS.—HYDRODYNAMICS.

LESSONS 1—5. *Preliminary Notions.*

Definitions of physics. Phenomena. Physical laws. Experiments are designed to make them spring out of the phenomena. Method of induction. Physical theories; different character of the experimental and mathematical methods.

General Properties of Bodies.

Extension. Measure of lengths. Vernier. Cathetometer. Micrometer screw. Spherometer. Dividing engine.

Divisibility. Porosity. Ideas generally received on the molecular constitution of bodies. These conceptions, which are purely hypothetical, must not be confounded with physical laws. Elasticity. Mobility. Inertia. Forces; their equilibrium, their effects, their numerical estimation.

Weight or Gravity.

Direction of gravity Plumb-line. Relation between the direction of gravity and the surface of still water.

Weight. Center of gravity.

Experimental study of the motion produced by weight. In vacuum, all bodies fall with the same velocity. Disturbing influence of the air. Inclined plane of Galileo. Atwood's machine. To prove by experiment; 1° the law of the spaces described; 2° the law of velocities. Morin's self-registering apparatus with revolving cylinder.

Law of the independence of the effect produced by a force upon a body, and the motion anteriorily acquired by this body. Law of the independence of the effects of forces which act simultaneously upon the same body. Experimental demonstration and generalization of these laws. Law of the equality of action and reaction.

Mass. Acceleration. For equal masses the forces are as the accelerations which they produce. Relation between the force, mass, and acceleration. Collision.

General laws of uniformly accelerated motion. Formulæ.

Pendulum. Law of the isochronism of small oscillations and law of the lengths deduced from observation.

Method of coincidences or beats. Use of the pendulum as the measure of time. Simple pendulum; formulæ. Compound pendulum: the laws of the oscillations of a compound pendulum are the same as the laws of the oscillations of a simple pendulum whose length may be calculated.

Determination by means of the pendulum of the acceleration produced by gravity. This acceleration is independent of the nature of the body.

Remark that the formulæ for the motion of oscillation apply to the comparison of forces of any kind, that may be regarded as constant and parallel to themselves in all positions of the oscillating body.

Identity of gravity and universal attraction.

Measure of weights. Balance. Conditions to be attended to in making it. Absolute sensibility; proportional sensibility. Method of double weighing. Details of the precautions necessary in order to obtain an exact weight.

Different States of Bodies. Hydrostatics.

Solids. Cohesion. Transmission of external pressures.

Elasticity. The true laws of elasticity are unknown. Empirical laws in certain simple cases, and for a very small action. Elasticity of compression, extension, torsion. Experimental determination of the co-efficients of elasticity. Limits of elasticity. Limits of tenacity.

Ductility. Temper. Cold hammering. Annealing.

Liquids. Fluidity. Viscosity. Physical laws which form the basis of hydrostatics:—1° the transmission of external pressures is equal in all directions; 2° the pressure exercised in the interior of a liquid upon an element of a surface is normal to that element, and independent (as to amount) of its direction. These principles are demonstrated by the experimental verification of the consequences drawn from them.

Application to heavy liquids. Free surface, and surface *de niveau.* Pressure upon the parts of the containing vessel, and upon the bottom in particular; hydrostatic paradox; verificatory experiments. Haldat's apparatus. Hydrostatic press.

Application to immersed or floating bodies (principle of Archimedes;) verificatory experiments. (In treating of the equilibrium of floating bodies, the conditions of stability are not gone into.)

Superposed liquids.

Communicating vessels. Water level. Spirit level; its use in instruments.

Densities of solids and liquids. Anemometers.

Compressibility of liquids. Piezometer. Correction due to the compressibility of the solid envelop.

Gas. Expansibility. Other properties common to liquids and gases. Principle of the equal transmission of pressures in all directions. Weight of gases. Pressure due to weight (principle of Archimedes.) Weight of body in air and in vacuum. Aerostation.

Superposed liquids and gases.

Communicating vessels. Barometer.

Detailed construction of barometer. Barometers of Fortin, Gay-Lussac, Bunten. Indication of the corrections necessary.

Mariotte's law. Regnault's experiments.

Manometer with atmospheric air—with compressed air. Bourdon's manometer.

Law of the mixture of gases.

Air pump. Condensing pump.

Primary Notions of Hydrodynamics.

Toricelli's principle. Mariotte's vessel and syphon. Uniform flow of liquids. The same of gases.

Molecular Phenomena.

Cohesion of liquids. Adhesion of liquids to solids. Capillary phenomena. Apparent attractions and repulsions of floating bodies.

Adhesion of drops.

Molecular actions intervene as disturbing forces in the phenomena of the equilibrium and motion of liquids.

HEAT.

EFFECTS OF HEAT ON BODIES.

LESSONS 6—9. *Generalities.*

General effects. Arbitrary choice of one of these effects to define the thermometric condition of a body. Conventional adoption of a thermometer. Definition of temperature.

Dilating Effects.

Definition of the co-efficients of linear, superficial, and cubic dilatation. Approximate relation between the numerical values of these three co-efficients. The value of the co-efficient of dilatation depends upon the thermometric substance and the temperature selected as the zero point. It becomes nearly independent of the zero point when the co-efficient is very small.

Relation between volume, density, and temperature. Linear dilatation of solid bodies. Ramsden's instrument. Cubical dilatation of liquids. Dulong and Petit's experiments on mercury. Discussion. Regnault's experiments.

Cubical dilatation of solids and of other liquids when that of mercury is given.

Relations between the volume, density, and elasticity of a gas, and its temperature.

Cubical dilatation of gases. Experiments of Gay-Lussac, Rudberg, and M. Regnault. Advantage of varying the methods of experimenting in these delicate researches.

Methods based upon the changes of volume under a constant pressure, and upon the changes of pressure for a constant volume.

The disagreement of these two methods is due to deviations from the law of Mariotte.

The constancy of the co-efficients of dilatation previously defined is only approximately true.

Necessity of employing two different co-efficients of dilatation according as consideration is being had to the variations of volume to a given pressure, or of pressure to a given volume.

Empirical formulæ for the dilatation of liquids.

Graphical constructions.

LESSON 10. *Thermometers.*

Construction of thermometers. Mercurial thermometer. Details of construction. Fixed points. Different scales; their relation. Arbitrary scales.

Change which takes place in the zero point. Different precautions to be observed in using the mercurial thermometer.

General want of comparability of mercurial thermometers with tubes of different material.

Air thermometers. They are comparable with one another within the limits of the errors of experiment, whatever the nature of the tube employed. This property entitles the air thermometer to a preference for all accurate measures. Comparison of the air and mercurial thermometers.

THERMOSCOPE, DIFFERENTIAL THERMOMETER, PYROMETERS, BREGUET'S THERMOMETER.

LESSONS 11—13. *Changes of State produced by Heat.*

Exposition of the phenomena which accompany the liquefaction of solids and the solidification of liquids. Constancy of the temperature whilst the phenomenon is going on.

Sudden melting and freezing. Persistance of the liquid state beneath the melting point.

Influence of pressure.

Exposition of the phenomena which accompany the conversion of liquids or solids into vapor, and the inverse passage from the gaseous to the liquid or solid state. Constancy of the temperatures whilst the phenomenon is going on.

Influence of pressure.

Phenomena of ebullition in free space. Augmentation of the temperature and pressure in a confined space. Papin's digester.

Properties of vapors in spaces and in gases. Saturated vapors. Their tension does not depend upon the space which they occupy, but only upon their temperature.

Effects of a diminution or increase of pressure without change of temperature; the same without change of pressure. Effects of lowering the temperature in a limited region of space occupied by vapor.

Tension of a saturated vapor at the boiling point of its liquid.

Measure of the tensions of the vapor of water. Experiments of Dalton, Gay-Lussac, Dulong, and Arago, and of M. Regnault.

Tables of the tensions of steam. Empirical formulæ. Graphical constructions.

It is assumed that non-saturated vapors are subject to the same laws as gases.

APPLICATIONS. CORRECTION OF THE BOILING POINT IN THE CONSTRUCTION OF THERMOMETERS. BAROMETRICAL THERMOMETERS.

LESSONS 14—16. *Various Applications of the Laws previously established.*

A phenomenon can not always be separated from the accessory phenomena which concur with it in producing the final result. Necessity of corrections to render complex results comparable *inter se.*

Density of solids when regard is had to the temperature and weight of the gases displaced by them.

Precautions to be attended to in the experiments. Empirical formulæ for the density of liquids. Maximum density of water. The temperature corresponding to the maximum must be determined graphically, or by interpolation.

Corrections for measures of capacity, for barometric measures.

The uncertainty of the corrections can not, in any considerable degree, affect the densities of solids and liquids.

Density of gases. Biot and Arago's experiments. Special difficulties of the question. The uncertainty of the corrections may sensibly affect the results. Regnault's method.

The same method may be applied to the determination of the co-efficient of dilatation for gases.

Density of vapors. Definition founded on the hypothetical application of the same laws to gases and vapors. Formulæ. Experimental method of Gay-Lussac and of Dumas. Corrections. Comparison of the two methods. Necessity of conducting the experiments at a distance from the saturation point. Latour's experiments. Relations between the weight and volume of a gas, and its temperatures; between the weight and volume of a gas mixed with vapors, and its temperature. Various problems.

Hygrometry. Chemical hygrometry. Hygrometry by the dew-point. Psychrometry.

PROPAGATION OF HEAT.

Lessons 17—18. *Propagation at a Distance.*

Rapid propagation of heat at a distance, in vacuum, in gases, in certain liquid or solid mediums. Experiments which establish this.

Rays of heat. Velocity of propagation. Intensity of heat received at a distance. Intensity of heat received or emitted obliquely. Emitting power, power of absorption, reflection, diffusion. The emitting and absorbing power are expressible by the same number in terms of their proper units respectively.

Analysis of calorific radiations by absorption. Different effects of diathermanous or thermochroic medium. Different influences of increasing thicknesses of the combination of different mediums. Radiations proceeding from different sources, various effects of different mediums on these radiations.

The calorific radiations emanating from different sources, have all the characters of differently colored heterogeneous rays of light.

THEORY OF RADIATION AND OF THE DYNAMICAL EQUILIBRIUM OF TEMPERATURES. APPARENT REFLECTION OF COLD.

Lesson 19. *Law of Cooling.*

Definition of the rate of cooling. Many causes may conspire in the cooling of a body.

Cooling in space. Newton's law only an approximation. Experimental investigation of the true law. Method to be followed in this investigation. The velocity of cooling is not a *datum* directly observable. It must be deduced provisionally from an empirical relation between the temperature and the time. Preliminary experiments. Course of the definitive experiments. Elementary experimental laws.

Hypothetical form of the function which expresses the velocity of cooling. To determine by means of the preceding experimental laws the unknown form of the function which expresses the law of radiation. Relation between the temperatures and the times. This relation only contains data immediately observable, and may be verified *à posteriori.*

The contents which enter into the preceding relation depend upon thermometric constants and the nature of the radiating surface.

The contact of a gas modifies the law of cooling.

LESSONS 20—21. *Propagation by Contact.*

Slow propagation of heat in the interior of bodies, in solids, liquids, and gases. Confirmatory experiments. Hypothesis of partial radiation. Theoretical law resulting from this hypothesis upon the decrease of temperatures in a solid limited by two indefinite parallel planes maintained at constant temperatures. Determination of the co-efficient of conductibility by the experimental realization of these conditions. This experiment determines a numerical value of the co-efficients; it is not of a nature to serve as a check upon the theoretical principles. Enunciation of the law resulting from the same theoretical principles upon the decrease of temperatures in a thin bar heated at one end.

CALORIMETRY.

LESSONS 22—23. *Specific Heats.*

Comparison of the quantities of heat. The quantities of heat are not proportioned to the temperatures. Definitions of the unity of heat. General method of mixtures to estimate the quantities of heat. Experimental precautions and corrections.

Application of the general method of mixtures. Specific heats of solids and liquids. Law of the specific heat of atoms. Heat absorbed by expansion, restored by the compression of bodies. Experiments on gases. Specific heats of gases under constant pressure. Measure of specific heats of gases under constant pressure. Special difficulties of the question. Succinct indication of one of the methods. Specific heats to a constant volume.

LESSON 24. *Latent Heat.*

Component heat of liquids absorbed into the *latent* state during fusion, restored to the *free* state during solidification.

Influence of the viscous state. Latent heat of ice. Ice calorimeter; its defects.

Component heat of vapors, absorbed into the latent state during vaporization, restored to the free state during condensation. Measure of the latent heat of vapors. Regnault's experiments.

Empirical laws on the latent heat of vaporization.

Applications of Calorimetry.

Means of producing heat or cold; 1, by changes in density; 2, by changes of state. Freezing mixtures. Vaporization of liquids. Condensation of vapors.

Steam-boilers. Warming by hot air and hot water. Various problems. Sensations produced by a jet of vapor.

Different physical and chemical sources of heat; percussion, friction, chemical combinations, animal heat, natural heat of the globe, solar heat, &c. It will be remarked that mechanical work may become a source of heat, and heat a source of mechanical work.

STATICAL ELECTRICITY.—MAGNETISM.—STATICAL ELECTRICITY.

LESSONS 25—27.

General phenomena. Distinction of bodies into conductors and non-conductors. Distinction of electricity into two kinds. Separation of the two electricities by friction. Hypothesis of electric fluids. Effects of vacuum of gases and vapors of points. Electrical attractions and repulsions. Electrization by influence. Case where the influenced body is already electrized. Sparks; power of points. Electrization by influence preceding the motion of light bodies.

Electroscopes.

Electrical machines of Van-Marum, Nairne, Armstrong.

Condenser. Accumulation of electricity upon its surface. Leyden jar. Batteries. Electrical discharges. Effects of electricity.

Condensing electroscope. Electrophorus.

Velocity of statical electricity.

Atmospherical electricity. Phenomena observed with a serene sky. Electricity of clouds. Storms. Lightning. Thunder. Effects of thunder. Return-shock. Lightning conductor.

Different sources of statical electricity.

MAGNETISM.

LESSONS 28—30.

Natural magnets. Action upon iron and steel. Artificial magnets. The attractive action appears as if it were concentrated about the extremities of magnetic bars. First idea of poles.

Direction of a magnetized bar under the earth's action. Reciprocal action of the poles of two magnets. Names given to the poles.

Phenomena of influence. Action of a magnet upon a bar of soft iron; upon a bar of steel. Coercive force. Effects of the rupture of a magnetized bar. Theoretical ideas on the constitution of magnets. More precise definition of the poles.

Action of the earth upon a magnet. The earth may be considered as a magnet. Its action may be destroyed by means of a magnet suitably placed. Astatic needles. The magnetic action of the earth is equivalent to a *couple*. Three constants define the couple of terrestrial action. Declination. Inclination. Intensity. Measure of the declination; of the inclination.

Magnetic metals. Influence of hammering, tempering, &c. Methods of magnetizing. Saturation. Loss of magnetism. Influence of heat. Magnetic lines. Armatures.

Magnetization by the earth's influence. Means of determining the magnetic state of a body.

Measure of Magnetism and Electricity.

LESSONS 31—32.

Coulomb's balance. Distribution of magnetism on a magnetized bar; distribution of electricity at the surface of isolated conductors. Comparative discussion of the conditions of the two problems and the methods of experiment.

Laws of the magnetic attractions and repulsions. Law of electric attractions and repulsions. Comparative discussion of the conditions of the two problems, and the methods of experiment.

Determination of the law of magnetic attractions and repulsions by the method of oscillations.

Comparison of the magnetic intensity at different points of the earth's surface.

Lessons 33—34. *Revision.*

Considerations on the totality of the subjects of the course.

SECOND YEAR.

DYNAMICAL ELECTRICITY.—GALVANISM.

Lessons 1—2

Chemical sources of electricity. Experimental proofs. Arrangement devised by Volta to accumulate, at least in part, at the extremities of a heterogeneous conductor the electricity developed by chemical actions.

Pile. Tension at the two isolated extremities; at one single isolated extremity; at the two extremities reunited by a conductor. Continuous current of electricity. Poles. Direction of the current, &c.

Various modifications of the pile of Volta. Woollaston's pile, Münch's pile, &c. Dry piles; their application to the electroscope.

Principal effects of electricity in motion, and means of making the currents perceptible. Experiment of Oersted. Galvanoscopes.

Currents produced by heat in heterogeneous circuits. Thermo-electric piles. Thermometric graduation of thermo-electric piles.

Currents produced by the sources of statical electricity.

PROPERTIES OF CURRENTS.

Lesson 3.—1. *Chemical Actions.*

Definitions. Phenomena of decomposition and transference. Reaction of the elements transferred upon electrodes of different kinds.

Principles of electrotyping.

Causes of the variation of the current in ordinary piles; means of remedying this; Daniell's pile. Bunsen's pile.

Lessons 4—8. 2. *Mechanical Properties.*

Reciprocal actions of rectilinear or sinuous currents parallel or inclined. Reaction of a current on itself.

Reciprocal actions of helices or solenoids. Continuous rotation of currents by their mutual action; by reaction. Analogy of magnets and solenoids. Electro-dynamical theory of magnetism. Action of magnets upon currents and solenoids. Action of currents upon magnets. Experiments of Biot and Savart. Continual rotation of a current by a magnet; of a magnet by a magnet.

Action of the earth upon currents; it acts as a rectilinear current directed from east to west, perpendicularly to the magnetic meridian.

Continual rotation of a current by the action of the earth.

Astatic conductors.

LESSONS 9—10. 3. *Magnetic Properties.*

Action of an interposed conductor upon iron filings.

Electro-magnets. Magnetization temporary or permanent. Principles of the electric telegraph. Electrometers. Reference to diamagnetic phenomena.

4. *Electro-motive Properties.*

Phenomena of induction by currents, by magnets. Phenomena of magnetism in motion. Induction of a current upon itself.

Induction of different orders.

Interrupted currents. Clarke's machine.

LESSON 11. 5. *Calorific Properties.*

Influence of the nature of the interposed conductor; of its section; of the intensity of the current. Unequal temperatures at the different junctions of a heterogeneous circuit.

6. *Luminous Properties.*

Incandescence of solid conductors. Spectrum of the electric light. Voltaic arc. Transfer of ponderable matter. Action of the magnet upon the Voltaic arc.

7. *Physiological Action of Currents.*

Some words on this subject. Muscles and nerves. Actions of discontinuous currents. Reotomic contrivances.

Reometry.

Compass of sines, of tangents. Experimental graduation of galvanometers.

The dynamical intensity of a current diminishes when the length of a current increases. Reostat.

Laws of the dynamical intensity of a current in a homogeneous circuit. Reduced length and resistance of a circuit. Specific co-efficients of resistance. Laws of the dynamic intensity of a current in a heterogeneous circuit.

The intensity of currents is in the inverse ratio of the total reduced length, and proportional to the sum of the electromotive forces. Formula of the pile. Discussion of the case of hydro-electric piles—thermo-electric piles. Conditions for the construction of a pile, with reference to the effects to be produced. Conditions for the construction of a galvanometer with reference to its intended application.

Laws of secondary currents in the simplest cases. The chemical intensity of a current is proportional to its dynamical intensity.

ACOUSTICS.

LESSONS 12—15.

Noise, sound, quality of the sound, pitch, intensity, *timbre.* A state of vibration in a solid, liquid, or gaseous body is accompanied with the production of sound.

The pitch depends on the number of vibrations. Unison. Instruments for counting the vibrations:—1st. Graphic method. 2nd. Toothed wheels. 3rd. Lever. Feeling of concord. Musical scale. Gamut. Limit of appreciable sounds.

Study of vibrating motions in solids. Vibrating cords. Vibrations transversal, longitudinal. Experimental laws. Sonometer.

Spontaneous division of a cord into segments. Fundamental sounds. Harmonic sounds.

Staight and curved rods. Transversal and longitudinal vibrations. Experimental laws. Division into segments. Nodes. Ventral segments. Membranes.

Plane and curved plates. The vibrations divide them into "*concamerations*." Nodal lines. Harmonic sounds.

Study of the vibrations in liquids and in gases.

Theoretical ideas upon the propagation of a vibratory motion in indefinite elastic media, on an indefinite cylindrical tube. Waves of condensation of dilatation. Progressive nodes and ventral divisions. Laws of the intensities of sound. Direct measure of the velocity of the propagation of sound in water. Measure of the velocity of the propagation of sound in air. Formulæ without demonstration. Comparison of the formulæ with experiment.

Sonorous waves reflected in an indefinite medium.

Fixed nodes and ventral divisions. Sonorous waves reflected in closed and open tubes. Fixed nodes and ventral divisions; the vibratory state and density thereat.

Series of sounds afforded by the same tube. Effect of holes.

Sonorous reflected waves in rods. Series of sounds afforded by the same rod vibrating longitudinally. Indirect measure of the velocity of sound in gases, liquids, and solids.

Experiments on the communication of vibrating motion in heterogeneous mediums, on the general direction of the vibrating motion commuicated.

Intensification of sounds. Interferences. Beats. Different stringed and wind instruments. Means of setting them in vibration.

A few words on the organs of voice and hearing. Incompleteness of our knowledge on this subject.

OPTICS.

Lessons 16—17. *Propagation of Lignt.*

Propagation of light in a straight line. Rays of light. Geometrical theory of shadows. Velocity of light. Rœmer's observations. Laws of intensity of light. Photometers of Bouguer, Rumford. Intensity of oblique rays. Comparison of illuminating powers. Total brightness. Intrinsic brightness.

Reflection.

Reflection of light: its laws. Experimental demonstration. Images formed by one or more plane mirrors. To ascertain if a looking-glass has its two faces parallel.

Spherical mirrors. Foci, formulæ. Discussion. Images by reflection. Measure of the radius of a spherical mirror.

Definition of caustics by reflection. Definition of the two spherical aberrations in mirrors.

Woollaston's goniometer.

Lesson 18. *Refraction.*

Refraction of light in homogeneous mediums. Descartes' law. Experimental demonstration for solids and liquids.

Inverse return of the rays. Successive refractions. Indices of transmission in terms of the principal indices. Consequences of Descartes' law. Total reflection. Manner of observing it.

Irregular refractions. Mirage.

Refraction is always accompanied with the accessory phenomenon of dispersion.

Geometrical consequences of the law of refraction. Focus of a plane surface. Focus of a medium bounded by two parallel plane surfaces; by two plane surfaces inclined in the form of a prism.

Foci of a spherical surface; of a medium limited by two spherical surfaces. Lenses.

Formula for lenses. Discussion. Varieties of lenses. Optic center. Images. Measure of the focal distance of lenses.

Definition of caustics by refraction. Definition of the two spherical aberrations of a lens.

Lessons 19—20. *Dispersion.*

Unequal refrangibility of the differently colored rays which compose white light. Analysis of heterogeneous light by the prisms. Newton's method. Solar spectrum. Homogeneity of the different colors. Second refraction of a homogeneous pencil. Experiment with crossed prisms. Precautions to be attended to in the experiments. The spectrum, obtained by Newton's method, differs from the spectrum produced at the focus of a lens placed between the prism and the picture, according to the method of Fraunhofer. Reasons of the comparative purity of this latter spectrum. Fraunhofer's lines. Different spectra of different sources of heterogeneous light. Marginal iridescence of a large pencil of natural light traversing a prism. Dispersion of light by lenses. Iridescence of focal images. Recomposition of light, by means of a prism at the focus of a spherical mirror or a lens, by the rapid rotation of a plane mirror, by the rotation of a disk with party-colored sectors. Compound colors.

Chemical and calorific radiations accompany luminous radiations.

Analysis of light by absorption. Characteristic action of transparent colored mediums upon different sorts of compound light. Different influences of increasing thickness. Effects of differently colored mediums upon heterogeneous light. Effects of differently colored mediums upon homogeneous rays separated by the prism.

Lesson 21. *Measure of the Indices of Refraction.*

Determination of the indices of refraction.

1. In solids. Measure of the refracting angles. Minimum of deviation. Measure of the corresponding deviation. Use of Fraunhofer's lines.

2. In liquids.

3. In gases. Special difficulties of the question. Experimental method. Biot's and Arago's experiments.

Any power whatever of the index of refraction diminished by unit is sensibly proportional to the density of the gas. Method of Dulong founded on this remark.

LESSONS 22—23. *Application of the preceding Laws.*

Rainbow. Different orders of bow.

Achromatism.

Achromatic prisms. Diasperometer achromatism of lenses; how to verify it Definition of secondary spectra: their nature gives the means of recognizing, whether flint or crown glass predominates, in an imperfectly achromatic lens.

Instruments essentially consisting of an achromatic lens. Magic lantern; megascope; solar microscope; camera obscura; collimators.

Vision.

Summary description of the principal optical parts of the eye. They act like the lens of a camera obscura to form an image upon the retina. Distinct vision; optometers; short sight; long sight; spectacles.

Binocular vision; perspective peculiar to each eye; estimation of distances; sensation of solidity; stereoscope; estimation of magnitudes.

PERSISTENCE OF IMPRESSIONS; DIVERS EXPERIMENTS.

LESSONS 24—26. *Optical Instruments.*

Camera lucida. A lens is necessary to reduce to the same apparent distance the two objects seen simultaneously. Instruments to assist the sight; simple microscope; the magnifying power; distinctness; field; advantage of a diaphragm; it modifies the field and the brightness variously according to its position.

Woollaston's double glass; its advantages.

General principle of compound dioptrical instruments.

Compound microscope; experimental measure of its magnifying power, by means of the diaphragm, by means of the camera lucida.

Astronomical telescope; object glass; simple eye-glass. Necessity for a diaphragm; its place; the wires, their place; optic axis of a telescope. Parallax of the threads of the wires; magnifying power of the object-glass; of the eye-glass; field of view of a telescope.

Optic ring; different methods of measuring the magnifying power.

Distinctness of a telescope; night-glass.

Different distances of drawing out the eye-glass for short-sighted and long-sighted observers.

Different sorts of eye-pieces; positive eye-pieces; ordinary double eye-piece of the astronomical telescope. Ramsden's eye-piece; treble eye-piece of the terrestrial telescope. Negative eye-pieces; simple eye-piece of Galileo. Compound *ditto* of Huyghens; advantages and disadvantages of these different combinations; general principle of catadioptrical instruments.

LESSONS 27—29. *Double Refraction.*

Crystallized mediums do not all act upon light like homogeneous mediums.

Double refraction of Iceland spar: the extraordinary image turns round the ordinary image. The ordinary and extraordinary rays cross at the interior of the crystal.

Huyghens' construction; measure of the ordinary and extraordinary indices of refraction; attractive and repulsive crystals; a ray falling perpendicularly does not always bifurcate in a camera with parallel faces, nor in a prism. Definition of uniaxial and biaxial crystals.

The dispersion of the ordinary ray differs from that of the extraordinary ray.

The two rays are unequally absorbed in many colored mediums. Tourmaline.

Doubly-refracting prisms; their construction. Use of doubly-refracting prisms to measure apparent diameters, &c.

Lessons 30—31. *Polarization.*

Successive refractions in doubly-refracting prisms. Special properties of the two rays emerging from the first doubly refracting crystal. Polarization by double refraction.

Reflection from transparent media polarizes the light partially or wholly according to the incidence. Brewster's law. Reflection of polarized light from a transparent medium.

Simple refraction partially polarizes the light. Many successive refractions polarize it almost totally. Piles of glasses.

Different methods to obtain a ray of polarized light, 1st, by reflection; 2nd, by simple refraction; 3rd, by double refraction, by eliminating one of the refracted pencils;—by a screen,—by total reflection, Nicol's prism, by absoption, tourmaline.

Distinctive characters of light completely or partially polarized.

Lessons 32—34. *Theory of Undulations.*

Hypothesis of luminous undulations.

Vibratory state of a simple ray of homogeneous light. Vibratory state at the intersection of two simple rays of homogeneous light intersecting at a very small angle.

Experimental proofs in support of this hypothesis:

1st. Experiment with interferences, fringes. Their breadth is different for different colors; they give the various colors of the prism in white light. The alternately bright and dark sheets are hyperboloids of revolution. The measure of the fringes give the means of estimating the lengths of the undulations corresponding to different colors.

2nd. Colored rings of Newton, observed by reflection, by refraction. Law of the diameters; these vary in absolute length for different colors. Variously colored rings with white light. Reflected rings with a white spot at the center.

The theory of the undulations does not apply merely to theses phenomena. Explication of the laws of reflection and refraction. Definition of polarization in the system of waves. Elementary application of double refraction and the polarization which accompanies it in uniaxial crystals when the face of the crystal is parallel to the axis, and the plane of incidence normal or parallel to this axis.

Chemieal and Calorific Radiations.

Chemical and calorific radiations are subject, like luminous radiations, to the laws of reflection, refraction, dispersion, double refraction, polarization, interferences.

Lessons 35—36. *Revision.*

Considerations on the totality of the subjects of the course.

MANIPULATIONS IN PHYSICS.

The practical exercises which constitute the subject of this programme will be performed in part by the pupils under the direction of the professors and *répétiteurs*, in part by the professors and *répétiteurs*, with the coöperation of the pupils.

FIRST YEAR.

Use of various instruments, designed for measuring lengths. Experiments on weight with Atwood's machine, the inclined plane, Morin's apparatus, and the pendulum.

Some experiments on elasticity.

Various verifications of the principles of hydrostatics and hydrodynamics.

Construction of aerometers.

Construction of a barometer, of a manometer. Various verifications of the law of Mariotte.

Various experiments with the air-pump.

Determination the density of solids or liquids by different methods.

Construction of a thermometer.

Experiments on the dilatation of liquids and solids by means of the ordinary thermometer and by means of the statical thermometer.

Experiments upon the dilatation of air by various methods.

Experiments upon the tension of vapors by different methods.

Determination of the density of vapors and gases by various methods.

Leading experiments on calorific radiation.

Experiments on cooling.

Determination of specific heats, heats of fusion, heats at which bodies pass into vapor.

Cooling mixtures.

Use of the chemical hygrometer, the wet bulb hygrometer.

Rehearsal of the leading experiments on magnetism.

To magnetize a needle, to reverse its poles.

Rehearsal of the principal experiments of statical electricity.

Experiments verificatory of the laws of electricity and magnetism.

Use of compasses.

SECOND YEAR.

Experiments upon the chemical actions of poles.

Leading experiments in electro-dynamics.

Leading experiments upon the magnetic properties of currents.

Experiments on induction.

Experiments on the calorific and luminous actions of currents.

Quantitative experiments on the laws of currents.

Experiments on the propagation of sound; on the vibrations of rods of plane or curved plates, membranes, sonorous tubes.

Experiments on mirrors, plane or curved.

Experiments on lenses. Experiments on the decomposition of light by the prism—by absorption. Measures of the indices of the refraction of solids. Use of the magnifying glass and microscope; measure of the magnifying power. Use of different telescopes, with and without corrections. Measure of the magnifying power. Experiments on double refraction and polarization. Experiments on interferences and colored rings.

THE SPECIAL MILITARY SCHOOLS OF FRANCE.

CONTENTS.

SCHOOL FOR ARTILLERY AND ENGINEERS

AT METZ.

HISTORY AND GENERAL DESCRIPTION.

The first French Artillery School was founded in the time of Louis XIV. (in 1679) at Douai. It had but a short existence: and it was only in 1720 (under the Regency,) when the Royal Regiment of Artillery received a new organization, that schools of theory were permanently founded in each of the seven towns where there were garrisons of artillery. But no academy properly so called was established before that founded by D'Argenson at La Fère, in 1756, with a staff of two professors of mathematics, and two of drawing. This was transferred to Bapaume, near the Flemish frontier, in 1766, re-transferred to La Fère, and suppressed, among other schools, at the beginning of the Revolution.

Of early Engineer Schools there was only one, the very distinguished School of Mézières, near the northern frontier. This was founded in 1749, also under the ministry of D'Argenson; Monge was a professor there; and it had a very high reputation down to its suppression in the Revolution.

When the wars of the Revolution broke out, Provisional Schools for giving a brief course of rapid instruction was established at Metz for the engineers, and at Châlons-sur-Marne for the artillery. These had to supply, at a great disadvantage, the officers needed for the protection of the invaded frontier.

It was intended originally that the Polytechnic, established in 1794, should send engineers direct to the army; but it was quickly found to be a better plan to allow the pupils destined for this service first to spend some little time at Metz; which thus, in October, 1795, became a School of Application for Engineers. The artillery pupils in like manner went to Châlons. This separate system of two Schools of Application continued till 1802, when the establishment at Châlons was united with that of Metz, and Metz became what it has since continued to be, the seat of the United School of Application for the two services. The Polytechnic students who select the *Artillerie de terre*, *Artillerie de mer*, or the *Génie militaire*, enter here to receive the special and professional instruction deemed requisite to fit them for actual employment.

The students quitting the Polytechnic in the manner described in the account of that school, at the average age of twenty-one, enter the School of Application, with the provisional rank, the uniform, and the pay of sub-lieutenants (*sous-lieutenants.*) The ordinary term of residence is two years. Under special circumstances this may be shortened; and in case of illness or want of application individual students are occasionally retained for a third year. Each new body of students, each *admission* or *promotion*, is classified at the end of the first year, and the students composing it are arranged in order of merit in accordance with the reports of the professors, but without an examination; at the close of the second year they pass a final examination before the Board of Officers, and are definitively placed in the corps they have chosen, the artillery or engineers, according to the order of merit. They are allowed to count, as regards retirement from the service and towards military decorations, four year's service on account of the two years passed at the Polytechnic School, and of the time passed in preparing for admission to it, reckoning from the day of their admission to the School of Application.

Metz is a fortified place on the Prussian frontier, the seat of war at the time of the school's first foundation; it is on the line of railway to Mannheim, about thirty miles from the point where this branch diverges from the main line to Strasburg. The Moselle flows through the town, and is employed, with its little affluent the Seille, in the military defenses. The garrison numbers 10,000 men; there is an Arsenal, a school of Pyrotechny for the manufacture of rockets, two Regimental Schools, one of Artillery and the other of Engineers. The School of Application occupies buildings erected on the site, and partly the original buildings themselves, of a suppressed Benedictine monastery. Three sides of the cloistered monastic quadrangle are devoted to the offices, lecture-rooms, galleries and halls of study. A fourth, formerly the ancient church, is converted into a *salle des manœuvres*. There is an adjoining residence for the commandant; and a separate modern building, four stories in height, affords lodging to the young men.

The *salle des manœuvres* is a large area under a lofty roof, rising to the whole height of the buildings of the quadrangle; it contains artillery of various descriptions, mortars, field and siege guns placed as in a battery, and is amply large enough to allow cannon to be moved and exercises performed when the state of the weather may make it desirable.

The amphitheaters or lecture rooms, much on the same system as those at the Polytechnic, are two in number, one for each of the two divisions. Officers of the artillery and engineers who are in garrison, are entitled, if they please, to attend the lectures, and other officers also may be admitted by permission.

The galleries, partly on the ground floor, partly on the first floor, contain very good collections of models of artillery, ancient and modern, of sets of small arms, of tools, of locks, barrels and other portions of muskets in various stages of the process of their manufacture, of specimens of carpentry and roofing, of minerals, of models of fortifications, bridges, coffer-dams, locks, &c.

The library on the first floor has an adjoining reading room; and near it is the examination room, of which further mention will be made. The three halls of study (*salles d'étude*) on the first floor are on a different plan from those of the Polytechnic, each one being large enough to accommodate a whole division (seventy students.) Three rooms are also provided for the professors to prepare their lectures in.

The barracks, on the opposite side of the open space used for drill and exercises, form a lofty and handsome building, entered by separate staircases, the ground-floor rooms of each being assigned to a servant, who undertakes to provide attendance for all the young men lodging in the rooms above. The rooms are comfortable, mostly double-bedded, the bedroom serving also as a sitting room, and a small adjoining closet being used for washing, &c. Twenty or twenty-two appear to be thus accommodated on each staircase; there are lodgings altogether for one hundred and forty-five. A certain number of the senior sub-lieutenants would, probably, on the arrival of the new cadets from the Polytechnic, be removed to lodge in the town.

There is a riding-school adjoining the court; stables, for thirty-three horses, which are kept for the use of the pupils, and lodgings for the attendants are provided in the neighborhood.

The mere description of the buildings shows at once that the system is different in many respects from that of the Polytechnic. Young men of twenty-one and twenty-two years of age, already holding provisional commissions in the service, receiving the pay and wearing the uniform of sub-lieutenants, are naturally allowed much greater freedom of action. They live, and partly also study, not in the halls of study, but in their own rooms; they take their meals in the town, where they frequent the *cafés* and *restaurants* of their choice. The *rappel* summons them every morning to rise and attend a roll-call at half-past five or six; military exercises, riding, or interrogations, similar to the *interrogations particulières*, require the presence of a portion of the number, but the rest are free to return to their rooms. At ten they have to attend either the day's lecture, followed by employment in the halls of study, till four o'clock P. M., or they proceed at once to the halls of study, and set to work on the drawings, designs, projects, &c., which are described hereafter in the account of the studies. From four to half-past five P. M., drill, exercises, and riding occupy a portion of the number, probably those who were not called for in the morning. After half-past five they are left to themselves.

This ordinary routine of studies is interrupted in the summer months by the occurrence of expeditions for making surveys, and for measuring and sketching machines in manufactories. The young men are sent, two together, to survey (*lever à boussole ;*) singly for the reconnaissance sketch (*lever à vue ;*) and generally, a certain number are distributed about a district not too large for an officer to make his round in it, and see each day that all are at work. The railways afford considerable facilities; the expeditions never occupy more than ten days at a time, but they may be extended as far as Strasburg.

There are no *répétiteurs* in the school; but the system of *interrogations particulières* is carried on; and an examination by the professor and an assistant professor takes place after, about, every eight or ten lectures.

THE STAFF AND GOVERNMENT.

The Staff of the Institution consists of—

1 General Officer, at present a General of Brigade of Artillery, as Commandant.
1 Colonel or Lieutenant-Colonel, Second in Command and Director of Studies, at present a Lieutenant-Colonel of Engineers.
1 Major of Artillery.
1 Major of Engineers.
5 Captains of Artillery.
8 Captains of Engineers.
1 Surgeon (*Médecin-Major.*)

The Commandant is taken alternately from the Artillery and Engineers, and the command lasts for five years only.

The Second in Command is always chosen from that arm of the service which does not supply the Commandant.

The inferior officers of each rank are taken in equal numbers from the two arms.

The Staff of Instructors is as follows:—

1 Professor of Artillery, at present a Captain of Artillery.
1 Assistant ditto also a Captain of Artillery.
1 Professor of Military Art, charged also with the Course of Military Legislation and Administration (a Captain of Engineers.)
1 Professor of Permanent Fortification and of the Attack and Defense of places (a Captain of Engineers.)
1 Assistant ditto ditto (a Captain of Engineers.)
1 Professor of the Course of Topography and Geodesy (a Captain of Engineers.
1 Professor of Sciences applied to the Military Arts.
1 Professor of Mechanics applied to Machines (a Captain of Artillery.)
1 Professor of the Course of Construction (a Captain of Engineers.)
1 Assistant ditto.
1 Professor of the German language (a civilian.)
1 Professor of Veterinary Art and Riding (a Captain of Artillery.)
1 Assistant ditto (a civilian.)
1 Drawing Master, Chief of the Drawing Department (a civilian.)

In all, nine Professors, four Assistant Professors, and one Drawing Master.

The School employs in addition an administrative staff, consisting of—

A Treasurer, } both of whom must have been Officers in the Artillery or
A Librarian, } Engineers.
A Principal Clerk.
An Assistant Librarian.
Two Storekeepers, intrusted with the *materiel* belonging to the two arms.
One skilled Mechanic.
One skilled Lithographer.
One Fencing Master.

clerks and draughtsmen are provided as required.

The school is under the general superintendence of two boards or councils, the Superior Council and the Administrative Council.

The Superior Council consists of the General Commandant, as President, the Second in Command, the Director of Studies, as Vice-President; the Major of Artillery, and the Major of Engineers, as permanent members; two Captains of the Establishment, one of each arm; two Military Professors, one of each arm; and one Captain of the Establishment; these five last being all removable at the General Inspections.

The Superior Council has the duty of drawing up the programme of the studies of the year, of suggesting changes in the regulations relating both to studies and discipline, all subject to the approval of the Minister of War; of preparing at the end of the year the classified list of the students, drawn up according to their conduct and progress in their studies, and of pointing out to the Jury of Examiners any students who should go again through the courses of the year, and stay in consequence an additional year at the school.

When questions relating to the instruction are brought before the Superior Council, the whole body of military professors attend and take part in the proceedings, and the Council is thus said to be constituted as a Board or Council of Instruction. Improvements are here suggested, and are subsequently submitted to the Jury of Examiners, and to the Minister of War; the value to be attached, in the system of marks or credits, to each particular course of study is determined; a statement is drawn up showing what printed works, models, &c., are wanted. The budget itself, to be submitted to the Minister of War, is finally drawn up by the Superior Council in its ordinary sittings.

The Administrative Council, composed of the Second in Command as President, the two Majors of Artillery and of Engineers, one Captain and one Military Professor, and the Treasurer as Secretary without the right of voting, takes cognizance of all the financial and other business matters of the school.

SUBJECTS AND METHOD OF STUDY.

The studies at Metz consist of topography and geodesy, including military drawing and surveying under special circumstances; field fortification, military art and legislation, permanent fortification, and the attack and defense of fortified places, accompanied by a sham siege, without, however, executing the details practically on the ground; architecture, as applicable to military buildings and fortifications; the theory and practice of construction, and artillery. The programmes of these studies are inserted at length in the Appendix.

The instruction is given principally (as at the Polytechnic) by means of a series of lectures, and the knowledge which the students have acquired is first directly tested by requiring them to execute various kinds of surveys of ground, either with or without the use of instruments; to prepare drawings of buildings, workshops, and machines in full detail (plan, elevation, and sections) from the measurements they have recorded in their note-books or on their sketches, and to accompany such drawings with descriptive memoirs of all particulars and calculations that may be necessary to exhibit their purpose or efficiency; to draw up projects and lay out works of field and permanent fortification, or of those of attack or defense of a particular place on certain given data, or according to the nature of the ground; to design a military building, bridge, machine, or piece of ordnance, accompanied by estimates and descriptive memoirs, showing in what manner the instructions and conditions under which it was drawn up have been complied with; and to prepare a project for the amelioration of the works of defense of a specified portion of a fortified place known to be defective in some respects.

The instruction during the first year's residence is common to the two arms; and the time is appropriated in the following manner, namely:—

	Days.
Military art and legislation,	33
Topography and geodesy,	47
Field fortification,	39
Permanent fortification,	88
Theory and practice of construction,	77
Total,	284

The *sous-lieutenants* who complete their first year's work are allowed nearly a month's vacation during November.

The instruction given to the Artillery and Engineers during the second year's residence is not entirely the same, as will be seen by comparing the accompanying table of the year's study:—

	Artillery. Days.	Engineers. Days.
Military art and legislation,	2	2
Topography and geodesy,	28	28
Attack and defense of places,	44	44
Permanent fortification,	44	129
Artillery, machines, &c.,	81	—
Theory and practice of construction,	46	42
	245	245
Brought forward from first year,	284	284
Total,	529	529

We should not omit to state that there is a short course on the Veterinary Art.

The lectures, as before said, begin at 10 A. M., and they last usually an hour and a half, and are followed by work in the halls of study. It would appear, however, that very frequently the day's occupation consists simply of work in the halls of study (or occasionally out of the school buildings, when the students are sent on some excursion;) and, accordingly, in giving the account of the studies, a *day* or day's work will sometimes mean a lecture followed by drawing or other employment, sometimes this drawing or other employment without any lecture preceding. Taking a general average, the proportion appears to be about two lectures to five *séances*, *i. e.*, sittings without lectures.

The system will be better understood by referring to the accompanying tables, which are translated from the Project for the Employment of Time for the year 1851—2, submitted for the approval of the Minister of War. The dates in the first column indicate the days of the commencement of each particular study. The school year, it should be said, begins on the 1st of December.

EMPLOYMENT OF TIME FOR THE YEARS 1851—1852.

Month and Date.	Second Division. First Year's Instruction.	Number of At-tend-ances.	Number of Lec-tures before Work.	Number of Total of Lec-tures.
December 1 " 2	Lectures on Military Art in Topography—Conventional Tints,	2	......	......
" 4	Study of Hill Drawing (in sepia with contour lines,)	2	......	......
" 6	Military Art, Plate 1 .... 5 Plate 2 .... 5 Plate 3 .... 5 Plate 4 .... 5 Plate 5 9	29	4	39
January 12	Front of Cormontaige,	24	3	13
February 9	Project of Field Fortification, Plate 1. Plan of the whole, ... 3 Plase 2. Organization of a work, ... 8 Plate 3. Details of Construction, ... 4 Memoir, ... 4	19	5	7
March 3	Plan of Stability of Revetments, &c.,	9	9	9
" 13	Study of the Drawing showing the effect,	8	1	1
" 23	Plan of a Building, Out-of-door work, ... 9 Laying down and drawing, Memoir, 23	32	......	......
April 29	Topographical Triangulation,	4	4	6
May 5	Defilement and Profiling on the Ground,	3	......	......
	Project of a Building, Sketches, ... 14 Drawing, ... 24 Memoir, ... 4 Estimate, ... 3	45	12	22
June 28	Survey with a plane-table, ... Out-of-door work, ... 0 Laying down and drawing, 3	13	1	......
	One day free in case of bad weather,	1	......	......
July 14	To find the Variation of the Needle,	1	1	......
" 17	Survey of Ground with the Compass, ... Out-of-door work, ... 8 Laying down and drawing, 2	10	1	......
	One day free in case of bad weather,	1	......	......
August 2	Reconnaissance Plan—Out-of-door work,	6	1	......
	One day free in case of bad weather,	1	......	.. ...
" 10	Study of Shaded Drawing (*Hachures* and colored,)	8	1	......
" 18	Laying down and drawing the Survey made with the Compass,	2	......	......
" 20	Project of Fortification on Level Ground, Plate 1 .... 6 Plate 2 .... 30 Memoir, ... 6	42	3	19
September October 8	Project of Fortification on Hilly Ground, ... Plate 1 .... 19 Memoir, ... 3	22	8	10
Nov. 3	Last day of week,			
" 6	Leave for their Vacation,			
	There remains therefore in this division:—1st. Three free days in case of bad weather; one after each survey. 2nd. Two days at the end of the year, the 4th and 5th November. Total five free day.			
	Total of the days employed 279 + 5 days free, ...	284		

EMPLOYMENT OF TIME FOR THE YEAR 1851—1852.

Month and Date.	First Division. Second Year's Instruction.		Number of At-tend-ances.	Number of Lec-tures before Work.	Number of Total of Lec-tures.
	Brought forward,		284	......	......
December 6	Laying down the First Survey by Reconnaissance,		8	......	......
" 16	Attack and Defense:—Plate, Batteries, with Plan and Sections of Detail,		4	5	6
" 20	Ditto, { Plate 1 ...... 25; Journal, ... 2; Plate 2 ...... 13 }		40	6	20
January					
February 7	Designs and Constructions of Revetments, Arches, &c.,		9	9	9
" 18	Project and Permanent Fortification in Hilly Gound, { Plate 1 ...... 19; Memoir, ... 3; Plate 2 ...... 8 }		30	8	19
	SPECIAL WORKS.				
	ARTILLERY.	ENGINEERS.			
March 25	Measurement and Drawings of a Cannon, ... 12	Project of Fortification in hilly ground, Plate 2 *cont.*, ... 12	12	......	......
April 8	Measurement of a Workshop.	Out-of-door Work, ...	9	30	30
" 19	Laying down the Measurement, ... 28	Laying down the Measurement, ... 24			
May 18		Project of Fortification in hilly ground, Plate 3, 14			
" 24	Project for Machines, ... 14				
June 4		Abstracting and calculating Measurements, ... 3			
" 8		Plate 4, ... 11			
" 9	Questions in Artillery, ... 5		97	2	2
	1st. Measurement of *Matériel*, Gun Carriages, &c., 8 Laying down ditto, ... 10	Register of the removal of Earth, ... 3 Estimate, ... 2 Memoir, ... 2 Project for Improvements, { Plate 1 .... 30; Plate 2 .... 6; Memoir, ... 2 }			
July 6	2nd. Measurement of *Matériel*, ... 8				
" 15	Project for a Cannon, ... 24				
	97				
August 12	Second Reconnaissance Survey,		......	......	......
	Out-of-door Work and Tracing of the Lines on the Reconnaissance Plan,		7	......	......
	One day free in case of bad weather,		1	......	......
" 21	Geodetical Calculations,		4	......	......
" 26	Laying down the Reconnaissance Survey,		8	......	......
September 4	Memoir on Entrenched Lines,		1	......	......
" 6	Tracing or laying out Camps,		1	......	......
" 7	Operations of a Sham Siege,		13	......	......
	One day free,		1	......	......
" 19	Preparing for the Examination,		......	......	......
October					
November 1	Examination for leaving,		......	......	......
	Total of the days employed, 522 + 7 days free.		529		

FINAL EXAMINATION.

About six weeks of free or voluntary study is allowed, immediately prior to the Final Examination, for the sub-lieutenants to prepare for their last effort.

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The examination which takes place prior to their leaving the School of Application, is entirely conducted by a board of six officers, under the presidency of a general officer alternately of the artillery or engineers, the remaining members of the board consisting of a general officer of each corps and three field officers of these corps; the last three being specially charged with the duty of examining. It takes place in a room set apart for the purpose, with a small interior room in connection with it, into which the members of the board retire to deliberate at the end of each student's examination. The jury assembles each year at the period fixed by the minister of war.

The three examining members conduct the examination of the students in three different branches of study; the first more particularly relating to artillery science, the second to engineering science, and the third to mechanical science in its connection with the art of war. The whole of the students who are to leave the school are first examined in such one or other of these branches of study as may be determined on.

The student under examination is specially questioned by the examining officer in his subject, and occasionally by the president or any other member of the board that may wish to do so, for three-quarters of an hour. As soon as the examination of the student has been concluded, the board retire to the adjoining room and compare their notes of the credits they have severally awarded to the student under examination, and they also examine his drawings, sketches, and memoirs relating to the subjects on which he has been questioned, and prepared during his two years of residence in the school. They severally note the credits to which they consider him to be entitled for them, and adopt the general mean.

As soon as the examination of the whole of the students in this particular study has been finished, the examination in the next branch is commenced, so that five or six days elapse between the first and second examinations of the same student; and the same interval of time occurs between the second and third examinations.

The credit allotted to each student by the board of examiners represents, on the scale of 0 to 20, the manner in which he has replied to the questions, or executed the drawings, sketches, memoirs, &c., belonging to each course. The importance attached to each particular branch of study is estimated very nearly by the amount of time allowed for its execution divided by 20; and the definitive marks which each student obtains for that branch of study is obtained from the products of the numbers respectively representing the credit for answering, and that for the importance of the subjects on which he has been examined.

The final classification of the order of merit, in each arm of the service, is arranged after a comparison of the total of the marks obtained by each student. This total is the sum of the definitive marks gained by each student in the sciences bearing on artillery, engineering, and mechanics in connection with the art of war, for the talent displayed in drawing, sketching, and writing memoirs, and for skill in practical exercises, as determined by the results of the examination conducted by the jury of examiners, added to the marks due to the previous classification in the school, with the weight or influence equal to one-third of that allowed for the examination by the jury.

The co-efficients of influence for the present year are—

For those particularly relating to Artillery Science,......	39.29
" " " Engineering Science,...	53.75
" " " Mechanical Science,....	43.00
For talent in drawing, sketching, writing memoirs, &c.,...	6.80
For practical exercises,.............................	16.75
Previous classification in the school,...................	45.30

So that the examination conducted by the jury of examiners exercises an influence on the position of the students very nearly approaching to two-thirds of the whole amount.

It is this final classification which determines their seniority in the respective services. We were permitted to be present during the examination, which was entirely oral, of two of the *sous-lieutenants*, before the jury of examiners.

The questions were replied to with great fluency and readiness, but it seemed to us that the examination was somewhat limited for the object in view, viz., that of awarding a credit representing the progress which each student had made in the particular science on which he had been questioned, especially as that credit would have very great weight in determining the candidate's future position.*

On quitting the School of Application at Metz, the sub-lieutenants of artillery and engineers respectively join the regiments, to which they are then definitely assigned as second lieutenants, and continue to be employed in doing duty, and in receiving practical instruction with them, until they are promoted.

* The examination chamber is a small room in the school buildings, near the library, ornamented with portraits of Vauban, and of D'Argenson, under whose ministry the original schools at La Fère and Mézières were founded. At a large table under these portraits, and extending across the room, General Morin, President, and four officers, members of the jury, were seated. The sixth member sat at a small table in front, near the blackboard, at which the student stood. The Commandant, the Director of Studies, and the other officers of the school were seated also in this part of the room.

The student who was first examined was questioned partly by the examiner, partly by the

SUBSEQUENT INSTRUCTION AND EMPLOYMENT.

The lieutenants of the artillery are employed on all duties that will tend to make them efficient artillery officers, and fully acquainted with all details connected with the drill, practice, and manœuvres of the artillery, and also with the interior economy and discipline of a regiment of artillery.

After the officers of artillery are promoted to the rank of second captain, but not before, they are detached from their regiments and successively sent into the various arsenals, cannon foundries, powder mills, and small arm manufactories, pyrotechnic establishments, and workshops, in order that they may become practically acquainted with the whole of the processes connected with the manufacture and supply of artillery, rockets, small arms, powder, material of all kinds, tools, &c., and also with the construction and repair of the buildings and factories required for these purposes. Sometimes they are employed as assistants in these establishments. The inspectors of the arms of regiments are selected from among those who have become acquainted with the manufacture of small arms.

When promoted to first captains they again rejoin their regiments, so that they may not lose the qualifications and knowledge required from a good practical artillery officer.

Field-officers of artillery are employed as superintendents and directors, and captains as sub-directors, of the important works intrusted to their arm.

In time of war, the officers of artillery have the construction of their own batteries, and the direction of the ordnance in battles and sieges, together with the formation of movable bridges and passages by boats.

It must be noticed, in contradistinction to the practice which prevails in England, that the artillery and engineer services manufacture their own tools.

The young engineer officers are employed with the men of their regiments, and with them pass through courses of practical instruction in the field, in sapping, mining, field fortification, sham-sieges,

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president, and gave his answers, working problems and drawing illustrations on the board as he went on. He was asked questions as to the details of the steam-engine, and as to the method of casting cannon. The German teacher of the School put him on to construe from a German book, and tried him in speaking; he succeeded just passably in both. The whole occupied about three-quarters of an hour.

The second student, after answering similar scientific questions, had opportunity given him to show his knowledge, which was considerable, of the geology of the neighborhood; and having lived in foreign countries, he was able to make a very good display of his knowledge of German, Spanish, Italian, and English.

After each examination the jury retired into the inner cabinet, by a door opening to it from behind their seats.

bridges, and castrametation. During this practical instruction one of the lieutenants belonging to each company is always present, and the captain of the company visits the work once in the course of the day.

The duties of the officers of engineers in time of peace are the construction, preservation, and repairs of fortresses and military buildings, and the command and instruction of the engineer soldiers.

In time of war, the officers of engineers are intrusted with the construction of works of permanent fortification, of the general works in the attack and defense of fortresses, and the reconnaissance connected therewith.

They *may* also be charged—

With the construction of such works of field fortifications as the commander-in-chief or the generals of division consider necessary; such as *épaulments*, trenches, redoubts, forts, blockhouses, bridge-heads, intrenched camps, as well as the opening of communications, the establishment of bridges resting on fixed supports, and the formation and destruction of roads.

After the officers of engineers have been promoted to the rank of second captain, and not before, they are mostly employed apart from their regiments, on the *état major* of the engineers in fortified towns and places, either in charge of the existing military buildings and fortifications, or with the duty of carrying on, or assisting to carry on, such new works as are in course of construction from time to time.

We have already stated that by the law in France one-third of the officers of the army is obtained from the military schools; one-third from the non-commissioned officers who have been raised to that grade from the ranks; while the remaining third is placed at the disposal of the supreme executive power. As regards the artillery and engineers this last third is in actual practice obtained, like the first third part, from the Polytechnic School, so that only one-third of the officers of those arms are promoted from among the non-commissioned officers, and these seldom rise above the rank of captain. Much attention is, however, paid to the improvement of the education of these latter officers, and we found that *four* officers of engineers and *one* officer of artillery so promoted were, by order of the minister of war, on the recommendation of the inspectors-general, passing through the School of Application at Metz, the course of instruction for them being modified on their account. And it was confidently expected that a large number of those officers who had been promoted in this way during the war would be ordered to the School of Application at Metz.

We should not omit to mention that occasional exchanges of service take place, during the first year of residence at Metz, among the pupils destined for the artillery, and those destined for the engineers.

The pay of officers of the artillery and of the engineers is the same. A small additional allowance is granted to officers of artillery when mounted.

ARTILLERY REGIMENTAL SCHOOLS.

There are ten regimental artillery schools established in places or towns that are usually garrisoned by the troops of this arm, and one of these schools exists at Metz.

ENGINEER REGIMENTAL SCHOOLS.

The soldiers of the engineers appear to be very well taught in their regimental schools, of which there are three, one for each regiment, established at Metz, Arras, and Montpellier, where the regiments are usually in garrison. The strength of each regiment is 4,500 men.

The instruction given in these schools has for its object to afford, to its full extent, to the officers, *sous-officiers*, and soldiers of the engineers, the requisite theoretical and practical knowledge to enable them satisfactorily to fulfill the duties of their various ranks, and to qualify them for promotion to higher rank.

It is so regulated that at the end of the first year the men have learnt the nature of the service and duties of a soldier; and that at the close of the second year, the practiced sapper is cognizant of mining, and the practical miner is acquainted with sapping.

In the lowest classes the men begin with learning to read and write; this if followed by arithmetic, grammar, writing from dictation, and composition. The next subjects are special mathematics, landscape, plan, topographical and architectural drawing. We attended a class in which a corporal of sappers was explaining to the mathematical teacher (a civilian) the theory of the inclined plane, and we saw a large number of their drawings, topographical and architectural, many of which were very well executed.

The theoretical instruction is given between the months of November and March, the practical instruction in the field, (already noticed) occupies the rest of the year. The combined courses are completed in two years.

REGULATIONS AND PROGRAMMES OF INSTRUCTION

OF THE

IMPERIAL SCHOOL OF APPLICATION FOR THE ARTILLERY AND ENGINEERS AT METZ.

(Abridged.)

I. POLICE REGULATIONS.

THE chief Regulations for the Police of the Establishment are as follows:—

I. BARRACKS.—The Students are lodged in Barracks in the School, under the command of a Captain of the Staff, with the title of Commandant of the Quarter. They take their meals, however, out of the Barracks, in the town. They are allowed free egress and ingress from and to their Barracks, from the call at 6 in the morning to 10 at night, excepting during the hours devoted to lectures and the studies in the rooms. During these hours they must give special notice of their times of going out and coming in.

II. ORGANIZATION INTO BRIGADES AND SECTIONS.—Each Division is arranged in Brigades of thirty Students at the utmost, and each Brigade in two sections. The Students of Artillery and those of the Engineers constitute, as far as possible, separate Brigades. A Captain of the Staff is attached to each Brigade for its superintendence. The students in these Brigades and Sections are arranged in the order of merit which they held on entrance, and the first Student on the list of each Brigade and of each section of a Brigade is called its Chief. This arrangement is preserved at their messes, which are held at the Restaurateurs', each section of fifteen having its own table, and its chief being the head of the mess. Private bills or private additions to the mess are forbidden, the maximum price for the daily fare being fixed by the Commandant of the School.

III. CONDUCT OF THE STUDENTS.—All games of chance are forbidden; and any debts discovered are punished. If a Student continues long without paying such, he is reported to the Minister of War.

IV. INSPECTION OF WORK DONE WITHIN THE HOUSE.—No work or drawing may be done out of the rooms of study, except in cases of illness.

All works to be executed by the Students are considered as service ordered to be done, which must be completed at the hours and within the period fixed in the order of the day. Students who are in arrears of work at the end of their first year are required to finish them during the time of vacation.

V. SUPERINTENDENCE OF OUT-OF-DOOR WORK.—After describing facilities afforded to the Students for working in the country, and stating minutely the method to be followed, the directions add that "on bringing back their plans, Students must present their sketches, and all the notes taken by them, in their rough state, to the Officer of the Staff intrusted to inspect them. They can not begin to put their work into shape till this Officer's visa has been affixed to the sketches, notes," &c.

VI. VACATION.—There is one vacation at the end of the first year. Any class, or any single student, under punishment, may be deprived of this. Any work to which the Professor gives a mark below 7, must be considered incomplete, and to be done again. Students are kept up in vacation to finish their work; but if it is done within fifteen days, and marked by the Professor's visa, they are allowed to go away for the rest of the vacation.

Young Officers, after their final examination, are subject to all the Regulations of the School, down to the moment of their leaving the town.

II. REGULATIONS FOR ESTIMATING THE VALUE OF THE WORK EXECUTED.

The time devoted to each of the courses in the School, to the works of every kind which belong to it, to the exercises, drill, theoretical instructions, &c., is fixed in accordance with programmes approved by the Minister of War; and the Table similar to that given at pages 180—181, exhibiting the employment, is each year submitted for his approbation by the Superior Council of the School.

Every kind of work, such as the out-door operations, sketches, drawings, memoirs, calculations, interrogations, manipulations, manœuvres, drill, &c., is valued by the Professor or Officer of the Staff charged with its direction, by the product of two numbers, one representing the merit of its execution, and the other the importance of the work.

The numbers representing the merit of the execution or instruction are regulated by the scale of 0 to 20, as at the Polytechnic School.

The co-efficient of importance is found by dividing the number representing the maximum value allowed for the execution of any work by 20, the maximum credit for merit; and the number representing the maximum value, allowed for the execution of any work has reference to all the circumstances bearing upon its execution. It is regulated by the number of hours appropriated to its execution; and in estimating this number of hours, regard is had, not only to the time occupied in making the drawing, but also to that which is necessary for the calculations, essays, and sketches indispensable to its execution. The lectures are reckoned at one and a half hours, and the sittings in the Halls of Study at four and a half hours.

The number of hours inserted in the Table giving the distribution of the time employed, being insufficient for the composition of the memoirs, specifications, estimates, &c., the value given for this kind of work, of which a great part is performed out of the Halls of Study, is fixed at twice the number of hours inserted in the Table showing the distribution of the time employed.

The interrogations are the subject of a special credit, the maximum being equal to the number of hours devoted to the lectures, multiplied by one and a half hour, the length of each lecture.

The credit given for a work performed outside the school is divided into two parts: one, equal to one-third of the total credit, is in the hands of the Officer charged with the superintendence of the work, who estimates the zeal and aptitude of the student; the other, equal to two-thirds, is applied by the Professor, and given according to the merit of the work.

The sum of the credits, given for work of all kinds in a course of study, forms the maximum credit for the course.

The method of fixing the credit for the execution of works, according to the time devoted to them, is equally applicable to the exercises, practice, and drill.

When the time granted for the execution of any work has expired, the Director of Studies sends this work to the Professor for his examination, who establishes the number or credit, showing its importance, and returns it to the Director of Studies.

Every work which has been finished and examined, is marked by the Professor by a number representing its merit, which number may be fractional.

This is multiplied by the number representing its importance, and the nearest whole number resulting from this product expresses the value of the examined work.

Every unfinished work receives a provisional value, and is then returned to the person executing it, and as soon as it has been completed a second evaluation is made, but only two-thirds of the difference between the first and second evaluations is added to the first; the same principle is applied to the works which have been valued below seven, or to those which have been amended or recommenced.

Every work which has not been executed by the student is marked 0; but the grounds for its non-execution are placed before the Jury of Examination.

In the event of two papers being so similar that it is evident one must have been copied from the other, and that it is not possible to decide which has been copied from the other, both are marked 0.

And on the other hand, if it is proved that there was no complicity between the authors of the two papers, the copied paper is the only one canceled.

At the end of each year's study, the Council of the School makes a classification of the students of the two divisions.

Each of these classifications is formed of the following elements:—

1st. Notes of conduct given by the General commanding and the Colonel Second in Command.

2nd. Notes of appreciation given by the General Commanding, and the Colonel Second in Command, and by the Officers of the Staff of the School.

3rd. Tables of credits given by two Field Officers of the Artillery and Engineers on the theoretical and practical instruction with which they are charged.

4th. Tables of credits given by each Professor for the works of all kinds, interrogations, &c., of his course.

The classification of the first year comprehends all the works, drill, and practice, executed during the first year, which have been valued, as well as the notes of appreciation and of conduct.

The number appropriated to these notes at the end of the first year is equal to the moiety of the total number allowed for the two years of study.

The classification of the students of the second year presents the reunion of the works executed by them since their entrance into the school.

The maximum number of credits appropriated to all the Officers of the Staff, as a note of appreciation, is equal to one-sixth of the total of all the courses taken together.

The same number, divided into two equal parts, is assigned to the notes of appreciation given by the General commanding and the Second in Command.

Lastly, the notes of conduct given by the General commanding and the Second in Command form one-fiftieth of the total value.

For the classification of each division the Director of Studies abstracts into a Table, for each arm, all the elements which should enter into this classification. Below the name of each student are inserted all the credits which belong to him, and the total, reduced in the ratio of the maximum 20, is the definitive number of the classification of each student.

The Director of Studies appends to these Tables a report containing everything which affords a means of estimating the work, the conduct of each student, the delays, and the causes, &c. In giving the names of the students whose credits are less than 7, he proposes, conformably with the Regulations, the measures that should be taken with regard to them.

The Superior Council of the School being assembled, the different Tables furnished by the Professors and by the Officers of the Staff, as well as those in which they are summed up, are collated, and the list of classifications for each division and for each arm is fixed separately, with the definitive numbers representing the credits.

These classified lists indicate for each arm the new rank of the Students, their rank at admission to the School of Application and of passage to the first division, the sum of the values for the works executed by them, and all the elements which would tend to enable a proper judgment to be formed of their merits and conduct.

The Superior Council adds to it, if there be any necessity for it, notes, exposing the grounds which have contributed to the principal alterations in the relative position of the Student, and points out those whose credit is less than 7, as well as those who by their bad conduct deserve to become the object of exceptional measures.

Examination for Leaving.

Each year the General commanding the School determines by lot, at least one month in advance, the order in which the examinations for the promotions in the Artillery and Engineers are to take place. The Students belonging to the same arm can change among themselves, but eight days after the lots have been drawn the list of the order of examination is definitely closed. The General commanding the School makes known at the same period the order of the examinations and the division of the subjects between these examinations.

The General commanding the School places before the General of Division, President of the Jury of Examination, the following:—

1st. The division of the subjects between the three examinations.

2nd. The order of examination of the Arms, and of the students of each Arm.

3rd. The provisional classification of the students of the first division made by the Superior Council.

4th. The particular reports relating to each student made by the General commanding the School.

5th. The list of the propositions made by the Superior Council and the proceedings of the sitting at which it was agreed to.

6th. The classification of the Students of the second Division.

7th. Tables of questions established for each course.

8th. The abstracts of the sittings of the Superior Council held since the last examination.

The Student Sub-lieutenants are successively examined in all the branches composing the theoretical and practical instruction of the School. The theoretical knowledge is grouped in three series, each of which is the object of a particular trial.

The drill and practice are executed in the presence of the Jury, who cause the command to be given to the Sub-lieutenant, in order to satisfy themselves of the amount of their instruction, and to assign marks of merit to them individually.

The subjects of the three examinations are divided in the following manner:

First. Examination, made by the Field Officer of Artillery in the—

Course of Military Art.
Course of Artillery.
Course of Veterinary Art.
Sham Siege (part relating to Artillery.)
Course of Military Law and Administration.

Second. Examination, held by the Field Officer of Engineers.

Course of Permanent Fortification and the Attack and Defense of Places.
Course of Construction.
Sham Siege (part relating to the Engineering.)

Third. Examination, held by the third Examiner, taken either from the Artillery or Engineers, in the—

Course of Mechanics.
Course of Applied Sciences.
Course of Topography and Geodesy.
German Language.

Every Student, on presenting himself before the Examiners, submits for their approbation the drawings and manuscripts relating to the subjects on which the examination is to bear. Independent of the questions which are placed before him by the Examiners, the Student Sub-lieutenant must reply to any objections or questions which the members of the Jury may think fit to address to him.

The German Master directly questions the Students, if the Jury wish it. The Professors or their Assistants must be present at the examinations relating to their course.

As soon as the examination is ended, the members of the Jury retire to an adjoining room with closed doors, to determine on the amount of marks to be given to the Student examined.

When the trials of all kinds are finished, the Jury proceed to the definitive classification of the Students belonging to each arm. In making this classification, regard is had to the following considerations:—

1st. Each examination has a co-efficient of importance equal to the sum of all the different courses which are included in it.

2nd. The co-efficient of importance for drawing is equal to the $\frac{1}{20}$ of the sum of the co-efficients of the three examinations.

3rd. The co-efficient of importance of the practice, drill, &c., is, as for the courses, the sum of the co-efficients appropriated to the works taught in the School.

By multiplying the co-efficients of importance by the mean number of marks of merit obtained by the Students in the different examinations, the definitive credit which must be assigned to each Student in the Table of Classification is obtained.

The classification of the School enters into the definitive classification for a value equal to one-third of the total number of the three examinations, without comprising the valuation of the drawings; this value is added to the credits determined above.

The Jury give an account of the proceedings of the examinations in a "*procès-verbal*" addressed to the Minister by the General acting as President.

III. PROGRAMME OF THE ARTILLERY COURSE.

FIRST PART.—INTRODUCTION.

Twenty-six Lectures common to Students of both Arms.

First Lecture.—(1.) Definition of the word Artillery. Material, personnel, science. Object and division of the course.

FIRST SECTION.—EFFECTS OF POWDER.

Ideas on the origin of powder and its use in fire-arms; mealed or pulverized powder; powder in grain. General conditions which powder ought to satisfy; action of each of its component parts. Proportion of component parts used in France. *Fulmi-ligneux.*

Considerations on the physical properties of powder. Size of the grains expressed by the number of grains to the gramme. Density of the grains and specific density of the powder; circumstances causing them to vary. Effects of damp upon powder.

Second Lecture.—(2.) Combustion of powder. Different modes of ignition of powder. Research respecting the laws of its combustion, process of observation employed, laws discovered. Influence of the density, the composition, the mode of manufacture, the damp, the tension and temperature of the surrounding gases.

Combustion of the grains of powder. Calculation applied to the spherical grain. The formula is applicable to the irregular grains of ordinary powder.

Calculation of the density of the gases of powder in a fixed space, on the hypothesis of a simultaneous ignition of the grains. Discussion of the formula obtained; influence of the density of the grains, of the duration of their combustion and of the space in which the powder is inclosed.

Inquiry into the rapidity of ignition of charges of powder. Experiments made upon trains of powder, and upon gun-barrels filled with powder. Conclusions drawn from the results obtained.

Third Lecture.—(3.) Calculation of the density of the gases of the powder on the hypothesis of successive ignition.

Results of the application of the formula to charges of a spherical and a truncated form.

Tension of the gases of powder. Impossibility of determining it by considerations of a purely theoretical nature. Experimental solution of this question. Experiments by Rumfort; description of his apparatus. Results obtained. Formula representing them. Observations on these results.

Fourth Lecture.—(4.) Effects of powder in a fixed space.

Hollow projectiles. The readiest bursting of a hollow sphere takes place in the direction of the plane of a great circle. Determination of the minimum bursting charge; law by which this charge varies with the thickness of the envelope. Influence of the fuse-hole of hollow projectiles; weakening of the envelope of the shell, diminution of the charge; loss of gas, increase of the charge. Effects of the shock of the exploding gases; means of estimating it. Influence of the vivacity of the powder in burning. Number and rapidity of the explosions.

Hollow cylinders burst more easily longitudinally than transversely. Consequences of this principle relatively to the employment of a fibrous metal for the manufacture of arms. Thickness necessary to resist bursting.

Fifth Lecture.—(5.) Effects of powder in cannon.

Analytical theory of the effects of powder in cannon.

Equation of the problem. General expressions of the quantity of force exercised by the expansion of the gases,—of the density of the different sections of gas and of their tension. Differential equations of the motion of the gases, of the projectile, and of the gun. Equation of condition leading to the establishment of the general formula which determines the position of a stratum of gas in the terms of the function of its original position, and of the other data of the question. General relations between the velocity of the projectile and that of the gun.

Density of the stratum of gas at a given moment. Position of the stratum which has a maximum density.

Sixth Lecture.—(6.) Approximative solution applicable to the cases ordinarily met with in practice. Hypothesis relating to the velocity and the tension of different strata of gas.

Relations between the velocity of the projectile and that of the gun. Approximate expression of the amount of force due to the expansion of the gases; line to be followed in the execution of the arithmetical calculations. Formula serving to determine the velocity of the projectile. General considerations on the state of the gases of powder during the burning of the charge. Influence of the motions of the projectile and of the bottom of the bore on the distribution of the gases at each instant. Influence of the successive generation of the gases combined with the enlargement of the space which incloses them on their density throughout the whole duration of the phenomenon.

Seventh Lecture.—(7.) Influence of the vent and of the windage of the projectile on the effects of powder in cannon.

Determination of the loss of velocity occasioned by the windage of the projectile. Influence of the weight of the piece upon the velocity of the projectile. Influence of the weight of the projectile on tension of the gases and upon the velocities of the two bodies set in motion. Influence of the weight of the charge of powder. Charge giving the maximum of velocity. Influence of the size and density of the grains of the powder as well as other circumstances which cause a variation in the law of generation of the gases. Advantage of very rapid combustion in short pieces and of slower combustion in long ones.

Eighth Lecture.—(8.) Influence of the length of bore; circumstances which modify it; length corresponding to the maximum of velocity. Comparison of the quantities of motion of the projectile and of the gun. Trial of a formula fitted to represent their relation. Determination of this relation with the help of the balistic pendulum.

Mean pressure exercised on the projectile during its passage through the bore. Injuries produced in guns by firing; enlargement of metal and cracks; lodgment and percussion of the projectile.

Different effects of the percussion; means tried to prevent injuries (in general.) Considerations on the metals employed in the manufacture of ordnance. Charging with elongated cartridge; use of wooden bottoms and wads.

Ninth Lecture.—(9.) Examination of the proper means for measuring the effects of powder. Eprouvettes of different sorts. Experimental processes founded on the measure of the velocity of the projectile. Grobert's rotatory machine. Process of Colonel Debooz. Process based on the employment of an electric current. Method by ranges (mentioned here by way of note.)

Balistic pendulum. Pendulum of Robins, of d'Arcy, of Hutton. Improvements introduced in France into the construction of these apparatus. Description of the pendulums in use at the present day; cannon pendulum; musket pendulum.

Tenth Lecture.—(10.) Analytical theory of the balistic pendulum.

1. Receiver pendulum; formula which gives the velocity of the projectile. Determination of the elements which enter into the formula, and the degree of approximation necessary. Simplification of the calculation of the velocities in the case of firing several times consecutively.
2. Cannon pendulum. Amount of recoil in the gun. Percussion of the knife-edges of the pendulum. Case where there is none. Means of correcting the position of the center of percussion.

Eleventh Lecture.—(11.) Examination of the effects of the recoil upon guns and their carriages. The question may be considered as resolving itself into two others.

1. Percussions of the carriage upon the points supporting it; analytical solution. Determination of the percussions and of the force of the recoil in the case of carriages on wheels, and that of mortar beds. Graphic solution of the same question by an analysis of the force which acts upon the bottom of the bore. Modification of the sketch according to the different cases presented by the direction of fire relatively to the ground.

Twelfth Lecture.—(12.) Discussion of points relating to the percussion of the carriage upon its supports, and to the force of the recoil. Influence of the elevation of the line of fire; of the inclination of the ground or of the platform; of the length of the carriage in proportion to its height and of the friction which results from the contact of the trail with the ground. Velocity of recoil of the collective apparatus. Determination of the extent of the recoil on a given ground. Recoil of the different pieces of ordnance in use. Case in which the forepart of the carriage has a tendency to be lifted up; velocity of this motion; determination of the effect resulting from it.

Thirteenth Lecture.—(13.)

2. Percussions produced by the gun upon its carriage. Determination of the amount of percussion of the breech upon the elevating screw, and of that of the trunnions upon the trunnion holes. Discussion of points relative to the effects produced. Influence of the elevation; of the dimensions of the gun, and of the proportion of its weight to that of the entire apparatus.

Effect of the elasticity of the different parts of the apparatus. It diminishes the wear of the parts struck, and renders it necessary to take into account the velocity of the parts striking.

Fourteenth Lecture.—(14.) Effects of powder in mines. Historical notices. Dimensions of the boxes containing the powder. Considerations on the effects of the expansion of the gases in an indefinite or limited compressible medium.

Definitions having reference to craters and chambers of mines. Ordinary charge of the chamber. The old rule for miners; its entire alteration. Table relating to different kinds of medium. Overcharged chamber. Overcharged chamber or "camouflet." Limit of the effects of compression which result from the action of the chambers. Use of gun cotton. Considerations on the effects of the petard. Dimensions of the cavity reserved for the powder. Means employed or proposed to diminish the charge of powder proportioned to a given effect.

SECOND SECTION.—MOTION OF PROJECTILES IN SPACE.

Fifteenth Lecture.—(15.) Science of projectiles. Historical notices. Utility of an acquaintance with the laws of the motion of projectiles in a vacuum. Definitions relating to the trajectory. Differential equations of the motion in vacuo. Equation of the trajectory. Inclination of its elements. Velocity of the projectile at any one point. Duration of its passage. Determination of the range and of the angle of greatest range. Relations between the ranges; the initial velocities; and the angles of projection. Examination of the cases where the theory of the parabola is applicable.

Preliminary ideas on the resistance of fluids; difficulties inherent in this question. Approximative formula of the resistance, established by the help of the principle of active forces; circumstances not taken into consideration by it.

Sixteenth Lecture.—(16.) Experiments relating to the determination of the resistance of the air.

1. Case of small velocities. Rotatory apparatus; results furnished by them in the case of thin planes; their essential defect. Apparatus with rectilinear movement. Mean value of the co-efficient of the theoretical resistance in the case of thin planes; modification of this value for the case of spheres, &c.
2. Case of great velocities. Direct determination of the resistance of the air by the aid of the balistic pendulum. Experiments of Hutton, their results. Experiments made at Metz in 1839 and 1840. General expression of the resistance based upon the total of the results obtained, and containing a function of the velocity in three terms. Search after a function in two terms fit to replace in each particular case the general expression.

Seventeenth Lecture.—(17.) Theory of the motion of projectiles in the air. Differential equations of the motion. Hypothesis on the relation of the element of the trajectory to its projection. Calculations based on this hypothesis, and leading to the final equation of the arc of the trajectory. Inclination of the element of the trajectory. Velocity of the projectile at a given point. Duration of the passage.

Eighteenth Lecture.—(18.) Examination of the functions employed in the formulas of the science of projectiles. Formation of the balistic co-efficient, and the series contained in the functions. Relations of the series and the functions to each other. Arithmetical tables designed to give their values. Determination of the relation of an arc of the trajectory to its projection. Error resulting from the introduction of the constant relation in balistic calculations.

Nineteenth Lecture.—(19.) Application of balistic theories to the movement of projectiles thrown at great angles. Analysis of the trajectory, and determination of all the circumstances of the movement. Trajectory of shells considered as a single arc. Solution of several problems involved in this hypothesis. Determination of the range. Velocity corresponding to a given range and angle of projection. Angle of projection corresponding to a known initial velocity and range. Angle of greatest range. Variation of the velocity of the projectile during the whole of its passage. Limit of velocity of projectiles falling vertically in the air.

Twentieth Lecture.—(20.) Application of balistic theories to the motion of projectiles thrown at low angles. Case where the relation of the arc to its projection can be supposed sensibly equal to unity. Problems relative to direct fire; distinction established between the angle of projection and the angle of fire. In ordinary cases in practice the angle of fire is very nearly independent of the height of the object aimed at. Relations between the angle of projection, the angle of elevation of the object aimed at, and the angle of descent. Problems relating to plunging fire. (Ricochet fire.) Determination of the initial velocity and the angle of projection for a projectile which has to pass, firstly, through two given points; secondly, through one given point, the trajectory having at this point a known direction. Case of practical impossibility.

Twenty-first Lecture.—(21.) Relations between the velocities, the spaces traversed, and the durations of passage in the rectilinear movement of projectiles. They are applicable to direct fire, and are independent of the function of the velocity which enters into the expression of the resistance of the air. Case where the resistance of the air can be supposed proportional to the square of the velocity. Establishment of balistic formulas in this hypothesis. Application of the formulas to the resolution of one of the problems connected with a plunging fire. Comparison of the results obtained with those arrived at by the use of general formulas. Indication of methods applicable to the resolution of several questions in projectiles.

Twenty-second Lecture.—(22.) Examination of disturbing causes which influence the motion of projectiles.

1. Disturbing causes acting on the projectile during its passage through the bore. Imperfections of form, such as want of straightness in the bore, faulty position of the line of sight and the trunnions.

 Influence of the windage of the projectile and of the percussions which result from it. Deviation from the original direction; its consequence in the different kinds of fire. Effect of the recoil and the vibrations of the barrel in the fire of small-arms.

 Influence of the various causes which are capable of modifying the initial velocity.

2. Disturbing causes acting upon the projectile during its passage through the air. Influence of the rotatory motion which results from the last percussion within the bore. Effects of the eccentricity of projectiles. Case where the rotation occasions no deviation. Influence of the proximity of the ground. Deviation produced by the wind (air in motion.) Influence of atmospheric changes.

THIRD SECTION.—MOTION OF CARRIAGES.

Twenty-third Lecture.—(23.) Importance of the question. Preliminary ideas. Resistance due to the motion of a carriage and determination of the effort necessary for drawing it in the case of uniform motion. Two-wheeled carriage on level ground; the effort of draught in a direction parallel to the ground; first, resistance referable to the friction of the wheels on the axle; secondly, resistance referable to their revolution upon the ground. Influence of the weight of the carriage. Advantage of large wheels over small ones, demonstrated in the two cases of a yielding soil and a hard soil scattered over with obstacles. Expression of the power of draught necessary to overcome the two resistances united.

Twenty-fourth Lecture.—(24.) General expressions of the effort of draught necessary for two-wheeled and four-wheeled carriages; case of a locked wheel. Influence of the direction of the traces and of the inclination of the ground upon the draught. Advantage of rolling over dragging for the transport of burdens. Examination of resistances which are developed in the passage from repose to motion. Considerations on the position of the fillet in the box, and determination of the co-efficient of friction for the case of the revolution of the wheel about the axle.

Influence of the length of the nave on the frictions when the axle is thrown out of a horizontal position.

Twenty-fifth Lecture.—(25.) Turning of carriages considered successively in the case of two-wheeled and four-wheeled carriages. Center and angle of the turn in four-wheeled carriages. Calculations of the angle of the turn and of the space required by the carriage to execute a half turn. Examination of the dimensions of the carriage which influence the angle of the turn. Diameter of the fore-wheels and height of the body of the carriage; distance between the wheels and breadth of the body of the carriage; position of the point of re-union of its fore and hind parts. Examination of the circumstances favorable or unfavorable to the action of the horse. Relation between the forces to which he is subjected, and the pressure of his feet on the ground. Sliding of the feet; influence of the weight of the animal; of the co-efficient of friction; and of the direction of the traces. Lifting of the fore-hand; influence of the weight of the horse, and of the increased distance between the points on which he rests; of the position of his center of gravity; and of the direction of the traces.

Twenty-sixth Lecture.—(26.) Considerations on the mode of action of the draught-horse. Effect of his weight, and of the inclination of the traces. Effort of draught of which the horse is capable, both momentarily and continuously; results of experiments. Composition of artillery harness. Harness à limonière (with shafts and cross-bar,) or on the French system; on the German system, with pole and support. Use and discontinuance of swing bars. Arrangement of the traces. General arrangement of harness. Bât-saddle.

SECOND PART.

CLASSIFIED ACCOUNT OF SMALL ARMS AND OF ARTILLERY MATERIAL.

Twenty Lectures, of which Fourteen are common to the Students of both Arms and Six confined to Artillery Students.

FIRST SECTION.—SMALL ARMS.

Twenty-seventh Lecture.—(1.) Classification of small arms. Arms not fire-arms. Classification of hand-weapons. Considerations on the profile and outline of cutting weapons. Effect of the curve. Division of the mass. Form of the hilt.

Considerations on the profile and outline of thrusting weapons.

Position of the center of gravity; form of the point. Description of arms other than fire-arms now in use. Sabres and swords. General ideas respecting their component parts; blade, hilt, and scabbard. Regimental arms. Infantry sword. Sword-bayonet of the artillery and chasseurs, cavalry sword; peculiar requisites. Sword of cavalry of reserve, of cavalry of the line, and of light cavalry. Horse artillery sword.

Officers' and non-commissioned officers' arms. Cavalry lance. Camping axe. Side-arms in use in the navy. Sword, pike, boarding-axe, dirk.

Defensive armor. Cuirassiers and carabineers' cuirasses. Cuirass and helmet of the sapper.

Twenty-eighth Lecture.—(2.) Fire-arms. Historical notices. First attempts in fire-arms. Hand cannons. Arquebuses, culverines, &c. Poitrinal, match-lock, firelock, pistol, and blunderbuss.

Means employed successively for loading and ignition of the charge. Twisted match, wheel-lock, flint-lock, percussion-lock, (the two last mentioned here by way of note.) Classified account of fire-arms now in use. Muskets. Considerations on the weight and principal dimensions of muskets. Detailed description of the infantry musket. Action of the flint and the percussion lock.

Twenty-ninth Lecture.—(3.) Comparison of the flint and the percussion musket. Voltigeur's, dragoon's, and double-barreled musket. Gendarmerie and cavalry carbine. Cavalry and gendarmerie pistol. Arms in which precision of aim is studied. Means employed to prevent the deviations caused by the windage of the projectiles and their rotatory movement in the air. Diminution and suppression of the windage; straight grooves in the barrel, spiral grooves, rifled arms. Rotation of the ball about its axis of flight.

Principles of arrangement of rifled arms. Charge of powder and inclination of the grooves; two modes of solution, powerful charge and long spiral, weak charge and short spiral. Length of the barrel: conditions which determine it; number and form of the grooves.

Thirtieth Lecture.—(4.) Loading of rifled arms; ramming the ball home; loading at the breech. Different methods tried. Loading with a flattened ball; effect of the flattening of the ball. Examination of the successive improvements to which this idea has served as a basis. Chambered arms; use of the short bottom and the patch. Arms *à tige*. Elongation of the ball; shortening of the spiral groove; diminution of the charge; advantages resulting from it. Pointed cylindrical ball; principles of its outline; effect of the notches of the ball; superiority of this projectile over the spherical balls. Summary examination of the different models of rifled arms which have been successively in use. Versailles rifles.

Wall-piece, pattern 1831. Common rifle, pattern 1842. Wall-piece, pattern 1840. Bored-up wall-piece, pattern 1842. Pistols for officers of cavalry and gendarmerie. Rifles *à tige*, pattern 1846, and artillery carbine *à tige*. Description of these two arms. Superiority of the rifle *à tige* over the arms for precise aim previously adopted. Trial relating to a new improvement in the construction of rifled arms. Disuse of the "*tige*." Ball with cup. Comparative notice of the fire-arms of the different European powers.

SECOND SECTION.—PROJECTILES AND CANNON.

Thirty-first Lecture.—(5.) Principles of construction of projectiles.

Considerations on the substances which may be chosen for the manufacture of projectiles. Essential conditions, density, hardness, tenacity, cheapness. Projectiles of stone, lead, cast-iron, iron, copper, gun-metal. Forms of projectiles.

Exterior form; conditions which serve to determine it. The spherical form preferable to any other in the actual state of artillery. Advantage of elongated projectiles. Conditions relating to their use. First attempts. Interior form of hollow projectiles; howitzer shells, bombs, and grenades. Thickness of the metal; fuse-hole; charging-hole of naval hollow projectiles; lugs or handles of shells. Density of projectiles. Recapitulation of the balls; howitzer shells; shells and grenades in use, their nomenclature, dimensions, weight. Cannon-balls. Choice of metal and weights. Different arrangements for the use of shot, case-shot, canister or naval grape-shot. Spherical case; conditions relating to their use. Charge of spherical case. Bar-shot. Rescue shells.

Thirty-second Lecture.—(6.) Cannon. Historical ideas on the subject. Principle of arrangement of ancient arms and machines of war. Motive force employed; its inferiority compared to that furnished by the combustion of powder. Earliest cannon.

Historical view of the different systems of ordnance which have been successively in use in France.

1. Cannon. Calibres in use in the 16th century. Edict of Blois, 1572. Cannon employed in the reign of Louis XIV. Regulation of 1732. System of Vallière. Modifications introduced by Gribeauval in 1765. Cannon of the year XI. Cannon in use at the present day.

2. Ordnance adapted to hollow projectiles. Difficulties inseparable from the throwing of hollow projectiles; first attempts. Mortars. Double fire. Ancient calibres. Mortars in use at the present day. Stone mortar. Howitzers, their first use in the French artillery; howitzers of 1765; of the year XI. Calibres in use at the present day. Considerations on the calibres of different kinds of cannon. Siege, garrison, field, coast, and naval ordnance. Siege, garrison, field, mountain, coast, and naval howitzers. Mortars and stone mortars. Considerations on the metals which may be employed in the manufacture of cannon for siege, garrison, field, coast, and naval purposes. Interior form of ordnance.

1. Part of the bore traversed by the projectile, transverse section; trial of rifled cannon, longitudinal section.
2. Part of the bore occupied by the charge; influence of its form; the spherical, cylindrical, truncated form. Chambers of mortars; reason for their adoption. Cylindrical and truncated chambers; comparison of their effects. Spherical chamber; pyriform chamber: interior form of the naval mortar *à semelle* (cast in one piece with the bed.) Chamber of howitzers; experiments with reference to their adoption for field howitzers. Dimension. Howitzers without chamber. Chamber of carronades. Junction of the chambers with the rest of the bore: form of the bottom of the bore or of the chamber.

Thirty-third Lecture.—(7.) Vent; its object, its dimensions. Bushes inserted before casting, (*masses de lumière;*) after casting, (*grains de lumière.*) Considerations on the position of the vent relatively to the charge. Experiments made with the infantry musket, and with 24 and 16 pounder guns.

Arrangement of the vent in guns of 1732; portfire chamber. Vent of mortars. Priming pans. Windage of projectiles; conditions which determine it for the different services. Rules received with respect to ancient guns. Dimensions in use at the present day. Different characteristics resulting from the windage of projectiles. Length of the bore. Question of the length of the bore considered with reference to the projectile effect of the powder. The length of ordnance is determined by considerations unconnected with this effect.

Length of bore of siege and defensive artillery, of field, coast, and naval guns. Length of bore of mortars, and of the stone mortar. Length of bore of howitzers. Thickness of metal and external outline. Cannon:—Theoretical determination of the external outline necessary for resistance to the effect of the gases of the powder. Co-efficient of resistance, its value in the guns in use. Thickness in the chase necessary for resistance to the percussions of the projectile.

Swell or moulding of the muzzle. Thickness at the position occupied by the trunnions. Thickness of metal of the different systems of cannon which have been successively in use in France. Thickness of metal in howitzers. Form resulting from the diminution of internal diameter, at the position occupied by the chamber. Exceptional form of the siege howitzer. Outline of the interior of mortars.

Thirty-fourth Lecture.—(8.) Line of sight; its object and arrangement. Considerations on the inclination of the line of sight relatively to the axis of the gun. Trunnions; object and arrangement of trunnions and their shoulders. Position of trunnions relatively to the center of gravity of the gun. Preponderance of the breech over the chase; manner of estimating it; preponderance allowed in the different guns in use. General principle serving as the basis for its adoption. Position of trunnions relatively to the axis of guns. Reasons for their depression; circumstances which cause it to vary. Trunnions of mortars; their reinforces. Dolphins of ordnance. Weight of ordnance; necessary relation between the weight of a gun, and the quantity of movement of its projectile. Conditions serving to determine the weight of the different species of cannon, howitzers, and mortars in use. Examination of the weights adopted for the pieces of ordnance of all sorts, which have been successively employed. General recapitulation of the different species of ordnance in use. Nomenclature. Dimensions, weight. Land artillery. Siege, garrison, and field guns. Siege, garrison, field, and mountain howitzers, mortars, and stone mortars. Naval artillery. Cannon, carronades, howitzers, mortars, stone mortar, blunderbuss. Observations on ordnance. Exceptional ordnance. Villantroy's howitzers. Belgian mortar of 60 c., &c. Description of the artillery petard.

THIRD SECTION.—WAR AND SIGNAL ROCKETS.

Thirty-fifth Lecture.—(9.) Historical ideas on the subject. Cause of the motion of rockets. Their exterior and interior form. Relation which should exist between the law of generation of the gases and the orifice for their escape. Measure of the tension of the gases in rockets. Results of experiments. Motion of the rocket. Variation of the velocity during its passage. Means of regulating the motion; effect of the directing stick. Influence of the wind upon the trajectory of the rocket.

Description of rockets in use.—1st. War rockets; calibres employed; body of the rocket; arrangement of the stick. Projectiles fitted to the head of the rocket; rockets without stick. 2d. Signal rockets; their calibres and composition.

FOURTH SECTION.—CARRIAGES.

Thirty-sixth Lecture.—(10.) Historical ideas on the subject. Arrangements originally in use for the service of ordnance. Successive improvements. Carriages on wheels. Introduction of limbers. General conditions which gun-carriages should satisfy.

General principles of their construction:—1st. With reference to the act of firing. 2dly. With a view to transport.

Mortar carriages. Particular requisites. Description of the carriages in use. Siege carriages; particular conditions. General arrangement of ancient siege carriages. Detailed description of the present siege carriage and its limber; its weight and different characteristics. Field carriage; particular requisites; general arrangement of the carriages employed before 1765. Field carriages of the system of Gribeauval; its defects. General arrangement and detailed description of the present field carriage and of its limber. Weight and different characteristics. Mountain carriages; particular requisites; description of the carriage and of the arrangement of its shafts (*limonière.*)

Thirty-seventh Lecture.—(11.) Garrison and coast carriages; particular requisites; object of the platform for the two systems; its principal dimensions; position of the pintle or working bolt (*cheville ouvrière.*) General arrangement of ancient garrison and coast gun-carriages. Description of the present garrison carriage; change of the carriage into a movable one on four wheels; weight and different characteristics. Replacement of the platform by a directing transom bed under certain circumstances of the service. Casemate carriage. Iron carriages; inconveniences of this kind of construction for siege purposes and on the field of battle; its advantages for the armament of coasts. Description of the coast carriage actually in use; weight and different characteristics. Naval carriages; particular requisites. General arrangement of naval carriages in use. Carriage on four small wheels for cannon. Bracket carriage (*à échantignolle,*) and carriage with double pivot platform for howitzers. Carronade carriage. Mortar bed, cast in one piece with the mortar, (*à plaque.*) Exceptional methods of construction. Depressing gun carriages for a very plunging fire. Villantroy's howitzer beds, those of the Belgian mortar of 60 c., &c.

FIFTH SECTION.—CARRIAGES AND OTHER PARTS OF AN ARTILLERY TRAIN. ARTILLERY OF FOREIGN POWERS.

Thirty-eighth Lecture.—(12.) Battery carriages. Ammunition wagon. Historical ideas on the subject. Requisites for carriages used for the transport of munitions of war. General arrangement and description of the present ammunition wagon. Principles of arrangement of the ammunition chest. Loading of the chest with munitions of various kinds. Mountain ammunition chest. Loading of the chest with howitzer ammunition and infantry cartridges.

Battery wagon; object of this carriage; patterns successively adopted. Description of the wagon, pattern 1833. Field forge; object of this carriage. Description of the forge in use. Arrangement and play of the bellows. Mountain forge. Description and loading of it.

Thirty-ninth Lecture.—(13.) Park carriages and machines.

Park wagon. General arrangement and description of the park wagon and its limber. Carriages destined to the transport of heavy burdens. Ancient gun wagon. Truck. Block carriage. General arrangement and description of the carriage. Siege cart; its object and description. Devil carriages. Arrangement of the ancient devil carriages with perch and with screw. Devil carriage with roller. Description of the carriage and of its mechanism. Gin. General arrangement of the different patterns successively employed. Description of the gin at present in use. Handscrew; its use, general arrangement, and description.

Fortieth Lecture.—(14.) Pontoon equipages. Conditions which military pontoon equipages should satisfy. Considerations on the nature of the supports to be employed. Reserve pontoon equipage. Boat of the reserve equipage; its general form and dimensions. Description of the boat and skiff; use of the boat for navigation; its weight and different properties.

Tackle and machines employed for bridge-making. Balks, moorings, chesses, blocks, and balk collar. Framework, with movable head; different kinds of piles. Means of anchorage. Common anchor; its properties. Anchor basket and chest. Buoy. Cordage. Ideas on its arrangement and on the measure of its resistance. Capstan. Windlass. Tackling. Handscrew. Pile driver. Hand rammer. Grapnel and hooks.

General arrangement of the boat carriage. Description. Its weight and properties. Light equipage.

Forty-first Lecture.—(15.) General ideas on the artillery of the different European powers, and comparison with the French material.

Ordnance; description, species, and calibres. Gun-carriages, carriages, and other parts of the train. General arrangement; facility of movement; modes of harnessing, &c.

SIXTH SECTION.—DETAILS OF CONSTRUCTION OF GUN CARRIAGES AND ARTILLERY CARRIAGES, AND MEANS OF PRESERVATION OF MATERIAL.

Forty-second Lecture.—(16.) Knowledge of woods. Preliminary ideas. Structures and general properties of woods. Diseases and defects of woods. Description and properties of the principal substances employed in the construction of the material; uses to which the different kinds of wood are specially destined. Selection of standing timber; felling; transport; reception of woods; cubature. Cutting up in large and small sizes. Observations on the shrinking of wood. Preservation of woods. Drying in the air. Round, squared, and blocked-out timber. Preservation in store; preservation in water. Steeping. Influence of the contact of woods with other woods, and with metals.

Forty-third Lecture.—(17.) General considerations on the substances employed in the manufacture of gun and artillery carriages. Different properties of metals. Choice of kinds of wood; effects of their being dried. Classified account of axles and wheels. Axles; substance employed, their forms and dimensions. Wheels; essential requisites. Importance of the elasticity of wheels. Effects of the dishing of a wheel, form of the spokes, coupling of the spokes with the nave and the felloes. Tires. Form and number of the felloes determined by the effects of the drying. Form of the nave. Wheel-boxes.

Forty-fourth Lecture.—(18.) Means employed for the connection of the pieces which enter into the composition of gun-carriages, carriages, and other furniture of the train. Nails, clinch nails, rivets, bolts, screws, &c. Examination of the joinings employed in the construction of gun-carriages, carriages, and other furniture of the train.

General principles. Joinings of gun-carriages. Joint plates ("*rondelles d'assemblage.*") Mortar beds, siege, field, and garrison carriages.

Forty-fifth Lecture.—(19.) Joining of other carriages and furniture. Hind parts, ammunition wagon, battery wagon, forge, park wagon, block carriage, cart, devil carriage, and drays. Boat and wherry. Fore parts, particular requisites. Fore parts of the field and siege carriage, of the park wagon, devil carriage, and drays. Barrels and cases.

Forty-sixth Lecture.—(20.) Means employed for the preservation of the material. Cost price of the principal parts of the material. Ordnance, projectiles, powder, carriages, and other furniture of the train. Small-arms. Preservation of ordnance in gun-metal and cast-iron. Preservation of projectiles. Formation and counting of piles. Rust-cleaning machine. Preservation of gun-carriages, carriages, and other furniture of the train. Different methods of stacking in use. Preservation of powder and made-up ammunition; stacking in powder magazines. Means proposed for avoiding the danger of explosion. Preservation of small-arms. Armories. Preservation of iron and cut wood.

THIRD PART.

FIRE OF ORDNANCE AND PORTABLE FIRE-ARMS. EFFECTS OF PROJECTILES.

Forty-seventh Lecture.—(1.) Fire of ordnance. Kinds of fire in use with ordnance. Choice of charges of powder. Charges of powder formerly in use; their progressive reduction. Charges of field, siege, garrison, coast, and ships' cannon; of howitzers and mortars.

Arrangement of the charge. Shot cartridge for field guns. Loading of the other kinds of guns, of howitzers, mortars, and the stone mortar. Loading for fire with red-hot shot. Armaments for the service of ordnance. Methods of igniting the charges of powder; tubes formerly in use, friction tubes. Percussion system; Swedish tube. Ignition of the charge of hollow projectiles, fuses of hollow projectiles, fuse with several pipes for the fire of spherical case, hand grenade fuse. Rapidity of fire. Laying of ordnance. Principal methods of laying guns; laying them by the help of the line of sight. Determination of the elevation. Instruments in use to obtain elevations. Negative elevations, means of using them. Laying guns for fire parallel to the ground; for breaching fire at a short distance.

Forty-eighth Lecture.—(2.) Determinations of elevations by experiment; construction of practice tables. Laying guns when the axis of the trunnions is not horizontal. Laying guns with the help of the plumb-line and quadrant; plunging fire, rectification of the aim.

Fire of mortars, means for directing it in use; use of pickets, of the line, of the quadrant. Laying pieces in the case of a defective platform. Means of laying them for night-firing. Laying naval ordnance; use of the front sight. Initial velocities of projectiles with the different charges in use. Angles of sight, and point-blank ranges of ordnance. Ranges at different sights. Maximum ranges.

Forty-ninth Lecture.—(3.) Probabilities in the fire of ordnance; known laws, facts ascertained by experiment. Distribution of projectiles over an object aimed at of indefinite extent. Mean point of impact. Fire of canister; effects of the dispersion.

Fire of spherical case. Effects of the bursting of the projectile; dispersion of the balls and of the explosions. Fire of the stone mortar; use of mortars for the same purpose.

Fire of small arms: charges of powder adopted. Ball cartridge. Initial velocities of balls with the different arms. Angles of sight and point-blank ranges. Rules for fire according to distances, for muskets, carbines, and pistols. Fire of rifled arms; use of the tangent scale. Probability of the fire of small-arms; comparison of arms with smooth-bored and rifled barrels. Different means employed for the estimation of distances.

Fiftieth Lecture.—(4.) Effects of projectiles on the different substances fired at. Effects of concussion and penetration. Effects on earth. Theory of the penetration of a projectile into a resisting medium. Formula to express the penetration, based on the results of calculation and experiment. Effects of penetration into wood. Effects on metals, cast-iron, iron, lead. Effects on masonry and on rock. Application to a breaching fire delivered in a regular direction relatively to the revetment. Effects of the shock of projectiles upon living bodies. Effects of hollow projectiles bursting in different media; earth, wood. Method of bursting employed against troops.

Effects of spherical case. Incendiary effects. Effects of war rockets. Explosive rockets. Incendiary rockets. Effects of concussion.

FOURTH PART.

TRACE AND CONSTRUCTION OF BATTERIES.

Six Lectures, common to the Students of both Arms.

Fifty-first Lecture.—(1.) Definitions. Meaning attached to the word "battery." Different denominations given to batteries: first, according to the circumstances of the war in which they are employed; secondly, according to their mode of construction; thirdly, according to the kind of ordnance with which they are armed; fourthly, according to the kind of fire for which they are intended; fifthly, according to the direction of their fire.

Principles of construction. General considerations on the elements which constitute the different kinds of batteries which have reference to them. Epaulment; its length, height, and thickness in different cases. Section of the epaulment. Ground-plan of the epaulment of the different kinds of batteries; returns at its extremities. Case where the battery is in advance of a parallel. Epaulment with redans; its trace.

Embrasures opened in the epaulment; their construction in different cases; slope of the bottom; interior opening; exterior opening; form of the cheeks.

Genouillère; fixing of its height for the different kinds of fire. Limit of the obliquity of the embrasures.

Fifty-second Lecture.—(2.) *Terre-Plein;* its position relatively to the ground; its length for the different kinds of batteries. Disposition of the part unoccupied by the platforms. Terre-plein of garrison, field, coast, and barbette batteries.

Ditch; cases in which it is employed. Its position with reference to the epaulment. Depth, breadth, section, and plan of the ditch.

Communications between the battery and the works in its neighborhood; parallels or trenches; plan and construction. Communication between the battery and its ditch.

Powder magazines: their object. Discussion respecting their site and capacity with a view to the different kinds of batteries, viz., siege, garrison, and field batteries.

Traverses of *crownwork* and garrison batteries. Width between them and dimensions.

Fifty-third Lecture.—(3.) Details of construction. Different materials employed in the construction of batteries. First, materials for revetments, fascines, gabions, hurdles, sods, bags of earth, withy-bands, stakes, &c. Secondly, materials for platforms; hurtoir, sleepers, planks, beams, pickets. Construction of revetments of different kinds employed in batteries. First, revetment of the interior slope of a battery upon the natural ground. Secondly, revetment in use when the terre-plein is more or less sunken. Ordinary siege battery, battery in a parallel, battery in a crownwork. Third, revetment of the cheeks of embrasures in the different cases met with in practice; direct batteries with point-blank range; ricochet, breaching, garrison, and field batteries.

Fifty-fourth Lecture.—(4.) Construction of platforms. Ordinary siege platforms, movable platforms (*à la Prussienne*,) garrison and coast platforms, ordinary mortar platforms, platforms for coast mortars of great range. Peculiar case where the fire has to be elevated or greatly depressed. Construction of the communications from the battery to the parallel and to its fosse. Construction of powder magazines in batteries. Magazines of siege batteries, Nos. 1, 2, 3, 4. Case of breaching batteries; garrison battery and field battery. Magazines. Degree of resistance offered by blinded magazines. Modifications adopted for the strengthening of magazines whose construction is already fixed.

Fifty-fifth Lecture.—(5.) Number of workmen to be employed on the construction of the different parts of batteries: revetments, platforms, communications, powder magazines. Earthworks.

Duration of the total labor necessary for the construction of each kind of battery. Duration of the duty for the different parts of the *personnel* employed upon the construction; officers, gunners, assistants. Definitive number of workmen necessary for the construction of the different kinds of batteries. Tools of different kinds.

Simultaneous execution. Preliminary operations. Reconnaissance. Prolongations. Sketch of the plan of a battery. Formation of the working party. Transport of materials. Plan of the battery. First, battery having its terre-plein on the level of the ground. Disposition of the working party. Work of the first night, of the following day, of the second night. Second, a battery sunk outside a parallel. Third, battery in a parallel or trench of some kind already established. Day labor, night labor.

(4.) Particular case of crownwork batteries.

Fifty-sixth Lecture.—(6.) Exceptional constructions. Blinded batteries for cannon or howitzers; for mortars. Batteries of earth-bags. Batteries on stony ground, on the rock, or marshy soil. Floating batteries. Construction on sites deficient in space. Case where the fire of the place is too dangerous. Coast batteries. General arrangement.

Instruction preparatory to working at the plans of batteries. (Course.)

FIFTH PART.

UNIFORM ORGANIZATION AND SERVICE OF THE ARTILLERY.

Ten Lectures common to Students of both Arms.

FIRST SECTION.—UNIFORM ORGANIZATION OF THE ARTILLERY.

Fifty-seventh Lecture.—(1.) Historical résumé. Progress of modern artillery, from its origin down to our time. Artillery of Charles VII. and of Louis XI. Progress under Francis I. Effects of the wars of religion. Edict of Blois, 1572. Improvements by Sully. Creation by Gustavus Adolphus. State of the artillery under Louis XIV. Employment of artillery on the field of battle at the commencement of the 18th century. Regulation of 1732. Introduction of howitzers into the French artillery. Regimental pieces. Progress of the artillery in Prussia and in Austria in the Seven Years' War. Reorganization of the French artillery in 1765. Résumé of the improvements owing to Gribeauval. System of the year XI. Present system.

Historical ideas on the personnel of the artillery. State of the personnel at the commencement of the use of fire-arms. Masters and grand-masters of the artillery, &c. Personnel employed originally on the service, and the guard of ordnance. Creation by Louis XIV. Account of the successive modifications in the personnel from this epoch down to 1765. Organization of 1765. Horse artillery. Pontoneers. Artillery train. Artillery of the Imperial Guard. Organization of 1829. Present state of the personnel. Regiments of artillery. Composition of the personnel of the different kinds of batteries. Companies of pontoneers, workmen, armorers, veteran gunners. Driver-corps ("*train de parc.*") Naval artillery.

Fifty-eighth Lecture.—(2.) Committee and central depôt of artillery. Organization of artillery commands Establishments for the instruction of the personnel; artillery schools. Creation in 1679. Present schools; personnel attached to them. Central school of military pyrotechnics. Establishments for the preservation of the material. Importance of the material of artillery. Its state in France at different epochs. Artillery directions. Division of the territory of France. Personnel of the directions.

Establishments for the manufacture of the material. Ideas on the subject of their management. Arsenals; their object, management, number, personnel. Forges; their object, management, districts, personnel, inspection. Foundries for land artillery; their number, management, personnel, inspection. Naval foundries. Manufactures of arms; their special management, number, personnel, inspection. Branch of the service connected with gunpowder and saltpetre. Powder manufactories and refineries; management, personnel. Direction of the service. Establishments existing in France. Percussion cap manufactory.

SECOND SECTION.—SERVICE OF THE ARTILLERY IN THE FIELD. ORGANIZATION OF THE FIELD ARTILLERY TRAIN, ETC.

Selection of ordnance, conditions which determine it; cannon, howitzers, relation between them. Proportion of the number of pieces of ordnance to that of the combatants. Mean proportion received in France; circumstances which may lead to a modification of it. Organization of ordnance in batteries. Account of the arrangements formerly adopted. Present system. Distribution of the batteries in the army. Principles received. Application of these principles to the artillery train of an army of a given strength. Infantry divisional batteries; cavalry divisional batteries; reserve batteries. Case of the formation of army corps. Composition and supply of batteries. Principles and details of the supply of batteries with ammunition for the guns and for the troops. Second supply distributed amongst the parks.

Fifty-ninth Lecture.—(3.) Field parks. Their composition, in carriages of all kinds. Application of the principles to the artillery train of an army of a given strength. Approximate relation of the number of the carriages and of the horses of the train to that of the pieces of ordnance. Means of renewing the supply of the parks.

Personnel of the field train. Personnel of the batteries; working companies. Companies forming part of the train. Personnel attached to the parks. Staff. Particular conditions, having reference to war in a mountainous country. Selection of pieces of ordnance. Proportion between their number and that of the combatants. Composition of some artillery trains employed in our African expeditions. Composition and supply of the mountain battery. Lading of the mules. Composition of pontoon trains. Reserve train, boats, wherries, tackle, carriages, and horses. Personnel of the train. Light train: material, personnel.

Sixtieth Lecture.—(4.) Marches of the artillery. Reception of a battery or of a park. Precautions to be taken before the departure. March at a distance from the enemy. Order of march. Distribution of the personnel; halts. Case of an accident to a carriage; ascents; descents; deep-bedded roads; passage through inhabited places; passage of bridges; of fords. Passage over ice. Night march. Transport of mountain artillery. March of pontoon trains. Transport of the trains by water; navigation by convoys; by isolated boats. Transport of ordnance, powder and projectiles in the boats. Transport of artillery trains by sea.

March in the vicinity of the enemy. Isolated convoys; rule with reference to their command; order of march; general measures of security; precautions to be taken during halts; manner of receiving an attack. Case where resistance becomes impossible; arrangements for the night.

Artillery in the march with other troops. Order of march. Relation of the different corps to each other. Exceptional difficulties which may occur on marches; privations of all kinds; bad weather; bad state of the roads; instances. March among high mountains; passes strongly occupied by the enemy; examples.

Encampments and bivouacs. Choice of ground convenient for a camp; disposition of the artillery camp. Establishment of artillery bivouacs. Disposition of the park; precautions relating to the superintendence. Different measures to be taken on arriving on the place of encampment or of bivouac. Attention to be paid to the horses: special precautions for the mules of the mountain artillery. Precautionary measures variable according to circumstances.

Sixty-first Lecture.—(5.) Artillery on the field of battle. Measures to be taken on arriving in the neighborhood of the enemy.

Choice of positions adapted for artillery.

1. Different considerations relative to the ground to be occupied; form of the ground; cultivated lands; nature of the ground; communications, &c.
2. Position of the artillery relatively to the enemy.
3. Position of the artillery relatively to the troops to be supported.

Execution of the fire. Choice of the different kinds of fire according to the nature of the object aimed at and the distance. Fire of cannon, with ball, with shot. Fire of field and mountain howitzers. Fire parallel to the ground.

Use of war rockets. General principles relating to the effects to be produced by artillery, and to the warmth of the fire. Proper use of stores; their replacement. Use of the prolong. Arrangements to be made after the engagement. Spiking and unspiking of ordnance.

Use of artillery in the principal circumstances of a campaign. General case of an offensive engagement. Part played by the artillery in supporting infantry and cavalry marching to the attack. Importance of the artillery for following up a first advantage which has been obtained. Examples. Use of the artillery in masses to strike a decisive blow. Examples. Defensive engagement.

Disposition and use of the artillery for the defense of fortified positions. Attack of entrenchments. Reconnaissance. Disposition and use of artillery; attack of lunettes by the gorge. Examples. Attack and defense of villages; disposition of the artillery under these two circumstances. Attack of squares. Importance of artillery towards preparing for it. Examples. Defense of squares; disposition of artillery. Examples. Case of a charge of cavalry upon artillery. Use of artillery in the advanced guard, in the rearguard, in a retreat.

Use of artillery in the passage of streams. Examples. Use of artillery to defend or force the passage of valleys or defiles. Examples.

THIRD SECTION.—SERVICE OF ARTILLERY IN THE ATTACK AND DEFENSE OF PLACES, AND IN THE DEFENSE OF COASTS.

Sixty-second Lecture.—(6.) Object to be attained with the use of artillery in the attack of places. Selection of ordnance, cannon, howitzers, mortars. Composition of the siege train. Method to be followed in order to determine it. Examples of trains employed in different sieges. Carriages of the train. Supply of the siege train with projectiles, powder, &c.

Personnel of the siege train; troops and staff. Transport of the siege train. Horses to be employed. Limit in either direction. Employment of water-courses. Examples. Establishment of the train before the place. Encampment of the artillery force. Organization of the parks. Workshops, powder magazines, trench-depôts. Rules relating to the direction of artillery works.

Commanding officers of attack.

Sixty-third Lecture.—(7.) Considerations on the different kinds of batteries to be employed in the attack of fortified places. Position of the batteries relatively to the point to be breached. Direct battery within point-blank range; enfilading battery, for a plunging fire, for direct fire within point-blank range, for plunging fire. Mortar batteries. Composition of the different kinds of batteries. Position of the directing lines of an enfilading battery, relative positions of the cannon, the howitzers, or the mortars. Position of the batteries relatively to the parallels and the rest of the trenches. Examination of the circumstances which affect the power of a plunging fire, command of the work over the battery; distance between the height of the traverses. Slope of the crests of the work.

General principles relating to the order of the works of the artillery, commencing from the opening of the trenches.

Times for the construction of the first batteries. Batteries of the first and second parallels. Use of field artillery to defend the flank of the attacks. Replacement of the fire covered by the advance of the works; batteries of the third parallel. Use of vertical fire. Mortars of 15c. Throwing of grenades. Breaching and counter batteries. Considerations relating to their position. Batteries in the covered way.

Case of a breach into an interior work. Composition of the breaching and counter batteries. Calibres to be used. Number of pieces of ordnance.

Ideas upon the operation of arming batteries. Precautions to be taken. Passage out of the parallels or trenches. March in the trenches; examples of some operations of this kind. Supply of the different kinds of batteries. Rule relating to their daily service. Firing of siege batteries. Opening of the fire. Direct fire within point-blank range. Plunging fire. Fire of mortars. Warmth of the fire by day and by night; mean consumption of material. Fire of breaching batteries. Effects to be produced. Height of the horizontal cutting, number of the vertical ones. Execution of the fire; fall of the revetment. Fire upon the counter forts. Fire to render the breach practicable; balls, shells, war-rockets, facts ascertained by experiment.

Consumption of powder and projectiles, length of the operation. Breaching fire in a very oblique direction. Fire upon masked masonry. Breach into an unreveted work. Fire of counter-batteries. Bombardment. Case where it can be employed; manner of executing it.

Occupation of the place; arrangements which must be made by the artillery. Case of raising the siege. Case of its transformation into a blockade.

Sixty-fourth Lecture.—(8.) Service of artillery in the defense of places. Object to be attained with artillery. Selection of ordnance, guns, howitzers, mortars. Use of war-rockets and arms of precise aim. Field artillery. Basis of the supply of fortified places. Projectiles, powder, small-arms, various carriages. *Personnel* of the artillery. Troops. Staff.

Measures to be taken before the siege. Reconnaissances. Arrangement of the material. Organization of the *personnel*, of the duty by local divisions, of the workshops of all sorts. Precautionary armament. Basis of its organization. Supply of ordnance. Defensive armament. General principles relating to the armament of different kinds of works. Bastions, cavaliers, demilunes, approaches, &c. Organization of the armament. Traverses, embrasures, gun-carriages to be employed. Powder magazines. Supplies. Service of pieces.

Employment of the artillery against the first works of the besiegers, against the construction and armament of batteries; against the besieging artillery. Partial disarmament in case of inferiority. Part played by artillery in sorties. Modification of the defensive armament in proportion to the progress of the attack. Last defensive armament. Principles relating to its disposition. Armament of the flanking part of the fortification. Increased use of vertical fire. Use of war-rockets against works in close proximity. Crowning batteries, cavaliers of the trenches. Heads of saps, &c. Blinded batteries. Conditions of the establishment. Defense of breaches.

Service of artillery in the defense of coasts. General considerations on the degree of extension admissible in the armament of coasts. Principal points to be defended. Selection of ordnance intended for the armament of coast. Objects to be effected. Effects of balls (utility of large calibres;) of howitzer shells and of shells. Fire with red-hot balls. Material appropriated to the defense of coasts.

Position of coast batteries, conditions which determine it. Composition of coast batteries; their supply. Ideas upon the organization of the batteries and their small redoubts (*réduits*.) Use of the fleet and of field artillery. *Personnel* allotted to the service of artillery on the coasts.

FOURTH SECTION.—APPLICATION OF THE PRINCIPLES PREVIOUSLY SET FORTH TO THE ATTACK AND DEFENSE OF THE FORTRESS OF METZ, (SHAM SIEGE.)

Sixty-fifth Lecture.—(9.) Composition of the siege train necessary for the attack of Metz. Carriages of the train.

Supply of the train with projectiles, powder, &c. Personnel of the train, troops and staff. Transport of the siege train. Establishment of the train before the place; encampment of the artillery force. Organization of the parks. Work-shops, powder magazines and depôts.

Sixty-sixth Lecture.—(10.) Object, disposition, and armament of all the batteries from the first opening of the trenches to the capture of the place. Use of field artillery to flank the batteries, &c.

Service of artillery in the defense of the place. Supply of ordnance, projectiles, powder, small-arms, and different carriages.

Personnel of the artillery. Troops, staff. Organization of the personnel and of the duties by local divisions. Precautionary armament; supply of ordnance. Defensive armament. Armament of the different works. Service of the pieces. Last defensive armament.

Lectures Preparatory to the Labors of the Course.

1. Drawing and tracing of ordnance,................	3	lessons.
2. Design for ordnance,............................	4	"
3. Application of the theories of the course,..........	1	"
4. Drawing of artillery material,.....................	1	"
5. Tracing of batteries,............................	1	"

The sixth lecture of the fourth part of the course (the fifty-sixth) is partly devoted to the communication of the instructions necessary for the execution of the work of tracing plans of batteries.

Studies in connection with the Artillery Course.

The practical studies which are connected with the artillery course, are,—

1. Drawing of ordnance,............................	12	days.
2. The designs for ordnance,........................	24	"
3. The application of the theories of the artillery course,.	6	"
4. The drawings of artillery material,................	26	"
5. The tracing of batteries,..........................	4	"
Total,..	72	days.

The tracing of batteries is executed by the students of both arms, the other tasks by the artillery students alone.

I. DRAWING ORDNANCE (12 DAYS.)

The survey of ordnance consists in constructing accurate sketches of a gun, howitzer, and mortar, in measuring their dimensions, and in giving a description of each of the pieces drawn. It is on this occasion that the students are practiced in the management of instruments to insure precision, such as the *étoile mobile*, and the sliding compass, &c. One day is devoted to this work.

The tracing of ordnance consists in the execution of a drawing upon colombier paper, containing an exact and detailed representation of a gun, a howitzer, and a mortar, with their projectiles.

This work is performed with the help of the tables for the construction of ordnance. Eleven days are devoted to it.

Detailed Programme of the Drawing.

1. For each gun, howitzer, or mortar, a longitudinal section in the direction of the axis, and at right angles to the axis of the trunnions, and a plan parallel to the axis of the bore and of the trunnions.

Besides this, for those cannon and howitzers which have dolphins, a transverse section taken across the middle of the dolphins and the axis of the trunnions. For mortars, a transverse section made by a plane passing in front of the dolphins, the whole on a scale of one-fifth.

2. Detail of the button (comprising the cascable and breeching loop for naval ordnance) on a scale of two-fifths.

3. Detail of the tracing of a dolphin, on the scale of two-fifths.

4. Tracing of the bush of a gun, on a scale of two-fifths, and tracing of a priming-pan at the real size.

5. For garrison ordnance, in cast-iron, detail of the widening of the base ring on a scale of two-fifths.

6. Tracing of a cannon-ball, of a howitzer-shell, and of a shell, on a scale of one-fifth.

Tracing of the lugs of a shell, ring and lug at the real size.

All the parts of the drawing must be colored in uniform tints in conformity to the table of conventional colors; the annexation of the figures of measurement is not required.

This work is preceded by three or four lectures intended to make the students familiar with the tracings which they have to execute, and the solution of the problems in geometry and descriptive geometry, to which the representation on paper of pieces of ordnance and their projectiles give rise.

II. DESIGN FOR ORDNANCE (24 DAYS.)

The design for ordnance has for its object the complete determination of the nature of a projectile, and of a piece of ordnance in accordance with certain special conditions, inquiring into the laws of the motion of the projectile, and into its principal destructive effects, and the settlement of practice-tables for the gun. The general case for treatment is that of a howitzer, which comprehends the gun and the mortar as particular cases.

The data usually adopted are,—

1. For the projectile, its weight and the quantity of powder which it is capable of containing.
2. For the piece, the initial velocity of its projectile. This operation comprises calculations, a drawing, and a memoir.

The drawing, on colombier paper, which must be figured in all its parts, contains,—

1. The tracing of the profile of the piece, as it is determined by calculation, so as to satisfy the different conditions of resistance, on a scale of one-fifth.
2. The complete tracing of the piece executed in conformity with the rules laid down for the tracing of ordnance on a scale of one-fifth.
3. Tracing of the projectile on a scale of one-fifth.
4. Tracing of the wooden bottom and of the fuse of the projectile, executed in the case of each of these objects in two figures—the one on a large scale (two-thirds, or even the size of nature,) representing the inquiry into their forms and dimensions, the other giving on a scale of one-fifth the results of this inquiry. To this is added, for the mountain howitzer, or any other howitzer for which it is admissible, a tracing of the mounted howitzer carriage.
5. The representation in drawing of the laws of the motion of the projectile, the trajectory, inclinations, remaining velocities, durations of the passage.

   In addition, the scale of the elevations and that of the angles of fire, for an object of aim placed at different distances.
6. An inscription showing all the essential elements by which the projectile and the piece are distinguished.

The final tracings of the gun, the projectile, the bottom, and the fuse, must be colored in uniform tints conformably to the table of conventional colors.

As to the tracing of the profile founded upon the calculation, it should receive merely an edging of the color which represents the metal used.

PROGRAMME OF THE MEMORANDUM ON THE DESIGN FOR ORDNANCE.

INTRODUCTION.

Object of the work. Data of the Question.

A. PROJECTILE.

First Section.—Substance, Forms, and Dimensions.

1. Choice of the metal employed in the manufacture of this projectile.
2. Forms of the projectile.
3. Internal diameter.
4. External diameter.
5. Dimensions of the vent.
6. Diameters of the high and low gauges.

7. Densities of the projectile empty and filled with powder.
8. Weight of the cast-iron ball of the same calibre as the howitzer shell.

Second Section.—Minimum Bursting Charge.

9. Theoretical bursting charge for the hollow sphere.
10. Effect of the shock of the gases, and of their loss through the vent.
11. Résumé of the results arrived at in this chapter.

B. ORDNANCE.

First Section.—Metal, Calibre, and Length of Bore.

12. Choice of the metal of which the piece is to be formed.
13. Windage of the projectile and diameter of the bore.
14. Effect of the windage on the velocity of the projectile.
15. Length of the bore and charge of powder which satisfy the data of the programme.
16. Résumé of the results arrived at in this section.

Second Section.—Thickness of Metal necessary in order that the Piece may resist the Expansion of the Gases.

17. Explanation of the method employed to resolve the question of the thicknesses of metal.
18. First propulsion of the projectile, mean density of the gases after this propulsion.
19. Second propulsion of the projectile, mean density of the gases after this propulsion.
20. Third, fourth, &c., propulsions of the projectile, mean density of the gases after each of them.
21. Density and position of the strata (of gas) at the moment of the maximum of mean density.
22. Density of the last stratum for the positions which come after that of the maximum of mean density.
23. Tensions which result from the densities found.
24. Corresponding thicknesses of metal.
25. Résumé of the results obtained.

Third Section.—Profile of the Piece.

26. Inclosing curve, resulting from the calculations of the second section.
27. Modification rendered necessary by the form of the posterior part of the projectile.
28. Utility of the chamber and its dimensions.
29. Tracing of the chamber and of its junction with the bore.
30. Thickness of metal around the chamber.
31. Chase and reinforce.
32. Determination of the angle of sight.
33. Vent and base ring.
34. Minimum weight of the piece for the resistance of the carriage.

35. Approximate calculation of the weight given by the profile previously obtained. Modification of this profile, if there is any.

Fourth Section.—Trunnions, Breech, and Handles.

36. Dimensions of the trunnions and of the shoulders.
37. Tracing of the breech.
38. Base rings and other moldings.
39. Object and fixing of the preponderance of the breech.
40. Exact settlement of the position of the trunnions, definitive length of the reinforce.
41. Center of gravity of the piece; dimensions and position of the handles.
42. Means of executing the calculations indicated in the two preceding articles.
43. Table of the dimensions of the piece.

C. FIRE OF THE HOWITZER. EFFECTS OF THE PROJECTILE.

First Section.—Elements of the Charging of a Howitzer.

44. Tracing of the shot bottom.
45. Tracing of the fuse.
46. Diameter of the cartridge (or of the bag.)
47. Charge of powder for firing with ball.

Second Section.—Laws of the Motion of the Projectile. Establishment of Practice Tables.

48. Preliminary calculations.
49. Trajectory.
50. Curve of the inclinations.
51. Curve of the remaining velocities.
52. Curve of the durations of the passage.
53. Determination of the elevations for the fire at different distances.
54. Angle of fire, corresponding to the different distances of the object aimed at.
55. Angles of descent.
56. Résumé of the laws of the motion and of the practice tables.

Third Section.—Effects of the Projectile.

57. Depth of penetration in the media indicated by the programme.
58. Effects of explosion in earth.
59. Résumé of the results relating to the effects of the projectile.

NOTE.—The formulas cited in the memoir need not be accompanied by their demonstration, except in the case of the latter not having been already developed in the lessons of the artillery course. It will be sufficient to insert in this notice only the final result of the calculation relating to each formula, without entering into the details of such calculations.

The study of the design for ordnance is preceded by four lessons intended to make the students acquainted with all the details of its execution, and the substance of which is indicated in the programme of the memoir

III. APPLICATION OF THE THEORIES OF THE ARTILLERY COURSE (6 DAYS.)

This study is intended to apply to the students those theories of the course which have not found their application in the design for ordnance. It comprises the solution by arithmetical calculations of certain questions on the effects of powder, the balistic pendulum, the effects of recoil, the science of projectiles, the draught of carriages, &c. The number of the questions may vary according to their nature and the time which their solution requires. The stating of the questions and the results of the calculations are inscribed on separate papers. This study is preceded by a lesson in which the students have recalled to them the formulas which they have to employ.

IV. DRAWING OF ARTILLERY MATERIAL (26 DAYS.)

The drawing of artillery material has for its object the representation by figured sketches of a gun-carriage, carriage, or other furniture of artillery material. The sketches, on paper put together in the form of a book, and headed by a special programme for the object to be drawn, consist of plans, sections, or elevations of the object, executed on certain scales, and of detailed projections of the principal iron-work and joints. The whole fixed by the special programme in question.

All the simultaneous projections of any one part of the object drawn (fore part or hind part for carriages) must be completely figured; they are accompanied by explanatory inscriptions, with letters of reference to show the names of the pieces in wood or metal which they comprise.

Each collection of sketches must contain as well a notice in confirmation of the drawing, giving the complete description and the properties of the object to which it refers.

The students make two surveys of the same kind; eight days are allowed for each of these surveys, including the composition of the confirmatory notice.

The first survey is followed by the execution of an unfigured drawing, containing a complete representation of the object surveyed (elevation and plan,) obtained by the combination of the partial projections contained in the sketch. The drawing should be colored in the conventional uniform tints, and accompanied by an explanatory inscription, with letters of reference. Ten days are devoted to this work of composition.

V. TRACING OF BATTERIES (4 DAYS.)

This work consists in executing sketches showing, each in accordance with a separate programme, the complete plan of a battery and the essential data having reference to its construction and to its armament. The sketches, made by scale and completely figured, must comprise in the case of each battery to be represented—

1. The general plan of the battery, on the scale of $\frac{1}{200}$.
2. The sections or elevations necessary for the understanding of this plan, including the detail of the powder magazines, lines of communication, &c., on the scale of $\frac{1}{100}$.
3. An inscription giving the object of the battery, its armament, its general arrangement (*terre-plein*, embrasures, revetment, communications,

magazines, &c.,) the workmen, materials, and tools necessary for its construction, and finally the duration of the labor and its distribution by day and night.

Four days are devoted to this work, which must be executed on a half sheet of colombier paper. The separate programmes relating to each of these batteries are shown on the study orders of the rooms.

RECAPITULATIVE TABLE.—ARTILLERY STUDENTS.

LECTURES.	Number of the Lectures.	Credits given for the Lectures. With application at $1^h\ 50^m$.	Without application at 3^h.	Total Credits.	Number of the Questions.	Observations.
Division of the Course—						
First Part. Theory, Sections 1, 2, 3,..................	26	18	42	60	4	
Second Part. Description of the Material, Sections 1, 2, 3, 4, 5, 6,................	20	30	....	30	3	
Third Part. Fire of Ordnance, ...	4	....	12	12	1	
Fourth Part. Construction of Batteries,.............	6	9	....	9	2	
Fifth Part. Organization and Service of the Artillery, Sections 1, 2, 3,..........	8	....	24	24	1	
Sham Siege,...................	2	3	....	3	....	
Lectures in preparation for the Studies,..............	9	13 50	....	13 50	....	
Totals,.............	75	73 50	78	151 50	10	

STUDIES.	Number of Sketches.	Drawings.	Memoirs.	Inventories.	In-door attendance, $1\frac{1}{2}$ hours.	Out-door attendance, $1\frac{1}{2}$ hours.	Credits in round Numbers.	Observations.
Survey of Ordnance,........	1	....	....	....	....	1	5	
Tracing of Ordnance,.......	....	1	....	....	11	....	50	
Design for Ordnance—								
Calculations,............	....	....	....	1	10	....	45	
Drawing, ...	....	1	....	....	8	....	35	
Memoir,.................	....	....	1	....	6	....	55*	* The time is doubled for the Memoirs.
Application of Theories—								
(Artillery Question,)......	....	....	1	....	6	....	55†	† Ditto.
First Survey of Material—								
Sketch, ...	1	....	....	....	....	8	35	
Composition of Notice,...	....	1	....	....	10	....	45	
Second Survey—								
Sketch,.................	1	....	....	....	....	8	35	
Sketch of Batteries,........	1	....	....	....	4	....	20	
Totals,............	4	3	2	1	55	17	....	

RECAPITULATION.

Lectures,.. 150 }
Studies,... 380 } 530.

RECAPITULATIVE TABLE.—ENGINEER STUDENTS.

LECTURES.	Number of the Lectures.	Credits for the Lectures.		Total Credits.	Number of the Questions.	Observations.
		With application at 1h 50m.	Without application at 3h.			
Division of the Course—						
First Part. Theories, Sections 1, 2, 3,	24	....	72	72	4	
Second Part. Description of the Material, Sections 1, 2, 3, 4, 5, 6,	14	....	42	42	2	
Third Part. Fire of Ordnance,	4	....	12	12	1	
Fourth Part. Construction of Batteries,	6	9	....	9	1	
Fifth Part. Organization and Service of the Artillery, Sections 1, 2, 3,	8	....	24	24	1	
Mock Siege,	2	3	....	3	....	
Totals,	58	12	150	162	9	

STUDIES.	Number of		Credit.	Observations.
	Sketches.	In-door Attendance.		
Sketches of Batteries,	1	4	20	

RECAPITULATION.

Lectures,	162	182. Round number, 180.
Studies,	20	

IV. PROGRAMME OF THE COURSE OF MILITARY ART AND FIELD FORTIFICATION.

The course is divided into six parts, and is made up of lectures and works of Application in the Halls of Study and on the ground.

I. LECTURES.

The 1st part contains sundry historical notices on the Organization of Armies,		6	Lectures.
2d part is on Tactics,		3	"
3d "	Castrametation,	2	"
4th "	Field Fortification,	16	"
5th "	Military Communication,	10	"
6th "	Strategy,	6	"
	Total,	43	

FIRST PART.—HISTORICAL NOTICES ON THE ORGANIZATION OF ARMIES.

The first lecture commences with explanations relating to the Greek and Roman armies; their order of battle, mode of marching; comparison of the

Roman Legion with the Greek Phalanx, and of the Roman Legion under Marius and under the Emperors.

2. Military organization of the Franks under the Kings of the first race. Consequences of the feudal system, acting on the military organization. Feudal armies. Chivalry. Crusades, and war against England. Establishment of the first standing armies. Results dependent on the introduction of fire-arms. Progress made in the Art of War and in the organization of armies, from the sixteenth century to the present time.

3. Necessity for standing armies. Their proper character. Recruiting. Promotion. Degrees of rank. Station of the officers. Various positions of military men. On the composition of armies, Infantry, Cavalry, Artillery, Engineers. *Corps d'Etat-Major.* Composition of the army during the Revolution and during the Empire. Actual formation of a French army.

General Staff. Commissariat. (*Intendance.*)—Different services dependent on it. Relations between the strength of each of the arms that make up an army. On other corps which are not classed among the principal arms.

4, 5, 6. Summary relating to the military organization of the principal Powers of Europe.

SECOND PART—ON TACTICS.

1. Definitions. Formations. Manœuvers; character of a good manœuver. Order of battle: first, of the Infantry; second, of Cavalry; third, of the Artillery; relating to Sharpshooters (*tirailleurs.*)

2. Brief summary of the principal movements in battalion drill to pass from line to the order in columns and reciprocally. Movements in column. Movements in battle. Dispositions to be made against Cavalry.

3. Of the principal movements in line. Order of battle. Line of battle. Formation of Infantry to advance against the enemy. Action of Cavalry. Principal formations. Charges of Artillery. Use of the Three Arms.

THIRD PART.—CASTRAMETATION.

1. General principles of castrametation. Situation. Construction and disposition of barracks. Camp of a Regiment of Infantry, of Cavalry, and of a Battery of Artillery.

2. Manner of tracing a camp on the ground. Huts; details relating to their construction. Tents. Bivouacs. Screens. Kitchens and camp ovens. Choice of the site of a camp; precautions to be taken for its security. Main guards. Advanced posts. Patrols and sentinels.

FOURTH PART.—FIELD FORTIFICATION.

1. Definition of fortification in general. Object and character of field fortification; its utility demonstrated by historical examples. Napoleon's opinion. Essential principle of field fortification. Discussion on the ordinary profile of earthen entrenchments; on the dimensions to be given to the ditch in level ground.

2. Definitions relating to the trace; general principles. Redoubts.

3. On the elements of lines. Relation that should exist between the crest and the internal size of a closed work. Maximum and minimum of the sides of a square redoubt. Defects inherent to the trace of this kind of redoubt. Circular redoubts. Redoubts *en crémaillères.* Star forts. Lines with bastions.

4. Revetments of various kinds; case in which the slope of the ditch should be reveted; choice to be made of the different kinds of revetments.

5. Exterior dispositions; accessories to the defense; abattis; *trous de loups;* palisades; *chevaux de frise*, &c. Precautions to be adopted with reference to such accessories.

6. Interior dispositions; armament of musketry, artillery, barbettes, and embrasures; their advantages and disadvantages; construction of.

7. Powder magazines of different kinds. Small earthen entrenchments; palisades, carpentry, or blockhouses; advantages and disadvantages of blockhouses. African blockhouse. Closing of field-works.

8. Artificial inundations; under what circumstances they can be considered as obstacles. Positions and dimensions of dikes. Details of their execution; what advantage can be drawn from an inundation having less than five feet depth of water.

9. What is understood by the defilading of a work. The defilading of field-works should, above all things, be made to depend on their trace and situation. Definitions: dangerous ground; dangerous points. Defilement of an isolated and closed work; in what case it is practicable. Use of traverses. A partial defilement may sometimes be sufficient.

10. Continuous lines. Broken lines. Traces of redan, tenailles, cremailleres. Bastioned lines. Comparison between continuous and broken lines. Principal objections to their use. Utility of each demonstrated under certain circumstances.

11. Lines in broken ground: their form should depend on the nature of the ground. On the manner of fortifying a table-land. Expedients for defilading portions of lines. On the manner of making use of the natural obstacles of the ground; forests, scarps, marshes, water-courses, &c. Method of fortifying a house, village, an open town. Defense of a bridge or road.

12. *Têtes de pont.* Utility of small earthen entrenchments in these cases to facilitate the passage of a retreating army. Traces of a large *tête de pont.* Principal circumstances relating to the use of lines in war. Lines of circumvallation and countervallation. Frontier lines. Retrenchments against a descent. Lines that an army should make in an enemy's country, far from its base of operations. Entrenchment on the field of battle. Lines, mixed, proposed by General Rogniat.

13. Attack and defense of entrenchments, of a continuous line; of a line at intervals; of an isolated work, &c. Examples of the attack and defense of lines.

14. Instruction relating to the operations for profiling and defilading on the ground.

15. Instruction on the project of field fortification. Calculation of the dimensions of a ditch corresponding to the face of a work of a variable relief, and to be constructed in level or other ground. Details relating to traverses, small entrenchments; defensive caponnieres, and accessories to defense, &c.

16. On the construction of entrenchments. Practical operations and organization of workshops to obtain durable and solid work. Necessity, in most cases, for accelerating the construction of entrenchments. Vauban's precepts. In what manner the work must proceed to obtain a useful result; and, in the event of plenty of hands, how to finish it promptly.

FIFTH PART.—ON MILITARY COMMUNICATIONS.

1. On roads. 1 and 2, Classification of roads. Section and trace of roads in level and mountain country. Details connected with the study of a project for a road. Particular conditions relating to military roads. Execution of paved and macadamized roads. Roads for passing difficult places by the use of fascines, logs, &c. Maintenance and destruction of roads.

2. On military bridges.

3. Observations on the currents and change of form in the bed of rivers. Fords. Transverse sections, &c. Reconnaissances of rivers. Properties essential to military bridges. Relation between the buoyancy and the load in the case of floating supports. Anchorage. Construction of the abutments. Means of rendering bridges stable.

4. Construction of a bridge of boats in different ways. Bridges made of ordinary boats. Method of withdrawing a bridge of boats.

5. Raft bridge. Relation between the weight and the extrinsic load of a raft. Number of trunks of trees required for a raft bridge on a river of given dimensions. Weight of the trunk of a tree. Number and space between rafts. Construction of a raft and a bridge of rafts. Bridges of casks and trestles.

6. Rope bridges; their use. Calculations respecting the tension and diameters of ropes. Construction of a suspension bridge, and calculations relating to it.

7. Bridges on piles, carriages, gabions, &c.

8. Measures to be taken for the preservation of military bridges. Destruction of military bridges; also of masonry bridges. Reëstablishment of bridges.

9. Flying bridges. Ferry-boats, tubs, passage by fords, on the ice, by swimming.

10. Execution of the passage of rivers. Advancing and in retreating. Examples.

SIXTH PART.—STRATEGY.

1. Definition. Fundamental principles of all operations in war. In all cases there are—first, the base of operations; second, the point to be arrived at; third, the line of operations. Strategetical points and lines.

2. On marching. Preparatory and manœuvering marches. Advanced and rear guard. On provisions. System of magazines. Requisitions. Invasions. Battle. Examples.

3. On positions. War in a mountainous district. Retreats. Pursuit. Convoys. Partizans.

4. Winter quarters. Cantonments. War against irregular bands. Military reconnaissances.

5. Precis of the campaigns of the French armies.

6. Analysis of the principal campaigns of great captains.

II. PROGRAMME OF THE WORKS OF APPLICATION EXECUTED IN THE HALLS OF STUDY.

These works consist of four Plates of Drawings, two Memoirs, and a Project of Field Fortification. Of the four Plates of Drawings, two relate to Field Fortification, and two, accompanied by Memoirs, relate to Military Communications.

Plate 1.—Elements of lines. Tracing, on the scale of $\frac{1}{1000}$ of the interior crest (only) of a redan, lunette, redoubt, star fort, bastioned fort, according to particular data given to each Sous-Lieutenant. Construction on the scale of $\frac{1}{200}$ of a complete profile for each of these works, supposed to be established on level ground. Complete calculation of the deblais and remblais for one of the preceding works, according to the instructions of the Professor.

Plate 2.—Details of a field-work. Trace on the scale of $\frac{1}{200}$ of a portion of the work of which the deblais and remblais has been calculated. Graphic construction of a barbette and of a direct or oblique embrasure. Details of revetments in fascines, hurdles, turf. Pisé. Drawing of a blockhouse.

Plate 3.—Accompanied by a Memoir. Project of a portion of road on ground represented by certain lines, according to certain data.

Plate 4.—Accompanied by a Memoir. Military bridges.

1. Drawing of a portion of a bridge of boats, three openings being shown; the two first relating to the successive construction of the bridge, and the third, of the construction by portions.
2. Project for establishing a raft bridge; the width of the river; the kind of troops to pass over the bridge; the length; mean diameter of the available trunks of trees and the length and scantling of the joints being given. The drawing to exhibit a plan of two openings of the bridge, and a transverse section.
3. Tressel bridge. To draw a longitudinal elevation and a transverse section of a tressel bridge, being given the length of the top and of the feet of the tressels up and down the stream.
4. Project for the repair of a broken arch; being given the opening of the head, the elevation of the roadway of the bridge above the level of the water; the depth of the water, the rapidity of the current, the kind of troops to pass over the bridge, and the available time and the resources as regards men and materials which can be had recourse to.

Programme of the Project of Field Fortification.

This project is made by the Sub-Lieutenants, according to certain data given to each of them. It has for its object to cause them to study:—1st. The trace. 2d. The complete organization necessary for its defense. 3d. The details of construction of a field-work. In consequence, the work comprises three Plates of Drawings and a Memoir divided into three parts.

Programme of the Drawings.

Plate 1.—Plan of the whole. This plate has for its object the research of a trace and of a combination of suitable works for the fortification of a certain portion of ground under certain circumstances of war defined by particular data. Each Sub-Lieutenant receives a lithographed sheet representing the ground to be fortified, and he has to exhibit on this sheet the works he proposes, in tracing in plain lines the horizontal projections of the interior crests and superior limits of the ditch, and in dotted lines the stockades or palisades; to show in black figures at the angles of the works the relief of the interior crests; the sites of barbettes, embrasures, traverses, barriers, &c., being indicated by reference letters and explanatory notes, the lines in red showing the directions and objects of the line of fire.

Plate 2.—Organization of a work.

This plate has for its object the study of the details of the interior and exterior organization of a work of a certain form, in order to render it susceptible of making a good defense.

Each Sub-Lieutenant will draw a complete plan of such one of the works shown on Plate 1, as may be pointed out by the Professor. He will represent the ditches, parapets, embrasures, accessory defenses, small entrenchments, descents into the ditch, &c., according to the particular data furnished to him; the figures of the relief of the crests of all kinds, the deblais and remblais being marked at all the angles. The figures of the natural ground will be underlined. The same plate will contain figured profiles which have served for the determination of the complete projection of the work. Scale $\frac{1}{250}$.

Plate 3.—Details of construction.

The object of this plate is to show the composition of workshops and the manner that should be adopted in the construction of field-works, according to circumstances, for the execution of the deblais and remblais.

Each Sub-Lieutenant will indicate the manner in which the work drawn on Plate 2 should be constructed:—1st. To render it durable and solid. 2d. To arrive rapidly at a useful result, even with limited resources of workmen and tools. 3d. To finish the work in the shortest possible time, by making use of all the necessary means. A plan will show the composition of the workshops under each of these hypotheses, and the successive advancement of the work will be represented by certain profiles supposed to be made at certain periods of the construction through the center of one of the faces of the work. In these profiles a firm trace, figured with altitudes, will show the limits of the deblais and remblais at the period represented by the profiles; and in addition, by dotted lines, the final results proposed to be obtained. All these projects must be accompanied by a figured plan, showing the principal altitudes in meters. The remblais will be colored with gamboge, the undisturbed earth in bistre, and the deblais will be left white.

Programme of the Memoir.

Each Sub-Lieutenant will write at the head of his Memoir the text of the particular programme, to which he is obliged to conform in the preparation of his project, and he should add to the text of the Memoir all the sketches properly figured, which are necessary for the proper appreciation of the dispositions which are not sufficiently detailed on the Drawings.

The Memoir is divided into three parts, corresponding to the three Plates of Drawings.

FIRST PART.—CONSIDERATIONS RESPECTING THE WHOLE PROJECT.

1st. General principles, according to which it would be proper to trace the works indicated in the particular programme, such as lines at intervals, continuous lines, têtes de pont, &c.

2d. Description of the tracing in Plate 1. Reasons deduced from the form of the ground or the nature of the military operations that led to the adoption of the trace. Object of the works, and their connection with each other.

3d. Number, description, and position of the pieces of artillery composing the armament.

4th. Maximum and minimum of troops that could be employed in the defense of these works.

5th. Dispositions which should be adopted (relatively to the necessary preparations in materials and to the separation and movement of troops) for the attack and for the defense.

SECOND PART.—COMPLETE ORGANIZATION OF A WORK.

1st. Particular object of the work shown in Plate 2. Trace of the complete projections of the parapets, barbettes, ramps, embrasures, traverses, &c.

2d. Conditions that should be fulfilled by the ditch. Approximate calculation of dimensions which should be given to it, taking into account the increased means of providing for an excess or defect of the deblais.

3d. Discussion on the site and the part which might be expected from small entrenchments, accessory defenses, shutters, descents of ditches, &c.

4th. Site of powder magazines; capacity that should be given to them, suitable to the state of the munitions necessary for the armament of the work.

THIRD PART.—DETAILS OF CONSTRUCTIONS.

1st. Means of ascertaining the nature of the earth; considerations respecting relays for the transport of earth with the shovel.

2d. Description, number and disposition of the workmen in a shed for deblai and remblai, according to the nature of the ground and number of relays.

3d. Explanation of Plate 3. Organization of the sheds and conduct of the work where the duration and solidity of the work are the greatest essentials; where, on the other hand, rapidity of execution is the principal thing to be fulfilled.

4th. Which of the modes of construction exhibited in Plate 3 it would be desirable to employ for the proposed works, according to the circumstance specified in the particular programme. Calculation for this mode of construction, of the time and of the numbers of men and tools necessary for the execution of the deblais and remblais of the work given in the plate.

5th. Details of construction of the revetments, magazines, shutters, accessory defenses, artillery platforms, &c.

III. PROGRAMME OF EXTERIOR WORKS.

These works consist of an exercise in tracing out a camp, and an exercise on the profiling and defilement of field-works.

The exercise on tracing camps has no particular programme, but is preceded by a lecture given by the Professor.

Programme of Practical Exercises on the Defilement and Profiling of Field Works.

This exercise comprehends: 1st, work on the ground; 2d, a Memoir.

The work on the ground has for its object: 1st, the trace of the projections of the interior crest of a work, whose position and form are known; 2d, the determination of the relief of the interior crest; 3d, the profiling of the different parts, so that the relief of the different parts of the parapet, barbettes, traverses, &c., may all be fixed.

The Sub-Lieutenants for this kind of work are divided into groups of six or eight, employed together on the same work, each group being divided into two squads. The work may be a lunette or a redan of given dimensions, having a parapet of three meters thick, and a natural slope of one to one. 1st. The direction of the capital will be marked out in front by two numbered pickets. 2d. The tracing will be executed by means of poles or pickets placed at all the angles, and at the extremities of the gorge; the relief will be determined by the practical methods of defilement adverted to in the lecture which preceded the work.

3d. The relief obtained by the defilement will be marked on all the poles or pickets placed at the angles, and at the extremities of the sides of the work.

4th. On each face two vertical profiles will be executed, perpendicular to the horizontal projections of its interior crest. In order that these profiles shall not interfere with those placed at the angles, they must be established at several meters distant from the extremity of each face.

5th. The profiles of the angles will be deducted by simple prolongations, and the same for the profiles of the gorge. If the homologous crests of two contiguous faces do not meet each other, they should be reconciled by joining two points taken on each of them at half a meter from the intersection of their projections.

6th. On the traverse, designed to secure the defenders from a reverse fire, two profiles are constructed, near to its extremities if its crest is a right line, but if it is bent, another profile must be set up at the junction.

7th. The data of all these profiles are, the relief of the interior crest at the point where it is encountered by the profile, the thickness of the parapet, the constant parts of every profile, and the natural slope of the ground; the portion of the slope of the traverses exposed to the view of the dominant heights should not be reveted, the others should be.

8th. At the points of intersection of the profiles with the projections of the ridges of the works, as well as at the points used for adjusting, poles or pickets are placed, on which the points belonging to the ridges are marked. These points will be joined together in each profile by twine, indicating the different planes of the work.

9th. The form and dimensions of the batteries, either of barbettes or embrasures, will be equally determined by poles or pickets placed at all their angles, and united together by twine in the manner that will be subsequently explained.

10th. For the barbette batteries, the first thing to be done is to establish and to construct the front coupé of the salient of the interior crest, and substitute an interior horizontal crest throughout the extent of the barbette for that situated in the plane of defilement. The necessary adjustments are then made between the slope of the parapet of the barbette and that of the rest of the face, and indicate by means of twine the intersections of the terre-plein of the barbette and of its slope with the different planes of the work.

11th. For the embrasures, after having determined their direction, the intersections of the cheeks and bottom, with the interior and exterior slope of the parapet, and with its slope; also the slope which terminates the interruption of the banquette throughout the extent of the battery. In the case where the platform is formed more than 0^{m} 4 elevated above the soil, a ramp is constructed with its slope, and the intersections with the slope from the platform are shown.

12th. After the batteries, the slope of the ends of the traverses and of the passages for entry and exit are constructed.

13th. The traverse will be finished by adjusting its different planes with those of the parapet. In the particular case, where it was interfered with to make a passage over the banquette, it is finished by reveting the slope passing by the crest of the banquette of the work.

14th. At the passages of entry and exit from the work, the parapets will be finished by the slope of the revetment, whose intersections with the different planes of the parapets must be determined.

15th. For each squad of workmen, the distance of the salient of the work to the point on which it will be defiladed must be determined.

MEMOIR.

1st. Object of defilement—which is considered to be dangerous ground, dangerous point, plane of defilement.

2d. Position of the dangerous point relatively to the work which is to be defiladed. Practical method on the ground. Results to which it leads.

3d. On the field this method is not always applicable to an isolated work, and never is so to entrenchments of a great development, such as lines, large têtes-de-pont, &c. By what proceeding is it generally expedient to attempt to fulfill in war the indisputable condition of defilement.

RECAPITULATION FOR THE SUB-LIEUTENANTS OF ARTILLERY AND ENGINEERS.

First Lectures.—Parts of the Course.	No. of Lectures.	Credits for Lectures.			No. of Interrogations.	Observations.
		With application.	Without application.	Total.		
1st Part. Historical notions on the Organization of Armies,	6	....	18	18	1	The number 90 is applied to the interrogations and to the obligations of the notes.
2nd Part. Tactics,	3	....	9	9		
3rd " Castrametation,	2	....	6	6		
4th " Field Fortification,	16	24	....	24	2	
5th " Military Communications,	10	15	....	15	1	
6th " Strategy,	6	....	18	18	1	
Totals,	43	39	51	90	5	

Execution of Work.	Number of					Observations.
	Drawings.	Memoirs.	Attendances.		Credits.	
			In the Halls.	Outside.		
Drawings of Military Art,—						
Plate 1. Elements of Lines,	1	....	4	....	20	
" 2. Details of a Field-work,	1	....	8	....	35	
" 3. Project of a Road,	1	....	8	....	35	
Memoir,	....	1	1	....	10	
Plate 4. Military Bridges,	1	....	8	....	35	
Memoir,	....	1	2	....	20	
Project of Field Fortification,—						
Plate 1. Plan of the whole,	1	....	3	....	15	
" 2. Organization of a work,	1	....	8	....	35	
" 3. Details of Construction,	1	....	5	....	20	
Memoir,	....	1	3	....	30	
Tracing of Camps,	....	....	....	1	5	
Tracing on the ground,	....	....	....	2	10	
Memoir,	....	1	1	....	10	
Totals,	7	4	51	3	280	

RECAPITULATION OF THE CREDITS OF INFLUENCE.

Lectures,	90
Execution of Work,	280
Totals,	370

4th. Methods of defilement employed. Determination of the different planes of barbettes, of their ramps, of the profiles of the gorge, &c. Construction of embrasures.

5th. Means made use of in practice for determining the distance of the salient of the work to the dangerous point on which it is defiladed.

V.—PROGRAMME OF PERMANENT FORTIFICATION, AND THE ATTACK AND DEFENSE OF PLACES.

The course of instruction in Permanent Fortification and the Attack and Defense of Places, is divided into three parts, viz:—

		No. of Lectures to	
		Artillery.	Engineers.
The first part consists of the study of the Construction of existing Fortifications, and it is common to the two services; it comprises,		10	10
The second part contains the principles of the Art of Fortification, divided into three sections, of which the....	1st section relates to Fortification on level ground,	19	19
	2nd section relates to Fortification on hilly ground,	19	26
	3rd section relates to general questions of Fortifications,	4	5
Third part relates to the Attack and Defense of Places,		24	24
Total number of Lectures,		76	84

The first part contains a description of the various works of permanent fortification, their respective uses, and the changes that have been successively made in them, together with a short history of ancient fortification prior to the invention of powder, and the changes introduced by the use of fire-arms.

The systems of Errard, Beville, Pagan, Vauban, Coehorn, and Cormontaigne.

The first section of the second part describes the principles on which the various parts of a front of fortification on level ground, and according to Cormontaigne's system, are regulated, such as the command, relief, defilement, form, length, and material of which the various parts should be constructed; the modifications required by the absence or presence of water; the changes which are necessary as regards exterior or advanced works, and ending with a comparison of a front of fortification according to Cormontaigne, with a modification of the same system introduced by the French engineers.

The second section commences with the principles of defilement and its application under various given circumstances, proceeds with the description of an imaginary work founded on certain given data, and furnishes the data of its proposed construction. It then supplies the theory relating to mines, and their use in the attack, defense, and destruction of places, and points out the particular duties of engineers in fortified places, and the proper and most efficient manner of carrying them on.

The third section relates to the preparation of projects for the improvement of inefficiently fortified places, and to the utility, particular organization, and proper position of fortified places on a frontier line. It then explains the necessity for military law in providing for the security of fortified places and districts along the frontiers of a state.

The third part describes the various operations connected with the attack and defense of a bastioned fortification, commencing with the operations preliminary to the siege and investment of the place, and continuing to describe the several processes to be employed in the attack of the place, with the corresponding efforts that should be made during its defense, and ending with an historical account of certain sieges.

This course requires the practical completion of the following:

Nature of the Work.	Time allowed for its completion.	Subject of the Work.	Scale.	Observ'ns.
		1st Part.—On existing Fortifications.		Common to Students of both Services.
Single Plate,	20 days,	Complete projection of the front of Cormontaigne without counterguard or cavalier, ...	$\frac{1}{1000}$	
		Three profiles of the front,........	$\frac{1}{500}$	
		2d Part.—Principles of the Art of Fortification.		
Plate, No. 1,	8 "	1st Section: Fortifications on level ground.—Principal graphical constructions of the front on level ground according to particular data given to each Student........	$\frac{1}{1000}$	
Plate, No. 2,	28 "	Complete projection of the whole of the visible and underground parts of the same front, ...	$\frac{1}{1000}$	
		Three profiles of the front, ...	$\frac{1}{500}$	
Memoir, ...	6 "	Description of the principles of the Fortification, with a detailed discussion of the dispositions adopted in the particular case treated by the Students.		
Plate 3, ...	20 "	2d Section: Fortification on hilly ground.—Drawing of the ideal fortress and of its Tête-du-pont, with the interior entrenchments, inundation, sluices, and all necessary details to enable a proper comprehension to be had of the action of the water.		
		Drawing complete of one of the fronts of the place and its outworks, described by a particular programme. Defilement of all the works of this front and of the masonry of one of its faces, ...	$\frac{1}{5000}$	
Memoir, ...	3 "	On the situation of the fortification; description of the imaginary fortress, and of the management of the water; explanation of the operations of defilement drawn on Plate 3.		
Plate 4, (Artillerie.)	10 "	Plan and profile of a full revetment of the escarp with its counterforts, ...	$\frac{1}{200}$	Artillery.
		Plan, profiles, and elevation of a revetment "en décharge."	$\frac{1}{200}$	
		Detail of a gallery and small chamber of a mine, of its tamping and mode of firing, ...	$\frac{1}{50}$	
Plate 4, (Engineers.)	20 "	Detailed project of one of the parts of the front of fortification defiladed in Plate 3. Plans at different height; disposition of the galleries and small chambers of mines required for blowing up the whole of the ground between two listening galleries, ...	$\frac{1}{250}$	Special to Engineer Students.
Plate 5, ...	10 "	Sections and elevations of the preceding project. Foundations, coping of vaults, dressing of cut stones, &c.,........	$\frac{1}{125}$	
		Detail of a small gallery and chamber of a mine, comprised in the dispositions of Plate 4. Tamping and mode of firing.		
Avant, ...	3 "	Abstractions of measurement of a part of the preceding project,........	......	
Plate 6,.....	11 "	Study of the alterations in the earth of the same part of the projects, representing the four principal periods of the work, by a plan and section, with an elevation of the 4th period, ...	$\frac{1}{250}$	
Memoir, ...	2 "	General theory of the removal of earth. Application to a particular project, ...	......	
Register,....	3 "	Register of the removal of earth as represented in Plate 6.		
Estimate, ...	1 "	Estimate of the part of the project to which the abstraction of measurements has been applied.		
		3d Section: Projection of the improvement of an existing fortified place.		
Plate 7,.....	30 "	Complete projection of the project for improving an existing fortified place,........	$\frac{1}{1000}$	
Plate 8,.....	6 "	Details of the most interesting parts of the project, in plans, sections, and elevations,........	$\frac{1}{250}$	
Memoir, ...	2 "	Marginal notes on the defects presented by the existing system, and on the means employed for correcting them.		
Calculation,	5 "	Balance of the "deblais" and "remblais" of the project.		
		3d Part.—Attack and Defense of Places.		Common.
Single Plate,	30 "	Project of attack of a front of fortification on level ground,	$\frac{1}{2000}$	
		Details of the attack, ...	$\frac{1}{200}$	
Journal, ...	4 "	Journal of the siege. Details relating to the composition of the garrison and of the besieging army; also on the material for the Artillery and Engineers required for the attack and defense. Pen sketch of the most elementary works of attack.		

RECAPITULATION FOR THE ARTILLERY.

I. Lectures. Parts of the Course.	Number of Lectures.	Credits for the Lectures.			Number of Interrogations.	Observations.
		With application (*a.*)	Without application (*b.*)	Total.		
First Part. Study of existing Fortifications,........	10	4.5	21	26	1	(*a.*) The Lectures with application count for 1 hour 5 minutes. (*b.*) Those without application for 3 hours.
Second Part. Principles of the Art of Fortification,..	....	....	....	....	....	
First Section. Fortification on level ground,....	19	24.0	9	33	2	
Second Section. Fortification on hilly ground.....	19	19.5	18	38	2	
Third Section. General questions of Fortification	4	....	12	12	....	
Third Part. Attack and Defense of Places, ...	24	24	24	48	2	
Totals,..............	76	72	84	157	7	

II. Execution of Work.		Number of				Credits.	Observations.
		Drawings.	Memoirs.	Various.	Sittings in the Halls of Study.		
First Part.	Front of Cormontaigne,...............	1	..	..	20	90	
Second Part.	Plate 1. Construction of Project on Level Ground,.........................	1	..	..	8	35	
	Plate 2. Project on Level Ground,......	1	..	..	28	125	
	Memoir on ditto,......................	..	1	..	6	55	
	Plate 3. Project on Hilly Ground,......	1	..	..	20	90	
	Memoir on ditto,......................	..	1	..	3	30	
	Plate 4. Project of Details. Plan,.....	1	..	..	20	90	
	Plate 5. Project of Section. Plan,.....	1	..	..	10	45	
	Abstraction of Measurements,..........	..	..	1	3	25	
	Plate 6. Removal of Earth,...........	1	..	..	11	50	
	Memoir on ditto,......................	..	1	..	2	20	
	Register of ditto,......................	..	..	1	3	25	
	Estimate of the Project,...............	..	..	1	1	10	
	Plate 7. Project of Improvements,.....	1	..	..	30	135	
	Plate 8. Details of ditto,.............	1	..	..	6	25	
	Memoir on ditto,......................	..	1	..	2	20	
	Balance of Deblais and Remblais,.......	..	..	1	5	45	
Third Part.	Project of Attack,....................	1	..	..	30	135	
	Journal of the Siege,..................	..	1	..	4	35	
	Totals,.......................	10	5	4	212	1,085	

RECAPITULATION OF THE CREDITS OF INFLUENCE.

Lectures,..	165	1,250
Execution of Works,...............................	1,085	

RECAPITULATION FOR ARTILLERY—*continued.*

II. STUDIES AND EXECUTION OF WORK.		Number of				
		Drawings.	Memoirs.	Sittings in the Halls of Study.	Credits.	Observations.
First Part.	Front of Cormontaigne,	1	..	20	90	
Second Part.	Plate 1. Construction of the Project on Level Ground,	1	..	8	35	
	Plate 2. Project on Level Ground,	1	..	28	125	
	Memoir,	..	1	6	55	
	Plate 3. Project on Hilly Ground,	1	..	20	90	
	Plate 4. Details of the Project,	1	..	10	45	
	Memoir,	..	1	3	30	
Third Part.	Plate. Project of Attack,	1	..	30	135	
	Journal of Attack,	..	1	4	35	
	Totals,	6	3	129	640	

RECAPITULATION OF THE CREDITS OF INFLUENCE.

Lectures,	160	800.
Studies and Execution of Work,	640	

RECAPITULATION FOR THE ENGINEERS.

I. LECTURES.		Number of Lectures.	Credits for Lectures			Number of Interrogations.	Observations.
			With Application.	Without Application.	Total.		
First Part.	Study of existing Fortification,	10	4.5	21	26	1	The number 162 is applicable to the Interrogations.
Second Part.	Principles of the Art of Fortification,	..	..	..	..	..	
	First Section. Fortification on Level Ground,	19	24.0	9	33	2	
	Second Section. Fortification on Hilly Ground,	26	36.0	6	42	2	
	Third Section. General Questions on Fortification,	5	1.5	12	13	..	
Third Part.	Attack and Defense of Places,	24	24.0	24	48	2	
	Totals,	84	90.0	72	162	7	

VI. PROGRAMME OF THE COURSE OF TOPOGRAPHY.

The course of Topography comprehends two parts.

The first relates to the art of topographical drawing, and the second to the art of making topographical surveys. Both parts are carried on *pari passu;* but as the order in which the different branches of the instruction can be given depends very much on the other works carried on in the School, it will be more convenient to give the programme for each separately.

FIRST PART.—INSTRUCTION IN TOPOGRAPHICAL DRAWING.

The instruction in topographical drawing comprehends lectures and exercises in graphical representation. It is based on a complete exposition of the conventional principles of this species of drawing, and it is illustrated by engraved examples of the characteristics adopted for the representation of the various details.

First Section.—Lectures.

The lectures have for their object the explanation of the general principles of the instruction in topographical drawing, and the geometrical conditions which should regulate the shading of maps and their reduction. They immediately precede the exercise to which they relate.

Lecture 1 relates to small maps, copies, and reductions of these; and it explains the object of topographical maps, the various kinds and the different scales generally used. The manner in which the form of the ground is represented by equi-distant contour or level lines is also explained, and mention is made of the conventional tints used, and the species of writing and value of the scale employed.

Lectures 2 and 3 relate to the execution of shaded plans by the brush and the pen, under different circumstances of light and shade.

Lecture 4 explains the different methods for reducing topographical maps, also the description, mode of using, and verification of pentagraphs.

Second Section.—Exercises.

These exercises are intended to teach the students the conventional signs used in topographical drawing, and to give them facilities with the pencil and brush for producing shaded maps, and in reducing them from one scale to another.

SECOND PART.—INSTRUCTION IN TOPOGRAPHICAL SURVEYING.

This instruction comprises:

1st. Lectures given in amphitheatre.
2d. Practical lectures or exercises.
3d. The execution of topographical surveys.

First Section.—Oral Lectures.

These lectures are divided in two classes, which comprehend:—

1st. Those relating to the description of the instruments, and of the methods used in topography.

2d. Those which have reference to the manner in which the students should proceed in the execution of the work, and principally of surveys of limited extent.

Eight lectures are devoted to the description of the various instruments, the method of adjusting their errors, and the manner of using them, as well as to the different ways of proceeding in topography; touching also on the various modes of measuring distances, with descriptions of the compass, plane table, and instruments used for leveling, and on the taking observations for and preparation of sections, and the orientation of maps.

Four preparatory lectures are given, showing the manner in which the students should proceed when on the ground to make a survey of small extent.

Two lectures relate to the methods that should be employed in making a survey of considerable extent, and on the appropriate scales.

Two lectures on military reconnaissance plans; instruments and scales employed.

Two preparatory lectures relate to the execution of a reconnaissance plan, in which the operations of a sham siege are intended to be recorded.

Second Section.—Practical Lectures or Exercises.

The object of these lectures, which take place on the glacis of the fortification, is to show the students the practical modes of using the instruments, and the precautions which must be taken, together with the most elementary proceedings in topography. They are given to ten or twelve students at the same time, and the Professor is assisted by an officer of the staff. Each lecture lasts two and a half hours.

Third Section.—On the Execution of Topographical Surveys.

The object is to familiarize the students with the use of the principal instruments and the principal operations, and they comprehend out-of-door work, of which the results are sketches, registers, and minutes made in pencil, and in the construction of plans, and inking in of the minutes in the Halls of Study.

The out-of-door work is performed under the superintendence of officers of the staff, who assist the students in their work. The construction of the plans is not commenced until the pencil minutes have been examined by the Professor.

These exercises comprise:—

1st and 2d. Construction of plans by the aid of the compass.
3d. The plan of a fortification made with the plane table.
4th. The determination of the variation of the compass.
5th. The execution of a second survey by the aid of the compass.
6th. " " rapid survey by pacing the distances.
7th. " " reconnaissance survey.
8th. " " an itinerary and reconnaissance sketch.
9th. The preparation of a plan on which the whole of the operations of a sham siege may be laid down, as the works of attack and defense proceed.

RECAPITULATION FOR THE ARTILLERY AND ENGINEERS.

Lectures.	Number of Lectures.	Credits for Lectures. With Application.	Without Application.	Total.	Number of Interrogations.	Observations.
1st part:						* The credit is diminished here and carried forward to the exercises, which serve for the interrogations of many lectures These lectures have therefore really three series of interrogations.
Topographical Drawing,.........	4	6	......	36	2	
Art of Surveying—						
On the instruments and Topographical processes,..........	8	12	......			
On Surveys of considerable magnitude, ...	2	......	6			
On Reconnaissance Plans,......	2	1.5	3			
Preparatory to out-of-door work,	5	7.5	......			
Total,...........	21	27	9	30*	2	

RECAPITULATION—*continued.*

Execution of Work.	Number of Drawings.	Memoirs.	Various.	Attendances In the halls.	Out of the halls.	Out of doors.	Credits.	Observations.
1st Part:—								
Topographical Drawing:								
Conventional Tints,............	1	....	....	3	....	....	10	* The description Itinerary is reckoned with the simulated siege operations.
Study of Maps,...............	4	....	....	26	....	....	120	
Reduction,....................	1	....	....	2	....	....	10	
Construction of a Triangulation with the Compass,...........	1	....	....	3	....	....	15	
1st Survey with the Compass:								
Out-of-door work,............	....	....	1	....	....	6	50	
Laying down,.................	1	....	....	4	....	....	20	
Survey of Fortifications with the Plane-table:								
Out-of-door work,.............	1	....	1	....	....	10	80	† For a Memoir.
Laying down,.................		1	....	4	....	....	25	
Determination of the Variation of the Compass,...............	1	....	....	1	1h	....	5	
2d Survey with the Compass:								
Out-of-door work,............	1	....	1	....	....	8	65	‡ This number is formed with 5 taken from it for the credit of the interrogations because the exercises serve for the interrogations of several lectures
Laying down,.................	1	....	....	2	....	....	10	
Rapid Survey:								
Out-of-door work,............	1	....	1	....	....	6	50	
Laying down,.................		1	....	4	....	....	25	
Reconnaissance Survey:								
Out-of-door work,............	1	....	1	....	....	4	30	
Laying down,.................		1	....	3	....	....	20	
Itinerary and Reconnaissance,*...	1	....	....	....	....	1	10	
Topographical operations relative to a sham siege†,.....	....	....	....	....	....	....	....	
Topographical exercises, each of 2½ hours duration,..............	....	....	....	....	6	....	20‡	
Total,...........	15	3	5	52	7	35	565	

RECAPITULATION OF THE CREDITS OF INFLUENCE.

Lectures,..30 } 595.
Execution of work,.. ....565 }

VII. PROGRAMME OF THE COURSE OF GEODESY AND DIALLING.

This course is divided into two parts—the one part special for the engineers, and the other common to the artillery and engineers.

The first comprises:—

1st. The study of the execution of a triangulation of some extent, and of its connection with the general triangulation of France, executed under the superintendence of the Dépôt de la Guerre, and

2d. Leveling with the barometer.

The second contains:—

1st. The study of reflecting instruments.

2d. The principles of dialling.

Each of these parts comprehend:—

1st. Lectures given in the amphitheatre.

2d. Practical lectures or exercises.

3d. An application.

FIRST PART.—SPECIAL FOR ENGINEERS.

1st Section—Lectures.

These Lectures include:—

1st. A description of the principal geodesical instruments.

2d. The establishment of the triangulation.

3d. The survey and the calculations connected with it.

4th. The orientation of the triangulation.

5th. The calculation of the co-ordinates of the points and their construction from the minutes of the survey.

6th. The geodesical and barometrical leveling.

The first lecture is devoted to the explanation of the different kind of signals used under various circumstances; on the method of measuring bases and angles, and the principles on which these operations are performed; and concluding with the description and mode of using certain instruments for measuring angles.

The second lecture continues and enlarges on the subject of the measurement of angles, horizontal and vertical, with different kinds of instruments.

The third lecture relates to the corrections and reductions which must be made to observed angles, such as the correction for the eccentricity of the instruments, to the reduction of the angles to the horizon, and to the center of the station, and also on the adjustments of the instruments, or the application of corrections for certain errors.

The fourth lecture discusses the calculation of the triangles and their errors, and points out the best organization that can be given to the triangulation, and the exactitude which can be expected from it.

The fifth lecture also relates to the calculation and the development of the triangulation, and explains the nature of the geodesical operations for the map of France.

The sixth lecture explains the manner of observing for, and determination of the azimuthal bearing, for the orientation of the triangulation.

The seventh lecture has reference to the convergence of meridians, calculation of rectangular co-ordinates, sundry problems, and geodesical leveling.

The eighth lecture shows in what manner the barometer is made use of for the determination of differences of altitude, the nature of the corrections to be applied to the instrument, and the degree of exactitude to be found in the results of this process.

The ninth lecture points out the order in which geodesical calculations should be performed and the verifications which should be exacted.

The Second Section contains five lectures or exercises, and they have for their object to familiarize the students with the use of the various kinds of instruments employed in carrying on the operations which have been shortly described in the first section.

The Third Section relates to the practical application of the preceding principles, and mostly consists of geodesical applications.

SECOND PART.—COMMON TO THE ARTILLERY AND ENGINEERS.

The First Section consists of lectures given in the amphitheatre, and relates to reflecting instruments, such as the sextant, reflecting circle, and the method of using them, and also on the principles of dialling, and its connection with various problems in astronomy; describes also the different kinds of dials.

SECOND SECTION.—PRACTICAL EXERCISES.

In which the students are called upon, in the presence of the Professor, to adjust the sextant, and to use it in connection with an artificial horizon for the measurement of the angle between any two objects of the altitude of these objects above the horizon, and also the same altitude.

Third Section contains the practical application of the principles enunciated in the preceding sections, in the preparation by the students of two drawings, in which they will exhibit the graphical representation of the hour in terms of the altitude of the sun previously observed, and show the various constructions of a sun-dial, according to the specified conditions based on the observation of the hour angle.

RECAPITULATION FOR THE ENGINEERS.

Lectures.	Number of Lectures.	Credits for Lectures.			Number of Interrogations.
		With application.	Without application.	Total.	
First Part:—Geodesy:					
Lectures with application,.	4	6	...	21	1
" without application,	5	...	15		
Second Part:					
Reflecting Instruments,...	1	1.5	...	4.5	1
Dialling,................	2	3			
Total,...............	12	10.5	15	25.5	2

Execution of Work	Number of					Credits.
	Drawings.	Memoirs.	Etats Divers.	Attendances		
				In the Halls.	Out of the Halls.	
First Part:						
Geodesical calculations,...	..	..	1	4	..	20
Exercises of 2½ hours,....	..	..	1	..	5	10
Second Part:						
Drawings of Dialling,....	2	..	..	4	..	20
Exercises of 2½ hours,....	..	..	..	..	1	5
Total,............	2	..	2	8	6	55

RECAPITULATION OF THE CREDITS OF IMPORTANCE.

Lectures,.. 25 } 80.
Execution of Work,.................................... 55 }

RECAPITULATION FOR THE ARTILLERY.

Lectures.	Number of Lectures.	Credits for Lectures.			Number of Interrogations.
		With application	Without application	Total.	
Reflecting Instruments,.............	1 }	4.5	..	5	1
Dialling, ...	2 }				
Total,.........................	3	4.5	..	5	1

Execution of Works.	Number of				Credits.
	Drawings.	Days.		Memoirs.	
		In the Halls.	Out of the Halls.		
Drawings of Dialling,..............	2	4	..	..	20
Exercises of 2½ hours,..............	..	..	1	..	5
Total,........................	2	4	1	..	25

RECAPITULATION OF THE CREDITS OF IMPORTANCE.

Lectures,.. 5 } 30.
Execution of Works,............................... .... 25 }

VIII.—PROGRAMME OF THE COURSE OF SCIENCES APPLIED TO THE MILITARY ARTS.

		Lectures.
1st part	—Geology,	12
2d "	On the Metallurgy of Iron, on Working in Iron,	6
3d "	Applications of the Working in Iron,	3
4th "	On the Manufacture of Small-arms,	4
5th "	" " of Ordnance,	5
6th "	" " of Powder,	5
7th "	On Pyrotechny,	2
	Total,	37

FIRST PART.—GEOLOGY.

Lecture 1.—Preliminary notions. Definition of geology expressed from its applications. Division in four sections:—1st. Mineralogy. 2d. Paleontology. 3d. Geognosy. 4th. Geogeny. (Only the three first are here treated of.)

First Section.—Mineralogy. Generalities. Distinctive characters of minerals. Fundamental principle of a mineralogical classification. Minerals are distinguished as having characters either exterior, crystalline, chemical, or physical; classification of minerals.

Lecture 2.—First class: Simple bodies forming one of the essential principles of minerals. Genus silica, quartz, sulphur. Second class: Alkali and alkaline salts, potass, soda, &c. Third class: Alkaline earths, and earths. Genus lime. Fourth class: Metals. Iron of various kinds; copper, lead, tin, zinc.

Lecture 3.—Fifth class: Silicates of various kinds. Sixth class: Combustibles, minerals.

Lecture 4.—Description of various rocks. Classification of rocks.

Lecture 5.—Use of rock and stone in the arts, and particularly in the art of construction.

Lecture 6.—On the calcination of calcareous stones, lime-kilns.

Lecture 7.—Manufacture of artificial hydraulic lime, manufacture of bricks, stucco, or cements.

Lecture 8.—Second Section: Paleontology. General division established in zoölogy and botany. General notions relating to the different kinds of animals and vegetables, of which the remains are found in various geological formations. Third section: Geognosy. Lectures 9, 10, 11, 12, occupied with the explanation of the various formations.

SECOND PART.—ON WORKING IN IRON.

Lecture 13.—Preliminary notions. Definitions and general considerations. Characteristics of iron, steel, cast-iron, &c.

Lecture 14.—On iron ore and the various kinds of fluxes.

Lecture 15.—On combustibles. Vegetable combustibles, mineral combustibles.

Lecture 16.—Manufacture of cast-iron. High furnaces, different modes of proceeding with vegetable and mineral combustibles.

Lecture 17.—Manufacture of iron and steel and the different kinds of iron.

THIRD PART.—APPLICATION OF THE WORKING OF IRON.

Lecture 19.—Making of projectiles, carriages for guns and mortars, axle-trees and anchors. Use of cast-iron for artillery. General notions in moulding. Use of wrought-iron and steel. Materials first made use of for the making of projectiles, and in the casting of cannon-balls, &c.

Lecture 20.—On the manufacture of hollow projectiles and the carriages for guns and mortars.

Lecture 31.—On the manufacture of axles and anchors.

FOURTH PART.—ON THE MANUFACTURE OF SMALL-ARMS.

Lecture 22.—Preliminary considerations. Assay of metals. Fire-arms, manufacture of gun-barrels, describing the various details.

Lecture 23.—Bayonets, locks, &c.

Lecture 24.—On the making of stocks. Finishing. Rifling small-arms.

Lecture 25.—Manufacture of sabres, swords, lances, hatchets, cuirasses, and on the preservation, maintenance, and repair of arms.

FIFTH PART.—ON THE MANUFACTURE OF ORDNANCE.

Lecture 26.—Preliminary notions. Metals proper for the manufacture of ordnance. Composition and properties of gun-metal. Wrought and cast-iron ordnance. Moulding generally. Moulding of cannons.

Lecture 27.—Moulding of howitzers. Foundries. Fusion of the metals.

Lectures 28, 29.—Boring. Turning. Carving. Turning of the trunnions, &c. Manufacture and reception of bushes. Insertion and replacement of bushes.

Lecture 30.—Last operations. Proofs and reception of cannon. Chemical operations. Assay and analysis of the metals employed in the casting of gun-metal; proportion of the several ingredients.

SIXTH PART.—ON THE MANUFACTURE OF POWDER.

Lecture 31.—General notions. Various kinds of powder, &c. On saltpetre and sulphur.

Lecture 32.—Charcoal; wood employed; various kinds of charcoal; proceeding followed in making powder in various ways by the pestle.

Lecture 33.—Manufacture by mills, &c.

Lecture 34.—Influence of the proportion of the several ingredients, and of the manner of making it on its various properties. Preservation, inflammation, and combustion.

Lecture 35.—Proofs and reception of powder. Proof of its projectile force. Mortar proof, and various kinds of other proofs to which it is subject. Reception and analysis of powder.

SEVENTH PART.—PYROTECHNY.

Lecture 36.—Preliminary ideas. Objects of the course. Precautions that should be adopted to prevent accident. Mixture of the materials. Manufacture of leaden balls of various kinds. Caps. Fireworks for warlike purposes, used for setting buildings, &c., on fire. Firing cannon and exploding mines.

Lecture 37.—Fireworks employed under various circumstances in war. Signal rockets. For illuminating or setting on fire. For explosions. Petards. On ordinary fireworks.

Works of Application.—The works of application which are connected with the course of science applied to the military arts are as follows:—

1st. Study of samples of mineralogical specimens.
2d. Study of geological maps to be followed by a memoir.
3d. Memoirs on: 1st. Iron and its applications. 2d. Manufacture of cannon. 3d. Manufacture of small-arms and powder.
4th. Out-of-door geological excursions to be followed by memoirs.
5th. Manipulations relative to moulding in earth or sand.
6th. Chemical manipulations.
7th. Pyrotechnic manipulations.

First.—Study of Samples of Mineralogical Specimens.

This study has for its object the determination of the kind of minerals described in the course. It is made in sections of ten or twelve Sub-Lieutenants and by attendances of one hour, each Sub-Lieutenant being called upon to reply at least three times.

Second.—Study of Geological Maps, followed by a Memoir.

The study of geological maps will consist in indicating, by conventional colors, the different geological formations of a lithographical map, and to make a section in a particular direction. The map will be the same for all, and it will be conceived so as to correspond with the geological formation of France, but the sections will differ for each student.

An explanatory memoir will have for its object to call the attention of the Sub-Lieutenants to the most salient facts which will be placed in relief by this study.

One attendance in the halls of study will be devoted to this work.

Third.—Three Memoirs.

Three memoirs on different parts of the course, other than the geological, will be made immediately after the interrogations relative to each section. Particular data will be furnished to each Sub-Lieutenant. Three attendances in the halls of study will be allowed for these memoirs.

Fourth.—Geological Excursions.

Three geological excursions will be made in the environs of Metz by groups of ten or twelve Sub-Lieutenants under the direction of the Professor, and at the period of the out-of-door work, so as not to interfere with the current work in the halls. The first excursion will have for its object the study of the lias and lower oolite, met with in the vicinity of Metz. If the time will admit of it, a reconnaissance will be made to the great oolite at Taumont or at Amanvillers.

The second excursion will be made in the direction of Gorze for the study of the lower oolitic formation and to trace it up to Bradford clay, where an important fault occurs in this direction near to Metz. The study of this fault will be the great object of this excursion.

The third excursion will be made in the direction of Forbach, meeting with the lias, chalk-colored freestone, &c.

Three entire days will be devoted to these excursions, and each Sub-Lieutenant will enter his observations in a note-book, and make a certain number of sections, and report the results of these excursions in three memoirs in a specified time.

Fifth.—Manipulations relative to Moulding in Earth or Sand.

These mouldings of projectiles will be made by sections of ten or twelve Sub-Lieutenants, two attendances of three hours each being devoted to them, one for ordinary and the other for hollow projectiles.

The manipulations for the moulding of cannon will be executed by the Professor.

All the Sub-Lieutenants will be successively called by sections a certain number of times, in order that they may be enabled to render an account of the different states of advancement of the work.

Programme of practical instruction for the casting of projectiles.

1st attendance. Making shot, &c.

2d attendance. Making hollow projectiles.

Programme of the moulds to be executed by the Professor.

Manufacture of cannon; moulding in earth and the various processes to be carried on.

Sixth.—Chemical Manipulations.

The chemical manipulations are made by sections of ten or twelve Sub-Lieutenants.

Nine attendances of three hours each are employed.

1st. To the determination of the specific gravity and real density of gunpowder and to its analysis.

2d. To two other analyses of gun-metal, iron-ore, &c.

Seventh.—Manipulations in Pyrotechny.

The manipulations in pyrotechny will be made by the whole division, divided into three brigades. Each brigade will be assembled in one of the halls at the School of Pyrotechny, and will execute the different manipulations indicated in the following programme, under the direction of the Professor, and with the assistance of the master artificers of the School of Pyrotechny. Five attendances of three hours will be employed at these manipulations.

PROGRAMME OF THE PRACTICAL INSTRUCTIONS ON MUNITIONS AND FIREWORKS.

1st Attendance. Munitions for small-arms.

Infantry cartridges, { Construction of bullets.
" of pouches and caps.
" of cartridges. }

Cartridges with oblong bullets.

2d Attendance. Ammunition for field guns.

Construction and filling of pouches, packing in wood, &c.

3d Attendance. Ammunition for siege artillery, &c.

Construction and filling of cartridges, &c.

Charging hollow projectiles.

4th Attendance. Fireworks for war purposes.

Construction of matches, quick matches, tubes, fusees for shells and grenades.

Construction of signal rockets.

5th Attendance. Carriage of field ammunition.

Loading and unloading field ammunition chests for cannons, howitzers, and infantry wagons.

Construction of ornamental lances and Roman candles.

RECAPITULATION FOR THE ARTILLERY AND ENGINEERS.

Lectures.—Parts of the Course.	No. of Lectures.	Credits for Lectures. With application, 1h. 5m.	Credits for Lectures. Without application, 3h. 0m.	Total Credits.	No. of Interrogations.	Observations.
1st Part, Geology,............	12	15	6	20	2	
2d " on Working in Iron,..	6	......	18	20 }	1	The first series of interrogations relates to mineralogy.
3d " Applications of working in Iron,........	3	15	6	10 }		
4th " Manufacture of Small Arms, ...	4	......	12	10	1	The second to geognosy.
5th " Manufacture of Cannon,...............	5	......	15	15	1	
6th " Manufacture of Powder,...............	5	......	15	15 }	1	
7th " Pyrotechny,..........	2	3	......	5 }		
	37	19.50	72	95	6	

Works of Application.	Number of Studies.	Sketches.	Memoirs.	Exercises.	Manipulations.	Attendances in halls, 4h. 5m.	Attendances out of doors, 6h.	Attendances at the Laboratory. 1h. to 2h.	Attendances at the Laboratory. of 3h.	Attendance at the School of Pyrotechny 3h.	Credits.	Observations.
Study of Mineralogical Specimens...........	3	....	....	....	....	....	....	3	......	......	5	
Study of Geological Map, followed by a Memoir												
Map,...............	....	1	....	....	...	1	....	......	......	......	5	
Memoir,................	....	....	1	....	....	....	....	......	1	......	10	
Memoirs on the Metallurgy of Iron, and its—												
1. Application,.........	....	....	1	....	....	1	....	......	......	......	10	
2. Manufacture of cannon	....	....	1	....	....	1	....	......	......	......	10	
3. " " small arms or powder,......	....	....	1	....	....	1	....	......	......	......	10	
Geological Excursions, followed by Memoirs :												
Excursions,........	....	....	....	3	....	....	3	......	......	......	20	
Memoirs,..........	....	....	3	....	....	....	....	......	......	......	20	
Manipulations in Moulding	....	....	....	....	2	....	....	......	2	......	5	
" Chemistry	....	....	....	....	9	....	....	......	9	......	25	
" Pyrotechny	....	....	....	....	5	....	....	......	......	5	15	
Total,..........	3	1	7	3	16	4	3	3	12	5	135	

RECAPITULATION OF THE CREDITS OF INFLUENCE.

Lectures,..	95	230.
Works of Application,....	135	

IX. PROGRAMME OF THE COURSE OF APPLIED MECHANICS.

FIRST SECTION.—GENERAL PRINCIPLES.

Lectures 1 and 2.—Short account of the general principles which serve as a base for the application of mechanics to machines, under the compound ratio of their establishment and of the calculation of their effects.

Lecture 3.—General composition of a factory; power, recipient, transmission of movement, tools. General method of calculating the effect of forces in a complete factory.

Lectures 4, 5, and 6.—Theoretical rules and the results of experiments concerning the flow of liquids. (Particular reference is made to the principles which relate to the large orifices of machines moved by water.)

Lecture 7.—Guaging of the volumes and valuation of the dynamical power of water-courses which feed machines.

SECOND SECTION.—MOTOR MACHINES.

Lecture 8.—Theory of the effect of water on hydraulic wheels. Determination of the elements of the calculation.

Lectures 9 to 13.—Application of the general theories to the principal hydraulic recipients. Conditions of the maximum, relative to the useful effect of each kind. Results of experiments, &c. (With reference to turbines, those which are most generally employed in the artillery workshops must be adverted to.)

Lecture 14.—Comparative abstract of the usual properties of various hydraulic "recepteurs." Operations that must be carried on in order to arrive at their results and to their reception in manufactories.

Lecture 15.—Physical ideas relative to the use of the vapor of water as a motive power. Theoretical bases of the calculation of the effects of steam-engines. Force exerted by the compression and expansion of elastic fluids.

Lectures 16 to 18.—Practical notions and results of experiments relating to the effects and to the usual properties of the principal systems of steam-engines in use, as to the employment, reception, and maintenance in workshops.

THIRD SECTION.—RESISTANCE OF MATERIALS.

Lecture 19.—Resistance to compression: 1st, by gradual pressure; 2d, by shock. Results of experience. Application to wooden and cast-iron supports, and to the foundations of machines. Stocks of hammers.

Lecture 20.—Resistance to traction. Application to the shank of a piston, to bolts, chains, cordage, and leather straps. Resistance to flexure. Practical formulæ for calculating the transverse dimensions of the wooden or cast-iron arms of hydraulic wheels, of the catches or sails.

Lecture 21.—Continuation of the resistance to flexure. Practical formula for calculating the dimensions of the several parts of such machines. Cranks, winches, and handles in wood or in metal.

Lecture 21.—Resistance to torsion. Practical formulas. Results of experiments relative to the resistance of wood and metals to boring and turning. Resistance of cast-iron plates to clipping.

FOURTH SECTION.—WORKING MACHINES.

Lectures 23 and 24.—Of blowing machines. General expression of their useful effect. Conditions of the maximum effect. Ventilators; their use in workshops and galleries of mines. Practical bases of their construction. Blowing machines with a piston. Description. Calculation of the effects and results of experiment.

Lectures 25 and 26.—Description and properties of alternative and circular sawing machines. Practical rules for their establishment. Results of experiments concerning the motive power they require, the useful effect obtained, and the resistance of various kinds of wood to the action of the tool. Results of observation relative to the work in shops by hand-saws.

Lectures 27 and 28.—Machines which act by shocks. Practical formula for the calculation of the loss of acting force in the shock. Description and usual properties of various kinds of hammers employed in workshops. Results of experiments proper for serving as the base for the establishment of lever hammers and pestles in powder manufactories. Results of calculation and observation relative to hammers and pestles moved directly or by the transmission of a movement by steam.

Lecture 29.—Grindstones for powder manufactories. Rapidity suitable to the different parts of the work. Means of obtaining it. Calculation of the necessary motive power. Sharpening grindstones for the manufacture of arms. Ventilation.

Lecture 30.—Lathes and drilling bits. Description. Rapidity of movement and form of the tools, according to the nature of the matter and kind of work. Results of experiments concerning the motive force required, and its relation to the useful effect obtained. Composition of a workshop of turning-lathes for an arsenal of artillery.

Lecture 31.—Boring. Machines for cutting and boring. The form of the tool and the rapidity of its action must depend on the nature of the material and the kind of work. Results of experience concerning the motive power required, and its relation to the useful effect obtained, principally for the boring machines of the manufactories of arms and of foundries. Boring machines, disposal of them in an arsenal.

Lecture 32.—Flatteners. Machines for centering, for making screw holes. Descriptions. Different rapidity of the work, dependent on its nature and that of the material. Results of experiments concerning the amount of the motive power and its relation to the useful effect obtained.

FIFTH SECTION.—LECTURES PREPARATORY TO THE WORKS OF APPLICATION.

Lecture 33.—Proceeding to be followed in the preparation of the sketches of a machine. Observations on the effects of machines, their duration, original cost, and cost of maintenance, mode of making, &c. Indications of the difficulties which are met with, and means which should be employed.

Lecture 34.—Project of a factory (specially for the sub-lieutenants of artillery.) Legal conditions respecting the erection of factories. General mode of proceeding with the project. Choice of motor machines dependent on local circumstances and the nature of the work to be performed.

Lecture 35.—(Special for the sub-lieutenants of artillery.) Determination of the effects supported by the pieces, whose dimensions should be calculated in applying the practical formula of the resistance of materials. Selection of materials.

Lecture 36.—(Special for the sub-lieutenants of artillery.) Principal assemblages of various pieces of machines. Building, foundations, supports of trunnions and pivots.

SECTION SECOND.—WORKS OF APPLICATION.

Survey of Workshops.

This survey of workshops comprehends:—

1st. Figured sketches and observations made on the ground.

2d. Drawing of the whole and of details shaded.

3d. A memoir containing an accurate description of the machines and workshops, the calculation of the dynamical effect, the exposition of the mode of fabrication, and, in general, the results and consequences of the observations made on the spot. It must be executed by each, conformably with the particular programme, and to the instruction which will be given to him. He is allowed for this work thirty-four days.

Project of Machines.

This work, executed immediately following the preceding, by the sub-lieutenants of artillery only, has exclusively for its object the establishment of a workshop for the service of the artillery, comprehending the driving machines and the principal operators; or, if there be time, the improvement of the workshops of the same arm, described in the preceding work. This project must be executed conformably to the particular programme given to each sub-lieutenant. It comprehends; 1, sheet of drawings: 2, a memoir. Twenty-six days are allowed for this work.

RECAPITULATION.

Oral Instruction—Parts of the Course.	Artillery.					Engineers.				
	No. of Lectures.	Credits for Lectures. With application.	Credits for Lectures. Without application.	Total Credits.	No. of Interrogations.	No. of Lectures.	Credits for Lectures. With application.	Credits for Lectures. Without application.	Total Credits.	No. of Interrogations.
1st Section—General Principles, ...	7	6	9	15	1	7	6	9	15	1
2d Sec.—Driving Machines,..	11	12	9	21	1	11	12	9	21	1
3d " Resistance of materials, ...	4	5	3	8	......	4	5	3	8	...
4th Sec.—Working Machines,	10	15	....	15	1	10	15	....	15	1
5th " Lectures preparatory to the works of application,..........	4	6	....	6	......	1	1.50	....	1.50	...
Total..........	36	44	21	65	3	33	39.50	21	60.50	3

RECAPITULATION.

Works of Application.	Number of					Number of				
	Sheets of drawings.	Memoirs.	Attendances		Credits.	Sheets of drawings.	Memoirs.	Attendances		Credits.
			In the Halls.	Out-of-doors.				In the Halls.	Out-of-doors.	
Survey of Workshops:										
Figured sketches and observations, ...	1 note book.	....	....	8	65	1 note book.	......	....	8	65
Shaded drawings, ...	1	....	22	....	100	1	......	22	....	100
Memoir, ...	....	1	4	....	40	....	1	4	....	40
Project of Machines:										
Calculations and drawings,	1	....	20	....	90	....	......	....	....	......
Preparation of memoir, ...	....	1	6	....	60	....	......	....	....	......
Total, ...	1 note book 2 sheets	2	52	8	355	1 note book 2 sheets	1	26	8	205

RECAPITULATION.

	Artillery.		Engineers.
Credits for lectures assigned to the interrogations,...	65	....	60
Credits for works of application, ...	355	....	205
	420	....	265

X.—PROGRAMME OF THE COURSE ON CONSTRUCTION.

The course on construction is divided into four parts.

The first part relates to the elements of masonry and the principles which should regulate the form, dimensions, and the construction of walls, and the different parts of buildings; it contains eighteen lectures.

The second part is devoted to the architecture of military buildings—twelve lectures.

The third part supplies the theory of the stability of construction, and is divided into—

1st section, relating to the resistance of materials—six lectures.

2d " to the stability of walls of revetments and arches—nine lectures.

The fourth part applies to constructions in water—twenty lectures.

The course is very nearly the same for the Artillery as for the Engineers.

ELEMENTS OF MASONRY, ETC.

Lectures 1, 2, and 3.—Relate to the elements of which masonry is composed, such as the different kinds of stones, usual dimensions, manner in which good stone may be known; bricks, lime, cement, sand, mortar, stucco, mastic plaster, asphalte, &c., and to the general considerations relating to foundations, and the different kinds of walls under various circumstances.

Lecture 4.—Treats of sustaining walls and the probable effects of the pressure of the earth. Of the conditions which must be fulfilled to insure stability. Various formulæ on the subject. Details of construction and on the proper material to be used.

Lecture 5.—Refers to the manner of facing masonry. Openings in walls, windows. Partition-walls.

Lecture 6.—On cylindrical arches, vaults, key-stones. Formulæ for the calculation of the thickness of piers of an arch or vault. Construction and use of tables for the calculation of the thickness. Construction of arches and vaults in different materials.

Lecture 7.—Arches continued, flat arches, plate bands, &c.

Lecture 8.—On the woods used in construction. On the influence of the soil on its quality. Characteristics of good wood. Preservation of wood. Proper wood for constructions.

Lecture 9.—Flooring. Beams. Girders. Joists. Ceilings.

Lecture 10.—Staircases, conditions respecting. Construction of different kinds of staircases, part of masonry, wood, &c.; steps. Construction of landing-places, &c.

Lectures 11 and 12.—Roofs in carpentry. Conditions which should be satisfied. Composition of the roof of a building. On the different kinds of roofs.

Lecture 13.—On the different ways of joining pieces of wood or timber together.

Lecture 14.—On permanent kinds of roofing. Conditions which should be fulfilled by good roofing. Composition of roofing. Tiles, lathing, cut slates, ridge tiles, hollow tiles, Dutch tiles. On slate roofing. Metallic roofing. Metal mostly used. Precautions to be taken with reference to all metal roofing.

Lecture 15.—Details relating to inhabited buildings. Cellars. Privies. Drainage. Chimneys; cause of their smoking. Most favorable forms of the flues, pipes. Bake-house, hearth.

Lecture 16.—On joinery and locksmiths' work. Flooring of different kinds. Doors. Camp-beds. Racks and mangers in stables. Shutters.

Lecture 17.—Apparatus for heating and for cooking food. Hearth, ash-pan. Grate-flues. Amount of surface to be given to heating apparatus. Furnace of kitchens in barracks. Summary notions on the heating and ventilating of buildings. Calorifières with hot air, steam, and hot water.

Lecture 18.—Plan of a building. Projections adopted for the representation of a building. Plans, sections, and elevations. Order in which the measurements should be made, and the sketch prepared. Height at which the horizontal plane of projections should pass, &c.

SECOND PART.—ARCHITECTURE OF MILITARY BUILDINGS.

Lecture 1.—Decoration, without making use of the orders of architecture. Principal conditions relating to decoration. Symmetry, regularity, simplicity, unity, and apparent solidity. Proper character. Proportions of the façades. Height of the stories. Basements. Horizontal chains or fillets. Vertical chains and pilasters. Proportions of the doors and windows. Arcades and arched windows. Cornices, pediments.

Lecture 2.—Distribution of buildings. Considerations that should have weight in the distribution. Number composing the edifice. Circumstances that guide in the disposal of masses. Conditions that should be satisfied in placing a building. Locality and suitable dimensions. Relations that should exist between them. Interior and exterior communications. Stories on the same floor.

Position of the large rooms. Separation of the rooms. Position and arrangement of staircases. Verification of stability.

Lecture 3.—Conditions to be fulfilled in the distribution of the principal military establishments. Arsenals. Polygons for drill. Military establishments to the School of Bridges.

Lecture 4.—Foundries. Manufacture of arms.

Lecture 5.—Refining saltpetre. Powder. Powder magazines. Details relative to the construction of lightning conductors.

Lecture 6.—Infantry and cavalry barracks.

Lecture 7.—Hospitals. Military prisons and penitentiaries.

Lecture 8.—Storehouse for corn. Store-pits. Storehouse for fodder. Preserving houses.

Lecture 9.—Cisterns. Filtration.

Lecture 10.—Military tribunals. Guard-house. Gates of cities. Hotels and dwelling-houses. Officers' quarters.

Lecture 11.—Preparatory to the execution of a project for a building. Method of proceeding. Composition of the sketch; approximate surface of all the locality; separation into symmetrical groups in the case of several buildings; number of stories; surface of the ground floor; length and breadth of the building between its walls; distribution of each story; verification of the relation between the stories. Elevation of the building. Sketches. Memoir. General details, and details of execution.

Lecture 12.—Discussion before the abstraction of the measurements and the preparation of the estimate of the building.

THIRD PART.—FIRST SECTION: ON THE RESISTANCE OF MATERIALS.

1. Resistance of prismatic bodies to extension and compression. Elasticity of bodies. Modulus of elasticity. Limits of permanent efforts. Resistance to extension and compression of stone, bricks, and analogous materials; also of wood and metals. Applications.

2. Transverse resistance. Some cases in which it is brought into play. Results of experience. Resistance of bodies submitted to the effects of transversal flexure. Results of experience and conventions. Conditions of equilibrium of bodies submitted to efforts directly transversal to their length. Direction and value of molecular efforts. Equation of the axis of the body. Equation of the squaring. Discussion of these equations.

3. Geometrical method for determining the inertia. Application to the research for the inertia of various sections. Applications of general equations of equilibrium and of squaring to straight pieces.

- 1st. A horizontal piece set in a frame at one extremity, and subjected to a weight acting at the other extremity, with a uniform vertical effect.
- 2d. Horizontal beam placed upon two supports, and subjected to a weight acting at its center, and with a uniform vertical effect.
- 3d. Beam placed horizontally on two supports, and having two equal weights symmetrically placed with respect to its center.
- 4th. Beam placed horizontally on two supports, and subjected to a weight acting at any point whatever throughout its length.
- 5th. Horizontal beam fixed at both its extremities, and subjected to a weight acting at its center with an equal vertical effect.

6th. Horizontal beam placed on three points of support, at unequal distances, and weighted with two weights acting at the middle of the intervals between the supports.

7th. Vertical beam fixed at the foot, and charged with a weight acting at a certain distance from the axis of the beam.

5. Solids of equal resistances. Most suitable form for cast girders. Applications of the formula of equilibrium and squaring to various kinds of carpentry.

6. On polygonal roofs. Conditions respecting them. Arched roofs, pressure, &c. On the stability of walls required to resist the pressure of roofs.

SECOND SECTION: ON THE STABILITY OF REVETMENT WALLS AND ARCHES.

7. On the pressure of earth. Explanation of the theory on Coulomb's system. Investigation of the pressure of earth by analysis. Hypothesis necessary in order to simplify the calculations. General formula of the value of the pressure, &c. Equations of stability and equilibrium under the hypothesis of slipping and rolling.

8. Simplification of the general equations of equilibrium in three particular cases. Determination of the co-efficient of stability in Vauban's profile. M. Poncelet's formula for calculating the thickness of revetment walls with perpendicular face. Transformation of the profile of a revetment to another of equal stability. Vauban's counterforts, &c.

9. Geometrical method for determining the pressure of earth, whatever may be the profile of the wall and of the earth, taking into account the friction of the earth on masonry. Geometrical determination of the amount of the pressure. Proceeding for the determination, by geometry, of the thickness of a revetment wall at the level of the exterior ground.

10. On buttresses. Geometrical determination of the buttressing of earth, and of its momentum. Simplification of the geometrical constructions of the pressure, of the buttressing, and of their momenta under certain hypotheses.

11. Points of application of the pressure and of the buttress. 1st. In the case of a terrace sloping less than the natural slope of the ground. 2d. In the case of the ordinary revetments of fortification.

On the stability of the foundations of revetment walls.

Compressible soil. The resultant of all the forces should pass through the center of the base. Size of the footing of the wall or depth of the foundations to arrive at the result. Possibility of the wall slipping over the base of the foundations. Use of the buttress to prevent this movement. Graphical method to determine the depth of the foundations. Depth of the foundations in unstable soil.

12. Pressure of arches. Case of cylindrical arches. Explanation of the theory of the pressure of arches. Point of application of the pressure in the five modes of possible rupture. Expression for the pressures and resistances by rolling or slipping. Proceeding to be followed to find by calculation the pressures and resistances.

13. Geometrical determination of the pressures and resistances by rolling. Explanation of the solution of this question. Construction of lines proportional to the surfaces of the voussoirs. 1st. In the case of an arch. Extrados without coping or additional weight. 2d. In that of an arch with extrados in the form of coping, and with or without additional weight. Construction of the

verticals passing through the center of gravity of the voussoirs. Abstract of the operations to be performed. Determination by geometrical means of the pressure and resistance against slipping.

14. Co-efficient of stability of arches from the springing. Manner of finding the outline of an arch for a certain given co-efficient. Stability of a cylindrical arch on its piers. Thickness of the piers. Considerations relative to the value of the co-efficient of stability. Stability of an arch on the base of its foundations. Filling in and depth of the foundations of piers.

Extension of the geometrical methods serving for the determinations of the pressures and thicknesses of piers in case of cross vaulting, arcades, and spherical vaulting.

15. Investigation by analysis of the pressures and resistances of an arch.

1st. Hypothesis of a plat-band; stability at the springing charge necessary on the coussinet; stability of the plat-band on its piers; thickness of the piers. Squaring of a tie-beam of iron which annihilates the pressure.

2d. Hypothesis of a semicircular vaulting with arched extrados. Pressures and resistances. In similar arches the pressure is proportional to the square of the radius.

FOURTH PART.—HYDRAULIC CONSTRUCTION.

1st. Classification of ground on which it may be necessary to place a foundation. Soundings. Their object. Various kinds of sounding line. Dams in earth, and in wood and earth combined. Case of an unstable foundation. Construction on rock. Thickness of dams and of the clay work. General disposition of a dam. Bottom-springs. Means of choking or smothering them or of diverting them. Use of sunk dams. Service bridges. Their height and disposition. Railways in great constructions. Their disposition.

2d. Summary review of draining or pumping machines. Choice between the different methods of draining. Table of the useful effect of such machines.

Pile driving. Pile driving machine with hand ropes. Preparation of the pile and operation of driving. Pile driving machine with catch. Choice between the two kinds of pile driving machines. Precautions to be taken in the driving of piles. Distribution of piles, the space to be left between them, and the squaring of them. Disposition and driving of planks. Method of drawing up piles and planking. Execution of a foundation on piles. Driving stakes out of water. Machine for squaring piles.

3d. Parafouilles. Their object and construction.

Foundations in mortar under water. Preparation and immersion of the mortar. Examples.

Thickness of sunk dams with the enceint in mortar.

4th. Foundation frames and platforms. Their object and their construction. Preparation of the foundation frames in masonry.

Foundation by packing.

Foundation by coffer-dams. Details of a coffer-dam.

5th. Foundations on solid gravel. Properties of gravel. Case where it is advantageous to make use of gravel. Examples.

Foundations on sunk wooden piles, in gravel, and in gravel and mortar.

Foundation on pillars built in masonry.

Foundations on quicksand.

Species of foundation to adopt according to the nature of the ground.

6th. Banks of reservoirs. Conditions which should be fulfilled in their establishment. Banks in earth; their profile; revetments to protect them; the wet slope; sort of remblai; precautions which exact a large remblai. Banks in remblai and sustaining walls combined. Banks entirely in masonry; movements observed in walls; most suitable profile. Comparison between banks in earth and masonry. Works which are employed in connection with banks of reservoirs. Dikes of inundations. Their profile; defense of their slope against the action of water; their establishment and works in connection with them.

7th. Batardeaux in the ditches of strong places. Situation; profile; details of construction. Weirs. Their object; effect of a weir in a current. Advantages of the wedge or circular form. Height to give to a weir; and longitudinal form of the swelling occasioned by a horizontal dam. Construction of weirs with vertical walls, with a long slope down the stream. Injuries to which weirs are liable. Profile to adopt according to the nature of the ground.

8th. Sluice-dams, their object; form of the piles; distance apart, and dimensions. Details of construction. Various kinds of apparatus for opening and shutting sluice-dams. Play of a revolving gate. Calculation of the dimensions of the two half sluice gates and of the wicket. Carpentry of a revolving gate. Movable dams with iron wickets. Modifications to render them applicable to the retention of water at a greater height than 2.80 meters.

9th. Navigable locks. Canal lock; its management; form of the chamber; profile of the cheeks. Trace of the pier on which the gates work. Means of filling and emptying the chambers. Means of raising the paddle-valves. Wood-work of the gates sheathed in timber. Planes. Details of the pivots, collars and rollers. Arrangements for the management of the sheathed gates.

10th. Gates sheathed in wood; curves. Ties of cast-iron, and lining in wood or sheet-iron. Cast-iron gates.

River Navigation.—Advantages and disadvantages of water transit. Conditions of a navigable river. Works for the improvement of the navigation on a river.

Artificial Navigation.—Classification of canals. Conditions which determine the best position for a summit level. Search after a minimum of elevation. Expenditure of water at the summit level.

11th. Principal processes employed to economise the water in passing through a lock. Profile of a navigable canal.

Deep cuttings; their profile. Great landslips and means of remedying them.

Tunnels; their profile. Piercing of a tunnel.

12th. Bridges in masonry. Position; breadth of the roadway; outlet to be left for the water; size and form of the arches; trace of the surbased arches on more than five centers. Expansion of the bridge-heads. Profile of the arch. Thickness of the piles and abutments. Apparatus for the arches and bridge-heads. Parts above the arches. Leveling with the banks. Fixed and movable centerings. Removal of the centerings of arches.

13th. *Wooden Bridges* composed of straight pieces. Arrangement of the stakes and starlings. Different construction of the openings according to their span. Arrangement of the platform.

American Bridges.—Arrangement of the earliest form of bridge on Town's system. Height of the trusses constructed in the form of trellis-work. Modifications introduced to increase the resistance of the bridge. Calculation of the resistance of the trusses.

Arched frame-work of bridges. Composition of the arches. Junction of the straight beams with the arches.

Cast-iron Bridges.—Different systems. General principles of their construction.

Aqueducts in masonry; in cast-iron.

14th. *Suspension Bridges.*—Equation of the curve of the chains and construction of this curve. Tension supported by the suspension cables, their thickness. Influence of the length of the flèche upon the tension of the cables. Inconveniences resulting from a long flèche. Vibrations and means of diminishing them. Limits of length of the flèche. Length of the curve of suspension. Causes operating to vary this length; means of obviating the effects produced by them. Length of the suspension rods. Number of supports to be adopted. Thickness of the piles. Points at which the fixing cables are to be attached. Advantages and disadvantages of chains composed of bars and of cables of iron wire. Some details of construction.

15th. *Drawbridges.*—Conditions which they must satisfy. General principle of their balance.

Drawbridges with Plyers.—Special theory of this bridge. Reduction of it to practice. Alteration of equilibrium and means of remedying it.

Disadvantages of the drawbridge with plyers.

16th. Spiral drawbridge of Captain Berché. Trace of the spiral. Determination of the radius of the chain-roller, and of the greatest radius of the spiral.

17th. Drawbridges with variable counterbalances, invented by M. Poncelet. Construction of the chains of the counterbalance. Establishment of the leverage. Calculation of the counterbalances for the special case of the pulleys in front corresponding to the axis of the platform. Influence of the nature of the chains. Method of allowing for the weight of the small chains. Definitive construction of the chains of the counterbalance. Provision of loose cords.

18th. Succinct ideas upon the motion of the sea, and its action on the shore.

Undulating movement. Height of the waves, and depth at which the agitation is perceptible. Effects of the waves on the coasts. Tides; spring-tides; neap-tides. Height of tides and hour of flood. General currents. Action of the sea on its shores. Protection of level and steep shores.

19th. Sea-ports. Requisites of a good port. Ports in the Mediterranean. Conditions of a good roadstead. Moles and breakwaters. Ocean ports, channel tide-dock, floating dock, and sluice of floating dock, laying-up dock, and sluice for the ditch of fortifications. General arrangement of a harbor.

20th. Construction of moles. Stones dropped for foundations. Profile of a loose heap. Volume of the materials which insure their stability. Settling of masonry resting on a heap. Instances of masonry constructed at sea. 1. Wall of Cherbourg. 2. Fort Boyard.

Piers.—Direction, length, form of interval between, and profile of piers. Their construction. Passages reserved through piers.

RECAPITULATION.

First Part.—Parts of Buildings,		18
Second Part.—Architecture of Military Buildings,		12
Third Part.—First Section. Resistance of Materials,	6	15
Third Part.—Second Section. Stability of Constructions,	9	
Fourth Part.—Hydraulic Constructions,		20
Total,		65

WORKS OF APPLICATION.

Name of work.	No. Days allowed for execution of work to Students of Artillery.	No. Days allowed for execution of work to Students of Engineers.	Subject employed on.	Observations.
Survey of a Building: Sketch (out-of-door work,). Drawing,..... Memoir,.......	8 21 2 } 31	8 21 2 } 31	Representation of an existing building or a part of a building by means of plans, sections, and elevations. The memoir contains an accurate and critical description of the distribution, construction, and decoration of the building.	Each day is equivalent to 4½ hours' work. The sketches are executed to scales approximating to one-fiftieth for the whole drawing, of one-twentieth for the large details, and of $\frac{1}{5}$ to $\frac{1}{2}$ for the minute details. The drawing prepared from the sketches is made on the scale of 1-100th.
Project for a Building: Sketch, (first study in pencil,) .... Drawing, (fair copy,)...... Details,....... Memoir, ... Abstraction of Measurements and Estimates	12 18 4 4 4 } 42	12 18 4 4 4 } 42	Study and preparation of a project of a building, in accordance with certain given data. The sketches, the result of the first study, are made in pencil; the drawing is the fair copy of the sketch, modified as may be necessary. The memoir contains an explanation of the rules and principles which must be observed in the construction of buildings, and the grounds on which the dispositions contained in the building have been adopted. The abstraction of the measurements and their reduction to the proper elements, and the estimates, are prepared in conformity to the instructions laid down for the Engineer Service in towns: these supply the estimated cost of the construction of the building according to the project.	This work, common to the students of the two arms, is an application of the first part of the course. The scale for the drawing is in general 1-200th for the plans and elevations, and 1-100th for the sections. It is restricted by the condition that the whole of the drawings should be given on a single sheet of paper. The details need only occupy half a sheet of paper, and its scales must depend on the size of the objects to be represented. The project for a building is an application of the two first parts of the course, as well as of the 1st section of the 3d part.
Diagram of the Stability: Drawing,..... Memoir, ...	6 3 } 9	6 3 } 9	Determination of the profile for a revetment wall, according to certain conditions. Verification of the stability of an arch, and calculation of the pier supporting this arch. In the memoir a short explanation is given of the theory relating to the strength of revetment walls and arches, as well as the results of the application of these principles to the particular case.	The drawing is executed to the scale of 1-100th. This work is an application of the 2d section of the 3d part.
Project for an Hydraulic construction: Sketches,..... Drawing,..... Memoir,......	10 15 3 } 28	12 18 4 } 34	Study and composition of a project for a great work of art on certain given data. In the memoir an explanation is given of the principles and the results of the theories which are to be applied in making this project The arrangements adopted in the project are discussed for the foundation and all other parts of the construction.	The scale of the drawing is chosen in such a manner that the project may be placed on a single sheet; generally it is 1-200th, or smaller. The project of a hydraulic construction is an application of the 1st section of the 3d part as well as of the 4th part of the course.
Total,....	110	116		

1st. Lectures.—Parts of the Course.	Artillery. No. Lectures.	Artillery. Credits for Lectures. With application.	Artillery. Credits for Lectures. Without application	Artillery. Credits for Lectures. Total.	Artillery. No. Interrogations.	Engineers. No. Lectures.	Engineers. Credits for Lectures. With application.	Engineers. Credits for Lectures. Without application	Engineers. Credits for Lectures. Total.	Engineers. No. Interrogations.
1st Part: Elements of Masonry, form and dimensions of the different parts of buildings,.........	18	24*	6	30	2	18	24*	6	30	2
2d Part: Architecture of military buildings,....	12	18	......	18	1	12	18	......	18	1
3d Part: Theory respecting stability: 1st section—Resistance of materials,	6	6	6	12	1	6	6	6	12	1
2d section—Stability of revetment walls and arches,.	9	10.5	6	16.5	1	9	10.5	6	16.5	1
4th Part: Hydraulic Constructions,............	20	24	12	36	1	20	24	12	36	1
Total,........	65	82	30	112	6	65	82	30	112	6

Observations.

* A lecture with application is equivalent to 1⅓ hours of work, and a lecture without application is equal to 3 hours.

2d. Execution of the Work.	Artillery. Number of Drawings and Sketches.	Artillery. Number of Memoirs.	Artillery. Number of Various.	Artillery. Number of Attendances in halls 4½ hours.	Artillery. Number of Attend'nces out of doors, 6 h.	Artillery. Credits.	Engineers. Number of Drawings and Sketches.	Engineers. Number of Memoirs.	Engineers. Number of Various.	Engineers. Number of Attendances in halls 4½ hours.	Engineers. Number of Attend'nces out of doors 6 h.	Engineers. Credits.
Plan of a Building:												
Sketches (pen,)....	1	....	....	....	8	50	1	....	....	....	8	50†
Drawing,..........	1	....	....	21	....	95	1	....	....	21	....	95
Memoirs,..........	....	1	....	2	....	20	....	1	....	2	....	20‡
Project of a Building:												
Sketch,...........	1	....	....	12	....	55	1	....	....	12	....	55
Drawing,..........	1	....	....	18	....	80	1	....	....	18	....	80
Detail,...........	1	....	....	4	....	20	1	....	....	4	....	20
Memoir,...........	....	1	....	4	....	35	....	1	....	4	....	35
Abstraction of quantities and estimates,	....	....	1	4	....	20	....	....	1	4	....	20
Diagram of Stability.												
Drawing,..........	1	....	....	6	....	25	1	....	....	6	....	25
Memoir,...........	....	1	....	3	....	25	....	1	....	3	...	25
Project of an Hydraulic construction.												
Sketch,...........	1	....	....	10	....	45	1	....	....	12	....	55
Drawing,..........	1	....	....	15	....	70	1	....	....	18	....	80
Memoir,...........	....	1	....	3	....	25	....	1	....	4	....	35
Total,........	8	4	1	102	8	565	8	4	1	108	8	595

† Of which 20 is for the out-of-door work, and 30 for the sketch.

‡ The time allowed for the preparation of the memoirs in the halls should be doubled, in order to take an account of the correction out of the halls of study.

RECAPITULATION OF THE CREDITS OF INFLUENCE FOR THE COURSE.

Artillery, { Lectures,........................112 } 677, or about 680.
{ Execution of Work,..............565 }

Engineers, { Lectures,....... ....112 } 707, or about 710.
{ Execution of Work,..............595 }

XI.—PROGRAMME OF THE COURSE IN THE GERMAN LANGUAGE.

SECOND DIVISION.—FIRST YEAR'S STUDY.

Number of Lectures, 50.

Grammar and composition during the 25 Lectures forming the odd numbers.

Oral translations of German authors. Phraseology. Lecture on idioms, founded on the passages which have been translated and given in the form of conversation during the first half of the 25 Lectures forming the even numbers.

Dialogues and conversations, on various subjects of every-day life, such as are particularly useful to an officer traveling in Germany, carried on during the second half of the Lectures of the even numbers.

FIRST DIVISION.—SECOND YEAR'S STUDY.

Number of Lectures, 100.

Translations of German authors, and conversations in German on the passages translated, during fifty Lectures, reckoning the odd numbers.

Military reconnaissances, in the form of a dialogue in German and in French, during the first half of the fifty Lectures, even numbers.

Translation of French into German: 1st, Narratives; 2d, Historical and descriptive fragments; 3d, Dramatic scenes; 4th, Epistolary style, during the second half of the fifty Lectures, even numbers.

At the close of the second year, the Sub-Lieutenants give in a composition on a certain subject.

The Sub-Lieutenants most advanced are not obliged to follow the course in German, but they should make translations of articles taken from German military works. These translations, after having been corrected, are deposited in the Library of the School.

Abstract of the course in German:—

1st year's study, ...	50	Lectures.
2d " "	100	"
Total, ...	150	at ½ hour each—112. 3 0.
Credits of influence, ...	110.	

XII.—PROGRAMME OF A SHAM SIEGE.—(Common to the Artillery and Engineers.)

FIRST SECTION.—PRELIMINARY MEASURES.

ART. I.—*Commission charged to study the Project for a Sham Siege.*

A Commission is charged with drawing up and presenting to the General commanding the School a project for a sham siege. This is composed of:—

The Colonel second in command of the School, ...President.

The Major of Artillery, ...
The Major of Engineers, ...
The Professor of Artillery, ...
The Professor of Fortification, ... } Members.
Clerk.

The Professors of Artillery and Fortification may be replaced by the Assistant Professors.

The General Commandant of the School decides in a Council of Instruction on the dispositions to be adopted for the project of a sham siege.

ART. II.—*Preparatory Lectures.*

By the Professor of Military Art, ... 2

1st. Considerations relating to the fortress of Metz. Circumstances which might bring on a siege of it. Force of the garrison and of the besieging army. Investment.

2d. Trace of the lines of circumvallation and of countervallation.

By the Professor of Topography, ... 1

Execution of the second reconnaissance plan (*memoire,*) (1 lecture.)

1st. Measure of the base. Plan of the ground of the attack. Construction of the plans. Plans of the work executed.

By the Professor of Permanent Fortification, ... 2

1st. Discussion on the points of attack Organization of the *personnel* and *matériel* of the Engineers of the besieging army and of the garrison.

2d. General progress of attack, and general dispositions of defense.

By the Professor of Artillery, ... 2

1st. Composition of the personnel and matereil of the Artillery of the besieging army. Transport of the siege equipage.

2d. General dispositions of the artillery in the attack and defense.

SECOND SECTION.—COMPOSITION OF THE PERSONNEL.

Director of the Siege.—The General Commandant of the School.

Chief of the Staff.—The Colonel second in command of the School.

Chief of the Artillery Service.—The Major of Artillery attached to the Staff.

Director of the Park of Artillery.—This may be given to the preceding.

Chief of the Engineer Service.—The Major of the Engineers attached to the Staff of the School.

Director of the Engineer Park.—This may be given to the preceding.

Major of the Trenches.—A Captain. Chiefs of Attacks. Captains.

Chiefs of Brigades.—Named by the General Commandant of the Siege.

THIRD SECTION.—CONFERENCES.

Before proceeding to the ground, the sub-lieutenants assist at conferences which are held for the purpose of explaining to them the successions of the several operations of the siege, as well as upon the traces which they have to execute. These conferences, eight in number, are divided as follows:—

The Chief of the Artillery Service will hold 4 conferences, and
The Chief of the Engineer Service " 4 "

FOURTH SECTION.—TRACING OF LINES AND TOPOGRAPHICAL WORK.

1st. The second reconnaissance survey (comprised in the course of topography.) Tracing of lines; one day is allowed for this work.

2d. "Director" plan. The execution of this plan comprises out-of-door work and drawing. The out-of-door work includes the measurement of one or many bases, the observation of the angles which are formed by this base, and the direction of certain remarkable points in the city and fortification, and the formation of a net-work of triangulation, intended to co-ordinate the surveys of the details.

The work of constructing the plan consists in laying down, day by day, the surveys of the details of the ground, as well as of the traces executed. Five days are allowed for the execution of the topographical work, which precedes the opening of the trenches. The Director Plan is kept close up during the whole duration of the siege.

3d. Itineraries and sketches (comprised in the course of topography.)

The Professor of Topography directs the whole of the surveys and the execution of the Director Plan.

FIFTH SECTION.—TRACING OF THE WORKS OF ATTACK, AND ACTUAL EXECUTION IN FULL RELIEF OF CERTAIN WORKS.

The sub-lieutenants, divided into brigades, trace the works of the siege, under the direction of the officers of the staff, and take part in the superintendence of the works executed in full relief when the exigencies of the service will permit the chief of the Artillery Service and the Colonel of the Regiment of Engineers to place workmen at the disposal of the General Commandant of the School. Six days are appropriated to this work.

SIXTH SECTION.—WORK IN THE HALLS OF STUDY.

The work in the Halls of Study consists of:—

1st. A memoir on the sham siege, which memoir must be approved by the General Commandant of the School.

2d. Of a sketch representing one of the works traced or executed in full relief. These works in the Halls are performed during the interval of the attendances devoted to out-of-door work. Two days are appropriated to the preparation of the memoir, and two to the execution of the sketch. This time is included in the eleven days allowed to the sham siege.

RECAPITULATION FOR THE ARTILLERY AND ENGINEERS.

Lectures and Conferences.	No. of Lectures or Conferences.	Credits for Lectures or Conferences. Lectures.	Conferences.	Total.	No. of Questions.	Observations.
By the Professor of Military Art,	2	3	..	3		One series of questions by the Chief of the Artillery Service, as to what relates to that arm.
" of Topography,	1	1½	..	1½		
" of Permanent Fortification,	2	3	..	3	2	
" of Artillery,	2	3	..	3		One series of questions by the Chief of the Engineer Service, as to what relates to that arm.
Conferences by the Chief of the Service, of Artillery,	4	..	6	6		
of Engineers,	4	..	6	6		
Total	15	10½	12	22½	2	A Credit of 11 is assigned to each series of questions.

Works of Application.	Number of Drawings.	Memoirs.	Attendances out of doors. of 4½h.	of 8 h.	Attendances in the Halls.	Credits.	Observations.
2d Reconnaissance Plan (Memoir,)							
Topographical Work,	..	..	4	..	..	20	Credits given by the Professor of Topography.
Itinerary and Sketch (Memoir,)	..	..	..	..	..	..	
Plan "Director,"	..	..	..	..	1	5	
Tracing of Lines,	..	..	..	1	..	10	Credits given by the Captains of the Staff, Chiefs of Brigades.
Tracing of Works of Attack and of Defense,	..	..	6	..	..	25	
Sketch,	1	..	..	..	2	1	Credits given by the Chiefs of the Service of the Artillery and Engineers.
Memoir,	..	1	..	..	2	2	
Total,	1	1	10	1	5	90	

XIII.—PROGRAMME OF THE COURSE ON THE VETERINARY ART.

FIRST PART.—INTERIOR OF THE HORSE.

Lecture 1.—Classification and nomenclature of the various matters which constitute the horse. Skeleton (head and body.)

Lecture 2.—Skeleton (limbs.) Mechanical importance of the skeleton. Nomenclature and use of the muscles. Cellular and fatty tissues, grease, skin. Insensible perspiration.

Lecture 3.—Functions for maintenance. Arteries of the nerves. Animal heat.

Lecture 4.—On various functions.

SECOND PART.—EXTERIOR OF THE HORSE.

Lecture 5.—Proportions. Equilibrium. Description and importance of the natural beauties and defects of the head and region of the throat.

Lecture 6.—Description and importance of the other parts of the horse. Blemishes. Soft tumors.

Lecture 7.—Osseous tumors. Various accidents. Temperaments. Description of clothing, &c.

Lecture 8.—Data respecting horses.

Lecture 9.—To know the age. On various bad habits. Examination of the eyes; their diseases.

Lecture 10.—Defective paces, &c. Draught and pack horses. Mules.

Lecture 11.—Stud and remounts. Races.

Lecture 12.—Vicious horses, and different bits. Manner of bitting a horse. On grooms and punishment.

THIRD PART.—ON THE HEALTH OF THE HORSE.

Lecture 13.—Examination of the foot, and shoeing with the hot shoe.

Lecture 14.—Shoeing with the cold shoe. Different kinds of horse-shoe, &c.

Lecture 15.—On stables. Food. Rations.

Lecture 16.—Description and nomenclature of the saddle. Harness and pack. Various saddles.

Lecture 17.—On work and rest. Horse and mule on the road and in bivouac. On diseases and accidents.

Abstract of the course:—

Interior of the horse,	4	17 lectures at $1\frac{1}{2}$ hours. Total time, $25\frac{1}{2}$ hours. Credits, 25.
Exterior, ...	6	
Health, ...	7	

The instruction on horseback can, under certain circumstances, be considered as connected with this course; and questions are asked during the time when the sub-lieutenants are not engaged in actual riding exercise. This instruction is described under the head of Practical Military Instruction; it comprises at the maximum 272 attendances, and its credit of influence is valued at 240.

ARTILLERY AND ENGINEERS' REGIMENTAL SCHOOLS.

I. ARTILLERY REGIMENTAL SCHOOLS.

These are intended for the theoretical and practical instruction of officers, *sous-officiers*, and gunners.

Each School is under the orders of the General of Brigade commanding the Artillery in the military division in which it is situated.

Independent of the general officer, the school has the following staff:—

A Lieutenant (associated assistant to the General.)
A Professor of Sciences, applying more particularly to the Artillery.
A Professor of Fortification, of drawing, and construction of buildings.
Two *Gardes* of Artillery (one of the first, and the other of the second class.)

There are, in addition, attached to each school the number of inferior officers (captains, lieutenants, or *sous-lieutenants*) required for carrying on the theoretical courses, which are not placed under the direction of the professors.

A captain of the first class, assisted by two first lieutenants, is the director of the park of the school. Another captain, also of the first class, but taken from the regiment of Pontooneers, has the direction of that portion of the bridge equipage necessary for the special instruction of this corps, as well as of the material of the artillery properly belonging to this instruction.

The lieutenant-colonel, assistant to the general, fulfills, independent of every other detail of supervision with which he may be charged, the functions of *ordonnateur secondaire*, in what concerns the expenses of the school and their propriety (*justification.*) He corresponds with the minister of war for this part of the service.

The instruction is divided into *theoretical* and *practical*, and the annual course is divided into half-yearly periods, or into summer and winter instructions.

The summer instruction commences, according to different localities, from the 1st of April to the 1st of May, and that of the winter from the 1st of October to the 1st of November.

The winter and summer instruction is subdivided into school and regimental instruction.

The school instruction comprehends all the *theoretical* and *practical* instruction common to the different corps which require the assistance of the particular means of the school, the employment of its professors, locality, and material, as that of the practical instruction in which the troops belonging to the different corps of the army are united to take part.

The regimental instruction is that which exists in the interior of the regiments and the various bodies of the artillery. It is directed by the chiefs of these corps, who are responsible for it, with the means placed at their disposal, under the general surveillance of the commandant of the school.

The special instruction of the Pontooneers not admitting of their following the same instruction as the other regiments of artillery, the chief of this corps directs the special instruction according to certain bases prescribed by the regulations.

There are for the captains of artillery, each year during the winter half-year, six conferences for the purposes of considering and discussing projects for the organization of different equipages and armaments for the field service, and for attack and defense of places.

In a building belonging to each school of artillery, under the name of the hotel of the school, are united the halls and establishments necessary for the theoretical instruction of the officers and sous-officers, such as halls for *théorique* drill and drawing, library, depots of maps and plans, halls for machines, instruments and models, &c.

Each school is provided with a physical cabinet and a chemical laboratory. There is also a piece of ground, called a polygon, for exercising artillerymen to the manœuvers of cannon and other firearms of great range. Its extent is sufficient in length to furnish a range of 1,200 meters, and in breadth of 600 meters.

Permanent and temporary batteries are established on this ground, and they seem not only for practice, but also to accustom the men to the construction of fascines, field batteries, &c.

The administration of each school, and the accounts relating to it, are directed by an administrative council, consisting of—

The General Officer commanding the Artillery (President.)

The Colonels of the regiments of Artillery in the towns where two regiments of the Artillery are quartered, and in other towns, the Colonel and Lieutenant-Colonel of the regiment.

The Colonel of the regiment of Pontooneers in the town where the principal part of the corps may be stationed, and in any other town the Lieutenant-Colonel or the Major.

The Lieutenant-Colonel associated assistant with the General Commandant.

The functions of secretary of the council are intrusted to a *grade* of the first class.

The functionaries of the corps of intendants fulfill, in connection with the administrative councils of the artillery schools, the same duties as are assigned by the regulations relating to the interior administration of bodies of troops. They will exercise over the accounts, both of money and material of the said schools, the same control as over the administration connected with the military interests of the state.

II. ENGINEER REGIMENTAL SCHOOLS.

The colonel of each regiment has the superior direction of the instruction.

The lieutenant-colonel directs and superintends, under his orders, the whole of the details of the regimental instruction.

A major, selected from among the officers of this rank belonging to the *état-major* of this arm, directs and superintends, under the orders of the colonel, the whole of the details of the special instruction.

The complete instruction consists of—

General instruction, or that of the regiment, by which a man is made a soldier.

Special or school instruction, having for its object the training of the miner or sapper.

The instructions are each separated into *theoretical* and *practical* instruction.

The theoretical instruction of the regiment comprehends the theories:—

On the exercises and manœuvers of infantry. On the interior service. On the service of the place. On field service. On the maintenance of arms. On military administration. On military penal legislation.

The practical instruction of the regiment comprises:—

The exercises and manœuvers of infantry. Practice with the musket. Military Marches. Fencing.

The teaching of these various duties is confided to officers, *sous-officiers*, and corporals of the regiments, as pointed out by the regulation, and the orders of the colonel.

The fencing school is organized in a similar manner to those of the infantry, and the military marches are also made in the same way as in those corps.

The *special* and *theoretical* instruction consists of:—

Primary instruction. Mathematics. Drawing. Geography. Military history of France. Fortification and the various branches of the engineering work.

Three civil professors (appointed by competition) are attached to each regimental school, for the special theoretical instruction, as regards the primary instruction, drawing, and mathematics.

The courses are distributed and taught in the following manner:

Primary instruction for the Soldiers.		By the Professor of Primary Instruction.
French grammar for the Corporals.		
Book-keeping for the *Sous-Officiers.*		
Elementary arithmetic for the Corporals.		By the Prof. of Mathematics.
Complete arithmetic Elementary geometry	for the Serjeants.	
Complete geometry Trigonometry	for the Serjeant-Major.	
Surveys for the *Sous-Officiers.*		
Special mathematics for the Officers.		
Drawing for the Corporals and *Sous-Officers.*		By the Professor of Drawing, who is also charged with completing the collection of models which relate to it.
The elements of fortification for the Serjeant-Majors.		By the Officers of the regiment, named by the Colonel, independently of those appointed by the regulations
Construction, and theories on practical schools	for the *Sous-Officiers.*	
Permanent fortification The attack and defense of places Mines Bridges Ovens Topography	for the Officers.	
Geography Military history of France	for the *Sous-Officiers.*	

At the end of each course the colonel of the regiment causes a general examination to be made in his presence of the whole of the men who have followed this course, and has a list made out in the order of merit, with notes of the capacity and aptitude of each.

These lists are consulted in the formation of tables of promotion, and placed with the said tables before the inspector-general.

Each captain and lieutenant are obliged to give in at least a single treatise on five different projects, consisting of a memoir discussing or the journal of a siege, with drawing of the whole, and of details in sufficient number to render them perfectly intelligible.

The *special practical* instruction is composed of seven distinct schools, relating to:—

Field Fortification. Saps. Mines and Fireworks. Bridges. Ovens. Topography. Gymnastics.

And they comprehend, in addition, sham sieges, and underground war. Each of these seven schools is taught in accordance with the special instructions annexed to the regulation, which, however, are not published.

Winter is more especially devoted to the course of special theoretical instruction, which commences on the 1st November, and usually finishes on the 15th March, and the course of *special practical* instruction is carried on during the summer from the 15th March to the 15th September. The second fortnight of September and the month of October are devoted to sham sieges and underground war, to the leveling of the works executed, and to the arrangement of magazines.

SCHOOL FOR INFANTRY AND CAVALRY

AT ST. CYR.

GENERAL DESCRIPTION. CONDITIONS OF ADMISSION. STAFF.

It will have been seen in the accounts of the Polytechnic School and the School of Application at Metz, in what manner young men destined for commissions in the artillery and engineers receive their previous education, and under what conditions appointments as officers in these two services are made in France. The regulations for the infantry, the cavalry, and the marines are of the same description. There are in these also the same two ways of obtaining a commission. One, and in these services the more usual one, is to rise from the ranks. The other is to pass successfully through the school at St. Cyr. Young men who do not enter as privates prove their fitness for the rank of officers by going through the course of instruction given, and by passing the examinations conducted in this, the principal, and putting aside the School of Application at Metz, the one Special Military School of the country.

The earliest foundation of the kind in France was the Ecole Royale Militaire of 1751. Like most other similar institutions of the time, it was intended for the young nobility. No one was to be admitted who could not prove four generations of *Noblesse.* The pupils were taught free of charge, and might enter at eight years old. Already, however, some marks of competition are to be discerned, as the best mathematicians were to be taken for the Artillery and Engineers. Buildings on the Plain of Grenelle (the same which still stand, occupying one end of the present Champs de Mars, and retaining, though only used as barracks, their ancient name,) were erected for the purpose. The school continued in this form till 1776, when it was dissolved (apparently owing to faults of discipline,) and replaced by ten Colleges, at Sorrèze, Brienne, Vendôme, and other places, all superintended by ecclesiastics. A new Ecole Royale Militaire, occupying the same buildings as the former, was added in 1777.

This came to an end in 1787; and the ten colleges were suppressed under the Republic. A sort of Camp School on the plain of Sablons took their place, when the war had broken out, and lasted about a year under the name of the Ecole de Mars.

Under the Consulate in 1800, the Prytanée Français was founded, consisting of four separate Colleges. The name was not long after changed to the Prytanée Militaire; and after some time the number was diminished, and La Flèche, which had in 1764 received the youngest pupils of the old Royal Military School, became the seat of the sole remaining establishment; which subsequently sunk to the proportions of a mere junior preparatory school, and became, in fine, the present establishment for military orphans, which still retains the title, and is called the Prytanée Militaire de la Flèche.

A *special* Military School, in the meantime, had been set up at Fontainebleau in 1803, transferred in 1808 to St. Cyr, and thus taking the place of the Prytanée Militaire and of its predecessor, the original Ecole Royale Militaire, gradually assumed its present form.*

The course of study lasts two years; the usual number of cadets in time of peace is five, or at the utmost six hundred; the admission is by competitive examination, open to all youths, French by birth or by naturalization, who on the first of January preceding their candidature were not less than sixteen and not more than twenty years old. To this examination are also admitted soldiers in the ranks between twenty and twenty-five years of age, who, at the date of its commencement, have been actually in service in their regiments for two years.

The general conditions and formalities are the same as those already stated for the Polytechnic. It may be repeated that all the candidates, in accordance with a recent enactment, must have taken the usual degree which terminates the task at the *lycées*—the baccalaureate in sciences.

Those who succeed in the examination and are admitted, take an engagement to serve seven years either in the cavalry or infantry, and are thus under the obligation, if they are judged incompetent at the close of their two years' stay at the school to receive

* Founded the Ecole Royale Militaire, 1751. Junior pupils transferred to La Flèche, 1764.
Suppression of the Ecole Royale Militaire and establishment of ten Colleges, 1776.
New Ecole Royale Militaire, for the best pupils of the Colleges, 1777.
Suppression of the Colleges and of the Ecole Royale Militaire, 1787.
Foundation of the Ecole de Mars, May 1794.
Foundation of the Prytanée Français at Paris, Versailles, St. Germain, Fontainebleau, 1800.
Foundation of the Ecole Spéciale Militaire at Fountainebleau, 1803.
The four Schools of the Prytanée Français are converted into the Prytanée Militaire, 1806; and are transferred to La Flèche. 1808.
The Ecole Spéciale Militaire is transferred to St. Cyr, also in 1808.

a commission, to enter and serve as common soldiers. The two years of their stay at the school counts as a part of their service. It is only in the special case of loss of time caused by illness, that permission is given to remain a third year.

The ordinary payment is 60*l.* (1,500 francs) per annum. All whose inability to pay this amount is satisfactorily established, may claim, as at the Polytechnic, an allowance of the whole or of half of the expenses from the State, to which may be added an allowance for the whole or for a portion of the outfit (from 24*l.* to 28*l.*) These *bourses* or *demi-bourses*, with the *trousseau*, or *demi-trousseau*, have during the last few years been granted unsparingly. One-third of the 800 young men at the school in February 1856 were *boursiers* or *demi-boursiers*. Candidates admitted from the Orphan School of La Flèche, where the sons of officers wounded or killed in service receive a gratuitous education, are maintained in the same manner here.*

It was the rule till lately that cadets appointed, on leaving St. Cyr, to the cavalry should be placed for two years at the Cavalry School at Saumur. This, however, has recently been changed; on entering St. Cyr those who desire appointments in the cavalry declare their wishes, and are put at once through a course of training in horsemanship. Those who are found unfit are quickly withdrawn; the remainder, if their place on the final examination allows of their appointment to the cavalry, are by that time sufficiently well practiced to be able to join their regiments at once.

Twenty-seven, or sometimes a greater number, are annually at the close of their second year of study placed in competition with twenty-five candidates from the second lieutenants belonging to the army,† if so many are forthcoming, for admission to the Staff School at Paris. This advantage is one object which serves as a stimulus to exertion, the permission being given according to rank in the classification by order of merit.

The school consists of two divisions, the upper and the lower, corresponding to the two years of the course. Each division is divided again into four companies. In each of these eight companies there are sub-officers chosen from the *élèves* themselves, with

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* About twenty-five are sent every year from La Flèche. The admissions from the army (*i. e.*, of soldiers between twenty and twenty-five years old) do not amount to more than four or at the utmost five per cent. They are very frequently young men who have previously failed for St. Cyr. and who then enter the army as privates, and come in as such. They have to pass the same examination.

† Few usually present themselves; and these also, it is said, are very generally old *élèves* of St. Cyr, who had not succeeded in obtaining admission to the Staff School before. They are not examined *with* the pupils of St. Cyr, but are intercalated in the list according to their merit.

the titles of *Sergent*, *Sergent Fourrier*, and *Caporal;* those appointed to the companies of the junior division are selected from the second year cadets, and their superiority in standing appears to give these latter some considerable authority, exercised occasionally well, occasionally ill. The whole school, thus divided into eight companies, constitutes one battalion.

The establishment for conducting the school consists of—

A General as Commandant.
A Second in Command (a Colonel of Infantry.)
A Major, 4 Captains, 12 Lieutenants, and 5 Second Lieutenants of Infantry; the Major holding the office of Commandant of the Battalion.
A Major, 1 Captain, 34 Lieutenants, and 3 Second Lieutenants of Cavalry to superintend the exercises, the riding, &c.
A Director of Studies (at present a Lieutenant-Colonel of Engineers.)
Two Assistant Directors.
Six Examiners for Admission.
One Professor of Artillery.
One Assistant ditto.
One Professor of Topography and Mathematics.
One Professor of Military Administration, Military Art, and Military History.
One Professor of Fortification.
One Professor of Military Literature.
Two Professors of History and Geography.
One Professor of Descriptive Geometry.
One Professor of Physics and Chemistry.
Three Professors of Drawing,
One Professor of German.
Eleven Military and six Civilian Assistant Teachers (*Répétiteurs.*)

There is also a Quartermaster, a Treasurer, a Steward, a Secretary of the Archives, who is also Librarian, an Almoner (a clergyman,) four or five Surgeons, a Veterinary Surgeon, who gives lessons on the subject, and twelve Fencing Masters.

The professors and teachers are almost entirely military men. Some difficulty appears to be found by civilians in keeping sufficient order in the large classes; and it has been found useful to have as *répétiteurs* persons who could also be employed in maintaining discipline in the house. Among the professors at present there are several officers of the engineers and of the artillery, and of the staff corps.

There is a board or council of instruction, composed of the commandant, the second in command, one of the field officers of the school staff, the director of studies, one of the assistant directors, and four professors.

So, again, the commandant, the second in command, one of the field officers, two captains, and two lieutenants, the last four changing every year, compose the board or council of discipline.

St. Cyr is a little village about three miles beyond the town of Versailles, and but a short distance from the boundary of the park. The buildings occupied by the school are those formerly used by Madame de Maintenon, and the school which she superintended.

Her garden has given place for the parade and exercise grounds; the chapel still remains in use; and her portrait is preserved in the apartments of the commandant. The buildings form several courts or quadrangles; the Court of Rivoli, occupied chiefly by the apartments and bureaux of the officers of the establishment, and terminated by the chapel; the Courts of Austerlitz, and Marengo, more particularly devoted to the young soldiers themselves; and that of Wagram, which is incomplete, and opens into the parade grounds. These, with the large stables, the new riding school, the exercising ground for the cavalry, and the polygon for artillery practice, extend to some little distance beyond the limit of the old gardens into the open arable land which descends northwards from the school, the small village of St. Cyr lying adjacent to it on the south.

The ground floor of the buildings forming the Courts of Marengo, Austerlitz, and Wagram appeared to be occupied by the two refectories, by the lecture-rooms or amphitheaters, each holding two hundred pupils, and by the chambers in which the ordinary questionings, similar to those already described in the account of the Polytechnic School, under the name of *interrogations particulières*, are conducted.

On the first floor are the *salles d'étude* and the *salle des collections* the museum or repertory of plans, instruments, models and machines, and the library; on the second floor the ordinary dormitories; and on the third (the attics,) supplementary dormitories to accommodate the extra number of pupils who have been admitted since the commencement of the war.

The commission, when visiting the school, was conducted on leaving the apartments of the commandant to the nearest of the two refectories. It was after one o'clock, and the long room was in the full possession of the whole first or junior division. A crowd of active and spirited-looking young soldiers, four hundred at least in number, were ranged at two long rows of small tables, each large enough, perhaps, for twelve; while in the narrow passage extending up and down the room, between the two rows, stood the officers on duty for the maintenance of order. On passing back to the corridor, the stream of the second year cadets was issuing from their opposite refectory. In the adjoining buttery, the loaf was produced, one kilogramme in weight, which constitutes the daily allowance. It is divided into four parts, eaten at breakfast, dinner, the afternoon lunch or *gouter*, and the supper. The daily cost of each pupil's food is estimated at 1 f. 80 c.

The lecture rooms and museums offer nothing for special remark. In the library containing 12,000 books and a fine collection of maps, there were a few of the young men, who are admitted during one hour every day.

The *salles d'étude* on the first floor are, in contrast to those at the Polytechnic, large rooms, containing, under the present circumstances of the school, no less than two hundred young men. There are, in all, four such rooms, furnished with rows of desks on each side and overlooked in time of study by an officer posted in each to preserve order, and, so far as possible, prevent any idleness.

From these another staircase conducts to the dormitories, containing one hundred each, and named after the battles of the present war—Alma, Inkerman, Balaclava, Bomarsund. They were much in the style of those in ordinary barracks, occupied by rows of small iron beds, each with a shelf over it, and a box at the side. The young men make their own beds, clean their own boots, and sweep out the dormitories themselves. Their clothing, some portions of which we here had the opportunity of noticing, is that of the common soldier, the cloth being merely a little finer.

Above these ordinary dormitories are the attics, now applied to the use of the additional three hundred whom the school has latterly received.

The young men, who had been seen hurrying with their muskets to the parade ground, were now visible from the upper windows, assembled, and commencing their exercises. And when, after passing downwards and visiting the stables, which contain three hundred and sixty horses, attended to by two hundred cavalry soldiers, we found ourselves on the exercising ground, the cavalry cadets were at drill, part mounted, the others going through the lance exercise on foot. In the riding-school a squad of infantry cadets were receiving their weekly riding lesson. The cavalry cadets ride three hours a-day; those of the infantry about one hour a week. The exercising ground communicates with the parade ground; here the greater number of the young men were at infantry drill, under arms. A small squad was at field-gun drill in an adjoining square. Beyond this and the exercising ground is the practice ground, where musket and artillery practice is carried on during the summer. Returning to the parade ground we found the cadets united into a battalion; they formed line and went through the manual exercise, and afterwards marched past; they did their exercise remarkably well. Some had been only three months at the school. The marching past was satisfactory; it was in three ranks, in the usual French manner.

Young men intended for the cavalry are instructed in infantry and artillery movements and drill; just as those intended for the infantry are taught riding, and receive instruction in cavalry, as well as artillery drill and movements.

It is during the second year of their stay they receive most instruction in the arms of the service to which they are not destined, and this, it is said, is a most important part of their instruction. "It is this," said the General Commandant, "that made it practicable, for example, in the Crimea, to find among the old *élèves* of St. Cyr, officers fit for the artillery, the engineers, the staff; and for general officers, of course, it is of the greatest advantage to have known from actual study something of every branch."

The ordinary school vacation last six or seven weeks in the year. The young men are not allowed to quit the grounds except on Sundays. On that day there is mass for the young men.

The routine of the day varies considerably with the season. In winter it is much as follows:—At 5 A. M. the drum beats, the young men quit theis beds; in twelve minutes they are all dressed and out, and the dormitories are cleared. The *rappel* sounds on the *grand carré;* they form in their companies, enter their *salles*, and prepare for the lecture of the day until a quarter to 7. At 7 o'clock the officers on duty for the week enter the dormitories, to which the pupils now return, at a quarter to 8 the whole body passes muster in the dormitories, in which they have apparently by this time made their beds and restored cleanliness and order. Breakfast is taken at one time or other during the interval between a quarter to 7 and 8 o'clock.

They march to their lecture rooms at 8, the lecture lasts till a quarter past 9, when they are in like manner marched out, and are allowed a quarter of an hour of amusement. They then enter the halls of study, make up their notes on the lecture they have come from, and after an hour and a half employed in this way, for another hour and a half are set to drawing.

Dinner at 1 is followed by recreation till 2. Two hours from 2 to a quarter past 4 are devoted to military services.

From 4 to 6 P. M. part are occupied in study of the drill-book (*théorie*,) part in riding or fencing: a quarter of an hour's recreation follows, and from $6\frac{1}{4}$ to $8\frac{1}{2}$ there are two hours of study in the *salles*. At half-past 8 the day concludes with the supper.

The following table gives a view of the routine in summer:—

$4\frac{1}{2}$	A. M.	to	$4\frac{3}{4}$	A. M.	Dressing.
$4\frac{3}{4}$	"	to	$7\frac{1}{4}$	"	Military exercises.
$7\frac{1}{4}$	"	to	$8\frac{1}{4}$	"	Breakfast, cleaning, inspection.
$8\frac{1}{4}$	"	to	$9\frac{1}{2}$	"	Lecture.
$9\frac{1}{2}$	"	to	$9\frac{3}{4}$	"	Recreation.
$9\frac{3}{4}$	"	to	$11\frac{1}{4}$	"	Study.
$11\frac{1}{4}$	"	to	1	P. M.	Drawing.
1	P. M.	to	2	"	Dinner and recreation.
2	"	to	4	"	Study of drill-book (*théorie*) or fencing.
4	"	to	6	"	Study for some, riding for others.
6	"	to	$6\frac{1}{4}$	"	Recreation.
$6\frac{1}{4}$	"	to	8	"	Riding for some, study for others,
8	"	to	$8\frac{1}{2}$	"	Supper.

The entrance examination is much less severe than that for the Polytechnic; but a moderate amount of mathematical knowledge is demanded, and is obtained. The candidates are numerous; and if it be true that some young men of fortune shrink from a test, which, even in the easiest times, exacts a knowledge of the elements of trigonometry, and not unfrequently seek their commissions by entering the ranks, their place is supplied by youths who have their fortunes to make, and who have intelligence, industry, and opportunity enough to acquire in the ordinary *lycées*, the needful amount of knowledge.

Under present circumstances it is, perhaps, more especially in the preparatory studies that the intellectual training is given, and for the examination of admission that theoretical attainments are demanded. The state of the school in a time of war can not exactly be regarded as a normal or usual one. The time of stay has been sometimes shortened from two years to fifteen months; the excessive numbers render it difficult to adjust the lectures and general instruction so as to meet the needs of all; the lecture rooms and the studying rooms are all insufficient for the emergency; and what is yet more than all, the stimulus for exertion, which is given by the fear of being excluded upon the final examination, and sent to serve in the ranks, is removed at a time when almost every one may feel sure that a commission which must be filled up will be vacant for him. Yet even in time of peace, if general report may be trusted, it is more the drill, exercises, and discipline, than the theory of military operations, that excite the interest and command the attention of the young men. When they leave, they will take their places as second lieutenants with the troops, and they naturally do not wish to be put to shame by showing ignorance of the common things with which common soldiers are familiar. Their chief incentive is the fear of being found deficient when they join their regiments, and, with the exception of those who desire to enter the staff corps, their great object is the practical knowledge of the ordinary matters of military duty. "Physical exercises," said the Director of Studies, "predominate here as much as intellectual studies do at the Polytechnic."

But the competition for entrance sustains the general standard of knowledge. Even when there is the greatest demand for admissible candidates, the standard of admission has not, we are told, been much reduced. No one comes in who does not know the first elements of trigonometry. And the time allotted by the rules of the school to lectures and indoor study is far from inconsiderable.

EXAMINATIONS FOR ADMISSION—STUDIES AT THE SCHOOL.

The examinations for admission are conducted almost precisely upon the same system which is now used in those for the Polytechnic School.* There is a preliminary or pass examination (*du premier degré*,) and for those who pass this a second or class examination (*du second degré.*) For the former there are three examiners, two for mathematics, physics, and chemistry, and a third for history, geography, and German. The second examination, which follows a few days after, is conducted in like manner by three examiners. A jury of admission decides. The examination is for the most part oral; and the principal difference between it and the examination for the Polytechnic is merely that the written papers are worked some considerable time before the first oral examination (*du premier degré*,) and are looked over with a view to assist the decision as to admissibility to the second (*du second degré.*) Thus the *compositions écrites* are completed on the 14th and 15th of June; the preliminary examination commences at Paris on the 10th of July; the second examination on the 13th.

The subjects of examination are the following:—

Arithmetic, including vulgar and decimal fractions, weights and measures, square and cube root, ratios and proportions, interest and discount, use of logarithmic tables and the sliding rule.

Algebra, to quadratic equations with one unknown quantity, maxima and minima, arithmetical and geometrical progressions, logarithms and their application to questions of compound interest and annuities.

Geometry, plane and solid, including the measurement of areas, surfaces, and volumes; sections of the cone, cylinder, and sphere.

Plane Trigonometry: construction of trigonometrical tables and the solution of triangles; application to problems required in surveying.

Geometrical representations of bodies by projections.

* The system was, in fact, first tried at St. Cyr, and adopted, on the representation of the Mixed Commission, at the Polytechnic. The previous method, by which different sets of examiners took different districts, had created distrust and dissatisfaction.

French compositions.
German exercises.
Drawing, including elementary geometrical drawing and projections; plan, section, and elevation of a building; geographical maps.
Physical Science (purely descriptive:) cosmography; physics, including elementary knowledge of the equilibrium of fluids; weight, gravity, atmospheric pressure, heat, electricity, magnetism, acoustics, optics, refraction, microscope, telescope.
Chemistry, elementary principles of; on matter, cohesion, affinity; simple and compound bodies, acids, bases, salts, oxygen, combustion, azote, atmospheric air, hydrogen, water; respecting equivalents and their use, carbon, carbonic acid, production and decomposition of ammonia, sulphur, sulphuric acid, phosphorus, chlorine; classification of non-metallic bodies into four families.
History: History of France from the time of Charles VII. to that of the Emperor Napoleon I. and the treaties of 1815.
Geography, relating entirely to France and its colonies, both physical and statistical.
German: the candidates must be able to read fluently both the written and printed German character, and to reply in German to simple questions addressed to them in the same language.

The general system of instruction at St. Cyr is similar to that of the Polytechnic; the lectures are given by the professors, notes are taken and completed afterwards, and progress is tested in occasional *interrogations* by the *répétiteurs*. One distinction is the different size of the *salles d'étude* (containing two hundred instead of eight or ten;) but, above all, is the great and predominant attention paid to the practical part of military teaching and training. It is evident at the first sight that this is essentially a military school, and that especial importance is attached both by teachers and pupils to the drill, exercise, and manœuvers of the various arms of the service.

The course of study is completed in two years; that of the first year consists of:—

	27	lectures in descriptive geometry.
	35	" physical science.
	20	" military literature.
	35	" history.
	27	" geography and military statistics.
	30	" German.
Total,	174	

In addition to the above, there is a course of drawing between the time when the students join the school early in November and the 15th of August.

The course of *drawing* consists in progressive studies of landscape drawing with the pencil and brush, having special application to military subjects, to the shading of some simple body or dress, and to enable the students to apply the knowledge which has been communicated to them on the subject of shadows and perspective. This course is followed by the second or junior division during the first year's residence.

The course of lectures in *descriptive geometry* commences with certain preliminary notions on the subject; refers to the representation of lines on curved surfaces, cylindrical and conical, surfaces of revolutions, regular surfaces, intersection of surfaces, shadows, perspective, vanishing points, &c., construction of geographical maps, and *plan côté.*

The lectures in *physical science* embrace nine lectures on the general properties of bodies; heat, climate, electricity, magnetism, galvanism, electro-magnetism, acoustics.

There are twelve lectures in *chemistry;* on water, atmospheric air, combustibles, gas, principal salts, saltpetre, metallurgy, organic chemistry.

There are fourteen lectures in *mechanics applied to machines;* motion, rest, gravity, composition and resolution of forces, mechanical labor, uniform motion, rectilinear and rotatory, projectiles in space, mechanical powers, drawbridges, Archimedean principle, military bridges, pumps, reservoirs, over and under-shot wheels, turbines, corn mills, steam-engines, locomotives, transport of troops, materials, and munitions on railways.

The twenty lectures in *military literature* refer to military history and biography, memoirs of military historians, battles and sieges, the art of war, military correspondence, proclamations, bulletins, orders of the day, instructions, circulars, reports and military considerations, special memoirs, reconnaissance and reports, military and periodical collections, military justice.

The thirty-five lectures in *history* principally relate to France and its wars, commencing with the Treaty of Westphalia and ending with the Treaty of Vienna.

The twenty-seven lectures in *geography* and *military statistics* are subdivided into different parts; the first eight lectures are devoted to Europe and France, including the physical geography and statistics of the same; the second six lectures are devoted to the frontiers of France; and the third part of thirteen lectures to foreign states and Algeria, including Germany, Italy, Spain, Portugal, Poland, and Russia.

The studies for the first division during the second year of their residence consist of—

	10	lectures in	topography.
	27	"	fortification.
	15	"	artillery.
	10	"	military legislation.
	12	"	military administration.
	27	"	military art and history.
	20	"	German.
Total,	121		

One lesson weekly is given in drawing, in order to render the students expert in landscape and military drawing with the pencil, pen, and brush.

We must not omit to call attention to the fact that mathematics are not taught in either yearly course at St. Cyr.

The course in *topography*, of ten lectures, has reference to the construction of maps, copies of drawings, theory, description, and use of instruments for measuring angles and leveling, the execution for a regular survey on the different systems of military drawing, drawing from models of ground, on the construction of topographical drawing and reconnaissance surveys, with accompanying memoirs.

Twenty-seven lectures are devoted to *fortification;* the first thirteen relate principally to field fortification, statement of the general principles, definitions, intrenchments, lines, redoubts, armament, defilement, execution of works on the ground, means necessary for the defense, application of field fortification to the defenses of *têtes de pont* and inhabited places, attack and defense of intrenchments, &c., castramentation; six lectures have reference to permanent fortification, on ancient fortifications, Cormontaigne's system, exterior and detached works, considerations respecting the accessories of defense to fortified places; eight lectures relate to the attack and defense of places, preparations for attack and defense, details of the construction of siege works from the opening of the trenches to the taking of the place, exterior works, as auxiliaries, sketches, and details of the different works in fortifications, plans, and profile, &c.

The students also execute certain works, such as the making of fascines, gabions, saucissons, repair of revetments of batteries, platform, setting the profiles, defilement, and construction of a fieldwork, different kinds of sap, plan and establishment of a camp for a battalion of infantry, &c.

Under the head of *artillery*, fifteen lectures are given, commencing with the resistance of fluids, movement of projectiles, solution of problems with the balistic pendulum, deviation of projectiles, pointing and firing guns; small arms, cannon, materials of artillery, powder, munition, fireworks for military purposes; range of cannon, artillery for the attack or defense of places or coasts, field artillery, military bridges.

The students are practically taught artillery drill with field and siege guns, practice with artillery, repair of siege batteries, bridges of boats or rafts.

The ten lectures allowed for the course of *military legislation* have for their object the explanation of the principles, practice, and regulations relating to military law, and the connection with the civil laws that affect military men.

The twelve lectures on what is called *military administration* relate to the interior economy of a company, and to the various matters appertaining to the soldier's messing, mode of payment, necessaries, equipment, lodging, &c.

Military art and history is divided into three parts. The first, of five lectures, relates to the history of military institutions and organization. The second, of fifteen lectures, refers to the composition of armies and to considerations respecting the various arms, infantry, cavalry, état-major, artillery and engineers, and the minor operations of war. The third part, of seven lectures, gives the history of some of the most celebrated campaigns in modern times. In the practical exercises, the students make an attack or defense of a work or of a system of fieldworks during their course of fortification, or of a house, farm, village, in the immediate vicinity of the school, or make the passage of a river.

The students receive twenty lectures in *German*, and are reouired to keep up a knowledge of German writing.

EXAMINATIONS AT THE SCHOOL.

The examinations at the end of the first year take place under the superintendence of the director and assistant director of studies. They are conducted by the professor of each branch of study, assisted by a *répétiteur*, each of whom assigns a credit to the student under examination, and the mean, expressed as a whole number, represents the result of the student's examination in that particular branch of study. The examination in military instruction for training (in drill and exercises) is carried on by the officers attached to companies, under the superintendence of the commandant of the battalion, and that relating to practical artillery by the officer in charge of that duty.

The pupils' position is determined, as at the Polytechnic, partly by the marks gained at the examination, partly by those he has obtained during his previous studies. In other words, the half of the credit obtained by a student at this examination in each subject is added to the half of the mean of all the credits assigned to him, in the same subject, for the manner in which he has replied to the questions of the professor and *répétiteur* during the year; and the sum of these two items represents his total credit at the end of the year. The scale of credit is from 0 to 20, as at the Polytechnic.

Every year, before the examinations commence, the commandant and second in command, in concert with the director and assistant director, and in concurrence with the superior officer commanding the battalion for military instruction, are formed into a board to determine the amount of the minimum credit which should be exacted from the students in every branch of study. This minimum is not usually allowed to fall below eight for the scientific, and ten for the military instruction.

Any student whose general mean credit is less than *eight* for the scientific, or *ten* for the military instruction, or who has a less credit than *four* for any particular study in the general instruction, or of *six* for the military instruction, is retained at the school to work during the vacation, and re-examined about eight days before the re-commencement of the course, by a commission composed of the director and assistant director of studies for the general instruction, and of the second in command and the commandant of the battalion, and of one captain for the military instruction. A statement of this second examination is submitted to the minister of war, and those students who pass it in a satisfactory manner are permitted by him to proceed into the first division. Those who do not pass it are reported to the minister of war as deserving of being excluded from the school, unless there be any special grounds for excusing them, such as sickness, in which case, when the fact is properly established before the council of instruction, they are permitted to repeat the year's studies.

Irregularity of conduct is also made a ground for exclusion from the school. In order to estimate the credit to be attached to the conduct of a student, all the punishments to which he can be subjected are converted into a specific number of days of punishment drill. Thus,

For each day confined in the police chamber, 4 days' punishment drill.

For each day confined in the prison, 8 days' punishment drill.

The statement is made out under the presidency of the commandant of the school, by the second in command, and the officer in command of the battalion. The credits for conduct are expressed in whole numbers in terms of the scale of 0 to 20, in which the 20 signifies that the student has not been subjected to any punishment whatever, and the 0, that the student's punishments have amounted to 200 or more days of punishment drill. The number 20 is diminished by deducting 1 for every 10 days of punishment drill.

The classification in the order of merit depends upon the total amount of the sum of the numerical marks or credits obtained by each student in every branch of study or instruction. The numerical credit in each subject is found by multiplying the credit awarded in each subject by the co-efficient of influence belonging to it.

The co-efficients, representing the influence allowed to each particular kind of examination, in the various branches of study are as follows:—

Second Division, or First Year's Course of Study.

General Instruction.	Descriptive Geometry, ...	Course,	6	40
		Drawing and Sketches,	2	
	Physical Science applied to the Military Arts, ..	Course,	6	
		Sketch and Memoir,	2	
	History,		6	
	Geography and Statistical Memoirs,	Course,	5	
		Sketch and Memoir,	2	
	Literature, Memoir on		4	
	German,		4	
	Drawing,		3	
Special Instruction:—Drill, Practice, Manœuvers (Infantry and Cavalry,)				7
Conduct,				3
				50

First Division, or Second Year's Course of Study

			Infantry.		Cavalry.	
General Instruction.	Topography, ...	Course,	3	35	3	32
		Maps, Memoirs, and Practical Exercises,	3		2	
	Fortification, ...	Course,	4		4	
		Drawings, Memoirs, and Practical Exercises,	3		2	
	Artillery and Balistic Pendulum, ...	Course,	4		4	
		Practical Exercises, School of Musketry,	2		1	
	Military Legislation,		2		2	
	Military Administration,	Course,	3		3	
		Sheets of Accounts,	1		1	
	Military History and Art,	Course,	4		4	
		Memoirs and applications,	1		1	
	German,		4		4	
	Drawing,		1		1	
Special instruction for	Infantry,	Theory of Drill, Manœuvers—3 Schools,	4	9		
		Practical Instruction,	3			
		Regulations,	2			
	Cavalry,	Riding,			3	12
		Theoretical and Practical Instruction,			7	
		Veterinary Art,			2	
Conduct				6		6
Total,				50		50

To facilitate this classification in order of merit, three distinct tables are prepared,—

The first relating to the general instruction;

The second relating to the military instruction; and

The third relating to the conduct;

and they respectively contain, one column in which the names of the students are arranged by companies in the order in which they have been examined; followed by as many columns as there are subjects of examination, for the insertion of their individual credit and the co-efficient of influence, by which each credit is multiplied; and lastly by a column containing the sum of the various products belonging to, and placed opposite each student's name.

These tables are respectively completed by the aid of the existing documents, the first for the general instruction, by the director of studies; the second for the military instruction, by the officer commanding the battalion; the third for conduct, under the direction of the commandant of the school, assisted by the second in command.

A jury formed within the school, composed of the general commandant, president, the second in command, the director of studies, and the officer commanding the battalion, is charged with the classification of the students in the order of merit.

To effect it, after having verified and established the accuracy of the above tables, the numbers appertaining to each student in the three tables are extracted and inserted in another table, containing the name of each student, and, in three separate columns, the numbers obtained by each in general instruction, military instruction, and conduct, and the sum of these credits in another column.

By the aid of this last table, the jury cause another to be compiled, in which the students are arranged in the order of merit as established by the numerical amount of their credits, the highest in the list having the greatest number.

If there should be any two or more having the same number of total credits, the priority is determined by giving it to the student who has obtained a superiority of credits in military instruction, conduct, general instruction, notes for the year; and if these prove insufficient, they are finally classed in the same order as they were admitted into the school.

A list for passing from the second to the first division is forwarded to the minister at war, with a report in which the results for the year are compared with the results of the preceding year; and the minister at war, with these reports before him, decides who are ineligible from incompetency, or by reason of their conduct, to pass to the other division.

The period when the final examinations before leaving the school are to commence, is fixed by the president of the jury, specially appointed to carry on this final examination, in concert with the general commandant of the school.

The president of the jury directs and superintends the whole of the arrangements for conducting the examination; and during each kind of examination, a member of the corps, upon the science of which the student is being questioned, assists the examiner, and, as regards the military instruction, each examiner is aided by a captain belonging to the battalion.

The examination is carried on in precisely the same manner as that already described for the end of the first year's course of study. And the final classification is ascertained by adding to the *numerical* credits obtained by each student during his second year's course of study, in the manner already fully explained, *one-tenth* of the numerical credits obtained at the examinations at the end of the first year.

The same regulations as to the minimum credit which a student must obtain in order to pass from one division to the other, at the end of the first year, which are stated in page 160, are equally applicable to his passing from the school to become a second lieutenant in the army.

A list of the names of those students who are found qualified for the rank of second lieutenant is sent to the minister at war, and a second list is also sent, containing the names of those students that have, when subjected to a second or revised examination, been pronounced by the jury before whom they were re-examined as qualified.

Those whose names appear in the first list are permitted to choose according to their position in the order of merit, the staff corps or infantry, according to the number required for the first named service, and to name the regiments of infantry in which they desire to serve.

Those intended for the cavalry are placed at the disposal of the officer commanding the regiment which they wish to enter.

Those whose names appear in the second list are not permitted to choose their corps, but are placed by the minister at war in such corps as may have vacancies in it, or where he may think proper.

The students who are selected to enter the staff corps, after competing successfully with the second lieutenants of the army, proceed as second lieutenants to the staff school at Paris. Those who fail pass into the army as privates, according to the terms of the engagement made on entering the school.

THE CAVALRY SCHOOL AT SAUMUR.

This school was established in 1826, and is considered* the most perfect and extensive institution of the kind in Europe,—perhaps the only one really deserving the title, the others being more properly mere schools of equitation.

It is under the control of the Minister of War, and was established for the purpose of perfecting the officers of the cavalry corps in all the branches of knowledge necessary to their efficiency, and especially in the principles of equitation,—and to diffuse through the corps a uniform system of instruction, by training up a body of instructors and classes of recruits intended for the cavalry service.

The instruction is entirely military, and is based upon the laws and regulations in force with regard to the mounted troops. It includes; 1st. The regulations for interior service; 2nd. The cavalry tactics; 3rd. The regulations for garrison service; 4th. The regulations for field service applied, as far as possible, on the ground, especially with regard to reconnaissances; 5th. A military and didactic course of equitation, comprising all the theoretical and practical knowledge required for the proper and useful employment of the horse, his breaking, application to the purposes of war, and various civil exercises; 6th. A course of hippology, having for its object practical instruction, by means of the model breeding-stud attached to the school, in the principles which should serve as rules in crossing breeds and in raising colts, to explain the phases of dentition, to point out the conformation of the colt which indicates that he will become a good and solid horse, the method to be pursued to bring the colt under subjection without resistance, and, finally, to familiarize the officers and pupils with all the knowledge indispensable to an officer charged with the purchase and care of remount horses. This course includes also a knowledge of horse-equipment, illustrated in the saddle factory connected with the school; 7th. Vaulting, fencing, and swimming. The non-commissioned officers are also instructed in the theory of administration and accountability. The course

* "Report of Observations in Europe during the Crimean War," by Major Gen. McClellan.

of instruction continues one year, commencing in the month of October. The pupils at the school are:—

1st. A division of lieutenants, (*lieutenants instructeurs.*)
2nd. " of sub-lieutenants, (*sous-lieutenants d'instruction.*)
3rd. " of sub-officers, (*sous-officiers élèves instructeurs.*)
4th. " of non-commissioned officers, (*brigadiers élèves.*)
5th. " of cavalry recruits, (*cavaliers élèves.*)

The lieutenants are chosen out of the regiments of cavalry and artillery, as well as from the squadrons of the park-trains and military equipages, from the lieutenants who voluntarily present themselves for the appointment to the General Board of Inspectors. Their age must not exceed thirty-six years.

The sub-lieutenants are appointed from the cavalry regiments, must be graduates of the Special Military School, not above thirty-four years of age, and have served at least one year with the regiment.

The sub-officers are selected from the cavalry corps—one from every two regiments of cavalry and artillery, and every two squadrons of the park-trains and military equipages.

The non-commissioned officers are chosen annually by the inspectors-general—one from each regiment of cavalry—from among those that show a peculiar aptness for equitation and are distinguished by good conduct, information, zeal, and intelligence; those who are recommended for promotion in their corps are selected in preference. Their age must not exceed twenty-five years, and they must have served at least one year in the ranks.

These pupils, numbering about four hundred, are sent to the school by order of the Minister of War. They continue connected with their corps, from which they are regarded as detached while they remain at the school. They receive additional pay. Those who after due trial are found deficient in the necessary qualifications, are sent back to their regiments.

Upon the recommendation of the inspector-general of the school, the officers who are serving as pupils, compete for promotion by choice with the officers of the corps from which they are detached.

The cavalry lieutenant, who graduates first in his class, is presented for the first vacancy as captain-instructor that occurs in the cavalry, provided he has the seniority of rank required by law. The lieutenant who graduates second obtains, under the same condition, the second vacancy of captain-instructor, provided his division consisted of more than thirty members. The sub-lieutenant graduating first, provided he is not lower than the tenth in the general classification of the officers of both grades, is presented for promotion to the first vacant lieutenancy that occurs in his regiment.

The non-commissioned officers who pass a satisfactory final examination, are immediately promoted to vacancies that have been preserved for them in their regiments—those who have graduated among the first ten of the class, being presented for promotion as sub-lieutenants, as soon as they have completed their required term of service as non-commissioned officers. Those who attend the school as non-commissioned officers, frequently return as officers for instruction, and again in a higher grade on the staff of the school.

Officers transferred from the infantry to the cavalry are generally sent to this school for a short time at least. The captains-instructor of the cavalry regiments, and the instructors of equitation in the artillery regiments, are mostly selected from the graduates.

The school also receives by voluntary enlistment, such young men, not above the age of twenty-one years, as desire to enter the cavalry service. They are not admitted until they have been subjected to an examination before a committee, by whom they are classified according to their fitness. These volunteer enlistments for the cavalry school are made at Saumur, at least a month before the commencement of the course, on presentation of the certificate of classification and of approval by the commandant of the school. The number is limited to fifty each year.

Such of these cavalry pupils as are distinguished for diligence and good conduct and pass a satisfactory final examination are transferred to the regiments of cavalry, for promotion to the rank of non-commissioned officers by their respective colonels. Those who have not been found fit for admission are sent back simply as privates.

A council of instruction is charged with the direction of the studies. They propose useful changes, and direct the progress of the studies. They are also charged with the examinations.

The recitations are by sections of about thirty each. In reciting upon the general principles of tactics, equitation, hippology, &c., the manner is as in our Military Academy; when reciting upon the movements in tactics, all the commands and explanations of the instructor to the troops are repeated "verbatim et literatim," and in the tone and pitch of voice used in the field. Perfect uniformity of tone and manner is required. The object of thus reciting is to teach the pupils the proper tone and pitch of voice, to accustom them to hear their own voices, and to enable them to repeat the text literally at this pitch of voice, without hesitation or mistake.

The course of hippology includes the structure of the horse, the circulation of the blood, organs of respiration, &c., food, working powers, actions, breeds, manner of taking care of him, ordinary ailments and remedies, shoeing, lameness, saddling, sore backs, sanitary police, &c., but does not comprise a complete veterinary course.

The practical exercises consist of:—the ordinary riding-hall drill, including vaulting, the "kickers," &c.; the carrière, or out-door riding at speed, over hurdles, ditches, &c.; cutting at head; target-practice; fencing; swimming; the usual military drills; skeleton squadron and regimental drills; rides in the country; finally, in the summer, frequent "carousels" or tilts are held.

The veterinary surgeons of the lowest grade are sent here upon their first appointment to receive instruction in equitation, to profit by the study of the model stud, and to learn the routine of their duties with the regiments. They form a distinct class.

In the *Model Stud*, the number of animals varies. There are usually two stallions and about twenty mares, (Arabs, English, Norman, &c.,) in addition to those selected from time to time from among the riding-animals. Attached to it is a botanical garden, more especially for useful and noxious grasses and plants.

School for Breaking Young Horses.—The best horses purchased at the remount dépôts are selected for the officers, and sent to this place to be trained. The number is fixed at 100 as a minimum. These, as soon as their education is complete, are sold or given, according to the orders of the Minister of War, to those officers who need a remount—in preference, to officers of the general staff and staff corps, those of the artillery, and mounted officers of infantry. These officers may also select from among the other horses of the school, with the approval of the commandant.

School of Farriers.—This is attached to the cavalry school, and is under the direction of the commandant. It is composed of private soldiers who have served at least six months with their regiments, and are blacksmiths or horse-shoers by trade. There are usually two men from each mounted regiment. The course lasts two years; it comprises reading, writing, arithmetic, equitation, the anatomy of the horse, thorough instruction as to all diseases, injuries, and deformities of the foot, something of the veterinary art in general, the selection of metals, making shoes, nails, tools, &c., shoeing horses. The establishment has a large shoeing shop and yard, a recitation-room, museum, and store-rooms. In the recitation-room there are skeletons of horses, men, &c., as well as some admirable specimens of natural preparations in comparative anatomy, a complete collection of shoeing-tools, specimens of many kinds of shoes, &c.—*Annuaire de l'Instruction* 1861, *and* "*Observations.*"

THE SCHOOL OF APPLICATION FOR THE STAFF.

AT PARIS.

DUTIES OF THE FRENCH STAFF.

The staff is the center from which issue and to which are addressed all orders and military correspondence.

The officers of the staff are divided into chiefs of the staff, sub-chiefs, staff-officers, and aides-de-camp.

The colonels and lieutenant-colonels are employed as chiefs of the staff in the different military districts of France, and in the divisions of the army on active service. The ordinary posts of the majors and captains is that of aides-de-camp to general officers.

When several armies are united together under a commander-in-chief, the chief of the general staff takes temporarily the title of *Major-Général*, the general officers employed under him that of *Aide-Major-Général.*

The duties of the chief of the staff are to transmit the orders of the general; to execute those which he receives from him personally, for field-works, pitching camps, reconnaissances, visits of posts, &c.; to correspond with the commanding officers of the artillery and the engineers, and with the commissariat, in order to keep the general exactly informed of the state of the different branches of the service; to be constantly in communication with the different corps, so as to be perfectly master of everything relating to them; to prepare for the commander-in-chief and for the minister of war, returns of the strength and position of the different corps and detachments, reports on marches and operations, and, in short, every necessary information.

The distribution of the other officers of different ranks, when it has not been made by the minister of war, is regulated by the chief of the general staff.

In every division of the army an officer of the staff is specially charged with the office work; the others assist him when necessary, but they are more usually employed in general staff duties, in reconnaissances, drawing plans of ground, missions, the arrangement of camps and cantonments, superintending the distribution of the rations, &c.

The officers of the staff may further be charged with the direction of field-works thrown up to cover camps and cantonments.

Staff officers of all ranks may be employed on posts and detachments. On special missions they command all other officers of the same rank employed with them. When a staff officer is charged with the direction of an expedition or a reconnaissance, without having the command of the troops, the officer in command concerts with him in all the dispositions it may be necessary to make to ensure the success of the operation.

The staff of generals of artillery and of engineers is composed of officers of their respective arms.

The war depot (*Dépôt de la Guerre*) was founded for the purpose of collecting and preserving military historical papers, reconnaissances, memoirs, and plans of battles; to preserve plans and MSS. maps useful for military purposes, and to have them copied and published.

It is divided into two sections—one charged with trigonometrical surveying, topography, plan drawing, and engraving; the other with historical composition, military statistics, the care of the library, the archives, plans, and maps. Each of these sections is under the direction of a colonel of the staff corps, who has under his orders several officers of his corps.

The war depot has taken a large share in the preparation of the map of France. The first idea of undertaking this important work dates from 1808. After various delays and difficulties, the trigonometrical survey, which had been for a time suspended, was recommenced in 1818. The work was placed under the war depot, intrusted to the corps of geographical engineers. Since this period the geographical engineers have been incorporated in the staff corps, by the officers of which the work has been continued. The primary triangulation was finished in 1845; the secondary is now finished; the filling in the details will occupy several years to come. The number of officers of the staff corps employed on the survey has varied from twenty-six to ninety.

THE STAFF CORPS.

The officers of the French staff constitute a distinct and separate corps, numbering thirty-five colonels, thirty-five lieutenant-colonels, one hundred and ten majors, three hundred and thirty captains, and one hundred lieutenants. None but officers of this corps can be employed on the staff. When, by accident, there is not a sufficient number present, regimental officers may be temporarily employed, but they return to their regiments as soon as officers of the staff corps arrive to replace them. The division of the staff into adjutant-general's and quartermaster-general's department does not exist in the French service.

The only means of entering the staff corps is through the Staff School of Application. Of the fifty student-officers which the School of Application usually contains, twenty-five leave annually to enter the staff corps, and are replaced by an equal number. Three of these come from the Polytechnic, the remaining twenty-two are selected from thirty pupils of the Military School of St. Cyr, who compete with thirty second lieutenants of the army, if so many present themselves; but, in general, the number of the latter does not exceed four or five.

The course of study in the Staff School of Application lasts two years. The students have the rank of second lieutenant. On passing the final examination they are promoted to the rank of lieutenant; they are then sent to the infantry to do duty for *two years*, at the expiration of which time they are attached for an equal period to the cavalry. They may finally be sent for a year to the artillery or engineers.

This routine can not be interrupted except in time of war, and even then the lieutenant can not be employed on staff duty until he has completed his *two years* with the infantry. However, officers who have a special aptitude for the science of geodesy or topography, may even earlier be employed on the map of France or other similar duty; and, further, two of the lieutenants, immediately on quitting the Staff School of Application, are sent to the war depot (*Dépôt de la Guerre*) to gain a familiarity with trigonometrical operations.

The General Officers at their Inspections are required to report specially to the Minister of War on the captains and lieutenants of the staff corps doing duty with the regiments in their districts, both as to their knowledge of drill and manœuvres, and their acquaintance with the duties of the staff. They are to require these officers to execute a military reconnaissance, never allowing more than forty-eight hours for the field sketch and its accompanying report.

Officers of all arms of the rank of captain or under, are permitted to exchange with officers of equal rank in the staff corps; but they must previously satisfy the conditions of the final examinations of the Staff College.

THE BUILDINGS AND ESTABLISHMENT.

The Staff School of Application is situated in Paris, in the Rue de Grenelle, close to the Invalides. Of the ninety officers attending it, sixty lodge in the building and thirty out of it, but all take their meals in the town. Each has, in general, a room to himself. Servants are provided in the proportion of one to about eight rooms. The officers are forbidden to have private servants.

The staff of the school is composed as follows:—

The Commandant, a General of Brigade.

The Second in Command, Director of the Studies, a Colonel or Lieutenant-Colonel of the Staff Corps.

A Major of the Staff Corps, charged with the superintendence of the interior economy and the drills and exercises.

Three Captains of the same Corps, charged with the details of the interior economy of the School, and to assist the Major in the instruction of the Officers in their military duties. The Captains are required to take the direction of a portion of the topographical works on the ground.

A Medical Officer.

Thirteen Military Professors, or Assistant Professors, viz.:—

A Major or Captain, Professor of Applied Descriptive Geometry.

A Major or Captain, Professor of Astronomy, Physical Geography, and Statistics.

A Major or Captain, Professor of Geodesy and Topography.

A Major or Captain of Engineers, Professor of Fortification.

A Major or Captain of Artillery, Professor of the instruction relative to this arm.

A Military Sub-Intendant, Professor of Military Legislation and Administration.

A Major or Captain, Professor of Military Art.

A Captain, Assistant Professor of Descriptive Geography; charged also to assist the Professor of Fortification.

A Captain, Assistant Professor of Topography; charged also to assist the Professor of Geography.

A Major or Captain of Cavalry, Professor of Equitation; he acts under the immediate orders of the Major of the College.

Two Lieutenants or Second Lieutenants of Cavalry, Assistant Professors of Equitation.

An Officer of Cavalry of the same rank, acting as Paymaster to the Riding Detachment.

The Non-Military Professors are:—

Two Professors of Drawing.

Two Professors of German.

A Professor of Fencing.

One hundred and forty-five horses are kept for the use of the student-officers, and eighty-two men belonging to the cavalry to look after them.

Both the studies and examinations at the Staff School hold an intermediate place between those of the Polytechnic and St. Cyr, being less abstract than the former, and higher and more difficult than the latter.

CONDITIONS OF ADMISSION.—ENTRANCE EXAMINATIONS.

The entrance to the Staff School of Application in France is, as is the case in all the French military schools, by means of a competitive examination, or, rather, by the results of three distinct examinations, and by the selection of different sets of successful candidates. *Three* are taken from the students leaving the Polytechnic, who have an absolute right to the three first places in the Staff School, and *twenty-two* are selected from the thirty best students leaving St. Cyr, and an equal number of sub-lieutenants of the line under twenty-five years of age, if so many present themselves. The sub-lieutenants must have one year of service in that rank, and they must make known their request to be allowed to compete for admission to the Staff School to the Inspector General, and, through him, to the Minister of War. It should be added, that their number is generally extremely small.

The usual number of young officers admitted yearly to the school in time of peace is twenty-five, but this number is sometimes considerably exceeded, and we found no less than ninety present. The *three* Polytechnic students select the Staff School after their final examination, and the St. Cyr students make known their desire when the whole are examined by a Board of Examiners, and the thirty best are then selected as competitors for admission into the Staff School of Application.

The sub-lieutenants also repair to St. Cyr, where they are examined separately by the same examiners who have just conducted the examination of the St. Cyr students, and in the same subjects.

Their marks or credits are then compared with those of the St. Cyr pupils; and the relative position of the two sets of candidates is ascertained, and the list of those to be admitted to the School of Application determined accordingly.

These examinations take place before a Commission of Officers, composed of,—

A Lieutenant-General President, appointed by the Minister of War.
The Director or Chief of the Dépôt de la Guerre.
The Commandant of the School of Application.
Four Colonels or Lieutenant-Colonels of the Staff, appointed by the Minister of War.
A Field Officer chosen from among the Officers employed at the Dépôt de la Guerre, as permanent Secretary.

This Commission is also charged with drawing up and proposing regulations for the approval of the Minister of War concerning the interior organization and the course of study to be followed in the school, and to make changes in the programmes for admission and for leaving the school.

A very detailed account of the subjects of the entrance examination is drawn out, and inserted in the *Journal Militaire*, and the *Moniteur* every year. The following are the subjects:—

(1.) Trigonometry and Topography.
(2.) Regular Topography—the measuring of plane surfaces and leveling.
(3.) Irregular Topography, Plane Trigonometry.
(4.) Military Art and History, including—
 (*a.*) History of Military Institutions at the chief periods.
 (*b.*) Present composition of the French army.
 (*c.*) Organization of an army in the field.
 (*d.*) History of some of the most memorable campaigns, as those of 1796—97 in Italy, and of 1805 and 1809, in Germany.
(5.) Artillery and Science of Projectiles.
(6.) Field Fortification and Castremetation.
(7.) Permanent Fortification.
(8.) Military Legislation.
(9.) Military Administration.
(10.) Manœuvres.
(11.) German Language.
(12.) Drawing.

The marks assigned and the influence allowed to each of these subjects are the same as those given in the final examination at St. Cyr. The entrance examination places the students in order of merit.

THE STUDIES.

All the details of the teaching are in the hands of a Council of Instruction, similar to that of the Polytechnic, and consisting of the General Commandant (President,) the Director of Studies, and three Military Professors, appointed yearly by rotation. Other professors and assistant professors, or officers of the staff of the school, may be called in to assist the Council, but (except in deciding the list at an examination) they have no votes.

This council does not interfere directly with the administration, the common work of the school. It draws up, indeed, the list of lectures, making any alterations in them, or in the books to be used which may seem from time to time desirable. But the officer accountable for the daily working of the school is the Director of Studies. His functions appeared to us to bring him into more constant connection with the pupils than was the case with the director of the Polytechnique. In all the schools the General Commandant and the Director of Studies live in the establishment; but at the *Ecole d' Application* and at St. Cyr the director "examines the methods of teaching, and proposes to the Council of Instruction any modifications or improvements which may raise or quicken the instruction. He inspects the work of the student-officers, both in and out of the school. He keeps a register of the marks given by the professors, and at the end of every three months brings the sum of them before the General Commandant in a detailed report." In fact, his school functions are not modified, as at the Polytechnic, by a body of able professors.

As already stated, there are fifteen professors, without reckoning those of equitation, and thirteen of them are officers; but the system of *Répétiteurs*, which we have seen so influential at the Polytechnic, does not exist here.

The hours of work are, in summer, *i. e.* from May to November, from six to five, and in winter from eight to five, with the exception of one hour for breakfast and one hour for *étude libre*, which appears to mean very little indeed. From seven to nine hours daily may be taken as the amount, but (as is the case with most French schools) there is a constant change, not only in the subjects taught but in part of the work being *out* and part *in* doors, some really head work, much purely manual. There does not appear to be the same intense application as at the Polytechnic; indeed, the work for three months in the year is almost entirely in the open air, consisting in making plans and military sketches, either in the neighborhood of Paris or in the more distant parts of the country; eight months are devoted to the in-door studies, one month to the examinations.

The in-door studies are entirely conducted in the halls of study (*Salles d'étude*,) in each of which we found parties of twelve or fifteen students seated. They are inspected constantly by the director or some of the professors. None of the regular work may be done in private. It seems everywhere a fixed belief in the French Military Schools that very much would be done idly and ill if done in private. This presents a striking contrast to the feeling on the subject in England.

The severer and preparatory studies of mathematics are supposed to have been completed prior to entrance into the Polytechnic or St. Cyr. Some, however, of the studies of applied science occupy considerable time at the School of Application.

The following analysis will show the time assigned to each branch:—

1. *Astronomy* occupies 1½ hours weekly for the pupils of the first year; afterwards it ceases entirely.

2. To *Applied Descriptive Geometry* a good deal of time is given, but still only by the pupils of the first year. 12 hours a week are spent upon it in the first half year, 10 in the second.

3. *Military Topography* occupies about 10½ hours in the first year, 6 in the second.

4. A good deal of time is devoted to *Field Fortifications.* The junior division, it is true, only begin it in their second half year of study, and then only work at it for 1½ hours weekly. But the senior division are occupied 4½ hours weekly in their first half year, and 7½ hours in their second.

5. *The Study of Military Administration and Legislation* is begun immediately upon entrance. It occupies during both years 1½ hours weekly.

6. *Lectures on Military Art and Tactics* are also given for 1½ hours weekly during both years, and after hearing these lectures the students are occasionally required to write a military memoir on a campaign, descriptions of reconnaissances, or of fields of battle, and to make sketches of ground with accompanying reports. This course was noted by General Foltz, the director of the school, as defective, on the ground that it was too difficult to find a teacher for, or indeed to teach military art; and he thought that lectures on military history, or such works as Napoleon's Memoirs, would be more useful to the pupils.

7. *Drawing* occupies throughout 4½ hours weekly, and great attention is bestowed upon it. We were shown a large number of works done by the young officers of the school. To enumerate some of the most important—there were specimens of objects, with shadows; perspective of the exterior and interior of buildings, with shadows; perspective views of country; machinery drawings, plan, section, and elevation; in fortification, a plan of comparison of a portion of ground with proposed field-works for defense; military bridges; reconnaissance, and memoir of a route, with accompanying notes and sketches, done both on foot and on horseback; plan of a portion of country made with a compass by parties of ten, under the direction of a Captain (for this the trigonometrical points and distances were furnished, and it was filled up by a minor triangulation;) plan of a field of battle, made without points; and a description of the battle.

These drawings were mostly executed with great care, and we were told that the course was fully as much as the student could accomplish in two years. Some parts of it are done entirely in the *Salle d'étude;* sketches are made on horseback in the neighborhood of Paris, always under the direction of the professors, others again at great distances, such as one at Biarritz last year, and the one on which the pupils are to be engaged this year, is the line of operations of Wellington from the Spanish frontier to Toulouse. The two last kinds of work are roughly sketched, and finished at Paris. These summer occupations seem to stand in place of vacations, of which there are none.

(1.) To *Fencing*, three hours a week are given throughout.

(2.) To the *Cavalry Drill* two hours weekly in the first division. It is replaced by *Infantry Drill* in the second.

The studies which none but the senior division pursue are,—

(1.) *Artillery* studies, which occupy 4½ hours weekly.

(2.) *Geography*, meaning chiefly the military geography of a country, with a few lectures on statistics and political economy; these take 1½ hours weekly.

(3.) *Geodesy*, or trigonometrical surveying, also for 1½ hours.

The only strictly literary occupation is the study of German for about three hours per week during the whole time. We were told that a large proportion of the pupils unite among themselves to learn English privately, but no public course is given.

THE EXAMINATIONS.

The students have two examinations to go through in each year; the first commencing about the first of June, the last in November, and each of the first year's examinations is held before a jury consisting of—

(1.) The General Commandant, or the Director of Studies; President.
(2.) The Professor of the Course examined in.
(3.) Two Officers appointed by the Council of Instruction.

The last examination in each year is, of course, the most important, inasmuch as the passage from the Second or Junior to the First or Senior Division, and in part from the Senior into the Staff Corps, is regulated by the results of these examinations; and the value allowed to the last examination in each year is just double of that assigned for the examinations in June.

The examinations of the first year are confined to the subjects of study followed during that year, viz.:—

Descriptive Geometry, Astronomy, Topography, Artillery, Fortification, Military Art and Administration, German, Drawing, Register of Notes and Memoranda.

The professors and members of the jury are directed rigorously to conform themselves to the following scale as regards the marks or credits they award for the oral answers, graphical representations, &c.

0	to 4	bad.
5	to 10	passable.
10	to 13	fair.
14	to 18	good.
19	to 20	very good.

The Co-efficients of influence of the various studies of the first year are as follows:—

Descriptive Geometry,	Theory,		4	9
	Geographical Representation,		3	
	Drawing of Machines,	Memoir,	1	
		Drawing,	1	
Astronomy,	Theory,		4	5
	Graphical Representation,		1	
Topography	Theory,		4	10
	Graphical Representation,		6	
Artillery,				4
Fortification,	Theory,		4	8
	Graphical Representation,		2	
	Memoirs,		2	
Military Art	Theory,		4	7
	Memoirs,	On various questions,	1	
		On surveys,	2	
Total,				43
Amount carried forward,				

Subdivision of the Co-efficients of the Graphical Representations.

Survey with compass,	1	6
Rapid sketch,	$1\frac{1}{2}$	
Itinerary of the first survey, / Itinerary of the second survey,	$1\frac{1}{2}$	
First Topographical Drawing,	$\frac{1}{2}$	
Second, with relief,	$\frac{3}{4}$	
Third, on the scale of $\frac{1}{20000}$,	$\frac{3}{4}$	

			Subdivision of the Co-efficients of the Graphical Representations.
Amount brought forward,		43	
Military Administration,	Theory, 4; Memoirs, 1	5	
Manœuvres,		2	
German,		4	
Drawing,		2	
Keeping of Memorandum Books,		1	
Conduct and Discipline,		1	
Riding and Knowledge of the Horse,		2	Riding, Hippology, 2
Total,		60	

As soon as the examinations are concluded, the Council of Instruction prepares a provisory classified list of the students, made out in order of merit from the credits or marks awarded by the Examining Jury in connection with the above-mentioned co-efficients of influence, in a similar manner to that already explained in the account of the Polytechnic School, the student with the largest numerical credit being placed at the head of the list.

This provisory list is submitted to the Consulting Committee of the Staff Corps for transmission to the Minister of War.

In order to pass from the Second or Junior into the First or Senior Division, every Student Officer must have obtained the following marks or credits from the Jury, viz.:—

In Astronomy and Geometry, six out of twenty in each.

In all other branches of theoretical instruction, four out of twenty.

In the classification of the graphical representations in topography, a mean of eight out of twenty, and in each of the other courses a mean of six out of twenty; and as the general result of his various works and of his examinations (the mean of the year being combined with the number obtained before the jury in the proportion adopted by the Council of Instruction,) he must have obtained a number of credits equal to one-half of the maximum (1,200.)*

Every Student Officer who in his oral examination before the Jury has failed in obtaining the minimum stated above is subjected to a fresh proof before the Consulting Committee of the Staff Corps, and if this is not favorable to him he ceases to belong to the school, and must return to his regiment, unless such failure can be attributed to an illness of forty-five days, in which case he may be permitted to double his first year's course of study.

If the second proof be favorable he is retained at the school, but

* There must be some error in the printed regulations on the subject.

placed at the bottom of the classified lists prepared by the Council of Instruction.

The co-efficients of influence for the second year are—

				Subdivision of the Co-efficients of the Graphical Representations, &c.		
Geography and Statistics,	Theory,	4	5			
	Memoir,	1				
Geodesy and Topography,	Theory,	4	10	Survey with the Compass,	1	6
	Geographical Representation,	6		Reconnaissance,	1½	
				Itinerary of the first survey, Itinerary of the reconnaissance	1½	
				Drawing of a Fortress and its Environs,	1½	
				Reduction of the Drawings,	½	
Artillery,	Theory,	4	8	First Drawing of a Military Bridge,	1	3
	Graphical Representation,	3		Second ditto,	½	
	Memoirs,	1		Breaching Battery	½	
				Drawing of Artillery Carriage,	1	
Fortification,	Theory,	4	11	Defilement,	1	3
	Graphical Representation,	3		Project of Fortification,	2	
	Memoir on a Fortified Place,	2½				
	Memoir on a Project of Field Fortification,	1½				
Military Administration,	Theory,	4	4			
Military Art	Theory,	4	8			
	Memoir on various questions comprised in drawing up a memoir,	2				
	Memoir on the survey with a Compass, or sketch reconnaissance,	2				
Manœuvres,			3			
German,			4			
Drawing,			2			
Keeping of Note Books,			1			
Conduct and Discipline,			1			
Riding and Knowledge of the Horse,			3	Riding,	2	3
				Veterinary Art,	1	
Total,			60			

The examinations of the students of the Senior or First Division is made in a similar manner to that already described for the Junior Division, but after they are concluded, and prior to these students being admitted into the Staff Corps, they are subjected to another examination before the Consulting Committee of the Staff Corps, consisting of—

3 Generals of Division on the Staff.
3 Generals of Brigade.

3 Colonels of the Staff.
5 Lieutenant-Colonels, including the Secretary.

The professors belonging to the school may be called in to assist at this examination, and when it is concluded the Consulting Committee proceeds to the definitive classification of the Student Officers of the First Division by causing the following documents to be placed before them, viz.:—

The register of the notes of each Student Officer.

Tables of the value of their work; the classified list of passage to the First Division, and the provisionary list for leaving, recently prepared by the Council of Instruction. The numerical credits obtained in these two classifications are added (each sum being halved) to the definitive classification prepared by the committee. The total is divided by two, in order not to exceed the regulated limit of 1,200 credits for the maximum.

Every Student Officer who, in this examination for leaving, has not obtained the half of the maximum number of numerical credits is considered to be inadmissible to the Staff Corps.

This classified list, prepared by the Consulting Committee of the Staff Corps, fixes the position of the Student Officers in order of merit, and according to this order of merit they enter the Staff Corps. The committee reports to the Minister of War the names of the Student Officers that are not eligible for the Staff Corps.

The first two or three places, we were told, are always remembered as marks of distinction, but the honor does not descend lower, as in the intense competition of the Polytechnic.

Students belonging to the First Division may also be permitted to double the second year's course of study on account of illness; but in no case can an officer be permitted to remain more than three years at the school.

MILITARY ORPHAN SCHOOL

AT LA FLECHE.

The *Collége* or *Prytanée Militaire* appears, in point of studies, to differ from the schools that have just been described, chiefly in its having only one department for the elder pupils, the scientific, with merely occasional subsidiary lessons in grammar and literature.

The institution is a school for boys between the ages of ten and eighteen; no one under ten or above twelve years old can be admitted: and no one can commence a new course at the school after completing his eighteenth year.

The prescribed instruction comprise the following courses:—

Humanities (Latin, &c.)
History and Geography.
German.
Mathematics.
Physical Sciences.
Natural History.
Figure Drawing.
Linear Drawing.

And the general object of the courses is to qualify the pupils to pass the examination for the degree of Bachelor of Science.

The pupils also go through military and gymnastic exercises, and learn to swim.

The school is under military discipline, is governed by a general officer of the staff corps or a colonel in active service, as commandant and director of studies, and by a lieutenant-colonel or major, with the title and functions of second in command and sub-director. In addition there are four officers, twenty-three professors and teachers, and eighteen *répétiteurs*.

The yearly charge for paying pupils is 850 francs, and the cost of outfit about 500 francs; but there are 400 free and 100 half-free places (400 *bourses* and 100 *demi-bourses*) granted by the state in favor of the sons of officers, the order of preference being regulated as follows, those who are orphans on both sides having the first claim, and those who have lost their father, the next:—

1. Those whose fathers have been killed, or have died of wounds received in action.
2. Those whose fathers have died in the service, or after retiring on a pension.
3. Sons of fathers who have been disabled in consequence of wounds received in action.

Sons of non-commissioned officers or of private soldiers who have been killed or have been disabled in action, who have been placed on the retired list, or have been discharged after twenty years' service, may also be admitted, as a special mark of favor.

The candidates undergo an examination, not, however, for the purpose of competition, but merely to show that they are qualified to enter the classes.

The school is inspected annually by a general officer sent by the war department, as also by an officer of the commissariat. There is no sort of engagement or expectation that the pupils should enter the military service. The nature of the studies holds out some inducement to them to compete for admission at St. Cyr or the Polytechnic; and in the examination for entrance at St. Cyr, it is stated that the sons of military men have the privilege of being raised fifteen places in the list of the order of merit. An officer's or soldier's son from La Flèche would, in case of 300 candidates being admitted to St. Cyr, be able to claim admission, if he came 315th on the list, to the exclusion of the candidate who stood 300th.

SCHOOL OF MUSKETRY.

The School of Musketry, formed by the Ministerial Order of 29th March, 1842, was only intended at first to supply instructors to the ten battalions of Chasseurs who were armed with rifles. The results of its establishment were, however, found so valuable, that the benefits of the instruction it afforded were by degrees extended to the whole army.

In 1845, the Duc d'Aumale, who had taken a special interest in the improvement of fire-arms and the better instruction of the soldier in their use, was nominated Inspector-General of Schools of Musketry. Besides the chief school at Vincennes, others were formed in the principal garrisons; and eventually a regimental School of Musketry was established in every regiment of infantry.

Some changes have been made in the system established under the Duke. The School of Musketry at Vincennes has only been regularly organized on its present footing since 1852. A portion of the fortress affords the accommodation required for the theoretical instruction, while the Polygon offers admirable facilities for practical instruction and target practice.

The Staff of the School consists of,—

A Commandant, a Lieut.-Colonel of Infantry.
An Instructor in Musketry, a Major of Infantry.
A Professor, a Captain of Artillery.
An Assistant Professor, a Captain of Artillery.
A Sub-Instructor in Musketry, a Captain of Infantry.

Each regiment sends an Officer (a Sub-Lieutenant or a Lieutenant) to Vincennes, to go through the course of instruction. The course commences on the 1st of March, and lasts four months. Two hours a day three times a week are devoted to lectures on the construction and use of fire-arms, and the theory of projectiles. Each officer is required to complete a certain number of drawings of the separate parts of arms. At the termination of the course, certificates are given, and, if favorable, go towards the officer's claim to be promoted "*au choix*."

We were conducted over the rooms of the fortress set apart for the school by the officer charged with the Theoretical Instruction (Captain Févre, of the Artillery.) They consist of a large paved room, where the officers perform their small-arm exercise in bad weather; of the study-room, in which the drawings are executed; of a lecture-room or amphitheater; of the library, chiefly supplied with technical works on arms; and of a model-room, containing a very good collection of French and foreign arms, and of portions of arms, to illustrate the lectures. There are, besides, private rooms for the instructors, and a room for the orderlies. On the ground floor a small forge has been fitted up for the purpose of giving practical instruction in some of the details of the manufacture of arms.

To produce accurate marksmen is not the only object of the School of Musketry. Its staff may be considered a description of standing committee, to whom inventions in arms and ammunition are submitted, to have their qualities practically tested. On the day of our visits experiments on the relative merits of three forms of balls were being carried on, which we witnessed.

Quitting the fortress by a bridge over the ditch, in an angle of which the Duc d'Enghien was shot, we entered on the Polygon or practice ground. In a few minutes two detachments of troops, one from the Chasseurs de Vincennes, the other from the 20th regiment of the line, arrived and took up their ground in front of the practice butts. Of the balls between which comparisons were to be made, one was proposed by M. Minié, who was himself present, another by M. Nessler, the third was named the ball "*de la garde.*" There were six targets in line in front of the butt; the Chasseurs fired at three of them, and the 20th regiment at the other three. A trench runs along parallel to the butts, and at a few yards in front of them. The line of targets is in the space between the trench and the butts. The trench gives cover to the range party, one of whom is stationed opposite to each target, in a rude recess cut into the side of the trench, to afford shelter in wet weather. Each time a target is struck, the man opposite to it raises his banderol, which is then seen by the firing party, and acknowledged.

The trench is continued to some distance beyond the butts, and is there met by another trench at right angles to it; so that one may go up from the firing party to the range party without any risk.

On the cessation of the firing, the officer in command of the range party numbered the hits in each target. He marked separately the hits where the balls had arrived sideways (shown by the form of the perforation,) a very important consideration in comparative experiments with oblong balls.

Prizes and honorable mentions are bestowed annually on the best shots. The number of the regiment and the names of the men thus distinguished are inserted in the official military journal.

MILITARY NAVAL SCHOOLS OF MEDICINE AND PHARMACY.

I. IMPERIAL MILITARY SCHOOL OF APPLICATION OF MEDICINE AND PHARMACY AT PARIS.

This school, which is located at Paris, at the military hospital of Val-de-Grâce, is under the control of the Minister of War. Its design is to introduce the pupils in the medical service of the army to an actual exercise of their skill, to complete their practical education, and make them acquainted with the regulations which govern the army in its relation to the sanitary service.

Admission to the School of Application as resident physicians and pharmaceutists, is gained by passing successfully a competitive examination. These examinations are held at Paris, Strasburg, and Montpelier, at uncertain periods, as the wants of the service may require.

For admission to the examination, the candidate for employment as resident physician must have his name enrolled in a bureau of military superintendence, and satisfy the following conditions:—1st. Be a native of France; 2nd. Be not above thirty years of age at the time of the examination; 3rd. Have received the degree of doctor of medicine from one of the medical faculties of the Empire; 4th. Be free from any infirmity that disables from military service; and 6th. Subscribe a pledge of honor that he will devote at least five years to the military sanitary service. The candidates are subjected to an examination in pathology, medical therapeutics, anatomy, and practical surgery. Candidates for the office of resident pharmaceutist must also be natives of France, be not above thirty years of age, have a diploma of pharmacy of the first class, be free from every disabling infirmity, pledge themselves to at least five years service, and pass an examination upon the materia medica, chemistry, and pharmacy.

During their continuance at the School, they receive a fixed annual salary of 2,160 francs, and an allowance of 500 francs for the first expense of uniform. After spending one year at the school and passing a satisfactory final examination, they receive the brevet rank of medical or pharmaceutical aid-major of the second class.

There is at Strasburg, in connection with the Medical School, a Preparatory School, designed to prepare for the degree of doctor of medicine the pupils belonging to the sanitary service of the army. It is annually supplied with pupils, who, without having passed the usual course of matriculation, are enabled to satisfy the conditions requisite for admission to the first grade of a doctorate. Every pupil of the preparatory school, has the right of admission to the Imperial Military School of Application.—*Decrees of* 13*th of Nov.*, 1852, *and* 28*th of July*, 1860; *Acts of* 18*th of June, and* 15*th of October*, 1859, *and* 4*th of August*, 1860.

II. IMPERIAL NAVAL SCHOOLS OF MEDICINE AND PHARMACY.

These schools, located at Brest, Toulon, and Rochefort, are under the control of the Minister of the Marine; their design is to prepare sanitary officers for service in the vessels of the imperial marine.

The posts of surgeon, or pharmaceutist, of the third, second and first classes are assigned on examination, according to order of priority determined by a medical jury. For admission as student in these schools, after attaining to the first grade of the third class, it is necessary to be at least sixteen years of age, and not above twenty three, to produce a diploma as bachelor of sciences, to prove French nationality, and to be exempt from every infirmity that can cause unfitness for the marine service. Examinations for filling the vacancies in each school commence on the 1st of April, and 1st of October, annually.

The instruction is continuous. The libraries, cabinets of natural history, the botanical gardens, anatomical theaters, chemical laboratories, cabinets of natural philosophy, are at the disposition of the students. The candidates admitted, receive cards of membership. They are required to pay the treasurer of the library a sum of 50 francs, which is devoted to its maintenance.—*Ordinance of* 17*th July*, 1835, *and* 15*th May*, 1842.

THE IMPERIAL NAVAL SCHOOL AT BREST.

This school, located at the Road of Brest, on board the ship "*La Borda*," and under the control of the Minister of the Marine, is designed for the instruction of youth destined for the corps of state naval officers. Candidates are admitted to this school after a public examination, which occurs annually. For admission to the examination, they must prove; 1st. By the production of the records, that they are French by birth or naturalization, and that on the 1st of January of the year of the examination, they were at least fourteen years of age, and had not passed the maximum of seventeen years; 2d. By the certificate of a physician, that they have been vaccinated, or have had the small-pox, and that they have no infirmity that disables them from the performance of marine duty.

The matriculation of the candidate is effected between the 1st and 24th of April, at the prefecture of the department in which the domicil of the family is located. The examination is made at the principal office for examination nearest to that domicil, or to the college where he has been educated; the choice as regards the place of examination must be made known at the time of matriculation.

There is required for admission into the school, a knowledge of arithmetic, algebra, geometry, plane trigonometry, applied mathematics, natural philosophy, chemistry, geography, the English language, and drawing, in conformity with the course of study pursued at the lyceums. The candidates must prepare a French composition, a translation from the Latin, an exercise in English, a numerical calculation in plane trigonometry, a geometrical drawing, and the off-hand sketch of a head. These compositions are done at Paris, and the principal towns of the departments simultaneously, on the 2nd and 3rd of July. The oral examinations are commenced at Paris on the 2nd of July, and repeated at the other towns in succession as previously announced. The oral examinations are of two grades; the lowest serving to determine whether the candidates are sufficiently well prepared for admission, the higher—to which only those are subjected, who have successfully passed the first—being the decisive one, and together with the compositions, determining the final classification in accordance with the order of merit.

The course of study continues two years, which are passed at the Board of Brest on the ship "*La Borda.*" The expense of board is 700 francs, and of the outfit, about 500 francs. A grant of the whole or half of the amount of the expense, may be made to young men without fortune. The insufficiency of the resources of a family for the maintenance of a pupil in the school, must be authenticated by a resolution of the municipal council, approved by the prefect. There may also be allowed to each beneficiary, at his entrance into the school, the whole or the half of his outfit. Application for this assistance must be made to the Minister of the Marine at the matriculation of the candidate.

The pupils that have passed the examinations of the second year in a satisfactory manner, are known as naval candidates of the second class.—*Law of 5th June*, 1850—*Decree of 19th January*, 1856—*Acts of Sept.*, 1852, *and 1st January*, 1861.

SCHOOL OF MILITARY GYMNASTICS NEAR VINCENNES.

THE practice of gymnastics is an essential part of the training both of officers and men in the French army, and constitutes a portion of the regular exercise in every military school. There are also several schools specially devoted to this department of physical education, and one styled the Imperial School of Military Gymnastics at the Redoute de la Faisanderie, part of the fortifications near Vincennes, may be regarded as the Normal School for training both officers and privates in order to act as monitors or instructors in their respective regiments and battalions. The following account of the instruction given, is abridged from an article in the *New York Tribune*, under the heading, "How the French and the English make their Soldiers." The writer says that Military Gymnastics, in the form and to the extent taught in this school, is exclusively French, and is thought to have an important bearing on the more frequent and deadly use of the bayonet in future warfare.

About three hundred privates and officers compose the School of Military Gymnastics near Vincennes, where three professors of the science and art of gymnastics give a course of practical instruction for about six months each year. The school is under the same regulations as the School of Musketry—each colonel being responsible for the instruction of his regiment, and the lieutenant-colonel directs the application of the rules and regulations.

I. ELEMENTARY GYMNASTICS.

The gymnastic exercises are divided into "elementary gymnastics," and "gymnastics applied," that is, applied to special military purposes. A general progression regulates all the exercises.

The men are divided into three classes. The third class comprises all the recruits. These are exclusively practiced in the first lessons of elementary gymnastics during the first fortnight of their enlistment, and before they proceed to regimental drill. The first class consists of those who are proficient in the first four lessons of the general progression; and the second class, of those who are preparing for the first. The first class practices twice a week; the second, three times a week; the third class twice a day, until the men have commenced their regimental drill, and then once a week. Each practice lasts one hour and a half. "Returns" are drawn up recording the zeal and progress of the men, as in musketry instruction; and the captain instructor of gymnastics has to send in, every month, to the lieutenant-colonel, similar returns as to the general progress of the instruction, so that the number of effectives of each company may be accurately known.

None but the prescribed exercises are permitted by the instructor. He must never allow the men to attempt any extraordinary or exaggerated feats, that might cause accidents. His aim must be to develop the strength, agility and dexterity of the soldier by a wisely regulated exertion, and inspire him with that self-reliance which the various occasions of his military life may demand. He must strive to rouse his pluck and emulation by rendering the exercises as agreeable and as easy as possible, taking all necessary precautions to prevent him from injuring himself or becoming discouraged. He must never forget that the perfect safety of the soldier under training, the pleasure of the various exercises, and, above all, the soldier's own desire to excel, are the first and secret elements of success in gymnastics. Harsh treatment must be carefully avoided, much more anything like turning his efforts into ridicule when he fails, or punishing him for involuntary awkwardness. In conclusion, he must not expect more than regularity, precision, and relative perfection in these exercises, to which a military form has been given merely to facilitate their study and their application to the whole army.

The men practice in their fatigue dress, in squads of ten or fifteen, and are provided with belts.

The first exercises are intended to make the body supple from head to foot, turning the head from right to left, forward and backward, or merely toward right and left, bending the body, raising the arms vertically, with and without bending them; flinging out the right or left arm, fists clenched, and describing a circle of which the arm is the radius.

No soldier marches so easily as the French. It is the result of his method of learning to march. In the moderate and quick cadence the foot comes flat to the ground, the point of the foot touching it first; in the running cadence the movement is an alternate hopping on the points of the feet. It is obvious that this mode of teaching to march must enable the soldier to avoid the great cause of universal bad marching and walking, namely, bringing the heel to the ground, thus shaking the whole body, especially the spine, and consequently distressing the brain and lungs. By the great elevation of the legs the soldier must habituate himself to bringing the toes first to the ground, instinctively, to avoid the shock, especially in the running cadence. During the practice the soldier repeats the words "*one—two*," as each foot comes to the ground, in order to practice the lungs at the same time, and also to give a rhythm to the performance.

In order still more to direct locomotion to the fore-part of the foot, so essential to good and easy marching, there is the following practice:—1. Attention. 2. Flexion of the lower limbs. 3. Commence. 4. Cease. At the second command the soldier brings both feet together, throwing the weight of the body forward. At the word *commence*, he slowly lowers his body by bending his hams, so that the thighs touch the calves of the leg, the arms falling beside the body, the weight of the body being entirely thrown on the points of the feet. He then gradually rises to the erect position.

There is also what is called the "gymnastic chain." Circles are traced on the ground contiguously; the men are posted in these circles, in a single rank, three paces apart. The instructor commands:—1. Squad will advance. 2. Double. 3. March. 4. Halt. At the first word the soldier throws the whole weight of his body on the right leg. At the word *march*, he throws the left foot smartly forward, the leg slightly bent, bringing the point of the foot to the ground, thirty-nine inches from the right, and so in like manner with the right, always keeping the weight of the body on the leg which feels the ground, allowing the arms to take their natural motion for equilibrium. The first man (a monitor, one of the best trained) runs successively through all the windings of the chain of contiguous circles without stopping; the others follow, preserving the distance. When the men meet each other at the intersections of the circles, they shorten or lengthen the pace, so as not to jostle each other, and so that two men shall not pass by the same interval.

To deliver a thrust or a blow with the bayonet, sword, or fist to the best advantage, requires training of the subsidiary muscles, and such scientific practice as places the body in the best position to aid and intensify the effect. This is done by the "Pyrrhic Exercise." The command is:—1. Pyrrhic Exercise (right or left limb forward.) 2. Ready. 3. March. 4. Halt. At the word *ready*, the soldier faces to the left, carries the right foot forward, the heel sixteen inches from the hollow of the left foot, the right knee bent, the left leg stretched, the right arm extended forward, the fist clenched, on a line with the shoulder, the nails slightly upward, the left arm in a line with the left side and but little bent, fist clenched, and about six inches from the thigh, the nails toward the thigh, the upper part of the body inclined forward, the head erect, the eyes looking to the front, the left shoulder lowered. At the word march, the soldier straitens his body, bringing the right heel near the hollow of the left foot without touching the ground, turns at the same time his right forearm, so that describing a circle from below upward, the fist lightly touches the right breast, then flinging the fist smartly forward, the nails a little upward, and advancing the right leg to about twenty-five inches, the foot striking the ground with force, or an "attack," as we call it in sword exercise, the upper part of the body inclining forward, the left leg stretched, the foot flat, the left arm turned outward and along the thigh as before. These movements are continued until the words "company—halt" are given, when the soldier faces to the right and comes to attention. The left arms are practiced in like manner, and a rhythm is given to the performance by the repetition of the numbers 1, 2, 3, by the soldier.

A soldier must not be easily knocked off his legs; so there are six positions for the practice devised to teach the soldier how to maintain his equilibrium. He stands alternately on the right or left leg, bending the other against the body with his locked fingers, or he stands on one leg, the other bent behind, or he comes slowly to the kneeling position and springs up smartly, flinging his arms suddenly above his head, the nails turned inward, and then comes to attention, or he bends forward on one foot, or backward in like manner, and to the right or left, all on one foot.

The elementary development of the muscles forms a most important part of the training. By word of command the soldiers strike their breasts with the right or left fist—strike out with the right and left as in boxing—support cannon balls in the hand, one or both arms extended, and hurl the balls to a distance. They fling an iron bar, held by the middle; they support a heavy club in every possible position, at the shoulder, behind the back, one with the left hand, another with the right, at right-angles, or two together, one in each hand. They swing the club horizontally and overhead, or vertically and behind, or round and round the body.

Preparatory to leaping. the proper muscles must be taught their necessary contractions, and this is done to the words of command—"Simultaneous flexion of the legs," "Simultaneous flexion of the thighs and legs," whereat they hop on the right or the left leg singly, and then on both together. They are practiced in advancing on the position of kneeling on one leg alternately, obviously a very useful mode of progression for a skirmisher in stealthily changing position behind a low wall or a hedge.

They are taught to walk systematically on the heels alone and on tiptoe, and to fling a cannon ball with the foot by means of a strap attached to it. As practice alone can habituate us to the proper inclination of the body in ascending and descending, both these modes of marching are carefully taught, attention being fixed to throwing the weight of the body on the point of the feet in the former, and on the heels in the latter.

Their wrestling takes every shape and mode of contest. With extended arms, the fingers interlocked, the left leg advanced, they push against each other; or, holding each other by the hands or by the wrists, they pull against each other; or, each man holding his left wrist with his right hand, the thumb underneath, seizes with his left hand the wrist of his antagonist, and then at the word "wrestle," he pulls or pushes uniformly or by jerks, to the right, to the left, forward, to the rear, upward and downward, striving to displace his antagonist.

Furnished with appropriate handles, with a short cord attached, they pull against each other, each striving to drag his antagonist with one hand, then with both hands; and then three wrestle together in like manner, the central man pulling or resisting the outer two, or both of these pulling against him in opposite directions.

Then two wrestle in a sitting posture. They sit, closing the legs, feet to feet, and sole to sole, with the aforesaid handle and cord between their feet, and at the word of command pull away, striving to raise each other. As soon as one is raised the contest ends, and the victor holds the handle in his left hand. The instructor then makes all those wrestle together successively who have won the handle, until only two remain, and then ascertains the strength of these two by a dynamometer, and makes a note of it.

The last of the elementary exercises are those of traction, or drawing against each other, holding on by a rope, either in pairs, or several together pulling against a fixed point, which may be a dynamometer, indicating the force of the combined pull resulting, or the men are divided into two squads and pull against each other.

As most of these exercises admit of a rhythm or cadenced sound emitted by the men themselves, this vocal accompaniment is strongly recommended. It certainly gives additional animation to the scene. Indeed the cultivation of the voice is considered eminently essential in the course of gymnastics. Singing exerts a salutary influence on the chest, and, moreover, it is incontestable that it will be the means of powerfully acting on the *morale* of the French soldier, by teaching him songs of patriotic and martial import. The singing-lesson at which I was present was particularly interesting. The system is one recently invented, wherein the ordinary notes are represented by arithmetical numbers—thus occupying about one-third of the usual space. Pointing by means of two canes to each representative number is all that is required by the instructor. The pupils, about 300 men and officers, intoned the notes with admirable precision. When the instructor opened out the canes they made a crescendo—swelling to the loudest—and when he closed them gradually it was a beautiful diminuendo, "in linked sweetness long drawn out." There was then sung a concerted piece in two parts, extemporized by the highly-gifted Commandant, who figured it on the blackboard. It was at once most accurately sung—first and second so admirably concerted that the whole seemed as it were an organ of human stops—alto, tenor, and bass most harmoniously blending.

Such are the elementary gymnastics of the course.

II. APPLIED GYMNASTICS.

The exercises of applied gymnastics must be directed with extreme prudence. Care must be taken by the instructor that the emulation of the pupils should not degenerate into a spirit of rivalry, instigating them to dangerous efforts.

During cold weather they must abstain from executing leaps that require violent efforts; at all times those who are not perfectly disposed should not be required to leap at all. Carelessness and inattention to the rules can alone cause those accidents apprehended in these exercises.

The dimensions of the obstacles to be leaped over must be gradually increased; but no downward leap must ever exceed sixteen feet—five meters. Such is the regulation; but really to leap down sixteen feet seems no small matter, considering that the height of an ordinary room—some ten or twelve feet—would make the nerves tingle if we had to leap down that height; however, the French soldiers perform such leaps with ease, and therefore we must conclude that all Anglo-Saxons here or elsewhere can "go and do likewise."

The words of command are: 1. Attention. 2. Forward—leap—one, two, three. At the second word, the man closes the points of the feet; at the word one, he stoops on his lower extremities, slightly raising the heels and stretching his arms to the rear, the fists clenched; he then rises again, the arms hanging naturally down. At the word two, he repeats the movement; at three, he recommences the same movement, stretches the hams vigorously, throwing his arms forward, leaps the distance, or over the obstacle, falls on the point of his feet, stooping down, and then comes to attention.

The same principle is observed in all leaping, whether to a height, downward, or forward and downward—the only difference being in the position of the arms. In leaping upward, the arms are flung overhead to aid the ascent—the same in a downward leap; but if the leap be forward and downward, the soldier begins with his arms in advance, and then places them perpendicularly for the fall. The reverse takes place when in leaping forward and upward.

Thus they practice leaping in every possible direction—upward and downward combined—upward, forward, and downward—to the right or to the left—to the right and to the left and downward combined—the arms being directed accordingly. They leap backward precisely in the some directions, and according to the same rules. In leaping backward from the top of a wall, the man first takes a glance at the descent, turns, closes his feet—the heels projecting over the wall, stoops—the upper part of the body being forward, places his hands outside his feet and seizes the edge of the wall, the four fingers above, the thumb underneath, and thus flings himself backward, his arms overhead. When there is width as well as depth in the backward leap, the body and the legs are flung off almost horizontally.

The running leap is performed in a similar manner—the run being quickened more and more up to the moment of springing forward. Some of the leaps I saw performed were from fifteen to twenty feet. As a complement to these leaping exercises, the ground may be prepared with various objects to leap over, such as benches, tables, heaps of stones, &c.

The men are also progressively practiced in all these leaps, carrying their arms and baggage. In such cases the downward leap must be restricted to thirteen feet. The soldier holds his rifle balanced at the trail with the right hand, the muzzle slightly raised, so as to prevent it from touching the ground; he holds his sword (as the French soldier has a sword) with his left hand. When the soldiers have become familiar with leaping, the difficulty is increased by rendering movable first the point of departure, and then the point of the fall, and, finally, both these points are made movable. To leap from a body in oscillation, the soldier leaps at the moment when the body is sinking. There is great danger in leaping from an object in rapid motion. In case of necessity, the soldier must face in the direction of the motion, and at the moment of quitting it he must lay hold of it, shortening his arms, and so push himself backward, lengthening his arms.

It is a general principle that in leaping from a height of any extent, the soldier should avail himself of anything at hand to diminish the shock of the fall.

The circumstances in which leaping must be resorted to are often unforeseen, and require prompt decision; it is therefore important that the men should be taught the following principles—useful to everybody—to apply them spontaneously on all occasions:—

First. To form a rapid judgment of the obstable, and also of the ground on either side. We scan the ground in advance of the obstacle, in order to make a good choice of a footing for the leap; if the ground is too smooth the foot may slip; on soft ground there can not be a good footing for the leap. By scanning the ground beyond the obstacle, we select our landing-place, and we foresee what difficulties we shall meet with. A difference of level between the point of departure and the fall modifies considerably the extent of the leap.

Second. During the leap the breathing must be restrained, and the air with which the lungs have been previously filled must be expired the moment the man reaches the ground.

Third. In leaps in width and height, fling out the clenched fists in the direction the body is to take, so as to augment the impulse given by the legs.

To prove the utility of this principle, the men, in leaping, sometimes hold in each hand a grenade of two-pounds weight, or a four-pound shot; with this auxiliary the width of the leap is augmented.

Fourth. In downward leaps, raise the arms vertically as soon as the body begins to descend, in order that the body, reaching the ground on the point of the feet, may sink vertically without losing its equilibrium. If a man leaps into water, he places his arms at his side, his hands on his hips, the feet close together, the points of the feet lowered, the body stiff and rigid.

Fifth. During the whole time of the leap keep the arms in the parallel position they have at its commencement, in order to preserve the equilibrium of the body.

Sixth. In forward or wide leaps incline the body forward, in order that the oblique action of the legs on the body may be more efficient.

The recommendation to precipitate the last movements of the run preceding the leap, has the important advantage of enabling the soldier to incline his body as much as possible.

Seventh Fall on the point of the feet, the legs being close together, bending all the articulations of the body from above downward, in order that the shock be not transmitted to the head without being lessened and attenuated by numerous decompositions of the force. The articulations of the feet concur efficaciously with this result, and it would be dangerous not to avail ourselves of them by falling on the soles of the feet, especially the heels, as previously explained.

Eighth. Avoid too rough a fall by giving to all the articulations a general and supple "setting up," so as to make a light bound on landing.

Ninth. On landing avoid all useless motion, allow the muscles to relax; their continued contraction and rigidity would interfere with the body's equilibrium.

They also practice leaping with poles. These are of different dimensions, beginning with the smallest—not longer than the rifle—and finished with long ones from nine to twelve feet in length. He then seizes the pole higher or lower, according to the distance of the leap. Of course perfect success in this exercise depends greatly upon the energy of the effort, and the long and rapid run by which it is preceded. They also leap with two poles together from a height, the poles being planted parallel and about two feet apart.

Suspension-bars are made subservient to the training of the French soldier. This exercise enables him to use his body as he pleases, in any possible position, provided he can get hold of anything. Its beautiful and splendid result is extraordinary strength of arms, legs, hands, and fingers. Indeed, these suspensions of the body by the hands, the elbow, the legs, by one hand, one leg, one finger, in every possible position, show how the men are prepared for the thousand casualties of the assault.

They climb ropes after the manner of sailors, and horizontal beams are raised at various heights from the ground, in which they learn to preserve a perfect equilibrium—sitting, moving along them by the hands, supporting the body, which is free to fall, and, finally, walking erect upon them like a rope-dancer without his balance-pole! In these ticklish positions they meet and pass each other—simulate a fall and recover; the beams may be inclined or even set in motion, it matters not—they hold on and do their work equally well—and drop to the ground without injury.

They are taught to pick their way over scattered stones or stakes driven into the ground; and it has even been thought expedient to teach them how to walk systematically on stilts.

They are taught swimming—all its necessary movements before they go into the water; and many, I was told, strike out at once, at the first trial, thus proving the physiological or anatomical efficacy of the well-considered mode of tuition. In the water they are practiced in performing the feats required in actual warfare, carrying their arms and accoutrements in a variety of ways, according to the supposed circumstances of the campaign.

Of course, if the men are taught to swim they must be sent regularly into the water. This regulation, therefore, insures personal cleanliness—the first rule of health, which is much needed in all armies. The morality of most armies is generally above the average; it should naturally be less—as nothing conduces more to long life than exercise, regular hours, and a rational discipline, But cleanliness, personal cleanliness is wanting, and we have to deplore the consequences.

With a view to escalading, the French soldier is assiduously trained in all the shifts of ladder-mounting—with ladders of wood and ladders of rope—and he becomes as good as a sailor in pulling himself up a rope, either looped, knotted, or smooth, from the ground to any reasonable or unreasonable height. If a scaling-ladder be not at hand, a tent-pole or any pole will do to enable him to get to the top of a wall or the crest of a parapet. He is actually taught nine different modes of performing this achievement so flattering to the ambition of the French soldier.

The scaling of a represented turrėt was something beautiful to see. "In the twinkling of an eye" or "done in no time," can alone describe the rapidity of the exploit.

Every appliance may, however, be wanting on certain occasions in war—it matters not—the French soldiers are taught how to mount a wall without any instrument whatever—with their feet and the hands and the fingers alone. Bullets and cannon balls leave holes and indentations in the hardest walls—these are represented on the walls of the Gymnasium—and thus they practice this last resort of the resolute and determined besiegers. If there be no holes—no *points d'appui* for the ascent—what then? Why, then they build a *pyramid of men*—four men stand as a base, two or four more perch themselves on the shoulders of these, and then one mounts to the top on the shoulders of the latter by way of apex!

They have adopted all the fetes of the *trapèze*, as performed by acrobats. These tend to strengthen the arms and promote that self-reliance and confidence which are the prime elements of a good soldier. Some of their swinging leaps with the *trapèze* were prodigious, from one end of the long gymnasium to the other, where they alighted, and caught on the top of the wall, and descended to the ground, with hands and fingers, by mimic bullet holes, as before described.

Flying leaps on and over a wooden horse are practiced in every possible direction, and the French cavalry are required to be able to leap on their horses from the rear while galloping, and to leap over a hedge or barrier together with the horses, but on foot, holding the reins! It is impossible to believe that very many can do this; but that is the aim, and the higher the aim the greater the effort, and something worth having is sure to be done, even if we fail of the highest attainment.

The most laborious of the practices is probably that of carrying, at the top of their speed, all the implements of war, fascines, sand-bags, gabions, projectiles, &c., whose weight is progressively increased from twenty to fifty pounds. They must also practice carrying ladders, beams, caissons, dragging gun-carriages, &c., and they are equally habituated to carry rapidly and skillfully the wounded from the field of battle, by placing men on litters, or any substitute at hand, in the gymnasium.

Sword exercise, bayonet exercise, boxing and fencing are also taught, but only the rudiments. In the regiments and battalions they have more opportunities of perfecting themselves in these accomplishments.

Such is a succinct account of the military gymnastics of the French. The 300 various fetes and practices have only one object in view, preparation for the possible and probable casualties of war, but they have, meanwhile, the positive and immediate effect of giving the men the utmost freedom of motion, *aplomb*, self-reliance, and that very useful self-estimate in the soldier, namely, that he is superior to every other in the world. It will take a vast deal to knock that conceit out of him.

REMARKS ON FRENCH MILITARY EDUCATION.

THE English Commissioners in their Report on "The best Mode of Reorganizing the [English] System of Training Officers for the Scientific Corps, together with an Account of Foreign and other Military Education," close with the following general remarks on French Military Education :—

THE following summary may close our account of French Military Education.

1. The French army combines a considerable proportion of officers professionally educated, with others, who form the majority, whose claims to promotion consist in their service, proved ability, and conduct. One-third of the officers in the line, two-thirds of those in the scientific corps, and the whole of the staff, receive a careful professional education; the remainder are taken upon the recommendation of their superior officers, from the ranks. But it was stated to us expressly that such officers do not often rise above the rank of captain.

2. There are no junior military schools in France, and no military education commences earlier than sixteen. This is the very earliest age at which pupils can be received at the Polytechnic or at St. Cyr, and the *usual* age is later; whilst in the case of the Special Corps, strictly professional education does not begin till twenty or twenty-one. The best preparation for the military schools is found to be that *general* (in France chiefly *mathematical*) education which is supplied by the ordinary schools of the country, directed as these are and stimulated by the open examinations for admission to St. Cyr and the Polytechnic.

3. The professional education for commissions in the line is that given at the school of St. Cyr. A fair amount of mathematics is required at entrance, but the chief instruction given at the school is of a professional character. Active competition, however, which is the principle of all French military education, is kept up amongst young men educating for the line by the competitive entrance to the school, by the system of examinations pursued in it, and in particular, by the twenty-five or thirty places in the Staff School which are practically reserved for the best pupils on leaving.

4. In the Staff School itself the competitive system is acted upon; there are strict examinations, and the pupils are ranged in the order of merit on leaving the College.

5. The officers of artillery and engineers may be said to be in quite a peculiar position in France, owing to the high education given at the Polytechnic School. The consequence is, that the preparatory education of French artillery and engineer officers is of the highest scientific character. We have already spoken largely on this point, and need do no more than allude to it.

6. We may remark, that preparatory military education in France is mainly mathematical—at the Polytechnic almost wholly so. The literary and classical elements, which enter so largely into all education in England and Prussia, are in French military education very much thrown aside. Lectures in military history and literature are said, however, to succeed at St. Cyr.

7. The system of State foundations (*Bourses*) existing in the Polytechnic and St. Cyr, and affording a curious parallel to the military foundations in the Austrian schools, requires some notice. Every pupil, in both the Polytechnic and St. Cyr, who can prove poverty, is entitled to State support, either entire or partial. At the present time, not less than one-third of the students in each of these schools receive such maintenance. The system of civil *Bourses* is of old standing in France; most of these were destroyed at the Revolution. They were renewed and greatly devoted to military purposes by Napoleon. The extent to which they are given may seem excessive, but it must prove a powerful incentive and assistance to talent.

8. It has been remarked that there is comparatively little practical teaching in the School of Application for Artillery and Engineers at Metz. But a very extensive practical training is in fact supplied to these officers after they enter the service, remaining as they must do with the troops until promoted to the rank of second captain, and subsequently being employed in the arsenals, workshops, fortified places, &c.

9. The French have no "senior departments" for military education. In this respect their practice differs from that of England and Germany.

PART II.

MILITARY SYSTEM AND SCHOOLS IN PRUSSIA.

AUTHORITIES.

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MILITARY SYSTEM AND EDUCATION IN PRUSSIA.*

I. OUTLINE OF MILITARY SYSTEM.

According to the law of the 3rd of September, 1814, which is the basis of the present military organization of Prussia, every Prussian above twenty years of age, is bound to service in arms for the defense of his country.

The military force of the country is made up of three distinct bodies, and the whole of the adult male population is distributed among them. It consists of,—

I. The Standing Army.

II. The National Militia or *Landwehr*, divided into two portions, viz., the first *Landwehr* and the second *Landwehr*.

III. The Last Reserve or *Landsturm*.

I. The standing army is composed of all young men between twenty and twenty-five years of age. The period of service in time of war is for five years, but in time of peace the young soldiers can obtain leave of absence after three years' service;—they belong for the remaining two years to what is termed the "reserve," receiving neither pay nor clothing, and they are subject to be re-called if war should break out.

Encouragement, indeed, is given and advantages held out to induce men to stay, and to take a new engagement for an additional term of six years; but it is said that only a small number are thus obtained. The bulk of the troops are men serving for this short time; and there are many, it should be added, whose term of service is even yet shorter. For all educated young men, all, that is, who pass a certain examination, are allowed, on condition that they pay for their own equipment and receive no pay, to shorten their service from three years to one. This privilege appears to be very largely used. It should also be stated, that young men of any class may volunteer to perform their service at any age after seventeen.

The Prussian standing army amounts at the present time to

* Compiled from the "Report, and Accompanying Documents of the Royal Commission on Foreign Military Education," 1857.

about 126,000 men. It is divided into nine army-corps or corps d'Armée, one of which is named the guard, and the others are numbered from I. to VIII. In each there is a regiment of artillery and a division of engineers. A regiment of artillery consists, in time of peace, of three divisions; each division of one troop of horse artillery and four companies, of which, one is Fortress artillery with two-horsed pieces. Each regiment has thus three companies for the service of the fortress and twelve for field service. The whole of the artillery is under the command of a general inspector, and it is divided into four inspections. An engineer division is composed of two companies. There are nine engineer divisions, one in each army corps. The whole are commanded by a general inspector, and they are divided into three inspections.

The promotion in the Prussian infantry and cavalry is regimental, and by seniority, up to the rank of major; after that it is by selection; and an officer who has been passed over two or three times may consider that he has received an intimation to retire from the service. In the artillery the promotion is by regiments; in the engineers it is general.

II. The first Landwehr, or Landwehr of the *first* summons (*des ersten aufgebots*,) consists principally of young men between twenty-five and thirty-two years of age, who enter when they have completed their period of service in the standing army. They are called out once every year for service with the divisions of the standing army to which they are attached, for a period varying from a fortnight to a month; and they may be sent in time of war on foreign service.

Those who have passed through the first Landwehr, enter at the age of thirty-two in the second Landwehr, or Landwehr of the *second* summons (*des zweiten aufgebots.*) They are called out only for a very brief service once a year, and they can not at any time be ordered out of the country, but continue to form a part of the *second* Landwehr until they are thirty nine years of age.

III. After the age of thirty-nine a Prussian subject belongs to the last reserve or Landsturm, and can only be summoned to service in arms upon a general raising, so to say, of the whole population, when the country is actually invaded by the enemy.

With the standing army, the center of the system, all the other forces are kept in close connection. For every regiment of the ˜anding army there is a corresponding regiment of Landwehr, and ˜wo together form one brigade. In the local distribution, every ˜and hamlet of the Prussian dominions belongs to a certain regiment of Landwehr, serving with a certain regiment of the army, and belonging accordingly to one of the nine army corps.

Such is the military organization, which, from the important part played in it by the *Landwehr*, is sometimes termed the Prussian *Landwehr* system. The history of its formation is remarkable, and the circumstances which led to its creation helped also to create the very peculiar education of the army.

The Prussian *Landwehr* or militia is not of modern origin; in its form at least it is but a revival of the old feudal military organization, so far as that consisted of raising the country *en masse*, instead of keeping up a permanent, trained, and limited military force. *Landwehr* or *Landsturm** was the old German name for this feudal array, before the system of standing armies was begun in Europe by Charles VII. of France, with his Scotch regiments. It was possibly the failure of the trained Prussian armies—long reputed the models of military discipline—in the attack upon France in 1792, and still more signally at Auerstadt and Jena, which partly led to the revival of the *Landwehr* as the peculiar national force of Prussia. The means by which Stein, and after his expulsion, Scharnhorst, called it into activity, was a master stroke of policy under the existing difficulties of the country. The following outline may be sufficient to explain its effects upon education.

The condition which Napoleon had exacted at Tilsit—a reduction of the standing army from 200,000 to 40,000 men—would have lowered Prussia at once to the rank of a second-rate power. It was adroitly evaded by the plan of keeping only 40,000 men in arms at one and the same time, disbanding these as soon as they were disciplined, and replacing them constantly by fresh bodies. Thus the whole population of the country was ready to rise in 1813, after the crisis of Napoleon's retreat from Russia. The plan was chiefly due to the genius of Scharnhorst, whose early death deprived Prussia of her greatest scientific soldier. The *Landwehr* then proved itself a most efficient force, though its success was promoted by the national enthusiasm, which must prevent our taking such a period as a criterion of its permanent military working. Since that time it has continued to be the national army of the country.

We were assured that this peculiarity of the Prussian army system, by which almost every man in the country serves in his turn in the ranks, has had a tendency to improve the education of the officers. It seems to have been felt that the officers would not retain the respect of intelligent privates unless they kept ahead of

* Thus *Landsturm* is the word used for the rising *en masse* of the Tyrol in 1809.

them in education. And this impression appears to have been the cause of the royal edicts passed in 1816, by which it was required that every Prussian officer should pass two examinations before receiving his commission, one to test his general education, and the other his professional knowledge.

II. HISTORICAL VIEW OF PRUSSIAN MILITARY EDUCATION.*

The Prussian system of military education stands in close connection with the general education of the country, just as the Prussian military organization is the peculiar creation of that country's history. And the greatest improvements in the army and in its scientific teaching have been made at those remarkable periods when we should most naturally have looked for them—the time of Frederick the Great and the Liberation war of 1813—1814.

The leading principles of Prussian military education consist, *first*, in requiring from every officer in the army proof of a fair *general* education before his entrance, and of a fair *military* education afterwards. *Secondly*, they encourage a higher military education in a senior school, which has almost exclusively the privilege of supplying the staff.

In this requirement of a fair education, both general and military, *universally* from its officers, Prussia stands alone among the great military nations of Europe, and this honorable distinction is in a great measure the result of the diffused system of education throughout the country, and of the plan adopted by Stein and Scharnhorst, to make the officers the leaders of the army both in education and in military science.

The military schools of Germany may be said to have begun with the Reformation wars. Some such were founded by Maurice of Saxony, the great political and military genius of Germany in that century; the example was soon imitated in Baden, Silesia, and Brunswick, and a curious sketch of military education, by the hand of Duke Albert of Brandenburg, has been lately published from the Berlin archives, in which theology and mathematics hold the two most important places.

The first school of any real importance was founded in Colberg, by the great elector, Frederick William, in 1653. This had considerable success, and both his successors, King Frederick and Frederick William I., improved it greatly, and finally transferred it to Berlin. It was the time (about 1705, 1706,) of the great advance in military engineering under Vauban and Coehorn, and a school

* The chief authority for this paper is a very detailed account of the Staff School, (*Kriegs-Schule*,) by Friedländer. pp. 1—360.

for engineering was founded, in which some of their pupils had a great share. The first Prussian trigonometrical survey also dates as early as 1702; that of England was not begun till 1784. It may indeed be said that the scientific arms began to take a more favorable place in the Prussian army about this time. They have held, and even still hold in some respects, a less distinguished position in Germany than in France, England, or Sardinia; and the first instance of an artilleryman being made a general, was in the reign of Frederick William I.

On Frederick the Great's accession he found several military schools in existence. These had been chiefly founded by his eccentric father, who had a passion for Cadet Houses and cadets, and their object is said to have been to supply an education to the nobility, who at that time were very ill-taught in Germany. After Frederick's first wars, his own attention was much occupied by the need of a better military education, and he continued to work at the subject very zealously till his death. His example on this point, as that of a great military authority, is most instructive, since his object was at first only to educate cadets *before* their entrance to the army, but was afterwards extended to completing the education of officers already on active service. His views on the last point were carried out by Scharnhorst. They were the germ of the present Prussian military education.

It is curious to observe that the Austrian Succession War and the Seven Years' War, the first great wars since Louis XIV., and which broke the Thirty Years' Peace of the eighteenth century, are periods at which scientific military education made a great step in Europe. A Treatise of Marshal Count Beausobre's on the subject first showed the existing want; it is entitled "*Utilité d'une Ecole et d'une Académie Militaire, avec des Notes, ou l'on traite des Ecoles Militaires de l'Antiquité.*" It attracted great attention on its appearance. Most of the military academies properly so called, date from about this time. The earliest warrant for Woolwich, dates in 1741. The Theresianum of Maria Theresa was begun at Vienna about 1748. The first French school was the celebrated engineer school of Mezières founded in 1749. This was soon followed by the old military school of Paris in 1751, and by the school for artillery at La Fère in 1756. Frederick's own *Ritter Academie* dates from 1764.

Frederick began this institution with his usual energy, immediately on the close of the Seven Years' War. "My fire is quenched," he writes, "and I am now only busied in improving the practice of my men. * * * * The position of the common soldier may be left as it was before the war began, but the position of the officers is a point to which I am devoting my utmost care. In order in future to quicken their attention whilst on service, and to form their judgment, I have ordered them to receive instruction in the art of war, and they will be obliged to give reasons for all they do. Such a plan, as you will see, my dear friend, will not answer with every one; still out of the whole body we shall certainly form some men and officers, who will not merely have their patent as generals to show, (*die nicht blos patentirte Generale vorstellen*,) but some capacity for the office as well." He had, in fact, seen with great admiration the improved military school recently founded by Maria Theresa; and as it is best on such points to let this great authority be heard for himself, we shall quote his own words:—

"In order to neglect nothing bearing on the state of the army, the Empress founded near Vienna, (at Wiener Neustadt,) a college where young nobles were instructed in the whole art of war. She drew to it distinguished professors of geometry, fortification, geography, and history, who formed there able pupils, and made it a complete nursery for the army. By means of her care, the military service attained in that country a degree of perfection which it had never reached under the Emperors of the House of Austria; and a woman thus carried out designs worthy of a great man."

His letters show that he contemplated an improved school, and he says to D'Alembert: "I send you the rules of my academy. As the plan is new, I beg you to give me your honest opinion of it." Accordingly, the academy was founded. We will describe it in his own words:—

"An academy was founded at the same time, in which were placed those of the cadets who showed most genius. The king himself drew up the rules for its form, and gave it a plan of instruction, which stated the objects of the studies of the pupils, and of the education they were to receive. Professors were chosen from the ablest men who could be found in Europe, and fifteen young gentlemen were educated under the eyes of five instructors. Their whole education tended to form their judgment. The academy was successful, and supplied able pupils, who received appointments in the army."*

This school, which was opened in 1765, was Frederick's only foundation of the kind; he was occupied with it incessantly. The plan of its studies was drawn up by his own hand, and we have

* "Histoire de mon Temps."—*Œuvres*, vi., p. 99.

many of his letters of encouragement to its pupils or professors. Whether he is writing to Voltaire, Condorcet, or "My Lord Marischal" Keith, he constantly shows both his well-known attention to the economy of his new school, and a paternal interest in his young cadets and their teachers.*

Accordingly, both in professors and pupils, the new institution soon gained an European character. Out of its twenty-first directors, no less than ten were distinguished foreigners; one of the best teachers at Berlin was D'Antoni, a distinguished soldier from the Turin institution and the artillery school at Alessandria—schools which were still the representatives of the military science of the great Italian generals, of the Duke of Parma, of Spinola, and Montecuculi.

This institution was still, as it would appear, upon the old principle of juvenile army schools, nor does Frederick seem to have set on foot any school for officers after entering the service. But he evidently felt strongly the need of improving his staff officers, and of raising the science of his artillery and engineers. Thus we find him referring to the French engineer school at Meziéres; and he endeavored to raise the intelligence and education of his officers. It may, however, be suspected that the spirit of the "Potsdamer Côterie," as it was called, became gradually, and particularly after Frederick's death, too literary and speculative to suit the rough work of war; and it may, perhaps, be thought that some defect of this kind is still traceable in the excessive amount of teaching and the abstract nature of some of the subjects taught in the staff school at Berlin.

Such seems to have been the opinion of Scharnhorst, the virtual author of the present system of army education, and whom the Prussians still regard as their first authority on that subject. "Instruction is given," he says, "at the military school in all literature, in philosophy, and in many various sciences. Frederick seems to have wished to lay in it the foundation of the education at once of an officer and of a learned man. Few men, however, are able to excel at once in various branches of human knowledge, and the surest means to do so in *one* is not to attempt it in *many*."

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* He gives himself, in his forcible style, the reasons for his attention to early military schools. He had found his young nobility excessively averse to such education. "They shrink from the army," he said, "because in this country it is a real training for the character. Nothing is passed over in a young officer; he is obliged to maintain a prudent, regular, and sensible conduct. . . . . . This is precisely what they dislike, and one still hears the absurd and insolent expression, 'If my boy will not work, he will do none the worse for a soldier.' Yes, he may do for a mere man-at-arms (*fantassin*,) but not for an officer fit to be advanced to the highest commands, the only end of a good soldier's life, and which requires a really extensive knowledge."—*Œuvres*, ix., 117, 120.

We have referred to Frederick and his school rather to show the interest he felt in military education, than because his institution was very important. Military education was still very imperfect, and it completely languished in Prussia till Scharnhorst established it on its present footing.

Scharnhorst was himself an Hanoverian, but entered the Prussian service, and had seen by experience the defects of their system in the campaigns of 1792, 1793, and 1805. He had long devoted especial attention to military education and to all the scientific part of his profession. Along with Blucher and Gneisenau, he was considered one of the first generals of the army, and, on the exhaustion of Prussia after Jena, he was selected to remodel its whole system. He did not live to complete his work, having been killed early in 1812; but his statue near the bridge at Berlin, remarkable for its noble and thoughtful expression, records the gratitude of Prussia to its greatest scientific soldier.

"The perfection of the French military organization," says Mr. Alison, appeared to him in painful contrast beside the numerous defects of that over which he presided. * * * * Boldly applying to the military department the admirable principles by which Stein had secured the affections of the burgher classes, he threw open to the whole of the citizens the higher grades of the army, from which they had been hitherto excluded. * * * * And every department of the public service underwent his searching eye."

The work began with the commission of 1807, of which both Stein and Scharnhorst were members. And the regulation of 1808 laid down the principle broadly, that the only claim to an officer's commission must be, "in time of peace, knowledge and education; in war, courage and conduct."

On these principles, during the next three years, Scharnhorst laid the foundations of the present education. He abolished most of the existing juvenile schools, with the exception only of the Cadet Houses, intended almost solely for the sons of officers. He changed the previous war school into a sort of school *d'Elite*, consisting of a senior and junior department, in which the younger soldiers of all arms were to be imbued with such knowledge as might give them a scientific interest in their profession, and in which senior officers (also of all arms) were to have a higher course of a similar nature, success in which was to form a recommendation for employment on the staff. He began the plan of the division schools, where all candidates for commissions, but not yet officers, might conduct their military studies along with the practice of their profession. Its idea was to make some military study *necessary*, and successful study *honorable*, in the army. Finally, he began the present system of careful examination on entering the army.

The following historical notice of the origin and successive changes of the division schools is taken from a communication by Col. Von Holleben, and a member of the General Inspection of Military Instruction to the English Commission.

The cabinet order of the 6th of August, 1808, laid the foundation of the present system of military education. It regulates the appointment of Swordknot ensigns and the selection of officers, and declares that the only title to an officer's commission in time of peace shall be professional knowledge and education, and in time of war distinguished valor and ability.

The cabinet order of the 6th of August, 1808, could only come gradually into operation; the system of military examinations had to be created, and the educational institutions had to receive a new organization, under the superintendence of a general officer. Four provincial boards of examination were successively established, and on the 1st December, 1809, a body of instructions, still very vague and general, was issued for their guidance.

A cabinet order of the 3rd of May, 1810, remodeled the military schools, directing, in addition to the cadet schools at Berlin and Stolpe, the formation of three military schools for Swordknot ensigns, (*Portepée-Fähnriche*,) one at Berlin for the marches (*Die Marken*,) and Pomerania, a second at Königsberg, for east and west Prussia, and a third at Breslau, for Silesia; and the formation of a military school at Berlin for officers. All these institutions were placed under the general superintendence of Lieutenant-General Von Dierieke, who had also the special superintendence of the boards of examination. A board of military studies was created and intrusted, under his control, with the task of carrying the regulations into effect.

Before, however, the new institutions attained to any stability the war years of 1813—14—15 intervened, and the operations of the board of examinations ceased.

Soon after the conclusion of peace directions were given that the examinations should recommence, with an equitable consideration of the claims of the Landwehr officers, ensigns, and other young persons who had grown up during the war.

At first there was only one board of examination at Berlin, with large discretionary powers as to their mode of procedure. In April, 1816, a cabinet order was issued to form boards of examination for the Swordknot at every brigade, as the present divisions were then called, besides the existing board at Berlin, for the examination for an officer's commission.

Contemporaneously with the nine boards of examination, the board of military studies, by an order of January, 1816, directed the establishment of schools for every brigade, and attempted to gradually regulate the instruction they gave. The schools contained two classes, the lower to prepare candidates for the Swordknot, the higher to prepare candidates for the rank of officer. As, however, no standard of attainment was required for admission into the schools, their instruction had to commence with the first elements, and was charged with more work than it could perform. The weaker scholars stayed two, three, or more years in the lower class, and the education of the better scholars was impeded.

During this and the following period the authority over the examination boards (the *Præsidium,*) was distinct from that over the schools, (the general inspection,) and it was not till later that both authorities were vested in a single person. This division of powers, intended to secure the independence and impartiality of the examinations, led to the result that the two authorities were occasionally led, from a difference of principles, to labor in different directions. Still, in the infancy of military education, the rivalry it occasioned was favorable to a rapidity of development.

An order of the 16th of March, 1827, added French to the studies for the ensigns' examination, and fixed a higher standard of attainments in military sciences for the officers' examination.

Nearly at the same time, a cabinet order of the 27th of March, 1827, directed that there should be only one class for Swordknot ensigns in the division schools, and that after October, 1829, the candidate should obtain a testimonial of fitness for the rank of Swordknot ensign previous to admission as a student.

Accordingly young men had to be prepared for examination for the Swordknot at their entrance into their corps, or might prepare themselves by private studies and instruction during their service.

The task of the schools, still very comprehensive embracing all the liberal sciences as well as the military, was accomplished during this period in two courses of nine months, in a higher and a lower class.

A cabinet order of the 31st of January, 1837, introduced the entrance examination, instead of the examination for the Swordknot.

it being declared that every candidate for the commission of an officer, after his reception into a corps, should prove in an examination his possession of the knowledge requisite for a Swordknot ensigncy before his actual appointment. At the same time a regulation of the ministry of war, of the 17th of December 1836, remodeled and more precisely defined both the entrance (Swordknot ensign) examination, and that for the commission of an officer. This regulation, while it essentially modified the instruction given at the division schools, furnished them at the same time with a more certain clue for their guidance. The preparation of youths for the Swordknot examination during their service in the corps was discontinued. But the standard of the entrance examination was still too low, requiring only a small portion of the branches of a general liberal education, and that not in the shape in which they are taught in our gymnasia. Hence the evil result, that young men, previous to their entrance into a corps, had usually to prepare for the military profession at private institutions instead of at the gymnasia, and nevertheless brought with them a very defective amount of preparatory training; on the other hand, the demands of the officers' examination were very multifarious. It still required the general scholastic sciences by way of formal education, and the military sciences as a special education for the military profession. Thus the task of the division schools continued overwhelming, and an aim was set before them which they could not attain.

A regulation of the 4th of February, 1844, reformed simultaneously the whole system of military examination and education.

The views which guided these reforms, the improvements and advantages which were hoped to be thereby obtained, were, in general, the following:—

1. The military profession, like every other, requires a general school education intended generally to cultivate the mind, distinct from the subsequent special and professional education for which the former is the necessary groundwork.

The former is tested in the examination for the Swordknot, the latter in the officers' examination.

2. The preparatory education required from the candidate for a Swordknot is the function of the ordinary schools of the country. Nothing but what they can impart is required, and from consideration of the youthful age of the candidates (seventeen years,) the amount of preparatory training required is not the attainment of the highest class of the gymnasium, but only that required for admission into the Prima.

3. The required previous training not only gives the candidate a more certain basis for his subsequent military education, but, as being the groundwork of all professions, leaves him afterwards at liberty to cultivate the special knowledge requisite for any profession that he may prefer.

4. The division schools are freed from a multifarious course of instruction in the scholastic sciences, a task beyond their power; the result of which was that the majority of scholars were very little advanced in formal and general education, and but superficially grounded in the elements of the professional sciences, while they spent years in being drilled for an examination, instead of being educated for life.

5. If the division schools have an able staff of military teachers, they can give a good professional education. The younger officers, even if they never received the full training of the gymnasium, may still, by their professional training, raise themselves above their subordinates, (a class in Prussia often highly educated,) and are started with an excellent preparation for their professional career.

6. By the amount of liberal education required in the examination for the Swordknot, the friends of those destined for the military profession are admonished to provide them an education equal to that received by the members of other professions.

7. By the method pursued in the examinations the power is retained of raising or lowering the standard according to circumstances. When the supply of officers is deficient, the standard can be lowered; at other times, as at present, it may be raised. Since the above-mentioned regulations, the following essential alterations have been introduced :—

1. The examination for the Swordknot is again placed after admission into the corps, but no one can be admitted to attend the division schools without a testimonial of fitness for the rank of Swordknot ensign.

2. A testimonial of fitness for the university, *i. e.*, to have passed the abiturient examination, dispenses with the examination for the Swordknot. In consequence of this rule fifty abiturients on an average annually enter the army. These, as well as the selectaner of the cadet corps, must be considered, in point of scientific education, an excellent supply of officers. From the powerful impulse that military instruction has received in the last fifty years, it may be expected that the time is not distant when the candidate for an officer's commission, instead of passing the Swordknot examination,

will have to bring the finished training of the gymnasium; in other words, to have passed the abiturient examination.

3. Instead of the seventeen division schools there are now by the regulation of 1844, only nine, and a further reduction of their number to four or three is contemplated, with an improvement of the staff of teachers and a stricter supervision of the scholars.

III. SYSTEM OF MILITARY EDUCATION AND PROMOTION.

The standing army composed in the manner and under the circumstances already described, is supplied with officers who must have a good general education, and have served in the ranks, or have obtained a certain amount of professional instruction. The usual course is as follows:—

Young men obtain a nomination from the colonel of a regiment. This nomination admits them merely to service in the regiment as privates, with a recognition of their being candidates, *aspiranten* or aspirants, for the rank of officer. Before they obtain that rank, the following conditions must be fulfilled. They must pass an examination in the common subjects of a good general education, such as the sons of well-born or wealthy civilians may be supposed to receive. They must serve six or nine months with the troops; they must attend nine months at a division school, or twelve months in the artillery and engineer school, where they receive a course of special military instruction; and they must pass an examination in professional subjects before a board sitting at Berlin. They are then eligible for a vacancy. In order to obtain a commission they require further the recommendation of the officers of the regiment.

It is obvious to remark, that in obtaining a commission in the Prussian service the candidate's chance depends greatly on the recommendation of the colonel and the after assent of the officers. The effect of this is to maintain an exclusive character in the army. Above two-thirds of the commissions are obtained by the course described above; the remainder are granted to those who pass through the cadet schools.

Of these there are five altogether, four junior establishments, situated in certain provincial towns, and one senior or upper school at Berlin, to which the others are merely preparatory. They are all supported by the state; mainly for the purpose of educating the children of meritorious officers in want of assistance; but they are also open to others. With the exception of the highest class of the upper school, the *Selecta* above mentioned, the instruction given is of a perfectly general character, and there is no obligation even for those who have received the most ample pecuniary assistance to enter the military profession. The discipline, however, is military, the teachers are mostly officers, the pupils are regularly drilled, and most of them actually go into the army. This they do in ordinary cases without going through the highest or select class in which professional instruction is given; they merely pass the same preliminary examination as the candidates nominated by the colonels of regiments; they enter the army without their commissions, and have to obtain them in the same manner as the other candidates, by serving six or nine months with the troops, and by following their professional studies in the division or artillery and engineer schools, and by passing the officers' or second examination before the examining board at Berlin. Those who do remain to go through the highest or select class receive their professional instruction in it instead of in the division or artillery and engineer schools, and they are examined for their commissions by the board while still at the cadet school.

Thus, in the course usually followed, three requisites are exacted in Prussia before a commission is given; first, a good general education; secondly, some actual military service; and, thirdly, professional knowledge gained by something like a year of military study. But the military service is not required from the upper thirty students of the *Selecta* of the Cadet House.

It will be well to mention, at the commencement, the names of the two examinations. The first, the preliminary examination, merely testing the general education, admits to a particular grade among non-commissioned officers; those holding it rank between sergeants and corporals, and in consideration of their being candidates (*aspiranten*) for a commission wear a different sword-knot, and hence have the name of Swordknot ensign or *Portepée-fähnrich*. The first or preliminary examination is accordingly called the *Portepée-fähnrich* examination. The second, the professional one, is the officers' examination, for the commission of second lieutenant.

These two examinations, for the grade of *Portepée-fähnrich* and for the officer's commission, are either conducted or controlled by the Supreme Military examinations Board, (*Ober-Militair-Examinations-Commission*) in Berlin, a body partly composed of military officers, partly of eminent civilians.

The various examining boards, the central and the local ones, which conduct these two examinations, are quite independent of the military schools, and were formerly presided over by a different head; but in order that the system should be uniformly carried out, and as Colonel von Holleben expresses it, that "*the examinations should exercise a salutary influence on education, and that their standard should be adjusted to the capacities of the schools,*" they have now been placed under the same control as the military schools.

The whole department of military education is therefore now under the control of a single high functionary, bearing the title of the general inspector of the military schools, military education, and military studies (*das Militair Erziehungs-und-Bildungswesen,*) who reports direct to the king on all subjects relating to examination and instruction. He submits his proposals on matters of administration to the minister of war, who issues the necessary orders to the boards charged with the financial control of the various schools.

The general inspector is assisted by a supreme council or board of military studies, composed of field officers of the general staff and of the special arms, the directors of the war school, of the supreme board of military examinations, of the artillery and engineers school, the commander of the cadet corps, some of the consultative assessors (*Vortragenden Räthen,*) of the minister of worship, and of individuals selected from the general body of learned men (professors.)

The principal military schools of Prussia may be divided into five classes:—

I. Those which give a good general education to the sons of meritorious officers, but which are open to others, such as—

1. The Cadet Houses or Cadet Schools (*Cadetten-Häuser,*) which supply a certain amount of instruction in military professional subjects.

II. Such as supply professional instruction to young men who are candidates for the rank of officer in the Prussian army. These are—

2. The Division Schools (*Divisions-Schule,*) nine in number, one for each army corps.

3. The artillery and engineers schools in Berlin.

III. Those which afford professional instruction to officers already in the service, to qualify them for special duty, limited to—

4. The War School or Staff School (*Kriegs-Schule,*) in Berlin.

IV. Those intended to give special instruction for the training of non-commissioned officers and men. Such as—

5. The School Division or Non-commissioned Officers School (*Schulabtheilung*,) at Potsdam.

6. The Regimental Schools (*Regiments und Bataillons Schulen.*)

7. The Music and the Swimming Schools, and the Central Gymnastic School in Berlin (*Central Turn-Anstalt.*)

8. The Veterinary School (*Thierarzeneischule.*)

V. Those intended to give gratuitous education to the children, boys and girls, of non-commissioned officers and soldiers, whose parents are too poor to provide for them. Such are,—

9. The Military Orphan Houses (*Militair-Waisenhaüser*,) at Annaburg, Potsdam, and Pretzsch.

10. The schools for soldiers' children.

In addition to these might be mentioned the Medical Institution, particularly the Frederick-William's Institution at Berlin, and the Knight Academy (*Ritter-Academie*,) or Noble School, in Liegnitz.

The annual cost to the state of the military schools in 1856, appears to be as follows:—

NAME.	Salaries. Dollars.*	Other Expenses. Dollars.*	Total Dollars.*	Number of Students.
Department of General Inspector,	5,872	250	5.922	......
Supreme Military Examinations Board,	5,400	300	5,700	......
Board of Military Studies,	848	......	848	......
Board of Examiners for Artillery Lieutenants,	.....	60	60	......
Cadet House at Berlin,	12,944	......	12,944	420
" " Potsdam,	15,805	24,285	40,090	200
" " Culm,	15,738	18,436	34,174	160
" " Wahlstatt,	16,253	22,706	38,959	200
" " Bensberg	15,935	24,853	40,788	200
General War or Staff School,	18,552	3,013	21,565	120
United Artillery and Engineers School,	15,025	1,910	16,935	240
Veterinary School,	8,514	4,165	12,679	......
Gymnastic School,	4,046	720	4,766	......
Division Schools,	10,800	6,195	16,995	Variable.
" Libraries,	400	1,200	1,600	......
Miscellaneous,	......	680	680	......
Totals,	146,132	108,777	254,909	

Or about £38,236 annually, exclusive of the charge for buildings and repairs, and the original outlay for their first establishment. The pay of the student officers, and the pay and allowances of the military professors and teachers, are, however, drawn from their corps, so that the above-mentioned seems only to include the extra pay granted to the professors, &c.

The expenses of the Non-commissioned Officers School, of the military orphan houses, and of the schools for soldiers' children, are not given in the printed paper from which these details have been extracted.

* A Prussian dollar is equal to three shillings of English money, and 70 cents of United States currency.

IV. EXAMINATIONS—GENERAL AND PROFESSIONAL—FOR A COMMISSION.

Two examinations, one in general and the other in professional knowledge are required of all candidates for a commission upon or soon after their entrance into the army, unless they can bring a certificate of having successfully completed the regular course of a gymnasium, in which case they are excused from the first.

These two examinations, through which alone admission is obtained to the rank of officer, are so important, and hold so prominent a position in the Prussian military system, that we propose to preface our account of the nature and extent of each of these examinations by a short tabular statement of the circumstances under which the candidates for each arm of the service respectively pass them.

The following Candidates offer themselves,	for the Preliminary, Ensign's, or *Portepée-fahnrich* Examination,	for the Second or Officer's Examination (in all cases before the Supreme Board at Berlin.)
Those presented by the Colonels of Regiments,	Before, after, or during (usually before) six months' service with the Troops, before the local Division Board;	After nine months' military instruction in the Division School.
Those coming at the usual time from the Cadet House (from the class called *Prima*,)	On quitting the Cadet House, before the Supreme Board at Berlin;	After six months' service with the Troops, and nine months' military instruction in the Division School.
Those who stay an extra year in the Special or Select class (*Selecta*) of the Cadet House,	Before admission to the Special or Select class (*Selecta*,) before the Supreme Board at Berlin;	On quitting the Cadet House, after one year's military instruction in the Select class *Selecta*.
Those for the Artillery or Engineers, except when they came from the Special or Select class, (*Selecta*,) of the Cadet House,	After nine months' service with the Troops, and three months' stay at the Artillery and Engineers School, before the Supreme Board at Berlin;	After one year's stay at the Artillery and Engineers School.

1. *The Preliminary or Ensign's* (*Portepée-fähnrich*) *Examination.*

According to a special law, any young man above seventeen and a half and under twenty-three years of age, whether he be a private or a corporal, if he has served six months in the army, and can obtain from the officers of his company a certificate of good conduct, attention, and knowledge of his profession, may claim to be examined for the grade of ensign or (*Portepée-fähnrich.*) If he succeed in this examination, he is recognized as a candidate, an *aspirant* for a commission; but his prospect of obtaining a commission is subject to a variety of subsequent conditions.

In practice, a young man who aspires to a commission applies to the colonel of the regiment and usually obtains a nomination before he actually joins; and, as the examination is entirely of a civil character, he is usually glad to try and pass it at once. Having recently come from school, he feels probably better prepared than he is likely to be at any subsequent time: for on joining the corps, he will have for some time to conform to the life of a private soldier, to sleep and mess with the men, and to mount guard in his turn; and with the drill and exercises, and the marching and manœuvring with the troops, he will have enough to occupy him to prevent his preparing for the examination. The two qualifications for the ensign's grade are, the test of the examination and the six months' service; but it appears to be indifferent in what order they are taken, whether service comes first and examination after, or *vice versâ.*

The examinations take place quarterly, at the beginning of every January, April, July, and October. They are held in the great garrison towns by local military boards, consisting of a president and five examiners. Applications for permission to be examined must be made at least a fortnight before, and must be accompanied by certificates stating the candidate's birth, parentage, &c.; certificates of diligence and good conduct from the schoolmasters or other teachers who have instructed him; and of bodily fitness from an army surgeon.

The local board of examiners is appointed by the general officer in command of the army corps, the centers of examination corresponding in present practice with the localities assigned to the division or army-corps schools, nine in number, presently to be described.

The first part of the examination is on paper; a *vivâ voce* examination follows.

On paper the young men have to write three themes or compositions in German, to translate two passages, one from Livy or Sallust, another from Cæsar's Commentaries, Cicero's Epistles, or Quintus Curtius; to translate sixteen or twenty lines from French into German, and two passages, a longer and a shorter, from German into French. They have one question in common arithmetic, one in eauations, progressions, or logarithms; one in geometry, one in trigonometry; they have one in mathematical or physical geography, one in the general geography of Europe and its colonies, and one in that of Germany and Prussia. There is one question in Greek or Roman history; one in the earlier German history; one in modern; and one in Prussian history. They have also to show that they are acquainted with the common conventional signs used in representing the surface of the earth in maps; and they have to copy a small map of a group of hills.

The time allowed for each question is about three quarters of an hour or an hour; for each German theme, it is as much as an hour and a half or two hours.

The questions are of a comprehensive character; *e. g.* Give a history of the campaign of 1813, or of the life of Alexander the Great; enumerate the rivers flowing into the Mediterranean Sea, with the principal towns situated upon each of them. The German themes are, first, a *curriculum vitæ*, an account of the candidate's life, which is, however, not supposed to count in the result, and is merely for the examiner's information; second and third, two themes on some sentence or proverb, for the first of which the examiner assists the candidate by *vivâ voce* questions and corrections in drawing up the preliminary outline of arrangement; for the second he is left entirely to himself.

There is a subsequent *vivâ voce* examination in all the subjects, drawing excepted. The candidates are taken in small classes, not exceeding seven in number, and are examined together, but not in public.

The results of the examination are considered according to the system of *predicates* or epithets, sometimes also called *censures.* The candidates' answers are characterized as excellent (*vorzüglich,*) good (*gut,*) satisfactory (*befriedigend,*) insufficient (*nicht hinreichend,*) or unsatisfactory (*ungenügend.* Numerical values are attached to each of these epithets; "excellent" is marked with 9; "unsatisfactory" counts as 1; and according to the amount of importance attached to the different subjects the marks thus given are multiplied by a higher or lower number, by 5 in one case, by 3 or by 1 in others. German, Latin, and mathematics have all the highest estimate of 5, and are each five times more important than drawing, which is marked by 1; geography, history, and French, are each valued at 3. A young man who gets the *predicate* "excellent," in German, will receive 45 marks, his 9 being multiplied by 5; whereas the same predicate for history would obtain him only 15, and in drawing only 5 marks.

German,	5	Total, 25.
Latin,	5	
Mathematics,	5	
History,	3	
Geography,	3	
French,	3	
Drawing,	1	

A report is then drawn up, and according to the marks or predicates, the candidates are pronounced as admissible with distinction, admissible with honor, or simply admissible; or their re-examination after six months, their re-examination after a year, or their absolute rejection, is recommended.

This report, with the candidates' certificates, is forwarded to the supreme military examinations board at Berlin, and, if approved by them, is submitted in their quarterly report to the king; and the result, when sanctioned by him, is communicated to the respective corps.

The candidates are all informed not only of the practical result, but also of the particulars of their examinations; they are told in what subjects they have failed, and in what they have succeeded. The candidates can not, under any circumstances, try more than three times.

The young men who pass, are thus, so far as their qualification in point of knowledge is concerned, pronounced admissible to the ensign's grade. They have of course to complete their six months' service with the troops. Yet even when this is completed, a vacancy in the list of ensigns must be waited for, and months may pass before the aspirant receives the distinctive badge, the special Sword-knot, which marks his superiority to the corporals, and shows that he has gained the first step that leads to a commission.

The examination that has now been described is obviously one for which preparation may be made in the common public schools, and under the usual civilian teachers. A young man of seventeen need not have been positively destined to the military profession, nor have gone through special preparation for any length of time beforehand. The boards of local military examiners are content to take them as they are offered, inquiry only being made as to their birth and connections, and their previous behavior at school or under tuition.

In fact, those who have passed successfully through the full course of a school which prepares for the universities (a gymnasium,) are excused the ensign's examination. The certificate they have received on going away from school, upon the *abiturient's* or leaving examination, as it is called, is considered quite sufficient; except in the case of candidates for the artillery or engineers, who are expected to show greater proficiency in mathematics; and certainly a boy in the head class of a gymnasium ought to be able to pass the preliminary examination with perfect ease and with credit. The amount of knowledge required and the particular subjects selected are not those of the first, and are scarcely those of the second class of a gymnasium; and the assertion was even made that a boy from the upper third class might very well hope to pass for an ensigncy. Possibly a little extra tuition from the preparatory establishments, which are said to have sprung up with the special function of "fabricating Fähnrichs" might in this instance be required.

The official programme is here given, and may be compared with the studies prescribed in the upper classes of the Cadet House at Berlin, (*see* the account of that school.)

1. In their own language, good legible handwriting, a correct style, free from orthographical or grammatical mistakes, facility of expression in writing and speaking; some evidence of a knowledge of German literature.

2. In Latin, facility in understanding the Latin prose writers ordinarily read in the second class of a Prussian gymnasium. A written exercise in translation from Latin into German; grammatical analysis of some passages.

3. In French, facility in reading and in translating from German into French, and French into German, grammatical analysis of French sentences, and a knowledge of syntax.

4. Mathematics:—

(*a.*) Arithmetic and Algebra;—familiarity with the ordinary rules for the extraction of the square root of whole numbers and of fractions; Proportion and its applications including questions in Partnership and Compound Proportion; the theory of powers and roots, with integral and fractional, positive and negative exponents. Equations of the two first degrees, with one or more unknown quantities; Logarithms, Logarithmic Equations, Arithmetical and Geometrical Progression, and practice in the application of the various theories.

(*b.*) The complete elements of Plane Geometry, measuration of rectilineal figures and of the circle, transformation and division of figures; the first elements of the application of Algebra to Geometry.

(*c.*) Plane Trigonometry, Trigonometrical functions and their Logarithms. Use of trigonometrical tables. Calculation of particular cases of triangles, regular polygons, and segments of circles.

In consideration of the especial importance of this discipline for officers of the artillery and engineers, a higher predicate (*i. e.* a greater number of marks) will be required in the exercises of candidates for these two services; the knowledge expected in their case will be, though not more extensive, more thorough and deep.

5. Geography:—The general principles of Mathematical and Physical Geography, knowledge of our planetary system, of the motions of the Earth, and of the phenomena immediately dependent upon them. Readiness in drawing from memory the outlines of the more important countries, with their principal mountains, rivers, and cities. General outlines of Political Geography, in the case of the mere states out of Europe; a detailed account of the elements of European statistics, more particularly in the case of Germany and Prussia.

6. History:—A knowledge of the more remarkable events in the history of great nations, of the general connection, causes, and consequences of these events; a knowledge of the remarkable men of all such nations down to the present time. Special knowledge of the history of Greece, Rome, Germany, Prussia, with particular reference in this last case to its external growth, inner

development, and to the principal events of the most important wars since the middle of the eighteenth century.

7. Readiness in general drawing, and in constructing mathematical figures; some skill in drawing plans of positions and mountains, in the way of preparation for military plan drawing.

8. The candidate may, in addition, be examined in other subjects, in which his certificates show that he has been instructed; for example, in Natural Philosophy, so far as included in his previous course of instruction.

It must be remembered that either before or after this examination some months must be spent in actual service with the troops by all but the pupils belonging to the *Selecta* of the cadet school; and that nine months of study at the division and artillery and engineer schools intervenes before the officers examination takes place.

2. *The Second or Officer's Examination.*

The second or final examination for a commission, which generally ensues when the work of the division school is over, is held in Berlin only, and is conducted immediately by the central commission, to which reference has so often been made—the supreme Military Examinations Board, the *Ober-Militair-Examinations Commission.* This board or commission, a list of the existing members of which is given in page 179, consists, for the purpose now in consideration, of a president and five examiners, selected from the larger number to examine candidates for commissions.

The examinations are held continually; two opportunities are afforded every year to the candidates sent from each of the various army corps. The requisite papers must be forwarded to the commission eight days at least beforehand, and the candidates must appear in Berlin, and take up their quarters in the buildings placed at the disposal of the board on the Friday preceding the day fixed for the examination. The examination usually begins on the following Monday, and lasts through the week. The expenses of the journey are allowed, except, perhaps, when the candidate comes up a second time.

The certificates to be presented are the following:—

1. The certificate of birth, age, parentage, &c. (This is called the *Nationale.*)

2. The *Curriculum Vitæ*, (an account of the circumstances of the candidates's past life, his education, employment, &c., &c.)

3. The certificate that he has already passed through a previous examination (the *Tentamen*,) held by the authorities of the division school.

4. A certificate of conduct during his stay at the division school.

5. A military drawing (*Croquis,*) with an attestation given by his instructor that it is the candidate's own doing.

This examination, like the preliminary one, is partly on paper and partly oral. General directions are given that the examiners in both cases shall look mainly to the question whether the candidate has sufficient positive knowledge of his subjects, and capacity to explain and express himself, that mere lapses of memory shall not be regarded, and that natural endowments shall be principally looked to.

In the written examination, the candidate has four questions given him in what is called the knowledge or theory of arms (*Waffenlehre,*) including under that term all kinds of ammunition; three in tactics; one question in the rules and regulations which touch the duty of a subaltern officer; two questions in permanent and two in field fortification; one exercise in surveying, to test his acqaintance with the common instruments, and one to try his knowledge of the principles of plan drawing (*Terrain-Darstellung;* while his general skill in military drawing is proved by his either copying a plan placed before him, or drawing one from a relief model of a mountainous district (*nach Bergmodellen.*)

There is a *vivâ voce* examination in all the subjects.

The commission meets once every month to consider the examinations held since their last meeting. The result is announced under the form of the *predicates* or epithets already more than once referred to. Honorable mention is accorded to an *excellent* examination, and mention to a *good* one. If there has been an unsatisfactory result in one of the subjects, the candidate may compensate for it by superiority in other subjects, but can only in this case be qualified as *satisfactory* (*befriedigend,*) and an adequate knowledge of "arms" and tactics is regarded as indispensable in candidates for the infantry or cavalry, and in "arms" and fortification in those for the artillery and engineers. No superior work in other subjects is allowed to make up for a deficiency in these.

If a candidate's work is marked as *insufficient* (*nicht hinreichend,*) he is sent back for another half-year, and if he has done *unsatisfactorily*, for a complete year of additional study, with leave to appear for re-examination after that interval. In a case of re-examination, the two last *predicates* (*nicht hinreichend* and *ungenügend*) entail final rejection.

The report of the board is submitted to the king; the results are communicated to the various corps. The announcements sent to the candidates state the predicates assigned to the various portions of their work. Those who have passed, receive certificates of being qualified for the second lieutenant's commission:—

This rank, however, is not immediately granted. A vacancy may be long in occurring, and must be waited for. Promotion is given according to their seniority on the list of ensigns in the regiment. Another condition must also be satisfied. When a vacancy occurs, the senior ensign's name can not be submitted to the king for his appointment without a document stating on the part of the officers of the regiment that he has the requisite knowledge of the duties of the service, and that they consider him worthy of admission amongst them (*würdig in seine Mitte zu treten.*) If the majority is opposed to his admission, the name of the next ensign in order of seniority is, without further discussion, brought forward; if a minority or merely some individual officers take exception, they state the grounds of their opinion, which are then submitted for consideration.*

Special merit in the examination may be, at the king's pleasure, held a sufficient reason for promotion before all candidates examined at the same time.

The following is the programme of the studies, proficiency in which is expected of candidates at the second or officer's examination:—

I. KNOWLEDGE OF ARMS AND MUNITIONS.

A. *Of Gunpowder.*

1. General views on gunpowder and its application.
2. Ingredients of gunpowder; its qualities and use.
3. Fabrication of the same; principles on which the manufacturing process is based.
4. Statement of the various kinds of gunpowder in use, and their distinctive qualities.
5. Of the ignition, combustion, and power of gunpowder.
6. Qualities of good powder; examination of the same:
    - *a.* According to their external characteristics.
    - *b.* According to force developed.
        - *a.* By the mortar eprouvette.
        - *b.* By the smaller eprouvette.
        - *y.* Or, in default of such instruments, by practical experiment.
7. Manner of preserving gunpowder; characteristics and treatment of damaged gunpowder.
8. Precautions to be taken in working with gunpowder, and transporting the same.
9. The most ignitible materials for percussion caps, and the like.

* This certificate, according to a statement received in conversation, is in the first instance from the officers of the company, to the effect that the ensign in question is well conducted and likely to be a desirable addition to their number; then from the major of the battalion, and from the colonel of the regiment.

B. *Of Artillery.*

1. Classification of guns, according to species, calibre, and the kind of warfare for which they are intended. (Field, siege, and standing artillery.)

2. General qualities to be required of a properly constructed piece of ordnance.

3. Construction of the piece; description of the same according to the various kinds of guns, specifying the use of the different parts. (An exact statement in figures is only called for in reference to the length, weight, and diameter of the piece.)

   a. Materials; qualities required of them; enumeration of the materials generally employed.
   b. Interior construction of the piece; length of bore, chamber, windage, and touchhole; their influence on the range.
   c. External construction of the piece; appliances for pointing and managing it, and connecting it with the gun-carriage.

4. Construction of the gun-carriages; enumeration of the different kinds of the same, according to the description of gun, its destination, and materials.

   a. Specification of the principal component parts of the carriages.
   b. Distinctive characteristics of the construction of the various denominations of carriages.
   c. General principles for determining the proper construction of the same.
   d. General notions relative to the proportion of the weight of the carriage to the piece.

5. Construction of the limbers.

   a. Enumeration of the different kinds of limbers.
   b. Principal component parts and distinctive characteristics of the construction of the various kinds of limbers.
   c. General notions relative to the weight of the limber in proportion to the piece and the gun-carriage.

6. Statement of the various descriptions of wagons used by the field artillery, and their destination.

7. Ammunition; enumeration and description of the objects belonging to it. (Exact statements in figures are only required for the diameter and weight of the principal kinds of projectiles.)

   a. Projectiles; statement of the species of projectiles used for the different kinds of guns, and their construction.
      α. Round shot, cannon ball, grape.
      β. Shells; their various species.
      γ. Light balls.
      δ. Stones.
   b. Charges; general description of them.
      α. In field-pieces.
      β. In heavy artillery.
   c. Primings; enumeration and description of the various kinds of primings.
   d. Other military fireworks; statement of the principal species, and their general construction.
   e. Transport of ammunition by limbers and carts; packing of the same.

8. Moving and working the guns:

   a. General notions on the working of field-pieces.
   b. Different kinds of operations with field-pieces; unlimbering and limbering up.
   c. Position of field-pieces in firing, with regard to effect, cover, and celerity of movement.
   d. Principal manipulations in working the same.
      α. Loading.
      β. Pointing.
      γ. Discharging; the process according to the different kinds of projectiles.

e. Ascertaining the efficiency of a gun previous to using it.
f. Momentary unserviceability of guns.
g. Expedients for repairing a disabled carriage.

9. Artillery practice.
a. Exposition of the theory of firing (as far as it can be elucidated by a knowledge of the elements of mathematics;) general notions concerning the curve of round and hollow shot, and the influence of the force of powder, of gravity, and of the air's resistance upon their velocity; the curve after the first graze; trajectory of grape shot.
b. Classification and denomination of the various methods of firing or throwing projectiles.
c. Range; conditions on which it depends; its practical limits.
d. Effect of projectiles.
α. Probable accuracy of practice; circumstances on which it depends.
β. Force of the blow; circumstances on which it depends.
e. Recoil, jumping, or bouncing; explanation of such occurrences.
f. Application of the various descriptions of guns, projectiles, and methods of firing, according to the nature of the mark, the distance, the position of the adversary, and the ground.

C. *Of Small Arms.*

1. Classification and denomination of small arms.
2. General principles applied to the construction of the musket, the infantry and wall-piece rifle, the carbine, the cavalry rifle, the pistol, and the engineer musket (if the candidate is in the engineers.)
3. Description of their construction and arrangement in particular; enumeration of the separate parts (an exact statement of dimensions only required for the principal ones;) object and effect of the same.
4. Estimate of the practical utility of the various kinds of fire-arms as employed by one infantry and cavalry (no technical or theoretical investigation, but only practical remarks.)
5. Ammunition, as the ball, cartridge, and patch:
a. Its preparation.
α. In the usual manner.
β. In cases of need, in default of the usual implements.
b. Preserving, packing, and transporting it, both in carriages and by the soldier himself.
6. Management of small-arms:
a. Theory of firing (in its general scientific bearings, *vide* artillery) as applied to small-arms: repeated elucidation of the curve, line of metal, axis produced, and the relative position of these three lines in the different ranges.
b. Practical rules for loading, presenting, taking aim, and discharging, at different elevations of the adversary, and at different ranges.
7. Cleaning and preserving the arms.

D. *Of Side-Arms.*

1. Classification and denomination of the same:
a. Cavalry side-arms.
b. Lances.
2. Statement of the general principles on which their construction is based.
3. Examination of the state of side-arms on receiving them (within the limits mentioned above in C. 4.)
4. Effect and management of the same.

II. TACTICAL BRANCHES.

A. *Army Organization.*

1. General sketch of the organization of the Prussian army.
2. Characteristics of the different kinds of troops (arms;) their peculiarities

(their weapons are included under the former head,) their equipment and destination.

B. *Elementary Tactics.*

1. Account of the regulations concerning the distribution and formation of a battalion of infantry, a regiment of cavalry, and a battery, in line or column.

2. Formation of the different columns from the line, forming square, deploying and forming line, movement in advance, to the rear and to the flank, changing front and direction in line and column.

3. Formation of *tirailleurs* and skirmishers; posting, covering, moving, reinforcing, reducing, and relieving the same.

4. General rules on the conduct of the separate arms in action.

  a. Engagement of infantry under fire and hand to hand, in close and extended order, in attack and defense.

  b. Charge of cavalry, attack *à la débandade*, wheeling off of the fourth subdivisions (platoons,) skirmishing.

  c. Employment and conduct of artillery in action.

5. General principles relative to the combined action of the different arms.

6. Tactical advantages of ground; level, hilly, open, close, uninclosed, and broken ground.

7. Attack and defense of localities, such as heights, woods, farm-buildings, villages, and defiles; false attacks, demonstrations.

C. *Field Service.*

1. Of Marches. General rules, method, and object; precautions, van and rear guards, covering parties.

2. Escort of transports of powder, provisions, and prisoners of war, in one's own and in an enemy's country.

3. Surprises, ambuscades, and reconnaissances.

4. Service in cantonments, camp, and bivouac, outposts, picquets, advanced picquets, reserve picquets (movable and stationary,) patrols.

5. Taking up quarters in ordinary marches and cantonments.

III. FORTIFICATIONS.

A. *Field Works.*

1. Object of breast-work and ditch profiles in plains. Plan of field-works; open works, salient angle, its dimensions.

2. Dead angle and dead ground. Removal of dead ground; flanking; line of defense; dimensions of re-entering angle.

3. Inclosed works; dimensions and space inclosed; works with salient angles only, and with both salient and re-entering angles.

4. Erection of works to be defended by artillery; firing *en barbette*, and through embrasures; platforms; magazines.

5. Communication with interior of inclosed works.

6 Artificial obstacles for strengthening field-works; requisites for their selection and application; method of construction; advanced ditches (demi and entire;) trous-de-loup; abattis; palisades and fraises; barriers; chevaux-de-frise; pickets; caltrops; harrows; sluices and inundations; fougasses; block-houses; caponiers; double, single, and demi-caponiers *à revers.*

7. Strength of garrison of field-works.

8. Defilading, horizontal and vertical, of open and inclosed works; traverses and bonnettes.

9. Construction of small open and inclosed field-works; marking out; tracing; profiling; number and employment of workmen; excavating the ditch; formation and revetment of the slopes with s ods, fascines, wicker-work, gabions, sand-bags, wood, or stones; selection, preparation, and application of the reveting materials. (Of the execution of the revetment only so much as may show

whether the examinee will be capable of undertaking the direction of such works in an efficient manner.)

10. Fortification of heights and defiles.

11. Object, general arrangement, and advantageous situation of a tête-de-pont.

12. Arrangements for the defense of woods, hedges, houses, churches, and churchyards.

13. Attack and defense of a redoubt; surprise; attack by open force.

14. Repairing and destroying roads, fords, and bridges, wooden and stone; construction of foot bridges, carriage bridges, bridges across swamps.

B. *Permanent Fortifications.*

1. Construction of a bastioned front in a plain, with ravelin, tenaille, and covered way, in plan and profile, after the first system of Vauban, with the improvements of Cormontaigne; name and destination of every single part, angle, and line.

2. Brief description of a regular attack upon a bastioned fortress; sketch of the preparations for attack; lines of circumvallation and contravallation.

Description of parallels, approaches, demi-parallels, and the duties of the infantry in them; saps, trench cavaliers; carrying the covered way, crowning the glacis, passage of the ditch, escalade of the rampart. These operations to be detailed according to their object, position, and arrangement, but without special reference to their technical execution.

General notions relative to the batteries of a besieging army, their position, object, calibre of guns, and practice.

3. Outlines of the system of defense of a fortress relative to the employment of infantry and cavalry in garrison, and of the standing artillery in arming the fortress and placing it in a state of defense against a regular attack or an attack by open force in all its stages.

Especial knowledge of the duties of infantry and cavalry in garrison, in guarding, occupying, and defending the works, and in sallies, required.

4. Historical sketch of an actual siege (on which the examinee has attended a lecture,) and the principles of the attack and defense of fortresses in general.

5. Account of the situation, form, arrangement, and object of some of the means employed for increasing the permanent strength of fortresses, exclusive of the more technical points.

a. The rampart of the body of the place. Angle of the bastions and its effect; length of flanks and faces; auxiliary flanks; empty and solid bastions attached and detached fausse-brayes.

The escarp, earthen wall, revetment, demi-revetment, simple crenneled wall, arched crenneled wall, revetment *en décharge;* perpendicular and parallel casemates.

b. The main ditch, dry, wet, and dry or inundated at pleasure; sluices, coffer-dams, reservoirs.

c. Outworks. Ravelin, tenaille, counterguards, cover-faces, envelopes, tenaillons, lunettes.

d. Advanced works. Simple and double tenaille; horn-work before a bastion or redoubt; crown-work; double crown-work; advanced ditch, with advanced covered way.

e. Detached works, open or inclosed at the gorge.

f. Interior works. Cuts inside the bastions; réduits; citadels.

6. Historical notions of the characteristics of some of the principal systems of fortification, *e. g.* the old and modern Italian, the old Dutch, Vauban's second and third manner, the ideas of Coehorn, Rimpler, the French school, and that of Montalembert, compared with Vauban's first system, but without statement of proportions; in addition to this, the characteristics of the latest Prussian fortifications, always with the omission of details more especially technical.

7. Modified methods of attack; surprise, assault, bombardment, blockade; explanation and statement of circumstances in which attacks of this kind are practicable.

IV. SURVEYING AND DRAWING PLANS.

1. Knowledge of the instruments generally employed in military surveying, and their use.
   - *a.* Instruments for measuring and marking out straight lines; viz.—
     Signals, bandrols, or *jalons*, common staves, picket posts, rods, measuring chains, measuring cord, the step.
   - *b.* Instruments used for protracting the lines measured, viz.—
     The step measure, calliper compasses, beam compasses, dividing and reducing compasses.
   - *c.* Instruments for measuring and marking out horizontal angles:
     The square, the plane table, caloptric compasses, the reflector, the sea-compass, the prismatic compass, the astrolabe:
   - *d.* Instruments for measuring vertical angles:
     Lehmann's dioptric rule, Schmalkalder's holometer, the quadrant.
   - *e.* Leveling instruments:
     The ordinary mason's level, the spirit level, the water level, the spirit level *à lunette*, the plumb rule, Lehmann's dioptric rule in connection with the plane table, placed horizontally, the surveyor's rule, Schmalkalder's holometer.

2. Operations in surveying with the plane table, astrolabe, reflector, and compass.
3. Topographical survey of a locality (theorectically and practically,) reconnoitring, geometrical triangulation, detailed survey.
4. Hasty or rough sketch of certain objects, and entire (but limited, sections of country.
5. Drawing plans.
   - *a.* Notion of the elements of topography; rising and sloping ground, running and standing waters, division of ground in a military point of view, and characteristics of the same; open, inclosed, elevated, hilly, mountainous, broken ground.
   - *b.* Theory of plan drawing.
     - α. The first elements of the science of projection, and the construction of instruments for measuring slopes.
     - β. Fundamental rules for plan drawing in general, and for drawing mountains in particular. Statement of the various angles of depression of inclined planes through mountainous regions.
     - γ. Of the horizontals, and the laws dependent upon them, relative to mountainous districts.
     - δ. On the laws of defiles.
     - ε. On ascertaining the difference of elevation, and drawing profiles.
     - ζ. View of the accessories of plan drawing; the choice of colors and of type, and the order in which the operations necessary for preparing a plan are performed.
   - *c.* Practical plan drawing from copies and models.

V. MILITARY COMPOSITION AND KNOWLEDGE OF THE SERVICE.

A. *Exercises in Military Composition.*

1. Drawing up reports on incidents connected with the service, and with the duties of a subaltern officer, directed to the military authorities and superior officers of every rank.
2. Instructions to subordinates.
3. Applications and memorials.

B. *Acquaintance with the General Regulations of the Service.*

1. The laws on disciplinary and military punishments.
2. The proceedings in courts-martial, drum-head courts-martial, and courts of honor.

The preparation for this second, severer, and professional test that has just been described, is usually obtained in the division schools, of which an account will short'y follow, and to which any young man once accepted as a candidate, who has served his six months with the troops, and has passed his preliminary or ensign examination, may be admitted, even though a vacancy has not yet occurred, and he has not yet received his definitive promotion to the ensign's grade.

V. MILITARY SCHOOLS FOR PREPARING OFFICERS.

The Cadet Schools or Cadet Houses.

The actual military education of Prussia commences with the cadet houses, the schools intended for pupils before entering the army. They are divided into two classes, the junior and the senior. They can not indeed be called exclusively military schools, since the education which most of their pupils receive is one which fits them for civil professions, and is not specially military; and there is no obligation even on those who have received the largest amount of pecuniary assistance to enter the military profession when they leave the cadet house. The highest class, however, of the Upper Cadet School of Berlin, called the *Selecta*, receives strictly military teaching for a year, and the schools may fairly come under this denomination, as being mainly intended to educate the sons of officers who are in want of assistance, and as possessing a military discipline, uniform, and spirit.

These are five in number, four preparatory schools, and one a finishing institution; the four first in the provinces, at Culm, Potsdam, Wahlstatt, and Bensberg, the last in the capital itself. At the four junior schools, boys may be admitted at 10 or 11, and may remain till 15; at the upper school the ordinary stay is from 15 or 16 to 18 or 19.

The whole constitute together a single body, called the cadet corps. Boys may enter the school at Berlin on passing an examination, without previously attending one of the lower schools; but those who are sent up by the authorities from Culm, Potsdam, Wahlstatt, and Bensberg, are received without examination, being already members of the corps. A single officer exercises the command of the whole; and a single commission, of which the general inspector is chairman, regulates all matters relating to the admission of candidates into the body.

The whole number at present is between 1,100 and 1,200, of whom 420 are in the Upper School at Berlin, 205 in the Preparatory School at Potsdam, and 200 at each of the other houses.

The cadets are of two kinds, the King's cadets and the Pensioners or paying pupils; the former are 720 in number, the latter about 420. The pensioners pay 200 dollars (30*l.*) a year for board and instruction together; the King's cadets are aided in various degrees accordingly to the following scale:—

240 pay 30 dollars (4*l.* 10*s.*) each.
240 pay 60 dollars (9*l.*) each.
240 pay 100 dollars (15*l.*) each.

Foreigners are admissible at a yearly payment of 300 dollars (45*l.*,) and a few extra day scholars (*Hospitanten*,) when the classes are not too full, are received for 20 dollars a year (3*l.*)

The King's cadetships are granted, according to the pecuniary circumstances of the applicants, to the children of officers of the standing army, or of the Landwehr, who have distinguished themselves or have been invalided in actual service in the field; to the children of non-commissioned officers who have in like manner distinguished themselves and received severe wounds in the service; and to those of any citizens who have performed any special service to the state. The sons of meritorious officers who have died in indigence or have retired upon pensions, the sons of indigent officers in general in the standing army, and the sons of meritorious non-commissioned officers of twenty-five years' standing, are also in like manner eligible.

In very special cases of poverty, the supplementary payment is dispensed with altogether.

Pensioners are admitted from all classes and professions according to priority of application, and to their qualifications as shown by their examination. A great number of these are said to be the sons of officers, of those, namely, who are not in need of pecuniary assistance. And the number of the pensioners generally appears to be steadily on the increase. In the regulations printed in 1850, the places open for this class of cadets are stated to be only 216; at present, as has been seen, provision is made for something like double that number.

The four junior schools at Culm, Potsdam, Wahlstatt, and Bensberg, are all divided for purposes of instruction upon the same uniform plan into four classes, numbered up from six to three—*Sexta* at the bottom; *Quinta; Quarta;* and *Tertia* at the top. The upper school at Berlin succeeds with three classes, the second, the first, and the special or select—*Secunda*, *Prima*, and *Selecta*. Each of these classes, however, may contain any number of co-ordinate subdivisions, all taught the same subjects, and presumed to contain pupils of the same capacity. No teacher, it is considered, can satisfactorily undertake to give a lesson to more than thirty at a time; and the Secunda at Berlin was thus parted out in the year ending March, 1856, into eight little sets of rather less than thirty, the Prima into six, and the Selecta into two.

Junior Cadet House.

The junior cadet house at Potsdam occupies four or five buildings a little way out of the town. The class-rooms are on the usual Prussian plan, not arranged for lectures to large, but for lessons with small numbers. One distinguishing feature is the character of the arrangements of the rooms up-stairs, in which the boys pass their time out of school hours. They are very comfortable chambers, perhaps rather small for the numbers at present placed in them; they are ranged along a corridor; ten pupils are placed in each, and between every two rooms is the apartment of one of the resident tutors (*Erzieher* or *Gouverneur*,) who sees that all goes on right in these two rooms under his charge. Here the boys sit and work, and during the hours when they are expected to be preparing their lessons, are carefully looked after by their tutors.

These little apartments occupy one whole floor of the building. The floor above is that of the dormitories, containing each, perhaps, as many as sixty. The number at present in the school was stated to be two hundred and five, and the accommodation properly intended for only one hundred and sixty.

Colonel von Rosenberg, the commandant of the school, stated that eleven was the usual age at which the pupils came. This he appeared to think was rather too early, and he was inclined to attribute to this cause certain points in the character of young men who have been educated in the cadet corps. Eighty of his two hundred and five pupils were pensioners, or paying pupils; many of these also were the sons of officers. The teachers and tutors are partly civilians and partly military men, about an equal number of each. The four classes, Tertia, Quarta, Quinta, and Sexta, are subdivided into nine, so that the average number at a lesson would not be more that twenty-three.

Senior Cadet House.

The upper or central cadet school is in the older part of Berlin, in the *Neue Friedrichs Strasse*, where on the pediment surmounting the gateway the inscription, MARTIS ET MINERVÆ ALUMNIS M.DCC. LXXVI, records the erection by Frederick the Great, ten years before his death, of the large and stately quadrangle which formed the original house. Here the pupils are quartered, and in the great court within, they go through their exercises. There are several houses on both sides of the street attached to the service of the institution, and buildings are in course of erection to accommodate additional numbers.

A large separate building contains the present class-rooms. In the first of these which we visited, thirty cadets were engaged in military drawing; in another, twenty-four of the second class, the Secunda, were busy at their Latin lesson.

The room was fitted up on what appears to be the usual plan, with a series of parallel desks on the same level, ranged along the outer wall, and a sufficient space between them and the inner wall for the teacher to pass freely up and down. His desk was at one end in front of the boys. The lesson was in Quintus Curtius. The teacher (a civilian) made them construe each a sentence, and asked questions in parsing, &c., &c., much in the English manner. There was no taking places. This in German schools appears to be confined to quite the lower classes. There is a separate lecture-room here again for lessons on Natural Philosophy and Chemistry, with a small gallery of models, instruments, &c., attached to it.

A large hall is used on state occasions, and serves the purpose also of an examination-room; it is called the hall of the Field Marshals, and is adorned with portraits of the sovereigns of Prussia from the Great Elector downwards, and of the field marshals both of the time of Frederick the Great and of more recent date, among whom is the Duke of Wellington. Here also is kept Napoleon's sword taken at "La Belle Alliance," and presented by Marshal Blucher.

Passing to the first floor of the great quadrangular building, we found ourselves in one of the sitting-rooms of the cadets. Seven boys had a couple of rooms, consisting of a common sitting-room, and a common bed-room. Five is the number for which this amount of accommodation was intended, and to five the number will be reduced when the new buildings are completed. In a second and larger pair of rooms we found twelve boys.

Here also is the library, containing 10,000 volumes, and comfortable apartments occupied by the various superintending officers.

The boys, their morning lessons completed, had been going through their military exercises under the superintendence of their officers; but they were now collected in their studying-rooms, and were seen forming at the doors, each small party under the command of its senior, ready to march into the large and handsome dinner-hall.

Into this the whole body of young men presently moved by companies, proceeding to station themselves in front of the tables. The tables are ranged in parallel lines on each side of the central passage, and accommodate each of them ten, four sitting at each side, and a senior at each end. The order was given by the officer on duty for "prayer" (*Nun beten wir*,) and a short silent grace was followed by the immediate occupation of the seats, and the commencement of the meal. The arrangements in general appeared to be excellent.

The number in the school during the past year had been 420. The four companies into which the whole body of the pupils is divided, each contain a certain proportion from each of the three classes; the senior in each company being invested with the charge of the juniors; those who are in the Selecta taking rank as under officers. In every room (*Stube* or *Wohnzimmer*) there is one *Selectaner*, who is responsible. The ordinary ages are 15, 16 in the Secunda; 16, 17 in the Prima, and as far as 19 in the Selecta. No one is, as a rule, allowed to pass more than one year in a class; if in that time he can not qualify himself for advancement, he is dismissed. The rule does not, however, appear to be strictly enforced. The general preservation of discipline appears to be a good deal intrusted, as in English public schools, to these senior pupils of the age of eighteen or nineteen. There are Resident Tutors (*Erziehers* or *Gouverneurs*) as at Potsdam, who see a good deal of the pupils, especially in the evenings, when they go into the sitting-rooms, sit with them, help them in their work, play at chess with them, &c., &c. But they do not sleep close at hand between the sets of rooms, as at Potsdam, but at some little distance off.

The official arrangements for the control of the discipline consist principally in the system of what are called *Censur* Classes. This is a peculiar system which requires some explanation. There are five *Censur* Classes quite independent of the ordinary classes of the school. A boy on entering the Cadet School is always placed in the third of these classes; if he behaves ill, he falls to Class IV. and is under restrictions. Class V. is reserved for serious cases of misconduct, and any one who incurs the penalty of descending to it, is subject to continual superintendence, and is confined to the walls. Class II. gives considerable, and Class I. still more ample privileges. The members of this class (usually only quite the elder boys) are allowed great freedom in the way of going out into the town.

In each of the studying-rooms (the *Wohnzimmer*) the list of the occupants' names hangs up on the door inside. One for example was noticed containing twelve names. To each was attached his rank in the *Censur* Classes, as well as his position in the ordinary classes. At the head stood one *Selectaner*, who in this instance was in charge of the room; then followed the *Primaners;* and the list was completed by nine of the *Secunda*. As at the time of our visit (just after the Easter holidays and the yearly examination) the whole Selecta of the year had just quitted, the room was in the charge of the senior *Primaner*. The authority exercised by these senior boys appears to be very considerable.

The competition for admission to the Selecta, and for the after selection for immediate promotion, was spoken of as very considerable.

The number who came to the Berlin Cadet House without previously going to one of the junior establishments was said to be only a small per-centage.

The boys both here and at Potsdam were of course all found dressed in a military uniform.

The studies pursued in the Cadet Corps agree nearly with those of the common public schools, but of these there are three different kinds:—

1. The ordinary first-class school, the *gymnasium* of the Prussian States, is, strictly speaking, a school which prepares for the universities.

2. The second-class schools have the name of *Real* or *Practical Schools;* they deal with the actual application to business and work, not with the theory of mathematics or of language, and they may be said to resemble in some degree the schools occasionally attached in English towns to Mechanics' Institutes, or in the United States, to the Public English High School or the Higher Department of a Union School. Young men who have passed successfully through a gymnasium may be admitted to the army without passing the preliminary or *Portepée-fähnrich* examination. Those who complete their time at a *Real* School have not hitherto been allowed the same privilege.

3. There is a third and intermediate class called a *Real* or *Practical Gymnasium*, and to this, according to the statements of the official books, the courses of the Cadet Schools have hitherto corresponded. It appears, however, that there is only one specimen of the *Real Gymnasium* now in existence, the Coëln School in the old town of Berlin. The system here is said to be more practical than the *Gymnasium*, and less professional or mechanical than the *Real School*.

It is intended during the present year to assimilate the course of instruction at the Cadet Schools more nearly to that followed at the *Gymnasium* or University School; the studies of the senior Cadet School at Berlin will be raised to a higher standard, but Greek and Hebrew, which are taught in all gymnasiums, will not be introduced.

The two systems have corresponded as follows :—

Class in the Cadet Corps.	Age.	Corresponding Class in the *Real* Gymnasium.
6th, or *Sexta*,	12	5th, or *Quinta*.
5th, *Quinta*,	13	4th, *Quarta*.
4th, *Quarta*,	14	Under 3d, *Unter-Tertia*.
3d, *Tertia*,	15	Upper 3d, *Ober-Tertia*.
2d, *Secunda* (at Berlin,)	16	Lower Second, *Unter-Secunda*.
1st, *Prima*,	17	Upper Second, *Ober-Secunda*.

The Selecta, the Military Class, corresponds with the classes of the Division Schools, and with the first year's course of the Artillery and Engineers' School.

The plan pursued, both as regards, first, the subjects taught, and second, the amount of time, is as follows :—

The instruction consists throughout, from *Sexta* up to *Prima*, of lessons in Latin, German, French, Arithmetic, History, Geography. Natural History begins in the *Quinta*, at 12 or 13 years old, with Botany and Zoölogy; Mineralogy follows, at 14 or 15; Natural Philosophy at 15 or 16. The first elements of drawing, with the use of rulers, compasses, &c., begins also in *Quinta*, at 12 or 13. Practice in regular plan-drawing is gradually and increasingly given in every year. The first elements of geometry are taught in the *Quarta*, and Euclid I. 47. *Pythagoras*, has to be mastered at 14 years old. Theoretical Arithmetic, in combination with Algebra, is commenced apparently in the *Tertia*.

The subjects taught in the *Secunda*, *Prima*, and *Selecta*, that is, the course of the Upper School at Berlin, has hitherto been as follows :—

In the Secunda:

Quintus Curtius, Cicero's Orations, and Ovid's Metamorphoses; in Mathematics, the completion of Plane and commencement of Solid Geometry; Quadratic Equations; the Physical, Statistical, and Ethnographical Geography of Europe; Ancient History, and History of the Middle Ages, down to the Thirty Years' War; a first course of Natural Philosophy; French and German Composition continued; Theory and Practice of Military drawing.

In the Prima:

Livy and Virgil; in Algebra, Progressions, Logarithms, Exponential Equations; Trigonometry, Mathematical and pure Physical Geography in general; Modern History; second course of Natural Philosophy, Heat, Electricity, Magnetism, Sound, Light; French, Exercise in Speaking, &c.; History of German Literature; Composition, extempore Exercises; Military Drawing continued.

In the Selecta:

Arms and Munitions, and Artillery; Fortification, Tactics, Military Literature Practical Exercises, Military Drawing and Surveying; exercises in French and German; Mental Philosophy; Chemistry; and the Differential and Integral Calculus for those who propose to enter the Artillery or the Engineers.

The Secunda have weekly—

6	hours	of Latin.
3	"	of German.
4	"	of French.
5	"	of Mathematics.
2	"	of History.
2	"	of Geography.
2	"	of Natural Philosophy.
2	"	of Lessons in Drawing.
2	"	of Religious Instruction.
2	"	of French Conversation.
Total,....... 30	hours weekly.	

The Prima—

The same amount in Latin, German, French, Mathematics, Natural Philosophy, French, Conversation, and Drawing; in History 3, and in General Geography 2, and Mathematical Geography 1; of Religious Instruction 1. 33 hours weekly.

The *Selecta* have—

4	hours	of Tactics.
2	"	of Military Literature.
1	"	of Military Law and Regulations.
5	"	of Artillery.
5	"	of Fortification.
2	"	of Plan Drawing.
2	"	of Mental Philosophy, or English.
2	"	of Chemistry.
2	"	of Mathematics.
2	"	of French.
2	"	of German.
Total,....... 29	hours weekly.	

The lessons appear to be going on from 8 to 11 or 12 in the morning, and from 2 to 4 or 5 in the evening. The pupils have two hours' drill twice a week. They get up at half-past 5, have breakfast, and an hour's preparation before lessons begin. There are similar hours of study in the evening from 6 to 8; and some of the pupils also take private lessons from the teachers.* During these special hours of study (*Arbeitstunde,*) the chambers are visited by the officers and tutors, assistance is given and diligence enforced. From 8 to half-past 9 they study as they please; the tutors are a good deal with them in the rooms; at 10 all are in bed. Wednesday and Saturday are half holidays; on Sunday they

* Not from the Tutors, but from the non-resident Professors and Teachers.

attend morning service in the garrison church, and after that is over, are allowed to be more or less absent in the town, to be with their parents, relations, and friends.

For the 420 cadets of the Institution at Berlin, there appear to be about twenty professors and teachers not residing in the school, the majority of whom are civilians; and in addition to these, twenty tutors and superintendents resident in the buildings. Of these, sixteen are military officers, half of whom are permanently attached to the corps, and half on duty from various regiments, and four are civilians. The cadets being divided into four companies, each containing so many of the Selecta, so many of the Prima, and so many of the Secunda, to each of these companies are attached one captain, one first-lieutenant, and two second-lieutenants, all of whom, however, take some part in the instruction; and one civilian (*Civil-Erzieher*) is added with the especial duty of looking after and assisting the studies of the cadets of the company.

The holidays are one month in summer (in July and August,) ten days or a fortnight at Christmas, eight days at Easter, and four at Whitsuntide.

The rules for the entrance of cadets into the army are as follows:—Those who complete their year in the Prima are considered to be sufficiently prepared for ordinary admission. They are sent in to an examination before the Supreme Examinations Board (the *Ober-Militair-Examinations-Commission*,) before examiners entirely independent of and unconnected with the instruction of the cadets; and the majority, if they pass, are admitted simply as *Portepée-fähnriche*, on the same conditions as the young men already spoken of who enter upon the recommendation merely of the commanding officer of a regiment and the approval of the commanding officer of an army corps. Like these, they serve in the regiment, they attend the Division Schools, and in due time offer themselves for examination for a commission.

Out of this number, however, the sixty who do best are retained, and reserved to receive in the special military class of the Cadet School the instruction which the others are to seek in the Division Schools. These remain another year in the Cadet House, and undergo at its close, before leaving the Cadet House, their officers' examination before the Supreme Board. The thirty best are once more selected, and receive immediate promotion. Their patents are signed and they join their regiments at once as second-lieutenants. The other thirty, if they have satisfied the examiners, receive a certificate of qualification, and enter with the rank of *Portepée-*

fähnrich, and with the prospect of receiving commissions without further examination, as soon as vacancies occur. Any one who fails to pass his examination must enter, if at all, simply with the rank of *Portepée-fähnrich*, and has to qualify himself in the Division Schools for attempting a second time the examination for the officer's patent.

Such is the system as recently modified. Till quite lately only thirty were promoted from the Prima to the Selecta, and these thirty, unless they failed wholly, obtained immediate commissions at the end of the year. It has been found desirable to introduce the stimulus of competition, to offer a definite reward in the way of superior advantages to the best students, and to make it obviously worth a young man's while to exert himself, and to be thoroughly diligent during this final year in the Selecta at the Cadet School.

Young men who, after passing the examination in the Prima, desire to enter the artillery and engineers, follow the usual course leading to the Artillery and Engineers' School. They enter an artillery regiment, or a division of the engineers; they serve for nine months, they enter the special school, they are eligible after the first quarter to the grade of *Portepée-fähnrich*, and at the close of their first year are examined for their lieutenant's commission. Those who remain in the Selecta have the great advantage of passing from the Cadet School immediately into the Artillery and Engineers' School as lieutenants, and commence their course there accordingly at the beginning of the second of the three years. As, however, the school-year closes at the end of April, in the Cadet Houses, and begins in the Artillery and Engineers' School on the 1st of October, these select cadets also pass five months with their regiment in actual service before recommencing their studies.

The average number who pass in this manner into the Artillery and Engineers' School is stated by the authorities of the Cadet House to be three annually from the Selecta, and six or eight from the Prima.

It can hardly have escaped observation, that the studies pursued as a qualification for entering the army are, with the exception of the Selecta, almost entirely non-professional, even here in this part of the general system, which is in other respects most military in its character; and the tendency seems to be to carry out to a still greater extent the theory of continuing to as late an age as possible a good general education. There is evidently a general desire in Prussia to take the officers of the standing army exclusively from the well-educated or the higher classes.

In the arrangements for the lessons, the very temperate or even timid use of the stimulus of competition deserves to be noticed. It appears, however, to have been lately employed with advantage in the highest class. At the same time, the provision made for giving really good instruction, and for placing all the boys in close relation with their teachers, can not but excite admiration. The small numbers of which the classes consist, and the care which seems to be taken in providing good teachers, both deserve attention.

The domestic arrangements, without being remarkable for the scrupulous cleanliness or the magnitude of the new institutions in Austria, certainly in some respects are more in accordance with English feelings. The greater privacy afforded by the use of rooms where few live together, is certainly more analogous to what has been found most desirable for English boys in large English schools, though most likely the contrary system is not less well-adapted to the national character in France and in Austria.

2. *The Division Schools.*

There are nine Division Schools for the whole army, one for each army corps, and they are placed at the following towns:—

Potsdam, Königsberg, Stettin, Frankfort on the Oder, Erfurt, Glogan, Neisse, Münster, and Trèves.

Here the young aspirant finds himself with nine or ten companions and a body of teachers amounting to about half that number, appointed by the commanding officer of the army corps, and differing considerably in different districts in their talents and ideas of education. They are often, though not always, selected from officers who have been at the Staff School, and afterwards at the Topographical Bureau. Their additional pay for teaching is uncertain; it depends upon the surplus remaining after the expenses of the household, and the money paid in purchasing books, instruments, &c., is deducted from the yearly allowance made to the school by the government. At best it is not high. It is calculated by the number of lectures, and at the most amounts to something more than 4*l.* 10*s.* (30 thalers) for the lectures on a single subject, given, it must be remembered, during the course of little more than six months in the year. The highest pay given in the Potsdam School to any one professor amounted to something more than 15*l.* (100 thalers) yearly for lectures on three subjects, averaging ten or twelve lectures weekly for about six months. This must be estimated by a Prussian, not an English standard, being nearly equivalent to five-twelfths of the annual pay of a second lieutenant in that service.

Still the sum is very low; and this, with some other obvious deficiencies, injures the working of the schools.

The young candidate for a commission begins a course of Tactics, Fortification, theory of Drawing and Surveying, Military Literature, Artillery, &c., Military Essays, and Drawing of Plans, which must be finished at the school in nine months, although it may be continued longer in private if the candidate is not prepared to pass his examination. As long as it lasts, twenty-three hours a week are devoted to study, besides the time occupied by questions, which the teachers are required to set from time to time, in order to keep up the pupil's previous knowledge of French and Mathematics. The course is divided into the purely theoretical and practical divisions, the first of six and a half months, the latter of two and a half. We have already given a very full account of the studies in p. 188.

The arrangement of studies is systematic, and the number of hours devoted each week to lectures on the various subjects of study and to gymnastic riding and fencing, is as follows:

WEEKLY:

	Hours.
Fortification,	4
Artillery, &c.,	3
Tactics,	4
Military Surveying (theoretically,)	4
Military Literature,	2
Instruction on Military Duties,	1
Plan Drawing,	5
Gymnastics,	2
Riding,	2
Fencing,	2
Total,	29

The subjoined plan gives the exact employment of time for each day during the week:—

PLAN OF LECTURES AT THE DIVISION SCHOOL IN POTSDAM, 1855–6.

Hours.	Monday.	Tuesday.	Wednesday.	
8—9, 9—10	Fortification.	Military Literature.	Tactics.	Dinner time, 3 o'clock. Time for studying, from 6 till 8 o'clock, or from 7 till 9 o'clock every evening.
10—11	Instruction on Military duties.	Artillery, &c.	Plan drawing.	
11—12, 12—1	Plan drawing.	12½–2½ Gymnastics.		
	Thursday.	Friday.	Saturday.	
8—9, 9—10	Fortification.	Artillery	Tactics.	
10—11, 11—12	Military Surveying (theoretically.)	Plan drawing.	Military Surveying (theoretically.)	
12½—2½	Riding.	12½–2½ Fencing.		

The lecturer has to draw up what is called the thread of the lecture (*leitfaden*,) a sort of programme containing its leading heads, intended to assist the memory of the pupils in giving a full account of it afterwards; and the contents of the different lectures on Tactics, Arms and Munitions, Fortifications, &c., are written out very minutely by the students. Ten pages of close print are devoted to these programmes in Helldorf; and the translation already given (pp. 188–194) will show that the list of military subjects adverted to is considerable.

At the end of the nine months spent at the Division School, the "*Officier Aspiranten*" go to Berlin for the examination for their commission. If they can not pass this, they return to study by themselves for their second trial. Unless by special permission from the King, they can not try more than twice.

The examination is conducted by the Supreme Commission for Examinations at Berlin, and has been already described.

The Division Schools were founded at the end of the great War. Their germ appears in Scharnhorst's general order in 1810, which, among other things, instituted three War Schools for the candidate for commissions (*Portepée-fähnriche*.) These three War Schools seem to have been changed into the Division Schools in 1813 and 1816. At first, indeed, they were much more numerous than at present, as their name implies, there being two Divisions to each Army-Corps. There are now, as we have mentioned, nine; and Corps School or Army-Corps School would be the more correct designation.

Their importance as the institutions for special military instruction to all "*Officier-Aspiranten*" of the army led us to inquire carefully with regard to their efficiency, and in particular from two distinguished officers, on whose judgment and scientific experience great reliance might be placed. One of these, it may be added, possessed constant means of knowing all the details respecting them.

I. Formerly, it appears, it was not possible to limit these schools to their true object, purely military instruction. This was the special object of their creation; but owing to the defective *general* education which candidates often brought with them into the army, the Division Schools were too much used as a means of meeting this deficiency.

II. The opinions we obtained were certainly not favorable with regard to the present efficiency of these schools. It seemed to be agreed, that from various reasons, the military education given was susceptible of much improvement: that some of the Division Schools were really defective in teaching, whilst none could be pointed to as strikingly good. But it was also admitted that these blemishes arose from remediable defects in the working of the schools; that their principle was in itself sound, and capable of being carried out more perfectly, and excellently adapted to the object of giving some military instruction to all desirous of becoming officers of the infantry and cavalry.

III. The causes assigned for the present defects in the efficiency of the Division Schools were chiefly the following:—

(*a.*) That they were far too numerous.

Educated and scientific as Prussia may be called, it is not found practicable to supply *nine* army schools with exactly the sort of men fitted for the work of education. The pay, it must be added, is insufficient to attract many, and thus (as we were informed,) although many officers of intelligence are sometimes not unwilling to leave the life of drill for the life of education for a year or two, few do so with the serious purpose of doing it *well.* Neither the position nor the emoluments tempt them to make it a profession. Officers in command of the district have made the appointments, and often have "good-naturedly," as it was said, appointed unfit persons, known as studious men.

(*b.*) The small number of pupils in each school was also spoken of as a very great disadvantage, as doing away with all emulation amongst themselves.

(*c.*) The independence which each school has enjoyed, and the want of any central body to watch its working and regulate its system, is also said to have had bad results. The teaching has been far from uniform,—in one school energetic, in another lax; in one school the most important subjects taught, in another, a little of everything; in a third, some special crotchet of a teacher. This has acted badly on the examinations, since it was thought hard to reject an "*aspirant*" who had done parts of his work well, and had been evidently ill taught or superficially instructed in others.

The remedies suggested were,—

(1.) Considerably to diminish the number of these schools. This, we were told, was about to be done by reducing them from *nine* to *three.* Such a course would obviously tend to remedy two of the evils complained of. It would give a larger choice of teachers, and afford more liberal means of remunerating them, and a larger attendance and competition of pupils.

(2.) To place the schools under the more direct regulation and management of the Central Educational Department at Berlin. This step would improve their teaching by subjecting it to constant inspection and reports. It would insure uniformity in the system of instruction and subjects of study; and, when combined with the presence of able teachers, it would enable the Board of Examiners at Berlin to pursue a more strict and unvarying course in rejecting ill-qualified candidates. By these means the teaching in the school would probably become more definite and higher.

One other point was mentioned to us as doubtful. It was thought that the time for attending the Division School came too soon after a young man's entrance into the army, when he had but recently obtained his liberty, and was likely to be much more unwilling to be sent to school again than might have been the case a year or two later. General von Willisen, who urged this objection to us, was consequently for deferring the attendance at the Division Schools several years in an officer's life.

We should add, however, that as in Prussia a young *Officier-aspirant* is still partly a private soldier, we were told that many were glad to exchange the severity of regimental discipline for the Division School.

3. *The United Artillery and Engineers' School at Berlin.*

Young men desirous of obtaining commissions in the Artillery or Engineers follow the course which has already been described. They join either with a nomination from a colonel of artillery or engineers, or as scholars from the Cadet House. They submit themselves for examination for the grade of Ensign (*Portepée-fähnrich*); they serve their time with the troops, they go through a course of professional study, and are examined in it for their officer's commission by the Board at Berlin. If they come from the highest class, the *Selecta* of the Cadet House, they have the privilege of joining the corps with the rank of officer.

In these respects the system is the same for them as for the *Aspiranten* in the other arms of the service.

The distinctions are, that first, in the preliminary or Ensign's Examination, a somewhat greater acquaintance with mathematics is required from them; secondly, that they prepare for the Officer's Examination, and follow their professional studies, not in the Division Schools, but in a separate Special Arm School at Berlin. Moreover, nine months' service with the troops, instead of six, is required before they can enter the Special Arm School. They enter it also with the rank only of corporal, and are not eligible to the grade of Swordknot Ensign until they have passed three months at least in the school.

Their Officer's Examination before the Supreme Board at Berlin takes place after nine months more, at the end of the first year at the school, and after passing they are eligible to the rank of officer.

When a vacancy occurs their claim to an actual commission is considered, and the usual formalities are fulfilled. Their names are submitted for approval to the officers of the corps, and with that approbation laid before the King; and they thus in due time obtain their rank as Sub-Lieutenants respectively of Artillery or of Engineers.

This rank, however, is provisional, and their position is that of supernumeraries. Their education as officers may be complete, but their education as officers of Artillery or of Engineers has scarcely in fact commenced. They have before them a third examination, that of the Special Arm, their *Vocation-trial* or *Berufs-prüfung.* Or, more correctly speaking, they have not one but two to pass, for the third examination is divided into two stages, one to be passed at the end of each of the two years which yet remain of the course. It is only when these are completed, after a three years' stay, that the young man is finally allowed to join his corps as a second-lieutenant.

Failure in the officers' examination at the close of the first year is attended with the penalty of returning to the corps and resuming service in the ranks with the troops. Whether or not the rejected student may be permitted to return after an interval to join again the classes of the first year, or after passing, upon a second trial, the officers' examination, to enter the classes of the second year, will depend upon the extent of his failure.

Failure in the examination at the close of the second year is similarly visited with the punishment of return to the corps. As they have already passed the officers' examination, they may endeavor to effect a transfer to a regiment of the line; or, under certain circumstances, they may be permitted to study privately in preparation for the third year's course, and may offer themselves for a second trial.

If a student fails in his last examination at the close of the third year, he may be allowed, in like manner, under favorable circumstances, to re-enter the third year's classes, and try to qualify himself by an additional year of study, losing, of course, his seniority. Otherwise, he joins the corps as a supernumerary, with the pay of an infantry officer, and waits till he can obtain a commission in the line.

Candidates for commissions in the engineers enter the corps, it should be observed, originally as volunteers, finding their own clothing, and receiving no pay; but as soon as they enter the school they are regularly paid by the state, and receive their pay in the usual course of the service from the division to which they belong.

The studies of the three years are arranged in accordance with the system that has just been described. Those of the first year are common to the two arms, and correspond, in a general way, with what is taught in the Division Schools or in the highest class of the Cadet House. Those of the second year are devoted to the special arm subjects. In Mathematics, Artillery, and Fortification, the lectures are common to the artillery and engineers; in drawing they are divided.

In the third year a considerable separation takes place. Mathematics are still taught, and there is a special class of the most advanced students in the Differential and Integral Calculus, the Higher Geometry, and in Analytical Mechanics and Hydraulics; this, however, is purposely restricted to about one-third of the class, by raising the requirements, if necessary.

The course is divided in each year into the theoretical and the practical part. The year commences in October with the former, and the studies for the nine months succeeding are for the most part theoretical only. In June the examinations take place. July, August, and a part of September are given up to practical exercises. Something like the last three weeks of September are allowed for a vacation.

The general control of the school is in the hands of the General Inspectors of the two services, the artillery and the engineers. These two are the *Curators* of the school and form the *Curatorium.* They make their reports to the General Inspector of Military Education, of whom mention has already been made. The immediate management is intrusted to a director, who is a field officer of artillery or engineers, of the rank of commandant of a regiment, and he has a captain, appointed by the *Cutatorium* as his assistant.

There is a Board of Studies, of which the Director is chairman, consisting of the Senior Professor of Mathematics, of the Instructors of Artillery and Engineering in the third Cœtus, and of an equal number of officers of the two services named by the Curators.

Four officers, three from the artillery and one from the engineers, acting under the captain, are charged with the care of discipline and order; these are the *Direction* Officers.

There are twelve military and eleven civilian professors and ers. Among the military professors and teachers may be included any of the direction officers.

The examinations of the first year are conducted by the usual Board, the Supreme Military Examinations Board; but for those of the second and of the third year, there is a separate board, chosen from the two services by the Curators, and otherwise unconnected with the School.

The numbers in the school vary from 216 to 240. In time of peace about five are yearly admitted for each regiment of artillery, and two or three for each division of engineers. The great majority have entered the army from the usual places of civil education, a few from the Prima of the Cadet House, on the same terms as the others, and a small number, who are usually among the best pupils in the school, from the Selecta, who come as officers, and after a short service with the troops, enter the second year's classes, provided there is room, preference being always allowed to the students already belonging to the school, who have succeeded in passing the examination of the first year.

The Artillery and Engineers' School buildings stand in Berlin itself, in the principal street, *Unter den Linden*, No. 74, near the Brandenburg Gate. They bear the following inscription: *Artillerie und Ingenieur Schule. Stiftung Friedrich Wilhelms* III. M.DCCC.XXII.

On the occasion of our visit to the school, we were allowed by the kindness of the authorities to be present at some of the lectures. The students of the second year were attending the course on the History of the Art of War, and the immediate subject was an account of and criticism on the battle of Blenheim. The young men, about forty-five in number, were ranged in desks facing the Professor, but not in the manner of an amphitheater. The lecture was interesting, animated, and generally instructive; it was perfectly professorial in character, and the young men took notes. A class of the students of the first year, thirty-five in number, were engaged in topographical drawing. The artillery division of the third year students were in another room, listening to and busily taking notes upon a lecture (also professorial) on the construction of gun-carriages: the number was about forty-five.

Only the students of the first year are lodged in the building; and owing to the unusually large number lately admitted, an adjoining house has been taken to afford additional room. The accommodation in general is rather limited. Two stories in the upper part of the building are occupied by the somewhat scantily furnished chambers; there appeared in some cases to be two young men in one room, in other cases four, or as many as six or seven to a bedroom and sitting-room. The students who lodge in the building dine together in a mess-room; and there is a billiard-room, with coffee-rooms adjoining it, for the general use, looking out from the ground floor front into the Unter den Linden. There is a library, a small laboratory attached to the lecture-room employed for the subjects of Chemistry and Natural Philosophy, and a small collection of apparatus required for illustration on the latter subject.

On quitting the school, the engineer students, as soon as they obtain their commissions, are employed for three years with a Division of Engineers; then for three years in a fortress to superintend buildings; and then again with a Division of Engineers. They are then eligible to promotion as first-lieutenants.

The artillery students, in like manner, join and serve with their regiments.

Promotion in the artillery is by regiments, in the engineers it is general throughout the whole corps.

We should not omit to call attention to the fact, that the only instance which has come to our knowledge of the promotion of *officers in their own arm of the service*, being made contingent on their passing an examination, is to be found in the Prussian Artillery and Engineers. First-Lieutenants belonging to those corps must pass an examination before they can be promoted to the rank of captain. This regulation does not exist for any other part of the Prussian service, and it is considered a great grievance by the officers of those corps, as it may be exacted at the age of forty, from the most highly educated officers of the Prussian army.

The pay of subaltern of engineers is somewhat higher than that of the artillery, infantry, and cavalry. Above the rank of subaltern, the pay of the artillery, cavalry, and engineers, is on an equality, but superior to that of the infantry. The engineers have, moreover, a prospect of employment of a civil nature when they return from active service; to lucrative positions of this kind they are not unfrequently appointed.

It should be mentioned before quitting the subject, that all the officers of the artillery and engineers are bound, in consideration of three years' maintenance in the school, to serve a period of six years, before they can exercise the usual privilege allowed to Prussian officers of withdrawing from the service.

[*A particular account of the Course of Instruction in this School will be given in a separate article under the title of the Institution.*]

VI. SCHOOL FOR STAFF OFFICERS AT BERLIN.

The War School (*Kriegs-Schule*) in Berlin has undergone many changes since its foundation in the time of Frederick the Great. It is now the Staff School of Prussia, *i. e.*, the only, or almost the only, means of obtaining a staff appointment is by passing through it, and the education given is particularly intended to form staff officers. Its plan and methods of teaching differ, indeed, from the very commencement from the French Staff School, and bear much more resemblance to the senior department at Sandhurst, with the exception that the senior department is not at present a necessary means towards a staff appointment.

Thus the *Kriegs-Schule* does not take young men of twenty-one or twenty-two and educate them (like the French Staff School) for the staff and the staff alone. Its pupils are men of twenty-five or twenty-six, officers of three years' standing, or five years' service since their first entering the army. At this comparatively ripe age they become candidates for entrance to the Staff School, and, if admitted, they spend there three years of laborious study, with no very brilliant prospects to crown it, as only a very small number obtain what may be called the lowest prize, admission to the Topographical Department; and out of these only two or three yearly of the most distinguished pupils gain the Staff. The rest return to their regiments, and are employed as adjutants or as teachers in the Division Schools.

The process of entrance is as follows:—An officer of three years' standing desires to go to the Staff School. Any one may send in his name as a candidate for the entrance examination to the minister of war, having obtained a certificate from his superior officer that he understands his regular duty, has no debts, and is capable, both as regards his abilities and bodily strength, of making a good staff officer. Little difficulty is made about admission to become a candidate, nor is there any regulation to limit the number from any one corps or regiment, so that there may be often found in the Staff School more in proportion from the infantry than the cavalry, and *vice versâ*. Some regiments, we heard, hardly ever send officers to the school. Practically, indeed, the regulation requiring three years of active service bears hard upon the artillery and engineers in comparison with the other services; for, as the officers of these two corps only enter their own school after they have been near a year in the service, and spend three years there, they must have been in the army nearly seven years before they can enter the Staff School.

The candidate for the Staff School is examined in the capital of the province in which his corps is stationed. The examination is early in April, and it is held at the provincial town instead of Berlin, in order to diminish expense. But the questions are sent from the board of examiners in Berlin, and the same are given in the different provincial towns at one and the same time. The examination is much on the same subjects, and requires about the same actual knowledge as that which was passed at least three years before for a lieutenancy, but owing to the difference of age, the questions are put and are expected to be answered in a much more scientific form than on the first occasion. Thus, we were told, such an essay as "Give an account of the wars of Francis I. and Charles V.," would at the *Kriegs-Schule* Examination rather be stated thus: "What was the influence of these wars on the policy and religion of Europe?"

The examination is entirely upon paper; it occupies from ten to twelve days of about five hours daily, the superintending staff officer in the province presiding over it. But his business is limited to reading out the questions sent to him, and taking care that no books are brought in, or any improper means used. The answers to the questions have to go through a double ordeal, the military ones being first examined by some of the staff of the general commanding in the province, and afterwards by the commission of examiners at Berlin. The final decision rests with the chief of the Prussian staff, who recommends the successful officers to the minister of war.

There is an average of sixty or seventy candidates yearly. Only forty of these can be taken. If some additional case seems meritorious, the officer may obtain a promise of appointment, but his entrance is deferred. It is not uncommon to try more than once.

The entrance examination passed, the school opens on the 1st of October, to continue its lectures, with a fortnight's break at Christmas and at Easter, till the first of June. It has its 120 pupils, divided into their three classes, one for each year, working (with only little of practical work) under professors, military for the lectures of a military, and civil for those of a non-military character. No difficulty, we understood, is found here, as we had heard to be the case at St. Cyr, in enforcing the fullest attention to the lectures of the civilian professors; each is respected according to his knowledge of the subject, and it would be thought as absurd for a military professor to undertake a non-professional subject, as *vice versâ.*

The method of working is that so commonly followed in the

Prussian universities of listening to numerous lectures, and taking copious notes upon them. Nearly five hours daily, from eight in the morning till one, are often continuously occupied in this manner; for although only twenty hours of attendance are absolutely exacted weekly (an amount which to our own students would seem more than ample) ten more are said to be necessary to enable an officer to do any justice to the various subjects of which he is expected to show some knowledge at his examinations.

These lectures are usually read aloud; there is no questioning and answering. The student, after five morning hours, must spend at least five or six more in copying them out, or in writing an essay on the subject of some of the lectures. Of these one is given about every three weeks, but only on military subjects. They are carefully corrected and sent back to the student with the notes of his teacher, and their merit influences the final estimate of his whole work.

Besides this daily work, the examinations are at once a stimulus and a means of testing proficiency. These occur every three months, but the yearly ones are the most important. They are entirely upon paper. In the quarterly ones the papers are only given for two hours at a time daily, and take the place of two common lectures; in the other examinations they are daily for four or five hours. They are entirely essays upon the numerous subjects lectured on in the school, History of War, Philosophy, Tactics. &c.

Perhaps there is no better way of giving an idea of the mode of studying than by a statement of some of the subjects of these essays. They have been supplied to us by the kindness of Lieutenant Berger, of the 28th Infantry, from whom we have received much valuable information on the subject.

General Essays.

On Tactics:—1. A Prussian Division, added to which is,—
1 Regiment of Infantry,
1 twelve pounder Battery,
1 Cavalry Regiment,
is in retreat from Goldberg to Jauer (in Silesia.) The enemy is following. A position is to be taken up to stop his advance, whatever his numbers may be.

A map of the position being given:—
(*a.*) Describe the position.
(*b.*) Draw up the troops.
(*c.*) Write an explanatory criticism.
(To be worked at home in two days.)

Three Corps d'Armée march against Berlin from different points. The army in Berlin is ordered to meet them. (To be done in five hours.)

Permanent Fortification. For what purpose are the fortifications in the main ditch intended, and how are they to be constructed? (Five hours.)

Military Geography. The Saxon land between the Elbe and Saale, and its influence upon the operations of war in North and South Germany. (Five hours.)

Criticism on the organization of the French Battalion. (At home in one day.)

Examination Essays, Staff School.—Military History, Tactics and Administration.

1. In what respects did the earlier form of military art, strategetically and tactically, favor defensive wars *generally*, and in particular assist Frederick II. in the Seven Years' War? (Two hours.)
2. The duties of the Staff in time of peace. (Two hours.)
3. Position of Landwehr Officers on and off duty. (Two hours.)
4. What is the value of the Cavalry formation *en échelon*, with particular reference to the Austrian mode? (Two hours.)
5. Is only one sort of Infantry necessary, or is Light Infantry essential? (Two hours.)
6. How may the mobilizing of an Army be best expedited? (Five hours.)
7. Describe the different sorts of fieldworks particularly used in war. (Two hours.)
8. How is the Artillery of a Corps d'Armée to be used in the different emergencies of battle? (Five hours.)

Literary and Scientific.

1. The Geological characteristics of the country between the Carpathian Mountains and the Vistula on one side, and the Valdai Mountains and the Dnieper on the other. (Two hours.)
2. By what political conjunctures was the power and influence of England peculiarly advanced in the 18th century? (Five hours.)
3. On the magnetic effects of the electric stream. (Two hours.)
4. Characteristics of Greek literature, and its chief authors in the time of the Peloponnesian War. (Two hours.)

The knowledge required is seen in the account of the Staff School, (p. 395) and in the list of the Lectures given above. Besides military jects, it includes a very full course of Ancient and Modern History, an addition to the History of War (which last alone occupies seven hours weekly for the last year,) a good deal of Logic and Philosophy of Art and Literature, and of Political Economy. Some of these lectures have probably been introduced from the school, having a double object, that of giving a diplomatic as well as a military education. This was the original idea of Frederick the Great, who, in all his plans of military teaching, laid a great stress on the general literature which he himself valued so highly. This diffusive study is a strong contrast to the principle of "little, but well," and to the constant practical exercises in the laboratories insisted on by the early teachers of the Polytechnic School in France.

The following is the plan of the lectures for the three years. Twenty lectures a week are the minimum:—

Course of First Year.

Obligatory.		For Choice.	
Tactics,	4 hours.	Universal History,	4 hours.
Artillery,	3 "	Universal Geography,	3 "
Field Fortification,	2 "	Physical Geography,	4 "
Military and Political Administration and Economy,	2 "		10 hours.
Mathematics, Pure and Mixed,	6 "		
	17 hours.	Total, 27 hours.	

Course of Second Year

Obligatory.		For Choice.	
Tactics,	4 hours.	Universal History,	4 hours.
Permanent Fortification,	2 "	Mathematics,	6 "
Special Geography and Geology,	4 "	Logic,	4 "
		Physics,	4 "
		Lectures on Horses,	2 "
	10 hours.		20 hours.
		Total, 30 hours.	

Course of Third Year.

Obligatory.		For Choice	
History of War,	7 hours.	General History of Literature,	4 hours.
Staff Duty,	3 "	Mathematics,	6 "
Art of Sieges,	2 "	Higher Geodesy,	3 "
Military Jurisprudence,	1 "	Chemistry,	4 "
	13 hours.		17 hours.
		Total, 30 hours.*	

It will be seen that the above course is entirely theoretical; no practical work (as in France) relieves the sedentary labor of ten

* Lectures each week in the War School, Prussia.

War School.	First Year.	Second Year.	Third Year.
Mathematics, Pure,	3	3	3
" Mixed,	3	3	3
H. Geodesy,	..	..	3
Physical Geography,	2	..	..
General "	4	..	..
Special "	..	4	..
Universal History,	4	4	..
General History of Literature,	..	..	4
Logic,	..	4	..
Physics,	..	4	..
Chemistry,	..	..	4
Veterinary Art,	..	2	.
Tactics,	4	4	.
Artillery,	3	..	.
Fortification, Field,	2	..	..
" Permanent,	..	2	..
" Sieges,	..	..	2
Military Administration,	2	..	..
History of War,	..	..	7
Staff Duty,	..	..	3
Military Law,	..	..	1
French,	6	6	6
Russian,	4	4	4
Total,	37	40	40

It would be impossible to enter on a detailed criticism either of these lectures or of the essays mentioned in the note above which evidently imply great study. We invite a comparison with the French plan, which we have given elsewhere, but the difference of age must be taken into account. The mathematical course at this school is,—

1st year. Plane and Spherical Trigonometry, Quadratic Equations, involving several unknown quantities, the Binomial Theorem, and the Elements of Analytical and Solid Geometry.

2d year. Analytical Geometry and the Differential and Intregal Calculus.

3d year. Mechanics, Statics, Dynamics, Projectiles, and slight Applications.

Only the first year is obligatory.

hours daily for more than eight months of the year. But as soon as the first year's course is ended, all the officers who are supposed to know drawing before coming to the school, are sent into the country for three weeks to practice military drawing and surveying; and those of the third year go through (also for the same period) a similar course of staff duty. These last are sent under the direction of the officer who is Professor of Staff Duty at the School; each student officer gets his separate orders, and they meet and are told off every morning for their day's work, reconnoitering fortresses, surveying the frontiers between Austria and Prussia, &c., &c. During the remaining three summer months the students are sent in successive classes to those arms of the service which are not their own, and after the usual military exercises are completed they must bring back with them a certificate of proficiency from the commanding officer. This amount of time was spoken of as being too little.

If we are surprised at not finding a greater amount of practical work included amongst the labors of the school, we must remember that it is chiefly postponed to a later period of the officer's career, when the probability of his being required to use it on the staff is greater. This is when he has gained his place in the Topographical Department, and is working there upon trial to test his fitness for the actual staff. He is then employed during winter in working on the Theory of War, and during summer in military surveying and drawing.

Such is the method and extent of the officer's work at the Staff School; a few more words are needed on the character of his examinations, which here as everywhere else must greatly influence the character of the work.

There are no less than nine examinations during the three years, one for every three months, but the final one at the end of each year is the more important, as a sort of summing up of the year's work. In marking for this the merit of the essays done at home is taken into account. The result in each branch of work and on every examination is entered by the several professors in a book kept at the directory, and the pupils have a right to inspect the report of their own work. The net result of his own three years' work is also sent to the officer after leaving the school through the authorities of his regiment. The certificate of this contains the criticism on each branch of his work in detail.

The subjects given for essays will show the nature of the chief examinations (*i. e.* those at the end of each year;) four or five hours is the time generally allowed to a difficult subject, the examination stretching over a number of days, in proportion to the subjects taken up. The pupil may bring in his notes of lectures, on which extraordinary care is bestowed, and which must contain everything that can be said on the subject. Much value is said to be attached to the rapidity with which an essay is worked, as showing a quality valuable in an officer. There is, as we have observed, no *vivâ voce* of any kind in this School. Some competition exists in the Staff School, (and it is almost the only Prussian school where we find it,) for the knowledge that only eight or ten out of the forty pupils can obtain the Topographical Department, and only two out of these eight or ten, the staff, acts as a competitive stimulus. We must add, however, that although a minute account of the *positive* merits of the pupils is drawn up and sent to them at the end of their career, they have no means of ascertaining their *relative* positions; and this may always leave room for doubt, whether the places in the Typographical Department and on the Staff are strictly given by merit, or whether patronage does not here step in. Another ambiguity may be remarked in the fact that the relative importance of the subjects of study is not known. It may of course be surmised, that a knowledge of the Peloponnesian War is not marked so highly as that of the Seven Years' War; but any indefiniteness as to what is or what is not important, will generally lead to an attempt to know something *of all* the subjects mentioned, and it would undoubtedly be better to affix its definite value to every subject. It would prevent what seem to us valid objections to the present system of the Staff School, the attempt to crowd in too many subjects, instead of mastering thoroughly a few.

The final examination having been completed in June, the student goes through the three weeks of staff duty we have described, and finishes his last three summer months in that branch of the army in which he has not yet served. He then returns to his regiment, where he receives the certificate of his three years' work. But no list is published of the order of merit in which the officers stand. If the certificate is satisfactory, he forwards it to the Chief of the Prussian Staff, with a request to be employed in the Topographical Department of the Staff. If this is granted, he receives an order to join it in about two years, *i. e.* about nine or ten years after first entering the service.

About eight officers are yearly sent to the Topographical Department, and serve there for two or three years, surveying and drawing in summer, working at military science in the winter. The correction of the Topographical Map of Prussia is in their hands. Finally, two out of these are selected for the Staff; the remainder return to their regiments, to become adjutants or to teach in the Division Schools.

The most immediate advantage of being in the staff corps is promotion to a captaincy at any age, which, considering the extreme slowness of promotion in Prussia, may be termed an early one. This is generally gained within two or three years after joining the corps, *i. e.* at thirty-three or thirty-four. In other corps hardly any one has a chance of becoming captain till after forty.

We may add, that the number of officers in the Topographical Department is about forty, on the staff itself sixty-four. No one belonging to the staff is below the rank of captain, or above that of colonel. Every general of division has one officer of the staff attached to him, and two adjutants, the first nominated by the chief of the staff, the two last by the king, and these two belong rather to the officer than to the general. They are not removable with him. The adjutants are not officers of the staff, though they are often chosen from amongst those who have been at the Staff School. They are nominated by the king upon reports sent into him by the generals of division, and the appointment is not considered a great prize, as it implies neither extra pay, promotion, nor permanency; the adjutants are promoted in the usual course, and then, upon promotion, return to their regiments. The adjutants of battalions and regiments are appointed, like our own, by the officers commanding. The name of aide-de-camp does not exist in the Prussian service, but that of adjutant is used in its place.

VII. ELEMENTARY MILITARY SCHOOLS FOR NON-COMMISSIONED OFFICERS.

1. MILITARY ORPHAN-HOUSES.

There are three Military Orphan-Houses in Prussia for the children of soldiers, two for boys, one at Potsdam, and the other at Annaburg, and one for girls at Pretzch. Although intended for orphans, they receive children whose parents are too poor to provide for them. They receive a good elementary education and are brought up for trades, and can make their selection between a civil and a military career. The English Commissioners report that they found 800 pupils in the Orphan-House at Potsdam, of whom 200 were under the charge of female teachers; 520 were in the senior department, including thirty-six in the music class, who will go into the Regimental Bands, and about twenty who formed a separate military class, who would probably enter the Artillery School.

The School at Annaburg, and the subsidiary Girls' School at Pretzsch, are both Protestant in character; no religious teaching is supplied for Roman Catholics. Roman Catholic boys are all sent to Potsdam, and Roman Catholic girls are provided for in ordinary schools, and in private families, and payment made on their behalf out of the funds of the institution.

Dr. Bache in his "*Report on Education in Europe*," gives the following account of these institutions.

Military Orphan-House at Potsdam.

This institution was founded in 1724, by Frederick William the First of Prussia. The reputation of Franke's Foundations induced this monarch to rival the benevolence of the clergyman, and to establish on a scale proportioned to his greater means, a house for the education of the orphans of his soldiers. While, however, the recipients of Franke's bounty are free to choose their career in after life, and only so far bound to the institution, as a sense of gratitude may prompt, the youth who passes through the Military Orphan-house of Potsdam, must enter the military service for twelve years. Three of these, indeed, are the term of service of every citizen, and I believe the three years in the non-commissioned officers' school are now counted as part of the twelve, and thus the actual number of extra years of service is reduced to six. The institution began with one hundred and seventy-nine children, both girls and boys being received; this arrangement continued until a few years since, when the girls' school was removed from Potsdam, and the establishment at present is for male pupils only. There are between three and four hundred in the elementary or boys' department. In the early history of the orphan-house two attempts are recorded to introduce manual labor, as a profitable speculation; neither of which appears, however, to have succeeded. The first of these, the manufacture of Brabant lace, was introduced in 1743, and after various modifications of the mode of applying the labor of the children, it was finally abandoned in 1795. In 1744, the culture of silk was introduced extensively throughout the kingdom, and especially enjoined at the orphan-houses; but this attempt was not more successful in the end than the other, and the culture is not kept up in this institution.

The present spacious buildings were chiefly constructed under the reign of the founder and of Frederick the Great. Additions have, however, been made from time to time since, and the whole plan is hardly yet completed. The institution may be considered as divided into three departments or schools; an elementary school, (called the Boys' House, *das Knabenhaus*,) a trade school, and a music school. The buildings for the elementary school are erected about a spacious court, which serves as an exercising and play-ground. On the ground floor are the refectory, in which all the youth from the different schools composing the institution, meet three times a day, and the study and play-rooms, lavatory, &c. The study-rooms form a long range, and when the doors of communication are opened, one teacher can superintend the whole of the classes. The school-rooms are on the first and second floors, and are calculated for divisions of forty boys each. There are six dormitories, furnished with wooden or iron bedsteads, the latter having been more recently introduced and found to answer well. The bedding consists of a straw bed beneath, and a mattress of hair above. Each dormitory is superintended by a teacher, who sleeps at one end of it. There are also dwelling-rooms for the teachers, officers, &c., and in the court a very large wash-house, with a drying-room above it.

The buildings occupied by the trade and music schools are separated by a street from the others, and with the dwellings of the officers, a room for gymnastic exercises, and musical practice, and the workshops, form a second immense series of structures. The infirmary is near to them, and is under a separate direction; subordinate, however, to the general executive body. It is divided into rooms assigned to patients suffering from different complaints. A schoolmaster gives instruction to the convalescent. The arrangements in the dormitories of the trades' school, are similar to those used in the army, and the superintendence and discipline are strictly military.

The part of the building occupied by the music school, contains separate rooms for practicing by individuals, class-rooms, and dormitories. There are rooms in the main pile for the meetings of teachers, for a small library, &c.

The executive board of this school depends partly on the ministry of war, and partly on that of public instruction; the former, however, is the controlling authority. Under this board is the military superintendent, or director, to whom the chaplain, the secretaries, the economist, the military superintendent of the day, the teachers, commandants of companies, the inspectors of the trades' and music school, and other officers, are directly responsible. The clergyman is the superintendent of the elementary school, and has a general charge of all the intellectual and religious instruction.

The orphan children of soldiers are received for maintenance, at any age, by the authorities of the establishment, but if under six years, are boarded with their friends or others until six, and then admitted into the house at Potsdam; they remain there until fourteen or fifteen years of age, and, if of sound constitution, are transferred to the trade, or to the music school, where they remain four years, and whence they pass, if their conduct has been good, to the school for non-commissioned officers. I have never seen a body of young men all so well physically developed as the pupils of the trade school, a result produced by constant attention to their education on this point. Children who are not healthy, or who have failed in the elementary school, are apprenticed at fourteen, and the institution ceases to have the charge of them.

In the *Elementary School*, the usual branches taught in the common schools of Prussia are pursued, including reading, writing, arithmetic, the German language, geography, drawing, religious instruction, and a little natural history. The boys are divided into four classes, according to their proficiency, and all the classes below the first are subdivided into two sections, each being under the charge of a teacher, and having a separate recitation room. These sections contain about forty pupils each. A monitor of order from among the pupils, has charge of a section on entering and leaving the school-room, and render such service as the master requires during the lesson; he is assisted by one of the class in the distribution of the books, slates, and other implements of instruction. The teachers keep each a roll, upon which the character of the recitation and conduct of the pupils is entered, and which is examined weekly by the chaplain, and submitted to the board of teachers at their meetings. No youth, who is below a certain grade upon this roll, is permitted to enter the trades' school. There are about five hours of instruction on four days of the week, and about twenty-three in the whole week. The holidays are, a week at Easter, four days at Michaelmas, a fortnight in the latter half of July, and from the twenty-third of December, to the second of January. For those who have no friends to go to, the Christmas festivities are kept up in the school, as in the private families of the country.

The board of teachers meet once every fortnight, and the director, or his substitute, or the chaplain, presides. At their meetings, all matters relating to instruction and discipline are discussed.

The form of the discipline of the school is military, but a spirit of mildness tempers it, suiting it to the age of the pupils. The boys, in general, are divided into four companies, each of which has a commandant, (a non-commissioned officer of the highest grade,) who has charge of the instruction in military exercises, and ranks with the teachers of the school. These companies form a battalion, and are drilled without arms, and inspected by the director, or an officer appointed by him. In turn the commandants of companies, acting as officers of the day, have general charge of the military and police duties. Two of the teachers, also, in turn, act as inspectors of the day, and have the general superintendence of the pupils in study and recreation hours, in the duties of personal police, at meals, and in the dormitories, relieving each other at different parts of the day. They are co-ordinate in authority with the officer of the day, and he is expected to relieve and aid them in the maintenance of order. These officers report immediately to the director.

The four companies are subdivided into sections of eleven, over each of which one of the boys is placed, with the title of overseer, or corporal, and he is responsible for the good order of his section, and may be assisted in his duties by one chosen from it. From among these corporals one is selected for the general control and superintendence of the others, and marches the company to the lavatory, to meals, to the dormitory, &c., being responsible for them whenever they are collected as a company. The boys composing a section are placed at meals upon the same side of the table with the corporal who has charge of them. The younger pupils do not join these companies at once, but are kept together in a division which is under female superintendence, has a separate overseer, and is under different regulations as to rising, going to bed, and other particulars of discipline and police from the elder pupils.

All the duties of domestic and personal police, and some of those of domestic economy, are performed by the boys enrolled in the four companies. They clean their own shoes, brush their own clothes, attend to the police of the different parts of the building, serve the meals, and make their beds. That the various duties may be attended to in an orderly way, there are, besides those already spoken of, special overseers appointed among the pupils, who have general charge of them while engaged in certain duties, and of particular localities. Thus there is an overseer of the room where the clothes and shoes are kept, who has charge of the exchange of the Sunday for week day dress, and vice versâ; an overseer of the room where the shoes are brushed and blacked; an overseer of the lavatory; four superintendents of cleanliness, who direct the pupils while washing and combing their hair; one of hair cutting; two of serving the table, who have charge of a detail of thirty pupils, who serve and clear the tables and clean the knives and forks; one, of the manual labor classes; one, of the sick in the hospital; one, of those who are unwell, and must report to the physician; one, of the lights; one, to prevent the passing of bounds; one of the pupils who sing the liturgy in the church; one to conduct the pupils, whose shoes require repairs, to the shoemaker; besides, those for the classes and the younger boys, already mentioned, and a few others. I make this enumeration in order to show the minuteness of the arrangements for police and discipline, and the extent to which they are conducted by the pupils themselves. The selections for appointments are made by the teachers and officers, and submitted to the chaplain and director for their approbation. A part of the pupils employed as superintendents recieve small pecuniary allowances, and all enjoy many privileges.

Some of the pupils, who are found to have a taste for music, receive special lessons, and are employed, when sufficiently proficient, to give the signals for the different duties of the day. Eight pupils are thus selected to be taught the bugle and fife, and twelve the drum.

In regard to conduct, the pupils are divided into four grades, according to the reports of the teachers and officers, a revision of the classification taking place every quarter, and the director having, in the meantime, the power to displace a pupil in a case of emergency. The first class grade is composed of pupils distinguished for unvarying good conduct, and on holidays its members are allowed to leave the orphan-house alone to make small purchases at discretion, and are neither subject to corporal punishment nor to the stoppage of their meals. The second class is composed also of meritorious pupils, but of a lower grade of conduct than the first; they are permitted to leave the school sometimes, but not so often as the others, and are generally under supervision. From these two grades only, the superintendents or overseers are taken. Pupils of the third grade stand between those who are decidedly good or bad, and are treated accordingly. They are the last who are permitted to pass from the elementary to the trades' school, on completing their course in the former. Those of the fourth, or lowest grade, are kept constantly under supervision, have no allowances, no leaves of absence, are separated, when possible, from the rest of the pupils, and are even punished by an inferior diet.

The health of the pupils is promoted by frequent bodily exercise, and, when the weather permits, in the open air. Thus they have regular gymnastic exercises four times a week, are drilled by companies four times, and by battalion twice a week, take frequent walks, and in summer, bathe every day. The regular manual labor in this department of the school is confined to knitting and tailoring. The gymnastic exercises are conducted by two teachers, each taking charge of one of the companies, of which two attend the lesson at the same time, and assisted by pupils selected from among the most proficient in the exercises. There are two swimming lessons given to each company, in summer, every week. In the ordinary division of the day, in summer, between two and three hours are allowed for manual labor, the same for recreation, two hours for exercise, and nearly eight for sleep.

Their clothing is a neat uniform jacket of blue cloth, of a military fashion, gray or white pantaloons for the winter, and a brown linen jacket and white linen pantaloons for the summer, and their officers are distinguished by badges similar to those worn in service. The diet is generous, and, besides the three meals, bread is served as a luncheon in the morning and afternoon intervals.

An opportunity is given to those who are to pass into the trades' school, to ascertain the trade which they may wish to follow, by a trial during the last year of the elementary course.

The order of the day, with merely slight variations during four days of the week, in summer, is as follows:—The pupils rise at a quarter before five o'clock, and proceed by companies to the lavatory, two companies occupying it at once and alternating, the other two being, meanwhile, engaged in cleaning their shoes. Wash and comb their hair. At half past five the boys detailed to serve the meals proceed to the refectory under their two superintendents. At a quarter before six the bugle sounds, and the companies assemble, by sections, in the court-yard. Morning prayers and breakfast. Those who are slightly sick report to the physician. At a quarter before seven, the boys assemble according to classes, and at seven are marched to the school-rooms. At a quarter before nine a luncheon of bread is served out to them. School closes at eleven, and the pupils are free for three-quarters of an hour. Dinner at about a quarter before twelve. The pupils brush their clothes, and are inspected by the officer of the day. From a quarter past one to half-past two, review the morning lessons in school. From a quarter to three until five, are occupied with manual labor in the work-rooms. Part of the pupils receive instruction in music, and the first and second classes in drawing; a stated number take a swimming lesson; the drummers, fifers, and buglers also have a lesson. A luncheon of bread is distributed. One of the companies is at drill, one at gymnastics, and the other pupils bathing or walking until seven. Evening prayers in the refectory, and supper. Wash, and have recreation until nine, when they retire. The younger pupils retire at half-past eight.

In winter, the different occupations of the day are each one hour later than in summer, until half-past two, when the hour of review of the lessons is omitted, and the exercises, as far as appropriate to the season, follow in the same order as in summer, until half-past five, at which hour the pupils go to the school-room, and remain until a quarter before seven.

On Wednesday and Saturday, an hour is devoted to religious instruction, the other lessons being omitted, except the physical exercises on Wednesday. Stated days and periods of the day are assigned for the exchange of the week-day clothes for those of Sunday, for taking clothes or shoes requiring repairs to the tailor or shoemaker of the establishment, for hair-cutting and combing, for washing the neck and shoulders, the feet, and for other minute matters.

The object of the *Trade School*, is, in part, to economize the funds of the institution, by making within its walls articles of clothing required for the pupils, but more to secure the acquisition, not only of general mechanical dexterity, but of a trade, which may serve to increase their emoluments when they enter the military service. There are, at present, one hundred and four pupils.

In order to pass into the trades' school from the elementary division, the pupil must have reached at least the second class, have been above the fourth grade in conduct, be between fourteen and fifteen years of age, and of a bodily constitution fitting him for the military service. The course lasts three years. The school has a special inspector, or superintendent, who is responsible to the director of the whole institution, or, in fact, to his substitute.

The different trades now taught here are those of blacksmiths, saddlers, tailors, shoemakers, and lithographers. The last named has but seven pupils admissible to its school, and the next to the last forty-four. These numbers depend upon the demand for the occupation subsequent to leaving the establishment, the space required for the operations of the trade, the difficulty of teaching, &c. As each pupil is in general permitted, on advising with the inspector, to choose his employment, it sometimes happens that boys are sent into the town to learn a trade not taught in the school. Changes of occupation are very rare, but are sometimes permitted. The blacksmiths are principally engaged in the repairs of arms, the saddlers make the caps and accoutrements, &c., used in the house, the tailors all the uniforms, the shoemakers supply not only this orphan-house, but that of the girls with shoes, and the lithographers are occupied in copying forms for the school or war department, manuals, &c. They work about seven hours a day, under a master-workman from the town.

An hour of each day is spent in gymnastic or military exercises in the open air in summer, and in winter in the large room before spoken of. The military exercises, besides the ordinary ones, comprise some which are peculiar to the Prussian service. The usual exercises of gymnastics are introduced, omitting any which seem to have a tendency towards the tricks of the mountebank. For instruction in these exercises, the whole school is divided into two parts, and each again into squads, so that the teacher need have but twelve to fourteen under his charge. Non-commissioned officers are the under teachers, and in turn are superintended by higher teachers, and by an inspector.

There can be no doubt that to these well regulated and perseveringly continued exercises it is, in great part, due that the physical development of these youths is, on the average, so perfect. Judicious recreation, a proper diet and clothing, great cleanliness, a proper number of hours of work, of instruction and sleep, no doubt, are necessary, each and all in their degree, but great influence must be besides allowed to the gymnastic exercises.

The pupils have two hours of instruction during the day, intended to keep up their knowledge of the branches taught in the elementary school, rather than to teach new ones. Military drawing is, however, added.

When not in the shops, nor in school, nor at exercise, they are superintended by non-commissioned officers. The discipline in this school is military in spirit, as well as in details.

Those pupils who have manifested a decided musical talent in the lower school, are here instructed thoroughly in the theory and practice of music. The object is to supply musicians to the regimental bands. These pupils have a separate superintendence from those of the other schools, and different hours of exercise and duty. They keep up the knowledge acquired in the elementary school, as is done in the trades' school.

Military Orphan-House at Annaburg.

The following plan of instruction was prepared by Dr Harnisch, one of the most distinguished teachers of Prussia, formerly Principal of the Teachers Seminary at Weissenfels.

In order to rise to the place of a non-commissioned officer, the pupil must have gone through the lowest classes of the Upper School, where there are the following studies:—

Religious instruction, arithmetic, singing, the German language, calligraphy, geography and history, algebra, geometry, trigonometry, and drawing.

The courses in the different branches are arranged as follows:—

FIRST. *Religious Instruction.*

LOWER SCHOOL.

Class VII Bible stories, psalms and hymns, appropriate to the season. Four hours per week.

Class VI. Histories from the Old and New Testament, portions of the history of the Christian church, catechism. Four hours per week.

Class V. Reading and explanation of the Bible, and of its arrangement. The gospel and historical works are selected, and the history is connected with the geography of the Holy Land. Catechism. Five hours.

Class IV. Doctrines of the Lutheran church, taught by Luther's catechism. Five hours.

UPPER SCHOOL.

Class III. Moral instruction, duties to God and man. Three hours.

Class II. Reading the Bible with comments, the pupils making abstracts. Three hours.

Class I. (Two years.) The first year a repetition of Luther's catechism. The second, a history of the Christian dispensation. Three hours.

Every class commits verses from the Bible to memory.

Second. *Arithmetic.* Mental and written arithmetic are taught together, that the readiness afforded by the one, and the accuracy of the other, may both be cultivated.

LOWER SCHOOL.

Class VII. The four ground rules, with three places of figures mentally. Application to questions in weights and measures. Three hours.

Class VI. The same rules extended. Three hours.

Class V. Fractions, with applications to weights and measures. Three hours.

Class IV. Proportions. Three hours.

UPPER SCHOOL.

Class III. The applications of proportions to questions of weight, strength, value, time, and general quantity. Two hours.

Class II. Exercises in practical algebra. Two hours.

Class I. Review of the course. First year, practical operations. Second, theory of arithmetical processes. Two hours.

Third. *Vocal Music.*

LOWER SCHOOL.

Classes VII & VI. Practice of songs, adapted to youth of a cheerful, serious, military, or religious cast, with one part. Two hours.

Classes V & IV. Choral and other songs, with the different parts. Elements of music. Two hours.

UPPER SCHOOL.

Classes III, II, & I. More difficult choral pieces. Theoretical instruction continued. One hour. There is, besides, instruction given to a select choir, intended to conduct the vocal exercises of the church.

Fourth. *Reading* In the lower classes, a readiness in reading, and in the higher, the style of reading, is attended to especially. Pieces learned previously, by heart, are recited.

LOWER SCHOOL.

Class VII. A good pronunciation, and some facility in reading. Six hours.

Class VI. Readiness in reading, and repeating the substance of what has been read. Familiar illustrations. Five hours.

Class V. Reading some work in reference to knowledge useful in common life. Four hours.

Class IV. Reading, with attention to emphasis. Four hours.

UPPER SCHOOL.

Class III. Reading the Bible and sacred melodies, with the view to correct reading in this kind of composition. Two hours.

Class II. Reading various selected works, in and out of the class.

Class I. Reading continued, and recitations from works previously read.

Fifth. *Orthography and Writing.* These may be taught together in the same way as mental and written arithmetic; the teacher is, however, at liberty to follow his own method.

LOWER SCHOOL.

Class VII. Copying on slates from the blackboard. Four hours.

Class VI. Copying on paper, from the board, and from books. Four hours.

Class V. Writing from copy-slips, from books, or from dictation. (Practice in spelling and writing.) Four hours.

Class IV. Similar exercises continued. Four hours.

UPPER SCHOOL.

Class III. Copying useful papers, such as registers, accounts, contracts, &c. Two hours.

Class II. Calligraphy, with Roman as well as German letters; practice in orthography; reading of letters and documents in various handwritings. Two hours.

Class I. Copying papers relating to the management of the institution, as a practical introduction to business. One hour.

Sixth. *Useful knowledge taught by induction*

LOWER SCHOOL.

Class VII. The pupils give their ideas, verbally, of surrounding objects of the most simple kind, of the commonest productions of nature and art. Conversations relating to them. Drawing the most simple mathematical figures on the slate. Three hours.

Class VI. Descriptions of animals and plants, the former in the winter, the latter in the summer term. Written remarks on these, serving to afford exercise in the formation of phrases and in orthography. Four hours.

Class V. The most essential parts of physics and natural history, the pupils taking notes of the lessons. Four hours.
Class IV. Compositions on various subjects. Letters relating to civil and military affairs. Four hours.

UPPER SCHOOL.

Class III. History of Prussia, and drawing of maps. Four hours.
Class II. General geography, particularly that of Europe. Passing from physical to political geography. Civil geography in connection with the former. Five hours.
Class I. Universal history. One year is devoted to ancient and one to modern history. Selections are made of the more important parts of history. Five hours.
The remaining studies only belong to the higher school.

SEVENTH. *German grammar and style.*

UPPER SCHOOL.

Class III. Logical and grammatical instruction of the German language taught.
Class II. Idiom of the language. Compositions on military subjects, with especial reference to correctness of grammar.
Class I. Acquaintance with the best writers. Exercises of composition on subjects taken from history.

EIGHTH. *Geometry.*

UPPER SCHOOL.

Class III. Teaching the names and properties of mathematical figures by induction, in connection with drawing.
Class II. Equations, with application to problems of common life.
Class I. Elements of trigonometry.

NINTH. *Drawing.*

UPPER SCHOOL.

Class III. Drawings from common objects, varying the positions, &c.
Class II. Copying flowers, or drawings of implements.
Class I. Architectural drawing with instruments, drawings of furniture, &c.

Dr. Bache makes the following remarks on the above plan:

I have allowed myself to present this extended programme, because it conveys, in as brief a compass as possible, excellent ideas of the succession of courses in an elementary school, and in a technical or trade school, for such the higher school must be considered. It should be remembered that the main purpose is the preparation of youth for the military service, and hence that the wants of the service are especially consulted. Another fact must be remembered, namely, that this is a Lutheran school, and therefore the religious instruction is adapted to the particular views of that church. The course of morals of the third class, I must say, however, seems to me out of its place, for although our duties to God and our neighbor are of course best learned from his Word, yet their inculcation by precept and example can not commence too early.

In the arithmetical course, the union of mental and written arithmetic is absolutely essential. The gradation appears to me good, and the application to questions of common life gives a zest to such studies, attainable in no other way. The theory of arithmetical processes, however, should accompany or follow more nearly their practical acquisition. Indeed, if they are taught as they ought to be, by induction, the theory goes with the practice.

If the youth at Annaburg take the same pleasure in the exercises of song, from the elements to the completion of the musical course, as those of the school* actually superintended by the author of this project, the success will be complete.

The connection of orthography and writing, especially if combined with early reading, is natural.

The exercises of induction, which in the lower classes are well drawn out, deviate from the appropriate track in the fourth class, and in the geographical and historical courses do not return to it. The system in both these branches is rather synthetical than inductive. There is a great temptation to break away from this method, into that of giving positive instruction, from the apparently greater rapidity of progress of the pupil; some teachers have abandoned it altogether, as too slow, though ultimately to their cost, as appeared to me in cases where I had an opportunity of comparing the results.

The writing is preceded by an introductory course of drawing, which might

* Seminary for Teachers at Weissenfels.

with excellent effect be so extended as to branch out into complete courses of drawing and writing.

As this plan results from an extended experience, the number of hours of instruction, per week, necessary to secure the results, is an important datum, and as such I have retained it, whenever it was inserted in the original programme.

II. THE SCHOOL DIVISION OR NON-COMMISSIONED OFFICERS' SCHOOL.

A military school of a somewhat peculiar character for training up young men for the duties of non-commissioned or *under* officers exist at Potsdam, and is known as the School Division.

The rules of the Prussian Military system, which require only three years absolute service in the standing army in time of peace, evidently entail a great practical difficulty in this respect. The soldiers, as a rule, prefer to quit the service at the end of their three years' time, and require great inducements to persuade them to remain. As one inducement, the state has declared that twelve years' service gives a non-commissioned officer a formal claim to civil employment; as, for example, on the railways or in the custom-houses. Their pay also as non-commissioned officers goes on increasing according to the length of their service; and it was stated to be the usual practice not to advance soldiers to be non-commissioned officers until they had signed an undertaking to serve for a longer period than could be exacted of them otherwise.

A further means of supplying the want has been sought, and appears to have been found in the School Division. The circumstances of its origin have placed this establishment in immediate connection with the Corps of Guards, to which, in a military sense, they belong, at whose head-quarters, the town of Potsdam, their buildings are situated, and whose garrison duty in the town they occasionally undertake.

At its first commencement the pupils chiefly came in drafts from the Military Orphan-Houses. But the applications from the country in general have been so numerous that this practice has been, it is said, abandoned, and a higher class of admissions has been attempted. The Commander of the Battalion of *Landwehr* for the Circle (*Kreis*) receives all applications in that Circle; he sees that the candidate is examined on the spot, in reading, writing, and cyphering; and forwards the name, height, age, and other particulars (the *Nationale*) to the authorities. The decision is said to be mostly made by the candidate's height, and his medical certificate, and to be rather a difficult matter. Only one-third of the applications are successful. A new boy had just presented himself with his father at the time of our visit; both son and father were well dressed, and apparently belonged to the middle rather than the lower classes. There seems every reason to be satisfied with the amount of acceptance with the country which the school had begun to receive.

The age of admission is from seventeen to twenty, and the youth on entering the school takes a military engagement to give two years of service in the standing army for each year of his maintenance at the school, in addition of course to those three years of military service to which every Prussian is bound, but with the privilege of counting as military service the period spent at the school.

The usual school course is one of three years, and his engagement is thus for a term of nine years; that is, deducting three spent at the school, six years' time with the troops.

The School Division is 496 strong; there are four companies of 124 men. The whole body is commanded by a captain, or major, who has an adjutant. To each company are attached four officers and fourteen non-commissioned officers; the latter teach in the two first years, the former in the third. The school course begins on the 1st of October; the afternoons of three days in each week are employed in ordinary school instruction, but the remainder of their time in winter and their whole time in summer is devoted to military training. The school instruction is not carried beyond reading, writing, and arithmetic up to the rule of three; geography, drawing skeleton maps, and copying, and learning the significance of military representations of ground. Some very respectable specimens of their skill in copying maps were produced; it appeared to be a favorite exercise.

About 150 are admitted yearly, an extra number being taken to supply possible vacancies; about 130 yearly are drafted into the army, six usually as *under* officers at once, forty at least with certificates of being qualified to receive the grade in a short time; and the whole number who go out have generally obtained their appointment before twelve months are completed. The highest number that may go out at once as under (or non-commissioned) officers is twelve; three for each company. Many, however, have latterly, it is said, become so within six weeks after their leaving.

Where the young men are strong and full-grown, they are allowed to join the army at the end of two years; their whole service (two years for each at the school) being therefore reduced to six years.

Young men, on the other hand, who show no disposition or likelihood to turn out good *under* officers, are sent off to complete the usual time as privates.

The proportion of non-commissioned officers in the standing army who are taken from the School Division was not easy to ascertain. It differs extremely in different regiments. In one, it was stated that out of the ordinary complement of 180, fifty came from hence. On the other hand, it was asserted that the general proportion was not more than one in forty. A certain number have obtained commissions; but no prospect of such promotion appears to be held out, and any tendency to carry forward the studies with a view to it is discouraged and checked.

The buildings, in the outskirts of Potsdam, are large, new, and handsome, forming three sides of a spacious court or imperfect quadrangle. The dining-rooms are used also as exercise-rooms, and it was made a point to let us see a portion of the pupils go through their gymnastics and exercises; and more particularly their sword and bayonet exercise. Twenty or thirty young men, very healthy and strong-looking, went through the latter exercise in two lines; after which came a single combat with the bayonet, all under the direction of an officer.

The sleeping-rooms are fairly large, and well ventilated, on the same floor. Twelve slept in each. During the day the wooden bedsteads are placed one above another. It was said that iron bedsteads are being generally introduced. Each young soldier is provided with a small cupboard above his bed. The non-commissioned officers had horsehair, the young men themselves straw paillasses. There was a stove in the room, but it was said not to be used.

The school-rooms are on the upper floor. The skeleton maps already referred to were here produced; one, of the two hemispheres, others illustrating Prussian history, showing the original size of the Prussian territory, its extent and condition under Frederick the Great, the whole course of its gradual extention, &c., very fairly drawn, and creditable to the young men.

The time devoted to the training which is given in the School Division appears long. What is now done in three years might as well be done in half that time. The object, however, is secured of retaining the service of the men during a lengthened period in the standing army.

III. REGIMENTAL SCHOOLS.

The Regimental Schools are chiefly intended to train up non-commissioned officers. This is more particularly the case in the artillery, which does not obtain its *under* officers from the School Division at Potsdam.

IV. THE NOBLE-SCHOOL AT LIEGNITZ.

The Noble-School at Liegnitz is merely an endowed school, founded by the Emperor Joseph I. while Silesia was yet an Austrian dependency, and specially intended for young men of good birth in that country. There are some military foundations in the school for the sons of officers of good birth; and the two military men who take part in the instruction are paid by the state, on the same footing as officers employed in the State Military Schools.

[Of one of the Institutions above described (The Artillery and Engineers' School at Berlin) we shall give a fuller account, and in the meantime we close this comprehensive survey of military instruction in Prussia with the following reflections of the English Commissioners.]

VIII. GENERAL REMARKS ON THE SYSTEM OF MILITARY EDUCATION IN PRUSSIA.

1. Attention has often been drawn to the peculiar feature of Prussian Military Education, the double examination for the rank of officer. The principle adopted seems to be the exaction of a proof from *all* officers that they have received a good, general, and professional education, rather than the selection of a smaller number for higher training in a military school. The decree of 1808 first laid down the rule for the whole army, "that the only title to an officer's commission shall be, in a time of peace, education and professional knowledge,—in time of war, distinguished valor and ability."

2. The spirit of emulation is not so much called out in Prussia as it is in France. Early distinctions are acknowledged and appealed to, but somewhat sparingly. The following words express the view taken on this point:—

"A testimonial of fitness for the University," says Colonel von Holleben, (*i. e.*, to have passed the Abiturient examination) "dispenses with the examination for the ensigncy. In consequence of this rule fifty *Abiturients* on an average annually enter the army. These, as well as the *Selectaner* of the Cadet Corps, must be considered in point of scientific education, an excellent supply of officers."

3. It will be seen that in the above words there is no reference to those rewards and advantages which are the stimulus of competi-

tion. There appears some want in this respect both in the earlier and later training of officers. Thus, in the instance of the Cadet House, there are numerous *free places*, but these are assigned to young men, not from any proof of merit or exertion, but entirely because they are the sons of officers or state servants. The most distinguished pupils, the *Selectaner* gain nothing more than to be permitted to pass these two examinations before, instead of after, entering the army. Honorable mention, is, however, made of the candidates for commission who distinguish themselves in the Division Schools. But in the Staff School—the natural resource of energetic young officers—the competition (which the school asserts as its principle by its entrance examination) loses some of its force, by the order of the pupils on leaving the school not being distinctly marked. It should be mentioned as an explanation of these facts, that in the general civil education of Prussia, competition is little encouraged, less than in our own, and far less than in the French, or even in the Austrian education.

4. The military system of Prussia, and in some degree its military education also, appear to have various objects in view. Thus the Cadet Houses, where the free places are chiefly given to the sons of military men, seem intended to keep up a military *esprit de corps*, and it is impossible not to be struck by the strong class spirit prevailing in the Prussian army. At the same time means are taken, as above stated, to obtain a good supply of highly educated officers.

5. Prussian military education seems to have been constantly correcting and extending itself. Of this the Division Schools are a striking example; and they deserve attention, both because their plan is peculiar to Prussia, and for the improvements they have received. The Prussians at first established numerous Division Schools, but they afterwards greatly diminished their number; and the general inspector of military education now contemplates, both for the sake of the instructors and their pupils, a further reduction to three or four. A large military school in three or four towns in Prussia, intended to teach professional knowledge to young officers after some short practical experience in the army, is thought a better mode of giving such knowledge than to place isolated, or few teachers, in regiments or army divisions.

6. One chief means of improvement has been the bringing the whole education under a single head. At first there were distinct boards for the examinations in Prussia, and for the schools, with a view to maintain the independence of each. It was found, however,

that this led to a want of harmony between the schools and the examinations; and accordingly, whilst the board of examiners and the school professors are kept perfectly distinct, they are both subjected to the general inspector, who controls all the departments of military education. The effect of this has been to give more unity to all the teaching; an essential point where that teaching is entirely on the same subjects. By constant inspection of the schools, and the receipt of periodical reports from them, the general inspector of military education is able to compare the results of each, and to keep the whole system going at an even rate of progress.

7. Attention should be drawn to the somewhat complicated system for working the Military Schools in Prussia. There are two distinct boards, as we have noticed above, the supreme board of studies and the examinations board, one of which reports to the inspector-general on all examinations, whilst the other acts as his assessors and advisers with regard to the schools and on all other subjects of military education. Besides these bodies, each school has its own board of studies, which is generally formed by some one person belonging to the school, combined with distinguished officers or professors. Suggestions with regard to each school appear to originate chiefly from these latter bodies.

8. The department of military examinations and education is under the control of the general inspector, who "lays his proposals on matters of administration before the minister of war, but reports directly to the king in all matters relating to instruction and examinations."

THE ARTILLERY AND ENGINEERS' SCHOOL

AT BERLIN.*

OBJECT AND COURSE OF STUDY.

THE object of the ARTILLERY AND ENGINEER SCHOOL is to give to such young men of the Artillery and Engineers as have been found fitted for promotion, the education necessary for the proper performance of the duties of a Subaltern Officer, and to enable them to draw profit afterwards from their private studies and the practice of the service.

The complete course of study lasts two years and three quarters. The instruction is divided into three courses, bearing the name of *cœtus;* on joining the institution, the young men enter the first cœtus. Before the commencement of the studies, that is, about the 1st of October, the General Inspectors of the two corps direct the young men who are to enter the school to come up from their regiments and divisions. They receive their pay and clothing from their regiments until they are promoted to the rank of Officer.

The first nine months of each year of study are principally devoted to theoretical instruction, the three last exclusively to practice. In the third cœtus, the course finishes with the theoretical instruction on the 1st of July.

The instruction of the first cœtus is directed to prepare the students for the ordinary Officers' Examination, and at the same time to enable them to follow with advantage the further studies of the school. The instruction, during the first year, is common to all the students. Those who pass the Officers' Examination enter at the commencement of the second year into the second cœtus.

In the second cœtus the greater portion of the instruction, but not the whole, is common to the two arms. In the third cœtus an almost entire separation of studies takes place.

In all the studies which are common to the two arms, if the number of students is too great for a single class, parallel classes are established.

* Translated from Helldorf's "*Dienst-Vorschriften der Könighlich-Preussischen Armée.*"

THE STAFF AND AUTHORITIES.

A.—The Superior Authorities.

The *Curatorium* of the School is composed of the General Inspectors of the two corps. To it belongs the authority of issuing orders and regulations; no important change in these can be made without its sanction.

The General Inspector of Military Instruction receives yearly at fixed periods, reports upon the state and progress of the school.

The accounts are under the control of the War Department, with which the Director of the School is in immediate communication. Questions of principle and unforeseen cases of importance are decided by the *Curatorium.*

The Inspector of the School, who is an Engineer Officer when the Director is an Artillery Officer, and *vice versâ,* has the immediate oversight of it. It is his duty to see that the orders and regulations are strictly followed.

B.—The Executive Authorities.

The Director is appointed by the King. He is a Field Officer of either Artillery or Engineers, and has the rank of Commandant of a regiment. He has as assistant, a Captain appointed by the *Curatorium.* The Director is immediately responsible for the discipline and the finance of the establishment, and conducts its ordinary details, assisted by the Captain. He is also President of the Board of Studies; as such he exercises a general control over the instruction, and regulates the ordinary examinations.

Under the Director and the Board of Studies are four officers, three taken from the Artillery and one from the Engineers. They have the immediate charge of the students, and are themselves under the direct orders of the Captain.

The duties of Paymaster, Librarian, &c., are divided among them. They must also give at least two hours of instruction weekly to the pupils.

The Board of Studies consists of the Director of the Institution as President, and usually of the Senior Master of Mathematics, and the Instructors of Artillery and Engineering in the third cœtus. In equal numbers are likewise added Superior Officers of the Artillery and Engineers appointed by the *Curatorium.* The duty of the Board is to control the whole of the instruction, and to give an opinion when required, upon the performance and capacities of the teachers and students.

C.—The Teachers.

The teachers are to be selected as much as possible from among the Officers of Artillery and Engineers. Where this can not be effected, civilians of proved ability and experience are to be appointed.

The number of teachers is to be arranged with reference to the amount and extent of the studies, in such a manner that in the event of illness among them, no interruption in the instruction may arise. In addition to the teachers, there is a certain number of assistant-teachers, partly civilians, partly taken from among the fire-workers of the Artillery. The latter are employed under the Librarian, and in the practical instruction; they may also, in case of necessity, assist as clerks.

THE STUDENTS.

The maximum number of students who enter each year is 80; 60 from the Artillery, and 20 from the Engineers. In addition, a few young men may be received from the smaller German States. In the event of the number from one corps being short, an increased number may be admitted from the other.

The number in the second cœtus is variable. It consists, first, of the students previously in the first cœtus who have passed the Officers' Examination; and, secondly, of such young officers as are appointed to the Institution by the General Inspectors.

The students of the first cœtus lodge, as far as room will admit, in the school buildings; the remainder, as well as the ensigns of the second cœtus, not yet promoted to officers, are quartered in a neighboring building. At least two of the direction officers lodge in the school buildings; a third lodges in the other.

The Director may grant permission to a student, as a matter of favor, to lodge with his parents.

The students quartered in the school and the neighboring building dine together in the mess-room of the school.

The officers (students) of the second and third cœtus live in lodgings in the town, and mess where they choose.

ENTRY INTO THE SCHOOL, AND PASSAGE THROUGH IT.

The entry into the first cœtus of the institution is conditional on the applicant having passed, in the manner officially prescribed, the examination for ensign. The necessary certificates are forwarded to the Director of the School.

The instruction in the first cœtus embraces in general the subjects required for the ordinary Officers' Examination, that is to say, the elements of Military Science, so far as every Subaltern Officer is obliged to know them. To this is to be added instruction in mathematics, in French, and in free sketching.

At the commencement of the instruction the teachers inspect the whole of the Ensign-Examination papers of the newly-arrived students, which are laid before them by the Director, in order the better to judge of their acquirements. During the first quarter they take pains to ascertain the ability as well as the amount of acquirements of each student, so as to be able to give a confident opinion upon him at the end of the quarter.

After the close of the first quarter a conference of the teachers, under the presidence of the Director, takes place, to form a report upon the students, and to furnish data for recommendations to the rank of ensign of such students as have given satisfaction by their conduct and progress. The students about whom the teachers have not yet been able to speak confidently, who, in certain studies, as in mathematics and the special branches of their arm, are behindhand, as well as those whose conduct has not been without blame, are proposed to the higher authorities for permission to continue to remain at the school. On the other hand, the Board of Studies proposes for dismissal from the institution, students whose conduct has been unsatisfactory, and principally who give too little hope of a favorable career. The Board is to express an opinion whether any prospect may be held out of a future recall to the institution, according as its unfavorable report has been founded on the want of ability or on the want of industry of the student.

The students favorably reported on are immediately, by the General Inspectors, appointed ensigns, subject to vacancies. The *Curatorium* decides regarding the further stay at the institution, or the dismissal of the others.

After the end of the second quarter, those pupils who can not yet be recommended for promotion to ensign are only in special cases allowed to remain till the end of the theoretical instruction of this year; if they can not then be recommended, they are sent back to their regiments.

Fourteen days before the close of the theoretical instruction for the year, that is to say, about the middle of June, the teachers give an opinion regarding each student of the first cœtus, as to whether or not they consider him capable of undergoing the Officers' Examination, and to pass into the second cœtus. These reports, joined to that of the Director, as regards the conduct of the students, enable the Board of Studies to propose to the higher authorities either that permission may be granted to undergo the Officers' Examination, (and, if successful, to enter the second cœtus,) or that the student be sent back to his corps. Students who have been refused permission on grounds not altogether unpardonable, from presenting themselves for the Officers' Examination, or who in the course of instruction have been sent for any reason to their corps, with the prospect of being afterwards called back to the school, may, on the proposition of the Board of Studies, through the *Curatorium*, be granted a second and final entrance into the first cœtus.

The *Curatorium* decides in every case whether a student who has not qualified himself for entry into the second cœtus, may return to the first cœtus after having left the institution, or in case he shall have in the meantime passed the Officers' Examination, whether he may, as an exceptional case, enter the second cœtus. In a case of the latter kind, the applicant can not present himself for the Officers' Examination without having previously passed a preliminary examination at the school, to do which, the permission of the General Inspector of his corps is necessary.

The theoretical course closes at the end of June. During the month of July the students of the first cœtus are employed in surveying operations. It is during this month that the examination for the rank of officer before the General Examining Board takes place. The students who pass this examination enter afterwards into the second cœtus; those who fail are, at the expiration of the practical course of their year, sent back to their corps.

The students who pass the Officers' Examination, and are found qualified to enter the second cœtus, are then proposed for election to the officers of their corps. If the decision be favorable, their names are submitted by the General Inspectors to the King, to be appointed, on vacancies occurring, to the rank of Supernumerary (*Ausseretatsmässigen*) Second Lieutenant.

To assist the Officers of the Corps in making their election, an extract of the reports above alluded to is sent to them, so far as it concerns the students who have successfully passed their Officers' Examination.

It is an indispensable condition for entering the second cœtus, that, if a student of the first cœtus, he should have passed the Officers' Examination, or if he should now enter the school for the first time, that he should have the rank of Officer. The sum of acquirements necessary for the Officers' Examination forms the basis of the instruction given in the second cœtus. In it the instruction ceases to be entirely common to the two arms.

At the end of the theoretical course of the second cœtus, a report of progress and conduct is drawn up, as in the first cœtus, by the Board of Studies, on the data furnished by the teachers as regards the studies, and by the Director as concerns the conduct of the students. In forwarding this report to the *Curatorium*, it is stated for each student whether or not he is considered qualified to pass the *former part* of the Special Corps Examination. Those who are unfavorably spoken of in this respect return to their corps, if there are no mitigating circumstances which permit a further stay in the second cœtus, following the decision of the *Curatorium.* They may either endeavor to obtain a transfer into another branch of the army, or by study and good conduct prepare themselves for admission into the third cœtus at a future period. But in this case they must not only be recommended by their corps, but they must also pass the *former part* of the Special Corps Examination.

The students recommended to present themselves for the *former part* of the Special Corps Examination undergo it before a Board appointed by the chiefs of the two corps in the beginning of July. It extends over the subjects of professional science which have been taught in the second cœtus. A particular regulation defines the mode of this examination, which is entirely written; it decides whether the student shall enter or not into the third cœtus.

The successful students pass, by direction of the *Curatorium*, into the third cœtus, while the unsuccessful ones, as well as those who have been reported unfit to undergo the examination, return to their corps. By good conduct and study they may obtain permission to come up again at the next examination for the *former part* of the Special Examination. Their definite return to the school depends upon their passing this examination, and upon the express order of the *Curatorium.*

The instruction in the third cœtus is chiefly directed to supply the special scientific knowledge required by each of the two arms. The students of the two corps, therefore, receive separate instruction. A further object of the instruction is to enable the students to make use of the knowledge which they have acquired, on which account instruction and practical application go hand in hand. Practice and theory go thus together in this the highest portion of the instruction, so that they both terminate at the same time, namely, at the end of the month of June.

Previous to leaving the School, the *latter part* of the Special Corps Examination is undergone before the same Board as for the *former part.* This examination tests their qualifications in their special arm, and proves their fitness for Artillery or Engineer Officers. The results of this part of the examination and of the former part of it passed at the close of the second cœtus, are combined by the Board, and forwarded to the *Curatorium.* Along with these reports is submitted a proposition for those who have passed the examinations to be admitted into their corps. In the preparation of patents (for commissions) they are antedated to the time of passing the Officers' Examinations, proper regard being had to the results of the Special Corps Examination for arranging the officers among each other.

Any officer who does not pass the Special Corps Examination, remains with the pay of an infantry officer in his corps until he either enters into another arm, or having obtained permission to re-enter the third cœtus, he qualifies himself for the final examination. A successful passing of the Special Corps Examination at this second trial can give, under the most favorable circumstances, no higher seniority than that of immediately after the officers who have passed their examination the previous year.

A.—*The Instruction in General.*

The general instruction may be divided into—

1. The theoretical part, designed with the view to the practical professional requirements of the students, and their further self-improvement.

The instruction ranges over—

(*a.*) Artillery.
(*b.*) Military Engineering.
(*c.*) Hydraulic Construction.
(*d.*) Elements of Tactics.
(*e.*) History of the Art of War.
(*f.*) Mathematics.
(*g.*) Theory of Surveying.
(*h.*) Physics.
(*i.*) Chemistry.
(*k.*) French Language.
(*l.*) Rules and Regulations of the Service.
(*m.*) The Horse.
(*n.*) Plan Drawing.
(*o.*) Free Sketching.
(*p.*) Descriptive Geometry.
(*q.*) Artillery Drawing.
(*r.*) Artillery Constructions Drawing.
(*s.*) Fortification Drawing.
(*t.*) Architectural Drawing.

2. The practical part of the instruction, designed by a series of practical exercises to exhibit the application of the theory taught, and to extend the knowledge previously acquired.

The practical part includes—

(*a.*) Visits to the Military Establishments and Institutions in Berlin and Spandau, examination of the objects, collections, models, &c., which they contain.
(*b.*) Chemical manipulation.
(*c.*) Examination of raw materials, of cannon, limbers, and ammunition wagons, of shot and shells, and of small-arms.
(*d.*) Management of machines.
(*e.*) Practical exemplification of the rules for placing guns with reference to the ground, and to tactical considerations.
(*f.*) Marking out and tracing batteries and field-works.
(*g.*) Drawings from Artillery objects, and from buildings, &c.
(*h.*) Being present at the practical operations of the Engineer Division of the Guards.
(*i.*) Solution of problems in the attack and defense of fortresses.
(*k.*) Practice in elementary tactics.
(*l.*) Practical surveying.
(*m.*) Artillery practice.

3. A course of Military and Gymnastic Exercises, requisite to prepare Officers for active military service.

They are divided into—

(*a.*) Exercises on foot.
(*b.*) Exercises with the different kinds of guns in position.
(*c.*) Fencing and gymnastics.

B.—*Instruction in Detail.—The Theoretical Part.*

The theoretical studies commence each year on the 1st of October, and end on the 30th of June. They may be reckoned, after deducting the vacation and holidays, to include a period of thirty-five weeks.

As a general rule, the studies take place only in the forenoon, namely, during the five hours between eight and one o'clock. Occasionally only are there hours of study for a small part of the students in the afternoon. A portion of the afternoons, during the theoretical course, are employed for drills and practice, but in no case more than twice a week, in order that the students may have the necessary time for recreation. The students are required (those who are officers excepted) to remain in their quarters in the evening, to prepare the work which has been allotted to them by the teachers.

The parallel classes of each cœtus, with the exception of the drawing classes, are, as a general rule, to be under the same teacher.

The theoretical instruction is distributed as follows:

AMOUNT OF STUDIES, WEEKLY.

<table>
<tr><th rowspan="2">Nature of Study.</th><th rowspan="2">1st Cœtus. Artillery and Engineers.</th><th colspan="2">2d Cœtus.</th><th colspan="2">3d Cœtus.</th></tr>
<tr><th>Artillery.</th><th>Engineers.</th><th>Artillery.</th><th>Engineers.</th></tr>
<tr><td>Artillery,</td><td>4</td><td colspan="2">3</td><td>8</td><td>0</td></tr>
<tr><td>Military Engineering,</td><td>4</td><td colspan="2">3</td><td>0</td><td>10</td></tr>
<tr><td>Hydraulic Construction,</td><td>0</td><td>0</td><td>0</td><td>0</td><td>2</td></tr>
<tr><td>Elements of Tactics,</td><td>4</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>History of the Art of War,</td><td>0</td><td colspan="2">3</td><td>0</td><td>0</td></tr>
<tr><td>Mathematics,</td><td>6</td><td colspan="2">6</td><td colspan="2">In two divisions. 4</td></tr>
<tr><td>Theory of Surveying,</td><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>Physics,</td><td>0</td><td colspan="2">4</td><td>0</td><td>0</td></tr>
<tr><td>Chemistry, Lectures,</td><td>0</td><td>0</td><td>0</td><td colspan="2">4</td></tr>
<tr><td>Chemistry, Manipulations,</td><td>0</td><td>0</td><td>0</td><td colspan="2">4</td></tr>
<tr><td>French Language,</td><td>2</td><td colspan="2">2</td><td colspan="2">2</td></tr>
<tr><td>Rules and Regulations of the Service,</td><td>2</td><td>0</td><td>0</td><td>0</td><td>0</td></tr>
<tr><td>The Horse,</td><td>0</td><td>0</td><td>0</td><td>2</td><td>0</td></tr>
<tr><td>Plan Drawing,</td><td>4</td><td>2</td><td>4</td><td>2</td><td>3</td></tr>
<tr><td>Free Sketching,</td><td>2</td><td>0</td><td>2</td><td>0</td><td>0</td></tr>
<tr><td>Descriptive Geometry,</td><td>0</td><td colspan="2">1</td><td>0</td><td>0</td></tr>
<tr><td>Artillery Drawing,</td><td>0</td><td>2</td><td>0</td><td>3</td><td>0</td></tr>
<tr><td>Artillery Construction Drawing,</td><td>0</td><td>2</td><td>0</td><td>2</td><td>0</td></tr>
<tr><td>Fortification Drawing,</td><td>0</td><td colspan="2">4</td><td>0</td><td>4</td></tr>
<tr><td>Architectural Drawing,</td><td>0</td><td>0</td><td>2</td><td>0</td><td>3</td></tr>
<tr><td></td><td>30</td><td>32</td><td>34</td><td>31</td><td>36</td></tr>
</table>

REMARKS.

In the first cœtus.—All the instruction in this class is common to the two arms, and is equally divided among the six forenoons of the week.

In the first and second cœtus.—With reference to the mathematical instruction, it is particularly ordained, that each of the two mathematical teachers shall give instruction to the same students in the first and second cœtus, so that the one who teaches in the first cœtus one year, teaches in the second cœtus the year following.

In the second cœtus:—

1. The larger portion of the instruction, as the table shows, is common; in Plan Drawing the only difference is that the Engineers receive two hours' additional instruction.
2. The instruction in French, for a select number of the most advanced students only, takes place on two afternoons.
3. The instruction in Free Sketching for the Engineers takes place also on two afternoons.

In the third cœtus:—

1. About one-half only of the instruction in this class is common; in Plan Drawing the Engineers have one hour more instruction a week.
2. The Chemical Manipulations (in which a very small number only of the students share) take place on two afternoons.

3. The instruction in French, in which only those already selected in the second cœtus take part, also is given on two afternoons.
4. For mathematical instruction the class is formed into two divisions. The first consists of those pupils who, in the opinion of the teachers, are able to follow profitably the instruction in the higher mathematics. The remainder form the second division, and go over a second time what they have already learned, to which is added a variety of questions in applied mathematics, important to the Artillery and the Engineers.

TENOR OF THE STUDIES IN GENERAL.

First Cœtus.

Artillery.—Elementary Description of all the *matériel* of the Prussian Artillery, and of the basis of its arrangement. Effect of the different natures of guns, and the simplest rules for their employment.

General Military Engineering.—The elements of field and permanent fortification. The principles of the attack and defense of fortresses. General notions on the construction of military bridges.

Tactics.—General organization of an army. Formation of the different kinds of troops. Fundamental rules for the placing, moving, and fighting of the separate arms, as well as their combination. Occupation of ground. Attack and defense of positions. Field-service.

Mathematics.—Algebra and Arithmetic. Simple and higher equations. Progression series. The binomial theory for integral exponents. Series of powers and logarithms. Analytical trigonometry. Plane and analytical geometry. Plane trigonometry.

French Language.—Translation from French into German, with parsing.

Rules and Regulations.—Official correspondence, with examples. Discipline. Military code. Courts-martial. Courts of honor. Service in and out of garrison.

Plan Drawing.—Theory of representing ground. Principles of topography. Surveying. Drawing from copies and simple models. Knowledge and description of the different conventional marks.

Free Sketching.—Drawing of straight lines, broken lines, and angles. First principles of figure drawing. Hatching with black chalk. More difficult studies in figure drawing.

Second Cœtus.

Artillery.—Description of the organization of the Prussian Artillery. Rules for the employment of artillery in the field and in sieges.

Special Military Engineering.—Extension of the course of field and permanent fortification, given in the first cœtus. Extension of the instruction on sieges. Formation of camps. Specialities of military engineering, in so far as it is of interest to artillerists.

History of the Art of War.—History in early times, in a very general manner; that in the middle ages, as they approach modern times, in greater detail; in modern times, very fully. Organization of the armies and mode of conducting war at each remarkable period, illustrated by the description of some campaigns and great battles.

Mathematics.—Solid geometry. Spherical trigonometry. The theory of projections. Theory of co-ordinates and conic sections. Statics, geostatics, and hydrostatics.

Physics.—General properties of bodies. Laws of the equilibrium of solid, fluid, and aëriform bodies. Heat. Application of steam and gases. Measurement of heights. Hygrometry. Acoustics. Optics. Magnetism. Electricity. Electro-magnetism. Magneto-electricity.

French Language.—Exercises in translating German into French, for a select number of pupils, about one-third of the whole.

Artillery Drawing.—Use of drawing instruments and scales. Drawing of the *matériel* of the artillery, and principally of the separate parts of an object in different views and sections, to a certain scale, without the original.

Artillery Constructions Drawing.—Construction of the different limbers, gun-carriages, &c., and the principles of their arrangement, forms, proportions, and admeasurements; in greater part, however, intended only as illustrations of the rules of perspective.

Fortification Drawing.—Instruction in the composition of drawings; the practice includes representations of projects of fortresses and their details in plan and section, and in cavalier's perspective (bird's-eye view); both etched and shaded with Indian ink, and colored. The chief object is to qualify the pupils to understand, and to prepare correctly, drawings and plans of objects in field and permanent fortification.

Plan Drawing.—Further practice in drawing of ground, with objects, buildings, &c., marked in black and colors. Further progress in geodesy. Sketches and reconnaissances.

Architectural Drawing.—Perspective. Drawings of architectural decoration in outline, with the lines of shadow, but without further detail.

Free Sketching.—Further figure-drawing. Landscapes and the drawing of ornaments, for the more skillful students.

Descriptive Geometry.—The theory of descriptive geometry. Projections of various bodies in space, upon planes. Drawing according to proportional scales. Theory of light and shade of drawings.

Third Cœtus.

Artillery.—History and Literature of artillery. Review of the general relations of the artillery system in the principal states of Europe. Scientific basis of artillery objects, and their technical description. Theory of the parabola and of projectiles. Organization and employment of artillery, considered in its highest point of view.

Exclusive Military Engineering.—Special application of the rules for sieges under given circumstances more or less connected. Complete instruction in building, and its application shown by projects for given sites.

Hydraulic Constructions.—General principles of the science. Knowledge of the construction of such works, of which the principles should be known to engineer officers. In this is chiefly to be considered fascine work for the protection of the banks of rivers and canals, the construction of bridges and sluices, and the laying the foundation of heavy masonry in water.

Mathematics.—(For the first division, about a quarter of the class.)—Differential and integral calculus. The higher geometry. Analytical mechanics and hydraulics.

(For the second division, about three-quarters of the class.)—Repetition of the most important part of the studies already gone through in the first and second cœtus, with practical useful problems. Mechanics and hydraulics, as well as some instruction necessary for artillerists, but so as not to require the higher analysis, and more of a practical than of a theoretical nature.

Chemistry (Instruction.)—The necessary preliminary knowledge of theoretical principles. Treatise of separate substances (of the metalloids and their indifferent combinations, of the acids, of the metals,) all illustrated by experiments. To conclude with a survey of the composition and alteration of the surface of the globe from a chemical point of view.

(Manipulation.)—Instruction in the principles of qualitative chemical analysis, illustrated by experiments. Manipulation by the students under the superintendence of the instructor. Instruction in the principles of quantitative analysis. Analysis by the students, of substances employed by the artillery. (Only four or five of the best qualified take part in these experiments.)

French Language.—Select conversation (only for the already selected students in the second cœtus.)

The Horse.—Natural history and anatomy of the horse. Good and bad points. Food. Internal and external sickness, with the mode of discovery and cure of of the same, as far as practicable, by the means to be had on actual service. Shoeing.

Artillery Drawing.—Continuation of the instruction. *Matériel* of the artillery, represented as combined artillery objects, partly on a given scale, partly drawn from a real object, by the more skillful students.

Artillery Construction Drawing.—Construction of each description of cannon. Principles of their forms, proportions, and sizes. Problems on the construction of existing and not existing guns, carriages, &c. Construction of the artillery *matériel* of foreign powers.

Fortification Drawing.—Projects of field fortification, to be constructed of earth, or of earth and gabions, with application to the nature of the ground. Drawings with the use of Von Prittwitz' copies of the fortification of places, as a continuation of the fortification drawings begun in the second cœtus. For all these exercises in projects and drawings, the concert of the teacher of exclusive engineering is required.

Plan Drawing.—Practice in copying and reducing large plans. Drawing of plans of battles with the position of the troops, and of plans of sieges, with the trenches and batteries.

Architectural Drawing.—Architecture in its application to military buildings, done in India ink. Finally, practical exercises in copying buildings.

PRACTICAL EXERCISES.

These are carried on, as has been already remarked, in part during the nine months of theoretical instruction, on some of the afternoons, but they principally take place during the three summer months of July, August, and September, in the forenoon. They commence early in the morning, and often last till the afternoon, on which account there are no evening hours of study during this period. As the students of the third cœtus return to their corps at the beginning of July, those of the first and second cœtus only take part in this practice. The visits to the Fortress and Military Establishments of Spandau, and the preparation of projects of military constructions, and of reconnaissances, must be made during the period of theoretical instruction. It is therefore suspended for one day for the students of the first cœtus, and for three days for the Artillery, and five days for the Engineer students of the third cœtus.

The distribution of time for each cœtus is as follows:

DURING THE NINE MONTHS OF THEORETICAL INSTRUCTION.

	Number of Days employed.				
	1st Cœtus. Artillery and Engineers.	2d Cœtus.		3d Cœtus.	
		Artillery.	Engineers.	Artillery.	Engineers.
Visits to the Artillery Workshops,......	2	0	0	4	0
To the Collection of Arms in the Arsenal....................	1	0	0	0	0
To the Models of Fortresses in do....	1	0	0	0	0
To the Ordnance, Gun-carriages, Ammunition-wagons, &c., in do.......	4	0	0	0	0
To the Foundry and Boring Machinery	2	0	0	2	0
To the Iron-foundry, and to one of the large Manufactories of Machinery in Berlin,.........................	0	0	0	2	0
To the Fortress of Spandau, the Powder-mill, and Small-arm Factory,..	1	0	0	0	0
Working in the Laboratory,...........	12	12	12	0	0
Examination of Ordnance,.............	0	0	0	6	0
" of Gun-carriages, and Ammunition-wagons,................	0	0	0	6	0
Examination of Shot and Shell,........	0	0	0	2	0
" of Small-arms,..........	2	0	0	0	0
Practical representation of the Rules for placing Guns:					
With reference to the ground,....	0	2	2	0	0
On given tactical conditions,....	0	0	0	4	0
Solution of problems in the art of Sieges, with reference to an actual fortress and the country surrounding it (Spandau,)	0	0	0	3	5
Practice in Elementary Tactics,........	4	0	0	0	0
Drawings of Ordnance, Carriages, &c...	0	12	0	0	0
" of Buildings, &c............	0	0	0	0	14
Practice in Geodesy,.	12	0	0	0	0

DURING THE REMAINING THREE MONTHS.

Practice in Geodesy,..................	16	28	32	Nil.
Practice in Fortification of the 1st cœtus, with the Engineers of the Guard,....	12	0	0	"
Practice in Fortification of the 2d cœtus,	0	10	10	"
Visits to the Models of Fortresses in the Model-house,.....................	0	2	2	"
Gun Practice, proof of gunpowder, the management of machines, &c........	14	14	14	"

Remarks.—The employment of time in the last three months above given, requires the whole of the months of July and August, and about the first third of the month of September, after deducting fourteen days for the Officers' Examination for the first cœtus, and occasional days lost through bad weather. The remaining two-thirds of September are given for vacation, as well to afford recreation to the teachers and students as to allow of the repairing and cleansing of the school-buildings.

MILITARY AND GYMNASTIC EXERCISES.

The month of October is appointed by the Director to the fitting and making uniform the regimental clothing brought with the students from their corps. Military exercises then take place once a week for two hours in the afternoon, till the 1st of April, or for about five months.

The military exercises are carried on under officers of the garrison, namely, a Captain and two Lieutenants of the Artillery of the Guard. They put themselves in communication with the Director to arrange the time, nature, and extent of the exercises.

The exercises consist of—

1. *Exercises on Foot.*—The whole of the first cœtus here take part, but only so many of the second cœtus as are required as non-commissioned officers. Considering the composition of the squad, (Artillery and Engineers,) and the object of the exercise, the perfection of the students in company-drill is less to be attempted than the endeavor to give to each a good position and carriage in the front as well as in the ranks, and more particularly to accustom them to military order and precision.

2. *Exercises with different descriptions of Guns in Position.*—In preference, the light field-pieces of the year 1842 are to be used for drill, and correct, united and prompt execution required. With the siege-guns, every student is instructed and practiced with at least one calibre of each nature.

In addition to their military exercises, there are also—

3. *Fencing and Gymnastics.*—In these exercises the students of the first cœtus only take part, and for two hours of the afternoon each week, during the first six months. There is neither time nor appliances to admit of the students arriving at a high state of excellence. The practice in fencing is only intended to give confidence in the use of arms, that in gymnastics to produce activity, and to afford bodily exercise to young men much occupied in study.

EXAMINATIONS AND CENSURES.

In addition to the several examinations already enumerated, by which the fitness of the students for a certain rank or for promotion into a higher cœtus is shown, some other examinations take place.

1. For the purpose of enabling the Director and the Board of Studies to learn the progress of each separate student, and to confirm by their own knowledge the opinion given by the teachers, there is twice in each quarter an oral repetition of some portion of such instruction in the first and second cœtus. The period of the examination is previously named by the Director.

2. To give a general view of the progress of the entire year, and

to incite the students to study, a public oral examination of those in the first cœtus takes place at the close of the theoretical instruction, in presence of the higher authorities of the school, superior officers of the two arms, and other persons interested.

As a further incitement to the students, and as a warning to those whose diligence or conduct has not been satisfactory, the quarterly "censures" are read out to the assembled cœtus. In general the names of the students are not mentioned, a number known to the individual only being used instead. The best pupils are, however, openly commended by name.

In the first cœtus, on the other hand, those pupils who have obtained very bad "censure" are mentioned by name.

FINANCIAL RELATIONS.

The annual expense of the School is fixed at 16,049 dollars. The sum is distributed as follows:—

Personal.

Salaries and allowances of Teachers	10,731	
Pay and allowances of the Staff,	3,478	
		14,209
Practical exercises,	520	
School necessaries,	720	
Keeping up materials for instruction,	110	
Cleansing the rooms	130	
Lighting,	100	
Bureau expenses,	210	
Covering unforeseen expenses,	50	
		1,800

In the event of war, and if the instruction is suspended for an indeterminate period, the salaries of the civil teachers cease. Application is not to be made to the King for the grant of a provisional indemnity, except under very peculiar circumstances.

The payment of the salaries and allowances is made monthly and in advance.

The administration of the funds is directly under the supervision of the Director. The Treasurer carries out the details. The superior orders for the administration of royal grants are most strictly to be followed.

The annual accounts are forwarded by the Director to the War Department.

The property of the School consists of—

The Library, the Collection of Instruments and Models for Artillery and Engineers, the Collection of Physical Instruments, the Collection of Chemical Apparatus, and the School Utensils.

The principal object of the Library is to serve as materials of instruction for the teachers and students, and the Officers of Artillery and Engineers present at the Institution. After that, as a center, for the collection of all the best works, old and new, on Artillery and Military Engineering.

The Director and Board of Studies take care that the instruments and apparatus for the studies are always kept complete and in good order. As the means of the school do not thoroughly admit of the collections keeping pace with the progress of science, special care is taken that at least the most necessary articles are not absent.

The utensils of the school are kept always complete, under the supervision of the Director.

The property of the school is examined yearly by the Director and Board of Studies, and a report to that effect sent in with the annual accounts.

PROGRAMMES OF THE PRINCIPLE SUBJECTS TAUGHT

IN THE

ARTILLERY AND ENGINEER SCHOOL AT BERLIN.

I. ARTILLERY.

THE instruction must commence with the first elements of the science, since the new arriving students have little preparatory knowledge. It must be carried on to such an extent that the pupil may be able, after going through the first cœtus, to pass his *officer's examination*, and after the completion of the entire course, not only to show at his *special* examination that he possesses the positive knowledge required for the ordinary duties of the service, but also to prove that he is qualified for continuing his studies by himself.

The Engineer pupils who close their instruction in artillery at the end of the second cœtus, are to be instructed in the composition of artillery, in the effect and the use of cannon, but more especially in its employment in sieges.

From this general notice of the limits of the course it is evident that neither a perfect exposition of the theory nor complete practical exercises are expected. Still to train the students properly in the different directions which an artillery education requires, the instruction must not consist only in a theoretical lecture, but be aided by judicious directions for drawing, and be perfected by practical exercises. For the attainment of the two latter objects special prescriptions are given, to which we refer.

Instruction in artillery is closely connected with the lectures on mathematics, physics, chemistry, tactics, fortification, and veterinary science.

a. As special points may be mentioned, *in mathematics*, calculation of contents, and fixing the centers of gravity, of cannon and its parts; calculation of piles of shot; strength, direction, and distribution of recoil on the separate portions of a piece of ordnance; theory of machines, of carriages, of parabolic and projectile curves, and calculation of the flight of rockets. In all these cases the mathematical lecturer develops the necessary formulas for the artillery student, but their application belongs to the course of artillery.

b. In physics.—Explanation, notice, and determination of the specific gravities of the materials used in artillery. The law of gravity. The absolute and relative strength of woods and metals. Friction. Resistance of the air. Expansive power of gases, especially of those generated by gunpowder.

c. In chemistry.—The general laws of chemical action of bodies on one another. The simple elements of the materials used in artillery. The chemical properties of their combinations. The acids exhibited in the combustion of gunpowder and their action on metals; the processes used in the reduction and manufacture of metals up to the point where they are fit for use in artillery; chemical analysis of gunpowder and of the most common metal-alloys. The action of the atmosphere on substances exposed to it, which are used in artillery.

d. In tactics.—The organization and tactics of artillery, so far as they stand in direct relation to other arms. A complete account of the conduct of artillery when coöperating with other troops.

e. In fortification.—Everything referring to the tracing, the relief, and the construction of fortifications; attack and defense of field-works by infantry and cavalry; complete exposition of the art of besieging, with a discussion of all the duties of an engineer, a sapper or miner, both in the attack and the defense of a fortress, also the use of infantry and cavalry in sieges, with the omission of the points specially belonging to artillery.

f. In the veterinary art.—The anatomy and physiology of the horse; general rules for feeding, treatment of diseases, and disinfection of the stables and utensils.

The instruction in the first cœtus must, as already mentioned, be so calculated, that the students at the end of the course of lessons may be able to satisfy perfectly the requirements of the *Officer's examination.*

As a further prosecution of the same subjects of instruction in the second, and again in the third cœtus, would lead to a great loss of time and to tiresome repetitions, the lectures are to be so planned that the separate subjects to be treated in the first and second cœtus, taken together, are of sufficient extent for the Engineer pupils in general; the further developments necessary for the Artillery pupils are reserved in preference for the third cœtus.

A. IN THE FIRST CŒTUS.

The separate subjects of the lecture are—

1. Definition and distribution of arms.

2. Theory of gunpowder: component parts—manufacture—ignition—force. Proving. Storing. Transporting. Necessary precautions in manufacturing. Marks of damaged powder, and the possibility of restoration. Mention of the substances which may be used in place of gunpowder for various military purposes.

3. Cannon. Materials. Dispositions. Manufacture. Proving. Storing, and duration.

4. Gun-carriages. Limbers and other artillery carriages. General explanations on the construction of carriages, with particular reference to those used for artillery. Materials. Distribution and composition of gun-carriages. Limbers and wagons. Their examination and storing.

5. Military combustibles. Elementary notions. General account of laboratory work and regulations; also with reference to later proceedings in a laboratory, and, omitting all figures not absolutely necessary, a description of the preparation of fire-works, matches, ammunition both for artillery and for small-arms, signal lights, and particular kinds of combustibles. Their packing and storing.

6. The service, working, and moving of cannon, and of artillery carriages, with account and description of the machines in use by the Prussian artillery; but without special explanation of the official regulations.

7. Firing. Theory of the movement of projectiles, of the effect caused by their movement, and the mode of turning this action to the best account for military purposes. Elements of the theory of firing. Practice. Various descriptions of fire; their effect, and their employment for various sorts of guns.

8. Small and side-arms. Purpose and description of the composition and arrangement of small-arms. Their manufacture, storing, and the practical rules for their use. Purpose and description of side-arms. Fabrication, proving, effect, and use of them.

B. IN THE SECOND CŒTUS.

The instruction in the second cœtus is a continuation of the lectures of the first cœtus, and embraces the use of artillery in the field and in sieges. Its object is to bring the Artillery students to that point that they are able, at its close, to discharge satisfactorily the ordinary practical duties of the service, and be prepared to follow the course of the third cœtus, and to give to the Engineer students, who, in the third cœtus no longer receive instruction in artillery, all the knowledge of the subject required for their future profession. The instruction must therefore be complete enough for the Engineers, and give the Artillerist a solid and thorough preparation for the third cœtus.

Instruction in the second cœtus should comprise, in particular—

1. The organization of the artillery: purpose and considerations in the putting together of all parts of artillery material, both in tactical and administrative respects, with historical mention of the diversities of practice of other Powers.

2. The use of artillery in the field. Marching and tactical movements. Taking up position. The engagement itself, and conduct in some particular cases; for example, in defile fighting, in entrenchments, passage of rivers, &c.

3. Use of artillery in sieges:—

a. *For Attack.*

Planning and throwing up the batteries. Preparation and use of the different kinds of materials of construction. Different sorts of batteries. Methods of construction. Repairing of damaged batteries, and the calculation generally of all the materials necessary for constructing them.

Purpose and equipment of besieging batteries, with the preparations, special and general, for a regular attack.

Proceedings in the regular attack, and their modifications in irregular sorts of attack, occasioned by the situation of the fortress with reference to the surrounding ground, or by the special nature of the defenses.

Proceedings after capture, and when the siege is raised.

b. *For Defense.*

The equipment of the fortress. Determination of its artillery. Preparations in the fortress when it is declared in a state of siege. Conduct of the artillery in the regular attack, and against irregular modes of attack, as well as in particular cases, such as when in detached isolated works, when the place is relieved, or when the garrison fight its way out.

C. IN THE THIRD CŒTUS.

In the artillery course of the first and second cœtus, the students have gained a general knowledge of the materials of artillery, as well as its organization and use as an Arm; but the lectures were for the most part limited to what was of the greatest immediate consequence, viz., the description of the actual condition and relations of the Prussian artillery.

The object of the instruction given in the third cœtus is, on the one hand, to expose the scientific laws of artillery and its various parts, and, on the other, to track the historical development of the Arm, so as by this means, and by consideration of the constitution of foreign artilleries, to extend the views of the students beyond our own practice, thus to form their judgment, and induce them to think and contrive for themselves.

In the comparison of our own and foreign existing systems with the results of scientific considerations, the teacher should proceed with caution, and not raise in the young men the inclination to or the habit of crude and officious criticism. Investigation of things as they exist must, therefore, not confine itself to the mere search after defects; it can be only profitable when employed to test our own powers at improvements, and to discern thereby the difficulties and impediments that accompany them The value which speculative reasoning has for the purposes of the artillery ought to be properly esteemed by the students, but, in face of the results of experience, not be estimated too highly; and in the comparison of different artilleries one with another, the influence must not be overlooked which the peculiarities and the history of a country ever exert on its institutions.

The final aim of the artillery instruction in the third cœtus must be a higher degree of preparation for the future practical ability of the students. As regards the material portion of the artillery, the students are to acquire a general knowledge of the construction, fabrication, and proving of the *matériel*, and for the tactical part, it is above all things to be made an object that they be made capable, by the instruction given them, of greater dexterity and confidence in dealing with special cases in the field or in siege operations.

The instruction commences with:—

1. Organization of the artillery service. The general relations of the artillery service are to be explained according to its different purposes, as an arm both in technical and administrative respects, then the principles for the organization of the service and of its separate portions in peace and war are to be developed, and comparison made with those carried out in the principal foreign artilleries.

At the same time, on the one hand, more details are to be gone into on the different branches of the artillery service (field, siege, fortress, and coast artillery, the technical and the administrative branches,) than was done in the second cœtus; and on the other, those considerations must be kept sight of in which the artillery appears as a portion of a greater whole, as in its relation to the Army and to the State.

2. Artillery, regarded as an arm. Since the elementary rules for the use of artillery in war have been given already in the second cœtus it will be the object in the third cœtus, first, to develop the principles of artillery tactics in the field, and in sieges, from an extended point of view, and then to apply the rules for the movements, placing in position and fighting of the artillery to the bodies now actually used in war, and to examine the great questions that may hence arise. For the field artillery, the tactics of single batteries and of masses of artillery and the collective relations of the artillery of a *corps d'armée* and of an army, must be shown. For sieges there will be less occasion to treat of the separate means of defense by artillery than of the various combinations under different circumstances, of its diversified applications.

To give this instruction its most practical tendency, historical examples of battles are to be taken, and not merely their results adduced, but the circumstances gone through in detail. These are to be compared with the rules previously given, and the causes and effects of any discrepancies, as far as practicable, and with caution, explained.

Themes are then given out of campaigns and sieges, in working which the students are to show applications of tactical rules under given circumstances.

As regards the preparation for the field and the conduct in marches, quarters, camps, or bivouacs, what was necessary has already been taught in the second cœtus, as far as concerns a corps of artillery as large as a battery. In the third cœtus, therefore, only more extensive and important relations have to be explained.

Finally, as the students at the close of the third cœtus are to enter immediately into active service in the regiments, it will be useful to give them a general view of artillery duties in time of peace, of which no mention was made in the first and second cœtus, and to show the principles on which they rest. Further, the education of the men, the selection, management, and care of the artillery horses, instruction in riding and driving, the various exercises in serving and moving the guns, artillery practice, the different fatigue duties, conduct in manœuvres, detachments, &c., are to be particularly explained.

3. Artillery in a technical and administrative point of view. In the instruction given in the first and second cœtus, a descriptive notice only was given, as regards artillery material, of the arrangement and effect of what actually exists; and the reasons for this arrangement were added only so far as was necessary for this principal object.

In the third cœtus the pupils are to learn by the inductive process how, according to existing principles of natural science and of tactics, with the known mathematical and technical aids, artillery material must be contructed, manufactured, and proved, so as to obtain the desired end in the highest degree; and then our existing material and that of other countries are to be compared in the manner above stated with the results thus obtained.

To this end, in the lectures, first, the necessary explanations of artillery requirements are to be brought forward from the doctrine of mechanics; after that the fabrication, proving, and action of gunpowder are to be introduced; and finally, the construction, fabrication, and examination of cannon, carriages, and ammunition of the artillery and of small-arms.

Of course the details of powder-mills, of cannon foundries, of artillery workshops, of laboratories and small-arms manufactories, are here to be explained.

The action of projectiles and the mode of applying it, are to be scientifically explained, by the aid of the parabolic and projectile theory, as well as the principles upon which artillery experiments are to be conducted.

Finally, the principles of the management of the artillery material in the artillery dépôts are to be explained.

4. The course of instruction will be closed by an historical description of the progress of artillery, and by an historical review of its literature.

D. GENERAL DISTRIBUTION OF THE TIME.

The total number of hours is, according to the constitution of the school—

For the	first cœtus,	35	weeks of	4	hours	= 140 hours.
"	second "	35	"	3	"	= 105 "
"	third "	35	"	8	"	= 280 "

The exact number of hours dedicated to each division must be stated by the teacher in the first instance in his special plan for lessons, as they in part depend upon his general experience. But, at all events, all the above-stated subjects for the first cœtus must be taught in the prescribed periods.

The lecture in the first cœtus must by no means be a mere mechanical preparation for the *Officer's examination;* even here the understanding of the pupil is not to remain unoccupied, though the memory is to be had recourse to in a very high degree, and the historical form, that is, description of objects as they are, predominates.

The principles of the arrangements can only be taken up in their chief features, (partly because) time will not allow a farther advance, and partly because the progress of the students in the other studies is not yet sufficiently forward.

In the second cœtus the advantage has been obtained that the students have gained a knowledge of the entire material of artillery in its various relations, and the lecture gives, therefore, an introduction to the use of artillery in the field and in sieges; and with special regard to a fundamental knowledge of the details, and with the view to what is necessary to complete the Engineer pupil and make an efficient preparation of the Artillerist for the third cœtus, aims at a somewhat more scientific treatment, without going into the full comprehensive details reserved for the latter student. For the same reason, this portion of the lectures is confined nearly throughout to the explanation of existing conditions of our artillery, and only where the necessities of the Engineer student may demand it, can mention be made of the earlier material, or of the most important matters of foreign artilleries.

The instruction, therefore, of the first and second cœtus is directed more to the general and historical, that of the third cœtus, more to the special and scientific culture of the student; the materials were there collected which are here to be worked up.

From this general point of view proceed also the methods which are to be observed by the teachers in each cœtus.

The principal point to be kept hold of in all three cœtus is, that everything that can be shown the students, or which they can learn by their own manipulation, should be brought visibly before them, and as far as time and circumstances permit, should be actually put in practice. The material objects, in their actual state for use, must as often as possible be shown and explained, for which the Practical Exercises offer the best opportunity to which reference is here therefore made.

After these, a collection of models, diagrams, tables, and literary notices are necessary, which may be partly used for immediate instruction in the class, and partly furnished the pupils as a necessary and time-saving aid to the memory.

Deficiencies in these aids to the lectures are to be laid before the Direction and Board of Studies by the teacher, and supplied as far as the existing means allow.

Those cases in which the proceedings are fixed by certain regulations require special mention; for instance, the transport of powder, examination of cannon, drills, harnessing of horses, stable and camp service, &c.

All these regulations are grounded on certain principles, from which no deviation can take place without evil. The method of drawing them up is, however, variable, on which times and circumstances, and even the views of the superior authorities, have infiuence.

It is, therefore, highly necessary that in this respect the essential be carefully in the instruction separated from the accidental, and by omitting the latter, not only gain time, but hinder that the students accustom themselves in a slovenly manner to look only to forms, and to seek in them the true being and life of artillery.

A true exposition of the principles on which these regulations rest ought not to be omitted from the lectures. They will suffice to prepare the students to act correctly in every case that occurs, for which actual service gives them, moreover, the separate instruction. The more completely the teacher keeps this point in view the less need he fear to form his pupils to immature critics, since the well-informed officer will more easily enter into the spirit of each such regulation, and more exactly carry it into execution for the benefit of the service, than he who has been accustomed to keep without reflection only to the dead letter; this, in the varied phases of practical life, will often enough leave him without guidance, unless he knows how to find it within himself.

As amongst the many existing class and hand-books for the artillery, none is entirely adapted to form a basis for the lectures, the formation of a special plan of lectures for each cœtus is indispensable, that the lecturer may have a defined path, and the students an assistance in their repetitions.

II. GENERAL AND SPECIAL ENGINEERING IN THE FIRST AND SECOND CŒTUS

The lecture commences with the first principles of fortification, supposes no previous knowledge, and comprises—

(*a.*) Field fortification, attack and defense of a redoubt, communication in the field, and,

(*b.*) Permanent fortification, the art of besieging, with the example of a siege that has actually taken place.

In the first cœtus it must be so far carried out that the pupil is capable of passing his *Officer's examination* according to the regulation of the 26th March, 1846. In the second cœtus the general knowledge of field and permanent fortification acquired in the first is carried on in such a degree as both Artillery and Engineer officers require to form a good foundation for the particular professional study of both arms in the third cœtus.

In the formation of the special plan of the lecture the instruction-regulations for artillery and exclusive engineering in the third cœtus are to be kept in view, so as to prepare for these subjects by the nature and the method of the instruction.

The principal contents of the lecture are—

A. IN THE FIRST CŒTUS.

a. *In Field Fortification.*

A correct description of the profile, the ground plan, the technical obstacles and modes of strengthening, the construction, and elementarily also, the use of field-works; attack and defense of a redoubt, and the military communications in the field, as roads, fords, and bridges.

b. *In Permanent Fortification.*

Exposition of the essential principles for plan and profile; acquaintance with the parts of a bastioned fortress with the outworks; special acquaintance with a work on Vauban's first system, and its improvements by Cormontaigne. Knowledge of the characteristics of the Italian, Dutch, and French fortification, of the ideas of Rimpler and Montalembert, as well as of the latest fortifications in Prussia; lastly, a knowledge of sieges as regards a regular attack and defense. The art of construction is taught to the Engineers in the third cœtus.

B. IN THE SECOND CŒTUS.

Applied art of fortification, and, namely, attack and defense of the various sorts of field-works, castrametation, permanent fortification, provisional fortification, and sieges. At their proper places, are to be introduced the precepts of military constructions which are suitable alike to the Artillerist and the Engineer, as well as the conduct of infantry and cavalry, and the duty of the Engineers in sieges.

Distribution of Time.

The first cœtus receives four, the second three hours weekly; therefore, in thirty-five weeks, the first 140, the second 105 hours. The number of hours which are to be dedicated to each portion will be indicated by the teacher in his special plan of the lectures, as it in part depends upon his experiences. All the above-named subjects must, however, be gone through within the prescribed period.

Before every principal division of the lectures, a general statement of its purport and essential principles is given; then follows a short historical exposition which is to explain the connection, the employment, and the thence arising conditions of the subject under consideration in reference to the other parts of the art of war.

The precepts hence deducible on the form of the parts of a fortification, and on the subsisting relations of fighting, are to form the latest and principal portion of each lecture.

The lecture is to be given in detail in such a manner, that its precepts may be deduced from one another in a way suited to the powers of perception of the pupils, and their mental powers accustomed to the carrying out of principles, rather than to a blind adherence to absolute regulations. To avoid repetition, the details of those doctrines which belong to different places are to be given only once, namely, where they are first required; and afterwards reference only made to them.

The military element, as indispensable both for the Artillerist and Engineer alike, is to be kept continually in view.

As regards the principal divisions, oral repetitions may be made from time to time for greater clearness; and, since individual and continued attention and self-reflection alone render a well-grounded progress in the student possible, written themes, besides those prescribed, are particularly recommended. It will not be necessary to submit each individual essay to a separate correction, but the teacher may content himself each time with giving a general view of important defects in the treatment of the subject, and then reading aloud one or more of the essays that have best succeeded, and showing by their analysis how the subject could be best treated.

In both cœtus, the existing models and full sized drawings in the school, as also the models in the arsenal, and for the second cœtus more especially the models of fortresses in the model-house, are to be used.

The means employed to complete the instruction in both cœtus, are fortification drawing, practical exercise in field-works, and an inspection of the fortress of Spandau.

The lectures are given without any fixed hand-book, from manuscript drafts or notes.

III. EXCLUSIVE ENGINEERING IN THE THIRD CŒTUS.

The instruction in General Engineering in the first cœtus was intended to teach the Artillerist and Engineer so much of the art of fortification, of sieges, and of field-works as is requisite for officers of every arm, and is necessary for the students to pass their *Officer's examination.*

In the second cœtus this instruction was enlarged, and connected with its application to field and permanent fortification, to such extent as the kindred arms of the artillery and engineer corps required equally to know, that they may execute effectually their separate duties in fortification and sieges.

The instruction in Exclusive Engineering in the third cœtus is, however, intended solely for Engineers, as it teaches only professional matters which the engineer shares with no other arm of the service; while, on the other hand, the Artillerist receives a special instruction in those branches which are only necessary for the artillery officer.

Since the lectures would receive a too great and heterogeneous extension, if to them were to be added that portion of hydraulics which the engineer officer ought to know, without being immediately connected with his military constructions, and if further, civil architecture applied to military buildings was touched on, these subjects will be taught contemporaneously in the third cœtus by special instructors, and are therefore in the lectures on Exclusive Engineering not to pass the limits of that instruction. Their respective teachers must receive reciprocally special information of each other's plan of lectures, and give mutual help by communications and inquiries where the studies might come into collision.

The teacher of the Exclusive Engineer class must learn the extent of those subjects of instruction which have been already treated in the lectures on Special Engineering in the second cœtus, and not only by inspection of the programme, but by personal consultation with their respective teachers.

In more remote relation, the instruction connects itself with the earlier lectures on artillery, tactics, history of the art of war, mathematics, physics, chemistry, and the exercises in plan-drawing and surveying. The special programmes of instruction of these branches of study are also to be taken notice of by the teacher, that nothing may be twice taught, and that where the use of doctrines from those studies is necessary, he may merely refer to them historically.

This instruction comprises, after an introduction, the following principal divisions.

1. The application of the rules for sieges already given to particular cases, with a general regard to the ground, more especially of irregular fortresses, shown by various remarkable sieges.

2. A theory of construction as auxiliary science in the execution of engineering works for field or permanent fortification, and in the execution of military constructions: building materials, modes of building, and the application of both for given purposes.

To this part belong—

a. A knowledge of the different building materials from the animal, vegetable, and mineral kingdoms; their production and preparation for various building purposes, and the data, so important in practice, regarding their durability and mode of employment.

b. The theory of the use and combination of these building materials for constructive purposes, and of the building of separate portions of an edifice.

c. The foundations of buildings and the means of improving the foundation bottoms.

d. Construction of ordinary buildings, as inclosures, inclined or unloaded revetments, loopholed walls, barracks and hospitals, dwelling and guard-houses, military prisons, stables, magazines, such as arsenals, wagon sheds, provision stores, bakeries, powder magazines, laboratories, communications, mines, weirs and stop-sluices, ice-breakers, &c.

e. Principles of machinery, with explanations of the forces necessary to move machines, with notice of the most common for raising and moving weights, for pumping, draining, dredging, &c.

3. The art, to apply the knowledge gained by the foregoing lectures by means of projects for certain special purposes, and under given circumstances of ground, such as his service may require of an Engineer Officer. The application of field fortification to given portions of ground is alone excepted, since the teacher of applied Fortification-drawing has this especially assigned to him, who still is only to give out his projects in unison with the teacher of Exclusive Engineering.

There belongs to this part—

a. The method of preparing plans and estimates of buildings, in the manner treated of under 2, at (*c*) and (*d*,) illustrated by frequent practice in making out such plans.

b. Practice in plans for special objects and given ground, which latter is to be chosen in the neighborhood of the fortress of Spandau.

c. Instructions generally conceived on the duties in a fortress of an Officer of Engineers, and on the practice of building in Prussian fortresses.

d. As appendix, notices on the formation and preservation of hedges, and plantations of shrubs and trees.

The time fixed for this instruction amounts in thirty-five weeks, at ten hours each, to 350 hours, which, according to the importance of the different sections, may, as a general rule, be appropriated as follows:—

Introduction and details of the first principal section, about	20	hours.
Theory of building, namely; the lectures on materials and their use,	140	"
Lectures on constructions,	80	"
Lectures on machinery,	30	"
Details of the third principal section,	80	"
Total,	350	"

The more particular distribution of this general division of time is matter of the special lesson plan, and it only remains to be observed, that with the approval of the Director, some afternoons are to be taken for viewing the most remarkable buildings in Berlin and neighborhood; and in conjunction with the teacher of applied Fortification-drawing, three days are to be set apart for a recognizance of the works of the fortress of Spandau, relative to the projects of fortifications mentioned under 3 at (*b*.)

The two first sections of this instruction, namely, the continuation of the instruction on sieges, and the theory of construction, keep their place in the regular lectures of the school, though naturally they have an immediate applicability to practical service, and the lectures therefore ought to be made his own by the pupil by frequent exercises and detailed plans.

The projects for a given ground, on the contrary, must be worked out by the pupils in conformity with the instruction given, as much as possible independently, and as on service a young officer would do under the guidance of his superior. The drawings need not be entirely shaded, but may be partially executed by lines only, but they must be distinct and clean. Here, as in Fortification-drawing, the prescriptions of the Engineer regulation of the 25th of April, 1820, are to be observed, a copy of which is therefore always present in the drawing-room, that they may be seen by each student. Attention is to be given also to the correctness of the scale, to correct coloring, entry on the drawing of the date when done, and of the name as well as the rank of the student, as directed by the above regulation.

In the exercises all propositions for improvements which vary from the mode of practice now in use are excluded.

The teaching auxiliaries are the books and models of the school.

IV. HYDRAULIC CONSTRUCTIONS IN THE THIRD CŒTUS.

The instruction in hydraulics is to comprehend:—

1. Those general principles of hydraulic architecture which in the lectures on Exclusive Engineering in the third cœtus of the School could not be specially explained without extending them too far, and therefore were there taken for granted.

2. Such hydraulic works, as do not immediately come within the scope of military buildings, and therefore could not be included in a lecture on Exclusive Engineering, but which on account of their connection with the profession of an Engineer Officer in general, independently of military construction proper, ought to be known by him in their most important principles.

Since in the instruction in engineering in the third cœtus, opportunities offer for projects of fortification, with application of the theoretical principles given above (at 1,) the exercise problems for the instruction in hydraulic architecture need only extend to those hydraulic works (at 2,) not referring to fortification.

The instruction is in immediate connection with the lectures on mathematics, physics, and exclusive engineering, the last of which will be lectured on at the same time as hydraulics; the lectures on physics and that portion of mathematics which is here necessary, with the exception of hydraulics, have been already treated in the first cœtus. In arranging the plan of the lectures, and in carrying it out, the plans for those sciences must be considered, and conferences held with the teachers it may concern, to prevent the frequent repetition of the same subject.

The entire number of nours is seventy, two of which are given weekly, which, that they may fall in at the same time with the lectures on exclusive engineering, are thus distributed:—

	Hours.
1. Introduction and laws of the motion of water in open channels and pipes, wells, suction and forcing pumps, about................	5
2. Motion of water in streams, hydrometrical measurements,.........	3
3. Regulation of streams by dams, cuttings, &c., explanation of ice-floats, and of the means to prevent their destructive power,.....	5
4. Execution and construction of these works and of securing the banks by dikes, packing, and weirs,..............................	14
5. Historical description of the works for internal navigation, canals, sluices, towing-paths, &c.,..	4
6. Draining and irrigation works, inundations,.....................	4
7. Harbors, moles, sands, lighthouses, roadsteads, &c.,...............	6
8. The principles of foundations under water, with accompanying notice of the usual pile and scoop machines,.........................	12
9. The general principles of bridge building; historical relation of the most remarkable works executed of this kind,................	17
Total,..	70

To make the lecture plainer, and to exercise the student in comprehending existing hydraulic buildings, eight afternoons, at the choice of the teacher, after a previous consultation with the director, are to be appropriated to the inspection and drawing of hydraulic constructions, at Berlin, namely, the sluices and mills.

Although this instruction embraces a large field in a very short period, it must not be extended over too many objects, but rather to be confined to what is indispensable to the practical use of the engineer; the matter of these, however, to be treated fundamentally and thoroughly, and all superficiality be avoided.

The lectures are to be given from private notes, without any prescribed hand-book.

V. TACTICS.

In the First Cœtus.

The Students of the first cœtus are to receive a thorough instruction in elementary tactics, and the employment of the different arms, both separately and united. The object is not merely that they may pass the *Officer's examination*, but that they may gain true general ideas on these subjects, which ought not to be strange to a well-informed officer of any arm. A frequent illustration of the lectures delivered, by examples and problems for actual ground, is particularly recommended.

Lectures on tactics are closely connected with those on artillery, fortification, rules of the service; and in certain respects the lectures on plan-drawing and veterinary art, as well as practical exercises in surveying.

More especially—

a. In artillery: Construction of cannon, of small-arms and side-arms, choice and training of horses for artillery service: organization of the artillery; regulation for the artillery on march and in camp; use of artillery in the field, as regards the specialties of its position, movement, and mode of fighting. The use of artillery in general, in attack and defense, with the use of the reserve artillery in more important battles, in village skirmishes, passage of rivers and defiles, and field fortifications, belongs to the lectures on artillery, but only in the second cœtus; these subjects are therefore to be treated historically with tactics, as far as knowledge of them is required for the *Officer's examination.* As a general principle, however, all the relations of detail in the constitution or the specialties of artillery are to be treated in the lectures on that science; in the tactics, on the contrary, only the more general relations which concern all the arms of the service, and where the artillery acts in union with infantry and cavalry.

b. In Fortification; the designing and construction of field-works and all means of obstruction. The manner in which ground in general, and the given position in particular, is to be used for the throwing up field-works. Attack and defense of field-works. Complete exposition of the art of sieges.

c. Veterinary art. Natural history, physiology, and general nourishment of the horse.

d. Plan-drawing and surveying. Everything that is to be said on the general physical laws of the form of the earth's surface, and specially on a knowledge of topography and its representation.

e. Rules of the service. A knowledge of military style. Discipline in all its various branches. The internal service on detachments, convoys, and separate commands, and some historical remarks on the provisioning of an army.

The lectures embrace the following principal sections:—

1. Introduction. General ideas of war. War materials. Aim of war. Conduct of war. Tactics and strategy. Army organization.

2. Organization of the Prussian army. Raising and equipping the troops. Formation and strength. Replacing of men and materials. Supplies.

3. Special ideas of tactics. Forming, changing position, and combat. Close and open fighting; distant and near fighting. Offensive and defensive. The enemy. The ground. Characteristics of the different sorts of troops. A short sketch of the development of tactics up to their present state.

4. The proscribed tactics of the infantry, cavalry, and artillery according to the Prussian regulations.

5. Ideas on the combination of the three Arms and order of battle.

6. Influence of ground on the use of troops. Classification of ground and cognizance of the individual objects on it.

7. Occupation, attack, and defense of objects on the ground, as heights, valleys, woods, river lines, farm-buildings, inhabited places, defiles, bridges, dykes.

8. Security of troops on a march. Service of advanced posts. Reconnaissances. Special duties for detachments, as escorting convoys in our own or enemy's country; foraging, surprises, ambuscades, covering of works in the field. In conclusion, some remarks on partizan warfare.

The total number of hours comprises, according to the regulation, in thirty-five weeks at four hours each, 140 hours, of which are to be employed:—

For the first and second	principal	sections about..........	15	hours.
" third	"	"	20	"
" fourth	"	"	40	"
" fifth and sixth	"	"	15	"
" seventh	"	"	25	"
" eighth	"	"	25	"
Total,....................................			140	"

The lectures on tactics furnish the student with the positive knowledge that is necessary as a general basis; but further care is particularly taken that by the application of the problems put before the students their knowledge is not made up of mere dead knowledge, but that throughout their understandings are exercised. It is, therefore, a special duty of the teacher to frame his lectures accordingly, and as well by a development of the basis upon which the organization, the elementary tactics, and the art of war is founded, as also by very frequent exercises given to the pupils on the lectures to press towards this end.

For the solution of the tactical problems, a number of plans of ground is necessary. They are obtained on the requisition of the teacher through the Director.

It is further necessary to illustrate the use of the different troops upon the ground itself, as well for attack as defense, and to have the examples and problems given by the teachers sketched by the scholars. For such exercises four days of two or three hours each will suffice.

Of the existing hand-books, none appears perfectly qualified to serve as a basis for instruction. The filling in, therefore, of a sketch of the lectures, and of a special plan of instruction, is indispensable to give the teacher a fixed basis, and the scholars an assistance in their repetitions.

VI. MATHEMATICS.

The mathematical lecture, besides its general tendency to sharpen the intellect, is to make the scholars acquainted with all those theories and laws which are indispensable to the Artillery and Engineer officer to enable him to solve with certainty and ease those problems which so often meet him in the service.

Since these problems in part require the application of rules of the higher branches of mathematics, lectures on these ought not to be wanting, and consequently the mathematical instruction for at least a portion of the pupils must embrace (with few exceptions) the entire field of this science.

In order, however, that this demand be accommodated to the time at disposal and the capabilities of the students, the following rules are to be observed:—

1. The students of the first cœtus having already passed their examination for *Portépée ensign*, and the Predicate *ziemlich gut*, in their mathematical examination, being requisite for entry into the School, it is to be presumed that they enter with a good or at least sufficient preparatory knowledge. Still, as it is not to be expected that the necessary requirement in arithmetic and algebra will be possessed throughout, the first part of the instruction must be considered as the most important, and be given thoroughly and fundamentally.

2. Such portions of mathematics as are less necessary for Artillerists and Engineers (for instance, astronomy and the higher geodesy,) are to be entirely omitted from the lectures.

3. As even in such portions as fall within the scope of the lectures, there is much that can not be exhausted, therefore all that belongs solely to speculative views, or possibly only serves to the rounding or perfecting a system, must be passed over. The instruction in mathematics stands in near and frequent connection with the lectures on artillery, architecture, mechanics, physics, theory of surveying, and with drawing lessons, as well as with practical mensuration.

These belong specially—

a. To Artillery: architecture, mechanics; the application of all those formulas which the mathematical lectures have to deduce and to prove.

b. To Physics: the theories of dioptrics, and catoptrics, which the students require to a perfect understanding of the construction of telescopes and reflecting instruments; what is necessary from aërometry and aërostatics.

c. To Drawing lessons: practical working out of the theory of perspection, and the construction of shadows.

d. To the theory of Surveying: a knowledge of all the instruments requisite for mensuration and leveling, and the principal theorems, with their application to cases occurring in mensuration.

The lectures on mathematics form of themselves a continuous, closely connected whole; consequently, the same teacher who gave instruction in the first cœtus is to retain his pupils in the second, so that each of the two teachers commence with the first cœtus in alternate years.

For the third cœtus there will be a selection made of those students who have made themselves noticed in the second cœtus by distinguished ability, special application, and peculiar talent for the study of mathematics, and have thus raised hopes that they may be conducted with success into the higher branches of the science.

They form a separate division, whose number should always be small if the selection be guided strictly by the contemplated purpose. All the other students of the third cœtus form a second division, in which the entire field of what they have already been taught in mathematics is again gone over, with a view to its application; and at the end of this course some other subjects necessary to the Artillerist and Engineer are to be treated, without, however, mere scientific speculations.

For each of these divisions a separate teacher is appointed.

A. THE LECTURES IN THE FIRST CŒTUS EMBRACE,—

I. *Arithmetic and Algebra.*

1. Algebra, with sums, differences, products, quotients, whole numbers, roots, powers with real exponents and logarithms. The qualities of fixed numbers, fractions, decimal and continued fractions. Extraction of square and cubic roots in figures and letters, practical use of logarithms.

2. Algebra, equations of the first and second degree, with one or more unknown quantities, proportions, and the higher numerical equations.

3. Arithmetical and geometrical progression, calculation of interest, theory of combination, binomial theory for real exponents, series for powers and logarithms and analytic trigonometry.

4. Cubic and biquadratic equations, pure equation of the *n*th degree, reciprocal equations. (4½ months.)

II. *Plane Geometry.*

Similarity of figures formed by straight lines, their contents. Theory of the circle; measurement of the circle and of its parts. Geometrical analysis and application of algebra to geometry. (2½ months.)

III. *Plane Trigonometry.*

Trigonometrical functions and their logarithms. Calculation of triangles and polygons, certain parts being given. Application to the circle. (2 months.)

B. THE LECTURES IN THE SECOND CŒTUS COMPRISE,—

I. *Geometry.*

1. Geometry of solids. Place of lines and superfices in space. Solid angles, solids, determination of their superfices and contents. Applications, with consideration of the weights of material bodies.
2. Solid trigonometry, with its application to the superfices of the earth.
3. The theories of projection and co-ordinates.
4. Conic sections. ($4\frac{1}{2}$ months.)

II. *Statics.—Geostatics and Hydrostatics.*

With application to practical cases, namely, determination of center of gravity for ordnance and their parts, pressure upon supports, rafters, against walls, dikes and arches; stability, carrying power, strength as well as regulation and calculation of power of machines which are moved by animals. ($4\frac{1}{2}$ months.)

C. THE LECTURES IN THE FIRST SECTION OF THE THIRD CŒTUS COMPRISE,

1. Differential and integral calculation. (3 months.)
2. Higher geometry. ($2\frac{1}{2}$ months.)
3. Dynamics (mechanical,) and hydraulics, with application of the determination of the strength, direction, and distribution of the recoil upon the separate proportions of a piece of ordnance, of the science of projectiles, of the theory of carriages, of the rise of rockets. ($3\frac{1}{2}$ months.)

D. THE LECTURES IN THE SECOND DIVISION OF THE THIRD CŒTUS COMPRISE,

1. Repetition of the most important results of the instruction in the first cœtus in a series of exercises.
2. Repetition of the theory of statics and solution of numerous problems from real life. (3 months.)
3. Dynamics and hydraulics without higher analysis, with applications. (3 months.)

E. GENERAL APPROPRIATION OF TIME.

The number of lessons (hours) amounts, according to the prescribed plan for the first and second cœtus, to six hours, for each division of the third cœtus four hours, weekly; if the course be taken, after deducting the holidays and other interruptions, at thirty-five weeks, then there will be for the first and second cœtus, 210, and for each division of the third, 140 hours.

The number of hours to be devoted to each portion must, in the first instance, be determined by the teacher in his special lecture plan, as it in part depends upon his previous experience; at all events, all the above-named themes for the first cœtus must be treated in the stated time. Only in special cases, in the second and third cœtus, can the omission or transposition of one or the other, on reference to the higher authorities, be permitted.

It has been already remarked that the course of mathematics should impart to the students not only that amount of positive knowledge which he requires for his immediate sphere of action and needs as incitement and guide to further study, but also should fill the important purpose of forming the mind of the students generally. This purpose will be the more certainly gained the more the teacher is enabled to render the scholar self-trusting, and in each separate study to lead to the development of a few select principles simple and easily understood, but comprising in natural and logical connection the whole theory, so that the scholar fancies they are his own discovery, and therefore prizes them as his own. The teacher must, therefore, gradually propose a series of connected inquiries, and those naturally first on which the usual systems are based, as questions to which the students have to submit answers deduced from the above-named principles, with constant application of simple common sense. By these means the students are not only continually gaining single results, made ready to their hand by use, but what is principally desired, they acquire thereby great mental activity.

As regards instruction in the separate cœtus, the following rules are to be observed:—

At the commencement in the first cœtus, the teacher should endeavor, by frequent questions to form a full and correct judgment of the previous knowledge of each student, that he may determine how he should proceed with his lecture, slower or quicker, and to what subjects generally for the entire class special notice and exercise should be devoted.

The most complete exercise of the elementary rules, forming, as it does, the indispensable basis for all future progress is in this cœtus the principal aim of the teacher.

In the second cœtus, in the application of the theory of co-ördinates to the commonest curves, no investigation of the specialties of the theory of curves is necessary, because this is reserved for later lectures, and it would here abridge the time required for subjects of nearer interest. The development of these theories must, therefore, be confined to the simplest elementary use. The study, too, of the analysis of finite numbers is to be continued only so far as the student requires for immediate application, without any intention of going deeper into the science. On the other hand, a suitably increased time is to be given to statics and hydrostatics, because the student ought to be acquainted with them in the most complete manner.

As the first division of the third cœtus consists of but few and only the best scholars, it may be required of them to work out independently at home separate questions given by the teacher, and submit them to him for examination. The progress of the student is more surely gained and advanced, the oftener he has opportunity of personally discovering mathematical truths, or by applying them to examples to come to a clearer comprehension and use of them.

In the second division the teacher will not always be able to avoid giving a repetition of the reasons of propositions. This is necessary when he perceives from the work or expressions of the students, that the majority have not perfectly comprehended the proposition. Still the teacher will here content himself with bringing forward the most important points in the chain of deduction The explanatory problems are solved by the teacher himself, who then sets similar ones for working out by the students at home.

For practical static problems, the teacher can use with great benefit objects often occurring in common life, and yet regarded so little; the numerous applications of the lever, of the inclined plane, &c., by artillerists and engineers, for their works, carriages, draught, &c., furnish sufficient material for such problems; as for instance, determination of the depth of a boat of given length and breadth when after putting into it a piece of ordnance a given height out of water is required; determination of the power requisite to overcome the resistance of a log lying in the track of a vessel; determination of the pressure of a laden beam on two or more supports with reference to the flexibility of the beam; determination of the center of gravity in an excentric hollow shot, both theoretically with given radius and known centers, as well as more practically when the centers and the radius of its interior are unknown, as by dipping the hollow shot into quicksilver; determination of the counterpoise of a drawbridge and examination of the best position for the axle; investigation of the strength of metal and wood pipes which are to serve as water-pipes at given heights of pressure, &c.

At the same time the teacher ought not to leave unnoticed the advantages which theory can offer to practice when rightly applied, by which is in no way meant that the practical man should enter every time into a prolix and anxious calculation, but from the improvement his mind and capacities have received, he may apply readily what he has learnt to the purposes of common life.

Dynamics and hydraulics will be rather treated in a physical and historical point of view; here, too, the application of known professional results is the principal object.

As the limited time will not allow separate mathematical repetitions, the teacher should therefore be the more careful to make his lectures as much as possible applicatory. To insure progress the students must, besides the usual writing out the lecture, have frequent themes given to them for work at home, and of which their own execution should be secured by proper means.

It is perfectly necessary that a hand-book should form the basis of the instruction, from which the teacher should lecture, and the students make repetitions.

The hand-books are to be proposed by the teacher to the Board of Studies, and must not be changed without permission.

These books, as well as the logarithm tables, every student must have a copy of, as he can not do without them in the school, and may frequently require them in future life.

Models of solids, to illustrate the projection theory, are in the collection of the models of the school.

VII. PRACTICAL ARTILLERY EXERCISES.

The practical artillery exercises are intended, in the first place, to furnish the students with a sight of that portion of the material of the artillery which they have had no previous opportunity of knowing, and of which the knowledge is indispensable for a complete understanding of the theoretical lecture. The exercises should follow the lecture as immediately as possible, and occur therefore during the continuance of the theoretical course.

The students are besides to become acquainted with the methods of execution of the most important artillery duties, in an extent compatible with their position, and the time at their disposition. For this portion of the exercises, the months of July, August and September are to be preferred.

In the major part of these exercises, the engineer students take part, so as to gain a knowledge of such parts of the artillery service as seem to be of the greatest importance to them.

The artillery exercises separate into numerous subdivisions, of which the following may be particularly remarked:—

I. EXERCISES OF THE FIRST CŒTUS.

A. *Visits.*

The visits happen, as already noted, at the period of the theoretical instruction. The students are to be divided into as many sections as is necessary, that each may gain the desired information. There belong to this part—

a. Visiting the foundry and the boring machine. All the students of the first cœtus are to be taken by the artillery teacher of this cœtus, on two afternoons, to the foundry, and to the new boring machine.

They will see the general construction of the foundry and the boring machine, and, in case such work is going on, the molding, boring, and turning, and receive the explanations necessary.

b. Examination of ordnance, gun-carriages, and ammunition wagons.

Those in the arsenal, as well as the exercising pieces of the regiment of artillery of the guard, are to be used for this purpose, to exhibit the construction of ordnance both in the Prussian and foreign artilleries, and also those of an earlier date, from the specimens kept there. In the same way as has been remarked for the ordnance, the gun-carriages and equipages of the guard artillery regiment in store will offer opportunity for a more exact scrutiny of these carriages, limbers, and wagons. For these visits four afternoons are to be taken.

c. Visit to the workshops of the artillery:—

The students will, in two afternoons, gain there a knowledge of the following objects:

1. The mode of work in general.
2. Processes in the manufacture of the most important objects of artillery material, as axles, wheels, carriages, mountings, sponges, harness, ropes, &c.
3. The raw material (wood, iron, leather.)
4. Objects furnished to field, siege, and fortress artillery.

d. Visit to the small-arms factory and powder-mills in Spandau:—

The scholars of the first cœtus will be conducted into both manufactories, to obtain a general insight into the various works.

In order that the work of the manufactories may receive no interruption, the teacher of the first cœtus is to communicate beforehand with their respective superintendents, and take the students in suitable small parties, and before entering the powder manufactory to insist, most carefully, on all the proper precautions being observed.

These visits are to take place during the theoretical course on the same day as is fixed for the first cœtus to visit the fortress of Spandau to study its fortifications; and, therefore, an agreement should be made between the teacher of artillery and the teacher of general engineering.

e. Visit to the armory at the arsenal:—

The students are to be conducted on an afternoon to the armory of the arsenal, where the superintendent will explain to them the peculiarities of match and wheel locks, with the most remarkable projects for loading at the breech, and with the form of small arms amongst other nations.

B. *Exercises.*

a. Examination of small arms:—

The students are to be taken by their teacher to the musket manufactory, where they will be shown the mode of proof of small arms in general, and with reference to the theoretical lecture then in progress.

Each student then receives a faulty musket, with direction to examine and note its defects. The teacher revises and corrects these notes.

b. The management of machines:

In the presence of the students the management of various machines, &c., as well as the repair of damaged carriages, will be undertaken. According to the means at disposal, such exercises will be selected as are most instructive, in exhibiting arrangement, strength, and care in their application.

The students will be permitted to lend a hand only in such cases as it is foreseen that their strength will be sufficient. For all other purposes where strength is necessary, workmen must be employed.

II. EXERCISES IN THE SECOND CŒTUS.

When the teacher judges proper, some of the previous visits are repeated on the afternoons disposable during the theoretical course.

A. *Marking out and Tracing Batteries.*

The students undertake these exercises under inspection of their teacher of artillery on two days in the last three months of the course.

The teacher instructs them then how to ascertain the prolongation of the enemy's lines, and the mode of determining the line of fire of the first embrasure of the different batteries, as well as the other points to be marked out, both with the use of the usual instruments, and with simple measurement by pacing, and laying down right angles by the eye.

A complete construction of a battery is not possible on account of the shortness of time, paucity of means, and strength of the students. The exercise, therefore, is confined to an explanation of the formation of the material and tool depôts; to marking out and tracing horizontal and sunk batteries on even, irregular, and sloping ground, and to the construction of the powder magazine.

B. *Practical Exemplification of the Rules for Placing Ordnance according to the Ground.*

These exercises are to be carried out on two afternoons by all the students, under the inspection of their artillery teacher.

They have only reference to the ground, and leave out of consideration all tactical considerations. This object may be fully attained even without guns, and the necessary instruction may be given without them, as it would not be easy to form all the batteries in the desired number.

The teacher chooses the ground, explains it by means of a plan to the students, and goes with them to the place. He divides them into various sections, and lets each select positions for from two to eight pieces, both for attack and defence with different kinds of ordnance, giving only generally the direction and distance at which the enemy is operating.

Each position is inspected by the teacher, and the views and reasons for it received and discussed as regards effect, mode of firing, and covering and free movement, and where it is necessary, improved; and at the same time the requisite precautions taken for the limbers and wagons.

C. *Drawings of Ordnance Carriages and Wagons.*

These exercises are to be undertaken by the artillerists of the second cœtus, under inspection of the teacher of artillery-drawing, on twelve afternoons in June.

The drawing of a piece of ordnance is to be clearly distinguished from the examination of it. For the first, taking the necessary measures is alone necessary, but not their comparison with given models.

The teacher will order these exercises, so that the students learn principally—

1. What scale they ought to take for a given object, so as to execute a drawing with the precision necessary for being afterwards worked from.
2. With what instruments and method of procedure they may most easily obtain their end.
3. How notices of improvements are to be taken and arranged.
4. How the rough draft is to be jotted down.

It must be here particularly remarked that our guns, carriages, &c., have no mathematically exact forms, and that therefore the number of measures to be taken must be often multiplied to have a true figure of the body.

A fair drawing from these measures in the above period is so much the less possible, as the number of objects is as much as possible multiplied. It is fully sufficient, however, for the purpose of this exercise, that the students learn to take complete and useful rough drafts.

On their entrance into the third cœtus, the complete drawings from these rough drafts take place.

In his selection of objects to be drawn, the teacher must, in having regard to variety, take care that the drawings by too great difficulty do not exceed the time and power of the students, nor by too great simplicity cease to be instructive.

Ordnance carriages, limbers, wagons, and the machines required in artillery, are the most suitable for choice, and are easiest obtainable in the arsenal.

The students must be divided into sub-sections, of at most three or four persons, and to each a separate task given.

The teacher is to be present at the drawings to see to their proper execution, and has delivered to him the notices and rough sketches to amend any errors that may be in them.

The relative section of the second edition of Burg's "*Drawing of Artillery Material*" is to be taken as the basis for these exercises. In addition to them, the students receive guidance and suitable instruction in drawing artillery objects off-hand by the eye, without the use of instruments. The first two days are to be chosen for this, and the students by this use of off-hand drawing receive at the same time a useful preparation for the drawings subsequently required to be taken by the aid of instruments.

D. *Exercises necessary in regard to Sieges*—

Are to be conducted by the teacher of artillery and special engineering jointly, and are given more in detail under *exercises in fortification.*

III. EXERCISES IN COMMON OF THE FIRST AND SECOND CŒTUS.

A. *Proof of Powder.*

This exercise is to be conducted by all the students of the first and second cœtus at the time of the gun-practice, and comprises—

1. Firing different sorts of powder from the proof mortar.
2. Firing different sorts of powder purposely brought into an abnormal state.
3. Instruction in weighing and measuring the powder.

B. *Artillery Practice.*

All the students of the second and third cœtus take part in the practice under the inspection of the two teachers of artillery, for which fourteen days in August and September are fixed. If possible, it is to be undertaken in the morning, and only when the practice-ground is otherwise occupied is it to be deferred till the afternoons.

The practice comprises—

1. The necessary preparation for firing; namely, laying down the platform, marking the range, fixing the targets, preparing the lists to note the shots.

2. Firing from different kinds of ordnance and with different projectiles.

3. Instruction of the students in the service of the guns; selection of the charge and direction under given circumstances, and their correction; effects of distance; noting and jotting down the shots and the time of flight; calculation of the length of fuse, of ranges and averages from the different data, and remarks on the effects sought.

4. Burning a portion of prepared laboratory materials for observation of its action and effect.

The following are to be objects of practice:—

a. Rounds of six, twelve, and twenty-four lbs. shot and shell out of the short 24-pounders, to note—

aa. The grazes, distances, and deviations at different elevations, and as regards ricochet fire.

bb. Probability of hitting upright targets at various distances.

cc. As regards dismounting.

dd. As regards firing against heads of saps.

b. Seven, ten and twenty-five lb. shells, carcases, and light balls, to note—

aa. The grazes, distances, and deviations at different elevations and charges, also as regards ricochet firing.

bb. The probability of hitting upright targets at various distances.

c. Shells, carcases, and light balls from mortars, to note—

aa. The probability of hitting upright targets at different distances.

bb. The calculation of the charge or elevation when one of these elements and the distance are given, or *vice versâ.*

cc. Calculation of lengths of fuse for given distances.

d. Throwing hand grenades, stones, 1-pound case shot, and 3-pound balls at various distances for comparison of the effects.

e. Firing from the hand and stock-mortars at differing distances.

f. Case shot from 6 or 12-pounders, also from short or long 24-pounders and 7 and 50-pound howitzers at different distances against planks, and both with case shot, and grape shot, for observing the effect:

aa. Of different charges.

bb. Of different weights of the entire case.

cc. Of the weight and size of balls used.

dd. There is also to be observed the scattering, the number of hits and wide balls, and determination of the best line.

g. Shrapnel shells from field-pieces against planking.

5. The number of the before-named rounds is not to be too great, partly not to increase expense, partly in regard to time, since the practice is intended for instruction, and therefore not to be hurried. Still for shot, shell, and grape shot, ten rounds is the *minimum* if a result is to be drawn; for the small mortar five rounds are sufficient.

Notwithstanding this limit, it will not be possible to take the practice all in one year. It seems, therefore, expedient to divide the whole into two portions, so that the most important practice happens indeed in each year, generally however, in one year the practice is to take place with field-pieces, in the following year with siege-pieces, so that the student who is present once in the first year and once in the second can complete the necessary course.

The teachers have, therefore, to determine, in the proposed plans for these exercises, the sort and number of rounds they judge necessary for the following year.

C. *Practice in the Laboratory.*

As the students of the artillery, by the present regulations of their education in the regiments, have not sufficient opportunity to learn the service of the laboratory perfectly, particular attention must be paid to this work in the school.

The students of the engineer corps also take part in it, in the second cœtus, not to become perfect proficients in the different operations, but so as to gain a general knowledge of ammunition, matches, and compositions, and the duties of the laboratory.

All the students of the first, and the artillery students of the second cœtus are therefore to be occupied by their teachers for twelve afternoons in the laboratory.

For the superintendence, so necessary in these works, and for variety of practice, the fireworkers employed as assistant teachers in the school, and others from the proof department of the artillery, and also five or six artillery officers of the third cœtus, are to be present at this practice, so that each of these students is present twice or thrice on the average.

The work embraces, first, the preparation of ammunition for the artillery practice, &c.

But as this would not suffice for the complete instruction of such a large number of students, it must receive an extension calculated for this purpose, and embrace not only the separate preparations, but also a large quantity of ammunition, which, as not required for the school, is therefore sent to the depôt.

The following work is to be preferred:—

Pounding of saltpetre, grinding meal powder, pounding sulphur and charcoal, boiling paste, making mastic, composition, quick-match, fuses, tubes, portfires, carcass composition, touchpaper, case and grape shot, loading shells for bursting, discharging empty shells in which a fuse only has been driven; carcasses, fire-balls, and light balls; infantry, cavalry, buck-shot, and percussion cartridges; ball, canister, howitzer, and paper cartridges. Fanal, signal rockets, pitch compounds, powder bags, and stink-pots. The teacher is to make a careful distribution of the students, (allowing for such as have missed any days by illness,) to be satisfied that each artillerist has made every article in the laboratory, if possible, or at least has carefully witnessed its preparation.

IV. EXERCISES IN THE THIRD CŒTUS.

All the exercises of this cœtus take place during the period of the theoretical course.

A. *Visit to the Workshops.*

The student will have to learn the mode of proceeding, the construction, and the use of the machines employed. Examination and storing of the most important raw materials.

B. *Visit to the Iron Foundry.*

All the students of the third cœtus are to be divided into two sections, and each section to be conducted on an afternoon under the care of the teacher of artillery concerned to the Royal Iron Foundry.

They will see there the molding, casting, and cleaning of case shot, cannon balls, and shells.

They will also have explained to them the construction of reverberatory and cupola furnaces, of steam engines, and of turning lathes, and planing benches.

C. *Visit to the Foundry and Boring Machine.*

The students of the third cœtus are to be present at the actual manufacture of cannon, their molding, casting, and boring. But as the circumscribed room and other considerations will not allow all the students to be present at one time, different divisions are to be formed, to visit the foundry and boring house on different days. The teacher concerned, will, therefore, make the necessary inquiries as to the time when the above works are going on, and arrange the visits by communication with the director.

The casting and preparation of iron ordnance require particular attention. On this, too, the teacher has to obtain information, and proceed as above.

D. *Examination of Iron Ammunition.*

The artillery officers of the third cœtus take these exercises in hand on two afternoons, under care of the artillery teacher in the same cœtus.

The purport of it is not so much a thorough instruction in this manufacture, as a completion of the theoretical lectures on the mode of conducting the processes by means of personal inspection and handling of the instruments. The teacher will pay particular attention to the errors that may occur in the measurements, &c.

E. *Examination of Cannon.*

This exercise is to be undertaken by the artillery officers of the third cœtus, under the inspection of their artillery teacher, in six afternoons. The object of it is exactly the same as of the foregoing.

The exercise must commence with directions for proving the instruments, when the teacher will show the mode of their manipulation.

As the use of such instruments only can be reckoned on as the school, the depôt, and the artillery proof department possess, only three sections of the

.. .. s can work each day simultaneously; the section consisting, at the utmost, of six persons, if individual handling of them is presumed necessary.

The teacher must, therefore, divide the students into sub-sections, and make such arrangement that each student, if possible, personally work every part of the exercise, or at least have a perfect sight of it.

That portion of the students which can not be immediately occupied on each exercise day, put their tables of dimensions in the order and forms required by the regulations.

F. *Examination of the Gun-Carriages and Wagons.*

The exercise is to be conducted by the artillery officers of the third cœtus, exactly as the foregoing, in five afternoons.

G. *Practical Exposition of the Rules for the placing of Guns according to given Tactical Relations.*

These exercises are to be performed by the artillery students of the third cœtus, under the direction of their teacher of artillery, on four afternoons.

The teacher makes known the ground by means of a plan; he then directs reconnaissances to be made, and receives the reports.

He selects a tactical problem, the nature of which offers opportunity to remark both on the placing of guns of different calibres, and also the reserve artillery at the decisive moment of a battle, as well as the more minute details of placing single divisions and guns, and the limbers, riding horses, and wagons.

Before he solves himself the problem completely, he gathers the opinions of the students in respect to single portions, and if necessary sets them right.

The principles to be followed refer so specially to the ground, that the object of illustrating the instructions can be attained without guns. The teacher may therefore content himself with marking by flags the situation of single guns and batteries, by which the advantage is obtained of an easier use of the ground.

II. *Exercises at Spandau in reference to a Siege.*

These exercises are to be conducted by the teacher of artillery, in unison with analogous regulations of the teacher of engineering, and are more particularly mentioned in the practical exercises of fortification.

The limits of time and means render it impossible to gain for the above-named exercises that extent by which the full acquirement of the necessary mechanical readiness could be insured. It is sufficient if the student has made a perfect personal examination and performed as much manipulation as circumstances permit.

The separate practical exercises can only be made after the termination of the theoretical treatment of the subject. This rule is necessary, partly because this practice is only a continuance and completion of the lecture, partly because the shortness of time restricts the exercises considerably, and therefore the days devoted to them can not be applied to theoretical explanations, which will be more profitably given in the lectures.

Where the nature of the exercises permits, the officers and elder *portépée ensigns* will take the superintendence, that having formerly learnt the execution, they may now make themselves acquainted with the duties of ordering and inspection.

The number of students engaged at one time in an exercise ought not to be so large that a portion of it remain unoccupied or not under the complete inspection of the teacher. The disturbances that occur too easily in such cases, being most injurious, must be most carefully avoided. The teacher will make the division above stated, and take all necessary measures for obtaining the requisite control.

If, at any of the exercises, danger can arise to the students, the teacher is previously to instruct them specially in what is to be observed for the safety of the workmen; after that, the superintendence of the students must be conducted with increased care, and any departure from the given orders visited with redoubled severity.

The determination of the days for these exercises rests with the director, after consulting the teachers. Should unexpected hindrances prevent the carrying out an exercise, the teacher may determine concerning it, but must consult with the Direction as to the fetching it up on another disposable day.

The necessary workmen will be demanded by the Direction from the respective services, of which the teacher will give to the Direction due previous notice.

The guns necessary for practice are to be lent by the Artillery Regiment of the Guard and the Artillery Depôt; all the other instruments, equipments, &c., are borrowed from the Depôt. All materials are received by order of the war department or by purchase. It is therefore the business of the senior of the two Artillery teachers, in his yearly demand for the practice, to state the full requirement of tools and materials, that the Direction may take timely measures for their supply.

VIII. PRACTICAL EXERCISES IN FORTIFICATION.

Practical exercises in fortification stand in immediate relation to the lectures on fortification, sieges, and field engineering. They complete, as far as possible under given circumstances, the theoretical lectures by personal view; they also offer the students opportunity for solving fitly chosen problems, to apply what has been learnt, and to prepare by reflection for practical service.

The exercises are to be conducted in each cœtus by the teachers who lecture on Engineering. The presence of the Artillery teacher is elsewhere separately noted.

A. THE EXERCISES COMPRISE—

a. *For the First Cœtus.*

1. In unison with the teacher of Artillery and of General Engineering, the examination of the fortress of Spandau, to make clear to the students the combination of the details of a complete fortress from an actual example.

2. Examination of the models of fortresses and their details in the Arsenal, to make clear the principles of a siege.

3. Visiting the exercising-ground of the Engineer division of the guard in all its details.

4. Marking out, tracing, profiling, calculation of the cubic measurements, of the time for building, of the number of workmen, and of the garrison for given fortifications on ground near Berlin.

5. Being present at the exercises of the Engineer division of the guard in sapping, mining, building redoubts, laying bridges, and their instructions.

b. *For the Second Cœtus.*

1. Examining the models in the model-house, partly to illustrate the systems taught, partly to show the influence of ground on the situation, form, and contrivance of the works; and again to explain by the aid of the necessary notices of the sieges of these fortresses the choice of the fronts of attack, and other matters relating to sieges.

2. Problems on the ground for sieges, such as may happen, to a subaltern officer, as simple as possible, but to be solved clearly and exactly.

These exercises refer principally to the marking out of parallels, zig-zags, and saps, as well as marking out and tracing siege batteries. They are to be undertaken under the united direction of the teachers of Special Engineering and of Artillery on the exercise ground of the Guard Engineer division.

8. Problems on field fortification, not too comprehensively drawn out, but of which the solution should be the more complete. Here belong, *e. g.*, the fortifying of a house, a farmstead, a bridge, or other defile, covering of an advanced post, &c., &c.

c. *For the Third Cœtus.*

1. For the Artillerists:—Exercises in reconnaissances of fortresses. Fixing the points for laying down batteries of attack. Statements of the arming of detached works against *coups de main* and formal attacks. Sketches of instructions for subordinates in particular cases. Construction of ammunition and other depôts in and before a fortress. Under the guidance of the Artillery teacher of the third cœtus, with regard to the analogous regulations of the teacher of Exclusive Engineering.

2. For Engineers:—*a.* Reconnaissance of Spandau in reference to projects in permanent and field fortification, as well as military architecture and hydraulic works, under the guidance of the teacher of Exclusive Engineering, with the assistance of the teacher of Fortification-drawing.

b. In conjunction with the Artillerists, reconnaissance of Spandau for fixing a front of attack, securing its investment by field fortification adapted to the ground. Placing the depôts of material. Marking out the first parallel, with its communications, as well as the subsequent works of attack. Measures of the defenders, special discussion on arming the works on the spot. Under the guidance of the teacher of Exclusive Engineering, having regard to the analogous regulations of the Artillery teacher in the third cœtus.

B. FIXING AND APPORTIONING THE TIME.

a. *For the First Cœtus:*—

1. The visits prescribed in 1 and 2 for this cœtus are to be made in spring, whilst the theoretical course is going on, and for them are fixed, ...	2	days.
2. The further exercises under 3, 4, and 5, are to be taken in the summer months; to them are allotted, for the visit at 3, ...	1	"
To the exercises at 4, ...	5	"
To " at 5, ...	6	"
Total, ...	14	"

b. *For the Second Cœtus:—*

The exercises under 1, 2, 3 for this cœtus, are to be held in the Summer, and are thus regulated:—

For the visit at 1,	2 days.
To the exercises at 2,	2 "
To " at 3,	8 "
Total,	12 "

c. *For the Third Cœtus:—*

The exercises ordered for this class are to take place only in Spring, whilst the theoretical instruction is going on, and for it are fixed:—

1. For exercises by the Engineers alone,	2 days.
2. For those jointly by Engineers and Artillerists,	3 "
Total,	5 "

The days of the calendar for these exercises are to be proposed by the teachers when delivering in their annual sketch of exercises, and their propositions will be laid by the Direction before the authorities for their approval.

To engage the pupils to work they are to be divided for the visits and exercises into suitable sections. Each section receives its problem from the teacher, who also nominates the president of the section. This president distributes the sub-sections among the other students, and sees that the work to be written and drawn is finished in the required time, signed by the author, and is delivered by him to the teacher. Great care is to be taken that single students do not remain unoccupied; the disturbances thence only too likely to arise are always injurious to the instruction and the discipline. In giving out problems, their principal conditions only are to be designated by the teacher, and the development left entirely to the student, or with little aid from the teacher, in order that the student may gain early that confidence and independence necessary to the soldier in carrying out matters committed to his charge.

In the exercises the workmen demanded for marking out, are to be limited as much as possible, as the students must perform the greatest part of the work themselves. The number indispensably necessary will be demanded in time by the teacher from the Guard Engineer Division through the Direction.

The necessary material, if the Guard Engineer Division can not furnish it as a loan, may be purchased at the charge of the school.

THE WAR OR STAFF SCHOOL AT BERLIN.

BY GENERAL VON HOPENER.

I. OBJECT, PLAN AND STAFF OF THE INSTITUTION.

THE War School (*Kriegs-Schule*) is intended to receive officers of all arms, who during three years of active service have given proof of ability and of particular capacity. They find there the means for acquiring the knowledge requisite for the higher ranks of the service, for the duties of officers of the staff, and for all other appointments which demand military and scientific studies of a higher and more general character than the common ones.

The course of study is for three years, and is divided amongst three classes. The courses begin on the 1st of October, and continue to the 1st of July. The number of officers who can be received is 120, neither room nor means of instruction sufficing for more. The three months of vacation in the summer are employed by the pupils in learning the service of those arms of the profession to which they do not belong.

The Special Direction of the War School consists,—

(*a*) Of the Military Direction.

(*b*) Of the Direction of Studies.

The Military Direction consists of a director, a field officer connected with the direction as inspector, and an adjutant, who directs the accounts of the Institution.

The military director is supreme, both over the military officers who are members of direction, and of the military officers who are studying in the school. The police, the discipline, and all the administration of the Institution are under his control. All the subordinate officers in the house are under his orders. The field officer attached to him is charged to look carefully to the discipline and to the due attendance at the lectures. The adjutant directs the correspondence and accounts of the establishment. The whole of the staff and the military directors are lodged in the school.

The Direction of Studies is in the hands of three field officers of literary and scientific attainments, and of two other persons, civilians of Berlin, of high literary reputation. Its president is the senior officer, who is generally also the military director. It has also a secretary attached to it.

The Direction or Board of Studies is exclusively intrusted with the care of everything affecting the teaching of the Institution, and its members are bound to be frequently present at the lectures. It has also under its inspection all the means and objects required for teaching, such as the library, the collection of maps and models, the collections for physical science, and the laboratory.

The Director of Studies selects the professors of the Institution, recommends them to the superior authorities, and in case of their appointment gives them their instructions.

At the beginning of each course the direction fixes the plan of the lectures, and if any alterations in them are required, proposes them to the superior authorities for their sanction.

The Direction of Studies regulates the examinations which the officers who are candidates for admission into the school are to undergo. With this view it draws up a certain number of subjects and questions suited for the purpose, which it sends, in the spring of each year, to the chiefs of the staff of the different Corps d'Armée, in whose presence the candidates do their work. Those of the candidates whose work is satisfactory are entered at once in the school.

In order to take account of the progress of the students the board of studies makes them pass an examination in writing at the end of every three months; makes a revision of the judgment of the professors upon the papers, and conjointly with the military board of direction, gives certificates at the end of the triennial course to the officers who have gone through it completely. In these studies it is the part of the board of studies to give a judgment on the scientific merit, and that of the military board to judge the moral conduct of the officers.

The two boards make a report yearly on the progress and the conduct of the officers of the school. This report is submitted to the king by the minister of war. Particular mention is made of those officers who by extraordinary success have deserved his ma jesty's favor.

II. SUBJECTS AND AIDS OF INSTRUCTION.

Attendance on the different courses is partly obligatory, partly compulsory, with this restriction, however, that every student must attend twenty lectures a week, given before 12 o'clock, including the obligatory courses. These last are those of the purely military sciences, and for the first class those of mathematics. As it is impossible for most of the pupils to give sufficient attention to all the courses to be examined in them at the end of each three months, they are allowed to select those of the courses which they may choose to follow. But this choice once made must be adhered to.

The instruction is divided into theoretical courses and practical exercises.

The theoretical courses comprehend all the subjects which come within the object of the Institution. They are the following:—

1. Mathematics, a course of three years, six lectures a week, half employed in statement of the theory, half in the practical application.
2. The Higher Geodesy, in the third class, three lectures a week.
3. Physical Geography, in the first class, two lectures a week.
4. General Geography, in the first class, four lectures a week.
5. Special Geography, particularly that of the probable theaters of War for Prussia, in the second class, four lectures a week.
6. Universal History, in the first and second class, four lectures a week in each.
7. General History of Literature, in the third class, four lectures a week.
8. Logic, in the second class, four lectures a week.
9. Physical Science, in the second class, four lectures a week.
10. Chemistry, in the third class, four lectures a week.
11. Physiology of the Horse, in the second class, two lectures a week.
12. Tactics, in the first and second classes, four lectures a week in each.
13. Artillery, in the first class, three lectures a week.
14. Fortification, a course of three years in the three classes. In the first class, Field Fortification; in the second, Permanent Fortification; in the third, the Conduct of Sieges; two lectures a week in each class.
15. Military Administration, in the first class, two lectures a week.
16. Military History, in the third class, seven lectures a week.
17. Duties of the Staff, in the third class, three lectures a week.
18. Military Law, in the third class, one lecture a week.

All these lectures are given in the morning, between eight and one o'clock.

19. The French Language, a course of three years in different classes; into each of which the pupils enter according to the knowledge they possess of the language; six lectures a week for each class.
20. The Russian Language, four lectures a week.

The above two courses are in the afternoon.

The practical work is done after the end of the courses of the second and third classes. They consist in making the officers draw plans for military objects, make sketches of ground.

These exercises are completed by a journey of fifteen days under the conduct of an officer of the staff, in order to teach the service of an officer of the staff in the country.

The instruments of teaching consist of—

1. A library for the use of professors and students, and a collection of maps and plans, all under the charge of a librarian living within the school.

2. A collection of models for the courses of artillery and fortification, under the care of a commissary of the school.

3. A cabinet of physical science, under the direction of a professor lodged in the house.

4. A laboratory and chemical apparatus, under the direction of a professor of chemistry.

There are no manuals specially used for the instruction.

For the courses of geography and of the history of war, the direction furnishes the pupils with the plans and maps required, as far as the means of the Institution allow it, or it procures them at moderate prices, to be repaid by instalments.

PROFESSORS AND STUDENTS.

The officers acting as professors in the school are officers of mature age, and high education, chosen from the garrison of Berlin. The teacher of the duties of the staff, must always belong to this corps. They are appointed to their work in the school for an indefinite time, without prejudice to their other duties.

The civil professors are generally chosen from those of the Royal University at Berlin.

With regard to discipline, all the professors are subject to the board of military direction; with regard to teaching, to the board of direction of studies.

Every professor is bound upon entering on his functions to lay before the board of direction of studies a programme stating the bearing, the successive subjects, and the arrangement of his course. This programme must be approved by the direction.

The payment of professors is fixed according to the number of their weekly lectures. It is less for the professors of Language, as they require less time to prepare their lectures.

The students of the school are under the immediate authority of the military direction; but they are ordered to look upon the professors, whilst engaged in their duties, as their superiors, so that offences against them are subject to military law.

Permission to follow the courses of the school involves for every officer the obligation to serve two years in the army for every year passed in the school.

Although the complete course is for three years, officers do not always continue it for more than one year. At the end of the year those only are allowed to return who have shown themselves deserving of this favor. Students lose the right of continuing their studies who neglect their lectures, or show indifference and a want of interest in their work, who come often too late, avoid the duties imposed upon them, or endeavor to escape their examinations.

Any ill conduct, or even want of capacity to continue a sedentary life, or any inaptitude for the branches of the service distinct from their own, shown in the part they take in them during the summer, are also disqualifications.

At the end of every annual course the boards of military direction and of studies meet together, to fix, in accordance with the preceding paragraph, the list of officers who have gained the right of returning to the school.

At the beginning of the courses the students must give notice as to which of the voluntary courses they mean to attend. After this notice, such courses are regarded as obligatory, and no dispensation from them can be obtained.

At the end of the course of each year, the officers are allowed to ascertain the judgment given upon their work in the three-monthly examination by the professors.

Other points relative to the students are the subject of special regulations.

An employé of the house, called the commissary, is charged with the surveillance of the buildings of the school and the furniture belonging to it. He has to look after its security, order, and cleanliness. He must take an inventory of all things belonging to the house.

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CONTENTS.

I. SAMUEL APPLETON.*

Samuel Appleton, whose success in the acquisition of a princely fortune was equaled by the beneficence with which he was ever applying it to useful and charitable ends, and whose whole career is eminently instructive to young men, was born in New Ipswich, N. H., June 22d, 1766, and died in Boston, July 12th, 1853, aged 87 years. Samuel was also the name of his two ancestors, who emigrated to America from Little Waldingfield, Suffolk county, England, of whom the father took the freeman's oath at Ipswich, Mass., May 25th, 1636, and the son, by his bravery and skill in King Philip's war, won the commission of Major.. Isaac Appleton, a grandson of the latter, was one of a company who began the settlement of New Ipswich, N. H. His son Isaac, born at Ipswich, Mass., in 1731, a few years before the removal of the family, was the father of the subject of this notice. He was a man of integrity and piety, highly respected, and honoring his office of deacon of the church.

In a family of twelve brothers and sisters, Samuel was the third. His chief early advantage was his training in the home of excellent and judicious parents. The auxiliary influences which contributed to develop the moral and intellectual qualities that distinguised him, were such as are incident to life in a newly settled frontier town. The essential equality of all, their mutual dependence, the common participation in privations and hardships, prelude the isolation and selfishness which the habits and the ambitious aims of large or old towns so greatly foster; and cause to be associated with successful enterprise those virtues which inspire confidence and affection.

All his opportunities for instruction, except that which he received at home, were limited to a few broken weeks each year at the district school, and this only from the age of ten to sixteen years. At the age of seventeen he was employed as a teacher; and gave so much satisfaction, that his services in this capacity were in great request in succeeding winters in his own or in neighboring towns. To the

* The materials of this sketch are principally drawn from a memoir by E. Peabody, D. D., in Hunt's "*Merchant's Magazine*," Vol. xxx., a memoir by Samuel K. Lothrop, D. D., in the "*Proceedings of the Massachusetts Historical Society*, 1855–58," and a sermon at the dedication of Appleton Chapel, by Prof. F. D. Huntington, D. D.

day of his death, he took the greatest delight in recalling the scenes, the friendship, and the labors of these seasons of school-keeping, when he often had scholars older than himself; and was sometimes obliged to be a hard student at home, that he might keep in advance of his pupils; and when his sovereignty over the young republicans about him required the exercise of prudence and self-control as well as vigor.

At the age of twenty-two years he joined a party of young men in beginning the settlement of a township in Maine; the conditions being that they should have each alternate lot, on which they should build a house and clear up a certain number of acres. "I took for myself," says Mr. Appleton, in one of his letters, "a lot of land more than two miles from any other settlement, and for some time carried my provisions on my back, going through the woods by marked trees to my log house." This experience of pioneer life served to develop yet further his energy and self-reliance, and was also the source of much amusement in after years. He also remembered the companions of his toils, of which even their children sometimes received the tokens. Nearly sixty years afterwards he presented a bell for a meeting-house erected in this town, then known as "Hope," now called "Appleton;" "rejoicing," as he says, "that the gospel is preached within three miles of the place where I spent three long summer seasons, during which I never heard the sound of a church-going bell, or even heard a sermon, or the voice of prayer, there being at that time no place of worship within twenty miles of my humble dwelling."

In boyhood Mr. Appleton had felt a preference for mercantile life, and now having an opportunity to gratify this inclination, he left Maine, and entered into trade, first with Col. Jewett, at Ashburnham, and subsequently with Charles Barrett, Esq., at New Ipswich. His enterprise soon demanding a wider sphere, he removed, in 1794, to Boston, where immediate and continuous prosperity was the reward of his sagacity, energy, and integrity. In 1799, having formed a partnership with his brother Nathan, he made his first voyage to Europe; and for the next twenty years much of his time was passed abroad in selecting importations and transacting the foreign business of the firm. At a later period he was largely interested in the cotton manufacture, in which, with a wise foresight of the future industrial wants of the country, he had been among the earliest to engage.

In 1819 Mr. Appleton married Mrs. Mary Gore, a lady whose just appreciation of all that was noble and excellent in his character, whose ready sympathy in whatever interested him, and in all things good and pure; whose gentle virtues, refined tastes, and elevating influence, made his home a scene of serene and domestic happiness, as delightful and attractive to others as it was blessed to its inmates. In this home he grew beautifully old. Gradually relinquishing all active participation in the active pursuits of business, and making it his great work to apply his ample income to further useful undertakings, and increase the sum of human happiness, and entering with warm sympathy into the pleasures of those whom he drew around him, no growing infirmities had power to cast a gloom over his declining years. Even when confined to his room, that room was the most cheerful in the house, and the center of attraction to kindred, to all who loved him best, and to the young children of his old friends.

The general estimate of Mr. Appleton by those who knew him best, finds only an adequate expression in the following eloquent tribute by Dr. Huntington:—

He belonged to that worthy class of New England men who are born in frugal homes, gain their balanced power of character by a modest conquest of many hardships, and pass out into large usefulness through a course of discipline and achievement as favorable to the attributes of a genuine manhood as almost any in the world. Forbidden a personal share in the culture of the higher seats of learning, they become the patrons of letters, the founders of institutions, and chairs of instruction, and command the esteem and confidence of scholars. Bred to habits of acquisition and calculation, they rise superior to the meager prospects of a mere mercenary ambition, not only dignifying commerce by their public spirit, but forwarding science itself by their practical sagacity and energy. For that part of education which consists in the study of books, Mr. Appleton was limited through his early years to the district school and such private hours as made the margin of a busy and laborious employment. But by assimilating and using what he learned, by an intelligent intercourse with men, by travels abroad, by a self-knowledge and sterling sense ever prohibiting in him the assumption which is the fatal mark of ignorance, and by that conscientious discipline of his faculties which is the nobler part of wisdom, he entered in unchallenged among our foremost order of men. The fullest and highest heads found a manliness in him that made him their peer. In the stainless justice and frankness that ruled his dealings, "he knew but one way of speaking, and that was to say, straight on, the truth." In a suit at law, a jury once found in his favor, even against some apparent odds of evidence, on nothing but the plain declaration of his word,—with this almost unexampled explanation of their verdict, that "they were quite sure Mr. Appleton would not dispute the payment of the note, except on the certainty that he did not owe it." Eager gainseekers, bewildered by financial success, or enslaved by a lucrative opportunity, saw in him the fine example of a self-control which subdued the passion for wealth just when it most apt to grow despotic, voluntarily withdrew from all the tempting prizes of fortune before he was sixty years old, and devoted the rest of his life to doing good. There was, indeed, as all who knew him will confess, and as it is more than proper here to remember, a singular sweetness and simplicity in the old age of this venerable, benevolent, unpretending citizen and Christian,—master of his possessions and of himself. There were sufferings and infirmities of the body, but he could better bear all these, than the pain of turning back the humblest deserving applicant from his door, or closing his bountiful hand on a dollar that was needed by Christ's poor. Such cheerfulness did this charity breathe through his household, that it would seem as if all the new gladness and the hearty benedictions of the wretchedness he brightened, came back and pitched their permanent tents about him. Simple as a child, the generous steward of God's bounty sat there amidst his affluence, listening, pitying, giving, till sordid riches were transfigured before him, till the pursuits that we commonly call worldly looked divine, the curse that clings to Dives' lot was loosened, and even money wore the stamp of Jesus of Nazareth.

In only a few instances did Mr. Appleton, during his life, give absolutely large sums to single objects. For the endowment of the academy of his native town he contributed $25,000. He also gave $10,000 to found a professorship of natural philosophy at Dartmouth College. He gave also liberally to other educational institutions, but not in such sums as to cause single acts of munificence to be proclaimed from one end of the country to the other. It was because he counted those unsatisfactory days, in which he had not done something to promote some one's welfare, or to relieve some one's distress, that the amount of his benefactions swelled to a million of dollars.

Mr. Appleton distributed by will over a million of dollars. Of this sum, his widow received about one-fifth; the children and grandchildren of his brothers and sisters, about three-fifths; and the sum of two hundred thousand dollars was left to his executors, Hon. Nathan Appleton, William Appleton, and Nathaniel A. Bowditch, "to be by them applied, disposed of, and distributed for scientific, literary, religious, and charitable purposes." The executors transferred ten thousand dollars to the Massachusetts Historical Society, "to constitute a fund, the income of which shall be applied to the procuring, preservation, preparation, and publication of historical papers." Fifty thousand dollars was transferred to the Corporation of Harvard College, for the purpose of erecting "a building of granite, freestone, or marble, as a chapel for religious services; twenty thousand dollars to Amherst College for the erection of a "Cabinet of Natural History;" ten thousand dollars to the Boston Atheneum; ten thousand dollars to the Boston School of Design; and ten thousand dollars to the Massachusetts Hospital.

II. MORAL EDUCATION: DUTY TO PARENTS.

No station, no dignity, can release the obligation to obedience and filial respect; and indeed those of higher position should in this be models to their inferiors.

Filial obedience extends even to heaven, whose law-regulated movements it resembles.

It includes the whole earth, of whose fruitfulness it is an image.

As man is the noblest among all creatures, so is it of all actions the most beautiful to honor and respect one's parents.

He who truly honors his parents, must honor them within his house, must supply their needs with pleasure, and must most strictly perform all his funeral duties to them.

A prince has attained to the perfection of virtue, when by his example he has established throughout all his kingdom childish love and obedience. *Chinese Book*, "*Hiacking.*"

Parents nourish and instruct their children, until they have trained them to be men.

The usefulness of a father and a mother is truly infinite, like the highest heaven. *Chinese Proverb.*

A son should rise early and wash himself, that he may appear before his father with the proper degree of cleanliness. He should go modestly into his father's room, should inquire after his health, should hand him water, and render him every service of attention and tenderness.

Chinese Book, "*Siao Hio.*"

If your father and mother love you, rejoice thereat, oh children, and forget it not.

If they are angry, beware of being vexed at it.

If a younger person meets one twenty years older, he should treat him as respectfully as if he were his father; if ten years older, like his elder brother. TSENY, *a Pupil of* CONFUCIUS.

Honor thy father and thy mother, that thy days may be long upon the land which the Lord thy God giveth thee. BIBLE. *Exodus* xx; 12.

The Lord hath given the father honor over the children, and hath confirmed the authority of the mother over the sons.

He that feareth the Lord will honor his father, and will do service unto his parents, as to his master.

Honor thy father and mother, both in word and deed, that a blessing may come upon thee from them.

For the blessing of the father establisheth the homes of children; but the curse of the mother rooteth out foundations.

Glory not in the dishonor of thy father; for thy father's dishonor is no glory unto thee.

For the glory of a man is from the honor of his father; and a mother in dishonor is a reproach to the children.

My son, help thy father in his age, and grieve him not as long as he liveth.

And if his understanding fail, have patience with him; and despise him not when thou art in thy full strength.
For the relieving of thy father shall not be forgotten.
Honor thy father with thy whole heart, and forget not the sorrows of thy mother.
Remember that thou wast begotten of them, and how canst thou recompense them the things that they have done for thee?
He that forsaketh his father is as a blasphemer; and he that angereth his mother is cursed of God.
Whoso honoreth his father, shall have joy of his own children.

Bible. *Ecclesiasticus*, iii.

He who curseth his father or his mother, shall surely be put to death.

Bible. *Exodus*, xxi; 17.

Hearken unto thy father that begat thee, and despise not thy mother when she is old.
The eye that mocketh at his father, and despiseth to obey his mother, the ravens of the valley shall pick it out, and the young eagles shall eat it.
My son, keep thy father's commandment, and forsake not the law of thy mother.
The father of the righteous shall greatly rejoice, and he that begetteth a wise child shall have joy of him.
Whoso robbeth his father or his mother, and saith, *It is* no transgression; the same *is* the companion of a destroyer.
Woe unto him who saith to his father, Why hast thou begotten me?

Bible. *Proverbs and Ecclesiasticus.*

My son, when I am dead, bury me; and despise not thy mother, but honor her all the days of thy life, and do that which shall please her, and grieve her not.
Remember, my son, that she saw many dangers for thee *when thou wast* in her womb; and when she is dead, bury her by me in one grave.

Apocrypha. *Tobit*, iv; 3, 4.

And he [Jesus] went down with them, and came to Nazareth, and was subject unto them.
——When Jesus therefore saw his mother, and the disciple standing by whom he loved, he saith unto his mother, Woman, behold thy son!
Then saith he to the disciple, Behold thy mother! And from that hour that disciple took her unto his own home.

Bible. *Luke and John.*

Children, obey your parents in the Lord: for this is right.
Honor thy father and thy mother, which is the first commandment with promise.

Bible. *Eph.* vi; 1, 2.

We should neither say nor do evil to our parents, but should rather obey them, whether they be lowly or eminent; and this under whatever circumstances of soul, body, and estate.
This is, for pious persons, right and reasonable.
Contempt for parents is a sin punished by the gods both in life and after death, hated by men, and punished in the abode of the godless.
For the faces of our parents are divine and glorious; and to cling to them and to serve them is more than the sun and all the stars which the heaven contains; and than all else that may seem glorious.
We should honor our parents as long as they live, and even when they are no longer alive.
We should never contradict them.
In case, however, they should err, from sickness or deceit, we should encourage and instruct them, but never treat them in an angry manner.

There is no greater sin and injustice among men than to be ungodly towards father and mother. PERICTIONE, *the Pythagorean.*

Say nothing evil of the dead; show the path to those who are in the wrong road; go not with evil companions; revere God; honor your parents. Let him who strikes his parent, be infamous. SOLON.

Children can have no more honorable adornment than aged parents; no more noble pleasure, than in honored ancestors.

Parents and grandparents are holy things of far greater value than lifeless statues of gods.

By honoring them, we do what is most pleasing to God.

And on the other hand, nothing can be worse for children than a father's or a mother's curse.

For the gods hear the prayers of parents.

Therefore children should never speak of their parents except with the highest respect; for Nemesis severely punishes even neglect and lightly spoken words. PLATO.

It is the duty of children and pupils to be grateful to their parents, their teachers, and the places where they were taught.

This gratitude is not only one of the greatest virtues, but is the mother of all the other virtues.

What is piety, except thankful obedience to parents?

Who are good citizens in war and peace? Those who are grateful for the benefits which they receive from their fatherland.

Who are the pious, and those who respect religion, except those who show their gratitude towards the immortal gods?

What pleasure is there in life, without friendship? And how can friendship exist among the ungrateful?

Where is there any one who has received a noble education, who does not retain a thankful recollection of his teachers and guides, and even of the silent locality where he was taught? CICERO.

Pupils should respect and revere their teachers, as their intellectual parents, the more, in proportion as they are conscientious in doing their duty.

Not only does the nature of the relation demand this pious feeling, but it promotes the objects of education; for pupils place more confidence in the words of teachers who command their reverence, obey them more implicitly, take more pleasure in listening to their instructions, and make greater exertions to gain their approbation. QUINTILIAN.

There are no greater benefits than those which parents bestow on their children.

A sacred respect should secure them from ingratitude on the part of their children.

No words can express the merit of being able to say, "I have gladly and faithfully obeyed the commands of my parents, whether reasonable or unreasonable." But this well-doing should not be restricted to the period of childhood, lest the efforts of parental love should be as vain as seed on which no attention is paid after it is sown.

The value of the services of parents and teachers can not be repaid in money.

A teacher who has taught us all he could, and has awakened our slumbering faculties, we must needs value as highly as a beneficent physician or as near and dear relatives. SENECA.

Children should love their parents, as the authors of their existence. They owe them, as to the gods and to the old, the more reverence, because no reverence can be enough to repay the benefits received from them.

And in like manner, it is a chief duty, and as it were the repayment of a borrowed capital, to care for and maintain parents in their old age. This is more desirable even than to be careful for our own support; and is one of the most affecting testimonies of the love of children for their parents. ARISTOTLE.

Children should know that it is their duty to honor their parents, to ask advice of them, and to observe their wishes.

What in the world can be more pious, than to honor one's parents and show gratitude to them; since even the natural reason commends this virtue as the highest, next after the service of God.

Aristotle testifies, That to the gods, to parents, and to teachers, no complete repayment can be made.

We are bound to honor our parents; but not in such a way that God will be blasphemed and dishonored.

Young persons should carefully guard against disobedience and disrespect to their parents, in the manner unfortunately at present too common, by being so foolish as blindly to contract dishonorable marriages, which bring shame on themselves, their parents and ancestors. LUTHER.

Those who are not grateful and obedient to their parents and teachers, do not possess inward peace of mind. SENECA.

A pious son is virtuous, and obedient to his father; does what pleases his parent, and saves him trouble by studying with all his might and not acting in a godless manner. He dresses himself respectably and not so as to make his parents ashamed; he does not try to flourish about and swagger like a baron. He pays willing attention to his teachers and is not given to vanities; and gladly receives good advice from any body. He comes home in good humor; honors his parents, and thinks well of them; takes care of them in their old age, and conceals all their faults; shows them, at every opportunity that, like the stork, he is grateful; and supports them as long as the Lord gives him bread. Such a one, God loves; daily forgives his sins; gives him a comfortable support; and willingly hears him in his need; and at his own time gives him flocks and herds and an intelligent wife; with whom he sees his children's children, all obedient to him. He lives undisturbed, is respected and honored; and at last falls asleep in peace, and without sorrow or pain, leaving to his children honor and riches. Thus is it with him who does God's will.

RINGWALD. (*Poem.*)

Those who are at the beginning of their days, in youth, must look forward, along the paths which their parents have traveled; and if they did right—must follow their footsteps.

But we parents, who are in the evening and going down of our days, must look back towards sunrise, towards our children, and must call out to them, "Here, not there! This way!" so that they may follow us correctly, and not run into any wrong paths.

You are Christian children; live therefore in Christian actions.

But scrutinize always your daily life, to see if and in what you have acted contrary to the law of God. So to do is the beginning of conversion. MOSCHEROSCH.

Love to God is developed and practiced in love to parents.

Love of parents is the first religion of the child.

Filial respect is the strong guardian angel of childlike innocence; the iron staff by which even the fallen may raise themselves up. ZSCHOKKE.

III. INTUITIONAL AND SPEAKING EXERCISES.

[Translated from Diesterweg's "*Teachers' Guide*" for the American Journal of Education.]

"UNFOLDED is the world only to the observing mind; the only avenues to the mind are the senses." L. FEUERBACH.

BASEDOW and VON ROCHOW, in the last third of the last century, contemplated the deplorable condition of the German people in regard to their intellectual development, and were led to ascribe one of its causes to the low state of the public schools. These philanthropic men earnestly endeavored to devise some method for ameliorating a condition so fraught, on every hand, with lamentable consequences. Rochow asked himself the questions, "Why are the common people so frequently imposed upon by quacks, pettifoggers, and other designing men into whose hands they fall? Why is it that they injure themselves by false measures, that they are so indifferent to the best advice, and seem unable to comprehend the disinterested counsel of their superiors? Why do they give credence to supernatural influences, ghosts, hobgoblins, and superstition in general?" These questions, which have certainly occupied the attention of every philanthropist, only in an altered color or form, according to the age in which he lived, can not be solved on the principle of self-love—that impulse of self-preservation in the prevalent disposition of the human heart toward bettering its own condition. Rochow believed that they might be explained through stupidity and the absence of judgment among the people, or, in other words, through the deficiency of all true illumination and development of the understanding. If he would therefore improve the social and intellectual condition of the people, he must bring some remedy to bear on this cancerous evil. The same sagacity which enabled him to probe and measure it, provided the means for its medication. This was nothing less than bringing the vivifying influence of truth, to bear directly upon the intellectual faculties of every mind, by the general diffusion of knowledge among the masses. No one who understands the condition of the German people at the close of the seven year's war, can mistake the beneficence of this effort and its peculiar adaptation to that age. In contrast with the former superstition and prejudice, mental illumination*—this attractive and intrinsic idea—became the watchword of the patriots of that time, and the standard under which all, who sympathized with the movement, enrolled themselves. Basedow† in his active inspiring nature, became the principal leader of all those who desired to exterminate the very root of the old evil, by bringing the rising generation under the influence of mental culture. Large sums of money flowed in from all sides, proving that his effort coincided with the tendency of his noble cotemporaries. To enlighten mankind in the proper and original meaning of the term—to lead them to a clear insight into their condition and to the comprehension of their destiny—to make them thinking, sensible beings, has ever been, and will ever be, one of the noblest aspirations of the soul. The possible or really false or one-sided tendencies which such an effort can attain, are not to be considered. We view it in its natural light and its peculiar adaptation to the necessities of the age; and we must rejoice in the salutary and blessed results, which we can better appreciate, when we compare the present state of the German people with their condition fifty or seventy years ago; and comprehend the improved condition of our public schools, through these insights and efforts.

The methodical culture of the understanding from the elementary school upwards was the object toward which these men directed their efforts. This they sought to accomplish by mental exercises, which at a later date were sometimes called *pure* or *direct exercises* to denote that their special aim was the unfolding of the thinking faculties, regardless of the possible profit in material knowledge; the latter being considered, at least, a secondary, if not quite an indifferent matter. The opposite of these so called *pure exercises* are those termed *practical; i. e.*, such as are performed on certain positive material of instruction, as number, form, language, &c. In that early period of educational excitement, the people did not believe that the intellect could be sufficiently exercised upon the ordinary topics in the public schools, or, if indeed possible, that it would be of any available benefit. The method of instruction was yet immature, and the

* True enlightening is enlightening by truth.—*Eberhard von Rochow.*

† He had, as is yet to be seen in his valuable historical elementary work, (3 vols., Dessau, 1774,) the maxim: "He who can not perceive, can not comprehend." Therefore he sought to teach his pupils first seeing, and *not first believing*. Partially in consequence of this there were charges made against him, *hinc illae lacrymae*. The following paragraph occurs in the same work, Part I., page 56: "Care must be taken that the pupil improves the opportunity for observation in the following manner: in company with his teacher he must spend fourteen days in a camp, fourteen days in a mine, fourteen days in a seaport where lie men-of-war, fourteen days in the counting-room of a merchant, fourteen days as an auditor in the classes of a city school, as well as with a clergyman of a large orphan asylum, and in winter four weeks in the court."

subjects presented were so buried in the dead forms of mechanism and common routine, that the people could not be convinced that every subject, even instruction in technical practices, could be treated in a manner improving to the intellect. That we, even now, have reached this stage of progress we are chiefly indebted to Pestalozzi, that philanthropic soul, to whose memory posterity will pay the tribute of an immortal fame. To its more perfect realization, however, the philanthropists, and the philanthropic, or as I would term them the philanthropinist, schools,* have ever been foremost to impart a vigorous impulse. The evident necessity of a reformation in the public schools, met with recognition and sympathy from all classes; the new plans of instruction received the hearty recommendation of the government, which, seized by the new impulse of the age, began now to make the cultivation of the people the object of its solicitude, and to employ only the most competent teachers. In this manner exercises in thinking and speaking were introduced into the schools; and from this date, especially in north Germany, they appeared on a plan of lessons, as an established subject of instruction. We may find the same state of affairs, in part, at present, after the expiration of three-fourths of a century; during which time the European people, as well as the public schools, have made such gigantic strides as must inevitably tend to revolutionize the entire theory of education throughout the world. At present the pure thinking exercises are used in many schools, on account of their formal advantage; others have never adopted them; while by some they have been entirely abandoned. The latter can be accounted for, from the fact that the old forms, in the meantime, were supplanted by new and improved methods.

The cultivation of the intellect alone, which, however, is only partial culture, and dead mechanism of method in the remaining material instruction, could not long remain side by side. As man generally, according to the necessity of his nature, extends gradually the culture and insight which he has gained in one direction upon every field of his activity, so every subject of school instruction was sought to be elaborated and refined for the quickening of every faculty and the enriching of the understanding. A light was thus enkindled whose reflected radiance influenced every part, from the antithesis of pure formal culture on the one side, to the material dressing, or actual knowledge on the other; and resulted in the reciprocal penetration and unity of both; that is, in the conviction that the isolated culture of the intellect was in itself deficient; nay, that it was abso-

* For the aims and methods of this school of educators see "*American Journal of Education*," *Vol. V. p.* 489, &c.

lutely injurious, or might become so; and that as, in the rational experience of mature life, man does not circumscribe or limit his observation to any one direction, so in the school also, the intellect is to preserve its equipoise by exercise on the common objects of instruction in all their relations, connections, and dependencies. But this important idea could not be carried into execution, until further progress had been made in the systematic arrangement of the subjects of instruction. At present we undeniably stand on this higher point of view, both in theory and in practice, as is evident from the condition of the better public schools: a condition worthy of our praise and acknowledgment. We have already said, that the tendency of the intellectual culture, together with the lifeless mechanical procedure in the remaining material instruction, was one-sided, and that this tendency might become injurious; and in the subsequent use of this system, which was tested by the ablest teachers in this department, it was seen that the exercises in thinking, which neglected the material worth, or practical understanding of the facts, could lead to a hollow formalism, and drive the pupil into vague and indeterminate incongruities, could create a mania for criticism, and has contributed largely to the unequal development of the faculties. Thus this endeavor, so laudable in itself, soon degenerated into an empty play with forms and ideas; and afterwards, when intellect was exalted to the throne as supreme arbiter of thought and action, led to the rejection of all that could not be comprehended or proved; and consequently, sometimes to the denial of all that is deepest and noblest in the sphere of feeling and religious life. For this reason, the conflict with this partial or unequal development was a most praiseworthy effort. We dare not, however, go so far as to reject the originally good, nay, necessary influence, which inspired the noblest hearts, and bore most glorious fruits; not to throw away the child with the bath water, as the Germans say. We are not to be induced to judge unjustly of that period, to which we are indebted for a movement, small indeed in its beginning, but the goings forth of which will touch infinity.

But the isolated exercises *in thinking** are no longer needed, since

* That which I greatly missed in my elementary juvenile culture, at least so far as my active observation reaches, was an adequate unfolding of the natural power of intuition, the proper exercising of the senses, the habit of observation, in order to place the world, which surrounds the scholar and his faculty of thinking and judging, in a reciprocal relation. I observe that the scholar brings from our preparatory schools to the higher departments of education a certain amount of ready attainments, taken up by the memory, and perhaps too with some talent of discrimination and application. But these acquirements do not extend beyond a certain sphere. They are limited to the field of abstract exercises in thinking, by means of which it is hoped to attain a developed self-consciousness, as desired by Pestalozzi, and, I add, as desired by nature and reason. They are an artificial product, something studied and

improvements have been made in every department of instruction, through the Pestalozzian school and those who have coöperated with it; and the improved method demands that every object shall be examined in all its bearings, or all-sided, as the Pestalozzian school are pleased to express it, in order that justice may be done to every subject and its happiest influence on the culture of youth be secured. This is our fundamental view of the present condition of this method of instruction. If the same is not introduced into all the schools of the German nation, so far as its theoretical establishment and practical carrying through in courses of instruction is allowed and required, the reason lies not in the thing itself, but in some transient, local, or personal hindrance, which will gradually disappear to make room for that which is acknowledged to be better. By this is not only granted, but made evident, that it would be unwise to at once unceremoniously banish from all schools the pure exercises in thinking, as an established system of instruction; but to advocate, on the contrary, their universal introduction, would be a marked retrogression. It has been proven in many teachers' seminaries and schools, where all subjects of instruction are treated in a thorough and comprehensive manner, and their influence on the culture of youth fully tested, as well in a material as a formal, or technical respect, that these exercises are superfluous and are rendered objectionable on account of the time they consume. From this principle we reject all tendency to the preferred cultivation of a single faculty or talent in man; and we may add, that such faculty is not sufficiently viewed in the light of its unity in the mind, but rather in its abstract or imagined dismemberment, not agreeable to truth, but as if the mind consisted of an aggre-

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useless; and instead of stimulating the mental economy to the digestion of all that is new and attractive, they press upon the soul like lead upon the stomach. I will illustrate by an example. The scholar has learned in the school to add to the idea horse every predicate possible; he knows that the horse moves, runs, trots, jumps, prances, &c. If I should now place a horse before him, would he have such a lively intuition of these actions that, when I question him, he could give me their distinguishing properties? Not at all. Perhaps he could scarcely give me a correct description of the outer figure of the horse, his color, &c. He can not characterize pace, trot, gallop, or other modifications of his motion; in short, a breach exists between his idea and the object. He is not exercised on the lively appearance of the animal, but solely on the unperceived abstraction, and however much he may have retained in this way from those thinking exercises, it is in reality of no use to him. A single walk with his teacher would have procured for him proportionably more solid and profitable knowledge than a score of such lessons.

How now! must we take walks with the children instead of *teaching school?* Occasionally, perhaps, for a change, but neither always nor for an express pedagogical purpose; which, at all events, would be a pedantry, an affectation, which posts placards to education by which people are informed what can be had in the show for good money—a merely external, affected training; which nevertheless is impressed for a lifetime, and engenders blind servility that can never be removed.

All culture that fails to improve nature in a natural manner, is injurious.—Director Weber, in "*Mager's Review,*" 1843, July No., p. 13.

gate of single talents or faculties. On account of this principle therefore, we declare ourselves against the one-sided, isolated management of the exercises of the intellect, as well as those for memorizing.* It

* 1. To exercise memory as a separate faculty is to use the intellectual powers as machines, and to use the contents of the soul as mechanical material. In this way man comes to dead knowledge, whereby his nature dries up.—*R. Niederer.*

2. The motives which Schweitzer advocates for separate exercises in memory and direct exercises in intellect, in his "*Method for Teachers of Elementary Schools*," the former of which he denies in the second edition, prove only that the memory and understanding in general, must be disciplined; but they do not prove what they were intended to prove, that for this separate lessons are requisite, and that they must be raised to standing subjects of instruction. "He who can remember nothing has but feebly apprehended. It is shallow receptivity, without intellectual self-activity. In the precise measure in which man has contemplative attentiveness, *i. e.*, self-acting, self-appropriating, or making his own, will his memory and thinking faculties grow." (Fichte in his philosophical work: "*On antithesis, turning point, and aim of Modern Philosophy*") This is just our view. Direct exercises in memory are not needed, they are injurious; a conviction acknowledged by many others. Separate exercises in intellect, separate exercises in memory—why not also exercises in wit, in imagination, in feeling—every thing separate, and pure abstract spirit. "He who intends to make hare ragout, must first find a hare."—*Mager.*

Under *direct* exercises of memory, in order to please certain critics, I place the learning by heart such pieces, songs, poems, &c., which do not belong to the regular order of recitations; not those, which pertain to the continuous course of instruction, as scriptural history, and that of the German nation, &c.; but those, which from time to time are assigned to the pupil by the teacher for the supposed purpose of strengthening the memory. This is a manifold mistake. The materials themselves on which the lesson is founded are to be remembered—there are plenty of them. But this learning by heart is not explained, and as it is not continually rehearsed will be forgotten. Every thing a scholar learns and forgets, affects injuriously.

It might be proper here, as the opportunity may not again occur, to say a word about this *learning by heart:* a practice. even now, by no means uncommon.

On Saturday a task is assigned the children of a song, catechism, &c.; on Monday they repeat the words. Are both right? 1. The former is not, if the pupil does not thoroughly understand the nature of the lesson. What is to be learned must be well understood Therefore during the hours of study, the teacher should accurately examine the lesson with the children, and explain and illustrate all that is indistinct. The learning by heart is done likewise, indeed principally. on account of the contents of the subject.

2. The latter, evidently not, because the repeating of what is learned by heart, as usually practiced, is good for nothing. It injures the mind, and the language of children renders the whole affair disagreeable, and is a crying sin against their nature. The scholars ought not to repeat the words they have committed to memory, because the ideas are strange, the word sounds of which are only apprehended. What they have acquired they should deliver, not in a declamatory manner and with gesticulation, but euphonically and logically correct, and with full accent, so that it may be clearly perceived that they have fully apprehended the subject. This is impossible, unless the children perfectly understand what they have learned. Only then can we require them to intrust it to memory's keeping. Where the teacher leaves the matter entirely to the pupil, a disagreeable and disgraceful recitation follows; and is such because the requirement has not been complied with, as Philo says, a *dies irae.* It is but half learned and imperfectly comprehended. Can the teacher account for this?

Therefore there should first be understanding; second, careful reading; third, learning; fourth, delivery; the latter singly and in concert. If it be read correctly, singly, and in concert, it will be delivered in concert as if by one voice. This in some studies and by judicious management on the part of the teacher, may be made an agreeable, and not unfrequently a very impressive exercise. The fifth part, in accordance with the above arrangement, is repeating so that nothing may be forgotten. The memory is not less exercised, and experiences no more loss in the absence of separate exercises for memorizing in the modern schools, than the understanding does where the pure intellectual exercises have disappeared.

We add a few sentences on this subject from and according to "*Mager's Review*," 1842, August number:—

Learning has two sides; apprehension—understanding and comprehending—and rememis an admitted fact, that it needs them both no more tnan it needs a separate culture of the feeling, the volition, the wit, the sagacity, &c.

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bering. Apprehension in itself is not sufficient, the things themselves must be perceived. There are two ways of remembering: 1. Judicious memorizing, when the object is perceived without retaining the precise words; second, verbal memorizing. Of the latter there are also two kinds: 1. Without intuition, dead, perverted, unintelligent, of the middle ages, a real learning outwardly, *or by heart*. 2. A verbal, yet, at the same time, an inward learning, a learning *par-cœur*.* The former is to be absolutely rejected, the latter to be zealously adhered to and practiced. The former is to be rejected even if the substance is afterwards explained. The learning by heart of the middle ages, the offensiveness of which caused even a hatred for the catechism, can not even be called a mechanical learning, because it lacked the indispensable element which exists in every mechanism. It ought to be called, *sit venia verbo*, the brutish learning. as it is nothing more than an artificial training. A being designed to reason will by this be degraded to a brute. Its unnaturalness is discovered in the aversion with which children regard it. The adoption of such a course outside of the school-room, would never be thought of. It is an acquirement which can be exhibited but not used; it separates the idea from the word; the idea must always be first, the word which is the sign dare only be given and remembered in connection with the idea. This lively true memorizing, is the changing of a mere possession into legitimate property. The memory then has only to retain what was previously comprehended, which causes no vexations.

Every thing that can be used as an impetus in the following instruction must be practiced till it works like a machine. The moment an idea is apprehended, it must be properly considered. He who every moment would think of every thing at once, will never be able to reason. What at first seems difficult must by practice become a habit, a mechanism. The mechanism which is not preceded by knowledge, is false; the true has thought as a stimulant within itself.

Still one more example of wrong doing: A boy of 8 years was by his teacher assigned the task of learning by heart three stanzas of the hymn, "How great the goodness of the Lord." The boy studied on the first stanza one half hour in vain. I heard him, in the adjacent room, repeat the word ten times in a drawling manner without vigor or accent, "H-o-w-g-r-e-a t t-h-e-g-o-o-d-n-e-s-s-o-f-t-h-e L-o-r-d." It was like the rumbling of a waterfall by which one may fall asleep. I pitied him. The hymn had not been interpreted to the pupil by the teacher. I explained to him the meaning from sentence to sentence. In twenty minutes he recited the lesson with expression. "If children," says Lichtenberg, "could only be brought to that point where every thing indistinct would be wholly unintelligible." "The greatest distinctness was ever to me the greatest beauty," says Lessing. All teaching should be rational, as is every arrangement, every operation in life. We know thoroughly and lastingly only that of which we have a vivid perception of the rational process by which we acquired it. Thus, the art of learning in general is attained and practiced, readiness developed toward infinity—onward and onwards; and thus, every thing else is easily and accurately learned at pleasure; by this adepts in learning are made; the first and exclusive condition of the practical artistic use of the sciences in life; by this artistic schools are formed for the scientific use of the intellect. Fichte's "*Deduced Plan*," &c., Stuttgart, 1817.

He who can not be prevailed upon by these aphoristical remarks to abandon the abstract and incorrect learning by heart, must consider the emphatic truths by Beneke: "There is

* "The French, who have in other matters not a rich and at this time not a deep meaning language, have preserved a paragraph from a more favorable period of their history, on what by the Germans is called learning by heart, which I may appropriately give here to simplify my view on a frequently exacted exercise of youth. *Apprendre par cœur*, say they, learn with the heart, or also, *savoir par cœur*, to know from the heart, or to know in the heart, *i. e.* to take up with the mind and the soul at the same time, and thus fix it for time and eternity. The German expression for learning by heart, or outward learning (*auswendiglernen*.) on the contrary, is only a substitute for outward forms. Thus the most indifferent things are learned by heart; alas, there is frequently, voluntarily or involuntarily, too much learned of this injurious and insignificant trash! Whose brain has not at times buzzed and been disquieted, without wishing that he might rid himself of the like. But what should be received into the heart and pass out from it, is easily and readily perceived to be the election between that which is worth knowing and that which is not worth knowing."—*Autobiography of Baron de la Fouque*, p 45.

Each subject of instruction offers sufficient inducement to memory and thought in its own material. Each should be treated skillfully and judiciously, and every thing worthy of being remembered should be retained in the memory. One material will incline more to the memory, and another more to the understanding, according to the peculiarities of its nature. Historical subjects stimulate the memory, mathematical the reason. Thus the demand for an equal development is supplied by the subjects of instruction themselves without the necessity of multiplying independent varieties of culture. The entire system of juvenile instruction, according to the present understanding of its design, assumes the task of laying the foundation for self-activity in every member of the people; and this design of the development of the force or dynamical direction ought to predominate, not the humanism* of olden times, nor the philanthropism of a later day, but the well balanced cultivation of mankind, the unfettering of every talent, the invigorating of every faculty; not abstract Basedow-Rochowianism, not formal Pestalozzianism, according to its strict observance, but just as little of the material-real as of the philological-humanism; not the exclusive cultivation of the intellect, but the universal culture—which has its foundation in the public schools.

Reasoning from the above we must reject the exercises for the intellect as a standing subject of instruction in our public schools; yet it is not our intention to exclude all exercises of a similar nature, but limit them to the lower classes, and designate them by the term, *Exercises in Intuition and Speaking*—of which we will speak hereafter.

All instruction in elementary schools, as shown above, must rest upon real intuition. We consequently limit the intuitional exercises to the lower classes, otherwise, it is to be feared, a hollow formalism

no general or universal culture of memory; he who learns to remember words, learns to remember words and nothing more, on each individual fact of the subject the memory is exercised," &c. Compare his "*Theory of Education*," vol. i., p. 81, 127, &c.

3 Wackernagel's "*Instruction in German*," Fourth Part of Reading Book. Stuttgart, 1843, p. 97.

The mere learning by heart destroys feeling and intellect. Only the love for the subject, the love which goes out from it, which I only can return, its beauty, unites me to it; this inner union can not be learned by heart. This beauty one retains as property, a thing directly comprehended; an attempt to learn it by heart estranges it. I hold it possible to utterly destroy all taste for poetry in a boy by requiring him to learn poems by heart. There can be no exercises exclusively in memory and exclusively in intellect for an attentive sprightly child; this we seem to recognize from his very genius. But there is another question, what will become of such a child through these exercises? He will probably approach nearer and nearer that condition in which every thing will be to him mere memory, or mere intellect. I have nothing against *knowing* by heart, I only oppose *learning by heart*. I know many men who have learned but little by heart and yet know a great deal by heart. He who knows a thing inwardly, knows it also easily outwardly. To read and hear any thing with pleasure, to read and re-read it, loving to labor with it—this leads to true knowledge, which, if need be, lives ever in the memory.

* Classical learning.—*Trans.*

would be induced not indeed so empty as that produced by the pure intellectual exercises, but calculated to lead the teacher to treat one lesson intuitively and another abstractly, unless he views the instruction from the highest stand-point. As the intellectual practices invented in 1770, &c., were manifestly a progress in school instruction, so also were the intuitional exercises which were introduced in the beginning of the present century, in the first two decennials. Both form in relation to the existing method, a fitting and instructive parallelism We have passed them both; they have become periods in the history of pedagogy; they form epochs. They join those venerable names, Rochow and Pestalozzi, and their faithful followers, Bruns and Wilberg, Laspé and Ramsauer.

If at the age of five or six the child enters school, he is generally in an intellectual condition which must be matured for the proper instruction. His attentiveness is to be awakened, his power of expression untrammeled, for on both of these especially depends the success of the method. His vacancy of mind must be filled, his attention concentrated and energized upon its object, and his ideas find ready expression in words. Thus exercises in intuition and speaking, or the first grade of instruction seek these important ends. These are exercises in intuition because the faculty of intuition is the basis of all intellectual culture; they are exercises in speaking because we can not be sure that the children have conceived the right ideas before they have expressed their ideas and thoughts; and the distinct thought arises only with the word. These two aims do not lie side by side, but one within the other. The former, forms the substance; the latter, the form of the exercises; substance and form exist together in every true method of instruction; hence the exercises in intuition and speaking form the foundation for universal elementary instruction.

The faculty of intuition has two sides. One is turned toward the outer, and the other toward the inner world of the mind. The former is first unfolded and leads to the development of the latter. Hence, the child in the school, as in the natural world, must open his senses to outward impressions, in order that the qualities and objects of the outward world may be reflected in pictures upon his mental retina and become to inner intuitions, the foundation of all later mental culture. In course of time the power awakened by outward intuitions must be turned toward the inner world of the spirit, to which other subjects of instruction will offer an inducement. Here we have to deal especially with outward intuitions, and we therefore take the material of the exercises from the outer world which surrounds the child.

These school intuitions do not indemnify the direct intuition and life of the child in the world. We suppose the child to have lived in the world six years of this life. He brings with him an endless number of intuitions. These we join closely together, refer to them and others which will be formed, and raise what is contemplated to clear consciousness. The instruction is here a reminding* and clothing of ideas in appropriate words and sentences.

In this respect a country child has manifold advantages over one of a city, especially one of a large city. The former has seen the natural world by which he is surrounded, and its thousand occurrences, the remarkable periodicity of the seasons—the sowing, planting, growing, &c.; while the latter, poor child, knows nothing but the rooms, the houses, and the streets. The first, for example, has observed the birds, how they fly, eat, build nests, feed their young, &c.; the latter knows, perhaps, the canary bird in its cage, and the birds which are sold in market. Nature's child possesses real practical knowledge, the town child can readily say this, or that, of what he has seen. Consequently the country child is more thoughtful, the town child more voluble. An untold advantage favors the former, and the difference will never be obliterated. The inhabitant of the city, by his volubility and cleverness, thinks to surpass the inhabitant of the village or country. But let them be examined in things of practical life, in the practical capacity of judging correctly. In consequence of this men are selected from the immediate practical walks of life to preside in the courts of large cities, in order to secure real experience and practical views in the highest tribunals of the country. The most advantageous relations will be formed for a child, who is to have the benefit of higher culture, by changing his country life at the age of twelve years, for that of the town or city.

Therefore—whenever it is possible, there should first be observation of life and nature, and afterwards reflection till every perception is brought into the realm of a clear consciousness. In school we make up, as far as possible, what was neglected in life.†

* It is the usual delusion of the reflection, arrogating all wisdom to itself, that it thinks to have discovered something by speculation, or to have demonstrated something new, when in fact it has only developed it, or at the most brought it to consciousness. Fichte, "*The idea of personality*," 1834, p. 112.

† "There is only one learning, one hearing and perception, one producing and one reproducing, one illumination and one illustrating, one having and being, one life, cultivation, existence, and experience, and that is life in childhood."

"A nail, a young sparrow and its beating heart in my hand, a fish taken out of the net and touched—taken hold of at any price with all ten fingers, with twenty, provided we had that number; that was a magnetism, it gave a clear perception."

The above quotations are from Goltz's valuable book, page 156 In the same work, page 138, is found, a poem of "Hay and Straw," from the experience of childhood. He is to be

Real objects will be presented to the senses of the younger children. They will be looked upon and contemplated, and what is looked upon and contemplated will be talked about. The teacher directs the attention of the children, he makes use of interrogatory instruction, and the children reply in a clear, precise manner, in single sentences, and with correct accent. Seeing, hearing, and speaking are united. The untrammeling of the speech is the principal thing outwardly. For this reason, incompleteness of expression, inarticulate enunciation, answering in a suppressed voice, or in single words, should not be tolerated. Marks or signs which the pupils do not understand, will be made known to them after they have acquired the lively direct intuition of them in the complexity of their uses. First, the idea, then the word expressing it. Speaking singly and speaking in concert, or by divisions, may occur alternately. Each sentence is to repeated by a single scholar until it is perfectly and completely expressed, when it may again be repeated in concert. The logical object word must be rendered distinctly prominent. It is well to make use of signals, on the principle that all unnecessary speaking be dispensed with. The teacher of course should always have every pupil in sight. The first name pronounced, (Fred!) designates the pupil who is to answer a question which was addressed to the entire school. Each pupil prepared for answering, raises his index finger. The raising of the same finger by the teacher is a sign that the scholar is to repeat the answer on account of inarticulate expression, or some other defect. A semicircular motion with the finger is the signal for a class to speak, and a circular movement, the sign for all the pupils to speak, *non-commissioned officer like.*

It is said that we are indebted for these useful exercises to the Pestalozzian school. Pestalozzi himself chose for the material of intuition the living human body, from which he composed his known "*Book for Mothers*," so called because he wished to introduce these exercises to the sitting room. We must differ from this; we can

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called happy who in his youth received impressions such as this man did, and for which he is indebted to life in the country and his own peculiar nature, hence, mostly to nature. Such an unconscious, direct, rich life, prepares the soil for most productive harvests. "It is nothing according to the ideas of grown up people. But children feel and perceive with heavenly instinct the world at every point and in every moment as *one whole*, and God in it as in his own personality. Here I found the elementary material in abundance for which my nature so yearningly longed. There were on account of the Baltic Sea, near by, hasty changes in the weather and heavenly metamorphoses all the year, which greatly exalted my imagination and influenced my destiny. This was life to me!" Goltz, p. 157.

"Such deep intuitional life, such immediateness! Or shall we laboriously change the clear gold of intuition for the paper currency of book definitions, and gain in life's length what we lose in its depth? Heine's "*Scenes of Travels*," II., p. 126.

not, according to the precedence of other pedagogues and from nearly related surrounding principles, approve of the exclusive selection of the human body. It is more agreeable to the purpose to choose the objects to be contemplated from the surroundings of school and every day life. Hence we seek the unity of the exercises, not in the unity or uniformity of the object, but in the unity of the end, in the unity of the method of treating and of varying the multiplied and produced materials. Modern authors in this department choose either regularly shaped bodies, or a house, or a model of a house, or objects of the school-room, or of its adjacent surroundings; plants, animals, objects of art, pictures, &c. The principal end may be attained through every one of these objects. Absolute necessity exists not in the materials.

More important than all means of instruction, is the apprehending and accomplishing; a view, which vindicates itself ever more and more, that all instruction, without exception, must be based on intuition. This heretofore presented thought deserves to be again recommended *most impressively* to teachers. He misapprehends who is of the opinion that, when with beginners he has used pictures and employed speaking lessons, he has fully satisfied the intrinsic demand of intuitional exercises. It is a principle in the instruction of youth, in universal instruction, also in every activity of the educator, that every thing which is to be actively and impressively felt, known, and wished, must have certain events and experiences, and an immediateness for its foundation.* Shallow perception, that which is heard, learned, and perceived according to words, answers not, develops not; but injures, produces a meager school knowledge, empty notions, a work of words, saps life, and injures the vitality and soundness of the soul.

That so much instruction remains without fruit up to this hour, is chiefly owing to its wholly unintuitive nature. Think only of the character of much of the instruction in language and religion! In the former the pupil is tormented with empty forms, and in the latter with hollow ideas. Exercises of this character are very deleterious. Few men ever again return to a fresh green life, after being driven into the world of abstract ideas by their youthful training. Nowhere is this danger greater than in the German nation. Only look around

* 1 "What sensation is to the will, namely, basis and source, *direct source* of the true, the good, and the beautiful, that is the intuition, the intuitive, direct recognizing to the intellect." Hoffmeister in his "*Schiller*," III., p. 109.

2. "Only that is *real, objective thinking*, which designates and ratifies itself through sentient intuition. That thinking is true and corresponds to the nature of the reality which is awakened by intuition." L. Feuerbach, "*Philosophy of the Future*," p. 74.

you and seek the explanation of much of the transcendental phenomena of our day.* But we continue the subject.

All religious instruction must begin with what is already known to the child, experienced by him, with what is immediate. And if *it* must begin here, surely all other teaching should be based upon the same principle. A life-awakening religious instruction joins piety and the relations which exist in the lively emotions of the child with the parent; also joins faith toward God with faith toward the parent, love to God with love to the parent; sin against the commandments of God with the consciousness of the child that he has not always obeyed the will of his parent; justification before God with repentance and improvement toward the parent, and forgiveness on those conditions, &c. These and similar experiences induce reflection; one's own life is rendered more intelligible. It is then impossible for us to be lost in the desert of school ideas. Some extracts from Beneke are here appropriate.

"The truthfulness, intuitiveness, and efficaciousness of a universal rule, originate only from self-experienced or, at least, clearly represented and impressively felt individual incidents. If from the beginning it be *only abstractly* formed, it will lack harmony and proportion, and tend at best to make us self-conceited, to be vain of a knowledge of which in truth we know nothing, and of which we can only arrogantly and audaciously prate. But where it concerns the application to special relations it will leave us in a dilemma."

"The child can associate with words only that of which he has an ideal. So long therefore as he fails to apprehend his intellectual activities, his sensibilities, the endeavors of his will, and his opinions, the words referring to them will be mere empty sounds. If his attention is frequently directed to words only, he will acquire the habit either of thoughtlessness, or an incorrect use of them, because he im-

* The newest philosophy of the fifth decennium of the nineteenth century agrees with elementary pedagogical science; that discovers now the truths, to which this has already devoted itself for half a century. Feuerbach, in 1843, advances this thesis:

"The essential instruments, organs of philosophy, are the head, the source of activity, of liberty, of metaphysical infinity, of idealism; and the heart the seat of suffering, of finitude, of necessity, of sensualism; theoretically expressed, thinking and intuition; for thinking is the requisite of the head; intuition the sense. the necessity of the heart. Thinking is the principle of the school, of system; intuition. the principle of life. In intuition I am determined by objects, in thinking I determine the object; in thinking I am *I*, in intuition not *I*. The true objective thought, the true objective philosophy, produces itself only from the negation of all thinking, from the being determined by the object, from the passion, from the source of all joy and need. Intuition gives that only which *is* immediately identical with existence, thinking gives the intervening condition through discrimination and abstraction from existence, therefore there is life and truth only where the condition is united with the existence, the thinking with the intuition, the activity with the passivity, the scholastic phlegm of German metaphysics with the anti-scholastic sanguine principle of the French sensualism and materialism."

properly refers the words to the outward which accidentally are connected with the intellectual; the first of which, indeed, is all he can comprehend up to this period. Such abstract exercises are exceedingly dangerous."

The danger consists in leading the pupil to regard the dry and abstract world of ideas instead of the real contents of intelligence; and to adjudicate to the intellect the supremacy in life as well as in science, and accordingly to reject all that can not be incorporated into ideas.

This was the sad result in the schools at the time when the almost exclusive culture of the intellect prevailed. This stand-point, for readily conceived reasons, we have passed in science farther than in life. The time has also passed when it was believed that the only success through the activity of the teacher rested in the skill by which he developed ideas, or in the so called art of catechising. The extreme opponents of this opinion and tendency, believe that we need no catechising, no development of ideas. In opposition to this, we say, every development is important, indeed the chief ability of the teacher consists in developing and therefore also in catechising;* but not in developing ideas, but intuitions and in his efficiency to awaken lively intuitions in the pupils. The teacher who would meet the demands of the present, must direct his efforts toward this end. Hence, not Dinter, *or* Pestalozzi, but Pestalozzi *and* Dinter!

Two questions are yet to be answered. 1. By what is instruction to be illustrated and enlivened, how is it to be learned? 2. Which or what different intuitions are to be called forth in the scholar, from what field do we take them?

First question. Very many teachers think the illustrations can be learned from books. But what are books? They in themselves furnish nothing more than a guidance to the treatment of the intuitions, where then are the intuitions themselves? These are not in lifeless books, but only in life. To this then we must refer the teacher. Look into life, into nature, into society, into the world of small and great men, into yourself; "keep your eyes open!" "Non scholae sed vitæ," said the old teachers, and mostly the humanists. It was a phrase blindly submitted to the tyrant "*custom*," in a dry abstract time. It was of no avail. The agitators themselves served the abstract knowledge, the dead learning, and, what they least anticipated (still considering it an offence,) materialism. Their business

* "He who banishes this method, catechising and examining, from the school, takes the sun from the world." Trotzendorf, in Puhkopf's "*History of the Condition of Schools and Education*, (*Geschichte des Schul-und Erziehungswesens*)," by Bremen, 1794.

was to educate renowned men, renowned lawyers, renowned philosophers, renowned theologians, renowned philologists. *Renowned-learned*—this gives the key.

Teacher, do you desire therefore to teach for the life? Then sink yourself into the life, into the life of the present, not into the past which was and has perished. Let the active life enter into you, expose yourself to its effects, retire from the study and take part in the drama of life as multilaterally as possible, gaining therefrom acquisitions for your purposes in life and in your profession. You are the man, you are the intuition of your scholars, by your lively intuitions you will learn to illustrate. Books can show you the instructive method, but can not give you the intuitions themselves. No book can supply the (missing) life.* Goethe teaches this when he says, "What I have not learned from books, I have acquired by traveling. That which has been carefully observed can afterwards be reflected upon and judged. A decided exercise of the eye is necessary, and there must first be an observation in order to call forth an inquiry. I must bring it thus far, that every thing may become intuitive knowledge, and nothing remain traditional and nominal. I, too, am for the truth, but for the truth of the five senses. I am a mortal enemy of word sounds. Nature, indeed, is the only book that offers intrinsic merit on every page, &c."

Second question. What kind of intuitions? Which should you awaken, and from what field? Whence have you to take them? Let us consider the different kinds and enumerate them:

1. *Sentient intuitions;* not only mediated by the senses, but given through them directly—outward intuitions.

2. *Mathematical;* ideas of space, time, number, and motion—also belonging to the outer world, not given directly by the senses, but mediated by them.

* "It is very remarkable. Every body insists that the teacher should educate for the life, not for the school. Hence he must know the life and consequently reflect upon it, &c. And yet every body is allowed to express an opinion concerning life rather than the teacher. But we vindicate for him what Rosenkrantz claims for philosophers. The philosopher, especially, must not concern himself about every absurdity that would not only contest his right to have an opinion about public affairs, but also to openly express it. The philosopher may not be informed in a thousand details which belong to the special departments of knowledge; but this must not deter him from exercising the *Critic of Pure Reason* in regard to universal laws. Among the old philosophers it was considered right, when they not only concerned themselves about the theory of the state in which they lived, but also about its practical workings. And for this they are still commended; these thinkers were not abstract cosmopolitans, but real patriots. But are modern philosophers no longer allowed to be patriots? Has not Schelling, however, recently declared to the welcome surprise of all his auditors, that time and philosophy have advanced to you questions of life, to which no one is permitted, nay, it is not possible for any one to be indifferent." Rosenkrantz, "*Sketches of Koenigsberg*," Danzig, 1842, I., p. 11.

3. *Moral;* arising to mankind by the appearance of virtuous life.

4. *Religious;* those arising in man when he directs his mind toward God.

5. *Æsthetical;* from the beautiful and sublime appearance in nature and in the life of man, presentations of art.

6. *Pure human;* those referring to the nobler individual relations of mankind—in love, fidelity, friendship, &c.

7. *Social;* that which represents the associations of mankind as a unit—in corporations, in communities, and in states.

The school can not furnish all these intuitions according to their varied difference and full extent. It can not supplant life, it presupposes it, joins itself to life and leads toward it. But the school attracts whatever objects fall within the range of its influence, engages itself with them, and through this versatility lays the foundation of all intelligence.

1. The sentient intuitions refer to the material world and the changes in it. The pupil should as much as possible see and hear for himself, should use all his senses in seeking for the peculiarities of objects, on, in, or above the earth; minerals, plants, beasts; man and his works; sun, moon, and stars; physical phenomena, &c.

2. Mathematical intuitions unfold themselves from the sensual through easy and nearly related abstractions; the idea of extensions in space on all sides, of extensions of time succeeding each other, the idea of number, how much, the idea of motion, the idea of changes in space, and the passing through the same. The simplest of these ideas is that of space, the others, therefore, can be illustrated by this in using points, lines, and surfaces. The means for illustrating instruction in numbers, are points, lines and their parts, and bodies and their parts.

3. The moral intuitions are obtained by the scholar, through mankind, through life with its relations, through playmates and teacher in school. These of course are inner intuitions, which, however, incorporate themselves in the countenance, in the eye, and in the language. The main point here, as elsewhere, is the individual experience of the pupil. Happy is the child that is surrounded by only pure moral men, whose characters mold the moral foundation of his own life. Moral deeds from history may be vividly and impressively presented by the teacher through the living word of the eloquent tongue and the affected heart.

4. Religious intuitions are attained by contemplating nature, its beneficent influences and phenomena, by the piety and prayers of parents, by the holy meditations of the congregation in public wor-

ship, by sacred songs in school, by religious instruction in school and church, by religiously disposed teachers and faithful clergymen, by scriptural history, &c.

5. The æsthetical intuitions are awakened by viewing the sublime and beautiful in nature; flowers, trees, crystals, stars, the heavens, the ocean, rock and mountain; landscapes, storm and tempest; objects of art; statues, pictures, paintings, edifices, and productions of poetical and oratorical art. In the classification of the moral, æsthetical, &c., their specific difference may be disputed. But I consider it better to arrange them under a special category. The stern, moral law applying uniformly to all men, does not embrace them all in its province, for they can not absolutely be required. The contents of the æsthetical belong to the beautiful, free, human development which is dependent on conditions unsuited to the tastes of every one.

6. The so called pure human intuitions* refer to a noble formed life of individual men, the character of which surpasses the strictest idea of morals and duty, and relates to sympathetic inclinations, as friendship and love, sympathy and participation, and other excellent characteristics of the elevated human life as they are met with in the refined development and culture of eminent pure men. Well for the child who shares these! If the family accomplishes nothing in this direction, it will be difficult to supply the deficiency. The teacher should do his utmost to remedy this defect, by his deportment in the school-room and by his general appearance.

7. The social intuitions, that is, those of the social condition outside of the family, come to the child through the phenomena of social intercourse in school, in church, in public meetings, and at public festivities; and afterwards through history, by which the living intuitions of the teacher, from the associations of states, people, and wars, impress the pupils with the most lively representations and images of larger corporations. Our earlier, so familiar private life, renders difficult the source of these important, yet uncommon, intuitions. How can he who has no experience understand history? How can he who has never seen people possess a living image of them and of their

* Their special difference can be disputed, considering them under the heads of the moral, æsthetical, &c. But, I deem it more correct, to make a particular category of them, for the reason that greater attention will be paid to their nature. The severe moral law applicable to all mankind, in an equal degree, does not embrace them in its department, they can not be implicitly required of every body. They belong to the free, beautiful, human development, and are entirely dependent upon conditions not agreeable to every one's tastes—thus however showing the divinity in mankind. "The universal human nature in the pure human intuitions in the formation of a noble family life which finds sympathy in every pure heart, whether adorned by star or badge, or covered by the coarsest and plainest garment, is divine. The origin of every human being is divine." Egbert in, "*Traits of Character*," &c. From Frederick Wilhelm, III., p. 481.

life? Small republics have infinite preferences in this respect, and also in relation to the intuitions of a public life and for patriotic sentiment. Language, even the most eloquent, gives only a vague and unsatisfactory substitute for these intuitions. The year 1848 disclosed in Germany, a present and prospective progress in this direction.

From all this is made manifest the importance of the life, the intelligence, the stand-point, and the character of the teacher for the founding of living intuitions in the soul, in the intellect, and in the heart of his pupils. We can never awaken to a lively intuition in another that which is not a living intuition in ourselves. Therefore it is of the greatest importance that the teacher himself has seen, observed, experienced, investigated, lived, and thought as much as possible; and erected for himself an ideal in moral, in religious, in æsthetical, in purely human, and in social relations. Just as much as he is, just so much is the worth of his instruction. *He himself is to the scholar the most instructive, the most impressive object of intuition.*

It is the business of the teacher to introduce and to found the relation of the scholar to the subject of instruction. He is the mediating person between both, which were originally strangers to each other. The scholar should self-actively appropriate the intuitions to himself. This presupposes that the teacher from whom originates every thing, is able to awaken self-activity. He can accomplish this, only to the extent of his ability to awaken in the scholar an active desire for learning. The respect, affections, and obedience of pupils are won by the teacher's love for them and for his profession, remaining knowledge of the subject and methodical powers presupposed; and through these the pupils' disposition to submit to his guidance the tendency toward the object of instruction, is secured. In this manner attentiveness and the love of knowledge, the first condition of a successful progress, is attained; and the remaining conditions, the most important of which is the awakening of self-activity in the pupil, will follow of themselves through methodical treatment by the teacher.

IV. EBENEZER BAILEY.

Ebenezer Bailey, one of the founders of the American Institute of Instruction, was born in West Newbury, Massachusetts, June 25th, 1795. His father, Paul Bailey, with his mother and ancestors on both sides for many generations, were all natives of that ancient and beautiful town on the shores of the Merrimac. His father possessed a small but well-cultivated farm, and by his industry and economy, like so many of our New England yeomanry, reared his family of four children to those habits of enterprise and intelligence which lead to usefulness and honor in after life. The youngest of these children, Ebenezer, most resembled his mother in disposition. To her he was deeply attached; and her death, which took place soon after he graduated, he never ceased to deplore. Two of his own children in after life bore successively, her loved and honored name, Emma Carr.

Why he was selected as the aspirant for college honors, is not known, unless it were from the love of learning, and love of books he very early manifested. Not that he was in any sense a *book-worm* in his boyish days; on the contrary, he was full of life and activity, the foremost to engage in every manly sport, and the leader in every venturesome expedition. He had a taste for mechanical contrivances and was ingenious in making little machines, and, so to speak, philosophical playthings. Even then his warm heart and generous, kindly nature made him a general favorite, and some of those who wept at his grave, dated the beginning of their friendship from these early days.

The same enthusiastic love of nature, the same remarkable order and method, the same perfect neatness and propriety, the same regard for truth and honor which characterized him in after life, were conspicuous in him as a boy. So true it is,—

> "The child 's the father of the man."

He entered Yale College, New Haven, in the year 1813, at the age of eighteen. His father provided liberally for his education, and his college course was alike honorable to himself and satisfactory to his friends. Although always a close student, he was a favorite with his class, and many of his college friendships continued unbroken through life. Indeed this was the peculiarity of the friendships which he had the rare gift of inspiring—their warmth and devotion which neither time nor absence could quench, and which rendered them strong and lasting as life itself.

He graduated with honor, September 17th, 1817. His views and prospects at this time, may be learned by the following extracts from a journal which he kept for a few years.

"New Haven, Saturday, December 27th, 1817.

"I left Newbury the first of September, accompanied by my father, for New Haven, with a determination to visit the Southern states in the capacity of an instructor after I had taken my degree. Accordingly after commencement, my father who has never refused me a competent supply of money, gave me at my request three hundred dollars. I thought this would be sufficient to pay my bills, and leave $150 to defray my expenses to the South. But as is generally the case with those who had rather see a trader use his pen than change a note, my debts were greater than I expected; so that I had something less than $70 left for my Southern expedition. But my father had gone home; and with this sum I was to make my début into the wide world of active life!

Though I had lived at home but little since I was fifteen, and of course had been accustomed to associate and deal with strangers, still I was very little acquainted with the art of living. The generosity of my father had always hitherto supplied me with a *quantum sufficit* of cash; but now I began to suspect that to earn and to spend were not quite the same thing. Neither was it altogether so easy and pleasant for one to hold his own purse strings—especially if there be nothing in it but a memorandum of debts!—as I used to fancy it when a boy. I well recollect that then, when a hint to my father, like a merchant's word, would pass for more than it was worth—I engrossed in flaming capitals in my pocket book,—

'God loveth the cheerful giver,'

but were I now to honor my red morocco *vacuum* with a motto, it would be from Shakspeare; "Who steals my purse, steals trash;—'tis something, *nothing*."

But to return to my seventy dollars. A class-mate and particular friend, whose purse was not as long as his credit, needed fifty dollars to clear him out; and I freely lent him the sum, on condition he should send it back by the next mail after he reached home. It so happened that he did not return it for *eight weeks*. During this period I received several applications to go South, which I could not accept for want of funds to get there. And when, at last, my money did arrive, my expenses in the city had consumed it all into four or five dollars! What measures to take in this extremity, I knew not. I was about two hundred miles from home, without experience in managing, without money, without means of procuring any (unless by writing home, which my pride forbade) and I had almost said—without hope. I resolved and re-resolved till I found myself considerably in debt and not a cent in pocket. But conscious withal that

'A poor spirit
Is poorer than a poor purse,'

I determined not to yield to circumstances, but if possible, to make circumstances yield to me."

He then goes on to state that being unable to carry out his original plans, he concluded to purchase the good will and fixtures of a private school for boys recently established in New Haven. He found that he had been most grossly deceived in regard to the prospects and condition of the school, but by great energy, he brought it up to a good reputation, and the number of scholars rapidly increased. At the same time, he entered his name as student at law in the office of Hon. Seth P. Staples, intending to make that his profession. But he soon found this double burden too severe a strain even for his iron constitution. At that time it was his habit to study till midnight, and rise at five in the morning to resume his labors; and his health began to suffer from this unremitting toil day and night. So a favorable opportunity offering, he disposed of his school, abandoned forever the study of law, and engaged as tutor in Col. Carter's family at Sabine Hall, Richmond County, Virginia.

It is curious in this swift-moving age, to trace his slow and tedious journey by stage and boat. Leaving New Haven, December 29th, 1817, he did not reach Sabine Hall till the 12th of the following month. Here he was received with true Virginian hospitality, and soon won the attachment of his pupils, and the respect and confidence of all with whom he was brought into contact. His position was peculiarly favorable for seeing Southern customs in their best aspects, and his year's residence in Virginia was always regarded by him as a pleasing episode in his life. Col. Carter numbered among his friends and family connections some of the oldest and most aristocratic families in the state. The plantation was very extensive, the house, of the old English style, was at once peculiar and picturesque, the grounds were spacious and handsome, the equipages, attendants, in short, the whole establishment on the largest and most liberal scale. The free and open hospitality of the society there impressed Mr. Bailey very favorably; and he was no less struck with the lack of that thrift and home comfort so dear to the heart of a New Englander, which was often strangely blended with an almost princely magnificence.

While in Virginia, he accompanied Col. Carter's family in their annual summer excursion to the mountains, and spent some time at Oakly, a seat in the northern Neck of Virginia. His journal contains full and glowing descriptions of the various scenes he visited; particularly of Harper's Ferry, and the other wonders of nature in that region, and of his visit to the birthplace and the grave of Washington. The journey was mostly performed on horseback, and gave rise to many amusing and exciting adventures. In the absence of inns, the party used generally to pass the night at the residences of their various friends on the route, often prolonging their stay to several days. In his remarks upon the ladies of a family thus visited, may be traced the germ of the conviction which he afterwards so strongly cherished and so triumphantly maintained in regard to the mental powers and capacities of woman. "These ladies," says he, "show by their example, that the toilet ought not to engross the whole of a woman's life; that her mind is capable of higher and nobler attainments than to adjust a ribbon or display a gewgaw to the best advantage!"

His remarks on the frivolity of life at the Springs show an unusual gravity and dignity of character for a young man of twenty-three. After indulging in a vein of humor and sportive satire on the various classes of pleasure-seekers there congregated, he adds, "For a person who considers life too short to perform the active duties incumbent on man—who views all actions in reference to their ends, and receives pleasure from them in proportion to their utility, a watering-place has no charms; and even the votaries of pleasure soon become satiated."

Perhaps in the present excited state of the public mind, it may not be uninteresting to know how the subject of slavery was regarded in Virginia some forty years since; at least how it *appeared* to be regarded by one who had wide opportunities for observation, and who was certainly unprejudiced and dispassionate in his judgment. The following paragraph seems almost prophetic.

"Statesmen and politicians have already begun to discuss the most feasible plan for emancipating all the slaves in America. It is probable that a century will be too short a period to finish this great work; but there is no subject which so loudly and imperiously demands the attention of the American people as this. The people of the South begin to view slavery in its true light. Instead of a blessing, they regard it as a curse, entailed upon them by their ancestors, which it will require all their energies to do away. On this subject, I have heard but one voice in Virginia. *A dark cloud hangs over the future destinies of this section of our country, which few can behold without trembling, and of which its inhabitants are fully aware.*"

Mr. Bailey remained a little more than a year in Virginia, when he returned to West Newbury, and afterwards went to Newburyport, Massachusetts, where he opened a private school for young ladies. There he formed many life-long ties. His friendship with the Rev. John Pierpont, which death has hardly severed, there commenced;—and there are many others who still recall with pleasure these early days sacred to glowing hopes, and true and honest hearts. There too, he was introduced to the family of Mr. Allen Dodge, then a merchant of that town, who placed his daughters under his instruction; one of whom a few years later, became his wife. Her brother, Hon. Allen W. Dodge, now of Hamilton, Mass., has cordially furnished a most faithful portraiture of his departed friend and brother, which will be introduced hereafter.

Highly appreciated and successful in Newburyport; he yet regarded Boston as a wider and more congenial field of action; and in the year 1823, accepted with pleasure an appointment as head master of the Franklin Grammar School for boys in that city. This school had latterly fallen into a very low state of discipline, and the boys had almost held the reins in their own hands; but a few firm but judicious cases of discipline at first, soon established the authority of their new master, who then easily won their love and confidence. The power of his influence over them may be illustrated from the fact, that being unavoidably detained from school one morning, he bent his steps thither late in the forenoon, almost dreading to encounter a scene of anarchy and confusion; to his surprise, however, he found the whole school in perfect order and busily engaged in the preparation of their regular lessons, having elected two of the best scholars in their number, as teachers *pro tem.!*

Early in the year 1825, he was married to Miss Adeline Dodge of Newburyport. Although very young, only eighteen, she possessed a mind of fine natural endowments, improved by a much more liberal course of education than was common at that day. A constant sufferer from ill-health through life, she was ever the true sympathizing wife, whose love and reverence for her husband knew no bounds.

In the same year he was unanimously pronounced the successful competitor for the Prize Ode to be delivered at the Boston Theatre on the anniversary of Washington's birthday. A few extracts from this poem will show that he possessed poetic talent of no mean order. Many of the fugitive pieces from his pen that appeared in the journals of the day, were of marked beauty; and indeed, Griswold includes him among his "Poets of America." He was several times appointed Poet for the Anniversaries of the Phi Beta Kappa of his *Alma Mater*, an honor which, however, circumstances always prevented him from accepting.

The Ode which is entitled "The Triumphs of Liberty," opens with an invocation to the Spirit of Freedom, and then depicts her triumphs in the contests for liberty and independence in Greece, and on "the Andes' fronts of snow," which then claimed so large a share of the public sympathy and interest. He next turns to the oppressors and tyrants of the human race, and predicts their final overthrow. Then, by an easy transition, he invokes the spirit of Washington. The following passage commemorates Lafayette's visit to his tomb.

> "Say, ye just spirits of the good and brave,
> Were tears of holier feeling ever shed,
> O'er the proud marble of the regal dead,
> Than gushed at Vernon's rude and lonely grave;
> When from your starry thrones, ye saw the son,
> He loved and honored ?—*weep* for Washington."

The following are the closing lines of the poem,—

> "As fade the rainbow hues of day,
> Earth's gorgeous pageants pass away,
> Her temples, arches, monuments, must fall;
> For Time's oblivious hand is on them all.
> The proudest kings must end their toil,
> To slumber with the humblest dead,—
> Earth's conquerors mingle with the soil,
> That groaned beneath their iron tread;
> And all the trophies of their power and guilt,
> Sink to oblivion with the blood they spilt.
> But still the everlasting voice of Fame,
> Shall swell in anthems to The Patriot's name,
> Who toiled—who lived—to bless mankind—and hurled
> Oppression from the throne,
> Where long she swayed, remorseless and alone,
> Her scorpion sceptre o'er a shrinking world,

What though no sculptured marble guard his dust,
Nor "mouldering urn" receive the hallowed trust,
For him a prouder mausoleum towers
Which Time but strengthens with his storms and showers.
The land he saved, the empire of The Free,—
Thy broad and steadfast throne, triumphant Liberty!"

In the latter part of this same year, the High School for Girls was established as an experiment, and Mr. Bailey was selected as its teacher. He entered on the duties of his office, November 15th, 1825, and soon infused his own enthusiasm and spirit into the school. The number of applicants for admission, was more than the limited accommodations provided could possibly contain. But the jealousy of some of the members of the city government was early excited by the rapid strides of the school to popularity, and it was subjected to various petty annoyances, and worst of all to neglect, by those who should have cherished and fostered it.

The mayor of the city, Hon. Josiah Quincy, in particular, had never been friendly to the school, and pronounced it an "entire failure" in a report which he presented regarding the Public Schools of Boston. Though this report was published after Mr. Bailey's resignation of his position as master of the High School, and when the private school he had opened was in the full tide of success, still he felt called upon to vindicate the High School from such a charge. He accordingly wrote a "Review of the Mayor's Report," in which he set forth the facts with great power and vigor. This Review attracted much attention at the time, and as it not only contains the history of the High School for girls in Boston, but also presents some of Mr. Bailey's own views on the subject of education, it has been thought advisable to condense it, and append it to this article, where accordingly it will be found.

The "Young Ladies' High School" established December, 1827, in rooms taken in Spring Lane, may almost be said to have inaugurated a new era in female education. Here Mr. Bailey could give free scope to the development of his favorite and long-cherished ideas as to the wisdom and propriety of extending the widest and most liberal culture to the female mind. How successfully these ideas were carried out, how nobly maintained, how closely they appealed to the sympathies of the community, may be read in the history of this school. From the first it commanded a wide-spread patronage, and enjoyed a high reputation, not only in Boston and its vicinity, but in remote and distant quarters. It numbered among its members, those from the South and West, from the British Provinces, as well as from the larger cities and towns of the East. Mr. Bailey was always extremely liberal in freely bestowing all the advantages of the school on those whose means would not allow them to acquire such an education as their talents merited. Beside many others he thus aided, he was for a long time in the habit of educating without charge, one of the graduates from each of the public schools for girls in Boston, leaving it to the masters to select the most deserving. An incalculable amount of good was thus done, and so kindly and delicately that none but the recipients knew the fact.

All the arrangements of the school were on the most liberal scale. The rooms, particularly those at Phillips Place and the Masonic Temple, were spacious, and conveniently, not to say elegantly, furnished. It will be remembered that these points were not considered so important thirty years since, as at the present day; and Mr. Bailey may almost be regarded as much a pioneer in this respect, as in his views of female education. The convenient desks, the handsome cases filled with works of reference and of literature, the cabinets of shells and minerals, the extensive and valuable apparatus, most of it imported from Europe at great cost, were new features in most school-rooms of the day, and added not a little to the interest of the scholars. Then too, if there were a spot for flowers to grow, it was soon covered with bright and blooming plants, for he was not only enthusiastic in his love for flowers, but was a successful cultivator of them. While every species of innocent amusement was not only allowed, but encouraged at the hour of recess; that once over, the most perfect order was enjoined and expected.

Justice can hardly be done at this late day, to the various excellencies of the school; to the order and precision combined with a rare spirit and enthusiasm; to the thoroughness in every department, united with a wide spread culture, and acquaintance with general literature. The course of instruction was liberal, embracing the ancient and modern languages, and the exact sciences, and *never* neglecting the common English branches. To carry out these objects, the best teachers of modern languages and modern accomplishments were obtained that could be procured, and in most cases their instructions were given in classes, that met after the regular exercises of the school had closed. Besides these, an experienced and accomplished preceptress, and an excellent corps of teachers trained under his own eye, were constantly employed. The aims and scope of the school may be inferred from his own words, in his annual catalogue. "I regard the discipline of the mind and the acquisition of knowledge as the two ends of education. The principal object in a well-regulated school, should not be to teach the pupils a *great many* things, though this should not be neglected. But it should be to call into exercise the various intellectual powers, and to establish such habits of thought, as shall lead the learner to regard the work of education as only *begun*, when the days of school-discipline are finished." How well this idea was carried out, let those testify who still are reaping its benefits. Another prominent object of the school, was to fit young ladies for teachers; indeed, he often recommended teaching for a few months as a proper finale, to those who were about to finish their school course. The young ladies, educated by Mr. Bailey, were eagerly sought for as teachers in academies, &c., at the North, and as governesses at the South. His correspondence on this one point is of no inconsiderable amount, and he probably furnished hundreds of young ladies with situations as teachers. These still sought his advice, told him the difficulties of their new position, and losing him as a teacher, yet retained him as a faithful and valued friend.

Visitors from every quarter were attracted to the school, though there was never any public exhibition or display of any kind. Other teachers often came, who noted down all the minutiæ of plan and execution, and strove to catch the spirit of the place. To such, Mr. Bailey always freely gave his advice and aid, even when sought by those who were about establishing similar schools in the same city, for he was far above the petty rivalry of little minds, and was generous in his friendship. Perhaps the secret of *his* success lay in the unbounded influence which he possessed over his scholars, and in the *animus* which fired the whole school. The master's eye was felt to be on each one of the whole number, and the utmost thoroughness and precision attended each movement of the complicated machinery. How was this accomplished? By a very simple method apparently. While the First Class in any particular branch, was under his especial charge, and each of the other classes had its appointed teacher, often when least expected, he came into one of the subordinate classes, and there would be an exchange of teachers. Woe then to the delinquent class, and the delinquent scholar! In tears and trembling, they hear their sentence to review the whole ground again, or are sent into a lower class. But if they do *well*. how precious is the smile and word of praise which they win! Never did he fail, in spite of cunningly devised plots and sly manœuvres, to appear before the class in Cæsar, as a guide over the *pons asinorum!* If they stumbled or halted, they were compelled to retrace their steps to the beginning of the journey, and so gather strength for the conflict!

The system of reviews was very comprehensive and thorough. Every book that was gone through with by a class, was reviewed to him; she who could satisfactorily recite the long lessons assigned, could take another book; otherwise must go over the same ground with the next class. The Latin Grammar in particular was studied with almost unequaled thoroughness, and, in fact was never abandoned, while the study of Latin was continued. Every lesson and exercise was carefully marked, and merits were deducted for tardiness and misconduct. At the close of the term, a balance was struck; she who had the greatest number of merits, took the "first rank," and so on through the whole school. There was an immense amount of competition for these honors; and as extra merits could be obtained for extra exercises, the contest sometimes became not only exciting, but almost injurious to health and strength. There was no *prize* held out to these competitors, some of the "little girls" to be sure, wore medals while at the head of their classes, but *these* victors, like those in the Olympic games, contended for the honor of the victory alone.

The reputation which the Young Ladies' High School enjoyed for excellence in *reading*, and in compositions, may excuse a somewhat extended account of the means employed to bring about this proficiency. Perhaps the shortest explanation may be to say, that these classes were under Mr. Bailey's personal supervision, and thus put forth every effort to meet his expectations. Arranged solely in reference to these two branches, without regard to any other, the poorest scholar in other respects, felt that *here* she might achieve a success. The reading was always in presence of the whole school, who were required to give their attention to it, and often to vote on the promotion of those they thought worthy of advancement. The reading was remarkably distinct and natural, and free from every thing like "mouthing" or affectation. Original compositions were required weekly, from each scholar, who was usually allowed to select her own subject. These compositions were most carefully corrected and criticised; and when one appeared of unusual excellence, it was "recorded," that is, copied into a book kept for that purpose, and the writer, if in a lower class, was at once promoted to the first class. Thirty large quarto volumes were thus filled with essays, tales, poems, and even dramas, many of which were of high order. Three of the best readers in the school were selected by ballot, to read these compositions, and this exercise weekly attracted a large and intelligent audience, drawn not from curiosity alone, but by the interest of the pieces, and by the excellence of the reading.

Perhaps the eyes of some may rest upon this page to whom this sketch, imperfect as it is, presents no vague abstraction. *They* can recall the kindling eye and glowing cheek of these youthful aspirants for knowledge; *they* can tell of the untiring interest which never flagged in ascending her rugged steeps. No teacher ever held more absolute control over the hearts of his scholars, or ever had more entire confidence reposed in him, which was constantly manifesting itself in various ways. From the many expressions of love and friendship which he received from time to time, the conclusion of the farewell address of his pupils on his giving up the charge of the Young Ladies' High School, is selected as showing how they regarded him.

"We are grieved that you deprive us of the advantage of your instruction. We are disappointed that you leave the sphere which has seemed so peculiarly your own. We should better love to see you continue to occupy the station for which you are so admirably qualified. We are sure that many, many voices from abroad will echo our sentiments; that many amongst your former pupils, who have witnessed your faithful exertions in the cause of intellectual advancement, observe with feelings of regret, your abdication of the seat where you have so long remained, surrounded by pleasant associations and grateful remembrances.

You go from us—how shall the mind know its home, when the genius that identified it, has departed! We *can not* forget you; but where *you* go, you will not be reminded of us by everything about you. May we ask you then to take this simple piece of plate, that the sight of it may bring before your mind's eye, those whom you now leave, whose kindest wishes for your happiness, whose deepest interest in your prosperity, will ever be with you."

While Mr. Bailey's time and thoughts were chiefly occupied by the duties of his profession, yet he was by no means, the mere pedagogue. His mind was comprehensive and far-reaching in its aims; his industry, untiring; and his public spirit led him to accept many positions which were no sinecures. In 1830, he was one of a committee to draft the constitution for the permanent organization of the American Institute of Instruction;* and he held various offices in that body, which involved a large amount of labor and correspondence. He was also appointed on committees to publish volumes of the Lectures delivered before the Institute, and to arrange the programmes of the meetings when held in Boston—which duties must have encroached considerably on his time. He was a member of the City Council of

* See Barnard's "*American Journal of Education*," Vol. II., p. 24.

Boston for several years; and was also a Director of the House of Reformation, in which institution he always manifested a deep interest, and to promote the welfare of which, he labored faithfully and judiciously for many years.

His literary productions during this period were important, and involved much time and labor. He was a frequent and welcome contributor to the columns of the "*Courier*," then edited by his friend Mr. Buckingham, and to several other papers and periodicals. He was often called upon to deliver lectures before lyceums, and indeed was president of the Boston Lyceum and one of the directors of the Boston Mechanics' Institution. Several unfinished works on Geometry, Astronomy and other scientific subjects, and copious Note-books, attest his industry. Besides these, he compiled in 1831, an excellent selection of reading lessons, well known for many years, as "*The Young Ladies' Class Book*." This was followed by "*Bakewell's Philosophical Conversations*," an English treatise on Philosophy, written in a familiar style, which he revised, and adapted for use in American schools. But the work which most bears his peculiar stamp as author, and by which he is best known, is "*Bailey's Algebra*," published first in 1833, and designed especially for the use of young ladies—though it has also been extensively used as a text-book for boys. It was the first work on the science that pretended to be adapted to the wants of beginners, and its popularity was such, that it continued to be used in spite of the numerous and more modern treatises that were constantly issued from the press. So much so that its publishers have recently had it thoroughly revised and enlarged, in order to adapt it more fully to the wants of schools of the present day.

It will be asked, "How was Mr. Bailey able to accomplish so much?" By simple, unremitting industry, and method in all his operations. He rose very early, sometimes at three and often at four o'clock, and studied before breakfast. Though very hospitable, he did not mingle much in general society. His pleasures were simple; to cultivate his little garden, bowl for a few hours with some of his chosen friends, take a ride with his family in the beautiful environs of Boston, these he enjoyed keenly, and entered into with all his heart. His health was almost uniformly good; he was never troubled with dyspepsia and headache, these banes of the school-room. And when even *his* strength and power of endurance flagged at the end of the year's work, a run into the country in the summer vacation, or a few weeks' gunning on the marshes of Cape Cod, would soon restore his wonted vigor. His massive frame, and uncommon stature, together with his somewhat peculiar style of dress, would at once cause him to be singled out in a crowd. His features were decided and strongly marked, and denoted power and force of character; while his eye was expressive of a kind and tender nature. A hard worker while he worked, no one enjoyed more the hour of leisure, a pleasant talk with his friends, or a merry romp with his children.

Thus happily and usefully the busy years fled on. Blessed with health and prosperity, almost idolized by his scholars, surrounded by a circle of true and noble hearted friends, men and women of talent and refinement, happy in his family and home—his cup of earthly blessings seemed indeed to be full and running over. But a change was near at hand; misfortune overtook him suddenly, and from every quarter; so that to use his own expressive words, it needed not the assurance of Holy Writ to convince him, "that man is born unto trouble, as the sparks fly upward."

The crisis of 1837 is doubtless well remembered. Mr. Bailey suffered heavy losses in the general panic and pressure from the failure of those who owed him, to meet their engagements, and from the withdrawal of patronage from his school. At the same time, he was deprived of the income of his books, through the failure of his publishers. His current expenses had always been great; for he had always spent freely so long as he had means, and had been generous almost to a fault; and the crash found him with his resources crippled, and totally unprepared to meet the storm.

In this emergency he acted promptly and decidedly. He at once broke up his establishment in Boston, disposing of every superfluous article, including even the greater part of his large and valuable library, and determined to relinquish his connection with the Young Ladies' High School, and to open a private school for boys in the country. But his troubles had not reached their climax. The gentleman who purchased the good-will and fixtures of the school, died suddenly of brain fever, after the papers had been signed and before the first payment was made, leaving his estate utterly insolvent. Mr. Bailey was almost ruined by this event; yet he was not crushed by it, as a weaker nature might have been. His warmest sympathy as a man and a Christian was at once excited for the family thus suddenly rendered desolate; and he endeavored as much as possible to arrange matters for their benefit, and was never heard to utter a word of reproach in reference to the whole matter.

Having settled up his affairs as well as possible, Mr. Bailey opened his school for boys in the following summer at Roxbury, feeling that he was indeed a poor man and had the world to begin over again, but going to work with a brave heart and a cheerful spirit. The school was intended to be select and of a high character, and the number was limited to twenty, all of whom were engaged to enter at the time of his death. Should this sketch come to the notice of any of those who then had the privilege of being his pupils, they will readily recall the delightful relations subsisting between him and them. At once friend and teacher, they not only sought his counsel in their studies, but in all their sports and amusements. No expedition was quite complete without his presence. They loved him as a father, and their grief at his death was deep and uncontrollable.

In the spring of 1839, he removed to Lynn, and rented the estate, then known as "Lynn Mineral Spring"—but now as the elegant seat of Hon. Richard Fay—"Linmere." In this charming spot, he seemed to breathe a freer life and air. The wild and romantic scenery on the shores of that beautiful pond, might well satisfy the most ardent lover of nature, while his tasteful hand found abundant and pleasing occupation in arranging the grounds, and bringing order out of confusion. Never had he seemed so perfectly happy, never did life seem to open such noble aims. He was content to live simply and to work hard, that he might thus be enabled to discharge every obligation he had incurred; and a long, happy, and useful career seemed opening bright before him. But the end was drawing nigh.

One sultry afternoon in mid-summer—Friday, July 26th,—coming hastily into the house, he stepped on a large nail with such force, that it ran its whole length through his boot into his foot. Entering the house, he drew it out with some effort, and handing it to his wife, said, "lay that away, there may be a sad tale to tell of it." It is a little singular that he had always had a peculiar dread, almost an instinctive horror of the lock-jaw. With this feeling, no time was lost in applying the proper remedies, and in consulting the best medical advice at hand. He also consulted Dr. Hayward of Boston, formerly his family physician, and nothing that could be done, was neglected; though after a few days, the pain and inflammation had so much subsided, that it was hoped by his family that their apprehensions of danger were groundless.

On Saturday, the ninth day after the accident, the summer vacation commenced, and most of his scholars departed for home. He took leave of them pleasantly and cheerfully, giving each a kind word, and then sat at his desk the rest of the morning busily engaged in writing. It was afterwards found that he was occupied in arranging his papers, and leaving directions for the guidance of his family in case of his death. At dinner he appeared composed and calm and cheerful as usual, but it was noticed he did not eat. To the anxious inquiry as to the cause, he acknowledged, slowly and reluctantly, as if unwilling to give pain, that he *did* have "a sort of tightness about his jaws, but perhaps it was only fancy." Who can picture the horror and dismay of that moment? A physician was immediately sent for, and powerful remedies applied. The hope was still cherished that he might escape, but in the night, he was seized with severe pain and stricture across his chest, and much against his will, his wife insisted on rousing the family and again sending for Dr. Peirson of Salem. He insisted on dressing and coming down stairs, "it seemed too much like being sick to stay up stairs." Almost always in vigorous health, he hardly knew the meaning of the word *sick;* and now as he sat conversing on various interesting subjects, more thoughtful of others than of himself, it was hard for those around, to realize his danger; but *he* did fully and completely. In the same composed way he met his physician, apologizing for the trouble he had put him to, in calling him up at midnight. It was afterwards told how calmly he had inquired into the probable effect of an amputation, and how with equal calmness he received the answer, "Too late." At three o'clock Sunday morning, only twenty-four hours before his death, he walked slowly up stairs with the assistance of his cane—never, alas! to descend alive.

The next day was a bright and beautiful Sabbath. Gay flowers were blooming, and sweet birds were singing, each noted in turn by the sick man. Powerful opiates had been administered to relieve the pain, but in vain. He was able, however, to swallow liquids through the day; though when one of his little children anxiously asked him if his jaws had locked any more, he seemed to brace himself up and nerve himself to answer, "I think they are; it comes on slow but very sure." The most skillful physicians were summoned; anxious friends and relatives gathered to the house of sorrow. To each, in the intervals of the paroxysms of pain which grew more and more severe, he addressed a kindly word, sending flowers to one, and messages of affection to another. In the presence of his family he was calm, but in their absence, his anxiety for their fate, thus left alone in the world, was uncontrollable—"Oh God!" he cried, "what *will* become of my poor wife and children?"

And so the weary day wore on. As the sun set, he seemed drowsy, it was difficult to rouse him to take his medicine. It was but the precursor of the last, long sleep. The disease mercifully went to the brain rather than to the spine, as had been feared, and there the strong man lay in an unconscious stupor, breathing out his rich life in deep groans of agony. That ear which had ever been open to the voice of suffering, was now deaf to the cries and entreaties of his loved ones to give them one last word, one last sign. The life was slowly ebbing from the stout, loving heart,—

> "And when the sun in all his state,
> Illumed the eastern skies;
> He passed through Glory's Morning gate,
> And walked in Paradise."

Of Mr. Bailey's character as a man and as a teacher, others will be allowed to speak. As a husband and a father, who can tell his worth? To that family of five young children, the memory of their dead father, of his wishes and hopes, of his words and instruction—has been as fresh and binding, and more sacred than that of many a living parent. And in all the blessings of their after life, they have ever felt that their richest inheritance has been to call themselves *his* children. His wife too, having lost the strong arm she had hitherto leaned upon, nobly discharged the double duty now devolving on her, and bent every energy and devoted all her strength to the task of rearing these children, as he would have them reared.

His friends were deeply stirred by his death. During his long residence in Boston, his uniform courtesy and dignity of bearing, and his kind and unaffected regard for the welfare of others, had won him many friends, from every walk in life. After the first shock of grief, these true friends began to inquire into the best way of showing their love and regard for the memory of him who was gone. And they most liberally and wisely decided to subscribe a sufficient sum to free the copy-rights of the books which he had published, from the encumbrances upon them, and thus secure a sure provision for the education of his children.

Those who so long had sat under his watch-care and instruction, heard of his sudden and most unlooked for death with sorrow and dismay. But one voice went up from among them, that of anguish, mingled with sympathy. The following lines, being a portion of a poem on his death by one of his pupils, may not be inappropriate or unacceptable;—

> "Not I alone deplore thy hapless fate,
> Thou good and gifted, generous and great!
> She, that sad mourner by thy silent bier,
> Shedding in speechless grief, the frequent tear;
> And they, whose names dwelt latest on thy tongue,
> O'er whom a father's shield of love was flung,—
> Their depth of woe His might alone can scan
> Whose eye beams love, whose voice "speaks peace" to man.

Rest thee in peace! thou tired and trusty friend!
Shall we in hopeless grief around thee bend?
Oft have thy smiles the sorrowing heart made glad,
Thy presence cheered the doubting and the sad.
In many a heart thy monument is reared,
Whose grateful thoughts record thy name revered,
Each princely deed though done in secrecy,
Shall rise to heaven, and thy memorial be.
Thy soul shall enter its immortal rest,—
Home of the weary—guerdon of the blest!"

Many obituary notices appeared in the papers of the day, from which the following is selected from the "*Salem Gazette*," August 13th, 1839. *What* friend wrote it, is not known to his family.

"So many tender and affecting recollections crowd upon the mind, in contemplating the sudden close of a life of such varied usefulness and excellence, that words utterly fail to express the overwhelming grief which has been brought into his own family, the deep sorrow which will be felt by so many other families of which he was the honored and beloved friend, or the strong feeling of sadness and sympathy which his death will occasion in the community of which he was so long a valued citizen.

Of Mr. Bailey's scientific and literary attainments—of his high reputation as an instructor, of the untiring industry which led him to occupy the intervals of responsible and exhausting professional duty in the preparation of many valuable works in science and literature, of the energy and fidelity with which for several years he discharged the duties of a member of the city government of Boston, of his *various* usefulness in his relations to society, we have not time or inclination now to speak. They are well known to that community of which he was so long a member.

But it is of the virtues of his heart, it is of the qualities that make the true man, which he so eminently possessed, on which we would for a moment, dwell.

Mr. Bailey had a noble soul, a soul which disdained everything mean and base, and which had an instinctive admiration for everything elevated and excellent. He had a strong love of honesty and truth. Sincerity and frankness characterized his whole intercourse with others. He carried his heart in his hand. He was not willing that anybody should take him for better or wiser than he actually was. He possessed an ardent temperament, but it was united with a spirit of feminine gentleness. He entered with zeal and animation into every scheme for the benefit of his fellow men, but he never gave way to any popular impulse, or thought any plan or project a useful one simply because it happened to be fashionable. His constitutional ardor, his benevolent feelings, his gentle temper, united with his vivacity and playful wit, rendered him the delight of the social circle. Benignity sat upon his countenance. He was liberal, almost to a fault. He never thought of himself, when he could serve another by self-forgetfulness or self-denial. He professed a firm belief in Unitarian Christianity, and his practice attested the sincerity of his profession. What he was, in short, as a husband, a father, a brother, and a friend, those best can tell, who feel that their loss in these relations, is irreparable.

This may seem excessive eulogium to those who did not know the man. But it is the heart-felt tribute of one who was the friend of his youth, and who has watched with the interest of a friend, his onward career of goodness and usefulness. Its fidelity will be attested by the voice of that community of which he was a citizen, and by the thousands of young hearts who will tearfully acknowledge that they owe to him their highest intellectual attainments and the development of the best principles and feelings that make up their character."

We are happy to be able to close this too imperfect sketch of so useful a life, by the testimony of three of his near and dear friends, each of whom was situated in circumstances peculiarly favorable, for forming a correct estimate of his character as seen from different stand-points.

The first is from his pastor and beloved friend, the Rev. John Pierpont; who knew him long and well, under every varying circumstance of life. He writes as follows, under the date of August 14th, 1859.

"When I say that Mr. Bailey was a member of my family six or seven years; that in all that time, he had his seat at the table next to me, on my right hand; that I thus "wintered him and summered him;" that for a part, at least, of that time, some of my children were under his instruction; and that I was a member of the School Committee all the time he was in the service of the city, first as master of the Franklin School, and afterwards as the first and only principal of the High School for girls, it may well be supposed that I had opportunities of acquiring some knowledge of his character.

The routine of a public teacher's professional duties, presents but few salient points for his biographer. Yet I think that there is no vocation in society that affords a more trying field of labor, or a better one for gaining a knowledge of human nature, or for the improvement of the whole character of the individual, than that of a teacher of a large common school. And, taking into view his fidelity to his trust, his full acquaintance with the matters to be taught, his *entire self-control* under exciting circumstances, his perfect impartiality in the administration of law, the facility, and the wonderful felicity with which he secured the attachment and unqualified confidence of his pupils, the invincible patience with which he treated either willfulness or dullness in the objects of his care; the wisdom with which he adjusted discipline to character, when discipline must be administered, in one word, when I consider *all* the qualities that go to the making up of the perfect teacher, I think that Ebenezer Bailey was the *nearest* perfect teacher that I have ever known. More exciting to me than to witness a trial of two generous steeds, with all the blood of all the Morgans in their veins, was it to see, as I have seen, in the High School for girls, even in moments of "recess," two of those girls of fourteen or fifteen years of age, stand up side by side, before the great blackboard, and "merely for the fun of it," with the same algebraical problem in hand, race "neck and neck" down the board, to see which should reach the answer first! No one, I think, could witness that spectacle "in play-time" without coming to the conclusion that the *genius loci*—the spirit that presided over that school, was not one that haunted *every* academic grove.

And what was the consequence? So popular did that school become, so strongly had it taken hold of the affections of the people while yet in its infancy, such a perfect *furore* had it excited at the time when the first class that entered it was to take leave of it, that, as was supposed, the jealousy of the aristocracy of the city was awakened—"*tantane animis cœlestibus ira!*"—the knowledge that, at the public expense, the daughters of plebeians could secure a higher education than those of the patricians could, at whatever cost, was fatal to the school itself. *One* High School for girls could not contain all that were eager to press into it. Even could ten Master Baileys be found, *ten* High Schools would not be sustained by those by whom the public burdens were principally borne, and because not *enough* could be done in this line, to meet the public demand, it was determined to do nothing at all! The school was discontinued. The enterprise of a High School for girls in Boston became a *failure* by reason of its triumphant success!

I never recall the image of Mr. Bailey, but with a melancholy pleasure. Like Ossian's "memory of joys that are past," the thought of him is always pleasant, but mournful to the soul. In all the years during which we sat side by side at my table, I never saw in him a *little* thing. Large, generous, manly, in all his views and ways, he always commanded my respect for him as a man, and my affection for him as a friend. During all that time, I think I may say with literal truth, never an unkind word passed between him and any one member of my family. He had a merry wit and knew how to give and take a "joke," but never gave or took offense. We all loved him. We loved him after he left our family, and began to build up his own. We all felt, and deeply deplored his too early death. "Too early?"—No. He "who doeth all things well" never sends his angel, Death, to call any one of his children home *too early*. 'The righteous perisheth, and no man layeth it to heart; and merciful men are taken away, none considering that the righteous are taken away from the evil to come.'"

The following is from a lady, for several years associated with Mr. Bailey in the Young Ladies' High School, of rare talents, and known on both sides of the Atlantic for her philanthropic labors, and her literary efforts. Educated in England, and spending a great portion of her subsequent life on the continent, her views possess a double value, as being the conclusions of a large and liberal mind, and as also showing the strong and lasting influence exerted by Mr. Bailey over those with whom he was once brought in contact. Writing under the date of September 1st, 1859, she says:—

"My mind is profoundly stirred by the information that a memoir of Mr. Bailey is about being prepared. No one will read it with a deeper interest than myself, for no one more truly appreciated his educational influence, or has been more greatly benefited by it. That wonderfully influential faculty was in him a thing apart and unlike any power of the kind I ever saw in another. It combined all the qualifications that go to make up the high military genius. It was at once exact and enthusiastic; scientific and imaginative. Without ever having pronounced the words, 'Woman's Rights.'—*he* laid the foundations of the broadest and truest woman's rights, for New England. The contest he maintained with the mayor of Boston, in behalf of the daughters of Boston, and the manner in which he asserted their right to a high public instruction, did a work which will never die out in New England, but which will be communicated with unceasing power from age to age.

I remember many of his judgments given in the spirit of an observer of the nicest qualifications both philosophical and physiological, and in the happiest popular manner. It was always his way to *settle* a question, rather than *debate* it. Of the comparative powers of girls and boys as students, of which he was so amply qualified to judge by his great experience in teaching both, he said, 'girls beat boys of the same age, at the same literary and mathematical studies, but they *cry* over them more." This remark covers the whole ground of difference of organization.

I should never be weary of telling of his unequaled method, by which, as a general reviewing and employing an army, he could deal with hundreds like one—of his inspiring sympathy, of his skill in imparting instruction, of his bounty in gratuitously bestowing it on the deserving. *He* knew of no infantine or feminine road to learning, any more than a royal one; and that unconsciousness has been a blessing to thousands of the New England youth of both sexes, whom he knew how to stimulate and inspire with his own profound sense of realities, and hatred of pretence, cant, and sentimentalism.

May the time soon come, when such men may look to the presidency of Harvard, Yale, and other kindred institutions, as the natural reward of their educational labors and the natural field for ever-renewed exertions. Happy indeed, would be that literary institution, that could secure the services of such a man as EBENEZER BAILEY!"

We will conclude with the letter before alluded to, of his brother-in-law, the Hon. Allen W. Dodge. This letter is dated March 27th, 1861, and will be especially appreciated by those who know Mr. Dodge's cool, clear judgment and keenness of discernment. The analysis which he gives of Mr. Bailey's character and mental habits, is peculiarly valuable, and will be acknowledged by his friends to be a tribute to his memory no less just, than grateful.

"My first acquaintance with the late Ebenezer Bailey, commenced somewhere about the year 1820, when he was teaching in Newburyport. His success here was very flattering, and he soon received an appointment as head-master of the Franklin Grammar School, Boston. He at once entered on his duties in this new position, and taught there with great and increasing success for several years. Afterwards he was appointed principal of the High School for girls in that city, an institution that owed its establishment mainly to his advocacy of it in the journals of the day.

Under his management, the experiment—for it was the first attempt of the kind in New England—became a success, and the daughters of the humblest citizen here received at the public expense, an education as thorough and as valuable, as could otherwise be obtained only at great cost, and by a favored few. But this did not avail to save the school from an untimely end; indeed it was perhaps the chief cause of its destruction. Mr. Bailey always maintained that this was accomplished by the influence of Josiah Quincy

Sen., who was then mayor of Boston, and publicly proclaimed this conviction in a pamphlet of marked ability, in which he sharply reviewed mayor Quincy's proceedings.

On resigning his position as head master of the High School for girls, he immediately opened a private school for young ladies in Boston. To rehearse the history of the 'Young Ladies' High School,' would be to tell the early history of many of the finest minds that have graced our New England homes or adorned her literature, for the last quarter of a century. But in schools as in every thing else, 'the fashion thereof passeth away,' and this circumstance, together with the general stagnation of business during the great panic of 1837, led him to quit the scene of his greenest laurels, and of so many pleasant associations, and to open a home boarding school for boys in a retired and romantic spot, then known as the 'Mineral Spring,' in Lynn, Massachusetts.

The chief cause of this great change of life in Mr. Bailey, was the pecuniary embarrassments that had now overtaken him. His school had been carried on in a style regardless of expense; the best teachers, the best equipments, the best of every thing needed for its success, were always procured, if possible. His own style of living too, had been on the most liberal scale; for one of his means, he lived like a prince, not, however, for his own selfish enjoyment. Large and extravagant entertainments were positively distasteful to him, but his every-day hospitality was unbounded. His house, his table, his books, and his purse were always open to his friends, and no man had warmer or truer friends. So, finding himself unable to keep up the expense of a city home according to his ideal, he withdrew to the simpler life of the country.

Hardly, however, had his new career opened before him, when he was suddenly stricken down with that dreadful disease, the lock-jaw. I was with him during the last sad days of his life. He knew the peril he was in and took all known precautions, under the best of medical advice and skill, to escape it. But all in vain—the strong man bowed before the fell destroyer. During the intervals of paroxysms of pain, he was calm, resigned, and even cheerful. On observing to him the mysterious nature of his disease, a mere incision of the nerves by a nail—and the whole system deranged, 'I was just thinking' he replied, 'of those beautiful lines of Dr. Watts,'

> 'Strange that a harp of a thousand strings,
> Should keep in tune so long!'

He then spoke of his approaching death with the same calmness—

spoke of it, and of his happy family so soon to be bereaved. Never was a tenderer husband and father, and to leave his wife with shattered health, those five little children needing more than a mother's care—*this* was the bitterest drop in his cup of agony—which absorbed all the rest. On assuring him that I would endeavor to be to them a father and a protector, he grasped me firmly by the hand saying, 'Then I can die in peace.' And so this friend of his race, this man of letters and of wisdom, this illustrious teacher of the youth of his time, passed away from earth; but the good that he did, lives after him, and will yet live through many generations.

To me his memory is as fresh as if were but yesterday he was here. His noble form, his commanding stature, his broad, manly chest; his strongly marked features, seem yet present before me. I hear his sonorous voice, his well-articulated words, his cheerful and contagious laugh, so hearty and spirit-stirring. I listen to the anecdote he relates with such spirit and interest to illustrate some point in our conversation. I hear his clear and simple explanation of some scientific fact or law of nature. For the study of these, he had a great passion. Astronomy, chemistry, botany and the natural sciences generally, were known to him, not as a dry series of names and formulas, but as practical truths to be applied to every day life.

As a scholar his learning was varied, extensive and thorough. Always a *student*, he scorned to pretend to knowledge which he did not possess. Least of all did he make a parade of his learning. In pure mathematics he was eminently an adept. As a poet, he held no mean rank, even in New England. His ear was quick to detect an error of rhythm, or a word mispronounced. His sense of grammatical construction was as unerring as an instinct. Indeed, if he had one favorite study more than another, it was philology. His library possessed a rare and valuable collection of standard authorities on the use of language; and his critical eye and taste filled the margins of the books he read with notes and queries. His literary taste was nice and discriminating, cultivated by long and patient discipline, and remarkably free from all capriciousness. His style of writing was clear and simple, yet always fresh and vigorous; and had he devoted himself to literature, he would have been as widely known as an author, as he now is as a teacher. In this respect, I can not speak of his character from personal knowledge. The illustrations of his success are to be found in the hundreds of young persons educated by him, and living witnesses of his power over the mind and the heart. I am persuaded that not one of these would fail to bear testimony to his faithful, devoted, and enthusiastic endeavors to promote their growth in knowledge and in virtue.

But it is as a man and a friend, as a companion in social intercourse, that I would essay to present him to the teachers of the present day. I knew him intimately for twenty years; most of that time I was with him more or less, and for the remainder was in frequent correspondence with him. I never knew a man so uniformly cheerful, often under the most trying circumstances, so kind and attentive to the feelings and the happiness of others. Full of interesting knowledge, with a never-failing vein of wit and vivacity, he at once charmed and instructed. And he was ever ready himself to listen to others, and be instructed by them in turn. He never carried the *schoolmaster* into the private walks of life, but entered warmly and appreciatingly into the topics of the day, and imparted fresh interest to their discussion. So genial his disposition—so open-hearted and free from deceit—he was the very soul of honor and honesty in his dealings with others. He commanded their respect, and enjoyed their confidence, while he received their most devoted and heart-felt affection. In all my intercourse with him, I never knew him to give way to unbecoming anger, or to utter a judgment of others, that he would wish unsaid. He was deliberate in his words and acts to a remarkable degree. His temper, though warm, was under the most perfect control, even in the most trying circumstances. He was tolerant of the religious and political views of others, however much they might differ from his own. While a firm believer himself in the liberal views of Christianity, he held in high esteem the members of all other denominations, and in return received their confidence and support. No man had a deeper respect for the Bible than he, or had more thoroughly read and studied its sacred pages.

But I must close this brief sketch, hardly drawn perhaps with sufficient distinctness to mark the individuality of one with whom I took sweet counsel in the earlier part of my life, and the fragrance of whose memory has followed me along its subsequent pathway, and will continue with me to its end."

V. REMARKS

OF

DR. WILLIAM E. CHANNING ON EDUCATION AND TEACHERS.

In 1833, Dr. Channing brought the aid of his personal influence and powerful pen, to the service of the teacher. In an article in the Christian Examiner, for November, 1833, written for the express purpose of commending the Annals of Education, and the great subject to which it was devoted, under the editorial charge of William C. Woodbridge, to the attention of the best class of minds in the community, the following views are presented as to the importance of institutions for the education of teachers, and the true nature and dignity of the office:

"We are not aware that in this country a single school for teachers is supported at the public expense. How much would be gained, if every state should send one of its most distinguished citizens to examine the modes of teaching at home and in Europe, and should then place him at the head of a seminary for the formation of teachers."

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"There is no office higher than that of a teacher of youth; for there is nothing on earth so precious as the mind, soul, character of the child. No office should be regarded with greater respect. The first minds in the community should be encouraged to assume it. Parents should do all but impoverish themselves, to induce such to become the guardians and guides of their children. To this good, all their show and luxury should be sacrificed. Here they should be lavish, whilst they straiten themselves in every thing else. They should wear the cheapest clothes, live on the plainest food, if they can in no other way secure to their families the best instruction. They should have no anxiety to accumulate property for their children, provided they can place them under influences which will awaken their faculties, inspire them with pure and high principles, and fit them to bear a manly, useful, and honorable part in the world. No language can express the cruelty or folly of that economy, which, to leave a fortune to a child, starves his intellect, impoverishes his heart."

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"We know not how society can be aided more than by the formation of a body of wise and efficient educators. We know not any class which would contribute so much to the stability of the state, and to domestic happiness. Much as we respect the ministry of the gospel, we believe that it must yield in importance to the office of training the young. In truth, the ministry now accomplishes little, for want of that early intellectual and moral discipline, by which alone a community can be prepared to distinguish truth from falsehood, to comprehend the instructions of the pulpit, to receive higher and broader views of duty, and to apply general principles to the diversified details of life. A body of cultivated men, devoted, with their whole hearts, to the improvement of education, and to the most effectual training of the young, would work a fundamental revolution in society. They would leaven the community with just principles."

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"We maintain that higher ability is required for the office of an educator of the young, than for that of a statesman. The highest ability is that which penetrates farthest into human nature, comprehends the mind in all its capacities, traces out the laws of thought and moral action, understands the perfection of human nature, and how it may be approached, understands the springs, motives, applications, by which the child is to be roused to the most vigorous and harmonious action of all its faculties, understands its perils, and knows how to blend and modify the influences which outward circumstances exert on the youthful mind. The speculations of statesmen are shallow, compared with these. It is the chief function of the statesman to watch over the outward interests of a people; that of the educator to quicken its soul. The statesman must study and manage the passions and prejudices of the community; the educator must study the essential, the deepest, the loftiest principles of human nature. The statesman works with coarse instruments for coarse ends; the educator is to work by the most refined influences on that delicate, ethereal essence—the immortal soul."

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"One great cause of the low estimation in which the teacher is now held, may be found in narrow views of education. The multitude think, that to educate a child, is to crowd into its mind a given amount of knowledge—to teach the mechanism of reading and writing—to load the memory with words—to prepare a boy for the routine of a trade. No wonder, then, that they think almost every body fit to teach. The true end of education, is to unfold and direct aright our whole nature. Its office is to call forth power of every kind—power of thought, affection, will, and outward action; power to observe, to reason, to judge, to contrive; power to adopt good ends firmly, and to pursue them efficiently; power to govern ourselves, and to influence others; power to gain and to spread happiness. Reading is but an instrument; education is to teach its best use. The intellect was created, not to receive passively a few words, dates, facts, but to be active for the acquisition of truth. Accordingly, education should labor to inspire a profound love of truth, and to teach the processes of investigation. A sound logic, by which we mean the science or art which instructs us in the laws of reasoning and evidence, in the true methods of inquiry, and in the sources of false judgments, is an essential part of a good education. And yet, how little is done to teach the right use of the intellect, in the common modes of training either rich or poor. As a general rule, the young are to be made, as far as possible, their own teachers—the discoverers of truth—the interpreters of nature—the framers of science. They are to be helped to help themselves. They should be taught to observe and study the world in which they live, to trace the connections of events, to rise from particular facts to general principles, and then to apply these in explaining new phenomena. Such is a rapid outline of the intellectual education, which, as far as possible, should be given to all human beings; and with this, moral education should go hand in hand. In proportion as the child gains knowledge, he should be taught how to use it well—how to turn it to the good of mankind. He should study the world as God's world, and as the sphere in which he is to form interesting connections with his fellow-creatures. A spirit of humanity should be breathed into him from all his studies. In teaching geography, the physical and moral condition, the wants, advantages, and striking peculiarities of different nations, and the relations of climate, seas, rivers, mountains, to their characters and pursuits, should be pointed out, so as to awaken an interest in man wherever he dwells. History should be constantly used to exercise the moral judgment of the young, to call forth sympathy with the fortunes of the human race, and to expose to indignation and abhorrence that selfish ambition, that passion for dominion, which has so long deluged the earth with blood and woe. And not only should the excitement of just moral feeling be proposed in every study. The science of morals should form an important part of every child's instruction. One branch of ethics should be particularly insisted on by the government. Every school, established by law, should be specially bound to teach the duties of the citizen to the state, to unfold the principles of free institutions, and to train the young to an enlightened patriotism. From these brief and imperfect views of the nature and ends of a wise education, we learn the dignity of the profession to which it is entrusted, and the importance of securing to it the best minds of the community."

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"We have said that it is the office of the teacher to call into vigorous action the mind of the child. He must do more. He must strive to create a thirst, an insatiable craving for knowledge, to give animation to study and make it a pleasure, and thus to communicate an impulse which will endure when the instructions of the

the school are closed. The mark of a good teacher is, not only that he produces great effort in his pupils, but that he dismisses them from his care, conscious of having only laid the foundation of knowledge, and anxious and resolved to improve themselves. One of the sure signs of the low state of instruction among us is, that the young, on leaving school, feel as if the work of intellectual culture were done, and give up steady, vigorous effort for higher truth and wider knowledge. Our daughters at sixteen, and our sons at eighteen or twenty, have *finished* their education. The true use of a school is, to enable and dispose the pupil to learn through life; and if so, who does not see that the office of teacher requires men of enlarged and liberal minds, and of winning manners—in other words, that it requires as cultivated men as can be found in society. If to drive and to drill were the chief duties of an instructor—if to force into the mind an amount of lifeless knowledge—to make the child a machine—to create a repugnance to books, to mental labor, to the acquisition of knowledge—were the great objects of the school-room, then the teacher might be chosen on the principles which now govern the school-committees in no small part of our country. Then the man who can read, write, cypher, and whip, and will exercise his gifts at the lowest price, deserves the precedence which he now too often enjoys. But if the human being be something more than a block or a brute—if he have powers which proclaim him a child of God, and which were given for noble action and perpetual progress, then a better order of things should begin among us, and truly enlightened men should be summoned to the work of education."

In an address delivered at the Odeon, in Boston, on the 28th of Feb., 1837, he thus advocates the establishment of an institution for the professional training of teachers:

"We need an institution for the formation of better teachers; and, until this step is taken, we can make no important progress. The most crying want in this commonwealth is the want of accomplished teachers. We boast of our schools; but our schools do comparatively little, for want of educated instructors. Without good teaching, a school is but a name. An institution for training men to train the young, would be a fountain of living waters, sending forth streams to refresh present and future ages. As yet, our legislators have denied to the poor and laboring classes this principal means of their elevation. We trust they will not always prove blind to the highest interest of the state.

We want better teachers, and more teachers, for all classes of society—for rich and poor, for children and adults. We want that the resources of the community should be directed to the procuring of better instructors, as its highest concern. One of the surest signs of the regeneration of society will be, the elevation of the art of teaching to the highest rank in the community. When a people shall learn that its greatest benefactors and most important members, are men devoted to the liberal instruction of all its classes—to the work of raising to life its buried intellect, it will have opened to itself the path of true glory. This truth is making its way. Socrates is now regarded as the greatest man in an age of great men. The name of *king* has grown dim before that of *apostle*. To teach, whether by word or action, is the highest function on earth.

Nothing is more needed, than that men of superior gifts, and of benevolent spirit, should devote themselves to the instruction of the less enlightened classes in the great end of life—in the dignity of their nature—in their rights and duties—in the history, laws, and institutions of their country—in the philosophy of their employments—in the laws, harmonies, and productions of outward nature, and, especially, in the art of bringing up children in health of body, and in vigor and purity of mind. We need a new profession or vocation, the object of which shall be to wake up the intellect in those spheres where it is now buried in habitual slumber.

We want a class of liberal-minded instructors, whose vocation it shall be, to place the views of the most enlightened minds within the reach of a more and more extensive portion of their fellow-creatures. The wealth of a community should flow out like water for the preparation and employment of such teachers—for enlisting powerful and generous minds in the work of giving impulse to their race.

Nor let it be said that men, able and disposed to carry on this work, must not be looked for in such a world as ours. Christianity, which has wrought so many miracles of beneficence—which has sent forth so many apostles and martyrs—so many Howards and Clarksons, can raise up laborers for this harvest also. Nothing is needed but a new pouring out of the spirit of Christian love—nothing but a new comprehension of the brotherhood of the human race, to call forth efforts which seem impossibilities in a self-seeking and self-indulging age."

From the outset, Dr. Channing exhibited great interest in the establishment of the Board of Education, and the permanent organization of the Normal Schools. In a letter addressed to Mr. Mann, in August, 1837, congratulating him and the commonwealth on his acceptance of the office of Secretary of the Board, he says:

"You could not find a nobler station. Government has no nobler one to give. You must allow me to labor under you according to my opportunities. If at any time I can aid you, you must let me know, and I shall be glad to converse with you always about your operations. When will the low, degrading party quarrels of the country cease, and the better minds come to think what can be done toward a substantial, generous improvement of the community? 'My ear is pained, my very soul is sick,' with the monotonous, yet furious clamors about currency, banks, &c., when the spiritual interests of the community seem hardly to be recognized as having any reality.

If we can but turn the wonderful energy of this people into a right channel, what a new heaven and earth must be realized among us! And I do not despair. Your willingness to consecrate yourself to this work, is a happy omen. You do not stand alone, or form a rare exception to the times. There must be many to be touched by the same truths which are stirring you."

A few months afterward, he attended, at Taunton, one of the series of county conventions, which Mr. Mann held, in pursuance of the plan of the Board, to attract attention to the improvement of common schools, and took part in the proceedings by submitting and advocating a resolution affirming the immediate and pressing necessity of public and legislative action in behalf of common education. We make a few extracts from a newspaper report:

"We are told that this or that man should have an extensive education; but, that another, who occupies a lower place in society, needs only a narrow one: that the governor of a state requires a thorough education, while the humble mechanic has need only to study his last and his leather. But why should not the latter, though pursuing an humble occupation, be permitted to open his eyes on the lights of knowledge? Has he not a soul of as great capacity as the former? Is he not sustaining the same relations as a parent, a citizen, a neighbor, and as a subject of God's moral government? To educate a child is, in fact, a greater work than to perform the duties of a governor. What is it? It is to take the direction of mind, to cultivate the powers of thought, and to teach the duties which we owe to God and to our neighbor. Can a parent teach his child these duties, unless he has learned them himself? Every one, no matter what is his occupation or place, needs an education, in order that he may have the proper use of his powers, and be enabled to improve them through life.

Some say, were these views of education to prevail, there would be little or no work done—manual labor would fail. But for the purpose of working effectually, one should be intelligent; he will bring the more to pass, because he labors for some known object, and is stimulated by motives which he understands and feels.

We want worthy laborers, who exalt themselves while they benefit others. The circumstances in which they are placed, are fitted to call forth their mental powers, to awaken thought, and to impress them with their responsibilities. They are brought into intimate connection with their fellow-men, and, if qualified by education, may exert over them, even in the humble walks of life, a most salutary influence.

He said, that, on the same principle that he would educate one, he would educate all. The poor man, as to his natural capacity, does not differ from others. He is equally susceptible of improvement, and would receive as great advantages as others from a well-bestowed education.

Other views, he said, made him desire that education might be diffused among all classes. Our institutions demand this general diffusion. They are for the common mass of the people; and unless the people are educated, they both lose the benefit of these institutions and weaken their power. Liberty requires that every citizen, in order to its proper enjoyment, should have the means of elevation.

Again, all participate in the sovereignty of the country. Men, in other countries, have been fighting to be sovereigns. Here every man is one. Every citizen participates in legislating for the commonwealth, and in administering the government. Ought not every man who has such duties devolving on him, to receive as liberal a training as possible?

For the sake of union, this should be done; especially in our country, where there are no titled orders born to higher privileges than others. In other countries, the class in power have the principal means of knowledge, and, in order to keep the civil power in their hands, their object is to withhold from others the means of mental improvement. But, according to the genius of our government, education must bring all conditions and all classes together.

He said, in proportion as men are educated, they are more on an equality as to property. They communicate together—maintain a more agreeable intercourse—live in more harmony, and in greater love. Barriers are broken down; and society, by its general culture, is raised to a higher state of refinement and happiness.

He rejoiced that we had colleges liberally endowed; and he would not divert from them one stream of bounty. But he thought more of the mass than of the few; and wanted men educated for the community at large, and not for themselves alone. He rejoiced that we had academies, and that they were rising in importance; but he felt a deeper interest in the common schools. He desired the education of all the citizens, not as a politician, or as one seeking public favor; he was a candidate for no office; but he desired it as a man—a friend to his race.

He affirmed that the common schools have not kept pace with our wealth; that it is more essential to the prosperity of a school that it have a good teacher, than it is to the prosperity of a nation that it have wise and able rulers. We have, in many of our schools, teachers who do honor to the name: many, he regretted to say, were untaught and incompetent. They were not so much to blame, because they were not furnished with those means for qualifying themselves, which every other profession provides for those who would enter it. He most deeply regretted that our Legislature had not appropriated their surplus funds last winter, in establishing an institution for teachers. How much more good those large funds would have done! He hoped no more would come into their hands to be disposed of as these had been.

He could speak from experience. He was, for some time, in early life, a teacher, and he ever felt pain in remembering his deficiencies. Though he had no reason to suppose he was then behind others in the same employment, yet the remembrance of his lack of skill in discipline, and ignorance of the modes of access to the youthful mind, ever gave him deep regret. He had not, while filling the responsible station of teacher, learned how to make education a pleasure to a child.

But an institution for teachers is not all. There must be funds raised to pay them for their laborious services. How strange that the man who has the care of our children, should be thought to hold so low a place! But it must be seen and felt that his services are of vital importance, and deserve a generous recompense. In Prussia, where education has made great progress, teachers are obtained easily, and at a moderate expense, because other lucrative occupations are not open to them. In this country other occupations afford higher wages, and, therefore, that of a teacher has not risen to the honor of a profession. No good teacher can be obtained without ample compensation. Boston, though recently disgraced by its mobs, is doing much in compensating its teachers—is giving as great a salary to one of its teachers as to its mayor.

How is Massachusetts, he asked, to sustain its high character and rank? Look on the map, and you perceive how diminutive it is in size, compared with many of the other states. What is to prevent this little state from falling behind others which have greater natural advantages, and losing its influence? Nothing but cultivating the minds of its citizens—cultivating them in learning and virtue. On this foundation its eminence and greatness will stand firm."

In a discourse on self-culture, delivered in Boston, in 1838, in the course of Franklin Lectures, which were attended mainly by those who were occupied by manual labor, Dr. Channing holds the following language:

"They, whose childhood has been neglected, though they may make progress in future life, can hardly repair the loss of their first years; and I say this, that we may all be excited to save our children from this loss—that we may prepare them, to the extent of our power, for an effectual use of all the means of self-culture, which adult age may bring with it. With these views, I ask you to look with favor on the recent exertions of our Legislature, and of private citizens, in behalf of our public schools, the chief hope of our country. The Legislature has, of late, appointed a board of education, with a secretary, who is to devote his whole time to the improvement of public schools. An individual more fitted to this office than the gentleman who now fills it, (Horace Mann, Esq.,) can not, I believe, be found in our community; and if his labors shall be crowned with success, he will earn a title to the gratitude of the good people of this state, unsurpassed by that of any other living citizen. Let me also recall to your minds a munificent individual, (Edmund Dwight, Esq.,) who, by a generous donation, has encouraged the Legislature to resolve on the establishment of one or more institutions called Normal Schools, the object of which is, to prepare accomplished teachers of youth—a work, on which the progress of education depends more than on any other measure. The efficient friends of education are the true benefactors of their country, and their names deserve to be handed down to that posterity for whose highest wants they are so generously providing. * * * We need for our schools gifted men and women, worthy, by their intelligence and their moral power, to be intrusted with a nation's youth; and, to gain these, we must pay them liberally, as well as afford other proofs of the consideration in which we hold them. In the present state of the country, when so many paths of wealth and promotion are opened, superior men can not be won to an office so responsible and laborious as that of teaching, without stronger inducements than are now offered, except in some of our large cities. The office of instructor ought to rank, and be recompensed, as one of the most honorable in society; and I see not how this is to be done, at least in our day, without appropriating to it the public domain. This is the people's property, and the only part of their property which is likely to be soon devoted to the support of a high order of institutions for public education. This object, interesting to all classes of society, has peculiar claims on those whose means of improvement are restricted by narrow circumstances. The mass of the people should devote themselves to it as one man—should toil for it with one soul. Mechanics, farmers, laborers! let the country echo with your united cry, 'The public lands for education.' Send to the public council men who will plead this cause with power. No party triumphs, no trades-unions, no associations, can so contribute to elevate you as the measure now proposed. Nothing but a higher education can raise you in influence and true dignity. The resources of the public domain, wisely applied for successive generations to the culture of society and of the individual, would create a new people—would awaken through this community intellectual and moral energies, such as the record of no country display, and as would command the respect and emulation of the civilized world. In this grand object, the working-men of all parties, and in all divisions of the land, should join with an enthusiasm not to be withstood. They should separate it from all narrow and local strifes. They should not suffer it to be mixed up with the schemes of politicians. In it, they and their children have an infinite stake. May they be true to themselves, to posterity, to their country, to freedom, to the cause of mankind."

In a letter written in 1841, in reply to a communication respecting the Normal School at Lexington, he refers to his own experience as a teacher, and to the attempt in the Legislature to break down the Normal Schools:

"I have felt, as you well know, a deep interest in their success, (Normal Schools,) though, perhaps, you do not know all the reasons of it. I began life as a teacher, and my own experience has made me feel the importance of training the teacher for his work. I was not more deficient than most young men who pass through college. Perhaps I may say, without presumption, that I was better fitted than most to take charge of a school; and yet I look back on no part of my life with so much pain as on that which I gave to school-keeping. The interval of forty years has not relieved me from the sorrow and self-reproach which the recollection of it calls forth. How little did I do for the youthful, tender minds intrusted to me! I was not only a poor teacher, but, what was worse, my inexperience in the art of wholesome discipline led to the infliction of useless and hurtful punishments. I was cruel through ignorance; and this is the main source of cruelty in schools. Force, brute force, is called in to supply the place of wisdom. I feel myself bound to make this confession as some expiation for my errors. I *know* the need of a Normal School. I speak not from speculation, but sad experience.

But, indeed, does it not stand to reason, that, where all other vocations need apprenticeship, the highest of all vocations—that of awakening, guiding, enlightening the human soul—must require serious preparation? That attempts should have been made in the Legislature to break down our Normal Schools, and almost with success, is one of the most discouraging symptoms of our times. It shows that the people will not give their thoughts to the dearest interests of society; for any serious thought would have led them to frown down such efforts in a moment. I rejoice that the friends of education are beginning to visit the Normal School at Lexington. I earnestly implore for it the blessing of Heaven."

VI. INSTRUCTION IN GERMAN.

BY RUDOLF VON RAUMER.

II. THE GERMAN LANGUAGE IN THE SCHOOLS AT THE PRESENT TIME.

CHAPTER I.—KARL FERDINAND BECKER.

We concluded our first book with a masterly passage from Jacob Grimm, upon the nature of language. On the principles there expressed, therefore, the question now comes up, what is the duty of the schools in reference to instruction in the native language? If we understand by "native language" only the New High German—for the Middle and Old High German are not strictly speaking any longer our native language—still we must inquire, Can there be and should there be a regular school study of the native language? Or must the school be left quite out of the question? For the "strictly scientific" study of German referred to by Jacob Grimm at the end of the above extract, should not be taken up, any more than any other strictly scientific pursuit, before entering the university.*

Karl Ferdinand Becker is one of the most prominent of those who have endeavored in more recent times to answer the question, what should be the management of the native language in the schools, supposing it to be considered not a result of arbitrary laws, but as an organic product of human nature. Becker was born at Liser in the electorate of Treves, in 1775, and died in 1849. He was at once a physician, a philologist and a teacher; a union of characteristics which was the cause of the profound influence which his writings produced upon the school system of Germany. In the general principles of his grammatical writings, Becker, according to his own statement, conforms to the views of Wilhelm von Humboldt. The most important of his works, the "*Organism of Language*,"† is dedicated to Wilhelm von Humboldt, and contains numerous references, by citation, &c., to the works of that profound author. We therefore ask

* Even if we abate something of the force of the terms "strictly scientific," and permit a beginning to be made in it at the gymnasium as in other scientific studies, it is still easy to see that "grammatical studies" which, Grimm says, "must be either philosophical, critical or historical," must not be taken up before the highest classes of the gymnasium. Such is the sense of the often quoted expression of Grimm in the preface to the second edition of vol. I, of the "*German Grammar*," p. xix. Grimm's views, however, on elementary grammar, are not thus interfered with at all. That study and its relations to the study of the native language, are there the principal subjects handled.

† "*Organism der Sprache.*" Frankfurt on the Maine, 1827. Second revised edition, at the same place, 1841.

with astonishment how it could happen that a man who was laboring with the most honest efforts and no small talent, in what he believed to be the spirit of Wilhelm Humboldt, should become the progenitor of those extravagant perversities with which Raimund Wurst and others have tormented our schools? The reason of this surprising fact is partly a scientific defect in Becker's views, and partly, and to a greater extent, in a practical error almost inconceivably great. The scientific defect was this: that Becker had not rightly conceived the relations of language to logic. Although his clear mind and the number of his philosophical investigations of a positive character, made him frequently enough aware of the distinctions between language and logic, still his philological method never escapes from the tendency to "inquire into concealed relations between logic and language." I can not of course go in this place into a consideration of the repetitions of this error, and of the extent to which Becker pursued it. Such an undertaking would make it necessary to examine the relations of language, on one hand to the laws of logic, and on the other to the other fields of activity of the human mind. But this is one of the profoundest and most comprehensive problems of science, and whose solution could only be approached by means of a union of strictly abstract speculation and thorough positive investigation. At present it will be sufficient to indicate how Becker himself, and still more his followers, were necessarily carried by their over-valuation of the logical element in language, to a practically one-sided development of the understanding, directly opposed to the true principles of language.

There is the less necessity for going, in this place, into an illustration and refutation of Becker's theoretical system, since the practical error into which, though in other respects so acute, he fell, would have turned even the most correct views of language to the injury of the schools. The course of thought by which Becker passes from his theoretical system to its application to the schools, is as follows: "The function of language (see his '*Organism of Language*') is an organic function; that is, a thing living by means of functions which proceed from the very life of the thing itself, and also from an inward necessity; and which functions also have as their object the existence of that thing, since the thing can only exist and continue in the mode proper to it, by means of the functions. The function of language originates from the organic life of man, by an inward necessity."* From this follows the further principle laid down by

* "*Organism of Language*," 2d ed., p. 1.

Becker in the same work: "Since spoken language proceeds of itself and by necessity from the life of man as a spiritual and bodily existence, therefore it can properly be neither taught nor learned. Grammar teaches, strictly speaking, not how we ought to speak, but only how we do speak."* Becker begins with the same idea in the little work which he wrote expressly "on the method of instruction in German."† And accordingly, we are naturally curious to learn how this German language, which "can not properly be taught," can nevertheless be taught, and that according to a "Guide," a "School Grammar," and a "Complete German Grammar, in the form of a commentary on the School Grammar." But Becker explains this thus: The mother tongue can not strictly be learned by the scholar, at all; "for he understands and speaks his mother tongue before receiving any instruction."‡ But since instruction in language must be admitted to be a very important study, both in town and country, it is necessary to fix upon some purpose, as that for which it is given. This is stated by Becker to be, "That every one of the people shall learn to understand the High German language perfectly."§ But what is the meaning of the terms "to understand a language?" Becker answers, "We understand a language, when we know the true meaning of its words and of their connections."‖ "More important than an understanding of the words and their combinations, is the understanding of the grammatical forms, such as the cases, conjugations, &c., which furnish the means of defining the relations of the ideas used in language. These are also far more difficult to understand; for it is not so easy to comprehend and distinguish accurately the relations of ideas, as the ideas themselves."¶ All this, and much more of the same kind, is to be studied in the "common school."** In the lowest classes, where "there can be no instruction in language, properly so called," drills in language are to be the chief means of instruction; which should at the same time be exercises in thinking. "They will be exercises in thinking, principally by making the pupils acquainted with and ready in the most important distinctions between ideas and their relations. The teacher must from the first teach his pupils how to distinguish, on one hand between the thought (conception) and the idea (representation;) between the idea of a thing and of an action; between a person and a thing; and on

* "*Organism of Language*," 2d ed, p. 9.

† "*Ueber die Methode des Unterrichts in der deutschen Sprache*" Frankfurt on the Maine, 1833. It claims to be "intended as an introduction to the manual for the first instruction in German grammar."

‡ "On the method of instruction in the German language," p. 1.

§ Ib, p. 2.

‖ Ib., p. 3.

¶ "*Guide* (*Leitfaden*,)" Frankfurt on the Maine, 1833; preface, p. viii.

** Ib., p. 5.

the other nand between the ideas of space and time, practicability, possibility and necessity, cause and effect, &c., &c."* "After the pupil shall have been thus prepared in the lowest class," (of the common school, observe!) "a beginning with the actual instruction in language may be made in the middle class."† For the subsequent portions of the course thus commenced, however, I must refer the reader to the "Guide to the first instruction" itself. It is easy to see that what is here set forth as the rudiments of instruction in German, is neither more nor less than formal logic with a mixture of metaphysics. While a controversy is going on overhead as to whether logic shall be taught exclusively in the university, or shall be admitted into the highest class of the gymnasium, our children of seven years old are thus to be studying under the village schoolmaster the same things which we were heretofore made to know in the university course on logic.

It may be imagined that so monstrous an improvement found favor with a very extensive circle. A royal road was here opened at once to all classes, by which, without the wearisome study of the ancient languages, and indeed without any positive knowledge whatever, they could penetrate at once to the profundities of learning. Some, as Raimund Wurst in his "*Logic of language* (*Sprachdenklehre*,)" and the "*Introduction* (*Anleitung*,)" belonging with it, carried out Becker's views into details for the use of the elementary schools. By these, the village children were to be made to compose "variations of sentences, with qualifying clauses in the different moods, so arranged as to describe their analogies,"‡ or to "express the clauses modifying the principal one (conditional and qualifying clauses) in the interrogative form," &c., &c.§ Those who know the acuteness of Becker's investigations will lament that they can not acquit him of the blame of being the originator of such a monstrosity. He began with the right principle; that an organism could not be developed, but only investigated, by instruction. But instead of reserving with Grimm, this investigation, for a future strictly scientific method of study, he sought a new method of elementary instruction; and thus fell into a new and unnatural error.‖

* "On the method, &c., p. 58. † Ib., p. 60.

‡ Wurst, "*Introduction to the use of Grammar* (*Anleitung zum Gebrauche der Sprachdenklehre*.)" 3d ed., Reutlingen, 1851, Vol. I., p. 194.

§ Ib., p. 201.

‖ Although I reject the fundamental scientific principles of Becker, (see above, p. 461.) and oppose his applications of it to the schools, still I am far from refusing to recognize the importance of his labors both for science and for the schools. I have already observed (p. 461.) that Becker finds himself in various ways driven beyond his special design to refer language back to pure logical principles. Even in reference to school instruction, there are many

CHAPTER II.—THE OFFICE OF THE SCHOOLS WITH REFERENCE TO INSTRUCTION IN THE NATIVE LANGUAGE.

We have seen how Becker was led by his definition of the innate necessity of speech, to the position that "Grammar does not instruct how we ought to speak, but only how we do speak."* It follows further; that the design of all instruction in the native language, even of elementary instruction, is, "to teach every one of the people to understand the High German language perfectly."† And by this, Becker means, not that each person shall be enabled to understand a High German book when he reads it, or oration, when he hears it, but that he shall "perfectly understand" the language itself and its relations. There is of course an immense difference between these two requirements. In the first sense, a man who never saw a school, perfectly understands his own dialect; that is, he will comprehend with entire clearness and accuracy whatever is said to him in his dialect, so far as he is capable of comprehending it. In the second sense, however, the writer of the Iliad did not understand a single word of his own language. But both Becker's own expressions and the views of persons recognized by himself as his disciples, prove that this perfect understanding in the second of these two senses, was what he proposed as the proper aim of elementary education. "The teacher," he says, "can develop by means of the inner intuition into actual consciousness, what is already existing within the mind of the pupil; and in the manner in which it exists there."‡ Thus the precise design of Becker's instruction in language would remain exactly the same if the High German written language were not in existence

places in his writings where the true doctrines may be observed forcing themselves into view by the side of the errors mentioned in my text. He proceeds from the principle that every one speaks his own dialect perfectly without any instruction whatever. ("On the method, &c." p. 1.) He even expresses himself in relation to the feeling for language, in such a manner as to show that, notwithstanding his grammatical and pedagogical errors, he may be considered a pupil of Wilhelm von Humboldt. "We acquire," he says, (ibid, p. 20 *et seq.*) "by hearing and speaking our native language constantly from childhood, and by expressing and hearing expressed in it the same relations of thoughts and ideas in the same way, a feeling for language, which enables us without our being conscious of any rules in the matter, easily to distinguish between correct and incorrect speaking." "Not being based upon a knowledge of definite laws and rules, this feeling does not tell us why an expression is faulty; but as a feeling, developed within us together with language itself, it guides us, if properly educated, more surely than any rules of language. For the native language, which is not learned like a foreign one, by rules, this feeling is of the greatest importance; and its development should receive, in our common schools especially, the utmost attention. The common people have usually a very definite and correct feeling for whatever is said in their dialect; but when those who speak the common dialect in their daily employments undertake to speak High German, they lose most of this feeling." And Becker from this concludes that it is of the utmost consequence to make use of this feeling or sense of spoken language, for the High German also.

* "*Organism of Language*," 2d ed., p. 9.

† "On the method," &c., p. 2.

‡ Ib., p. 16.

at all, and the whole instruction were devoted to the pupil's oral dialect already acquired by him. This dialect the pupil "understands," in our first, practical sense, without any instruction at all. The elementary school, however, according to Becker, must lead him to a perfect theoretical and abstract understanding of his dialect. That this is his meaning is shown by the fact that Becker's own words, taken strictly, assert that only the language which the pupil already knows can be the object of methodical instruction in language. However strangely this may sound, still Becker says so in express terms, in the extract already quoted. And to show that this does not misrepresent him, I will cite one of the most eminent of his disciples. "I must in advance," says F. C. Honcamp, "refer to the extremely important truth that the pupil is not prepared to receive instruction in grammar, until he understands the High German language, and in particular the language of books, just as well as that in which he has been accustomed to express himself, whether a vulgar dialect, or the High German as spoken in families; for the pupil can show forth only that which he actually possesses."* A perfect theoretical understanding,† therefore, of the language and its relations, is, according to Becker and his school, the proper object of elementary instruction. No man of liberal education needs any special arguments to show that this is an absurd requirement. Any one who has seriously labored to acquire a "perfect understanding" of any language whatever, either old or new, knows what kind of work it is; and that it can not be the business of the elementary school. Take the first grammatical question that occurs, and endeavor to "understand it perfectly," and you are at once involved in the profoundest and most difficult questions of philology and speculation. For example: What is the German dative? Let the reader undertake to acquire a "perfect understanding" of the essence of the German dative; and unless he is destitute of all depth and acuteness whatever, he will agree with me that it is no child's question. A surprising amount of labor has been laid out in trying to find it a name which should to some extent indicate its character. The name of "dative," now given up, which was formed by the Romans on the model of the Greek πτῶσις δοτική, describes only a few individual applications of it. Instead of it was therefore adopted the name of "person-case."‡ But notwith-

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* F. C. Honcamp, "*Thoughts on instruction in grammar* (*Gedanken über der Unterricht in der Sprachlehre.*)" Soest, 1845, p. 37.

† In subsequent chapters the question of the different modes in which a language may be said to be understood, will be considered.

‡ "*Personenkasus, Personenfall.*" Becker, 'Organism," &c., Frankfurt, 1827, p. 221; and his "Complete German Grammar," 2d ed., 2 vols., Frankfurt, 1843, pp. 165, 225.

standing the correct idea which was contained in this view of the case, it was soon found necessary to except, by the aid of the most laborious learning in comparative philology, all those cases where the dative only filled the place of other obsolete cases; and even then the object was only attained by the use of great acuteness, and only imperfectly at that.

In despair at finding a satisfactory name, some have had recourse to mere numbers, and called the dative the "third case." Others still have called it, briefly, the "to-whom case;"* on the ground that they intend the name to really signify a dative, and accordingly declaring that the dative is—the dative. Practically this mode of giving the information is far from being a bad one. But the declaration that this case is that which answers the question "to whom?" is far enough from a "perfect understanding." A result similar to that indicated in this simple example follows, wherever the disciples of Becker seriously set about producing a perfect understanding of actual forms of speech in elementary classes. Even the most able of them endeavor, and even in stating their general views, to keep a retreat open; for while on one hand they demand that Becker's "perfect understanding" of language should be afforded in the common schools, on the other hand they sometimes propose a distinction between understanding and comprehending (*Verstehen* and *Begreifen*,) and sometimes say that they do not mean that elementary pupils should be brought to a conscious apprehension of the "whole" system of grammar. With our opinions, we are naturally inclined to approve of these modifications; although we consider that they ought to lead directly to the admission that it is absolutely out of the question for a perfect understanding of our language and its relations to be taught in the elementary part of instruction.

If now, we conclude that this "perfect understanding" of the language is an object not attainable by the ordinary school instruction in German, the question then arises, whether, with Grimm, we shall banish elementary instruction in the mother tongue entirely from the schools. Shall we no longer "include the native language of the country among the subjects of school instruction?" Are we ready to declare plainly, like Grimm, that "there is no such thing as a grammar of the native language for school and home?" An impartial

* Becker adopted the name of "person-case," even in his "Guide," (2d ed., Frankfurt, 1836, p. 27.) But even strict adherents of his differ from him in this particular, declaring for the unassailable, though, indeed, tautological term "to-whom case;" as for instance, Wurst in his "Logic of Grammar," 3d ed., Reutlingen, 1839, p. 141. I do not, as will of course be understood, express any opinion whether a satisfactory name has been discovered for this case; I only desire to show how great and acute are the efforts which have been made to express intelligibly the essence of the dative case.

view of the real wants of the school and of life will lead to an opposite conclusion. And if we appeal to history, we shall find, that exactly these requirements of school and home were the influences which for more than three hundred years have been calling into existence the almost numberless multitude of German grammars. It is true that Grimm rejects all these grammars; and declines to be considered as having any thing in common with them. But has he succeeded in curing the evil which he alleges? The annual booksellers' catalogues will answer that question. So far from diminishing, the number of German school grammars, since Grimm's decree of condemnation, it has every year increased. And what is the strongest circumstance of all, there has been added to the number of different classes of German school grammars, a respectable number of school and elementary grammars, whose authors declare that they adhere to the views of Grimm. This phenomenon reminds us of the scene in Shakspeare's "Julius Cæsar," where Brutus, after the murder of Cæsar, appeals to his fellow-citizens in behalf of republican freedom with so much power and success, that in their enthusiasm they cry out "Let *him* be Cæsar!"

Our historical investigation, however, will not only lead us into this labyrinth of contradictions, but will put into our hands the clew to a safe escape from it. These apparent contradictions will present no difficulty to any one who has attentively followed the historical development of our first book. But what is the reason why it is necessary to include the native language within the scope of our school instruction? For on this subject, it is not safe to expose ourselves to deception. However much we contract the limits of the study of German at school, there will always remain something or other which is only to be known by those who have learned it. Such, for instance, is correct spelling. But why is not this imbibed with the mother's milk? Why can we not trust for this to the creative instinct for language, as implicitly as we do to the nature of every child for its learning to talk? The answer is this: Because for more than a thousand years we have not only been speaking what we call our mother tongue, but also writing it. In this way there has arisen a universal written language, holding a position superior to any of the spoken dialects prevailing in separate localities of Germany; which is equally current everywhere, but is nowhere spoken by the common people.* The beginning of a written literature† designates the point

* On the method by which a written language is developed from and over popular oral dialects, see my work "*The influence of Christianity on the Old High German (Die Einwirkung des Christenthums auf die Althochdeutsche Sprache.)*" Stuttgart, 1845; pp. 12–22.

† I venture to use the expression "written literature," in distinction from unwritten poetry,

where the individual assumes or may assume a different relation to his mother tongue from his previous one. Before the period of written notation of the language, the individual learns his language only from the persons about him; from his parent and companions; the language passes from their mouths to his ear. With the rise of a written literature, there appears a new instrumentality both for the acquisition and the development of the native language. He who obtains access to this source of information, brings himself into contact with authorities respecting his language, whose writers are separated from him by hundreds of miles, and hundreds of years. The influence of these written works begins to cause a distinction between the language of the reader, and that of those about him, who do not read; and when he himself begins to write, he will commonly find it necessary to follow the rules of what he has read. Thus the written language will elevate itself more and more from the local popular dialect. But as speaking continues to be practiced as well as reading, and the oral transmission of the language from one generation to another continues to exert its proper influence, the oral dialects in this manner maintain their separate existence and their natural course of development. And as no man—or at least none of the ablest men—learns exclusively by reading and out of books, and as every man, even the most cultivated, talks for some years before he reads, thus the language of those who write flows from two sources; from what is read on one hand, and from the spoken language on the other. The influence of these two sources can be distinguished, even almost to the point of the entire disappearance of one of them. But they are both operative in every living written language. If now, as with us in Germany, there is a well defined written language, that language reacts again upon the spoken one; and then there grows up, even for oral purposes, a language which is distinct from the oral dialects, and which develops into the most various gradations and provincial forms, from the fusion together of the dialects with the written language.

From what has now been said, can be deduced the proper duty of the schools with respect to instruction in German. The scientific investigation of the language itself does not belong to the beginning, but to the final portion of literary culture. Its proper place is at the university, and the place for the studies preparatory to it, the upper classes of the institutions which immediately precede the university. The general duty of the course of instruction in schools, however, is,

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&c.; for though the term "literature" does not in etymological strictness apply to unwritten intellectual utterances, still, our histories of literature have habituated us to such a use of it.

to deal with the High German written language and its literature. Thus, also, we shall find the means of fixing the limits of instruction in German in different schools; namely, by deciding to what extent those classes of the community who are taught in them, ought to acquaint themselves with the High German language and literature.* For it is not the oral dialect which the child learns at home without any instruction, which is the subject of his school instruction, but his introduction to the understanding and use of the written language.

If it is here objected, that we are thus returning to a position which has already been held by previous teachers of German in schools, we reply as follows: So far as this charge is true, we have no objection to the fact. We are, rather, inclined to believe that, practically speaking, a method which amongst the most various modifications has maintained itself for more than three hundred years,† in spite of all the misunderstandings and perversions of different persons, must contain some grains of truth in it. For the purpose of finding these grains of good corn amongst the heap of chaff, we find nothing so useful as the great discoveries which have attended the historical progress of German grammar. And while we do not exert ourselves to avoid being ranked along with the ancient teachers on the right side of any question, it is at the same time evident enough from what has thus far been said, that on any other question we are sufficiently their opposite. Language was to them something rude and barbarous by nature, which they reduced for the first time into something like order by their schoolmaster's rules. Accordingly, they gave all their respect to this work of theirs, and looked with contempt upon the "imperfect and unregulated" language of the common people, as has been so exceedingly well described by Jacob Grimm. Consistently with these opinions, they naturally desired to subject the child to their rules instantly upon its entrance into the world, and thus by one stroke to drive out the vicious and undisciplined dialects. What we propose is precisely the opposite of this mode of proceeding. We would consider "the wonderful provision of nature; which gives us speech along with our mother's milk, and introduces us to the possession of it within the home of our parents," as the great pattern for the mode of teaching the written language in the schools. Far from wishing to intrude the conscious methods of the schoolmaster upon the domestic hearth, we would rather endeavor to adopt in the acquirement of the written language, as nearly the

* That is, so far as reading is concerned. † See Book I, above.

quiet unconscious mode of nature, as possible. But where circumstances, or the necessary imperfection of all human efforts, prevent the full attainment of this object, there we would at least endeavor to interfere as little as possible with the operation of the living and life-giving instinct of language.

From this view, which is based on one hand on the history of the German language and on the other on the history of German grammar, may be deduced the statement of the proper position of German grammar in the schools. The treatment of the German language as an object of scientific investigation belongs to the upper grades of learned education. If we take the word "scientific" in the strict sense, this mode of treatment should be commenced only at the university. The immediate preparation for it, like that for the other general departments of learning, should be made at the gymnasium. The extent to which other high grade educational institutions should aid in this scientific study of German, depends upon the views entertained of the proper relation of these institutions to purely theoretical science. In all previous grades of study, however, the purpose of grammatical instruction is a merely practical one, viz., the acquisition and practice of the German written language. This however does not imply that in those lower grades, this instruction in grammar can dispense with the theory as its basis. All grammar, even the most elementary, is the practice of speaking, as opposed to its theory; although even in its lower grades, it is necessary to remember that all the time the theory is being subservient to the practice; the knowledge of the subject to the practical wielding of it. And that very exercise of the understanding and of the other intellectual powers which is most proper for the pupil during this period, will be more successful in proportion as it is not made a subject of investigation for its own sake.

CHAPTER III.—GERMAN IN THE COMMON SCHOOL.

By common schools, we mean all the elementary schools in which no foreign language is taught, whether in city or country. Farmers and working people receive their education in these schools; that is, the classes who gain their living principally by bodily labor. For the present purpose, the term "farmers" will be used to designate the whole country population who are employed in laboring to cultivate the ground; and "operatives," to designate all those who procure their living in the workshop or in the manufactory. That portion of the industrial population which receives a further share of education in the higher burgher schools and similar institutions beyond the sphere of the common schools is not included in this enumeration; as the institutions alluded to are designed for the precise purpose of supplying their necessities. But among the common schools themselves, which we are proposing to discuss, there are various gradations, which are well entitled to attention. As the two chief varieties, or, if the term be preferred, extremes, may be taken the elementary schools of one class and the fully developed city common schools. There are of course more or less intermediate varieties between these; and the city common schools, on the other hand, sometimes interfere with the department of the higher burgher schools, which is at present not within our scope.

The mode of dealing with German in the common schools depends entirely upon the answer to this question: To what extent and in what manner shall the masses of the farmers and operatives be made acquainted with the High German written language?* If the answer to this question had been made quite clear, it is scarcely conceivable that men not otherwise deficient either in goodness or in understanding,† should have come to the most repulsive views on the subject of instruction in German in the common schools. We find it required that there shall be given in elementary schools a course of instruction in German which "shall place with certainty before the eyes of the pupil the whole course of his own thinking and judging, and its laws; and which shall be for him a continued practice, in the discovery and consideration of the relations according to which the mind distinguishes ideas, and in the laws according to which it connects them with each other in thinking and judging."‡ Raimund Wurst declares himself unsatisfied even with this; but requires besides, as a special subject of instruction, "elementary exercises in thought and style, for the purpose of introducing the pupil to the ascertaining of the thought-contents of their written matter."§ This means, that it was to be the task of farmers and operatives to think about their thinking, and write down sentences, the thought-materials of which they were to provide by artificial means. Our own opinion, on the contrary, is, that the best means of providing for the good of those classes would be, to spare them any such miserable

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* See the preceding page.

† These words seem to have escaped the notice of a critic of the first edition. I am far from denying to the late Herr Wurst, good qualities of mind and character; for he certainly possessed them. But the very narrow character of his culture incapacitated him from a profound insight into the nature of language, or into speculative methods.

‡ Wurst, "*Theoretical and Practical Hand-book for elementary exercises in Thought and Style* (*Theoretisch-praktisches Handbuch zu elementarischen Denk-und Styl-übungen,*)" 2d ed., Reutlingen, 1851, p. 14. And there is a reference to Becker, "On the Method," &c., pp. 6–8.

§ Id., ibid.

crumbs from rich men's tables, and instead, to take good care that they can read such High German books as are adapted to them; and can execute such writing as their ordinary avocations will require of them. Reading and writing, the ancient elementary studies of the common school, are so still; and all instruction in the German language which is directed to other objects, is injurious to the common schools.

Reading, writing, and the hearing of talking, are the means by which the people at large, without knowing it, master the first elements of the High German written language. Reading is learned and practiced by the standard of that language; and whether the method is syllabic or phonic, it obliges the child to adopt the forms of the written language with both mouth and ear. We can not in this place enter further into the discussion of the various methods of instruction in reading and writing.* I should be the less inclined to venture upon any unconditional decision upon the merits of these systems, because the most intelligent and experienced teachers do not succeed in coming to an agreement on the subject. What I shall hereafter say upon the practical acquirement of the High German written language, is to be considered as applicable, with some subordinate variances, to any good method of teaching reading and writing. I will make an observation only on a single point, which is of immediate importance to a really natural method in acquiring the High German written language. We are assured by many experienced and able teachers that what is called the *Lautir* or phonic method, is much more rapid than the literal and syllabic one. If this is true, it is only necessary, in employing it, to guard against making requisitions not adapted to the physiological nature of the sounds; and still more, not to lead the pupils into repulsive affectations of elegance by pedantic habits of holding the mouth, by teaching them to give undue prominence to any particular sounds, a fault of most foolish appearance and in the very worst taste, or by teaching them constrained habits of self-observation, which destroy all naturalness of demeanor. Perhaps the best method of avoiding all such difficulties is, to begin by teaching the children their A B C; and then teaching them to distinguish in the names† of the letters, (which may be considered the simplest combinations of sounds,) the proper sound of each.

Now, how shall reading be learned, and practiced? It has been

* On these various methods, see Th. Hegener, "*On instruction in the written language* (*Über den Unterricht in der Schriftsprache*,)" Arnsberg, 1843; p. 3, &c.

† The simple Roman names (*vau*, *we*. *ypsilon* and *zet*, are not among them) are the more suited for this purpose, because they distinguish well the liquids and aspirates from the mutes; the vowel standing before the alphabetic letter in the former, and after it in the latter. See on the determination of the sounds, my work "*The Aspirate and the location of sounds* (*Die Aspiration und die Lautverschiebung*.)" Leipzig, 1837, p. 15, *et seq.*, and p. 96, *et seq.*

argued that whatever is learned with so much labor, and repeated so often, as the first lessons in reading, is impressed so deeply upon the memory, that only the very best materials should be used for the purpose; and therefore that children should learn to read in the Bible. But to this it is correctly answered, that the mechanical labor of the early instruction in reading makes the matter read, disagreeable; so that it would be a desecration of the Bible to use it for that purpose; and reading should therefore be learned and practiced in a special reading-book for the purpose. But here the question meets us again: shall the best matter be subjected to the repulsive effects of the laborious efforts of learning to read; or shall the best matter be avoided, and shall the reading books for the common schools be filled with worthless material? I believe that a proper division of the question would furnish an answer. The reading book should be entirely distinct from the elementary primer. The primer will naturally be variously arranged, according to whichever method of instruction in reading and writing it follows. But there will probably be a progression similar to the course of nature, from reading single words, as soon as possible to reading whole sentences. The mode in which these sentences may be made to include the most important facts of grammar, will be discussed further on. But in any event, their contents ought not to be entirely empty and worthless. These single sentences may be interspersed with little connected stories and poems, the deciphering of which will early teach the child the true purpose and advantage of being able to read. Such little pieces ought of course not to be without sense and meaning, but neither ought they to be the best matter which can be laid before the people. A certain medium quality both in prose and verse will be found most serviceable. For it must be remembered that it is always possible that the matter thus learned may be rendered unpleasant to the child for its whole life. The two dangers between which it is necessary to steer in selecting, are, excessive maturity and childishness. The older books are more apt to err in the former direction, the later ones in the latter. A number of simple Bible texts, such especially as are found in the Proverbs of Solomon, may be added as a special chapter at the end of the primer. From this chapter, the child, now already somewhat advanced, may learn what is the highest purpose of reading. There are various reasons for not intermingling Bible texts with the previous part of the primer.

The reading book should be entirely distinct from the primer, even externally, in print and size. When the child has learned and practiced from the primer the elements of reading, he proceeds to the application of what he has learned. In the previous case, the reading was the chief object; now, it is the matter read. Reading is applied to two uses; a religious and a secular. Its religious use of course is intrinsically entitled to be valued most by all; and it is besides this, rendered most important among the farming and operative population, where in a healthy state, by its preponderance in extent. In the Protestant countries of Germany, the Bible, hymn-book and catechism are peculiarly the reading-books of those classes. And as to the Roman Catholic half of Germany, there also the conviction is constantly more and more forcing itself upon the ablest men, that the increase of the ability to read renders it more necessary to put into the hands of the people some religious book which shall be their true companion during their whole life. If a Protestant may venture an opinion on this side of the subject, it is to be recommended that such a Roman Catholic popular book should consist mostly of matter taken from the Bible. And it would probably moreover be a benefit to the book, if it should give the biblical histories and teachings which are appropriate for the purpose, as far as possible in the very words of the Bible; and still further, if this should be done, wherever no dogmatic point is involved, in the strong sound German of Luther; the great reformer, of course, not being cited by name. Indeed, the Munich College of Jesuits in 1595, published the German grammar of Johannes Clajus, "collected from Luther's Bible."*

A religious use of reading is also made, as soon as the primer is gone through with, in the usual religious instruction, whether given by the pastor himself, or by the school teacher under his oversight. Besides these religious uses, a secular use of the power of reading is also made by the common people; and this requirement, so far as the school is concerned, should be met by the reading-book. Views on the requisites of such a reading-book will be found the more diverse, for the reason that it has frequently not been clearly perceived that such a book can not at the same time supply the needs of the religious side of popular instruction. Not that we recommend a non-religious or irreligious reading-book. Its relations to religion, and even to that particular Christian confession for whose schools the reading-book is intended, should by no means be equivocal or hidden. But still, the compiler of such a book should always clearly recollect that the people will draw their religious nutriment, not from the reading-book, but from their Bible and hymn-book.

Aside however from the question of the proportion of religious

* See above, p. 415.

matter, views differ very widely as to the contents of a reading-book for common schools. While some consider beauty the most important object, and would endeavor mainly to awaken and maintain poetical feeling among the people, others prefer a body of such practical knowledge as would be the means of gain in subsequent life. Although these are very divergent tendencies, still their abler advocates agree in the principle that the contents of the reading-book should possess a permanent value for after life. If we consider that we are speaking of the common schools, in which the pupils are to acquire their whole stock of knowledge for subsequent life, we shall scarcely be inclined to deny to the prose of valuable knowledge its place by the side of poetry. Even farming people and operatives, also, should carry from the schools some little acquaintance, if only on the most indispensable points, with nature and history; and as the means of persons of this class will not commonly allow them to purchase libraries for themselves, the more indispensable portion of this matter should be given in the reading-book. I would here however express myself in favor of a doctrine which has had many and distinguished opponents. It is my unconditional belief that the properly instructive part—in speaking of a work of a higher grade I should say the scientific part—of the reading-book should be entirely separated from the poetical part, and that for general information.* Where practicable, there should be two separate books.† The argument which has been put forward for mixing the two kinds of material does not hold, that "The life of children is employment and relaxation;"‡ for life requires not intermixture, but separation. Different objects require different management. A large part of the instructive portion of the reading-book must be dry and brief, going more into detail at intervals only, by suitable extracts from distinguished authors in natural science, history, &c. The value of this portion will depend on its selection of facts. In every thing relating to natural history and geography, the best results must be obtained from actual inspection and additional expositions; for the brief noti-

* Similar opinions have been expressed by F. C. Honcamp in his "*Thoughts on Instruction in Grammar* (*Gedanken über den Unterricht in der Sprachlehre*,)" Soest, 1845, p. 47 *et seq.*

† The difference in price here would deter no one who knows how cheaply the large editions of such books are furnished. In the present instance the only additional expense would be that of one binding, amounting only to a few kreutzers; and even this might be saved to the poor, by binding the two parts in one, as the sizes might be the same.

‡ "*Reading-book for the evangelical common schools of Wirtemberg* (*Lesebuch für die evangelischen Volksschulen Württembergs*,)" first course, p. vii. The experienced compilers of this reading-book have happened upon the page just preceding this, to use the expressions " In selecting among the writings of several authors *of equal value* on the same subject, *especially poetical*," &c.

ces in the reading-book can not serve except as heads or memorandums of what is seen. In the historical part, however, room should be given in the reading-book only for a vivid and characteristic account of the most celebrated achievements of the German people and princes.* For this purpose, those periods of history will be found especially difficult, during which Germany has been internally divided. Many such matters should not be referred to at all in a popular reading-book, and others only briefly. Many of them, however, require a more detailed account; both because the narratives of such contests form some of the most important parts of German history, and because some of our greatest men have been at the head of the contending parties. In doing this work, the impossibility will soon be seen of setting forth at once and similarly for all German countries, the great destinies of our nation. But ought this to be an unattainable object; that the reading-books of each nation should be content to set forth its own achievements as great and glorious, and at the same time to allow its adversaries their due share of praise, either expressly or at least by silence? Should it be impossible for the Austrians to acknowledge the great qualities of Frederic II? And would not that great genius, the conqueror and defender of Silesia, be elevated in the eyes of the Prussian youth, if full justice should be done to the Empress Maria Theresa and her brave generals?

If the department devoted to useful knowledge be thus definitely laid off, the other department of the reading-book can be much more easily kept from interfering with it. With regard to the contents of this second part, correct views have prevailed since the principle was recognized that only matter of the most excellent quality should be admitted into it; and that this should be selected by some of our great authors, and chosen from the treasures which our nation has possessed from time immemorial. But those limits should be carefully observed in this selection, which have been fixed, and should be fixed, to the field of acquirement in the common school. The separation which we have insisted on of the strictly instructive class of matter, would preserve this portion from any harmful attempt after an imaginary completeness, such as has frequently occasioned the adoption of pieces only moderately useful, or quite improper. There is one additional suggestion which I would make to those professionally acquainted with the subject; namely, whether it would not be

* It should be observed that here only the secular reading-book is spoken of. The most important part of the historical instruction of the common people, that is, biblical history, belongs to their Bible reading and religious instruction. See the two preceding pages.

useful to set apart again from this portion, all the songs, into a section by themselves. This would give the common people, besides their principal religious manuals, the Bible, the hymn-book and the catechism, three little books for secular instruction; a text-book, a reading-book, and a song-book. While the religious ones are beyond all comparison the most important for building up the immovable foundations of all popular education, still, the secular ones, if well compiled, would not be without their use.

The second connecting link between the people and the written language, is writing. On this subject, we propose to discuss by itself the influence of writing upon the mastery which is acquired of the written language, without at the same time passing any judgment on the question of the association together of writing and reading in instruction. The practical exemplification of the principles which we shall lay down will of course vary with the different methods of instruction pursued; but the final results would be extremely similar, if not quite alike. We shall first inquire in what manner writing and the intercourse between teacher and pupil connected with it, affects the pupil's acquirement of the High German written dialect, without any reference to the study of grammar. It is after this that we shall examine the question of the position of grammar in the common school. We shall not at that time decide when and how the actual study of grammar should be commenced. We may, however, here say, that it is a chiefly unconscious acquisition of the written language which gives their distinctive character to the simplest and lowest class of elementary schools; and it is accordingly here that our inquiry should commence. The first question is this: What occasions have the agricultural and operative population, in their ordinary occupations, for writing? "None at all," is the answer of our unconditional panegyrists of the past. But the question is not so easily answered. The employer who can not keep his own accounts is in danger of being ridiculed, and perhaps fooled and cheated by his apprentices, or his own children in the school. The farmer who notes down his rent-day in the calendar is better off than one who has to trust to his memory for it. Any parish officer, no matter how excellent the organization of the official system, must sometimes find himself under the necessity of writing. And consider how many persons travel abroad of late years; how many families are scattered apart, often with broad lands and oceans between their members. And no one can fail to perceive how great a pleasure it must be to receive a few pages, even if not remarkably well written, from a son or daughter, for instance in America. These considerations alone ought to dispose of the assertion that instruction in writing is useless to the mass of the people.

It is however a further question, whether the masses of the people, who commonly receive their only general instruction in the elementary school, can be and should be made able to write the correct German of books. The objections which have been made to such an undertaking are by no means insignificant; and it must also be admitted that if the regularly correct writing of the German of books is claimed to be a result practically attainable in the elementary schools, then the efforts hitherto made to attain it have been fruitless. For it can not be denied that now, as heretofore, the farming and operative population introduce their "oral dialectic faults" into their writing; and that no labor has availed to prevent it. For these reasons the proposal has been made to exclude entirely the writing of the High German written language from the common schools, and instead of it, in each portion of Germany, to instruct in the writing of the oral dialect prevailing there. But each teacher, in order to know exactly what to teach, would, on this plan, first have to make himself master of the local dialect of his particular nationality. If this proposition should be put in practice, one of two things would result: either the undertaking would very soon fail as impossible, or in the course of time we should have, instead of one High German written language, a dozen new literary dialects. And all these new written languages would, each within its own province, find themselves in the same sort of opposition to the spoken dialect of single villages and towns, which exists with the High German written language. Let us therefore conform to the natural progress of German History; and allow to the High German written language the honor of being, within the boundaries of Germany, the only form of German taught in the schools and used in writing.

It is however a quite correct doctrine, that instruction in the common schools must begin with the local spoken dialect. This is the proper mother tongue of the pupil; he grew up with it; it was the original vehicle of his thoughts and feelings.* The duty of the common school is, therefore, to conduct the scholar from his own dialect to the written language, so far as he is to learn the latter. This object is to be accomplished, as the whole aim and character of the common schools indicates, as far as possible by means of actual practice. The popular dialect which the pupil brings with him from his own home, will come into opposition to the reading of books in writ-

* Compare Th. Hegener, in Diesterweg's "*Rhenish Gazette* (*Rheinischen Blättern*,)" new series, vol. 37, pp. 5–27.

ten German, the singing of written German hymns, and the hearing of sermons in more or less pure written German. In numberless cases the religious instructor will find himself obliged, for the sake of the most necessary explanations, to descend to the employment of the oral dialect of his pupil. The very same matters will be also met with by the pupil in print, in written German, without having there any reference to instruction in language; and then there will arise an interchange of dealing with oral dialect and written German, which without any express instruction in language, will communicate to the pupil a tolerable understanding of the written German. Again, when the pupil himself, say during his religious instruction, has occasion to speak, he will at first use exclusively his own oral dialect. He will, however, by little and little mingle more and more of the written language with his dialect, and this all the more because the texts and hymns which he must repeat, and the printed biblical narratives which he must read, are in written German. The language used by a person about to be confirmed, during the time of instruction, will quite involuntarily differ from that which he uses to his companions in the street, although very often the differences could only be detected by one thoroughly acquainted with the popular dialect. Thus the pupil gradually learns something of written German, in a manner much more like that in which he learned his native dialect, than like that in which we learn Latin or Greek in the schools. At the same time, the learning and practice of writing goes on parallel with that of reading. The pupil writes down the words which the teacher has written for him on the blackboard; by degrees comes to copy whole sentences written in the same way; and perhaps is allowed to copy from his printed books into a blank-book kept for the purpose, the texts and verses of hymns which he learns during his instruction in religion. In this way also, he obtains some further familiarity with the written German idiom, principally for the purpose of writing. Should he however now, without preparatory instruction, endeavor to write down some thoughts of his own, he will be at a stand; he will commonly not know how to set about it. He needs some preparation for such a task; not for the purpose of "ascertaining its thought-contents," but to learn how words thought or spoken are put into written letters, and how thoughts are arranged which are to be put on paper. The easiest transition in this direction from mere copying, is by the process of dictation and correction of what is dictated. It will of course be understood that for this purpose, it is not necessary to wait for the complete mastery of the exercises above mentioned. Dictation should rather begin at an early period to go on parallel with copying. As soon as they begin to write down what is dictated to them, the children will show their tendency to make use of the peculiarities of their dialect; and this will be still more strongly the case, if they are now and then made to write down something of their own wording, such as some little story which has before been told them. In such a composition, besides errors from ignorance and carelessness, the words will in numberless cases be written not as the books have them printed, but as the pupil speaks them. Still, it will be found that the pupil, without any special instructions on that point, will usually write, not his own street dialect alone, but the sort of mixture of oral and written German, which he has been accustomed to use in the school. It is to this intermediate instruction that, in the common schools, instruction in orthography should be adjoined. This should chiefly strive to assimilate as much as possible the language as written by the pupil, to that which he reads in books. It is not however such a strictly regulated conformity of what farming and operative people write to the German books, which is the most important object of the lowest and most elementary common schools, but rather, the greatest possible facility in writing; so that the knowledge of that noble art may not subsequently be wholly forgotten at the plough or the anvil. And as one means of promoting this practical purpose, the children should be practiced, towards the close of their school attendance, even in these most elementary schools, in writing the commonest forms of receipts and similar documents, which might perhaps be best done after a book of lithographed copies.

Thus far, we have considered the influence of writing on the acquirement of the written language, without any distinct study of grammar. It is not however without grammar; for the simplest elements of reading and writing are a part of grammar; and the study of orthography, no matter how simply and practically arranged, leads at once into the most of grammar. This statement must however be defended against opponents from two entirely opposite directions. The first class are those who believe that they have succeeded in banishing grammar entirely from the school, if only they have prevailed to have no special hour set apart for that study. And the others are those who would exclude those important elementary exercises from any thing so dignified as grammar. But both these classes should remember, that these very elements, no matter how simple, constitute the original conception of grammar. Whence does grammar derive its name if not from *grammata*, i. e. letters?*

* See, as to the precise relation of grammar to reading and writing, Xenophon's "*Memorabilia*," iv., 2, 20.

We have however remaining to be considered, the important question, What is the right place of the study of grammar, proper, in the common schools? In considering this question, we shall include the whole range of common schools (*Volksschule*), as already defined above. Our consideration of the subject itself will therefore show best what is to apply to separate species of common schools; what relates to the most elementary country schools, and what to the more advanced common schools of the towns. To draw a sharply defined line in advance between the different classes of schools seems the less proper, on account of the great number of intermediate grades between the country school of one class and the developed city school. We may however here repeat, that what we are now about to say does not apply to the higher burgher schools.

In discussing the study of grammar in the common schools, the only question proposed is commonly this; How much can be done; how far can the pupil be carried in the knowledge of grammar? This takes it for granted that the proper and highest object of popular education in grammar is, to instill the greatest possible quantity of it. But the reasons of such a proceeding as this are just as wrong as the selection of such an object. Notwithstanding all the assurances to the contrary which have become common since the appearance of Becker's grammatical writings, the belief still prevails that the mother tongue of the children as they bring it to the school, is worthless or at least a matter of entire indifference, but that grammatical knowledge is something valuable. The majority of those teachers who thus believe—often very well-intentioned persons—have no conception of the fact that a wrong method of studying grammar may corrupt and destroy that most excellent possession of the common people, their own free, simple, natural language. And it is still more to be lamented, that frequently even men who have an acute and correct perception of the needs of the common people, have been carried away by the prevailing current towards an object of whose undesirableness a more careful examination must convince them.

In order to obtain a correct idea of what is to be given and received by the study of the German language, we must begin by considering the language as the people acquire it without any direct study of it. This language is to be found in the German oral dialects. To consider these as corruptions of the written German language, is an error long since disproved by science. They rather set forth to us the unconscious natural progression of the language. All persons practically acquainted with the peculiarities of the dialects, are wise enough to praise them although they may concede to the written language the superiority over them all. The school study of the native language is an important continuation of this natural implantation and development of it. We have already seen that such a study has become, in consequence of the rise of the written language, indispensably necessary;* and I am far from undervaluing the great advantages of the cultivation of the written language. But we should not conceal from ourselves the fact that the spread of the written language, especially through the medium of the schools, constantly gains ground upon the popular dialects. Some of these have already substantially perished.† Others are daily losing their peculiarities. Even those which differ most from the written language, are already beginning here and there to make approaches towards it.‡ No forcible stop can be or ought to be put to this career of conquest by the written language; for since it exists, and is much richer and fuller than the dialects, its gradual modification of them and victory (at least in part) over them, seems a natural process. It is however our duty not to permit this unavoidable contest between the written language and the dialects, to degenerate into a mere violent war of extermination. We can not use any forcible means of maintaining the dialects; but at the same time, we should not forcibly attack them, and we should permit their existence in the schools, as long and as far as they are really entitled to it. It is true that in the schools, only the written language should be taught; but this should be done so as cautiously to lead the pupil from his native dialect onward to the written language. If this can be accomplished, we may hope that the written language, so far as it can and ought to do so, will become a natural inheritance of the common people. But if in the operation we transgress the limits fixed by nature, we shall rob the people of the natural hereditary language in which they express themselves with freedom and accuracy, and shall force upon them instead a tongue strange and repulsive to them.§

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* See above, Book II, chap. 2.

† See Firmenich, "*Voices of the German People* (*Germaniens Völkerstimmen*,)" vol. i, preface, p. 1.

‡ Much additional information on all these points may be found in Frommann's very excellent periodical, "*The German Dialects* (*Die Deutschen Mundarten*,)" Nuremberg, (Ebner, bookseller.)

§ On a previous occasion I have quoted from K. F. Becker's works, extracts containing correct views on this point. I must not omit in this place to name some of his followers who have ably developed this side of his views. Above all I must name F. C. Honcamp, whose "*Complete introduction to elementary exercises in language and to elementary instruction in grammar* (*Vollständige Anleitung zu elementarischen Sprachübungen und zum Elementarunterricht in der Sprachlehre*,)" 2d ed., Soest, 1848, and his "*Thoughts on instruction in grammar* (*Gedanken über den Unterricht in der Sprachlehre*,)" Soest, 1845, contain

It has been shown in a previous chapter, that the office of our lower schools is, not to teach a theoretical knowledge of language and its laws, but a practical acquaintance with the written language and its forms. The fact that we do not exclude the employment of a correct theory for attaining this practical purpose, may suggest, on a superficial view, that there is no substantial distinction. The distinction is however in fact a very substantial one. In the first place, the practical basis thus laid down for the application of theory, affords a definite limit which is entirely wanting if we assume as the object of the common schools, a complete theoretical knowledge of language. The more superficial of Becker's followers do not observe this fact, because they believe that the dry and scanty wisdom which they deal out to the pupils, includes the complete understanding of language. It however gives much trouble to the abler and profounder of them. On one hand they perceive clearly that a complete understanding of language can only be attained by a really scientific mode of procedure; and on the other hand their sound practical judgment tells them that such a scientific method has no place in the common school. As usual in such cases, they accordingly seek a mode of evading the difficulty.* In the second place, again, our practical rule points out the right road for us to follow, and preserves us from the incredible perversions of the natural order of instruction, which we find in Becker. Thus, according to Becker, as we have seen, the pupils are to master the whole of the High German written language, before the beginning of their instruction in grammar; whereas according to us, the mastery of that language is exactly the proposed object of that instruction.

If any one is disposed to think this object too insignificant, and unworthy the dignity of the common schools, let him consider the fol-

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many correct and valuable observations. Honcamp has since published a special "*Manual and practice-book for instruction in language in the Low German country schools* (*Lehr-und Uebungsbuch für den Sprachunterricht in nieder-deutschen Landschulen*,)" Soest and Olpe. 1851. There is also much that is valuable in Honcamp's "*Essay on popularized forms of statement* (*Abhandlung über volksthümliche Darstellung*,)" in Herrig's "*Archives*," vol. 16, for 1854, pp. 293 to 323. An adherent of Honcamp's, yet with independent views of his own, is his pupil Th. Hegener, who wrote, at the instance of Honcamp, the very valuable little book, "*On instruction in the written language* (*Ueber den Unterricht in der Schriftsprache*,)" Arnsberg, 1843. He also wrote, "*The pupil in reading and writing, in the Low German common schools* (*Der schreib und Leseschüler in niederdeutschen Volksschulen*,)" Part I, 3d ed., Arnsberg, 1849, Part II, 1850. Although obliged still further to oppose both these writers, and in the most important points, I still believe that we stand upon common ground, and can not suppress the wish that we shall ultimately arrive at an agreement. The direct tendency of the Low German to bring about a simplification of the instruction in language, has been well stated by H. Burgwardt, in his "*Primer for Low German youth* (*Fibel für die niederdeutsche Jugend*.)" Altona, 1855.

* Honcamp affords evidence of these assertions. See, for instance, in his "*Thoughts on instruction in grammar*," p. 22, as compared with p. 10.

lowing suggestions:—The theory of numbers is certainly a beautiful thing, and the thorough knowledge of it is one of the most dignified attainments of the human understanding. But is the theory of numbers to be included in the plan of the common schools merely because it improves the understanding? Is not the true state of the case rather this; that a knowledge of the four ground rules and a few other points in arithmetic are indispensable to the class of people who are educated in the common schools; and that a correct method will so adjust the process of learning these indispensable parts of arithmetic that the understanding of the pupil will be sharpened and developed during the whole time? And in like manner; the attainment of the High German written language is, on our principles, so far as it lies within the department of the common schools, a purpose; during the attainment of which a reasonable method will practice the intellectual powers of the pupil.

To what extent however, and in what manner, is the acquisition of the High German written language a proper task for the common schools? For an answer, I must recur to my previous principle. Reading and writing are the attainments which are objects of the common school; and the study of grammar must be made subservient to them. The purpose of reading is the understanding of such High German books as are for the common people; and that of writing, the ability to indite in correct written German, such things as actual life requires to be written. The understanding of High German books is here intended in its simple original sense; the sense in which Homer understood his own poems; not that in which he did not understand them. He knew very well what he said; but he could not have given a grammatical account of any one of his sentences. To such an understanding as is here meant, therefore, grammar, in itself, is entirely unnecessary. It becomes necessary, or perhaps can become so, only when the language learned is not the native dialect of the pupil, but a written German, distinct from it. Of course, however, grammar is in a position entirely different, when the object proposed is merely a plain understanding of what is read, and grammar only an auxiliary to it, from that which it occupies when grammatical analysis as such is the purpose for which reading is used. But we can not go into this subject until our examination of the relation of grammar to writing.

What is the duty of the common schools in respect to writing? Their first object, so far as this study is concerned, is, to give a general ability to write with some ease. Even this lowest grade of attainment includes as has been already shown, a practical introduction to the written language, and a very important portion of grammar. The actual study of grammar only begins when it becomes necessary for the pupil to possess some certainty in his use of the High German written language; for in order to this end, he must know what is correct and incorrect in any portion of the written language; which he will learn from the grammar. This knowledge of what is according to the rules of the written language and what not, is a further advance in the understanding of the language, but is still very far from a complete understanding of the language and its relations. And even this grade of knowledge finds its proper limits defined by its purpose; which does not propose perfection, but is restricted to things indispensable to correct writing. Of these, the chiefest are, the correct rendering of the sounds (orthography,) and correctness in the modifications of words (etymology.) Of these parts of grammar, therefore, an elementary general view must be given in any event. This will of course include only the principal points, many subordinate ones being left for any suitable subsequent occasion. Such a general view is necessary for reference on such subsequent occasions as occur for the exemplification and practice of details under it. Practice will naturally be confined to points on which the pupil has not gained certainty by practicing them in his own dialect. The practical design of the study will, in these exercises, as in others, bring out the necessary distinction between such of these points as are of immediate importance, and those which are less so.

In syntax, it has already been shown in various quarters, that there is a material difference between the written language and the dialects;* the dialects using much simpler forms in their sentences than the written language, and very many of the more artificial modes of connecting sentences of the latter, and a portion of its conjunctions, being unknown to the popular dialects. These alleged facts are correctly stated. For though the various oral dialects differ much among themselves both in respect to formation of sentences and syntactical forms of expression, these observations apply with more or less truth to all the popular dialects of Germany. But the conclusions which have been deduced from these facts relative to common school instruction were wrong, because the practical object of that instruction had been lost sight of. If we assume as such object the complete understanding of the written language and its relations, in the grammatical sense of those terms, then the field of syntactical instruction in the common school is the same as that in the university.

* See especially the works already cited of Honcamp and Th. Hegener.

But the object of that instruction in the common school is very different from the other. It is primarily an auxiliary to the study of writing; and here, moreover, it is not intended to acquaint the masses with the use of artificial and intricate forms of sentences, but only to modify the forms already in use by the common people, so far as is required for the sake of agreement with the written language. This part of instruction should, accordingly, in the first place take charge of the construction of words, where the dialect varies from the written language, and secondly of the disuse of such modes of expression as are foreign to the written language, and the substitution for them of the proper ones. These points will be sufficient for the necessities of the common people, so far as relates to the writing of the High German written language. For any one who has learned so far, will write German which is syntactically correct; whereas the practice of artificial and involved forms, foreign to the popular dialect, are not merely superfluous for writing, but positively injurious. It is scarcely comprehensible, how it can be required, on one hand, that these forms shall be admitted to be disadvantageous to the popular powers of expression, and on the other hand that the people shall still use them, and shall be expressly instructed in them. An examination of the fruits of such a mode of instruction in style will easily convince us of its ill consequences. Much the greater part of the wrong and often ridiculous forms of expression which we so frequently find in the letters of operatives and farm laborers, are constructions learned in this manner. And if some individual by years of practice becomes able to use such artificial forms of expression with some correctness, he usually loses all freshness of apprehension and expression, under the cumbrous weight of such heavy armor. That charming directness which gives us so much pleasure in the writings of uneducated men, is gone, and in its place appears the halting style of a second-rate newspaper article.

The common school does not need to drill the pupils in artificial constructions for the sake of understanding what they read. For firstly, those who write for the common people, must take pains to write with simplicity; and secondly, such instructions for that purpose as may be indispensable, will easily be subjoined to a properly arranged course of instruction in reading. The repeated translation of the artificial forms into the more familiar and simpler ones, will in most cases suffice. As to the understanding of what is read, the practice of reading holds a place, relative to the written language, similar to that of hearing spoken words for the first acquirement of the native dialect. Innumerable points will in this way be learned of themselves by the aid of the mutual relations of the substance and form of what is read.

In making use of reading to teach language, there are two things which must be kept carefully separated; the practice of forms of language for writing, and the explanation of its difficulties, for understanding what is read. The confusion of these two with each other, in the well intended plans for making a good use of the reading-book in teaching language, has led to incredible errors. Grimm's stories or Uhland's songs have been treated as if they were these to furnish exercises in declension or syntax.*

Grammatical exercises, so far as necessary for the purpose of writing, should be upon sentences and extracts prepared for that purpose. And on this point we refer to what has already been said as to primers and reading-books, namely, that there should also be a visible separation between the sentences and extracts expressly for the practice of grammar, and the reading-book proper, which is read for the sake of its contents. The same reading-lesssons which were used in the primer at a previous period to learn reading, can afterwards be used again to practice grammar.† For this purpose, the sentences and reading lessons in the primer should be so selected and arranged, as to agree in arrangement with the little grammar which the pupils use during their second period of their studies. This grammar should of course be kept within the most moderate limits, and should include only the most indispensable matter.‡ If however this use of the primer is not sufficient, or if it is thought impracticable to arrange

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* The "*German reader for gymnasia, seminaries and real schools, with explanations of facts and language, and many hints on practical instruction in German, by Joseph Kehrein* (*Deutsche Lesebuch für Gymnasia, Seminarien, Realschulen mit sachlichen und sprachlichen Erklärungen nebst vielfachen Andeutungen zu einem praktischen Unterricht in der Deutschen Sprache von Joseph Kehrein*,)" annexes to Grimm's "Aschenputtel," the following notes, besides many similar ones:—"A rich man, whose wife was sick. (How could this sentence have been differently worded? Give the subject, predicate and copula of the sentence. Grammar, § 154, 156.)" "The poor step-child (*Stiefkind.*) (From the Old High German *stiufan*, to deprive of. What therefore is the meaning of step-child? Of step-father?)" Aschenputtel went to (*zu*) her mother's grave. (Should *zu* be used, where the words are transposed? Grammar, § (219.)" "All the time there came a little bird from the tree, and the bird threw down to him whatever he wanted. (What words might be omitted from this sentence?)" "With slippers embroidered with silver and gold. (Change this sentence into a relative one with 'which.' Grammar, § 321.)" "A dim little oil-lamp was burning. (Was it really the lamp that was dim?)" And so on. And this is called by a reviewer in the "*Journal of the Gymnasia*," (Berlin, 1853, p. 719,) "the author's vivid and stimulating method of instruction!" Every rightly feeling mind will of itself see that such a method applied to the Bible, properly the chief reading-book of the Protestant schools, would be an actual sacrilege.

† Of course this use should not be made of the extracts from the Bible in the latter part of the primer.

‡ Its size something like that of the "*Small German grammar* (*Kleine Deutsche Sprachlehre*)" by H. Bohm and W. Steinert, 8th ed., Berlin, 1857. In the contents of this otherwise very convenient little book, our views would require many alterations.

the sentences and reading lessons so as to answer both the proposed ends, the children might be made to use, besides the manual of grammar, an additional little book provided for the special purpose, with sentences and lessons for grammar practice. This use should however never be made of the real reading-book, as it would do harm in two distinct ways. First, it would interfere with the impression made by the valuable matter in the reading-book, and with the pleasure of reading it; and secondly, it would give the pupils entirely wrong impressions of the way in which they ought to read, and to understand what they read. Oral explanations should be given, with the reading-book, only when required for the understanding—in the simplest sense of the word—of what is read.

I have in the foregoing, not given a course of instruction in teaching the German language, but only some hints upon its purpose and method. That purpose will only very seldom be fully attained, by whatever method. But for that very reason, the road to it is not a matter of indifference. We have sought so to choose it, as to lead in the simplest manner from the oral dialect to the written language; and in this last, also, we would preserve to the common people the simplicity and naturalness which belong to them. The object of the more advanced common schools, even of those of the cities, is, we apprehend, to teach correct High German. If however this purpose should not be entirely attained, but some dialectic expressions and inflections should continue to appear even in the written language of the great masses of the people, the truly educated man will not be shocked. He would far more probably be disgusted at that sort of vulgarity which tries to avail itself of the more artificial book-language, without the capacity to use it.

CHAPTER IV.—GERMAN IN THE TEACHERS' SEMINARIES.

The treatment of the German language in the seminaries where teachers are trained for the common schools, naturally stands in the closest connection with its treatment in those schools themselves. The opinions entertained on the latter point will naturally determine those held on the former. In what we are about to say therefore, it will be assumed that the reader is familiar with the substance of our third chapter, on teaching German in the common schools. Still, however true it is that this study in the common schools fixes the conditions of the same in the teachers' seminaries, it is nevertheless very different from it, both in extent and in character.

The first requisite in the teacher is, of course, that he understand what he is to teach his pupils. When accordingly we assume that it is the ultimate object of the common schools to enable their pupil to write High German correctly, we must require this ability from the teacher. This requisite is sometimes considered to be of such trifling importance, that it is beneath the dignity of a teacher even to mention it. The truth is, however, that it is an attainment which can, even at the teachers' seminary, be made only a final object. And if the complete attainment of it should be strictly insisted upon, not nearly enough pupils could be obtained to fill the existing demand for teachers. It will not be denied that during the last generation, Prussia has shown a very remarkable degree of activity in elevating the character of its common schools and of their teachers. And nevertheless a thorough investigation has recently shown that in one province, there was no teachers' seminary in which such a degree of excellence had been reached that the German exercises of the graduates were "free from faults of orthography, punctuation and grammar."* And with reference to another country of Germany, I can add from my own experience, that a teacher who at graduating from the seminary received the highest mark, and had invariably afterwards received the commendations of the school inspectors, committed gross solecisms in his German compositions. The requirement of correct composition should not therefore, be reckoned unimportant; but we should rather rejoice even at an approximation to its attainment.

But it would be an entire misapprehension of the scope of the teachers' seminary, to suppose it not essentially distinct from that of the common school. The pupil of the latter learns the High German written language, in order to use it; of the former, in order to teach it. This difference of objects necessitates a difference in modes of study. While the linguistic culture of the preparatory students and seminary pupils follows a course similar to that of the common school pupil, still the very ideas of grammar are different, which belong to the two courses. The question, how good an account of grammar the farmer or operative shall be able to give in after life, is one commonly of very subordinate importance. The important point for him is, to be able to use the language correctly. But on the other hand, the teacher must above all things be able to give a good account of grammar and its rules. This is an ability necessary to his vocation. Without therefore claiming that the common school teacher must be a man of learning, it must not be forgotten that grammar, *i. e.*, the theory of language, occupies a very different position in the

* "*Documents for the history and elucidation of the three Prussian Regulatives (Aktenstücke zur Geschichte und zum Verständniss der drei Preussischen Regulative,)*" edited by F. Stiehl, Berlin, 1865, p. 89.

studies of the teacher, from that which it holds in those of the common school pupil.

But upon now inquiring more closely, in what manner German grammar is to be studied in the teachers' seminary, we come at once upon a great difficulty. Evidently, a higher grade of attainment is needed by the teacher of the advanced city school, at least of its higher classes, than by the teacher of the country school of one class. But upon the practical means of answering these different demands, opinions are very different. Many would make the attainments needed by the teachers of the upper classes of the city schools, the standard for all teachers. Others, on the contrary, would restrict the public seminaries to the course of study necessary for country teachers, and would leave it to the few who are more highly endowed by nature or favored by circumstances, to obtain the further accomplishment necessary for teaching in the more advanced city schools. It would however be found impossible to avoid making some regular provision for the wants of the city schools, either by the addition of higher courses to the ordinary seminaries, or by especial seminaries to train teachers for the higher classes of city schools. And under any circumstances it would also be necessary to use special care not to forget, in this more advanced course, what is the proper object of the teacher, viz., service in the common schools.

The studies in language of the student preparing for the teachers' seminary should be substantially similar to those in a good city common school. If the preparatory student can not pursue these studies in a fully developed common school, his course will still not greatly differ from that of his common school, because he needs to master thoroughly that which he is afterwards to teach. But the real distinction between the common school studies, and those of the preparatory course, and still more of the seminary course is, that what the common school pupil merely learns, the seminarist studies also as a subject to be taught. This requires, firstly, knowledge and practice in instruction; and secondly, a more profound comprehension of the subject to be taught. But the teacher can not pursue philological investigations, which require a knowledge and preliminary training not in his possession. He must however possess as correct a conception as possible of the language, adapted to his grade of attainment. On this point, however, care is necessary to avoid wrong ideas. Every one forms some conception of any subject which occupies him so much as language does the teacher; and if not supplied with a correct one, he forms an incorrect one for himself. A correct conception of a language, however, can be reached only by a historical process of study. The course in German, in the teachers seminary, must therefore have reference to the historical development of that language. I do not doubt that this principle will be opposed, and on the most various grounds; and I therefore admit in advance, that it is liable to great misunderstandings. I however also believe that if correctly understood, it would be admitted on all hands. I would explain in the first place, that I would not introduce into the teachers' seminary, the study of the Middle High German, or of any other ancient German dialect.* All that I should require is, that the grammar of our New High German written language should be studied in the seminary with reference to the history of the German language. At this point also, I anticipate an objection; that this method would only confuse the minds of the pupils, as all half knowledge does. Here I must permit myself one general observation. It is not the quantity of knowledge which has filled the minds of part of our teachers with confusion, but its species and management. A dry outline of all sorts of sciences has been furnished them, and they have then been given to understand that they are now in possession of the main facts of them. "The remainder of them, which learnedly educated persons study," they are told, "is only learned stuff, not only unsuitable to you, but without any value in itself." Thus has been developed that ridiculously inflated conceit which despises all profound learning, and, were its power equal to its wishes, would plunge us into the barbarousness of a monotonous superficial mediocrity of attainment. Precisely an opposite result would be produced by allowing common school teachers some insight into the real elements of learning, though only here and there, and at appropriate points. If the teacher shall thus obtain an idea that that which he is able to understand and acquire, is only the first rudiments of what the man of real learning is obliged to master, he will, if of respectable mental capacity, have an increased respect for learning. And it is no trifling matter to induce so important and respectable a class as that of teachers, not merely to submit murmuringly to the authority of those who rank above them in culture and station, but to regard them with real respect.† The study of the history of language in the teachers' seminary must of course be restricted within very modest limits.‡ This reference to the history of the language in the study

* There is no objection to such study on principle; it is in practice that it would be found difficult.

† I refer of course only to mental culture and external rank. The moral worth of men is independent of these. It is agreed among rightly thinking men of all parties, that as to outward circumstances, there are many places where teachers ought to be much better situated than they are.

‡ Of course the teacher in charge of the German language in the seminary, must possess at

of German grammar in the teachers' seminaries will operate favorably in two ways. First, the teacher will by this method obtain correct views of the relations between the written language which he is teaching, and the popular oral dialect which he finds already used by his pupils; and secondly, he will be saved from the delusion that every thing which does not agree with our present written language is for that reason vulgar and bad in itself. This is a point of great importance for this reason; that the most important religious books of the common people, Luther's translation of the Bible, and the hymn-book, use some forms of language which are no longer current.*

Care must of course be taken that this historical treatment of the language shall not in any way interfere with the principal aim of the teacher, namely, assured correctness in the use of the written language as now current. A right method however will leave little to fear in this respect; for infinitely the greatest portion of the seminarist's time and powers will be devoted to the acquisition and practice of the present written language. This is the object not only of the actual lessons themselves, but also of the instruction in teaching which constitutes an important part of the seminary course. Upon this latter important branch of our subject we shall be unable to enter further; as a detailed discussion would be without our limits, and the chief principles applicable follow of course from our chapter on the common schools. We will only add one single reminder; that according to the principles laid down in that chapter, the mode of teaching the use of the reading-book should be very different from that frequently recommended.

CHAPTER V.—GERMAN IN THE GYMNASIUM.

Under the term Gymnasium we include all those schools whose principal business is the teaching of Latin and Greek, from the first elements of Latin up to the time of entering the university. Now, what is the proper place, in these institutions, of the instruction in German? If we have in a previous chapter found opinions very various on the subject of teaching German in the common schools, the

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least so much knowledge of the Old German, as our seventh chapter prescribes for a philologist. The more extensive his knowledge, the freer will he be from the characteristic fault of half-taught men, of parading his learning. He should in particular strictly refrain from all merely hypothetical etymologizing.

* This is still true, even if the ancient text of Luther's translation of the Bible is not adhered to *verbatim*; for even in such a universally authorized approximation to the present forms of the language as is made in all the editions now in actual use, the antique character should not be entirely extinguished. On this point see "*Germania*," edited by Franz Pfeiffer; 1857, p. 109 *et seq*.

conflict of views as to its treatment in the gymnasium will be found still greater. While some are expecting a new era for the gymnasia, in which is to be introduced into them a comprehensive course of instruction in German, to occupy many lessons, others would exclude it entirely from them; and these latter certainly sometimes base upon their banishment of the German language, almost as great hopes for the future of our race, as do the former upon its extensive introduction. We shall be best able to find the correct path through this labyrinth, by determining accurately, on one hand what is the essential object of the gymnasium, and on the other, what in general is the business of the schools with reference to the German language.

What is the object of the gymnasium? The answer is, to afford to our future pastors, judges, and physicians, the rudiments of their higher general education. This is their practical aim; for those pupils who do not propose to enter either of those professions, are unimportant in comparison with those who do. Thus the question, if put again more closely, becomes: What are the requisites of the higher general education of pastors, judges and physicians? I shall assume that my reader agrees with me in considering classical studies as the most important part of the basis of those studies; for I can not here either controvert the views of any others, or adjust my discussion to them. I must however at the outset lay especial stress upon one point; namely, that the gymnasium is to afford the *rudiments* of this higher general culture. Our gymnasia have happily escaped the foolish notion that they are to fit the future pastors, judges and physicians immediately for the practice of their employments. They have been less successful in avoiding another error, namely, that the gymnasium should complete and finish the formal education of its pupils. This is an error capable of being fatal both to the gymnasium, and to the cause of general culture. It proposes an absurdly extensive scope for the gymnasium; dulls the opening intellect by unreasonable requirements; and after all its magnificent promises, sends to the universities youths whose over-stimulated palates reject with loathing that higher education which is there affored. Even with regard to the formal part of education, the duty of the gymnasium is not to turn out finished men, but students, well prepared and fond of learning.

We shall hereafter observe the special application of these remarks to the subject of instruction in German. Our immediate task is, to compare what we have stated as the business of the gymnasium, with what was defined in the first chapter to be the object of the study of German in the common schools. The business of these schools was there defined to be, the study of the High German written language; and the limits of the instruction in it, in the different grades of schools, were stated to be determined by the extent to which the classes of persons taught in them were intended to master the written language and its literature. The application of this rule to the gymnasium is made somewhat difficult by the fact that that institution furnishes to the class of persons attending it only the first half of their education, the remainder being received at the university. If we take a general view of the culture of our clergy, judges and physicians, it will be found to require, so far as relates to the High German written language and its literature, nearly this: that to those classes, the High German written language shall, for their written and oral use, become if possible so much a second nature, that, they can use it with as much ease for their purposes, as the man unable to write has in the use of his own dialect for the purpose of talking. For the newer German literature, these classes constitute the most important part of the public. It is for them that our great poets and prosemen have written their works, not exclusively indeed, but mainly. Except so far as may be left to actual life, it is the schools which must be the medium of introduction between our great writers and the educated classes. Last of all, at the university, comes the scientific treatment of our language and literature; and for this also the gymnasium must supply the elementary preparation.

Section 1. *Culture of German Style, and German Grammar, at the gymnasium.*

"To write well," says Buffon, "it is necessary to think well, to feel well and to express one's self well; that is, to have mind, soul and taste. Style comprehends a union and training of all the intellectual powers."* The style is not, therefore, the proof of the receipt of lessons in grammar or style, but is the expression of the whole culture of the man. In this, educators of the most different opinions are agreed; as, Friedrich Thiersch, in his well known work on classical institutions,† and Hiecke, in his instructive book on instruction in German at the German Gymnasia. Hiecke has very clearly shown the conclusions which follow respecting instruction in the native language, from these principles relative to style, namely; that that instruction should be given "during all the lessons, even those not expressly devoted to it." "The teachers in every study," he adds, "give practical instruction in the native language, even without in-

* Hamann's translation of Buffon's Discourse before the French Academy, 1753, In Hamann's Works, vol. 4, p. 462.

† IV, p. 338.

tending it."* Philipp Wackernagel, however, in his excellent dialogue on instruction in the native language, has brought the profoundest knowledge of the subject to the elucidation of this view of it.†

The relations of German grammar to that ultimate practical object of instruction in language, an individualized German style, are however not determined by the fundamental principle just laid down; and we do in fact find men who agree in this important principle, but who differ very widely as to the elementary study of German grammar. Some would banish it entirely, others would admit it. But even among these last, there is a difference as to the practical mode of teaching it. The necessary instruction in German grammar may, for instance, be either entirely distributed among the lessons in the ancient languages, or may besides such instruction, be also taught at special hours set apart for it. Such a wide difference among persons acquainted with the subject sufficiently shows that the question is a difficult one. And in fact, the inherent difficulty of the subject is aggravated, in the case of the gymnasium, by the intermediate station which that institution occupies, bounded by the elementary schools below, and the university above. This very situation however may indicate to us the double purpose of the study of German grammar at the gymnasium. It must, first, afford the means of learning and correctly using the High German written language; and secondly, furnish the beginning of a scientific study of German. In the former capacity, its purpose is similar to that in the common schools; in the latter, it is an introduction to the University. It will thus naturally follow that the former object should belong to the first half of the gymnasium course, and the latter to the last half.‡

The acquisition of the High German written language must at the gymnasium be in great part a work of practice and habituation. This is not merely from the necessity, of the case, but because such

* "*Instruction in German at the German Gymnasia, A pedagogical attempt* (*Der deutsche Unterricht auf deutschen Gymnasien. Ein pedagogischer Versuch.*)" By R. H. Hiecke. Leipzig, 1842, p. 27. I find my opinion on Hiecke's book a somewhat singular one. No unprejudiced person will deny that the author has written with a warm love for his subject and an extensive knowledge of it. While however many portions of it seem to me to have been written with the sincerest feelings, there are others which seem so entirely objectionable that I almost think the author himself would retract them.

† "*Instruction in the native language. By Dr. R. E. Ph. Wackernagel. Fourth part of the German Reader.* (*Der Unterricht in der Muttersprache. Von Dr. R. E. Ph. Wackernagel. Vierter Theil des Deutschen Lesebuchs.*) Stuttgart. 1843 I would gladly take it for granted that all my readers are acquainted with this excellent work.

‡ We mean by "gymnasium," the whole course, from the beginning of Latin to the entrance into the university. The upper half of this course includes, nearly, the four years last preceeding the entrance into the university. But in mentioning this last half, we do not always necessarily mean the whole of its duration.

is the only way of acquiring a real practical mastery of the language. The whole organization of the gymnasium affords opportunities for the practice and habit thus required. Of the influence of classical studies on the object proposed, we shall speak hereafter. In this place we shall call attention only to one additional point.

The majority of the boys who commonly attend a gymnasium stand, even at their entrance, in a very different position relative to the German written language, from that of the great mass of the common school pupils. The majority of the gymnasium pupils are found by experience to belong to families in which from the beginning they hear a language spoken which is considerably nearer the written language than is the dialect of those parents whose children constitute the mass of pupils of the common schools. And while in the gymnasium, they hear for from eight to ten years from their different teachers, a German which usually differs from that of books still less than that spoken at home, they will themselves be required to give accounts of the most various matters, and answers about them, which only retain some shade of coloring from their dialect, but which follows the written language in the most important respects. Thus the gymnasium pupil, aside from what direct instruction he receives on the subject, lives in the oral practice of the High German written language.

While however it is true that a great part of the acquisition of the written language must arise from practical use, still, entire correctness in the use of it can not be attained without express instruction as to what is correct and incorrect in it; that is, without grammar. In this connection I may refer to what I have said generally in the second chapter, on the school and the native language; and in the third chapter, on German in the common schools. But in the gymnasium particularly, the error should be avoided, of supposing that the pupils learn the written language without any grammar, because they receive no continuous and connected instruction in the German grammar. The truth is rather, that the pupils acquire the real elements of grammar while they are taught reading and writing; that while learning the Latin forms and practicing in Latin syntax, they are continuing their study of German grammar; and lastly, that during the revision of their translations from the ancient languages, they hear a great quantity of observations which apply to German grammar likewise. German grammar is thus in fact all the time being taught; and the only question is, how soon shall commence at least an elementary connected survey of its most important portions. There are several reasons why such a connected survey had better begin at an early period. First, even the pupils in Latin will begin to feel the want of grammatical knowledge as soon as the distinction begins to be made between the written dialect and their own home dialect. The instruction and where it is necessary the practice in the correct rules of written German, require reference to elementary grammar. Secondly, however, the acquisition of the Latin grammar will naturally join itself on to this elementary knowledge of German grammar.* Only, on this last point, the error must be avoided of imagining that the German grammar must be studied quite through before the Latin is begun. The study of German grammar should rather, after its foundations are early laid, proceed to extend and complete itself hand in hand with the acquirement of the Latin and afterwards of the Greek.

The theoretical object of the scientific culture of German whose beginning is given at the gymnasium is of course the understanding of the language itself. But this object lies not at the beginning, but at the end, of this whole course. While however this variation of purpose causes many differences between the mode of studying German in the common school and in even the lower portion of the gymnasium course, still the really scientific study of the German language can not begin before the upper classes of the gymnasium, to be continued in the university. In the lower gymnasium classes, the aim of the instruction in German grammar is on the contrary eminently a practical one; to teach the pupil the correct use of the written language.† This is like its aim in the more developed common school, but differs from it in this, that in the common school correctness in using the written language is an object proposed, while at the gymnasium it is an attainment required. This distinction is one which exists in the nature of the case. It is, for instance, a proper government rule that all persons proposing to pursue any official career of a higher grade, shall know the German written language well enough to be able to write it without gross errors. None who do not meet this requirement are permitted even to study the professional studies. But it would be out of the question to exact this

* A number of our ablest classical educators are for very weighty reasons in favor of special separate lessons in German grammar, in the lower stages of the gymnasium course. See H. Bonitz in the "*Gazette of the Austrian Gymnasia* (*Zeitschrift für die œsterreichischen Gymnasien*,)" 1852, part 10, p. 820; and compare the observations in my "*German Orthography* (*Ueber Deutsche Rechtschrseibung*,)" Vienna, 1855, p. 105 *et seq.*

† This practical object should accordingly be regarded in preparing the text-book of grammar for the lower gymnasium classes. This book should make use of the discoveries of the philologists, for the arrangement and management of its matter. Still, it has for its object neither the philosophy nor the history of language, but instruction in the cotemporary German written language.

degree of correctness in the common schools. We could not prohibit boys from learning a trade, because at the end of their school attendance they still violate the rules of the written language. And the case is still stronger as to the girls. Shall marriage be prohibited except to those who have learned to make no errors in spelling? Another broader distinction between the practical duty of the gymnasium and the common school is this; that the former teaches also the use of the book language proper. The common school as well as the gymnasium instructs in the practical use of the written language; but our third chapter has defined the limits within which this object is to be sought; while the gymnasium seeks to accomplish it within an entirely different sphere and in an entirely different manner.

The limits to the capacity of the gymnasium in this direction, are fixed by considerations in part relating to written expression, in part to the order of thought. There are there two coöperative means of training in written expression; the translation of the Greek and Latin classics into German, and the reading of German classics. The translation of the masterpieces of antiquity is an unequaled school for readiness and propriety in expression. And the fault to which a wrong mode of pursuing that exercise may lead, of a stiff imitation of Greek and Roman idioms and feeling, to the injury of the spirit of the German language, will be remedied by the reading of our German classics. It is sufficiently evident, however, that the influence of German reading upon the pupil's powers of expression can not be otherwise than favorable; and I need therefore say nothing more on the subject, than what will be observed in a subsequent section on the reading of the German classics in schools.

What can the school accomplish for the second object, viz., instruction in correct arrangement of thought? First of all, at this point, a caution must be given, that the schools must not propose to themselves objects entirely without their proper scope, nor endeavor to accomplish results which can not be reached by school training, but must be the work of nature. And here, also, nothing will so secure us from excessive expectations, as to keep carefully in mind what is the purpose of the school. This is, not to train authors, nor graduates intending to be authors; but men able to make such a practical use of the written German language as their future vocations shall require. The schools are not to leave their own proper ideal arena, and to lay down by their lessons a measure of practical usefulness; but on the contrary it is both the most difficult and the noblest task of the school, in a thoroughly unassuming manner to determine the proper extent of general culture, with reference to the future occupations of its pupils.*

For the purpose of training the pupil in the correct arrangement of his thoughts, work in German compositions of his own should be added to his translations from the ancients. The gross errors which have been current on this subject are now beginning to be better and better understood. More than one book which has had a wide currency in our schools has contained themes for composition far above the comprehension of the pupils, and accordingly serving merely as an introduction to habits of empty talk or of useless rhetorical flourish. At present, however, men of very different opinions in other respects are agreeing in the recognition of this evil. although much divided in their views of the proper remedies. With the view of preventing injurious premature development, it has been well suggested that the written compositions of the pupils should be as closely as possible connected with their reading. That however the German compositions of gymnasium pupils should be principally connected with their German reading, I must consider a new and dangerous error, notwithstanding that very respectable authorities maintain it. If any where, it is just here that the inestimable advantages are shown, which the education of the young derives from the study of the Greek and Latin classics. Apart from all other considerations, one such chief advantage for our purpose is this; that their different language, and distance from us in point of time, render them much less provocative of immediate imitation. "Standing throughout at a great distance from us," says a profound writer upon sound culture, "they leave us far less influenced by them, however constantly occupied with them, than authors cotemporary or nearer to us in time; who endanger our mental independence and lead us into an unconscious imitation, in proportion as they please us more."† The goodness or the badness of themes selected from the substance of the pupil's classical reading depends upon the fact whether or not they possess that simple and elementary character which should be the choice of every person of classical education, whatever his natural

* I have been misunderstood, in this passage, to intend a lowering of the standard of the duty of our gymnasia. This error has however only shown that its entertainers have a very superficial conception both of the creative activity of authors and the dignity of public officers. The gymnasium is intended to educate not authors, but readers; a task lofty, yet practicable. The few who are ordained by nature to be authors, will owe gratitude to the gymnasia if their pupils shall ripen into a thoroughly cultivated circle of readers. Again; it is easy to perceive that in the passage above, the occupations referred to are regular callings; and therefore that the term "author" is used of persons who follow authorship as a regular vocation.

† *Collection of some discourses by President von Roth* (*Sammlung etlicher Vorträge des Präsidenten von Roth*,)" Munich, 1851, p 119.

character and gifts. Such may be extracts from historical works, careful repetition of some more detailed passage, perhaps a composition from several authorities worked up together; or an analysis of an oration of Cicero or Demosthenes, or of one of the easier Platonic dialogues. Besides such tasks, the whole materials for which are ready prepared for the pupil, occasional but not too frequent original compositions may be furnished, upon carefully selected themes. The more seldom this latter dangerous plan is resorted to, the easier will it be to avoid those unsuitable subjects which many good books have been prevented from excluding on account of that lack of materials, so frequently and unnecessarily complained of.*

The question still remains to be asked, whether it should be the duty of the gymnasium to afford the instruction and practice necessary for an express introduction to German oratory. If this term is used in as strict and full a sense as would have been given to it by the Greeks in the time of Demosthenes or the Romans in the time of Cicero, I would unhesitatingly answer in the negative. To train orators is not at all the business of the gymnasium. But if it is only meant that on one hand the pupil shall learn the free use of his tongue, and on the other that he shall be taught to put his thoughts into good order, this has in part been admitted and required in what has already been said; and some further advances towards oratory may not be without their value, provided caution is exercised not to form chatterboxes and extemporaneous sophists. The pupil is learning to talk throughout all his lessons, if the teacher understands how to guide him with that view. The oral translation of the ancient authors will however be found of very remarkable value as a school of striking and well chosen expression. The upper classes might take one of the easier writings of Cicero, and translate it from the Latin text, with the rule that each sentence must, after very brief consideration, be rendered into good German, without emendation, hesitation or repetition.‡

It is a question much discussed, how far theoretical rhetoric is a

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* Among others, Bomhard's book, "*Materials for exercises in style for the upper classes of gymnasiums* (*Materialien zu Stil-Uebungen für die höheren Classen der Gymnasien*,)" contains some excellent observations on this subject. (Ansbach, 1844.) Some however of the themes there given are such as we should not approve A rich store of materials and many valuable remarks, will be found in Götzinger's "*Style-school for exercises in the mother tongue* (*Styl-schule zu Uebungen in der Muttersprache*,)" 2 vols., Schaffhausen, 1854, 1855. My text will sufficiently explain any points where I differ frem Götzinger.

† On this point see the condensed article of Dr. Gampe of Neu-Ruppin, in Mützell's "*Gazette for the Gymnasia* (*Zeitschrift für die Gymnasialwesen*,)" 1851, February, pp. 82–112. The conclusion on page 111 does not however seem to me wholly consistent with that so convincingly set forth on p. 95.

‡ A suggestion of President von Roth.

study for the gymnasium. The easiest way to dispose of it would be to declare it a question not relating to instruction in German; since all the instruction in the theory of rhetoric which is given in the gymnasium must be very closely adjoined to the reading of the classics. But since many teachers of German have exposed themselves to the blame of having pushed rhetorical studies very much too far in the gymnasia, I would here urge with the utmost emphasis its retention within the most modest limits.*

The actual results of the culture afforded in German style, should be shown in the examination for entrance into the university. It is entirely correct to lay great stress, at this examination, upon the German; but it is not yet generally and definitely agreed, precisely what shall be required. A first requisite, and an absolute one, should be grammatical and verbal correctness in the written use of the German language. The proficiency of the candidate on these points will appear not merely in his formal German compositions, but quite as much and sometimes even more in his other examination work, so far as it is to be done in German. Only, more strictness should be used than has been, in requiring correctness and suitability of expression. If this were done, the candidate's work on history, religion and mathematics, will afford materials enough for judging of his mastery of the German. The second requisite is skill in arrangement of thought; the third and last, good taste. A well arranged gymnasium course of study will cultivate also these two accomplishments. But it is much more difficult to fix the proper limits of acquirement in these directions, than in the case of the first point above. The examination work already mentioned will afford a means of judging of proficiency on these points also. Their German compositions will however be the best means; and the themes given should be chosen first of all with a view to this object. But what requirements should be made of fertility of thought, or of imagination, is a much more doubtful question. I hope not to be taken for an enemy of either of these qualities. The more the rising generation shall possess of them, the better. I only believe that it will be very difficult to form a reliable opinion as to the extent to which these high qualities are actually possessed. All gymnasium teachers should be competent to judge of correctness or incorrectness in the use of German. And at least the more skillful of them can detect disorderly thought, and violations of good taste. But as to the higher positive qualities of a

* Similar principles apply to rhetoric and poetry. It is a very difficult question, what is the utility of these two studies in the gymnasia, and in what manner they should be pursued. But as its discussion does not come properly within the scope of this work, I will satisfy myself with a warning against untimely superficiality.

pupil's composition, such as profundity and imagination, it will be found that even very able teachers are often quite wide of the truth. Still, at the same time it should not be denied that teachers of great talent may draw correct conclusions as to the future of a pupil, even from these lofty, but often profoundly hidden qualities.

If proper heed is given to these conditions, they will supply the necessary principles for deciding as to the study of German at the gymnasium. From the lowest class to the highest, attention should be paid to grammatical and verbal correctness in the use of the German language. With this object in view, a very different opinion will be formed of the importance of oral and written translation from the Greek and Roman classics, than has sometimes been imbibed from the consideration of classical philology exclusively. And in like manner, the inestimable value of classical culture for the purification of the taste and arrangement of thought, will be more clearly appreciated. But at the same time care should be taken not to give the pupil, by artificial means, the false appearance of a fertility of thought or of a poetical fancy which he does not really possess.

Section 2. The late German Literature at the Gymnasium.

By the term "late German literature," we mean the German literature since Klopstock and Lessing. I find it a peculiar task to deal with the question, what is the proper position of the gymnasium with reference to this literature. An almost innumerable multitude of writings have discussed this difficult problem; but while credit is due to most of them for the earnestness with which they have advocated the use of the better portion of our literature, yet I regret to have to say that there are important points upon which I am unable to agree with them on the question of dealing with German literature at the gymnasium.

Shall the gymnasium take any notice at all of German literature, or shall it leave chance to decide whether its pupils hear of Goethe and Lessing? I believe that this question may now be taken as definitely answered. Even the extremest rigorists among our present educators would scarcely think it well for a candidate in theology, as recently did in fact happen, to ask very coolly, on mention being made of Lessing, "Who is this Lessing? Has he written any thing?"* Or for a student who has been at the university for several years, to ask a professor to lend him "Goethe's Schoolmaster's Apprentice-

* I would add, for several reasons, that this specimen of erudition appeared not in Bavaria, but in another German country.

ship."* But such things are not merely possible, but even not to be considered surprising, so long as our public schools take no notice whatever of German literature. For the argument that all this knowledge must come of itself without the aid of the school, can be advanced only by such as would exclude all children of the lower ranks from learned studies, or by such as have very little knowledge of the character of the actual life of our so- called educated classes. We thus have to inquire only as to the mode and extent in which the study should be pursued.

In opposition to the despisers of the German literature, there has lately arisen an unexpectedly zealous advocacy for the study of it in schools. This has however unfortunately, as often happens in similar cases, overshot its aim in many respects. Instead of being satisfied with some possible attainments, such as in the present condition of affairs are very evidently the only desirable ones to seek, this demand has wrongly considered alike the age of the pupils, the purpose of the school, and the nature of poetry. The proof of this assertion I purposely draw, not from the writings of any subordinate authors, but from those of teachers of established reputation, and whose merits on other accounts I do not by any means attack. Viehoff, in his estimate of Schäfer's selection from Goethe's poems,† thus expresses himself as to the relation between the school, and Goethe's lyric poems: "The most important object, for the school, seems to me to be, to set before the pupil a complete picture of Goethe's course of development as a lyric poet. In this manner (I take the liberty of repeating my own expressions in Mager's Review) the successive metamorphoses of Goethe's lyric style, its advance, culmination and decline, the various motives which successively influenced him,‡ the different poetical forms which he cultivated one after another, their gradual perfection, his productive and unproductive periods, all these will clearly represent themselves to the pupil." And Hiecke, after giving a number of themes of an æsthetic character for compositions by the pupil, including for example, the characters of Weislingen and of Clavigo, then adds: "When the pupil shall thus have been gradually led to heights which afford him views more and more extensive, then the history of the formation of the works as read in the

This question as to Lessing is as if a graduate of Andover should ask the same question about Milton. The error as to Goethe is as if Scott had written a novel called "William Masters' Apprenticeship," and the ignoramus should ask for the "Schoolmaster's Apprenticeship."—(*Translator.*)

† In the "*Archives for the study of modern languages and literature (Archiv für das Studium der neueren Sprachen und Literaturen.*)" edited by L. Herrig and H. Viehoff, vol. i., part i., Elberfeld, 1846, p. 197.

‡ Observe this suggestion.

school or privately, the explanation of their connection with the poet's views of the world generally, and with the course of his own development—all of them matters of which his teacher will naturally speak—will be found both interesting and intelligible to him."* I conceive it will be much easier for me to show that these tasks are wholly unsuitable for the gymnasium, than to explain how so intelligent and talented a man as Hiecke could have contracted such extravagant opinions. In another part of his book,† Hiecke very correctly maintains that after Lessing, it is Goethe and Schiller who should be most fully understood by the young. But how are the pupils of a gymnasium to be made to understand what are the "views of the world generally," and the "course of development" of Goethe or even Schiller, in such a sense as to follow the development from them of their individual works, such for instance as the Egmont‡ or the Wallenstein? As to Goethe, Hiecke omits his Faust from the gymnasium course of reading. But how can Goethe's "views of the world generally," or his "course of development," be explained to people who have not read Faust, and indeed can not read it? And as to Schiller, it is well known that the philosophy of Kant was a very important influence with reference both to his views of the world and his course of development. But how can his relations to that philosophy be explained to persons who neither have read it nor ought to read it?

How have these writers arrived at opinions as to the study of the German poets so extravagant, and which become gradually less astonishing to us only because men become accustomed to whatever is wonderful? The answer to this question will expose an error similar though different in some respects, to that which we have already found in Becker's views on the study of German grammar in schools. When German literature was first made one of the studies of the classical schools, this was here and there effected at the expense of a thorough and careful study of the classics. "While in the lower classes" says Thiersch,§ "the love of the study of language has been destroyed by the fatal breath of a spiritless system of formulas, we find our pupils wandering at pleasure in their school in the society of the poets and prosemen of our literature. One day, there is declamation from Hölty or Bürger, and the next day readings of some fables, or of 'Nathan the Wise.' This easy life has become a feast and festival that lasts all the week long." What remedy could be

* Hiecke "*Instruction in German* (*Der deutsche Unterricht*,)" p. 181.

† Ib., p. 107. ‡ Ib., 180.

§ "*On the classical schools* (*Ueber gelehrte Schulen*,)" 1826, iv, p. 340.

applied to this state of things? Should the German classics be entirely excluded from the schools again? This was out of the question. But the happy alternative was hit upon, that the German poets could be studied and analyzed as the Greek and Roman poets were, and would thus become a valuable material for school exercises. None of our poets are so well adapted to this purpose as Klopstock. His "Messiah" is accordingly to be read in school, "together with the employment of a well-arranged chrestomathy from it, explained by suitable comments."* And above all, Klopstock's odes, whose obscurity is well known, afford a most desirable instrument for philological interpretation. "These should be used like Latin or Greek ode, but more rapidly, because the difficulties of the language are proportionably less, and there will thus remain for examination only the difficulties of the thoughts, and their connection."† In proportion, moreover, as the advocates of instruction in German put Klopstock in the background and bring Goethe and Schiller more forward, we have less and less "difficulties of language," and the skill bestowed applies more exclusively to "difficulties of the thoughts and their connection." And even in these respects, most of the works of our two great poets offer no particular difficulties to their reader, if he is satisfied to read them as any man of plain sense reads poetry. The case is quite otherwise however, if the reader undertakes to analyze their writings with the critical understanding, to explain the connection between the different scenes and acts, to show their relation to the "idea" of the whole work, &c. Under this method, no poem is so simple, no mode of treating a subject so clear, as to avoid leaving something to interpret; for which very reason many of our teachers of the German language are at present in its favor. Uhland's elegant romances and ballads are only to become understood by the pupil after he has, with his teacher's assistance, torn them into a thousand pieces, and handled over each dismembered fragment half-a-dozen times. After the poem has been first read over several times, and the necessary explanations given of any single points in it, then the serious work of this process commences.

"Now," says Hiecke,‡ "the teacher himself should give the contents and course of action of the first poem, showing the pupils by an example or two what they are required to do. The whole labor

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* Ibid. p. 355.

† Ib., p. 356. Friedrich Thiersch's services to the cause of thorough classical education do not need my praise. I have, also, already (see above, p. 449.) acknowledged the merit of a portion of his views on instruction in German. In discussing the German poets, however this very able teacher has permitted accessories to vitiate his views of the main question.

‡ Instruction in German, p. 151.

should however as soon as possible be transferred to them, so as to afford the means of a good correct estimate of their attainments in distinguishing what is essential from what is less essential, and of their power of comprehension and its development. In giving the account of the course of events of the poem, its own order should be entirely followed, even if not accurate in chronology; but attention should be drawn to the point where the action of the work begins, and how preceding occurrences are worked in. Attention should also at the same time be paid to the metre, (which should of course be very simple and comprehensible, to the rhyme and its arrangement, and the number of lines in a stanza. Next, the poem should be set off into its main divisions and these again into their parts. The extent of these parts, and their division into single stanzas and parts of stanzas should be adverted to. At the same time questions may be put as to changes of place and scene of action, if there be any. Thus, the acts in "Little Roland," may be thus designated; 1. Little Roland and Lady Bertha; 2. King Karl and his court; 3. King Karl, his court and Little Roland; 4. King Karl, Little Roland and Lady Bertha; 5. Lady Bertha, alone. Which of these acts are connected with the previous ones by means of transitions; and what are these transitions?"

Such being the mode of proceeding in the "first stages" of the "lower classes,"* it may easily be computed how subsequent progress is adjusted. In the upper classes, something will have been accomplished worth speaking of. There, the pupils are to write on the themes, "Is the scene with Montgomery superfluous?" "Why are the soliloquies so numerous in the Iphigenia and the Tasso?" "On the strictly dramatic construction of the story of the Iphigenia." Very quick pupils may also be caused to inquire whether such or such a scene might be altered or omitted; and whether such an experiment would presuppose or necessitate a change in the preceding or subsequent part of the story."† By such a route, that culmination of repulsiveness is finally reached, which the expressions of Herr Viehoff on the lyrics of Goethe and the school, have indicated to us.‡

In the treatment of our native poetry, as well as in that of our native language, the school should follow the path of unconstrained nature, in order to ascertain the treatment of it by the great universal mistress, before the time of schools, and aside from their influence. How was it in the days which breathed poetry like air? Read in Homer how Demodocus, the "much experienced bard," delighted the

* Ib., p. 150. † Ib., p. 179. ‡ See above, p. 503.

king and his guests by his song; and consider what the bard, the king, and the whole circle of hearers, "of long oars, ship-renowned," would have said, if any body had set out to "bring them to a conscious knowledge" of the lay of the singer, after the manner in which our pedagogue dismembers for his boys Uhland's "Little Roland." The nature of poetry and its primary and highest object remain the same in all time. If there is any one not convinced of this by the nature of the case, let him convince himself by the words of the greatest German poet: "Nothing can be wanting to the fortunate one who with peaceful soul receives this gift, woven of morning air and of sunshine, the veil of poetry, from the hand of Truth. And when the moon is sultry about thee and thy friends, wave it in the air; and the coolness of the evening breeze will whisper around thee, and the odors of aromatic flowers will breathe about thee. The woe of sorrowful earthly feeling will be silent, the vault will become a bed of clouds, all the fountains of life will flow more softly, the days will become more lovely and the nights more clear."

As in the case of our native language, so in that of our native poetry, our first feeling at the idea of its being subjected to the uses of the school is one of displeasure. As in the former case, so in the latter, the undertaking must in the first place be properly laid out. For surely, no one will think of aiding to secure the transmission to a succeeding generation of a knowledge of such poetry as is entirely in harmony with cotemporary life in thought and expression, by means of a school training of the public for the purpose. But in this case as well as in that of the mother tongue, a reason for its introduction among school studies is derived from the use of writing. The poetry of the present, strictly such, should never be made a subject of school instruction. But when the poetry of any age has become written, succeeding times grow slowly and imperceptibly away from it, and before we are aware, that which is in its own day greatest and most beautiful to the hearts of all, is a vanishing thing of the past to the generation that is growing up. Here it is that the school steps in as the preserver of the accumulating treasure, and interprets and transmits it to the rising generation. For it seems as if God's Providence had given to the nations that grow old and ready at writing, a compensation for their loss of that poetry that springs immediately from life, in putting into their hands for support and pleasure, the best productions of all times.

The first and most important task of the school in this direction is, to deal, with its pupils, with poetry as such; and if the double nature of the task should render it impossible not sometimes to injure its character as poetry, it should be all the more careful not to destroy it.

The remarkable growth of German literature from Klopstock down to the War of Freedom is constantly becoming to us more a thing of the past. This past however is still so near us that the older men of our own day have been cotemporary, if not with its most brilliant period, at least with its decline. However rapidly therefore our own age presses forward in many directions, fair consideration will convince us that the most important foundations of the intellectual culture of that age and of this, as well as their language, are in all their chief points the same. Thus the schools, if they do their duty even only generally, will, setting German literature out of the question, give their pupils an education that will bring them to a point very near that of the public for whom Goethe and Schiller wrote. Accordingly, the duty of the schools as to the later German literature will consist much more of the transmission than of the explanation of it. This transmission is effected, at the present day, notwithstanding all the modern means and substitutes, substantially by singing and recitation. Strictly lyric poetry depends therefore for its transmission to the memories of the next generation, upon a competent course of instruction in singing, and especially upon the conjoint practice of such pupils as can sing. Those who have not singing voices, must depend upon hearing from time to time what the rest sing. They already know the words that are sung; for the same songs which have been practiced during the singing lesson, have been read over to them during their lessons in the German language; and after having been repeatedly sung, the most appropriate of them will be memorized by the whole class, and repeated by some of the pupils.

Of those parts of our lyric poetry not adapted to singing, the teacher may read the best, and such as are adapted to the age of the pupils to his class; and may then after a time have them read by the pupils, who may lastly commit to memory the best of them and repeat them at lessons. If any passages seem to require an explanation, the teacher may give it when the poem is read for the second time, making it entirely simple; for this is not a proper occasion for the sort of exercises in the use of the understanding which are appropriate in most other lessons. And in general, special explanations will be found unnecessary, provided that only such poems are read as are adapted to the class, and that it is left to the progress of the pupil in general knowledge, to elucidate to him many things at first obscure.

During the latter half of the gymnasium course, the teacher may add, at the reading of a poem, a few remarks on the life of its author; not "in order to explain the poem by means of the whole of the general views of things entertained by the author," but in order to give the pupil gradually some of the important facts relative to our principal writers. By this mode of proceeding, the poetry of our great lyric writers, so far as it is adapted to school pupils, will during the eight or ten years of the gymnasium course be to a very considerable extent made familiar to the scholars. Regular lessons, to be exclusively occupied with this work, from one bell to another, should not be set. It should rather be made a recreation, to come between the hours of labor at severer studies, and to occupy only say a quarter of an hour at a time.*

What shall be the mode of proceeding, is our next inquiry, with the more extensive works of our German classic authors; the epic and dramatic poems, and the prose writings? Here we shall find the task of the school a double one. First, it will endeavor to direct the private German reading of the pupils; and secondly, to make them familiar within the school with the masterpieces of German poetry. As to private reading, we do not of course here refer to the reading of useful and instructive books whose contents are historical, geographical or otherwise didactic. The recommendation and direction of that description of reading belongs to the departments of history, geography, &c. However desirable therefore it may be that reading on these subjects should as far as possible be confined to masterpieces whose finished style and form entitle them to be ranked as belles-lettres works, still their study must be subject to very different conditions from those which should govern the reading of poetry. While the teacher can supervise the pupil's reading in the former departments by thorough questioning on the substance of what is read, such a mode of proceeding is not at all to be recommended for the reading of the German poets; for with them, that only is valuable which the pupil reads with pleasure, and no examining supervision is necessary over what is read with pleasure. The teacher can accordingly only give good advice; and the success of this must depend upon the confidence felt in him. Further than this, the gymnasium should

* This method is unquestionably best adapted to the nature of the subject. The danger of its being misused by indolent or unconscientious teachers could be prevented by the supervision of the rector. Nor can this danger be so great as I have formerly myself apprehended; for if it were, so experienced an educator as Thiersch ("*Classical Schools*," iv, p. 353,) would not recommend a similar practice. In the upper classes, where the reading of the greater lyric poems will sometimes require somewhat more time, the extent of it will of course be regulated by the whole proportion allotted to instruction in the German language.

afford a well chosen library, to furnish the pupils with the books which the teacher recommends to be read.*

The most effectual means however of properly directing the private reading of the pupils will be to cultivate their taste by a well digested course of reading in the school. This should consist in part of the reading of the Greek and Latin classics, in part of an introduction to our own great poets. How, therefore, can the school accomplish this latter purpose, on our principles? That the method of æsthetically analyzing and commenting is worthless, has been sufficiently shown. What should rather be sought is, to give the poetry read the same mode and kind of effect upon the pupils, which it has upon the poet's own public. Silent, solitary reading is the merest make-shift; supplying the place of reading aloud in epic poetry, and of acting in the drama. To afford opportunities for this last is out of the power of the school; and may God preserve us from degrading the productions of our great poets into school theatricals. The school is however competent to open the significance both of epic and dramatic poetry to its pupils, by instructing them how to read them correctly and elegantly.

Great stress is properly laid upon the acquirement by the pupil of the ability to read well and correctly. I am entirely of the same opinion; but I believe that the reading aloud of dramatic compositions has a somewhat different relation to the general culture of the pupil, from that of other kinds of writing. Every gymnasium graduate ought to be able to read prose clearly and correctly. Almost all studies furnish opportunities of acquiring this ability, especially the historical lessons. And it is just to require that every educated person should be able to read German poetry well. Our observations above on lyric poetry have shown how this should be taught. But it seems to me impossible and unnatural to enable every gymnasiast to read well a tragedy or a comedy. To do this, are requisite very peculiar and by no means common natural gifts, such as certainly can not be required of every gymnasium student, because without them it is practicable to be not only an excellent pastor, judge or physician, but a man of the most thorough culture and of the profoundest susceptibility to poetry. But what I would require from every educated person is, to be able to listen to and enjoy good dramatic reading by others. This art, the art of listening appreciatively, the gymnasium ought to teach to its pupils; and this art is of course to be learned not by rules, but by use and practice.

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* Hiecke, at p. 68, *et seq.*, of his work already frequently referred to, makes some very excellent observations on the private reading of gymnasium pupils. The points where I disagree with him will sufficiently appear from what I have already said.

The suggestion which I would make on this subject is this;—Let the reading of dramatic poetry, and also of epic poetry, which is however here less immediately under consideration, commence three years before entrance to the university.* If now one lesson a week be devoted to this most important and extensive department of our whole recent literature, this will be from four to five lessons a month. I would propose to set these four or five hours on the same day in each month, and on this day to read to all the pupils of the three last years collectively, an entire drama.

If it be remembered that these remarks apply to German literature only, and that translations from foreign languages, though to some extent desirable, must still for very important reasons constitute only a moderate proportion of what is read, it will very soon be admitted that the number of works to be considered here is not very large; for, firstly, only works of the highest rank can be admitted, and time has decided the question of rank; and secondly, a portion of those works which possess this requisite, are by their own nature excluded from the schools. After much consideration I have settled upon the following list for our use; of Goethe, Goetz von Berlichingen, Iphigenia, and Hermann and Dorothea; of Schiller, Wilhelm Tell, The Maid of Orleans; of Lessing, Minna von Barnhelm; and besides these, some of Shakspeare's works—perhaps Julius Cæsar and Macbeth, but not Schiller's translation; Herder's Cid, and something from Calderon. On this plan foreign works would constitute about a third of the whole; and our purpose would rigidly prohibit any important enlargement of this proportion. A few of the poems selected would require more than the estimated allowance of four or five hours, and should therefore be properly divided; but should still all be read in the course of the same or at most of two days. Others again would not occupy all the time allowed; so that the whole time occupied would scarcely if at all exceed the average allowed of four or five hours a month, or one a week.

We have given the names of twelve separate works; on the plan that one of them should be read each month to the three higher classes together; which would give twelve readings, or if the longest vacation be omitted, from ten to eleven readings, during a year. As these extend through the last three years of the gymnasium course, each pupil will attend from thirty to thirty-six readings, and thus will hear each work read two or three times; a fact very beneficial in its influence upon his remaining reading.

* For Bavaria I should say, "in the third class from above." In view however of the variety of divisions of each year's course in different German countries, I have preferred the words in the text, which as an average designation will not be misunderstood.

The question, Who shall read, will be suggested as a difficulty of this plan. The very extensively received error that it is disgraceful not to be competent to read a tragedy will probably, in many faculties of teachers, cause rather an overplus than a deficiency, of such as consider themselves fit persons. But as the correct doctrine gradually expels this false one, and it becomes understood that dramatic reading requires very peculiar gifts, without which it is perfectly practicable to be quite the ablest teacher in the country, this office will be more and more readily left to whichever member of each corps of teachers shall be found best adapted to it.*

But, is no explanation whatever of these masterpieces to be given to the pupils? I answer, that I am in fact of the opinion that these poems will fulfill their own great and important office, without a single word of explanation. Susceptible scholars will after the reading is concluded go quietly and silently home filled with the great conceptions and mighty fates of which they have been hearing. There will be however, in contrast with these impressions some subordinate points on which there will be some obscurity, of which the pupil will be unable to give any clear account. If now the very proper measure be contemplated of furnishing the pupil some assistance during his own voluntary and unsupervised re-reading of the work which he has heard read, which he may use as a resource in such individual cases of difficulty, I should recommend a printed collection of brief and well applied comments on the work. This might be used by any pupil desiring it, along with his own reading at home; and a number of copies of it should be in the gymnasium library, so that several pupils at once could use it. I will give an illustration to show what kind of commentary I mean. In the programme of the Nuremberg gymnasium for 1840, Joachim Meyer published an excellent explanatory commentary upon Schiller's Wilhelm Tell. This commentary is in more than one respect worthy of all praise as a contribution to German literary history; and I myself feel myself under substantial obligations to this industrious author, for his careful information. But for a collection of explanations suitable for gymnasium pupils, only a very small proportion of these comments would be appropriate.

* Space will not permit me to develop the details of my plan; but having carefully worked them out, I believe myself justified in the assurance that with good will and mutual accommodation, all obstacles can be overcome. How such physical difficulties as will sometimes arise can best be avoided, whether by changing the reader at each act or by dividing the lesson; and whether the maturer pupils, if indicating the requisite talents, should assist in the reading, are questions which experience must decide. In like manner I leave it to be decided by experiment, whether it might not be better to occupy successive afternoons for a reading, than a whole day. If the time which my plan requires shall seem too great, in view of other indispensable uses of it, a less number of readings in the year might be given without injuring the essentials of the plan.

Some of them would be already known to the pupils from their other studies, as for instance, what the "*Rigiberg*" is, (p. 42;) and most of the remainder of them are interesting only to such persons as are studying the history of the development of Schiller's dramas, which is not at all the business of a gymnasium student. Thus, we are grateful to the author for his quotation from Scheuchzer, of a passage which may have given Schiller the hint of his fisherboy's song. But no one would learn any thing from the quotation from Scheuchzer, who would not understand the song without it. Schiller, indeed, so fully apprehended the sentiment of the old tradition that he has far surpassed the dry and unambitious account of it in good old Scheuchzer. And if the youth who reads the opening scene of the Wilhelm Tell, shall without the help of any commentary find arising in his mind recollections of the fairy tales of his childhood, of nixes and watermen, of the clear glassy waters of the streams or of the dark lake with its floating water-lilies, he will have apprehended the meaning of Schiller's song much more correctly than he can do by consulting the quotation from Scheuchzer. But on the other hand, the explanations of Swiss idioms and of the very remarkable characteristics of Swiss geography and landscape, will in most parts of Germany be very gladly used.*

I have purposely delayed hitherto the consideration of a very important question, viz., how a German anthology for the gymnasium should be chosen; and my reason for doing so is, that it renders it necessary to refer both to dramatic and epic poetry. I may be the briefer on this topic, as so much has already been well said respecting it. Such a collection should in particular contain pieces fit for memorizing; including, besides lyric poems, some extracts from the dramas and epics already named. The mode of arrangement is of much less importance than a proper selection; as there is no necessity that the teacher should adhere to the order of the book. The teacher of each class will of course, as each class comes into his hands, want a list of what it has memorized before. He need not thus preclude himself from repeating what was learned before, but he needs to know whether what he gives to be learned has been studied

* Some objections which have been made to these views deserve consideration. With regard to these I would observe, in the first place, that the non-use which is recommended of comments along with the body of the work, does not preclude the furnishing of whatever preparatory matter may be needed to place the hearers in a proper relation to what is read. And secondly. I willingly admit that the complete execution of my design presupposes a favorable state of the school. Where these conditions are wanting, it will of course be better to give such explanations as may be necessary in the school. But if this be done during the first reading of any piece, it will at any rate be practicable to read it without interruption when it comes up the second time.

before or not. The use for which we intend this collection makes it proper that it should contain only the best kind of matter. Who, however, is to decide what is best, and what not? However various opinions may be in some single cases, still there is a sufficient answer to this question. The criterion must be, the permanent approbation of the best part of the people. And this is another reason, besides the general ones already given,* for not admitting the newest literature into the schools. It can not be left to the schools to decide which of these newest productions shall be allowed a place among our greatest classical writers. The proper task of the school is rather to transmit to the succeeding generation whatever the established approval of previous ones has stamped as excellent. Nor will such a course tend to discourage any cotemporary creative intellect. For the poet speaks to a free public; and will not desire to have his productions brought into vogue by means of the compulsory course of study in a school. If the taste of the pupil has been trained by what is of proved excellence, he will be better able to give the preference to what is best among new publications. But this interdiction of the newest literature from the precincts of the school is not intended to prevent the teacher from giving advice in private conversation to his pupils, even respecting publications not yet of established reputation. Still, that advice would be, as to immeasurably the greatest number of new publications, to leave them unread at least for the present.

Section 3. *The Old German in the Gymnasium.*

Any one who had proposed at the beginning of this century to introduce the Old German into the course of study of the schools, would have received the answer, which would have been very proper, that all mere amateurship must be kept out of schools. But the case is very different at present. Any one who has even glanced into Grimm's grammar, will not deny that the historical investigation of the German language has become a science of so much importance and of such strict principles, that it is entitled to a respectable place at the side of the more ancient departments of philology. Thus the question at present becomes this: Shall the knowledge of the Old German be confined to a little circle of men learned in that specialty; or shall it, though only to a moderate extent, become the common property of all persons of literary culture? I hope the time is not distant for a full discussion of this question; but on this occasion it must be dismissed with a few words. There is no need to explain

* See above, p. 502, *et seq.*

the value of a knowledge of the Old German to jurists. The most important authorities on German law have since the thirteenth century existed in German; and every one who has examined the subject knows that a knowledge of the present German language is not sufficient for an understanding of these authorities. German theologians will more and more fully recognize an acquaintance with our ancient language as necessary, in proportion as they recognize more fully the important place occupied during the Middle Ages by the diffusion of Christianity among the people, and its popularized forms of presentation. These considerations will cause an immediate intercourse with the writers of that important period to appear, to the German pastor, no less desirable than the study of many of the Latin Fathers. Even a Protestant theologian, who from ignorance respecting the mediæval Catholic period, does not consider it of much importance, will find a new light shed upon both the language and the facts of Luther's writings, if he shall acquire a knowledge of that portion of the productions of his mediæval predecessors which is valuable.

The fact however that jurists and theologians can usefully study the Old German in their own departments, will still not entirely justify its reception within the sphere of the higher general school culture, without the additional reason of a more thorough general culture. Here, however, the advocate of the study of the Old German finds himself in a somewhat difficult situation. Any one who has a moderately good knowledge of the Old German, will usually not need any argument to convince him of its value. But those who know nothing about it, must have a certain amount of predisposition in its favor, before they can be made to comprehend its merits. The philological student finds the Old German valuable for two reasons. He reads in the history of German literature, of the great number of German poems, some of them of great distinction, produced during the middle ages; and he also finds himself at every step of his progress unable to understand the structure of the cotemporary German without a knowledge of its history. If now in addition to these considerations those are applied to our own language and literature, which are commonly and with justice urged for formal culture by means of the Latin and Greek, two consequences will irresistibly follow; first, that it is an unnatural situation for our men of literary culture, to be able to read Greek and Latin poems in the original, but not our own ancient poems; and second, that it is reasonable to require some knowledge of the structure of our own language, from those who are justly required to possess quite a comprehensive knowledge of the Latin and Greek. I can scarcely believe that upon calm consideration, any one will deny these positions. The failure to carry them into actual practice will only be accounted for, by able educators, by the apprehension that the introduction of the study of Old German might prove detrimental to that of Greek and Latin. If this were actually the case, I should myself consider it necessary to use extreme caution in introducing the Old German to our gymnasia. But all such apprehensions arise from obscure or erroneous ideas of what is contemplated; as will most plainly be shown by a more particular statement of the extent of time and study which we should ask to be devoted to the Old German.

The question at what period of the school course the Old German should be studied, has been answered in three different ways. Some have maintained that natural principles require that we should begin with the Old German at the beginning of our instruction in language. But this plan has every reason against it. It misconceives the nature of our language, and of historical grammar, by undertaking to make boys of from eight to ten years old, analyze their own language historically. But aside from this unnatural character, practical necessities furnish the most substantial objection to this scheme. For, the boy must be master of our cotemporary written language, before he can think of beginning the Old German. But this is only accomplished at the time when, besides continuing the study of the written language, he is devoting all the strength he can command to the study of Latin and Greek. For these reasons, others have placed the study of Old German at the opposite end of the course of education, leaving it entirely for the university. Theoretically, it might appear as if there were many reasons in favor of this plan. But it is inconsistent with the idea of making some knowledge of Old German an attainment common to all educated persons; for even in the most favorable circumstances, only a very small part of the whole number of students would take up that study. Thus there only remains as the place for commencing the study of Old German, the upper classes of the gymnasium; and the opinions of competent judges seem recently to be becoming more unanimous in favor of it.

A second important question is, what shall be the extent of the gymnasium instruction in Old German. The first glance at Grimm's grammar will show that but a very small part of all the dialects there treated can be taught in a gymnasium. The decision which of them shall be taught, must depend not upon their intrinsic excellence, nor literary wealth; but altogether upon their relation to our own cotemporary German. On any other principle, we shall find the claims of the Old North German, with its rich literature and very remarkable grammatical forms, among the first; but no reasonable person would advocate its introduction into our gymnasia. The Middle and the Old High German are the dialects most nearly connected with our language; and therefore, together with the first elements of the Gothic, should be introduced into the schools. Proper management will remove any apprehensions as to the extent of this material. The Middle High German alone will not suffice; for although the regularity of its structure approximates it to the early condition of the language, its abbreviated and silent inflections are far more similar to the New than to the Old High German and the Gothic; so that while it would serve one of our purposes well enough, viz., of an introduction to the Old German poetry, it would fail in the other, the history of the German language. For this latter purpose it is necessary to go quite back to the Old High German and Gothic. This proceeding will be advantageous in two ways; our own language will come, through the Gothic and Old High German, into a connection, so far as relates to grammar and etymology, with both the classical languages; and also, the Old High German and still more the Gothic, form the best basis for the study of every other German dialect.

The practical arrangements for these studies might be thus: Let two hours a week during a year and a half of the gymnasium course be devoted to the Old German. The two half years of the second class and the first of the first* (or highest, *Translator*) might be chosen. In the second class, should be taken up the first elements of Gothic, and of Old and Middle High German etymology, studied together in comparison; after which a few little exercises in Gothic and Old High German may be read with the pupils. The greatest difficulty here will be found to be in preserving the proper medium between an unattainable thoroughness and a barren superficiality. The last fault will be most frequently to be apprehended, though sometimes it is the former. To be satisfied with merely being able to guess at the meaning of Gothic and Old High German is a useless waste of time; it would be better to let them entirely alone. Their study is profitable only when followed in a strictly grammatical manner. But on the other hand it is quite out of the question, and

* It is certain that the study of Old German properly belongs to the upper gymnasium; though it is not attempted here to decide definitely in which classes it should come. I anticipate in this place also, the objection that the time I require can not be afforded by the pupil without overworking himself. If this be true, the study must be confined within two half-years, the Gothic, Old and Middle High German all being commenced together, and to be continued after the manner above recommended.

would be quite useless, to require the pupil to be as much at home in the grammar of Gothic and Old High German, as he may properly be expected to be in Latin and Greek. The proper medium here seems to me to be, to let the pupil go through the lesson next to be recited, and make what he can of it by himself; the teacher adding such instruction as is necessary, but leaving as much as possible to be worked out by the pupil. Where the pupil's knowledge fails him, the teacher should explain, with the same thoroughness and fullness that every good school requires in Latin and Greek; without omitting any form, or slurring over any difficulty. The pupil should make notes of the teacher's explanations, in the same manner as is required in the upper classes on the Greek and Latin authors. By this method the scholar will derive great advantages, and his work, while not easy, will at any rate not be an unattainable enterprise.

In the second half year of the second class, the pupil should begin by a review of the most important part of his previous lessons. This having been accomplished after a few weeks, he should begin to read Middle High German poetry, and should continue this up to the end of the first half year of the first class. But care should be taken not to diminish the success and pleasure of the pupil by making him at the outset read too many disconnected fragments. It is better to take up fewer single pieces of some length. When shorter compositions have afforded sufficient practice on the principal points of grammar, the pupil may proceed to the Nibelungen. If it is thought best to take up still other works, they should be as far as possible complete ones; not mere illustrations of literary history; for reading this latter description of matter is appropriate to a subsequent period of study.*

If a skillful classical teacher will now glance backward at the requirements thus stated, he will admit, on a fair examination, that they are at any rate not dangerous; for if he will reckon up the amount of time and labor which our plan would require to be devoted to the study of German from the beginning of the study of Latin up to the last half year of the gymnasium, he will find that no more is wanted, even including the Old German studies, than most school courses of study allow for German without them.†

* Pupils who have at the gymnasium acquired the beginning of a knowledge of the Old High German, and can read with ease some Middle High German poetry, can with real advantage attend lectures during their university course on the history of the Old German Literature. This is the natural order; and if in exceptional cases it should be found expedient to enter upon this advanced department of study in the highest gymnasium class, an intelligent teacher will not fail to avoid the error of beginning the house at the ridgepole.

† It is self-evident that the Old German can not be studied except at gymnasia where German is throughout the language of instruction. At gymnasia however where, while that is

Section 4. German Literary History at the Gynasium.

A sufficient opinion has already been expressed of that sort of literary history in the gymnasium, which professes to conduct the pupil "into all the depths of the innermost life of the soul of our nation," and to develope the works of Goethe and Schiller "from their general views of the world."* I can here only repeat, that with respect to the study of German literary history in the gymnasium, nothing will need to be so carefully avoided as the increasing tendency to carry it to an unreasonable extent. If it is to be undertaken as is unfortunately often recommended by educators otherwise both able and useful, I have no hesitation in saying that it would be much better for Germany if the schools should have nothing at all to do with German literature.† Unless we are to injure more than we benefit the cause of German literary history at the gymnasium, we must always remember that the gymnasium must teach only the rudiments of it. Its further pursuit belongs to the university and to actual life; and for this precise reason, such a connected and symmetrical study of it as a book or even a university course of lectures on the subject would require, must not be allowed in the gymnasium. That institution must confine itself to such points as are most necessary, and adapted to the age of its pupils. Its aim should be not an exhaustive presentation of the intellectual history of our people, but on one hand to supply the pupil with such knowledge as is quite indispensable, and on the other to imbue him with the desire to proceed further in the study. Both these objects will in a great measure be attained by the means prescribed in our former sections. Some account of the most important monuments of the earliest German literature will be given by the teacher in the course of his treatment of Gothic and Old High German grammar. What is most necessary about the Middle High German poetry comes within the introduction to the course of reading in that language. Much will also be said upon the great New High German writers; on some, as Luther, in the historical course; on others during the reading of their poems.‡

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the case. there are very many pupils whose native language is not German, the question will require careful consideration, whether the study of the Old German will not too much interfere with the acquisition of the New High German written language. In gymnasia from which Old German is excluded for such reasons, a New High German translation of the Nibelungenlied should be one of the books to be read either within or without study hours.

* See above, p. 504.

† I had originally intended to work out this section in detail, with numerous authorities from text-books, periodicals, &c. I have, however, concluded rather to leave my material unused than to risk hurting the feelings of well-meaning persons. Errors are more easily to be forgiven in so new a department of instruction.

‡ See above, p. 511.

All these points can be by a competent teacher sufficiently well discussed during the last half-year of the gymnasium course. The reference made to Old German literature will be very short; for its fuller consideration must be left to the university, to which place indeed many would postpone the whole study from its A B C upwards; while others find themselves prepared when yet in the gymnasium to study something about the "Spirit of Old German literature," although of the opinion that conjugating and declining would more appropriately be left for the university.

In New High German literature, a brief review of our dramatic poetry should be added to the acquirements already prescribed in lyric poetry. There are two reasons for postponing this to this last half-year; because the pupil can now consider the great masterpieces of our dramatic literature without obstruction by any prejudices; and because he is now acquainted with some of the antique plays.

The teacher should now, however, direct the attention of his pupil especially to our great prose writers; and among these, most of all to Luther, Lessing and Goethe. How little the gymnasium can aim at completeness in this study, is shown by the considerations, that even as to Lessing, one of the most important phases of his literary activity can only be just touched upon; and that a very important department of German prose writing, the strictly speculative, must absolutely be passed over with a mere reference to future studies.

No department of the whole course of instruction underlies to so great an extent the individual plans of organization and educational requirements of single institutions or countries, as that of German literature. And in dealing with it, there are two considerations which should equally be kept in mind. One is, that the pupil, as long as he can be induced to learn, should be supplied with such knowledge as is most indispensable. And the other is; that the utmost care must be taken, not to anticipate superficially in the gymnasium what can not be thoroughly studied until during the university course.*

CHAPTER VI.—GERMAN IN THE HIGHER BURGHER SCHOOLS.

The higher burgher schools, as a public institution, are of very recent origin. This alone is sufficient to explain why the conception of

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* I would repeat once more, at the close of this section, that the practical plans which it suggests are not proposed as perfect ones. They will on the contrary permit modifications of the most various kinds without any material change of their fundamental principles. I would therefore beg of those able educators of whom so many are to be found among our gymnasium teachers, not to permit themselves to become prejudiced against all my suggestions because they may disapprove of some individual ones amongst them.

them has not been as definitely determined as those of the gymna sium, or the other older classes of institutions. Besides this novelty however, there is an intrinsic difficulty in the subject. These schools have been called into existence by the requirements of practical life. Certain avocations demand a school training more advanced than that of the usual common school, and yet substantially different from the education afforded by the gymnasium to the educated classes. It is to answer this demand that the higher burgher schools have been established. Very various opinions were early advanced as to whether these schools were properly professional* schools, or merely schools for general education, with a subjoined course of study for particular avocations. At present, the view may be considered established, which distinguishes the higher burgher schools from the special schools.† Accordingly, the higher burgher schools are not intended to afford the knowledge and skill required for any one particular calling, but to give that particular kind of general culture required for the classes for whom they were established. This endeavor to ascertain a definite ideal *status* for these schools, is deserving of nothing but approbation; though at the same time it must not be forgotten that this ideal location is determined both as to its nature and its limits, by the actual every-day requirements of the intended vocation of the pupil, just as is the case with the gymnasium.

Thus we are to look upon the higher burgher school as an institution of general culture; and to distinguish it from the schools in special departments,† although the particular wants of the community in which it is, may sometimes render it more or less approximately like them.‡ The schools in special departments will frequently find it necessary, besides their special course, to afford further instruction in general culture; and here, in Germany at least, German would be a prominent study. The extent and precise management of the instruction given in German would in such a case be determined by the future vocation for which the school prepares its pupils. Thus, the study of the German language and literature in a military school would be very much like the same in the higher burgher school or the gymnasium; while in a school of weaving or for training good servants, such a study would be out of place. In the intermediate classes of schools, the determination of the proper extent of this study must often be difficult. Every friend of the fatherland would favor

* "Avocational" (*Berufsschule*,) is nearer the idea.—*Translator.*

† *Fachschule.*

‡ Compare H. Tellkampf, "*Higher burgher schools of Hanover (Die höhere Bürgerschule in Hannover,)*" Hanover, 1845; p. 10.

and desire the best education for all classes. But to go beyond the proper limits is to do an injury both to our people and our literature. But as we can not here go further into detail on this subject, which would lead us into entirely new fields, we will now return to the general class of higher burgher schools.*

The characteristic studies to be taught by the higher burgher schools, as stated by their advocates, are modern languages and natural science, to which may be added, as common to these institutions and the gymnasia, religion, mathematics and history. There is however a controversy as to the addition of Latin, but a majority is in favor of it, though to a much more limited extent than in the gymnasium.†

The difference of opinions on the proper character of the higher burgher schools, and the uncertain definition of their scope, renders it scarcely possible to state in general terms what should be their position in regard to instruction in German. The best mode of answering the question will be, as in a previous case, to ascertain what is the relation of these schools to actual life on one hand and to other educational institutions on the other, and thus to deduce their office for the German language. This inquiry will naturally be made with a reference to what has already been decided on the subject of instruction in German, first generally, then in the common schools, and lastly in the gymnasium. If we compare the higher burgher schools with the common schools, we find the leading distinction of the former to be that they teach one or more foreign languages,‡ thus, as do the gymnasia, affording some collateral advantages for studying German. Here is however a most essential distinction—and not the only one—between the higher burgher school and the gymnasium, in that the former makes the study of the modern languages the central point of its instruction, while at the latter it is the ancient ones. The belief that there was no other substantial distinction than this has led to entirely erroneous conclusions respecting the higher burgher

* The question whether any one school is to be considered as for a department or for general culture is not so easily to be determined as many persons imagine. Thus; a military school may be looked upon as a special school, whose object is to afford officers the knowledge required by their profession. But as such a school affords to the officer at the same time his general education, it is just as properly the school for general culture, for officers. Theoretically, a distinction must be made between special education and education adapted to social rank (*Standesbildung*); but practically, individual schools can not be strictly grouped by this distinction.

† With respect to the variety of views which are entertained on the higher burgher schools, I refer to the books, articles, &c , of Tellkampf, Scheibert, Mager, Körner, Hopf, &c.

‡ This distinction must be maintained throughout, unless we are prepared to call every good common school of a high grade a higher burgher school, and thus to quite destroy the distinct idea of the latter. In countries where German is not the native language of the pupils, that language is of course an additional one, if learned.

schools. Their most important difference consists in the different objects they propose to themselves. The gymnasium affords an introduction to the scientific studies of the university; not, that is, to studies in special employments, but to those constituting a part of general culture. Thus it affords to its pupils only the preparatory half of their general culture, the remaining portion being left for the university. The higher burgher school, on the other hand, actually completes the general culture of its pupils, so far as they obtain it in schools; for its pupils leave it, in part to enter schools properly and exclusively devoted to some one vocation, and in part to enter at once upon practical life.*

From what has thus been said upon the study of German at the higher burgher schools, it follows that they can not undertake to instruct in the German language and literature in the scientific and comprehensive manner practicable by the gymnasium and the university with their indissoluble connection; for to this latter purpose a knowledge of the ancient languages, and a life devoted to learned pursuits, are conditions indispensable, and attainable only at the university, among all our public institutions.

The purposes to be attained in the higher burgher schools have reference in part to the German language, in part to the German literature. As to the former, a distinction must be made between practical and theoretical acquirements. In the practical direction the graduate should have accomplished as much as has above been prescribed for a graduate of the gymnasium; viz., correctness in the use of the written language, and a certain degree of development of the understanding and the taste. Experience must decide to what extent the higher burgher schools afford the means of reaching this result.† Quite an additional amount of theoretical knowledge of German may be allowed, beyond that furnished by the common schools, as the study of French and English in the higher burgher schools affords an excellent auxiliary means for a profounder knowledge of the native language.

An introduction to German literature is one of the most important and agreeable duties of the higher burgher schools. Much of what has been said in a previous chapter on this point at the gymnasium is applicable here also; though many modifications in it must also be

* Compare Tellkampf's views, at the meeting of educators interested in the German real schools, at Hanover, Sept. 1855; in the "*Pedagogical Review* (*Pädagogisches Revue*,)" Dec. 1855, p. 369.

† Some valuable suggestions are made by G. W. Hopf, "*On methods for exercises in German style in the intermediate schools* (*Ueber Methode der Deutschen Stilübungen in Mittelschulen*,)" 2d ed., Furth, 1851.

made. Thus, the absence of a knowledge of Greek must be supplied, to some extent, by the use of the best translations of some of the chief classics; of Homer, above all. I will not venture to judge what other authors should be so used.

The subject of Old German requires a few words more. Gothic and Old High German, as indispensable to a scientific knowledge of the structure of the German language, must not be omitted from the course of study at the higher burgher school, though this school can aim only to a less extent at any scientific knowledge. The Middle High German, however, should for several reasons only be introduced where its study will admit of the requisite correctness of attainment in the written German. And in particular; just in proportion as the higher burgher schools, by reason of their increased intercourse with the French and English, approach towards the danger of an estrangement from the native language, so much the more should the predominance of German be assured by every means; an object scarcely in any other way to be so well attained as by the reading of such Middle High German poems as were the true outgrowth of German soil. Where such poems can not be read in their own dialect, it should be done in the best translations.*

CHAPTER VII.—GERMAN AT THE UNIVERSITY.

It is true that the discussion of the study of German at the university is without the limits which we prescribed to ourselves. It is not our design however to go any further into the scientific elements of that study, but merely to discuss the university studies so far as may complete the practical view given in the foregoing chapters.

Section 1. *Old German at the University.*

The question whether the study of the Old German language and literature is a distinct science, must stand or fall with that whether classical philology is such. But as no one denies the necessity, for the purposes of classical philology, of special professorships for Greek and Roman antiquities, a similar arrangement must be admitted as proper for Old German philology, however the question may be decided.

No mind of penetration will doubt the great importance of the investigation of German antiquities. One single consideration is sufficient to prove the point, namely; that these studies are directed to a period during which the progress of German culture was not inter-

* As in the case of the mention of Homer just above, the proper limitations in this direction must be taken for granted.

fered with by difference of religious beliefs. However different therefore, opinions may be respecting the literary monuments of the middle ages, one fact is undeniable, namely, that the elements which resulted in the German Reformation were then still operating along with those of the Roman Catholic kind. Thus, the investigation, pursued in the right spirit, of the great past of the German nation, will strengthen the intellectual bands which hold our fatherland together, notwithstanding its religious subdivisions.

The advocates of classical philology should consider the investigators of German antiquities, not as adversaries or rivals, but as friends and allies against the common enemy, the growing tendency towards vulgarity in the character of the language. The dignity of German philology does not lower that of classical philology, but elevates it; just as, in natural science, the progress of chemistry does not hinder, but promotes, that of physics.

The object of the Old German philology at the university is a twofold one. It should firstly afford the means to such as desire them, of continuing the studies which were begun at the gymnasium; and secondly, should give the future gymnasium teacher the knowledge requisite for the performance of his duties in that institution. Like classical philology, it has the character in the former respect of a general science; in the latter, of a special professional science. These two characters will however frequently become united, as is the case also in classical philology, and even to a greater extent, because no definite limits have yet been assigned to the study of German philology in the gymnasium. If the gymnasium should fully accomplish all that we have above laid down for it, then the university will be able to carry a larger proportion of its students further in the history of the Old German literature, and in a knowledge of the whole development of the German mind.* It would also afford to any individuals whose taste, or whose profession, as German law, for instance, might so incline them, the opportunity of studying other German dialects, especially Anglo-Saxon or Old North German. Still however, the study of Old German philology must consider these dialects, which are more distant from us, and in part difficult, as holding a place more like that of Sanscrit or Arabic than that of Greek or Latin. For it would be unendurable to have a dainty amateurship occupy the place of thorough and useful studies.

At most of the German universities, the preparation of future

* We have already valuable means towards the accomplishment of this purpose, both in the works published on German literary history, and in the reading-books of Old German. Of both these classes, the works of Wilhelm Wackernagel may be taken as models.

gymnasium teachers and the supply of general requirements will amount to pretty nearly the same thing. Hereafter, however, the candidate for a place as gymnasium teacher must be required to have some knowledge of Old German, unless its study in the schools is to degenerate into mere injurious smattering. What I would propose for the present is, to require at the examination in philology, as much Old German as was prescribed for the gymnasium in our third chapter, the first elements of Gothic, Old High German and Middle High German,* and a few of the leading facts of German literary history. I would here also make the requirements as moderate as possible; for the Gothic and Old High German are not so easy as one unacquainted with them might imagine.† But hereafter, every philological student should know their elements; which may be accomplished without any injury to his classical studies. The examination will speedily show who has the greatest talent and inclination for Old German; and to such should the instruction in it be confided, besides their classical lessons.

But the question whether philological students shall acquaint themselves with the elements of Old German, must be kept distinct from that whether Old German should be studied at the gymnasium. Even those who answer the latter in the negative, ought not to deny the high value of that language to philologists. For even if Old German be excluded from the gymnasium, still every teacher must give instruction in German. But a scientific insight into the structure of our language can be acquired only upon the basis of a knowledge of its history. And this knowledge, while practically necessary to the philologist, has also its value for another reason. The comparative grammar of the Indo-Germanic languages has now been carried to such a point of development that the classical philologist must necessarily have to do with it. For while opinions may differ as to the great or small value of a study of the Asiatic branches of the Indo-Germanic family of languages, in any event a knowledge of the fifteen hundred years of the history of the German must constitute the best introduction for all our philologists, to the historical study of language.

Section 4. New High German at the University.

Neither at the gymnasium nor at the university does the study of

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* It is understood that more Middle High German is required than of the other two; and the point must be clearly ascertained whether the candidate has heard with advantage a thorough exposition of some Middle High German work

† The foolish remark which we sometimes hear at a first glance into a Gothic New Testament, "That is entirely easy, I understand all of that," will at once be exposed to deserved shame if a passage whose contents he does not know be shown to one of these born connoisseurs. The actual state of the case will very quickly appear.

the New High German require a separate teacher. Its grammatical structure will naturally be explained in the account of the history of grammar by the teacher of Old German. Style, and New High German literature, are not however in the same manner within the province of the professor of Old German. Besides the improving influence of all good lectures, all intelligent teachers of classical philology, even in the university, will coöperate in promoting the cultivation of a good German style, as well as of good taste.

The study of the New High German literature has even already experienced an important influence from the historical German philology; which, as may be easily foreseen, must much increase. For this reason, as well as for others, it is much to be desired that the teacher of the older German language and literature should include those of the more modern within the scope of his studies and of his lectures.

But whoever shall undertake to teach upon the New High German language and literature at the universities, whether philologist, philosopher or historian, will always be under the necessity of having at the foundation of his instruction, a correct, efficient and properly limited study of German, in the schools.

VII. THE BOSTON LATIN GRAMMAR SCHOOL.

The Free, Latin, or Latin Grammar, School of Boston, is one of the few historical schools in this country, its foundation having been laid either in a vote of the "townsmen" of Boston on the thirteenth day of April, 1635,* "entreating Mr. Philemon Permont to become schoolmaster for the teaching and nurturing of children," or in the subscription started "at a general meeting of the richer inhabitants," on "the 22d of the sixth month (Aug.) 1636," at which about 50*l.* "was given toward the maintenance of a free schoolmaster for the youth with us—Mr. Daniel Maud being now also chosen thereunto." In either case the school was in all probability what was then known as a Grammar School. Both Mr. Permont and Mr. Maud were men of education, as their subsequent connection with the ministry indicates, and it is not impossible that there was but one school, which was designated a *free* or *endowed* school, and that Mr. Maud was the first teacher, for the records are entirely silent as to Mr. Permont's yielding to the "entreaties of his fellow-townsmen;" and the early records of New Hampshire testify to his presence and labors as a clergyman in the settlements on the Piscataqua only a few years subsequent to the urgent call beforementioned—an early example of the too common practice of men of the right education to become pastors, giving up the feeding of the lambs, for the less onerous charge of attending the full-grown sheep, whose fleeces probably pay better than the frolicsome and mischievous pranks of the younger portion of the flock.

Whatever may be the date of its establishment, or whoever may have been its first teacher, the first "Free Schoole," or "Grammar School," or "Latin Grammar School," of Boston, was the lineal descendant of the old Free Schoole or Grammar School, or Latin

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* This was not the earliest movement in this country towards the establishment of a school—even a free school—Rev. Mr. Copeland having raised by subscription a larger sum than was raised in Boston, to establish a *Free School* in Charles City, in Virginia, as early as 1621; and among the officials of the Dutch West India Company, at Manhattan, in 1633, was Adam Roelandsen, "the schoolmaster," and the school which he taught, it is claimed by the Historians of New York, is still in existence in connection with the Dutch Reformed Church.

Grammar School in England—the connecting link between the public schools (in the original use of the term) of old and New England—the hearth-stones of classical learning in both counties. In its early history and down to the period of the revolution, this school preserved a close resemblance to its prototype in England—in the designation of its teachers and assistants as master and usher—in the tenure of office, as well as in the mode of the master's induction into the same, and in the manner of his compensation. But we do not propose in this article to trace out these resemblances, any further than they will be introduced in speaking of Ezekiel Cheever's connection with the Latin School, which is here reproduced* for the purpose of showing, by an account of the school as it is under its present learned and highly esteemed principal, Francis Gardner, the progress which has been made, not only in its material outfit, but its range of instruction. Our object in this article is to present the school at the two most flourishing periods of its history—separated by an interval of nearly one hundred and fifty years—and in both periods universally regarded as among the best, if not the best classical school in the country.

I. MASTERSHIP OF EZEKIEL CHEEVER. 1670—1708.

Ezekiel Cheever, the son of a linen draper of London, was born in that city on the 25th of January, 1614. Of his education and life in England, we find no mention. He came to this country in 1637, landing at Boston, but proceeding in the autumn of the same, or the spring of the following year, with Theophilus Eaton, Rev. John Davenport, and others, to Quinnipiac, where he assisted in planting the colony and church of New Haven—his name appearing in the "Plantation Covenant," signed in "Mr. Newman's Barn," on the 4th of June, 1639, among the principal men of the colony. He was also chosen one of twelve men out of "the whole number thought fit for the foundation work of a church to be gathered," which "elect twelve" were charged "to choose seven out of their own number for the seven pillars of the church," that the Scripture might be fulfilled, "*Wisdom hath builded her house, she hath hewn out her seven pillars.*" He sometimes conducted public worship, and was elected one of the "Deputies" from New Haven to the General Court of the Colony, in October, 1646.

He commenced his career as a schoolmaster in 1638, which he continued till 1650, devoting to the work a scholarship and personal character which left their mark for ever on the educational policy of

* American Journal of Ed., Vol. I, p. 297.

New Haven.* His first engagement was in the only school, which was opened within the first year of the settlement of the colony, to which the "pastor, Mr. Davenport, together with the magistrates," were ordered "to consider what yearly allowance is meet to be given to it out of the common stock of the town." In 1641, a second and higher grade of school was established, under Mr. Cheever's charge, to which the following order of the town meeting refers:

"For the better training of youth in this town, that, through God's blessing, they may be fitted for public service hereafter, in church or commonwealth, it is ordered that a free school be set up, and the magistrates with the teaching elders are entreated to consider what rules and orders are meet to be observed, and what allowance may be convenient for the schoolmaster's care and pains, which shall be paid out of the town's stock."

By Free Schoole† and Free Grammar School,‡ as used in this extract,

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* To the bright example of such a teacher, and especially to the early, enlightened, and persevering labors of the Rev. John Davenport, the first pastor of the first Church of New Haven, and of Theophilus Eaton, the first Governor of the Colony, is New Haven indebted for the inauguration of that educational policy which has made it a *seat of learning* from its first settlement for the whole country. The wise forecast and labors of these men contemplated, and to some extent realized; 1. Common Town Schools, where "all their sons may learn to read and write, and cast up accounts, and make some entrance into the Latin tongue." 2. A Common, or Colony School, with "a schoolmaster to teach the three languages, Latin, Greek, and Hebrew, so far as shall be necessary to prepare them for the college." 3. A Town or County Library. 4. A College for the Colony, "for the education of youth in good literature, to fit them for public service in church and commonwealth." The whole was made morally certain by the employment of good teachers from the start. After the retirement of Mr. Cheever from the school, the records of the Town are full of entries showing the solicitude of the Governor and Minister in behalf of the schools and the education of the children and youth. Under date of Nov. 8, 1652: "The Governor informs the court that the cause of calling this meeting is about a schoolmaster," that "he had written a letter to Mr. Bower, who as a schoolmaster at Plymouth, and desires to come into these parts to live, and another letter about one Rev. Mr. Landson, a scholar, who he hears will take that employment upon him," —and "that now Mr. James was come to town, who would teach the boys and girls to read and write"—"and there would be need of two schoolmasters—for if a Latin scholmaster come, it is found he will be discouraged, if many English scholars come to him." About the same date: "The town was informed that there is some motion again on foot concerning the setting up of a College here at New Haven, which, if attained will in all likelihood, prove very beneficial to this place"—"to which no man objected but all seemed willing." At a General Court of the Colony, held at Guilford, June 28, 1652, "it was thought [the establishment of a college for New Haven Colony] to be too great a charge for us of this jurisdiction to undergo alone. But if Connecticut do join, the planters are generally willing to bear their just proportion for creating and maintaining of a college there [New Haven]." "At a town meeting, held February 7, 1667 ['8], Mr. John Davenport, Senior, came into the meeting, and desired to speak something concerning the [Grammar] school; and first propounded to the town, whether they would send their children to the school, to be taught for the fitting them for the service of God, in church and commonwealth. If they would, then, the grant [made by Mr. D. in 1660, as Trustee of the Legacy of Gov. Hopkins] formerly made to this town, stands good; but, if not, then it is void: because it attains not the end of the donor. Therefore, he desired they would express themselves." Upon which several townsmen declared their purpose "of bringing up one or more of their sons to learning," and as evidence of the sincerity of their declaration, and of the former efforts of Gov. Eaton and Mr. Davenport, in favor of liberal education, Prof. Kingsley in his Historical Discourse, on the 200th Anniversary of the First Settlement of the Town, remarks:—"Of the graduates of Harvard College, from its foundation to year 1700 [the founding of Yale College], as many as one in thirty, at least, were from the town of New Haven"—with a population, so late as the year 1700, of only five hundred persons.—*See Barnard's History of Education in Connecticut.* 1853.

† The first establishment of the Free School—or School for the gratuitous instruction of poor

and in the early records both of towns and the General Court in Connecticut and Massachusetts, was not intended the Common or Public School,

children can be traced back to the early ages of the Christian Church. Wherever a missionary station was set up, or the Bishops' residence or Seat [*cathedra*, and hence Cathedral] was fixed, there gradually grew up a large ecclesiastical establishment, in which were concentrated the means of hospitality for all the clergy, and all the humanizing influences of learning and religion for that diocese or district. Along side of the Cathedral, and sometimes within the edifice where divine worship was celebrated, "a song scole," where poor boys were trained to chant, and the "lecture scole," where clerks were taught to read the sacred ritual, and in due time the "grammar school" when those who were destined for the higher services of church and state were educated according to the standard of the times, were successively established. The monasteries were also originally seats of learning, as well as places of religious retirement, of hospitality for the aged and infirm, and of alms for the poor of the surrounding country. Their cloister schools were the hearth-stones of classical education in every country of Europe, and were the germs of the great Universities, which were encouraged and endowed by learned prelates and beneficient princes for the support and exaltation of the Christian faith and the improvement of the liberal arts. But for the endowments and the ordinances and recommendations of early synods and councils, these schools might have been accessible only to the children of the titled and the wealthy. The council of Lyons in 1215, decreed "that in all cathedral churches and others provided with adequate revenues, there should be established a school and a teacher by the bishop and chapter, who should teach the clerks and poor scholars gratis in grammar, and for this purpose a stipend shall be assigned him;" and the third council of Lateran still earlier ordained—"that opportunity of learning should not be withdrawn from the poor, who are without help from patrimonial riches, there shall be in every cathedral a master to teach both clerks and poor scholars gratis." In the remodelling of the cathedral establishments, and the demolition of the monasteries by Henry VIII., and his successors, several of the cathedral schools were provided for, and Royal Grammar Schools founded out of the old endowments.—*See Barnard's National Education in Europe.*

‡ The names, by which the various educational institutions in the colonies were designated in the early records and laws on the subject, were adopted with the institutions themselves from the fatherland, and must be interpreted according to the usage prevailing there at the time. By a *Grammar School*—whether it was a continuation of the old Grammar School of the Cathedral, or the Cloister School of the Monastery, in some cases dating back even beyond the reign of Alfred—or newly endowed by Royal Authority out of the spoils of the religious houses, by Henry VIII., Elizabeth, or Edward VI.—or established by benevolent individuals afterwards—was meant a school for the teaching of Greek and Latin, or in some cases Latin only, and for no other gratuitous teaching. A few of the poor who were unable to pay for their education were to be selected—some according to the parish in which they were born or lived, some on account of the name they bore,—and to receive instruction in the learned languages, and under certain conditions to be supported through the university. These Public Grammar schools were thus the nurseries of the scholars of England, and in them the poor and the rich, to some extent enjoyed equal advantages of learning, and through them the way to the highest honors in the state, and the largest usefulness in the church was opened to the humblest in the land.—*See Barnard's National Education in Europe.*

"*Considerations concerning Free Schools as settled in England*" by Christopher Wase, published in Oxford, 1678. Carlisle's "*Endowed Grammar Schools in England and Wales*;" 2 vols, London, 1818. Ackermanns," *History of the Principal Schools of England*," London, 1816. Parliamentary Reports of Commissioners to enquire into the Endowed Charities of England and Wales from 1826 to 1850.

The Free Schools of England were originally established in towns where there was no old Conventual, Cathedral, Royal or Endowed Grammar School. With very few exceptions these schools were founded and endowed by individuals, for the teaching of Greek, and Latin, and for no other gratuitous teaching. The gratuitous instruction was sometimes extended to all the children born or living in a particular parish, or of a particular name. All not specified and provided for in the instruments of endowment paid tuition to the master.

The total value of Endowed Charities for Education in England and Wales, including the Grammar and Free Schools, and excluding the Universities and Great Public Schools of Eton, &c., according to a late report of the Commissioners for Inquiry into their condition, is returned at £75 000.000, and the annual income at £1.209.395, which, by more judicious and faithful management, it is estimated, can be raised to £4.000.000, or $20.000 000 a year.—*Barnard's National Education in Europe*, P. 736.

as afterwards developed, particularly in Massachusetts, supported by tax, and free of all charge to all scholars rich and poor; neither was it a Charity School, exclusively for the poor. The term was applied here, as well as in the early Acts of Virginia* and other states, in the same sense, in which it was used in England, at the same and much earlier dates, to characterize a Grammar School unrestricted as to a class of children or scholars specified in the instruments by which it was founded, and so supported as not to depend on the fluctuating attendance and tuition of scholars for the maintenance of a master. In every instance in which we have traced their history, the "free

* The Virginia Company in 1619, instructed the Governor for the time being to see "that each Town, Borough, and Hundred procured, by just means, a certain number of their children, to be brought up in the first elements of literature: that the most towardly of them should be fitted for college, in the building of which they proposed to proceed as soon as any profit arose from the estate appropriated to that use; and they earnestly required their utmost help and furtherance in that pious and important work." In 1621, Mr. Copeland, chaplain of the Royal James, on her arrival from the East Indies, prevailed on the ships company to subscribe £100 toward "a free schoole," and collected other donations of money and books for the same purpose. The school was located in Charles City, as being most central for the colony, and was called "*The East India School.*" The company allotted 1000 acres of land. with five servants and an overseer, for the maintenance of the master and usher. The inhabitants made a contribution of £1500 to build a house, &c.

A second Free School was established in Elizabeth City in 1642; although Gov. Berkeley, in 1670, in reply to the Question of the Commissioners of Foreign Plantations, "what course is taken about instructing the people within your government in the Christian religion; and, what provision is there made for the paying of your ministry?" answered as follows: —

"The same course that is taken in England out of towns; every man, according to his ability, instructing his children. We have forty-eight parishes, and our ministers are well paid, and, by my consent, should be better, if they would pray oftener, and preach less. But, of all other commodities, so of this, the worst are sent us, and we have had few we could boast of since the persecution in Cromwell's tyranny drove pious, worthy men here. But, I thank God, there are no free schools, nor printing, and, I hope we shall not have these hundred years; for, learning has brought disobedience, and heresy, and sects into the world, and printing has divulged them, and libels against the best government. God keep us from both!"

To the same question the Governor of Connecticut, replied: "Great care is taken for the instruction of the people in the Christian Religion, by the ministers catechising of them and preaching to them twice every Sabbath day, and sometimes on Lecture days, and also by masters of families instructing and catechising their children and servants, being required so to do by law. There is in every town, except one or two new towns a settled minister, whose maintenance is raised by rate, in some places £100, in some £90, &c." In a subsequent answer to similar questions the Governor states that one-fourth of the annual revenue of the Colony, "is laid out in maintaining free [common] schools for the education of our children."

The first school established in Manhattan [New York], was by the West India Company, in 1633. This was an Elementary Parochial School under the management of the deacons of the Dutch Church, and is still continued. The first "Latin Schoolmaster" was sent out by the Company in 1659. In 1702 a "Free Grammar School" was partially endowed on the King's farm; and in 1732 a "Free School for teaching the Latin and Greek and practical branches of mathematics" was incorporated by law. The bill for this school, drafted by Mr. Phillipse, the Speaker, and brought in by Mr. Delancey, had this preamble; "Whereas the youth of this Colony are found by manifold experience, to be not inferior in their natural geniuses, to the youth of any other country in the world, therefore be it enacted, &c."—*See Dunshce's History of the School of the Reformed Protestant Dutch Church.* 1853. *Smith's History of New York.*

The first school Act of Maryland was passed in 1694, and is entitled a "Supplicatory Act to their sacred Majesties for erecting of Free Schools," meaning thereby the endowment of "schools, or places of study of Latin, Greek, writing, and the like, consisting of one master, one usher, and one writing master," &c.

schools" of New England‡ were endowed by grants of land, by gift and bequests of individuals, or by "allowance out of the common stock of the town," were designed especially for instruction in Latin

* The earliest mention of the establishment of "free schools" by Gov. Winthrop, in his History of New England, is under date of 1645, in the following language: "Divers free schools were erected, as at Roxbury, (for maintainance whereof every inhabitant bound some house or land for a yearly allowance for ever) and at Boston (where they made an order to allow 50 pounds to the master and an house, and 30 pounds to an usher, who should also teach to read, and write, and cipher, and Indians' children were to be taught freely, and the charge to be by yearly contribution, either by voluntary allowance, or by rate of such as refused, etc., and this order was confirmed by the general court [blank]. Other towns did the like, providing maintainance by several means." Savage's Winthrop, Vol. II, p. 215.

We know by the original documents published by Parker in his "Sketch of the History of the Grammar School in the Easterly Part of Roxbury," the character of the Free School erected in that town. It was an endowed Grammar School, in which "none of the inhabitants of the said town of Roxbury that shall not join in this act (an instrument, or subscription paper, binding the subscribers and their estates for ever to the extent of their subscription "to erect a free schoole" "for the education of their children in Literature to fit them for publicke service, bothe in the Churche and Commonwealthe, in succeeding ages,") with the rest of the Donors shall have any further benefit thereby than other strangers shall have who are not inhabitants." The school thus established was a Grammar School, as then understood in England, and was *free* only to the children of those for whom, or by whom it was endowed, and only to the extent of the endowment. This school, although not till within a few years past a Free School, or part of the system of Public Schools, according to the modern acceptation of the term, has been a fountain of higher education to that community and the state.

The early votes establishing and providing for the support of the "free schools" in Boston, as well as in other towns in Mass., while they recognize, by grants of land and allowance out of the common stock, the interest and duty of the public in schools and universal education, also provide for the payment by parents of a rate or tuition. Among the earliest assignments of lands in Boston was a "garden plott to Mr. Danyell Maude, schoolemaster," in 1637; a tract of thirty acres of land at Muddy Brook, (now part of Brookline), to Mr. Perment, (or Permont, or Porment,) who, in 1635, was "intreated to become scholemaster for the teaching and nurturing of children with us." In 1641, "it is ordered that Deare Island be improved for the maintenance of Free Schoole for the towne." In 1654, "the ten pounds left by the legacy to ye schoole of Boston, by Miss. Hudson, deceased," is let to Capt. Olliver. Under date of August 6, 1636, there is, in the first volume of the Town Records of Boston, a subscription "towards the maintenance of free schoolemaster, Mr. Daniel Maude, being now chosen thereunto." In the provision made in 1645, it is provided that "Indian children shall be taught gratis;" implying that tuition was, or might be, exacted from all others. In 1650, "it is also agreed on that Mr. Woodmansy, ye schoolmaster, shall have fifty pounds p. an. for his teaching ye schollars, and his p. portion to be made up by rate." In a vote passed 1682, authorizing the selectmen to establish one or more "free schools to teach children to write and cypher"--the Committee with the Selectmen allow £25 per annum for each school, "and such persons as send their children to school (that are able) shall pay something to the master for his better encouragement in his work."

Mr. Felt in his Annals of Salem, has given transcripts from the records of that town, which show the gradual development of the Free School, from an endowed school, devoted principally to preparing young men for college, and free only to poor but bright children, who gave promise of becoming good scholars—into a system of public schools, for children of all ages, and of every condition and prospects in life, supported entirely by property tax or public funds In 1641, at the Quarterly Court, Col. Endicott moved "a ffree skoole and therefore wished a whole town meeting about it." In 1644 it is "Ordered that a note be published one the next lecture day, that such as have children to be kept at schoole, would bring in their names and what they will giue for one whole yeare and, also, that if any poore body hath children or a childe, to be put to schoole and not able to pay for their schooling, that the towne will pay it by a rate" In 1670, the selectmen are ordered "to take care to provide a Grammar school master, and agree with him for his mayntenance." He was to have £20 a year from the town, and "half pay for all scollers of the towne, and whole pay from strangers." In 1677, "Mr. Daniel Eppes is called to bee a grammar schoolemaster," "provided hee may haue what shall be annually allowed him, not be a town rate, butt in and Greek, and were supported in part by payments of tuition or rates by parents. These schools were the well-springs of classical education in this country, and were the predecessors of the incorporated Academies which do not appear under that name until a comparatively recent period.

The only Free Schools provided for in the early legislation of Connecticut were town or county Grammar Schools, to prepare young men for college; and instruction in these schools was not gratuitous. "Beyond the avails of any grant of land, endowment, legacy, or allowance from the common stock," parents, who were able, were assessed a certain rate according to the number and time of attendance of children sent. Thus, under the order of the town-meeting of New Haven, in 1641, above cited, "twenty pounds a year was paid to Ezekiel Cheevers, the present school-master, for two or three years, at first. But that not proving a competent mayntenance, in August, 1644, it was enlarged to thirty pounds a yeare, and so continueth;" and, that this allowance was not all that the school-master received is evident from the following entry, under date of July 8, 1643: "Mr. Cheevers desired 4 – 3 – 6 out of the estate of Mr. Trobridge, wch is justly due to him for teaching of children." This mode of supporting schools was continued in Connecticut in respect to public schools of every grade; a mode which recognizes at once the duty of the parent or guardian of children, and of the public, and encourages endowments so far as not to weaken the sense of parental and public responsibility as to education. Under this system, for one hundred and fifty years prior to the beginning of the present century, Connecticut solved the great problem of universal education so that in 1800 a

some other suteable way." In 1699, "each scholar is to pay 12d a month, and what this lacked should be made up out of the "funds sett apart for ye Grammar schoole." In 1713, "the committee perceiving that 2s a quarter for each boy of the Latin and English schools, in the body of the town, was insufficient, agreed that it should be 2/6 in money, payable at the commencement of the term. Every 'scholar that goes in the winter, to find three feet of wood, or to pay to their masters 4/6 in money, to purchase wood withal.'" In 1729, "Samuel Brown grants unto the Grammar school in Salem, to be kept in or near the town house street, £120 passable money, to make the same a free school, or towards the educating of eight or ten poor scholars, yearly, in the Grammar learning or the mathematics, viz: the mariner's art; the interest thereof to be improved only for that end forever, as a committee, chosen by the town of Salem, for the taking care of said school may direct, with the advice of the minister or ministers of the first church and myself or children or two of the chief of their posterity. Mr Brown then stated, that he gave £60 to the English school so that its income might be applied 'towards making the same a free school, or for learning six poor scholars;' and a like sum 'to a woman's school, the interest thereof to be yearly improved for the learning of six very poor children their letters and to spell and read, who may be sent to said school six or seven months in the year.' He required, that the two last donations should be managed by the same trustees as the first." By slow degrees the system was expanded so as to embrace Evening Schools for children who cannot attend the day Schools, Primary Schools for young children, Intermediate Schools, English High Schools for Girls, English High School for Boys, and a Latin School.

family, "which had suffered so much barbarism as not teach by themselves or others, their children and apprentices so much learning as may enable them to read the English tongue," or even an individual "unable to read the Holy Word of God, and the good laws of the Colony," was not to be met with.*

Mr. Cheever removed to Ipswich, in Massachusetts, in November, 1650, and took charge of the Grammar School, which was established and supported in the same manner as similar schools in other parts of New England. Public spirited individuals made donations, and the Town early set apart land "toward the building and maintaining of a Grammar Schoole and schoole-master," and in 1652 appointed a committee "to disburse and dispose such sums of money as have or may be given" for these objects, with power to enlarge the maintainance of the master, "by appointing from yeare to yeare what each scholar shall yearly or quarterly pay or proportionably." Of his labors here as a teacher, we have been able to gather no memorial—except that from an entry† under date of 1661, it appears that his agricultural operations required a barn, and that he planted an orchard on his homestead—thereby improving the soil of Ipswich as well as the souls of her children, by healthy manual labor. It is to be regretted that the early practice of attaching a house for the occupancy of the master, with a few acres of land for garden, orchard, and the feeding of a cow, adopted with the school from the old world, was not continued with the institution of new schools, down to the present time. It would have given more of professional permanence to the employment of teaching, and prevented the growth of that "barbarism of boarding round," which is still the doom of

* That the same system of Common or Public Schools prevailed in Massachusetts, is not only evident from the early records of Boston, Ipswich, Roxbury, Charlestown, and Salem and other towns in that colony, but it is expressly provided for in the first formal order on the subject of schools, enacted in 1647—"It is therefore ordered y[t] every towneship in this jurisdiction after y[e] Lord hath increased y[m] to y[e] number of 50 housholders shall then forthw[ith] appoint one within their towne to teach all such children, as shall resort to him to write and reade, whose wages shall be paid either by y[e] parents or masters of such children, or by y[e] inhabitants in generall by way of supply, as y[e] maior part of those y[t] order y[e] prudentials of y[e] towne shall appoint, provided those y[t] send their children be not oppressed by paying much more y[n] they can have y[m] taught for in other townes."

From that time to the present, the laws of the Colony and the State, have made it obligatory on towns to establish and sustain schools, but for near a century and half left them free as to the mode of paying the teacher and providing the incidental expenses of the school. Even after it was made compulsory on the town to keep a literally free school for a certain number of months in each year, out of a tax collected with other taxes of the town, the same school in a majority of the country districts was continued as a subscription or pay school under the same teacher, by the payment by parents of a certain rate for the number of scholars sent. The term of the free school was also prolonged by the system of boarding the teacher round in the families of the district, and by contributions of a certain quantity of wood for each scholar.

† "The barn erected by Ezekiel Cheever, and the orchard planted by him, were after his removal to Charlestown, bought by the feofees, [committee and trustees of the Grammar School] and presented for the use of the master."—*Felt's History of Ipswich.*

the teacher in District Schools in many parts of New England, and operates very powerfully to drive men with families from the service of the public schools.

In November, 1661, Mr. Cheever, after making the Free School at Ipswich "famous in all the country," and thereby, according to Dr. Bentley, making that town rank in literature and population above other towns in the county of Essex, removed to Charlestown, where early efforts had been made to establish a Town Free School, by granting, in 1647, "a rate of fifteen pounds to be gathered of the town," and by the rents of the island," and of "Mystik Wear." Of his labors here we find but scanty memorials. Even in these early days the schoolmaster was not always paid his pittance in due season; did not always find his school-house in good repair, and had reason to complain that other masters "took his scholars," and thereby doubtless diminished his income from rates or quarter bills. On the 3d November, 1666, Mr. Cheever presented the following "motion" to the selectmen:

"First, that they would take care the school house be speedily amended because it is much out of repair.

Secondly, that they would take care that his yearly salary be paid, the constables being much behind with him.

Thirdly, putting them in mind of their promise at his first coming to town, viz. that no other schoolmaster should be suffered, or set up in the town so as he could teach the same, yet now Mr. Mansfield is suffered to teach and take away his scholars."*

After laboring nine years at Charlestown, Mr. Cheever moved over to Boston, Jan. 6th, 1670, where his labors were continued for eight and thirty years—commencing from a period of life when most modern teachers break down. The manner of his engagement to teach the "Free Schoole," which has been known since 1790, as the Latin School,* of Boston, is thus recorded, under the date 22. 10th (December) 1670: "At a Meetinge of the honrd. Govern^{r}. Richard Bellingham, Esq. Major Generall John Leveret, Edward Tynge Esq^{r} Majestrates, Mr. John Mayo, Mr. John Oxenbridge, Mr. Thomas Thatcher, and Mr.

* Frothingham's History of Charlestown, p. 157. In the same year Mr. Frothingham gives an Order of the Selectmen relative to the behavior of children on the Lord's Day, in which Mr. Cheever is introduced: "We judge it our duty to commend it as our affectionate desire to all our inhabitants, concerned herein to further us with their cheerful endeavors, and that each person whom we nominate would in his term sit before the youths pew on Lords day during the morning and evening exercise. It being our joint expectation that all youths under fifteen years of age unless on grounded exemption by us, do constantly sit in some one of those three pews made purposely for them. It is our desire that all parents and governors will require their children and servants of the capacity aforesaid to sit and continue orderly in those pews except mr. Cheevers scholars, who are required to sit orderly and constantly in the pews appointed for them together. It is moreover commended to the conscientious care and endeavour of those that do sit before the youths pews Lords days to observe their carriage, and if any youth shall carry it rudely and irreverently to bring them before one of our magistrates with convincing testimony that due course may be taken with them for the discouragement of them and any others of like profane behavior."

James Allen Eld^{rs}, Capt. Thomas Lake, Capt. Jamss Olliver, Mr. John Richards, and John Joyliffe selectmen of Bostone. It was ordered and agreed that Mr. Ezechiell Chevers, Mr. Tomson & Mr. Hinksman should be at the Govern^{rs} house that day sevennight to treate with them concerninge the free schoole." "At a Meetinge of the same gentlemen" as above, with the addition of Mr. Hezekiah Usher, "it was agreed and ordered that Mr. Ezechiell Cheevers should be called to & installed in the free schoole as head Master thereof, which he, being then present, accepted of: likewise that Mr. Thomson should be invited to be an assistant to Mr. Cheevers in his worke in the schoole; wh^{ch} Mr. Tompson, beinge present, desired time to consider of, and to give his answere;—And upon the third day of January, gave his answer to Major Generall Leverett in the negative, he havinge had and accepted of, a call to Charlestowne." On the 6th day of the next month, the same honorable gentlemen, excepting Mr. Usher, "beinge met repaired to the schoole and sent for Mr. Tompson who, when he came, declared his removall to Charlestowne —and resigned up the possestion of the schoole and schoole house to the Govern^{r} &ca, who delivered the key and possestion of the schoole house to Mr. Ezechiell Cheevers as the sole Mast^{r}. thereof. And it was farther agreed that the said Mr. Cheevers should be allowed sixtie pounds p. an. for his seruice in the schoole, out of the towne rates, and rents that belonge to the schoole—and the possestion, and use of y^{e} schoole house."

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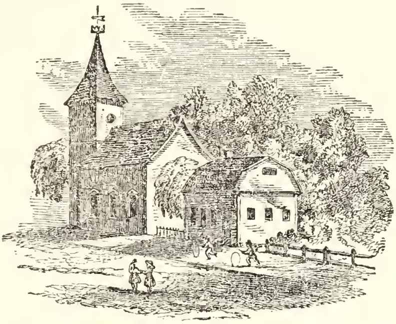
* The foregoing transcript from the Town Records are printed from Gould's "*Account of the Free Schools in Boston*," first published in the "Prize Book, No. IV., of the Publick Latin School," in 1823. Mr. Gould (Benjamin A.) was, for twenty-eight years, (1814 to 1838), head master of this school; and, under his administration, it rose from a temporary depression to which it had been gradually falling under his predecessor, into a high state of efficiency, from which it has never again declined. He is still living in the enjoyment of a green old age, which seems to have descended as an heir-loom from Master Cheever to his successors. His Account of the System of Public or Free Schools in Boston was a valuable contribution to the educational literature of the day, and helped to raise public attention in other cities of the state and country to a higher standard of popular education than had been reached or regarded as practicable out of Boston.

The History of "the Free Schools," the public schools and other means of Popular Education generally in Boston, from its first inception in the entreating of "Brother Philemon Pormont to become schoolmaster for the teaching and nurturing of children" in 1634, the setting apart of grants of land, and allowances from the common stock, the protection of trust estates and bequests for school purposes, and the raising of additional maintainance by subscription in 1636 to reduce the rate of tuition in higher, as well as elementary instruction—through all the stages of progress,—the introduction of the dame School, Grammar School, Charity School, Writing School, the admission of girls as well as boys, the Primary School, the English High School, and the Normal School,—the Reformatory and Farm School—the Library,—Social, Incorporated, and Free,—the Public Press, from the Newsletter of 1704, to the Quarterly, Monthly, Weekly, and Daily issue,—the Debating Class and Public Lecture in all their agencies and helps of self-education and social and literary amusement, as well as of scientific research—a History of Public Schools and Popular Education in Boston from 1630 to 1855, embracing a connected view of all the institutions and agencies which supply the deficiency, and determine the character of the instruction given in the Homes and the Schools of a people, would be one of the most valuable contributions, which could be made to the History of American Civilization and the Progress of Society

The SCHOOL HOUSE into which Mr. Cheever was installed as the "sole Master," by the Honourable Govenor, and Magistrates of the Colony, the Elders of the Churches, and Selectmen of the Town of Boston, and in which he continued to sway "the rod of empire" for thirty-five years over "govenors, judges, ministers, magistrates, and merchants yet in their teens," is thus represented.*



The SCHOOL itself under his long, faithful, and distinguished services became the principal classical school not only of Massachusetts Bay, but according to Rev. Dr. Prince, "of the British Colonies, if not of all America."

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* For this vignette of Mr. Cheever's School-house, we are indebted to the Rev. Edward E. Hale, of Worcester.

"Cheever's school-house occupied land on the North side of School street, nearly opposite the present Horticultural Hall. It was large enough to contain one hundred and fifty pupils. At the present time, the east wall of the Stone Chapel stands on the site of the old building, which was removed, after much controversy, to make room for the building of the Chapel, in 1748. The outline of the old building, and some general sketch of its appearance appear on an old map of Boston, dated 1722, of which, a copy is now in possession of Mr. Pulsifer, of Boston. On this map, every building was represented, on the spot it occupied. with some effort at precision. From this map Cheever's school-house is represented in this sketch. King's Chapel is drawn from a view of more pretensions, representing the whole town, from a point above the harbor, in 1744. In that view, unfortunately, Cheever's school-house does not appear. As King's Chapel was materially enlarged in 1710, it has been represented here as being, in Cheever's time, somewhat shorter than in the authority alluded to. In an early print, described by Dr. Greenwood, a crown was represented below its vane, which has, therefore, been placed there in this sketch."

Mr. Gould introduces into his notice of the controversy which attended the removal of the old school house, to make room for an enlargement of the church, the following impromptu epigram written by Joseph Green, Esqr., and sent to Mr. Lovell in the School, when it was announced that the town had agreed to grant permission to the proprietors of King's Chapel to take down the old house.

A fig for your learning: I tell you the Town,
To make the *church* larger, must pull the *school* down
Unluckily spoken, replied Master Birch—
Then *learning*, I fear, stops the growth of the *Church*.

We are also indebted to the Rev. Edward Everett Hale, for the opportunity of consulting his own "*Notes for a History of the Latin School of Boston*," [in which he has transcribed one of Cheever's Latin Dissertations from the "Cheever Manuscripts," in the Massachusetts Historical Society, and a synopsis of the rest, as well as a letter in Latin to his son, afterward the Rev. T. Cheever, of Marblehead, who had asked his consent to marry a young lady of Salem,] and other valuable memoranda and assistance.

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Some light is thrown on the internal economy of the school under Mr. Cheever's charge, of the age at which pupils were admitted, the motives to study and good behavior appealed to, the punishments inflicted, as well as on the importance attached to religious training in the family and the school at that day, in the biographies of several of his pupils who became eminent in after life.

The Autobiography of the Rev. John Barnard, of Marblehead, drawn up by him, in 1766, in the 85th year of his age, at the request of the Rev. Dr. Stiles, of Yale College, and printed for the first time in the Collections of the Massachusetts Historical Society—Third series, Vol. V., p. 177 to 243, contains a sketch of his school experience under Mr. Cheever's tuition, and glimpses of the family and college training of that early day. In the extracts which follow, the chasms are found in the mutilated manuscript, and the words printed in Italics are inserted from conjecture by the Publishing Committee of the Society.

"I was born at Boston, 6th November 1681; descended from reputable parents, viz. John and Esther Barnard, remarkable for their piety and benevolence, who devoted me to the service of God, in the work of the ministry from my very birth; and accordingly took special care to instruct me themselves in the principles of the Christian religion, and kept me close at school to furnish my young mind with the knowledge of letters. By that time I had a little passed my sixth year, I had left my reading-school, in the latter part of which my mistress made me a sort of usher, appointing me to † teach some children that were older than myself, as well as smaller ones; and in which time I had read my Bible through thrice. My parents thought me to be weakly, because of my thin habit and pale countenance, and therefore sent me into the country, where I spent my seventh summer, and by the change of air and diet and exercise I grew more fleshy and hardy; and that I might not lose my reading, was put to a school-mistress, and returned home in the fall.

In the spring 1689, of my eighth year I was sent to the grammar-school,

* Of the author of this autobiography, the Rev. Dr. Chauncey, of Boston, in a letter to Dr. Stiles, dated May 6, 1768, says: "He is now in his eighty-seventh year. I esteem him one of our greatest men. He is equalled by few in regard either of invention, liveliness of imagination, or strength and clearness in reasoning." On the burning of the Library of Harvard College, in 1764, he presented many books from his own library, and imported others from England to the value of ten pounds sterling; and, in his will, bequeathed two hundred pounds to the same institution. He died January 24, 1770, in the eighty-ninth year of his age. "Of his charities," he remarks, in his autobiography, "I always thought the tenth of my income due to our great Melchisedeck. My private ones are known unto God; but, there is one way of service I venture to tell you of; I have generally kept two boys of poor parents at school, and, by this means, have been instrumental in bringing up, from unlikely families, such as have made good men, and valuable members of the Commonwealth."

† It appears from this statement that this unnamed school-mistress adopted the monitorial system a century and more before Bell, or Lancaster, or their respective adherents convulsed the educational world of England by their claims to its authorship. She applied the principle of mutual instruction which is as old as the human family, and which has been tried to some extent, in all probability, in the instruction and discipline of many schools in every age of the world. Certain it is, that the system, with much of the modern machinery of monitors, was adopted by Trotzendorf, in Germany, in the sixteenth century, and by Paulet in France, many years before these two champions of an economical system of popular education, by means of one head master, with boys and girls for assistants, in a school of many hundred children, ever set up their model schools in Madras or London

under the tuition of the aged, venerable, and justly famous Mr. Ezekiel Cheever. But after a few weeks, an odd accident drove me from the school. There was an older lad entered the school the same week with me; we strove who should outdo; and he beat me by the help of a brother in the upper class, who stood behind master with the accidence open for him to read out off; by which means he could recite his * * *three* and four times in a forenoon, *and the same in the* afternoon; but I who had no such *help, and was* obliged to commit all to memory, could not keep pace with him; so that he would be always one lesson before me. My ambition could not bear to be outdone, and in such a fraudulent manner, and therefore I left the school. About this time arrived a dissenting minister from England, who opened a private school for reading, writing, and Latin. My good father put me under his tuition, with whom I spent a year and a half. The gentleman receiving *but little encouragement*, threw up his school, and re*turned me to my father, and again* I was sent to my aged Mr. Cheever, *who placed me in the low*est class; but finding I soon read through my * * * , in a few weeks he advanced me to the * * * , *and* the next year made me the head of it.

In the time of my absence from Mr. Cheever, it pleased God to take to himself my dear mother, *who was* not only a very virtuous, but a very in*telligent woman. She was* exceeding fond of my learning, and *taught me* to pray. My good father also instructed *me, and made* a little closet for me to retire to for my m*orning and evening* devotion. But, alas! how childish and *hypo*critical were all my pretensions to *piety, there* being little or no serious thoughts of God and re*ligion in me.* * * * * * * * * * * *

Though my master advanced me, as above, yet I was a very naughty boy, much given to play, insomuch that he at length openly declared, "You Barnard, I know you can do well enough if you will; but you are so full of play that you hinder your classmates from getting *their lessons;* and therefore, if any of them cannot perform *their duty, I shall cor*rect you for it." One unlucky *day, one of my classmates did not look* into his book, and therefore *could not say his lesson*, though I called upon him once and again *to mind his book:* upon which our master beat me. I told *master the* reason why he could not say his lesson was, his *declar*ing he would beat me if any of the class were wa*nting* in their duty; since which this boy would not look *into* his book, though I called upon him to mind his book, as *the* class could witness. The boy was pleased with *my* being corrected, and persisted in his neglect, for which I was still corrected, and that for several days. I thought, in justice, I ought to correct the boy, and compel him to a better temper; and therefore, after school was done, I went up to him, and told him I had been beaten several times for his neglect; and since master would not correct him I would, and I should do so as often as I was corrected for him; and then drubbed him heartily. The boy never came to school any more, and so that unhappy affair ended.

Though I was often beaten for my play, and my little roguish tricks, yet I don't remember that I was ever beaten for my book more than once or twice. One of these was upon this occasion. Master put our class upon turning Æsop's Fables into Latin verse. Some dull fellows made a shift to perform this to acceptance; but I was so much duller at this exercise, that I could make nothing of it; for which master corrected me, and this he did two or three days going. I had honestly tried my possibles to perform the task; but having no poetical fancy, nor then a capacity opened of expressing the same idea by a variation of phrases, though I was perfectly acquainted with prosody, I found I could do nothing; and therefore plainly told my master, that I had diligently labored all I could to perform what he required, and perceiving I had no genius for it, I thought it was in vain to strive against nature any longer; and he never more required it of me, Nor had I any thing of a poetical genius till after I had been at College some time, when upon reading some of Mr. Cowley's works, I was highly pleased, and a new scene opened before me.

I remember once, in making a piece of Latin, my master found fault with the syntax of one word, which was not so used by me heedlessly, but designedly, and therefore I told him there was a plain grammar rule for it. He angrily replied, there was no such rule. I took the grammar and showed the rule to him. Then he smilingly said, "Thou art a brave boy; I had forgot it." And no wonder; for he was then above eighty years old.

We continue these extracts beyond the passages which relate to Mr. Barnard's experience in Mr. Cheever's school, because they throw light on college life at that time.

"From the grammar school I was admitted into the college, in Cambridge, in New England, in July, 1696, under the Presidentship of the very reverend and excellent Dr. Increase Mather, (who gave me for a thesis, *Habenti dabitur*,) and the tutorage of those two great men, Mr. John Leverett, (afterwards President,) and Mr. William Brattle, (afterwards the worthy minister of Cambridge.) Mr. Leverett became my special tutor for about a year and a half, to whom succeeded Mr. Jabez Fitch, (afterwards the minister of Ipswich with Mr. John Rogers, who, at the invitation of the church in Portsmouth, New Hampshire, removed to them.) Upon my entering into college, I became chamber-mate, the first year, to a senior and a junior sophister; which might have been greatly to my advantage, had they been of a studious disposition, and made any considerable progress in literature. But, alas! they were an idle pack, who knew but little, and took no pains to increase their knowledge. When therefore, according to my disposition, which was ambitious to excel, I applied myself close to books, and began to look forward into the next year's exercises, this unhappy pair greatly discouraged me, and beat me off from my studies, so that by their persuasions I foolishly threw by my books, and soon became as idle as they were. Oh! how baneful is it to be linked with bad company! and what a vile heart had I to hearken to their wretched persuasions! I never, after this, recovered a good studious disposition, while I was at college. Having a ready, quick memory, which rendered the common exercises of the college easy to me, and being an active youth, I was hurried almost continually into one diversion or another, and gave myself to no particular studies, and therefore made no great proficiency in any part of solid learning. * * * * * * * * * * * *

In July, 1700, I took my first degree, Dr. Increase Mather being President; after which I returned to my honored father's house, where I betook myself to close studying, and humbling myself before God with fasting and prayer, imploring the pardon of all my sins, through the mediation of Christ; begging the divine Spirit to sanctify me throughout, in spirit, soul, and body, and fit me for, and use me in the service of the sanctuary, and direct and bless all my studies to that end. I joined to the North Church in Boston, under the pastoral care of the two Mathers. Some time in November, 1702, I was visited with a fever and sore throat, but through the mercy of God to a poor sinful creature, in a few days I recovered a good state of health; and from that time to this, November, 1766, I have never had any sickness that has confined me to my bed.

While I continued at my good father's I prosecuted my studies; and looked something into the mathematics, though I gained but little; our advantages therefor being noways equal to what they have, who now have the great Sir Isaac Newton, and Dr. Halley, and some other mathematicians, for their guides. About this time I made a visit to the college, as I generally did once or twice a year, where I remember the conversation turning upon the mathematics, one of the company, who was a considerable proficient in them, observing my ignorance, said to me he would give me a question, which if I answered in a month's close application, he should account me an apt scholar. He gave me the question. I, who was ashamed of the reproach cast upon me, set myself hard to work, and in a fortnight's time returned him a solution of the question, both by trigonometry and geometry, with a canon by which to resolve all questions of the like nature. When I showed it to him, he was surprised, said it was right, and owned he knew no way of resolving it but by algebra, which I was an utterly stranger to. I also gave myself to the study of the Biblical Hebrew, turned the Lord's prayer, the creed, and part of the Assembly's Catechism into Hebrew, (for which I had Dr. Cotton Mather for my corrector,) and entered on the task of finding the radix of every Hebrew word in the Bible, with designs to form a Hebrew Concordance; but when I had proceeded through a few chapters in Genesis, I found the work was done to my hand by one of the Buxtorfs. So I laid it by. * *

About two months before I took my second degree, the reverend and deservedly famous Mr. Samuel Willard, then Vice-President, called upon me, (though I lived in Boston,) to give a common-place in the college hall; which I did, the latter end of June, from 2. Peter, i. 20, 21, endeavoring to prove the divine inspiration and authority of the holy Scriptures. When I had concluded, the President was so good as to say openly in the hall, '*Bene fecisti, Barnarde, et gratias ago tibi.*' Under him I took my second degree in July, 1703."

In Turrell's "Life and Character of Rev. Benjamin Colman, D. D., late pastor of a church in Boston, New England, who deceased August 29, 1747," and published in 1749, there is the following sketch of the school life of this eminent divine.

"He was of a tender constitution from his birth, and very backward in his *speech* and *reading* till he arrived to the age of *five years;* when, at once, he grew forward in both, and entered (in 1678) young and small into the *Grammar School* under the tuition of the venerable and learned Mr. *Ezekiel Cheever.* His sprightly genius and advances in learning were soon (with pleasure) observed by his *preceptor*, insomuch, that, in his first and second years, he was several times called upon by him to reprove and shame some *dull boys* of upper forms, when they grosly failed in their catechism and some low exercises. He was fired with a laudable ambition of excelling at his book, and a fear of being outdone. By his industry at home, he always kept foremost, or equal to the best of the form at school; and, a great advantage he had (which, at that time, gave him no little (pain in the promptness, diligence, and brightness of his intimate companion, *Prout*, who used to spend his hours out of school, generally, in studies with him, the two or three last years of his life; and, their *preceptor* used, openly, to compare their exercises, and, sometimes, declare he knew not which were best, and, bid *Colman* take heed, for, the first time he was outdone, *Prout* should have his place. But, alas! a violent fever seized the lovely, shining, ambitious boy, and suddenly carried him to an higher form, to the great grief as well as hurt of *Colman*, who was now left without a rival, and, so without a spur to daily care and labour. However, he followed his studies so well that he was qualified for an admission into *Harvard* College in the year 1688.

His early piety was equal to his learning. His pious Mother (as he records it, to her eternal honour), like *Lemuel's*, travailed in pain through his infancy and childhood for the new birth; and, to her instructions and corrections added her commands and admonitions respecting every thing that was religious and holy; and, in a particular manner, about the duty of praying to God in secret, and, also, caused him and her other children to retire and pray together, and for one an other on the Lord's Days at noon.

While a *school-boy* for a course of years, he and some of his companions, by their own proposal to each other, under the encouragement of their *parents*, and, with the consent of their *preceptor*, used to spend a part of *Saturdays* in the afternoon in prayer together at the house of Mr. *Colman*, which continued until their leaving the school and going to college: *Mather*, *Baker*, *Prout*, *Pool*, *Townsend* were of this number; and, for the most part, behaved decently and seriously in these early exercises of piety and devotion.

After his admission into college, he grew in piety and learning, and in favor with God and man. He performed all his exercises to good acceptance; many of them had the applauses of his learned tutor, Mr. *John Leverett.* He was much animated to the study of the liberal sciences, and to make the utmost improvement in them from the shining example of the excellent *Pemberton*, who was a year before him in standing. To be next to him seems to bound his ambition until he passed his degrees of Batchelor and Master of Arts, which he did in the years 1692 and 95, under the Presidentship of the memorable Dr. *Increase Mather.* When he pronounced the public Oration, on taking his Master's Degree, his thin and slender appearance, his soft and delicate voice, and the red spots in his cheeks, caused the audience in general to conclude him bordering on a consumption, and to be designed but for a few weeks of life.

From the bright but brief career of young Prout, and from the "red spots" on the cheeks of the gifted Colman, we fear that Mr. Cheever did not always temper the undue ardor of his pupils.

Of Mr. Cheever's discipline, we may form some notion from the testimony of his pupils. The following lines from Coote's "English Schoolmaster," a famous manual* of that day in England, may have been the substance of his "school code."

THE SCHOOLMASTER TO HIS SCHOLARS.

"My child and scholar take good heed
unto the words that here are set,
And see thou do accordingly,
or else be sure thou shalt be beat.

First, I command thee God to serve,
then, to thy parents, duty yield;
Unto all men be courteous,
and mannerly, in town and field.

Your cloaths unbuttoned do not use,
let not your hose ungartered be;
Have handkerchief in readiness,
Wash hands and face, or see not me.

Lose not your books, ink-horns, or pens,
nor girdle, garters, hat or band,
Let shooes be tyed, pin shirt-band close,
keep well your hands at any hand.

If broken-hos'd or shoe'd you go,
or slovenly in your array,
Without a girdle, or untrust,
then you and I must have a fray.

If that thou cry, or talk aloud,
or books do rend, or strike with knife;
Or laugh, or play unlawfully,
then you and I must be at strife.

If that you curse, miscall, or swear,
if that you pick, filch, steal, or lye;
If you forget a scholar's part,
then must you sure your points untye.

If that to school you do not go,
when time doth call you to the same;
Or, if you loiter in the streets,
when we do meet, then look for blame.

Wherefore, my child, behave thyself,
so decently, in all assays,
That thou may'st purchase parents love,
and eke obtain thy master's praise."

Although he was doubtless a strict disciplinarian, it is evident, from the affectionate manner in which his pupils, Mather, Barnard, and Colman speak of him, and the traditionary reputation which has descended with his name, that his venerable presence was accompanied by "an agreeable mixture of majesty and sweetness, both in his voice and countenance," and that he secured at once obedience, reverence, and love.

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* The following is the title-page of this once famous school-book, printed from a copy of the fortieth edition, presented to the author of this sketch, by George Livermore, Esq., of Cambridge, Mass.

"THE
ENGLISH
SCHOOL-MASTER.

Teaching all his Scholars, of what age so ever, the most easy, short. and perfect order of distinct Reading, and true Writing our English-tongue, that hath ever yet been known or published by any.

And further also, teacheth a direct course, how many unskilful person may easily both understand any hard English words, which they shall in Scriptures, Sermons, or else-where hear or read; and also be made able to use the same aptly themselves; and generally whatsoever is necessary to be known for the *English* speech: so that he which hath this book only needeth to buy no other to make him fit from his Letters to the *Grammar-School*, for an *Apprentice*, or any other private use, so far as concerneth *English*: And therefore it is made not only for Children, though the first book be meer childish for them, but also for all other; especially for those that are ignorant in the *Latin* Tongue.

In the next Page the *School-Master* hangeth forth his Table to the view of all beholders, setting forth some of the chief Commodities of his profession.

Devised for thy sake that wantest any part of this skill; by *Edward Coote*, Master of the Free-school in Saint *Edmund's-Bury*.

Perused and approved by publick Authority; and now the 40 *time Imprinted: with certain Copies to write by, at the end of this Book, added.*

Printed by *A. M.* and *R. R.* for the Company of *Stationers*, 1680

Of the text-books used by Mr. Cheever,—to what extent the New England Primer had superseded the Royal Primer of Great Britain,—whether James Hodder encountered as sharp a competition as any of the Arithmeticians of this day,—whether Lawrence Eachard, or G. Meriton, gave aid in the study of Geography at that early day, we shall not speak in this place, except of one of which he was author.*

During his residence at New Haven he composed The Accidence, "*A short introduction to the Latin Tongue*," which, prior to 1790, had passed through twenty editions, and was for more than a century the hand-book of most of the Latin scholars of New England. We have before us a copy of the 20th edition, with the following title page:

"A SHORT
INTRODUCTION
TO THE
LATIN LANGUAGE:
For the Use of the
Lower Forms in the Latin School.
Being the
ACCIDENCE,
Abridged and compiled in that most easy and accurate Method, wherein the famous Mr. EZEKIEL CHEEVER taught, and which he found the most advantageous, by Seventy Year's Experience.
To which is added,
A CATALOGUE of Irregular Nouns, and Verbs, disposed Alphabetically.
The Twentieth Edition.
SALEM:
Printed and Sold by *Samuel Hall*, MDCCLXXXV."

This little book embodies Mr. Cheever's method of teaching the rudiments of the Latin language, and was doubtless suggested or abridged from some larger manual used in the schools of London at the time, with alterations suggested by his own scholarly attainments, and his experience as a teacher. It has been much admired by good judges for its clear, logical, and comprehensive exhibition of the first principles and leading inflexions of the language. The Rev. Samuel Bentley, D. D., of Salem, (born 1758, and died 1819), a great antiquarian and collector of school-books, in some "Notes for an Address on Education," after speaking of Mr. Cheever's labors at Ipswich as mainly instrumental in placing that town, "in literature and population, above all the towns of Essex County," remarks:—

"His Accidence was the wonder of the age, and though, as his biographer and pupil, Dr. Cotton Mather, observed, it had not excluded the original grammar, it passed through eighteen editions before the Revolution, and had been used as generally as any elementary work ever known. The familiar epistles of this master to his son, minister of Marblehead, are all worthy of the age of Erasmus, and of the days of Ascham.

"Before Mr. Cheever's Accidence obtained, Mr. John Brinsley's method had obtained, and this was published in 1611, three years before Cheever was born. It is in question and answer, and was undoubtedly known to Cheever, who has availed himself of the expression, but has most ingeniously reduced it to the form

* Unless some one, with more abundant material in hand, will undertake the task, we shall prepare ere long a Paper on the Early School Books of this country, published prior to 1800, with an approximation, at least, to the number issued since that date.

of his Accidence,—134 small 4to pages to 79 small 12mo., with the addition of an excellent Table of Irregular Verbs from the great work of the days of Roger Ascham."*

We have not been able to obtain an earlier edition of this little work than the one above quoted, or to ascertain when, or by whom, it was first printed.† An edition was published so late as 1838, under the title of CHEEVER'S LATIN ACCIDENCE, with an announcement on the title-page that it was "used in the schools of this country for more than a hundred and fifty years previous to the close of the last century." This edition is accompanied by letters from several eminent scholars and teachers highly commendatory of its many excellencies, and hopeful of its restoration to its former place in the schools. President Quincy, of Harvard College, says: "It is distinguished for simplicity, comprehensiveness, and exactness; and, as a primer or first elementary book, I do not believe it is exceeded by any other work, in respect to those important qualities." Samuel Walker, an eminent instructor of the Latin language, adds: "The Latin Accidence, which was the favorite little book of our youthful days, has probably done more to inspire young minds with the love of the study of the Latin language than any other work of the kind since the first settlement of the country. I have had it in constant use for my pupils, whenever it could be obtained, for more than fifty years, and have found it to be the best book, for beginners in the study of Latin, that has come within my knowledge."

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*Mr John Brinsley, author of the Latin Accidence referred to, was the author of a little work on English Grammar, printed in 1622, with the following title:—

"A
CONSOLATION
For Our GRAMMAR
SCHOOLES;
OR,
A faithful and most comfortable incouragement for laying of a sure foundation of a good Learning in our Schooles, and for prosperous building thereupon.
More Specially for all those of the inferior sort, and all ruder countries and places; namely, for Ireland, Wales, Virginia, with the Sommer Islands, and for their more speedie attaining of our English tongue by the same labour, that all may speake one and the same Language. And withall, for the helping of all such as are desirous speedlie to recover that which they had formerlie got in the Grammar Schooles: and to proceed aright therein, for the perpetuall benefit of these our Nations, and of the Churches of Christ.
LONDON:
Printed by Richard Field for Thomas Man. dwelling in Paternoster Row, at the Sign of the Talcot, 1622; small 4to.

Epistle, dedicatory, and table of contents, pp. 1 c84 and Examiner's Censure, pp. 2.

This rare treatise is in the Library of George Brinley, Esq., of Hartford, Conn.

† Since the above paragraph was in type, we have seen four other editions of the Accidence the earliest of which is the seventh, printed in Boston, by B. Edes & S. Gill, for I. Edwards & I. and T. Leverett, in Cornhill, MDCCIV. For an opportunity of consulting these editions an original edition of Dr. Cotton Mather's Funeral Sermon on the occasion of Cheever's death, and several other authorities referred to in this sketch, we are indebted to George Brinley, Esq., of Hartford, who has one of the largest and choicest collection of books and pamphlets, printed in New England, or relating to its affairs, civil and ecclesiastical,—state, town, church, and individual, to be found in the country.

Mr. Cheever was also the author of a small treatise of thirty-two pages, of which, the only copy we have seen [in Harvard University Library] was published forty-nine years after his death, and entitled—

"Scripture Prophecies Explained
IN THREE SHORT
ESSAYS.
I. *On the Restitution of all things,*
II. *On St. John's first Resurrection,*
III. *On the personal coming of Jesus Christ,*
As commencing at the beginning of the MILLENNIUM, described in the Apocalypse.
By EZEKIEL CHEEVER,
In former days Master of the Grammar School in Boston.
'We have a more sure word of Prophecy, whereunto ye do well that ye take heed, &c.'
BOSTON,
Printed and sold by Green & Russell, at their Printing Office, in Queen-street. MDCCLVII."

The author concludes his last Essay as follows:—

"*Lastly.* To conclude, this personal coming of CHRIST at or before the beginning of the thousand years, is no other but the second coming of CHRIST, and great day of judgment, which the Scripture speaks of, and all Christians believe, and wait for, only there are several works to be performed in the several parts of this great day. The first works, in the first part or beginning of this day, is to raise the Saints; destroy his enemies with temporal destruction; to set up his kingdom; to rule and reign on the earth, with his raised and then living Saints, a thousand years; after that, in the latter part of the day, to destroy *Gog* and *Magog:* To enter upon the last general judgment, raising the wicked, judging them according to their works, and *casting them into the lake of fire, which is the second death.* All this, from first to last, is but one day of judgment; *that great and terrible day of the Lord*, and is but one coming, which is his second, as we plead for. After this, the work being finished, CHRIST will deliver up his mediatory kingdom to his FATHER, and, himself, become a subject, that GOD may be all in all. With this interpretation, all the Scriptures alleged, and many more, will better agree and harmonize in a clear and fair way, not crossing any ordinary rules given of interpreting Scripture than in restraining CHRIST's personal coming to the work and time of the last judgment. And, though many of these Scriptures may have a spiritual meaning, and, may be already in part fulfilled, which I deny not, yet that will not hinder, but that they may have a literal sense also."

Of Mr. Cheever's personal history, after he removed to Boston, we have been successful in gathering but few particulars not already published. From a petition addressed by him to Sir Edmund Andross, in 1687, some seventeen years after he removed to Boston, it appears, that he was then in prime working order as a teacher—still enjoying his "wonted abilities of mind, health of body, vivacity of spirit, and delight in his work." The following is the petition copied from the Hutchinson Papers in the Massachusetts Historical Society and printed by Mr. Gould:

"*To His Excellency, Sir Edmund Andross, Knight, Governor and Captain General of His Majesty's territories and dominions in New England.*

"The humble petition of Ezekiel Cheever of Boston, schoolmaster, sheweth that your poor petitioner hath near fifty years been employed in the work and office of a public Grammar-schoolmaster in several places in this country. With what acceptance and success, I submit to the judgment of those that are able to testify. Now seeing that God is pleased mercifully yet to continue my wonted abilities of mind, health of body, vivacity of spirit, delight in my work, which alone I am any way fit and capable of, and whereby I have my outward subsistence,—I most humbly entreat your Excellency, that according to your former kindness so often manifested, I may by your Excellency's favor, allowance and encouragement, still be continued in my present place. And whereas there is due to me about fifty-five pounds for my labors past, and the former way of that part of my maintenance is thought good to be altered,—I with all submission beseech your Excellency, that you would be pleased to give order for my due satisfaction, the want of which would fall heavy upon me in my old age, and my children also, who are otherwise poor enough. And your poor petitioner shall ever pray, &c.

Your Excellency's most humble servant,

EZEKIEL CHEEVER."

He died,* according to Dr. Mather, "on Saturday morning, August 21, 1708—in the ninety-fourth year of his age; after he had been a skillful, painful, faithful schoolmaster for seventy years, and had the singular favor of Heaven, that though he had usefully spent his life among children, yet he was not become *twice a child*, but held his abilities, in an unusual degree, to the very last,"—"his intellectual force as little abated as his natural." It was his singular good fortune to have lived as an equal among the very founders of New England, with them of Boston, and Salem, and New Haven,—to have taught their children, and their children's children, unto the third and fourth generation—and to have lingered in the recollections of his pupils and their children, the model and monument, the survivor and representative of the Puritan and Pilgrim stock, down almost to the beginning of the present century.

President Stiles of Yale College, in his Literary Diary, 25th April 1772, mentions seeing the "Rev. and aged Mr. Samuel Maxwell, of Warren," R. I., in whom "I have seen a man who had been acquainted with one of the original and first settlers of New England, now a rarity."† "He told me he well knew the famous Grammar schoolmaster, Mr. E. Cheever of Boston, author of the Accidence; that he wore a long white beard, terminating in a point; that when he stroked his beard to the point, it was a sign for the boys to stand clear." In another entry, made on the 17th of July 1774, Dr. Stiles, after noting down several dates in the life of Mr. Cheever, adds, "I have seen those who knew the venerable saint, particularly the Rev. John Barnard, of Marblehead, who was fitted for college by him, and entered 1698." Rev. Dr. Mather, in 1708, speaks of him not only as his master, seven and thirty years ago, but, also, "as master to my betters, no less than seventy years ago; so long ago, that I must even mention my father's tutor for one of them."

* "Venerable," says Governor Hutchinson, in his History of Massachusetts, (Vol. II., page 175, Note), "not merely for his great age, 94, but for having been the schoolmaster of most of the principal gentlemen in Boston, who were then upon the stage. He is not the only master who kept his lamp longer lighted than otherwise it would have been by a supply of oil from his scholars."

† There is now living in Bangor, Maine, "Father Sawyer," who was born in Hebron, Conn., in Nov., 1755, and who has preached the gospel for 70 years. He knew Rev. John Barnard, of Marblehead, a pupil of Mr. Cheever. These three persons connect the present with the first generation of New England.

He was buried, according to an entry of Judge Sewall in his manuscript Diary,* under date of August 23, "from the school-house. The Governor, Councillors, Ministers, Justices, Gentlemen being there. Mr. Williams (his successor in the school) made a handsome oration in his honor."

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* We are indebted to Rev. Samuel Sewall of Burlington, Mass., for the following transcript from the manuscript Diary of Judge Sewall:

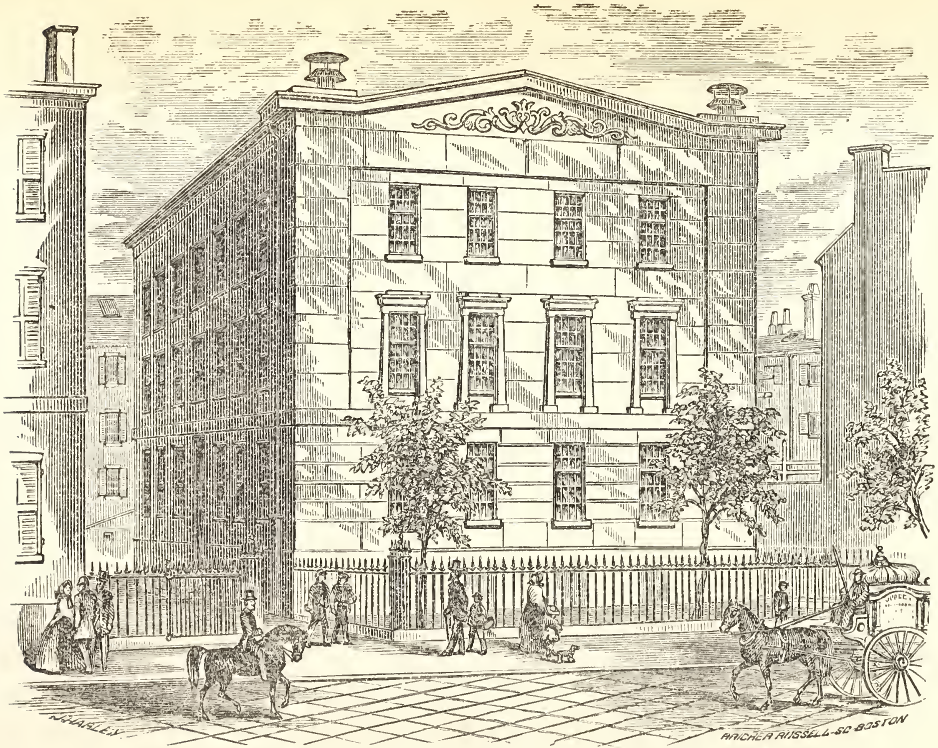
"Feria septima. August 21st (1708). Mr. Edward Oakes tells me, Mr. Chiever died this last night. N. He was born January 25th 1614. Came over to New England 1637, to Boston, land to New Haven 1638. Married in the Fall, and began to teach School, which work he was constant in till now; first at New Haven; then at Ipswich; then at Charlestown; then at Boston, wither he came in 1673; so that he has labored in that calling skillfully, diligently, constantly, religiously, seventy years—a rare instance of Piety, Health, Strength, and Serviceableness. The welfare of the Province was much upon his spirit. *He abominated Periwigs.*"

The Rev. Mr Sewall, in communicating the above transcript, adds the following remarks by the way of postscript. "Though Judge Sewall wrote the Sentence underscored last, yet it was not as what he conceived to be the *climax* of the characteristic excellence he had ascribed to good Master Cheever, but as a fact which happened to come into his mind as he was writing, and which he regarded as a recommendation of Mr. Cheever. In his prejudice against Periwigs, he was not singular. Such men as Rev. John Eliot was alike opposed to them; and Rev. Solomon Stoddard of Northampton wrote against them."

The assault of "the learned and reverend Mr. Stoddard," of Northampton, on Periwigs, was in a letter addressed to a distinguished citizen, no other than Chief Justice Sewall, and published at Boston, with other matters, in a pamphlet, in 1722, entitled "*An answer to some cases of Conscience respecting the Country.*" After disposing of some grave questions touching the oppression of the poor and ignorant by the knowing and crafty, in selling at an exorbitant profit, in depreciating the currency of the country, in taking advantage of the necessities of a man in debt, the author passes to the consideration of the lawfulness in the light of scripture, of men wearing their hair long, or of cutting it off entirely, for the purpose of substituting the hair of other persons, and even of horses and goats. "Although I cannot condemn them universally, yet, in wearing them, there is abundance of sin. *First*, when men do wear them, needlessly, in compliance with the fashion. *Secondly*, when they do wear them in such a ruffianly way as it would be utterly unlawful to wear their own hair in. Some of the wigs are of unreasonable length; and, generally, they are extravagant as to their bushiness." He not only condemns the wig because it is "wasteful as to cost, but, because it is contrary to gravity." "It makes the wearers of them look as if they were more disposed to court a maid than to bear upon their hearts the weighty concernments of God's kingdom."

But, Mr. Stoddard and Mr. Cheever were not alone in their abhorence of wearing periwigs. The Apostle Eliot, talked, prayed, and preached for its suppression. The legislative authorities of Massachusetts denounced "the practice of mens wearing their own or other's hair made into periwigs." It was made a test of godliness and church-membership. In spite of the authority given to the custom by William Penn, who, according to his biographer, "had four wigs with him, which cost him twenty pounds," the Friends, in their monthly session, at Hampton, in 1721, made this decision: "It was concluded by this meeting that the wearing of extravagant, superfluous wigs is altogether contrary to truth." In the second church of Newbury, in 1752, one Richard Bartlett was "dealt with": *First*, our said brother refuses communion with the church for no other reason, but because the pastor wears a wig, and because the church justifies him in it; setting up his own opinion in opposition to the church, contrary to that humility which becomes a Christian. *Second*, and farther, in an unchristian manner. he censures and condemns both pastor and church as anti-Christian on the aforesaid account, and he sticks not, from time to time, to assert, with the greatest assurance, that all who wear wigs unless they repent of that particular sin, before they die, will certainly be damned, which we judge to be a piece of uncharitable and sinful rashness." This custom prevailed in England and France, as well as in this country, and there, as well as here, provoked the attacks of the pulpit and the satirist, but gradually disappeared, or gave place to other fashions of the toilet, if not quite so monstrous, full as expensive and as absurd. "There is no accounting for taste." See Felt's *Customs of New England*.

In 1748, the modest structure which had accommodated the Latin School and the family of Master Cheever, was removed to make room for the enlargement of the Stone Chapel, and a new and larger building erected on the opposite side of the same street, the third floor of which only was used for school purposes until 1816, when the increased number of pupils under Master Gould, called for the use of the second floor, which had been used by the Central Grammar School. For several years prior to Mr. Gould's appointment to the mastership, the Latin School did not keep up with the demands of the wealthy and educated families of the city who had generally got into the way of sending their sons into the country towns, and particularly to the academies at Exeter and Andover, to be prepared for admission to college and their withdrawal thus perhaps contributed largely to keep the school in an unprogressive state—taking from it both the pupils and the parental interest and intelligence, which are the life of every public school. The vigorous administration, personal popularity, and better scholarship of Mr. Gould, with the increasing interest in the improvement of the public schools generally, placed its course of instruction in extent and thoroughness on a level with the best academies of the country towns, and made it the natural head of the public schools of the city. With an improvement in the classical course destined for college, there grew up a demand for a more thorough literary and scientific training for boys who were destined for other pursuits than those of law, theology, and medicine, which found their appropriate preparation in the College—and the English High School was established in 1821, to meet this demand. The establishment of the English High School for boys, very naturally created a desire for similar advantages for the girls, which led to the establishment of the Girls' High School, in 1825, which in its turn gave way to an extension of the studies and a prolonged attendance of the girls in all the Grammar Schools in 1829. The discussion and final recognition of the necessity of special preparation for the art of teaching in connection with the employment of a large number of females as teachers in the Primary and Grammar Schools of the city, led to the establishment of a Normal School for girls, in 1852, which, in a few years, became also a High School for the same class of pupils, and thus the System of Public Schools in Boston, rises from the broad basis of Primary Schools, through its natural expansion of Intermediate and Grammar Schools into the Latin, English, and Girls' High Schools, and a Normal Course in the latter for at least the largest number of teachers—the female teachers of the city.



LATIN AND ENGLISH HIGH SCHOOL-HOUSE, BOSTON. Erected, 1844.

In the School-house on Bedford Street, erected in 1843–4, for the Latin and English High Schools, the former is accommodated in the Hall H, and Class-rooms, C, C, C, C, on the left side, and the latter in the Hall and Class-rooms on the other side.

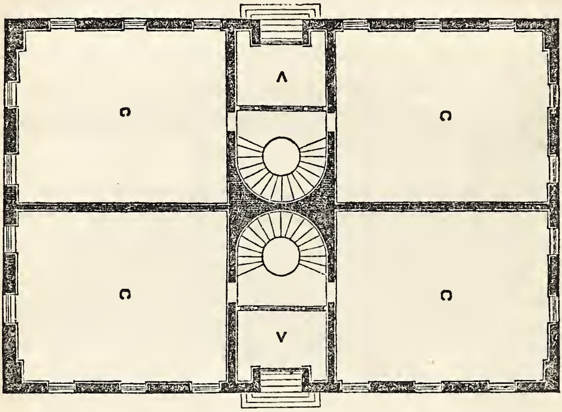


Fig. 1.—First Floor.

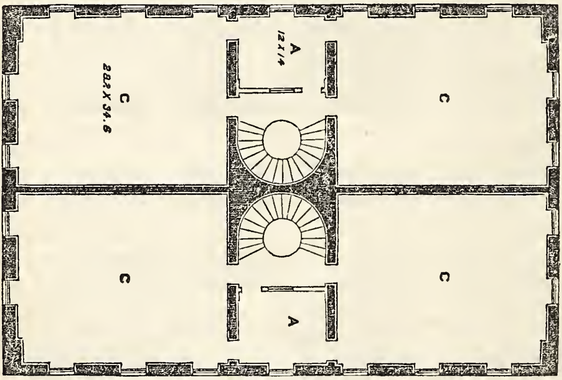


Fig. 2.—Second Floor.

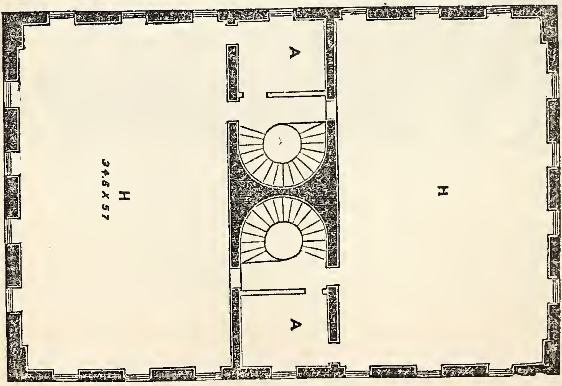


Fig. 3.—Third Floor.

II. MASTERSHIP OF FRANCIS GARDNER. 1852—1862.

Francis Gardner entered on the Mastership of the Latin School in 1852, having fitted for Harvard College under the instruction of Master Benjamin A. Gould, and been employed as an assistant in the same school under Masters C. K. Dillaway, and E. S. Dixwell. Under no former Master has the number of pupils been so large, the course of instruction more thorough, and the annual contribution to the colleges so high. The following account of the school has been drawn up by Mr. Gardner at our request:—

"As the Latin School is maintained to prepare young men for a collegiate career, its course of studies is in a great measure prescribed by the colleges, and it simply remains for the government of the school to accomplish the desired object, with the greatest benefit to the pupil. In the following sketch we propose to give some account of the existing regulations of the school and the reasons for their adoption.

I. QUALIFICATIONS FOR ADMISSION, ETC.

Every pupil must have reached the age of ten years, and pass a satisfactory examination in reading, spelling, writing, and in the elements of arithmetic, geography, and grammar.

Inasmuch as from the very nature of the subject, the memory is a very important agent in the acquisition of grammar—the pupil being ignorant of the whole nomenclature—it has seemed best to employ those years, when the verbal memory is strongest, in the acquisition of this indispensable knowledge. Therefore, for nearly the whole of the last fifty years, the age for admission to this school has been fixed at nine or at ten years.

II. METHOD OF INSTRUCTION.

The studies of the school are divided into two departments, the *Classic*, including Latin, Greek, Mythology, Ancient Geography and History; and the *Modern*, including Mathematics, French, Modern Geography, History, English Grammar, Compositions, Written Translations, Reading, and Spelling. Immediately upon entering the school, the pupil has assigned him a lesson in Latin Grammar, for one of his two lessons for each day, the other being in the Modern Department. As it is assumed that his knowledge is very limited, he is called upon to commit to memory a very short lesson, great care being taken that he shall understand, not only the general meaning of each sentence, but the particular signification of each word. When he has committed this portion to memory, test questions of all kinds are put, in order to ascertain if he understands fully what he can repeat. The reason why the words of the book are required are two-fold, because they express the ideas to be conveyed better than the pupil can give them in his own language, and because it is the shortest and easiest way of acquiring the desired knowledge; the test questioning making it impossible for the learner to acquire mere words without ideas. When the class has advanced as far as Syntax, they then begin to translate and parse, quoting from their grammars all that is applicable to the word under consideration. The rules of Syntax are learned as fast as they occur.

The test questioning is kept up during the whole course, so that upon every "advance lesson" the pupil is responsible for all that he has previously learned upon the subject, whether grammar, mathematics, or geography.

III. DISTRIBUTION OF TEACHERS AND SUBJECTS.

At the beginning of each year a class is assigned to a teacher who is to have its entire management, in both departments, for the whole year. This arrangement is found to produce better results than when frequent changes are made, or when the pupils pursue different studies with different instructors.

IV. HOURS OF RECITATION.

There is no fixed programme for the recitations, and the hours for them, experience having taught that what may be an excellent plan for one class would be a most injudicious one for another. The teacher is constantly employed in hearing recitations, and the only rule imposed on him is, that each class shall recite twice a-day, and shall receive its due share of his time and attention. If, in his judgment, one of the lessons of the day demands more of his time than the other, he gives it.

V. STUDY OUT OF SCHOOL HOURS.

To the youngest classes an out of school lesson is assigned daily, intended to occupy the pupils one hour; to the highest classes a two hours' lesson is assigned. The great advantage of this is that the teacher thereby can profitably employ all his time in drilling his classes. Were they to study only in school, he frequently would be obliged to wait for them to prepare a lesson, whereas now each of the three classes has a lesson in readiness to recite, upon entering school.

VI. DURATION OF COURSE.

Six years is the time allotted to those who enter the school at ten years of age. Very many however enter at a later period, and finish their course in two, three or four years. But experience has incontestably proved that it is impossible for a boy who begins the study of Latin at fifteen years of age, to make so good a scholar, at the time of entering college, as he would have been had he begun his Latin at ten, no matter how thorough his education may have been between ten and fifteen.

VII. CLOSING EXAMINATION.

The only closing examination is that made by the sub-committee of the school, in order to assign the Franklin Medals, and here the committee are required "to inspect the school records," to ascertain the standing of the candidates, as indicated by them. It is at the various colleges that the scholars undergo their examinations. If they fail there, any diploma or certificate of scholarship, which they might have received, would be but a mockery.

VIII. DISCIPLINE.

"As is the master, so is the school." Each teacher is held responsible not only for the order, but for the proficiency of his classes. There can be no order, no proficiency unless the teacher is really the master; unless the pupils are under his control. They perhaps may not know the fact, but unless it exists, there can be no satisfactory progress. The gentler the means by which this control is secured, the better for both teacher and pupil. He is the best teacher who produces the best results with the least application of force. But force of some kind must lie in the teacher or good results can not be produced. Some men have a kind of magnetic force to which a boy yields unconsciously, and which it is impossible for him to resist. Others are obliged to have recourse to mere external force. These men rarely become successful teachers, however talented or learned they may be.

This account would be incomplete without the addition of the writer's belief respecting all preparatory education. It is not what a boy learns at school that makes the man, but *how* he learns it. All the knowledge that a faithful student acquires before arriving at manhood is as nothing, compared with the intellectual strength he has gained, and the ability he has of taking hold of any work that may present itself, and doing it. If the acquisition of knowledge were the chief object in education, very useful as an acquaintance with the dead languages is—indispensable, in fact, to the man of letters—one might with propriety doubt the expediency of spending so large a portion of youth and early manhood in the study. But the earnest, laborious student of language develops a power, which no other training could possibly give him, and in comparison with which, all his acquisitions of mere knowledge sink into utter insignificance."

We give below the Regulations of the School Committee as printed in 1861, so far as relates to this school.

REGULATIONS OF THE LATIN GRAMMAR SCHOOL.

SECTION 1. This school, situated in Bedford Street, was instituted early in the 17th century.

2. The rudiments of the Latin and Greek languages are taught, and scholars are fitted for the most respectable colleges. Instruction is also given in Mathematics, Geography, History, Declamation, English Grammar, Composition, and in the French language.

The following regulations, in addition to those common to all the schools, apply to this school.

3. The instructors in this school shall be, a master, a sub-master, and as many ushers as shall allow one instructor to every thirty-five pupils, and no additional usher shall be allowed for a less number.

4. It shall be a necessary qualification for the instructors of this school, that they shall have been educated at a college of good standing.

5. Each candidate for admission shall have attained the age of ten years, and shall produce from the master of the school he last attended, a certificate of good moral character. He shall be able to read English correctly and fluently, to spell all words of common occurrence, to write a running hand, understand Mental Arithmetic, and the simple rules of Written Arithmetic, and be able to answer the most important questions in Geography, and shall have a sufficient knowledge of English Grammar to parse common sentences in prose. A knowledge of Latin Grammar shall be considered equivalent to that of English.

6. Boys shall be examined for admission to this school only once a year, viz: on the Friday and Saturday of the last week of the vacation succeeding the exhibition of the school in July.

7. The regular course of instruction shall continue six years, and no scholar shall enjoy the privileges of this school beyond that term, unless by written leave of the Committee. But scholars may have the option of completing their course in five years or less time, if willing to make due exertions, and shall be advanced according to scholarship.

8. The sessions of the school shall begin at 9 o'clock, A. M., and close at 2 o'clock, P. M., on every school-day throughout the year, except on Saturday, when the school shall close at 1 o'clock.

9. The school shall be divided into classes and sub-divisions, as the master, with the approbation of the Committee, may think advisable.

10. The master shall examine the pupils under the care of the other teachers in the school as often as he can consistently with proper attention to those in his own charge.

11. The books and exercises required in the course of instruction in this school, are the following:—

Class 6. 1. Andrews' and Stoddard's Latin Grammar. 2. English Grammar. 3. Reading English. 4. Spelling. 5. Mental Arithmetic. 6. Mitchell's Geographical Questions. 7. Declamation. 8. Penmanship. 9. Andrews' Latin Lessons. 10. Andrews' Latin Reader.

Class 5. 1, 2, 3, 4, 7, 8, continued. 11. Viri Romæ. 12. Written Translations. 13. Colburn's Sequel. 14. Cornelius Nepos. 15. Arnold's Latin Prose Composition.

Class 4. 1, 2, 3, 4, 7, 8, 12, 13, 15, continued. 16. Sophocles' Greek Grammar. 17. Sophocles' Greek Lessons. 18. Cæsar's Commentaries. 19. Fasquelle's French Grammar. 20. Exercises in speaking and reading French with a native French teacher.

Class 3. 1, 2, 3, 4, 7, 8, 12, 13, 15, 16, 19, 20, continued. 21. Ovid's Metamorphoses. 22. Arnold's Greek Prose Composition. 23. Xenophon's Anabasis. 24. Sherwin's Algebra. 25. English Composition. 26. Le Grandpere.

Class 2. 1, 2, 3, 4, 7, 8, 15, 16, 19, 21, 22, 23. 24, 25, continued. 27. Virgil. 28. Elements of History. 29. Translations from English into Latin.

Class 1. 1, 7, 15, 16, 19, 20, 21, 22, 23, 25, 27, 28, 29, continued. 30. Geometry. 31. Cicero's Orations. 32. Composition of Latin Verses. 33. Composition in French. 34. Ancient History and Geography. 35. Homer's Iliad, (three books.)

The following books of reference may be used in pursuing the above studies:

Leverett's Latin Lexicon, or Gardner's abridgment of the same.

Andrews' Latin Lexicon.

Liddell and Scott's Greek Lexicon, or Pickering's Greek Lexicon, last edition.

Worcester's School Dictionary.

Smith's Classical Dictionary.

Smith's Dictionary of Antiquities.

Baird's Classic Manual. Warren's Treatise on Physical Geography, or Carteé's Physical Geography and Atlas, is *permitted* to be used.

12. No Translations, nor any Interpretation, Keys, or Orders of Construction, are allowed in the School.

13. The instructors shall pay particular attention to the penmanship of the pupils, and give constantly such instruction in Spelling, Reading, and English Grammar, as they may deem necessary to make the pupils familiar with those fundamental branches of a good education.

The improvements made within even the present century, in this—the oldest school now in operation on the original plan in the country—as in all other grades, in material, outfit, and aids of instruction, as well as in the range of studies and methods of teaching are very beautifully alluded to by Mr. Everett in an Address at Faneuil Hall, in 1855, at the close of the Annual Examination of the Grammar Schools:—

"It was, Mr. Mayor, fifty-two years last April, since I began, at the age of nine years, to attend the reading and writing schools in North Bennet street. The reading school was under Master Little, (for "Young America" had not yet repudiated that title,) and the writing school was kept by Master Tilestone. Master Little, in spite of his name, was a giant in statue—six feet four, at least

—and somewhat wedded to the past. He struggled earnestly against the change then taking place in the pronunciation of *u*, and insisted on our saying *monooment* and *natur*. But I acquired, under his tuition, what was thought, in those days, a very tolerable knowledge of Lindley Murray's abridgement of English grammar, and at the end of the year could parse almost any sentence in the American Preceptor. Master Tilestone was a writing master of the old school. He set the copies himself, and taught that beautiful old Boston handwriting, which, if I do not mistake, has, in the march of innovation, (which is not always the same thing as improvement,) been changed very little for the better. Master Tilestone was advanced in years, and had found a qualification for his calling as a writing master, in what might have seemed, at first, to threaten to be an obstruction. The fingers of his right hand had been contracted and stiffened in early life, by a burn, but were fixed in just the position to hold a pen and a penknife, and nothing else. As they were also considerably indurated, they served as a convenient instrument of discipline. A copy badly written, or a blotted page, was sometimes visited with an infliction which would have done no discredit to the beak of a bald eagle. His long, deep desk was a perfect curiosity shop of confiscated balls, tops, penknives, marbles, and jewsharps; the accumulation of forty years. I desire, however, to speak of him with gratitude, for he put me on the track of an acquisition which has been extremely useful to me in after life—that of a plain legible hand. I remained at these schools about sixteen months, and had the good fortune, in 1804, to receive the Franklin medal in the English department.

After an interval of about a year, during which I attended a private school kept by Mr. Ezekiel Webster, of New Hampshire, and on occasion of his absence, by his ever memorable brother, Daniel Webster, at that time a student of law in Boston, I went to the Latin school, then slowly emerging from a state of extreme depression. It was kept in School street, where the Horticultural Hall now stands. Those who judge of what the Boston Latin School ought to be, from the spacious and commodious building in Bedford street, can form but little idea of the old school house. It contained but one room, heated in the winter by an iron stove, which sent up a funnel into a curious brick chimney, built down from the roof, in the middle of the room, to within seven or eight feet from the floor, being like Mahomet's coffin, held in the air to the roof by bars of iron. The boys had to take their turns, in winter, in coming early to the school-house, to open it, to make a fire, sometimes of wet logs and a very inadequate supply of other combustibles, to sweep out the room, and, if need be, to shovel a path through the snow to the street. These were not very fascinating duties for an urchin of ten or eleven; but we lived through it, and were perhaps not the worse for having to turn our hands to these little offices.

The standard of scholastic attainment was certainly not higher than that of material comfort in those days. We read pretty much the same books—or of the same class—in Latin and Greek, as are read now; but in a very cursory and superficial manner. There was no attention paid to the philosophy of the languages, to the deduction of words from their radical elements, to the niceties of construction, still less to prosody. I never made an hexameter or pentameter verse, till years afterwards I had a son at school in London, who occasionally required a little aid in that way. The subsidiary and illustrative branches were wholly unknown in the Latin School in 1805. Such a thing as a school library, a book of reference, a critical edition of a classic, a map, a blackboard, an engraving of an ancient building, or a copy of a work of ancient art, such as now adorn the walls of our schools, was as little known as the electric telegraph. If our children, who possess all these appliances and aids to learning, do not greatly excel their parents, they will be much to blame.

At this school in 1806, I had the satisfaction to receive the Franklin medal, which, however, as well as that received at the English school in 1804, during my absence from the country in early life, I was so unfortunate as to lose. I begged my friend, Dr. Sturtleff, a year or more ago, to replace them—these precious trophies of my school-boy days—at my expense, which he has promised to do. He has not yet had time to keep his word; but as, in addition to his other numerous professional and official occupations, he is engaged in editing the records of the Massachusetts and Plymouth Colony, in about twenty-five volumes folio, and is bringing out the work at the rate of five or six volumes a year, I suppose I must excuse him for not attending to my medals, although, like Julius Cæsar, the doctor possesses the faculty of doing three or four things at the same time, and all with great precision and thoroughness.

Mr. Mayor, the schools of Boston have improved within fifty years, beyond what any one will readily conceive, who has not, in his own person, made the examination. I have made it myself only with reference to the Latin School, but I have no reason to doubt that it is the same with all the others. The support of the schools is justly regarded as the first care of the city government; and the public expenditure upon them is greater in proportion to the population than in any city in the world. I had occasion, last week, to make a statement on this subject, to a gentleman from a distant State, and when I informed him that the richest individual in Boston could not, with all his money, buy better schooling for his son, than the public schools furnish to the child of the poorest citizen, he was lost in admiration. I do not think the people of Boston themselves realize, as they ought, what a privilege they possess in having that education brought to their doors, for which parents in some other parts of the country are obliged to send their children a hundred or a thousand miles from home; for we may well repeat the inquiry of Cicero, "Ubi enim aut jucundius morarentur quam in patria, aut pudicitius continerentur quam sub oculis parentum, aut minore sumptu quam domi?"

In a word, sir, when the Public Library shall be completed, (and thanks to the liberality of the city government it is making the most satisfactory progress,) which I have always regarded as the necessary supplement to our schools, I do really think that Boston will possess an educational system superior to any other in the world.

Let me, sir, before I sit down, congratulate the boys and girls in their success, who, as medal scholars are privileged to be here. The reward they have now received for their early efforts is designed as an incentive to future exertion; without which the Franklin medal will be rather a disgrace than a credit to them. But let them also bear their honors with meekness. Of their schoolmates of both sexes who have failed to obtain these coveted distinctions, some, less endowed with natural talent, have probably made exertions equally if not more meritorious; some have failed through ill health. Some, whom you now leave a good way behind, will come straining after you and perhaps surpass you in the great race of life. Let your present superior good fortune, my young friends, have no other effect than to inspire you with considerateness and kind feeling toward your schoolmates. Let not the dark passions, and base, selfish, and party feelings which lead grown men to hate and vilify, and seek to injure each other, find entrance into your young and innocent bosoms. Let these early honors lead you to a more strict observance of the eleventh commandment, toward those whom you have distanced in these school day rivalries, or who, from any cause, have been prevented from sharing with you the enjoyments of this day; and as you may not all know exactly what the eleventh commandment is, I will end a poor speech by telling you a good story:

The celebrated Archbishop Usher was, in his younger days, wrecked on the coast of Ireland, at a place where his person and character were alike unknown. Stripped of everything, he wandered to the house of a dignitary of the church, in search of shelter and relief, craving assistance as a brother clergyman. The dignitary, struck with his squalid appearance after the wreck, distrusted his tale, and doubted his character; and said that, so far from being a clergyman, he did not believe he could even tell how many commandments there were. "I can at once satisfy you," said the Archbishop, "that I am not the ignorant imposter you take me for. There are eleven commandments." This answer confirmed the dignitary in his suspicions, and he replied with a sneer, "Indeed, there are but ten commandments in my bible; tell me the eleventh and I will believe you." "Here it is," said the Archbishop, "A new commandment give I unto you, that ye love one another."

He prayeth best, who loveth best
All things both great and small;
For the dear God who loveth us,
He made and loveth all.

S. T. Coleridge.

NOTE.

EXTRACTS from the "*Report of the Committee on the Latin School* (N. B. SHURTLEFF, *Chairman,*) *to the School Committee, Sept.* 1861.

The usual annual and quarterly examinations have been made by the Committee, all the pupils in the various rooms having been inspected, both in reference to their general proficiency, and also in regard to their relative condition in comparison with former years. The several rooms have been frequently visited, and there has been a general attendance of the Committee on the usual days of exhibition and on the public Saturdays. Thus advantages have been had which have enabled the Committee to witness the thorough working of the school, to judge of the progress of the pupils, and to gain a perfect knowledge of the instructors as to their efficiency in discipline and in imparting instruction in the different departments in which they are required to teach. The visits and examinations have been of a highly satisfactory character, and have shown that the school retains the high position for which it has been so long distinguished, not only for instruction in the Greek and Latin languages, but also in the more elementary branches of a good English education. The extraordinary recitations of exhibition days, and the declamation and original debates of the pupils on the public Saturdays, have been as remarkable during the past year as heretofore, and have been listened to by large audiences.

The principal part of the visitation of the school in July was devoted to the graduating class, for the purpose of deciding who should have the Franklin medals; six of which were adjudged to individuals who had received the highest number of marks for the year, and whose examination had also been the most satisfactory. The appearance of the whole class was in a high degree satisfactory to the Committee, and reflected much credit upon the students, and upon the excellent master under whose charge they had been during the year.

The usual number of the class entered college, having completed the course of instruction at the school. Fourteen entered Harvard College, having passed an examination which showed that they were among the best fitted of those who were presented; one entered Amherst College, one Dartmouth College, one Monmouth College, and one Tufts College. Thus eighteen young gentlemen were prepared during the year to take honorable positions in college, thereby carrying out the cherished wishes of the friends of the school and the general object of its establishment upon its present basis; for, although many young men join the lower classes of the school to obtain an education preparatory to entering upon a business life, they, in most cases, leave the institution before reaching the highest class. The following table will exhibit interesting statistics relating to the young gentlemen educated at the school during the last ten years, for entering college:—

YEAR.	From Public Schools	From Private Schools.	Total sent to College.	Entered Harvard College.	Entered other Colleges.	Average Age.
1852	2	6	8	6	2	17.4
1853	8	6	14	11	3	17.4
1854	2	9	11	18	1	17.1
1855	4	6	10	7	3	17.5
1856	9	12	21	21	0	16.8
1857	10	12	22	20	2	17.5
1858	11	7	18	14	4	17.3
1859	16	12	28	24	4	17.5
1860	6	12	18	17	1	16.7
1861	9	9	18	14	4	17.4
Aggregate,	77	91	168	144	24	17.3

By an examination of the preceding table, and by a few simple calculations, the following particulars, being annual averages of the last ten years, are deduced, viz.:

Annual average number of those entering college, ...	16.8
Annual average number of these who were received from the public schools, ...	7.7
Annual average number of the same who were received from other schools, ...	9.1
Annual average number who entered Harvard College, ...	14.4
Annual average number who entered other colleges, ...	2.4
Annual average age at entering college, (which is probably too low by nearly six months, as the months which exceed the years as fractional years have been omitted in every case in the table given on page 559,)	17.3

It will, therefore, be seen that during the last ten years, one hundred and sixty-eight boys have been fitted for college at the Latin School,—seventy-seven who entered the school from the public schools, and ninety-one from private schools. Of these, one hundred and forty-four entered Harvard College, and twenty-four went to other colleges. In this connection it may be well to look back a few years, and see what the school has heretofore done toward producing college-educated men. In the year 1814, the school took a fresh start, recovering from the effects of the war then just terminated, and was restored to its proper standing under the excellent administration of our late distinguished citizen, Benjamin A. Gould, Esq. Mr. Gould was followed, in succession, by the eminent scholars, Frederic P. Leverett, Esq., Charles K. Dillaway, Esq., and Epes S. Dixwell, Esq., and these, by the present learned head of the school, Francis Gardner, Esq. The whole number of young men prepared for college by each of the above-named gentlemen, together with the years of service of each master to the school, and his average annual contribution to the colleges, can be seen at a glance in the following table:—

Master.	Number of Years.	Total No. Fitted.	Annual average Number Fitted.
Gould, ...	13	158	12.15
Leverett, ...	3	32	10.66
Dillaway, ...	5	39	7.80
Dixwell, ...	15	181	12.07
Gardner, ...	10	168	16.80
Aggregate, ...	46	578	12.56

Do not these figures show how eminently useful the Latin school has been in its highest vocation—the production of classical scholars? During the last forty-six years nearly six hundred young men have received their first instructions in classical learning within the walls of this school, and with such thoroughness that they have been admitted to honorable standing in the several universities and colleges of New England; and, undoubtedly, many more who have not proceeded immediately from the school to college have been indebted to the school for a large part of their preparation for college. Many of these young men are numbered among the first scholars of the country; and, indeed, we have the highest authority for stating that the Boston Latin School has a most important influence in sustaining the high standard of excellence demanded by most of the colleges in New England in the examination of applicants for entrance, arising chiefly from the eminent standing of the Latin-school boys after their joining classes at college. No school, we believe, is more thorough in imparting elementary knowledge of Latin and Greek to its pupils than is ours, an advantage which its scholars always prize and acknowledge.

VIII. ELEMENTARY CLASSICAL INSTRUCTION.

BY L. F. CADY, A. M.

Principal of Public High School, Warren, R. I.

The methods by which any object may be most successfully attained are best appreciated in view of the advantages to be derived from the object itself. Hence, in discussing methods of Classical Study, it will not be amiss briefly to draw attention to some of the advantages to be derived from its pursuit.

It is scarcely necessary to mention that, by Classical Study, we mean that of the Latin and Greek Languages, which, in spite of all objections that have been urged, and of all substitutes that have been suggested, are still found indispensable in any thorough course of liberal instruction. And, without pretending to consider the advantages of this study in the order of their importance, we will first advert to one of the most obvious, the power and facility which it secures to the English student in the understanding and use of his own vernacular. Every page of our English contains words derived from the Latin and the Greek. These, for the mere English student, have a hidden meaning which he is unable to appreciate. He can partially trace their etymology in an English quarto, and thus gain an approximate conception of their true significance and force; still, every student of Latin and Greek is conscious that he has a much clearer conception of their full meaning without the necessity of an appeal to the dictionary. And when we consider how indispensable and how powerful is the machinery of language, this can be regarded as no mean advantage.

Again, it is admitted that the study of Latin and Greek furnishes the best foundation for the study of the modern languages of continental Europe, which, from their close analysis to the Latin and Greek, may almost be regarded as dialects. Hence the student who has become familiar with the ancient languages, requires comparatively little time to become familiar with the modern. This becomes an important consideration in view of the increasing importance that has come to be attached to a knowledge of the French, German, Italian and Spanish languages, in consequence of the constantly extending intercourse between our own country and

Europe, stimulated by increased facilities for travel, the demands of a constantly expanding commerce, and an almost uninterrupted tide of immigration.

Nor should we overlook the fact, that classical knowledge possesses an intrinsic value of its own, independent of any collateral aid it may afford in various directions. It is an enviable attainment to be familiar with the instruments of thought employed by those gifted minds whose writings, coming down to us from a remote antiquity, still remain models of unrivaled power and beauty. It is a rare privilege to be able to explore the treasures of history which these writings contain, to appreciate the spirit of keen philosophy which they exhibit, and to revel among the grand and sublime conceptions of the old masters of poetry and eloquence, which no translation into modern phraseology can reproduce. But, leaving such considerations as these, we will pass to a topic which lies more directly within the scope of our main subject, viz., The Value of Classical Study as a Means of Intellectual Development and Discipline.

Whether intellectual development is the most valuable result of classical study, it is not necessary here to decide. Obviously it is so important that it should never be lost sight of, especially during the earlier stages of the student's course. In this respect it is eminently practical, if that is to be accounted practical which is the mainspring of all efficient action. Mind, we know, is the only ultimate motive power in the universe. Mind alone creates. Matter can not originate the slightest change, even in itself. Inertia is its unfailing attribute. As the infinite mind is the source and centre of infinite power, so, in finite beings, the same principle is the source of whatever power such beings may possess. Hence that course of discipline which most successfully develops and exercises the largest number of the faculties of the mind is that which possesses the highest practical value. A claim to this value, we believe, may be safely asserted in favor of the study of the Latin and Greek.

In making this assertion it is not necessary to deny the importance of other branches of study. In many instances these are, undoubtedly, more indispensable than the classics, much in the same sense that food and shelter are more indispensable to mere subsistence, than any present degree of mental culture, or any present amount of material wealth. And yet we do not regard the supplying of our physical necessities as, by any means, the most important object of existence. Its chief value consists in furnishing the foundation for a structure transcendently more valuable than any material fabric. Food and raiment, and just sufficient intelligence to procure them, may be indispensable to our animal existence; but when these are once in our possession, objects of vastly higher importance immediately present themselves for our attainment. These require reason and reflection. They make demands upon the memory and the judgment. They summon to their service the power to discriminate, to compare and to classify; and such power is, every where, practical power. It is as valuable in the counting room, the work-shop, or on the farm, as it is in the pulpit or at the bar. The power to think readily and clearly, and to express thought with force and precision, is the most valuable that man can possess; and it is our conviction that the discipline of no branch of study is so perfectly adapted to develop this power as that of the classics. The habits of thought and reasoning developed by the study of the languages, are admirably adapted to the requirements and exigences of ordinary business life. It is a very common opinion that the study of the mathematics is specially adapted to secure this development. From the nature of the subjects, however, it must appear that, for this very purpose, the results of mathematical study are inferior to those derived from the classics. The results of mathematical reasoning are all matters of precise demonstration. Absolute certainty is attainable at each successive step. This is far from being the fact in regard to multitudes of subjects upon which men are called to reason and decide in the occurrences and business of daily life. In these, men are often obliged to employ processes very much akin to those of the schoolboy in his endeavors to translate a difficult passage from Latin into English. He labors in the midst of uncertainty and doubt; he is obliged to make successive trials, to attempt the solution of the knotted thought at various points, to try various hypotheses, to observe peculiarities of structure and dependence in words and clauses, to exercise ingenuity and discrimination in the choice of English equivalents for the idiomatic expressions of the original, and can come to a full and satisfactory understanding of the thought only by comparing the results of several intermediate efforts. All this has a much closer resemblance to the processes required in the practical concerns of life, than the methods of reasoning and thought required in the solution of problems in algebra and geometry. It yet remains to be shown that the results of classical study, in preparing the mind for the discharge of the duties of common life, are not fully equal to those derived from any other branch that carries the student beyond the mere rudiments of learning.

If the advantages of classical study are such as we have indicated, the importance of adopting the best practical methods for its prosecution is obvious. There is no study in which success is more emphatically dependent upon the mode of its pursuit, than that of the classics. Pursued in a loose and superficial manner they utterly fail of their legitimate purpose. True success can be secured only by insisting upon accuracy at every step. Grammatical forms can not be made too familiar; the etymology of words can not be too thoroughly studied, and the rules of syntax can be neither too perfectly understood nor too rigidly applied. No word that has found its way into the English should be permitted to escape attention, nor should the changes of form and signification that have attended its transfer be overlooked. The appropriate English equivalents for the idiomatic forms of the original must be carefully studied before the thought can be clearly apprehended and handsomely transferred from the one language into the other. Any mode of study that aims at less than this must, to a greater or less extent, prove a failure. It will fail of securing the most valuable discipline, it will lead the mind of the student into loose and unphilosophical habits of thought, will leave him with imperfect and distorted conceptions of truth, will fail to awaken in him a relish for the treasures of ancient learning, and will leave him without taste to appreciate the beauty of their sentiments, and without judgment to estimate their scope and power. The neglect of careful and accurate habits of study has ever been a prolific source of failure in the pursuit of classical learning.

Among the important points just indicated, one of the most essential, and too often one of the most neglected, is the proper study of idiomatic forms. No terms can be found too emphatic for the proper condemnation of what has been called a literal, or more appropriately a "verbal" style of translation. What is often styled a "literal translation," may be almost the worst that is possible. Giving noun for noun and verb for verb, mood for mood and tense for tense, will often wretchedly fail of presenting either an elegant or a correct expression of the idea of the original. It may even express something entirely different. Besides this it tends to induce a loose and clumsy style of expression, and to tolerate forms which violate all correct rules of English construction. That only is a correct translation which renders the precise thought of the original into clear and elegant English. This result can not be secured by the verbal method. We fail to obtain a clear and satisfactory comprehension of any thought until it is expressed in the best form of language of which it is susceptible, and this can be secured only by rendering idiom for idiom. From a disregard of this fact, what is allowed to pass as a translation is frequently mere jargon. Good Latin and Greek are spoiled by being rendered into execrable English.

We can best illustrate our views on this subject by presenting a few examples. And as mistakes generally prove the more disastrous the nearer they lie to the commencement of an enterprise, we will make our selection from such as are likely to meet the eye of the pupil during the earlier part of his course. For instance let us take the following: "Interfecto Cæsare, bella civilia reparata sunt." The pupil renders, "Cæsar being killed, civil wars were renewed." This is verbally correct, and would be received by many teachers without questioning or hesitation, and yet it entirely fails to express the true meaning. The most important part of the assertion, the relations of time and cause, fails of the slightest recognition. English words are substituted for the Latin, but the Latin idiom is retained. Under careless and incompetent teachers, similar errors will constantly occur. "Finito bello" will become "The war being ended," instead of "After the close of the war;" "Tarquinio regnante," "Tarquin reigning," instead of "In the reign of Tarquin;" "Cæsar, victis hostibus," "Cæsar, his enemies being conquered," instead of "Cæsar having conquered his enemies," and so in countless other instances of this form of construction.

Similar errors in the translation of other cases of Latin participles are constantly allowed to pass without correction. The pupil renders "Post reges exactos," "After the kings having been banished," instead of "After the banishment of the kings;" "Ei benigne recepto filiam dedit," "Gave his daughter to him being kindly received," instead of "Received him kindly and gave him his daughter;" "Porsena ei auxilium ferente," "Porsena bearing him aid," instead of "By the aid of Porsena;" "Promittens se Pyrrhum occisurum," "Promising himself to be about to kill Pyrrhus," for "Promising that he would kill Pyrrhus," and so *ad infinitum.*

Equally inadequate renderings of the Latin infinitive are of constant occurrence. "Dicebat se Jove majorem esse" becomes "Said himself to be greater than Jupiter." "Ait trecentos alios juvenes conjurasse," "Said three hundred other youth to have conspired." "Respondit se vidisse," "Said himself to have seen," so that we almost invariably have the Latin idiom retained to the exclusion of the corresponding English.

By a similar inaccuracy, the Latin subjunctive often fails to receive its proper English equivalent. Take for example "Decemviri creati sunt qui civitati leges scriberent." In his attempt to make a literal transfer of the mood of "scriberent," the pupil will be likely to render the sentence by "Decemvirs were created who might write laws for the state," which entirely fails to recognise the idea that the decemvirs were chosen for the purpose of preparing laws for the state, which is the special idea that the construction of the sentence is intended to convey. So "Videtur, qui imperet, dignus esse" will be very likely to fail of being rendered so as to express the true idea, "He seems worthy to rule."

And thus, by what we are glad to regard as *the old method of verbal construction*, numerous forms both of the Latin and the Greek fail to receive their appropriate English expression. This is the inevitable result of endeavoring to render "word for word." By this method, "Puero est liber" means "A book is to the boy," not "The boy has a book." There is no word in the sentence, whose verbal equivalent is "*has.*" So in Greek, "Κάμνει τὴν κεφαλήν," must be, "He is in pain as to his head." The definitions of the lexicon will not warrant the translation "He has the headache." But we need say no more to indicate the inadequacy of mere verbal construction, and to suggest the importance of a careful study of idioms in the transfer of thought from one language into another.

The remedy for the defects which we have endeavored to exhibit is obvious. It requires the abandonment of the old method, so prodigal of time and patience, by which the mind of the pupil is burdened, at the outset, with an incongruous mass of grammatical forms and rules of syntax, whose significance and application he can not understand, and which he is compelled to learn, slowly and imperfectly, in prosecuting the work of verbal construction. A few teachers of rare skill, especially in the case of pupils who have already acquired considerable intellectual culture, may succeed, as they have heretofore succeeded, in making excellent Latin and Greek scholars while employing mainly this system. Their success, however, must be regarded as a triumph over the embarrassments of a tedious and unphilosophical method rather than a result of the method itself. The superior skill of the teacher, and the increased intelligence of the pupil, secure a result of which inferior qualifications must necessarily fail. The true method seems to us to be that which begins with the expression of a simple thought in its simplest form. The mind of the pupil needs be burdened with no forms or rules that are not involved in the proposition under consideration. These he will readily remember, because he understands their significance and application. He needs at first, only to master a few simple elements to enable him to work intelligently; and then by adding gradually to their number, and always having at hand exercises suited to illustrate each new increment, and to exhibit the changes of form and structure which give expression to the successive modifications of the leading thought, his course will be pleasant, rapid and successful. He will need constant practice in translating from English into Latin or Greek, as well as from these into English. In this way he will become familiar with the corresponding idioms of the two languages. He should master general principles and rules, before his mind is burdened with a long catalogue of exceptions. Exceptions are viewed successfully only in the light of general rules. The pupil can best master but one thing at a time. He needs to see things separately before his attention is called to their combinations. His progress should be from the simple to the complex, and from what has already become easy to what is more difficult. In this way the irksomeness of the study of the Latin and Greek may be almost entirely obviated. The pupil constantly acquires skill in the use of his own vernacular while he is gaining a comprehension of the meaning and force of the original. He learns to exercise a philosophical and discriminating taste, and is enabled to drink with ever-increasing relish from the fountains of both ancient and modern lore.

Among the various elementary Latin and Greek text-books which have hitherto appeared, we are acquainted with none so well adapted to their legitimate purpose as those of Prof. Harkness, of Brown University. These consist of a *First and* a *Second Latin Book* and a *First Greek Book*, published by the Messrs. Appleton & Co., of New York. The Latin books have been several years before the public, and have well sustained the best of all practical tests, that of actual use. The *First Greek Book* was first published during the autumn of 1860. The author informs us that the First Latin Book was prepared *mainly* from Arnold's *First and Second Latin Book*, which had been some five years before the American public, and had been received with great favor. In its general plan the original work was greatly superior to any of the elementary Latin books that had preceded it; but, notwithstanding its general excellence, the test of the class-room revealed several important defects. It was of a character too fragmentary and disconnected to answer, perfectly, the purpose for which it was intended, often perplexing the pupil by calling his attention to matters of remote detail before leading him to a clear apprehension of general principles. Its defective system failed to present any well-constructed outline of the subject, and illustrations of the exceptional were frequently given when attention was specially due to the illustration of general rules. These defects were so far obviated by the numerous additions and changes of Prof. Harkness as to leave but slight ground for objection. The clear, progressive, and systematic course through which the work now leads the pupil, justly entitles it to the earnest commendation and extensive use which it has received. Beginning with a few elementary instructions, it immediately draws the attention of the pupil to the simplest form of the Latin sentence, and teaches him, at once, to employ the language in the expression of thought. From propositions of the simplest form he is carried forward by gradations so easy and so natural that the irksomeness of the old methods is effectually obviated. His mind is not confused by presenting to it more at once than he can understand and apply. Whenever a new grammatical form is introduced it is immediately illustrated by employing it to express some modification of thought. The elements of the language are presented in their natural order, and the use of each is made clear, by appropriate exercises, before another is presented. The pupil is taught the use of the terminations in each paradigm for the expression of the required meaning at the same time that he is called upon to learn them, and he is thus prepared for a clear understanding of the accompanying rules of syntax. By the introduction into the exercises of no principle that has not been previously explained, he is gradually made familiar with all the regular forms of inflection, with all the leading rules of construction, with the formation of various classes of words from their appropriate roots, with the use and dependence of the moods and tenses, and the force and meaning of participles, gerunds and supines, and all the most important corresponding idioms of the Latin and the English. The principles of philosophical classification are constantly kept in view, and a uniform purpose is maintained to impart a knowledge of the language as a vehicle of thought. By these means the mind of the learner is constantly furnished with exercise suited to its healthy development, while it is rapidly acquiring flexibility of thought and expression.

The objection most likely to be urged against the plan of this book is the expenditure of time required for its mastery. We do not think the objection well-founded. The book certainly does not abound in superfluities. No unimportant subject is introduced, nor can the illustrations often be regarded as unnecessarily prolix. During several years of trial in the class-room, we have sometimes endeavored to hasten the progress of a class by making omissions, but have generally found it necessary subsequently to call the attention of the class to the omitted portions in order to secure a satisfactory progress. The subject is so gradually and systematically expanded, and the philosophical connection of its parts so well preserved, that we have been able to derive little advantage from omissions or changes. In some instances, perhaps, advantage might be gained from condensation; yet, in its present form, we know of no text-book better adapted to the purpose of imparting to the pupil with rapidity and precision, a clear understanding of the principles of the Latin language, and their application.

In the *Second Latin Book*, which is more exclusively the product of the mind of its author, the general plan is carried out with remarkable success. We regard the book as without a rival. Leaving out of view its valuable elucidations of the text, and the aid which it affords the pupil in presenting a clear, elegant and idiomatic translation, we fancy that it would be difficult elsewhere to find a series of exercises so well calculated to lead the pupil to a clear and satisfactory understanding of the Latin sentence, from its simplest form through the various modifications by which it assumes a complex and compound character capable of expressing any conceivable shade of thought and sentiment, as those contained in the work before us.

The *First Greek Book* of Prof. Harkness, we regard as superior, in some respects, to the First Latin. In its preparation, the author enjoyed the advantage derived from his previous experience in the same field of effort, and was also left unfettered by the work of any predecessor, in the selection and arrangement of his materials. Its plan is more brief than that of the *First Latin Book*, and it carries the pupil forward by more rapid gradations. This is the more admissible upon the presumption that the pupil is already familiar with the leading principles of the Latin, which obviates the necessity of so gradual a presentation of details, and admits the compression of a wider range of topics within a given space. The book is at once a Grammar and a Reader. The first hundred and thirty-six pages are devoted to explaining and applying the grammatical forms of the language; the next seventy are occupied by the subject of Syntax proper, embracing a view of the structure, formation and classification of simple, complex and compound sentences, together with their connection and various modifications; then follows something more than twenty pages of well-selected extracts for translation, embracing fables, legends, anecdotes and myths, accompanied by sufficient explanatory notes and vocabularies to make the work complete and independent in itself. Brief as is its compass it is really very comprehensive. To one who has plodded through the old routine, this book seems to promise to the pupil in Greek a luxury heretofore inaccessible.

We shall, perhaps, be charged with undue enthusiasm in favor of the methods adopted in these books of Prof. Harkness. But if these methods are more philosophical and efficient than those employed in former years, we may be justly pardoned for enthusiasm in their favor. It is by no means a matter of insignificant importance what methods the student shall follow, while pursuing so important a portion of his course of study as that embraced in the Latin and the Greek. A bad beginning may have a good ending; still, no one will deny that it is better that both shall be good. We admit that excellent scholars in the classics have been made, and may still be made, by pursuing the old courses. So might excellent scholars in geometry be made by committing to memory all the definitions, theorems, problems, corollaries and scholiums embraced in an entire treatise upon the subject, before commencing the demonstration of a single problem. The knowledge, *verbatim et literatim*, of all this would prove vastly convenient throughout his subsequent course; and yet we fancy few teachers would be inclined to recommend this method, and that quite as few pupils would be found to follow it with relish. But why would this be less philosophical and judicious than to require the memorizing of the whole of a Latin grammar before commencing the work of translation, or of employing in practical exercises the forms and principles already learned,? We believe that it is in accordance with the nature of the human understanding and the dictates of common sense, that the increments of knowledge shall be made practical, at the time of their acquisition, as fast and as far as the subject of study will allow, and that by this method, be the subject of study what it may, the most satisfactory and successful progress will be secured.

Metaphysicians tell us that the judicious culture of the memory involves, First, A clear understanding of the subject; Second, A proper classification of its parts; and Third, Frequent repetition. Tried by this standard, the old system of teaching Latin and Greek signally fails. It taxes the memory without sufficiently calling to its aid the exercise of the understanding.

We believe the methods we have been endeavoring to advocate are calculated to secure the healthy culture and development, of which the old method necessarily fails.

X.

IX. PUBLIC INSTRUCTION IN MODERN GREECE.

BY PHILIPOS JOHANNIS.

Director of the King's Private Library, Athens.

I. HISTORY OF EDUCATION UNDER TURKISH DOMINATION.

The protracted contest waged by the Sultans and their fierce Turkish hordes against the Byzantine Empire was, as is well known, not merely a war against a Christian power; it was a war as well, and chiefly, for the extermination of Christian civilization and of Christianity itself. The devastating fury of the barbarian conquerors was directed against all that was foreign to their rude natures or that seemed to oppose their projects of more extended conquests; hence Grecian enlightenment became buried under the ruins of her overthrown cities, and the torch of Grecian learning, whose light, though it had long indeed been dim, had never before gone out, now became quenched in the streaming blood of her slaughtered inhabitants. The few scholars who escaped the sword were forced to fly to foreign lands or hide in the privacy of the cloister, to avoid the pursuit of the cruel victors and the perils to which their lives were continually exposed. Convinced that the subjected Greeks would submit to their fate the more patiently as they should become more illiterate and consequently the less capable of feeling the shame of their servitude, the tyrants made it the policy of their government, by depriving them of the influences of liberal education, to stifle within them the most noble emotions of the soul. For this reason the establishment and maintenance of schools of an advanced grade for the instruction of Grecian youth in the language of their ancestors, in history, mathematics and philosophy, were even more strictly forbidden than the erection of churches, for which it was possible to obtain permission, at great cost. Moreover, the people were held under so strict subjection, and were so grievously burdened, that the care of warding off the manifold dangers that continually threatened them, and of providing themselves with the bare necessaries of life, left no room for higher considerations. Schools, therefore, and all other means of culture, fell into entire neglect, and ignorance became daily more general and more profound. It was only after a long period, and especially during the eighteenth century, that the Turks began to seem less suspicious of their Christian subjects, believing that their authority over them had now become so confirmed by long habit as to be beyond danger. The condition of the Christians grew somewhat more tolerable. As the limits of their knowledge were gradually extended by intercourse with other Christian nations of Europe, with whom they had now more frequent dealings, a stronger desire for learning was awakened, and increasing wealth made its gratification the more easy. Accordingly in the Grecian provinces, public schools, before so rare, began to increase in number, while there also sprang up by degrees, in some of the cities, schools of a higher grade, where were taught the ancient language of the nation, history, and here and there also the elements of philosophy, rhetoric, mathematics, and of natural philosophy. The most noted and efficient of these schools were those upon the islands of Patmos and Scio, at Cydonia, Smyrna, Zagora, (with a second at Meliá on Mt. Pelion in Thessaly,) the two at Yanina in Epirus, one on Mt. Athos, two in the Peloponnesus, (at Demitzana and Bytina,) one at Kurutschesme on the Bosphorus, and two in the Danubian principalities at Bucharest and Yassy, where they were founded and sustained by the Fanariot princes for the instruction of the Greeks who gathered thither from the Turkish provinces, and where they rendered great service in extending the Greek language and refinement among the higher classes of the Moldo-Wallachians. These schools, established and supported for the most part by the endowments of patriotic citizens or by voluntary contributions, were in many instances presided over by scholars who had received an excellent training in Italy, France or Germany, and who for moderate salaries that scarcely afforded them the necessaries of life, spent their days in zealously imparting instruction in their different departments; and although these schools were in many respects very defective, yet they sufficed to enlighten the spirit of the Grecian youth and render the soul sensitive to all that is true, beautiful and good; and here were gradually fitted those who were to arouse and give new life to their people and lead them on to national freedom.

The common schools of that period were of a miserable character. Only in the cities, market towns and a few of the more densely populated districts were even elementary schools to be found, where a teacher, who was usually the priest of the place, instructed a few children in reading and, rarely, in writing—sometimes following the "individual," sometimes the "simultaneous" method of teaching. Scarcely a hundredth part of the male population of the territory forming the present kingdom of Greece, could read or write; while the female portion remained so entirely without education that, except in the large cities, one that was even but poorly skilled in reading and writing was looked upon as a prodigy of learning. It was not till a few years before the Greek insurrection that a gradual improvement in the common schools was commenced through the instrumentality of Georgios Cleobulos, a learned Greek of Philippopolis, who had studied mathematics and physical science in Germany and France. Having made himself acquainted in Paris with the monitorial ("mutual") system of instruction, he determined to transfer it to Greece, prepared in his own language the necessary books and wall tablets, and after his return from Paris, gave instruction in the system at Bucharest and afterwards at Syra to a number of Greeks, who immediately, as teachers, introduced it into the common schools of several cities.

Such was the condition of public instruction in Greece while subject to the Turkish dominion. After the outbreak of the revolution and during the struggle for liberty, this condition, instead of improving, continually deteriorated—a result naturally to be expected to follow from a war that for nine years devastated all Greece, destroying nearly every city and village, and reducing the whole land to one wide waste. There had been, however, during this period, an improvement in the condition of schools on the neighboring Ionian islands, where the monitorial system had been introduced by Athanasius Polites, and several Hellenic schools and a gymnasium had been established by the Ionian government. In addition to these educational institutions, there had been established and endowed by the liberality of that zealous friend of Greece, the late Lord Guilford, a university which, though very imperfect, was still successful in effecting the object for which it was designed. At this university and these Ionian schools, many young Greeks were educated, who on the accession to office of Capo d'Istria as president in 1828, and afterwards when Otho ascended the throne in 1833, entered the public service and as the faithful officers of a regular government, assisted in organizing the young kingdom and in directing its affairs in accordance with its new relations. Count Capo d'Istria, who had assumed the reins of government upon his election as president by the national convention, endeavored, so far as the circumstances of the times permitted, to restore and elevate the national system of instruction. He erected public schools in several of the cities and market towns, or rather among their ruins, and established on the island of Ægina a gymnasium, called the "Central School," which, under the direction of the worthy Gennadios, was the source of great benefit to the many youth who gathered thither, thirsting for knowledge, from all parts of Greece.

A new era in the history of education and instruction commenced with the accession of King Otho. The relations of the schools and of the department of education, in common with the other departments of government, were regulated by such laws as seemed to be required. There was, in truth, much to be done—many and great defects to be remedied, and many improvements to be introduced—and the exertions that have been made for the gradual elevation of the schools throughout the kingdom and that are still continued by the king, with the Chamber and Senate, are truly commendable. A brief description of these schools in their present condition, will show the advancement that has been effected since the establishment of the government.

II. PRESENT ORGANIZATION AND CONDITION OF PUBLIC INSTRUCTION.

1. COMMON OR ELEMENTARY SCHOOLS.

The common schools of Greece are regulated by a law published by the Regency, February, 1833.* This law has, however, been modified in many particulars by more recent ordinances. It makes school attend-

* See "*Records, Laws and Ordinances of Modern Greece*," Vol. I., translated into German by G. L von Maurer, formerly a member of the Regency.

ance obligatory upon all children, of both sexes, between the ages of five and twelve years, and parents or guardians are required under penalty to send their children and wards regularly to the common schools, unless they can show that the same amount of instruction is provided in other ways. This requirement has not hitherto indeed been strictly enforced, and its observance is in fact impossible in districts where the villages are far apart and a scanty population is scattered over a wide territory. The monitorial system is pursued in all the common schools. There is required to be in each parish at least one such school, to be sustained from the income of the parish property, or by indirect or direct taxation. When the resources of the parish are evidently not sufficient to support the school, the government gives its assistance. There are, besides these, a number of common schools that are sustained by endowments or the revenues of certain churches or convents. The number of children admitted to a school is limited only by the dimensions of the building; the largest school edifice accommodates five hundred pupils. When, therefore, the number of children exceeds this limit, it is required that additional schools be provided, to be sustained in the same manner at the expense of the parish, with, in exceptional cases, the aid of the government. The educational department has adopted the rule, though without the authority of any law upon the subject, that there shall be one or two assistant teachers in every school where the number of scholars exceeds the maximum of one hundred and fifty, or two hundred and fifty. This rule has hitherto been followed in but very few schools, owing to the difficulty of meeting the increased expense. The schools at the chief towns only of all the provinces and districts,* are provided with assistant teachers. Elementary schools may also be established by private individuals upon their own account—no doubt existing respecting their capacity and moral character—under authority from the state department, in which, however, school instruction can be given only by regularly examined school candidates. These private schools are also subject to the oversight of the different boards of inspectors and to the superintendence of government. Besides these "regular" common schools, which are all conducted monitorially, there still exist many "irregular" schools, where the old system of individual instruction is still followed. These irregular, or "hedge" schools are tolerated only in villages where no regular school exists within a convenient distance and means are wanting for the establishment of one. They are sustained only by tuition fees, and for the opening of them the consent of the department is necessary. Separate schools for girls are found only in the cities; in the villages the schools are attended by children of both sexes.

As almost the entire population of the kingdom is of the Greek relig-

* Greece is divided politically into ten *nomoi*, (nomarchies, circles, or provinces,) which are again subdivided into thirty *eparchiai*, (eparchies, or districts,) and these again into 450 *demoi*, (or parishes.) The chief magistrates of these divisions are, in this article, styled, respectively, nomarchs, eparchs and burghermasters.

oin, with the exception of the islands of Syra, Tino, Naxia and Santorini, whose inhabitants are Roman Catholic, the state has made no provision for denominational schools, and the mixed population of these islands send their children, without prejudice, to the same schools. The Catholic clergy have established there a few schools, supported by private means, for the education of children of that faith.

The common schools of each parish are under the immediate supervision of a school committee, known as the "Local Board of School Inspectors," or in the Greek language, the "Ephorie," which is composed of the burghermaster as president, one of the priests of the place, elected by the nomarchs, and from two to four private citizens elected by the parish council. When the people differ in their faith, a priest is chosen from each sect. Upon this ephory,—whose members are elected, or re-elected, annually,—rests in general the oversight, care and management of all the schools of the parish, and especially the care of building and repairing the school-houses and maintaining them in good order, the providing them with furniture, apparatus, and other necessary articles, the regular visiting of the schools for the preservation of strict discipline and the supervision of the official conduct of the teachers, the management of the property belonging to the local school funds, and lastly the designation of such poor families as are to be exempted from school rates. The ephory visit the schools within their jurisdiction, at least every month, and report to the proper eparch (district commissioner,) or nomarch, (commissioner general,) the defects observed by them, the estimated probable necessities of the schools, and the improvements which are demanded, as well as respecting their financial condition. By the common school laws of February, 1833, there were contemplated in addition, district and provincial boards of inspection—of which the first was to be composed of the eparch as president, a justice of the peace residing at the capital of the eparchy, a priest elected by the nomarch, a teacher of the Hellenic school, and from two to four citizens chosen by the district council. The higher provincial board consisted of the nomarch himself as president, the presiding judge of the district court at the capital of the nomarchy, one of the priests stationed there, appointed by the state educational department, a professor of a gymnasium or university, and from two to four citizens of the province, chosen by the provincial council. It was made the duty of the former to oversee and control the schools of the district—of the latter, the schools of the whole province. These two higher ephories have never, however, as yet been organized, and in default thereof the eparchs and nomarchs are intrusted by the department with the superintendence of the schools within their respective districts and provinces, and are furnished with the necessary instructions under which to act. By these instructions the eparchs are required, every six months, and the nomarchs annually, to make tours of inspection for the purpose of informing themselves respecting the condition of their schools, the official conduct of the teachers and of the local boards of inspectors, and of the interests of the schools generally, of which they report in full to the ecclesiastical and educational department.

As respects the professional skill and capacity of the teachers, the schools of the several parishes which compose an eparchy, are placed under the supervision of the principal of the school at the capital of the eparchy, while the principal of the school at the capital of the nomarchy superintends not only the schools of that eparchy in which the capital of the nomarchy is situated, but also those of the different eparchies composing the whole nomarchy. These principals visit the schools under their charge every six months, and report thereon to the director of the Teachers' Seminary at Athens—to which person is intrusted the oversight of all the schools of the kingdom. He holds office in the ecclesiastical and educational department as chief superintendent of schools, and has the entire management of them immediately under the minister himself. He also visits the schools from time to time, that he may assure himself of their condition by personal observation.

Respecting the duties of the several boards of inspectors, we refer to the before-mentioned law of Feb. 1833.

The influence of the ecclesiastical authorities is confined to the oversight of religious instruction and to the approval of the religious books that may be introduced.

In the year 1830 there existed in the entire kingdom only seventy-one common schools, with an attendance of 6,721 scholars, male and female. Since that time the number of schools and of the children instructed in them has so increased that the statistics of the public schools in 1858, according to the official report of the department, show the following figures:—

Regular public common schools for boys and girls,	360
" " " " girls alone,	52
" private schools for boys and girls,	30
" " " girls alone,	12
Irregular private schools for both sexes, (aggregate,)	300
Total number of schools,	754
Scholars in the regular parish schools, boys,	30,520
" " " " " girls,	4,753
" " " private " boys,	4,580
" " " " " girls,	1,743
" " irregular schools, boys and girls, about	10,000
Total number of scholars,	51,596

As the whole population of the kingdom is nearly 1,050,000, it appears that the children attending the public schools form more than one twentieth of the whole. The need of Sunday schools, or schools for a higher moral culture, is now deeply felt, but none such have been as yet established.

In the regular parish schools there were engaged, in 1858,—454 male and 79 female teachers; in the regular private schools, 42 teachers, male and female. To these, add the 300 teachers, male and female, of the irregular schools, and the total number of instructors amounts to 875.

The salaries of individuals connected with common schools, required in the year 1858 an expenditure of 440,631 drachmas, (about $76,250—1 drachma = 100 lepta = $0.17.3,) of which sum 324,829 drachmas were derived from the parish revenues, and the remaining 115,802 drachmas from the government. It is to be understood that the expense of the regular and irregular private schools is not included in the above amount. The regular common schools are conducted in accordance with the "Manual, or Guide-book of Monitorial Instruction," (Εγχειρίδιον ἢ ὁδηγὸς τῆς ἀλληλοδιδακτικῆς μεθόδου,—3d ed. 1850,) a work prepared essentially after the plan of Sarasin, by J. Kokonis, formerly director of the Teachers' Seminary.

Instruction in the schools is divided into two grades, the lower monitorial ("mutual,") and the higher "syndidactic," or "simultaneous." The first includes eight classes, through which the scholars pass in from one to two years, and the latter, two (or in the city schools three,) annual classes. The classes are formed according to the degree of advancement of the scholars. The branches of study in the common schools are specified in the above-mentioned manual. All the scholars are instructed in reading, writing, arithmetic, the rudiments of modern Greek grammar, and the doctrines of religion. Religious instruction is usually imparted by the teacher, but in rare cases when the scholars are of different religions, those parents who differ from the teacher in their faith, being a minority, have themselves to provide for the religious training of their children. Instruction in the higher grade of classes is so arranged that the scholars acquire, in addition, some knowledge of geography, biblical and Grecian history, natural history, and also of the grammar of the ancient Greek,—which last is having great effect in the immediate improvement of the modern language. Short compositions are also required of the scholars, as an exercise in the correct and clear expression of their thoughts. Music and drawing are, from the scarcity of teachers, taught as yet in but very few schools. The gymnastic exercises, also, which are required by law under the guidance of a teacher twice a week, are generally neglected. The daily school sessions occupy three hours in the morning and three in the afternoon, and are both opened and closed with prayer. Text books in all the studies, as well as reading books, either original or translated, and in language pure and easily understood, have already been published. New and improved ones are being continually prepared, which are submitted to an examining committee, appointed for the purpose by the department, and if found deserving, are recommended to the department for acceptance and adoption. Religious books, before they can be introduced into the schools, require the examination and approval of the proper ecclesiastical authorities.

The teachers are required to keep the following journals and registers, after forms minutely prescribed in the manual:—I. A general register of the scholars. II. A record of school delinquencies. III. A book for the record of the visits of the school inspectors and of other persons of note. IV. A register of the children presenting themselves for admission, but who, through want of room, can not be immediately received. V. The roll of honor. VI. A record of reprimands and punishments. VII. A small book for each scholar, in which his conduct is noted twice a month, once by the teacher and again by the parents. VIII. Registers of the different classes,—and, IX. A monthly exhibit of the condition of the school, not only as respects the scholars and their studies, but also the school building, &c. From these monthly exhibits a tri-monthly report is drawn up, which is signed by the teacher and local board of inspectors, and delivered to the eparch or nomarch for remittance to the department.

The scholars are annually subjected to two general examinations, a minor one at the end of February, which is only attended by the members of the local board of inspectors, and another at the end of the school year in August, which is open to the public. A report of the result of the examination, and of the condition of the school, is then made to the department, both by the teacher and by the board of inspectors. Besides these general examinations, the scholars are subject also to partial examinations from the local boards of inspectors, the principals of the central schools, (as district or provincial inspectors,) and from the eparch, nomarch and the director of the Teachers' Seminary, (as inspectors-general of public schools,) whenever they may make their official visits.

As respects the final examination of the senior classes, it is held at the close of the scholastic year, before a special examining committee, whose members are usually appointed by the eparch or nomarch on nomination of the parish council; and with this committee rests the determination of what students are entitled to certificates of discharge. Besides the Sundays and the thirty-one legally established holidays, there are during the year five weeks of vacation. Of these, one falls at Easter, but the remaining four are distributed differently in the cities and country, so that the scholars of the town schools have their holidays immediately after the annual examination, while in the country the vacations are in the seasons of harvest and vintage.

The schools are furnished with printed copies of the school laws, which are read before the scholars, and remain the year through suspended from the walls of the school room. These laws, as well as the disciplinary penalties, may be found in the manual already referred to. Discipline is confined to the deportment of the scholars while present, and upon the way to and from school. The punishments inflicted are reprimands, loss of good credits previously received, standing erect for some length of time, kneeling, fasting, studying during hours of intermission, detention at study in the school room after school hours, erasure from the roll of honor, the wearing of a card on which the offense is inscribed, enrollment in the "black-book," reprimand before the school with threat of expulsion, and finally expulsion. Corporal punishment is forbidden.

On the other hand the scholars are rewarded and encouraged by credit-marks, praise, certificates of merit, admission to the roll of honor, and rewards at the closing examination of the year. Among the teachers a distinction must be made between those that have received the preparation required by law, who are alone entitled to employment in the regular schools, and those of the old system who are only temporarily tolerated, (vid. p. 574.) To furnish the teachers this required preparation, there has existed since the first year of the kingdom, a Teachers' Seminary at Athens, in which are employed two professors and six tutors, and an annual appropriation of 17,572 drachmas is made by government for its support. An additional appropriation of 9,000 drachmas is made for the support of thirty beneficiaries at the seminary. The number of scholars in 1858 was 135. The director of the seminary is also chief superintendent of schools. The course of study occupies two years, and the applicant for admission must have passed the second class of the Hellenic school. The subjects of instruction are the doctrines of religion, biblical and Grecian history, the language and grammar of ancient Greece to the extent to which they are taught in the Hellenic schools and the lowest class of the gymnasia, geography, arithmetic, the elements of geometry and mechanics, so much of natural history as is most essential in popular education, pedagogy and didactics, gymnastics, the art of singing, practical gardening and agriculture and the raising of trees. To the seminary is attached a model school where the students obtain some practical experience in their profession. The students that have received the due amount of instruction in these branches, as well as those presenting themselves for examination who have obtained the necessary instruction elsewhere, are examined by the teachers under the supervision of the director. Such as are successful receive a diploma of the first, second or third grade, according to the degree of proficiency shown by them, and their names are entered upon a list of "conditional school candidates." Under this diploma they are permitted to engage as assistant teachers only, obligating themselves to submit to a second examination at the end of two years, when they are decisively entered upon the list of candidates, of the first, second or third class. Owing to the scarcity of teachers, the candidates are often immediately engaged, but always with a similar obligation. The teachers for the schools at the capitals of the provinces and districts, can be taken only from the first class of candidates,—those for schools in parishes of the first rank, only from the first and second classes,—while the candidates of the third class are entitled to an engagement only in parishes of the second and third grade. For advancement from a lower to a higher class, a new examination is necessary. Though from forty to sixty candidates annually pass the examination and receive their diplomas, yet there is always a want of teachers, inasmuch as the seminary supplies the Christian population of the Turkish provinces also with teachers—as does the university with Greek professors and tutors. The location of the teachers in the parish schools is effected through the department on application from the parish.

For idleness or negligence, bad conduct, or immorality, the teachers are liable to reprimand, to the infliction of a fine, not to exceed twenty drachmas, or to suspension for from eight days to six months, with or without loss of salary. As the provincial and district boards of inspection, prescribed by law, have not as yet been established, these punishments, with the exception of the reprimand, are imposed by the department itself upon information given by the lower boards of inspection. In pressing cases only, the nomarch, or eparch, or even the local board of inspection can suspend a teacher from the duties of his office, under the obligation at the same time to report the case immediately to the department. In the worst cases, the department dismisses from the service, even when such punishment does not strictly accord with the legal penalty.

The minimum monthly salary is, for the teachers at the provincial capital, 100 drachmas; for the teachers at the chief towns of the districts, 90 drachmas; for the second class of teachers and the assistants in the city schools, 80 drachmas, and for teachers in the third class, 50 drachmas. The salaries of the teachers at the district and provincial capitals are increased ten drachmas every five years, but may not exceed the maximum of 140 drachmas. Besides the salary, the teachers of all classes are provided with lodging, free of expense, and receive from the parish treasury a monthly apportionment of 22 lepta (=$0.03.8) for each child of school age. The whole amount paid is apportioned by the parish council among the parents in such a manner that the poor are left entirely exempt, but the citizens in easy circumstances pay from 10 to 50 lepta monthly, in proportion to the amount of their direct taxes. For the support of the aged and sick teachers, and for the widows and orphans of those that have deceased, there has been for some years a fund established, for which two hundredths of the salary and some small school fees are set apart.

Special primary schools for girls have hitherto been established only in the cities. What has already been said of the common schools is true also of the girls' schools, so far as it is applicable, though it may be added that female teachers are preferred, that instruction is given in needle-work and other feminine employments, and that the punishments are adapted to the more delicate sensibilities of the pupils.

The education of female teachers is conducted in the higher female schools, especially the one founded twenty years ago by the "Association of the Friends of Education," in Athens, with which there is connected a model school for the benefit of those who are to become teachers. Of the management of these schools we will speak farther on. The examinations of the male and female teachers are conducted by the same committee.

Though the system of common schools in Greece has, since its independence, made great advancement, yet there still remains much to be desired. Neither the number of schools in the parishes, nor of properly educated school candidates, equals the actual want, and hence there yet exist many hedge schools. Many children remain entirely without education, especially in those parishes which contain several widely scattered villages. Other children leave the schools too early, and the law respecting school attendance can not be every-where strictly enforced. The want of Sunday and more advanced schools for moral instruction, is more strongly felt each day, the education of the teachers is also often very defective, and the supervision of the schools is still not conducted with the necessary regularity and thoroughness.

(*To be continued.*)

2. SECONDARY OR INTERMEDIATE SCHOOLS.

The intermediate school system includes the Hellenic schools and the gymnasia. During the war for independence, in which Greece became daily more and more desolate under the devastations of a hostile army, scarcely ten Hellenic schools succeeded in prolonging a miserable existence, of which the greater number were situated upon the islands. Under the administration of president Capo d'Istria, there was founded, in the year 1829, on the island of Ægina, a kind of gymnasium, called the "Central School," and placed under the direction of the most worthy Gennadios. Hither, over five hundred young men, many of whom had been actively engaged in the war, gathered from every part of Greece, influenced by their strong desire for a more advanced education. Soon afterwards several other Hellenic schools were established—15 in the Peloponnesus, with about 800 pupils, and 18 upon the islands with about 1100, while upon the mainland, which was still for the most part occupied by hostile forces, there were only two, with an attendance of about 100 pupils. Besides these there were several private Hellenic schools opened, in which many young people were educated. But a more active development of the school system generally, and especially that of the intermediate schools, began immediately upon the organization of the monarchy. The Hellenic schools and gymnasia were regulated by a royal ordinance promulgated on 31st December, 1837. Both kinds of schools were to be established and maintained at public expense, with the exception of such as were supported by endowment funds, or from the incomes of neighboring cloisters, and some "alumnate" or private seminaries. Tuition was exacted neither in the Hellenic schools nor in the gymnasia. The intermediate schools, if they receive support from the state, have no denominational character, even on the four islands whose inhabitants are in part Roman Catholic. Consequently all Greeks alike frequent the Hellenic schools and gymnasia, and enjoy the same instruction, except in religion, that pupils would receive from teachers of their own faith. The Hellenic schools correspond to what in Germany are called "Latin schools," and at the same time to the higher "burgher schools," inasmuch as their object is not only to prepare for the gymnasium, but also to afford to young men, looking forward to the ordinary branches of business, such higher intellectual training as may be preparatory thereto.

In each of the forty-eight districts of the kingdom there is required to to be at least one Hellenic school; in some districts there are several. The fully organized Hellenic schools have three annual classes and three teachers. But there are also in several places imperfectly organized schools, whose pupils, after passing through the existing classes, complete the course at the higher institutions.

Every fully organized school is under the control of a principal ("scholarch,") who is also the teacher of the senior class. With him is associated the "board of teachers," which meets for council once a month, or oftener if necessary,—in which the decisions of a majority are binding, the right being reserved to the principal to defer their execution at his pleasure, until reference may be made to the department. But all Hellenic schools that are connected with a gymnasium are under the direction of the principal of the gymnasium, (the "gymnasiarch.") Where-ever a Hellenic school exists there is appointed an ephory, or school committee, consisting of the eparch—or, away from the capital of the eparchy, of the burghermaster—as president, of an educated priest, an official of the place, and two of the citizens elected by the parish council. This ephory advise respecting every thing that relates to the maintenance and improvement of the school, assist the principal in maintaining order, watch over the morals of the school, see that the teachers perform their duty, and that the laws and ordinances in respect to instruction, text-books, vacations and holidays, are carried into effect, decide disputes that may arise with the teachers respecting the order and subject matter of the studies as well as all difficulties between the teachers and parents. It is also their duty to secure the preservation of the school building, to provide for the furnishing of the necessary text-books for the library, and the other means of instruction whenever informed of a deficiency of any thing that is required, to be present at the inspection and examination of the school, and to report thereupon, as well as respecting the general condition of the school, through the eparch to the department.

As respects the official conduct of the teachers and the course of instruction especially, the Hellenic schools of each province are under the supervision of the principal of the nearest gymnasium, who visits them annually and reports the result to the department.

The ephory and the principal of the gymnasium, as inspector, are the special organs of government in the management of the Hellenic schools; when such is not the case, the eparch, or nomarch, acts in that capacity, superintends and visits them in the same manner, and gives information of their condition to the department.

The gymnasia are designed to furnish youth who have passed through the Hellenic schools, with a still higher education, but especially to prepare for the university those who look forward to a learned profession.

The law requires that there should be a gymnasium in each of the ten provinces of the kingdom, located at the capital of the province—but on account of the small number of students in them, desiring a more extended course of instruction, there are yet four provinces without gymnasia. On the contrary, two gymnasia have been established at Athens, where, besides the students that belong to that province, there are many young Greeks who have come from the Turkish provinces for their education. Besides these that have been described, which are established and maintained at the expense of the state, every city that possesses a Hellenic school, is at liberty to establish a gymnasium, if it is able to sustain it. Private persons also, having the requisite acquirements and qualifications, can with the consent of the department open private seminaries ("alumnate,") of a character similar to that of the gymnasia, on the condition of employing only such teachers as are recognized by the department and submitting to the laws and ordinances which govern the gymnasia in relation to the course of studies, text-books and superintendence.

The immediate management of the gymnasium is in the hands of the principal, or "gymnasiarch," who however takes council with the associated "college of teachers" respecting the method of instruction; the arrangement of subjects taught, the text-books to be used, the programme that is to be drawn up, and all that relates to the interior ordering of the gymnasium and the discipline of the students. He has the same right in opposition to this college that the principal of the Hellenic school has in respect to the board of teachers. In cases of necessity he also summons the ephory to meet them in council. The ephory is composed of the nomarch as president, the demarch, one of the higher priests living at the capital of the nomarchy, and two citizens elected by the parish council, and has like duties and authority to those of the beforementioned ephory of the Hellenic schools, with which it is identical in the chief cities of the provinces. Besides the oversight which this ephory exercises over the gymnasium, professors of the philosophical faculty (of the university) are also directed from time to time by the department to visit different gymnasia and report their observations.

According to the official report of the department, the number of both perfectly and imperfectly organized Hellenic schools wholly supported by the state, in 1858, amounted to 79, which were attended by 5,342 students. The corps of instruction consisted of 142 teachers and 13 assistants—and the state expended annually in their support 257,511 drachmas. There have been, till recently, seven gymnasia, of which two were at Athens, one at Nauplia, one in Patras, one at Tripolitza, one at Lamia, and one at Syra—but there is now an eighth erected at Messolonghi, not yet fully organized. In these seven gymnasia there were engaged in 1858, 50 professors, and 1,124 students receiving instruction. The annual expenditure of the state for their support amounted to 199,755 drachmas.

To these Hellenic schools and gymnasia, supported at public expense, are to be added four private seminaries, three at Athens and one at Syra, and nine private Hellenic schools, in all which there are 50 teachers and 718 students.

The aggregate of students in all the intermediate schools which we have described, amounts to 7,184. Comparing this number with that of the children in the common schools, the ratio is nearly that of one to seven—but this is not entirely correct, since many students in the gymnasia and private seminaries are foreigners, while the whole number of those in the common schools, are natives of Greece. It is also to be observed that the district of Maina in the Peloponnesus, as well as Anatolia, Acarnania and Eubœa send very few scholars to the intermediate schools in comparison with the other parts of Greece.

For admittance to a Hellenic school there is necessary a certificate of having passed through the common schools, signed by the teacher and examining committee. The required age has hitherto been ten years. The fully organized Hellenic school has three annual classes, and each year's studies are usually pursued under the direction of their special teacher—but when the board of teachers deem it advisable, each teacher conducts his pupils through the several classes.

For admittance to a gymnasium it must be shown by an examination, conducted by a professor of the gymnasium, that the candidate has received in the Hellenic school the preparation that is required, *i. e.*, that he is acquainted with the forms ordinarily occurring in Attic prose, and the rudimental principles of Greek grammar, that he has a tolerable understanding of the easier prose of classic Greek, can write an exercise in the same from dictation correctly, or at least without any important orthographical error, knows the regular paradigms of the Latin grammar, and the arithmetic, geography and history that have preceded in the Hellenic schools.

A complete gymnasium has four annual classes. Instruction in Latin, mathematics, and often also in history, is intrusted to specially appointed professors, each of whom gives instruction in his department to all the classes. But in other branches of study it rests with the professors themselves, whether they teach only prescribed classes, which is usually the case, or shall (with the consent of the college of professors,) conduct their pupils through the several classes of the gymnasium. The studies in the Hellenic schools and gymnasia, so far as hours have been assigned to any of them, are regulated by the ordinance of 31st December, 1837—which has since undergone some modifications; for instance, natural history and anthropology have been dropped from the Hellenic schools, and chemistry from the gymnasia. We give here a tabular exhibit of the course of study, with the number of hours per week assigned to each :—

HELLENIC SCHOOLS.		Class I.	II.	III.
Religious Instruction and Biblical History,	—per week,	2 hours,	2 hours,	2 hours,
Greek Language and Grammar,	"	12 "	12 "	12 "
Latin " "	"	0 "	0 "	3 "
Geography,	"	3 "	2 "	2 "
History,	"	3 "	3 "	3 "
Mathematics, (Arithmetic and Geometry,)	"	3 "	3 "	3 "
French Language and Grammar,	"	4 "	4 "	4 "
Penmanship,	"	2 "	2 "	2 "

GYMNASIUM.		Class I.	II.	III.	IV.
Religious Instruction,	per week,	2 hours,	2 hours,	2 hours,	2 hours,
Greek Language and Grammar,	"	9 "	9 "	9 "	9 "
Latin " "	"	5 "	5 "	5 "	5 "
Geography,	"	3 "	3 "	0 "	0 "
Mathematics,	"	3 "	3 "	3 "	3 "
History,	"	3 "	3 "	3 "	3 "
Natural Philosophy,	"	2 "	2 "	2 "	2 "
French Language,	"	3 "	3 "	3 "	3 "
Elements of Philosophy,	"	0 "	0 "	2 "	2 "

Besides the above branches, in some of the gymnasia, instruction is also given in the English and German languages—which, however, are left optional. The Latin also in the Hellenic schools, where it is commenced in the third class, is not obligatory upon any student who is not preparing for the gymnasium but intends to engage in commercial or mechanical business. In the gymnasium at Syra, too, Latin is optional for such students, and arrangements are so made that in the hours set apart for instruction in the Latin language they can attend lectures in the same gymnasium upon technology, commercial geography and commercial law.

Religious instruction in the Hellenic school is given by one of the teachers, but in the gymnasium by a specially appointed priest. In the very rare cases in which there are found among the scholars a few who do not belong to the Greek church, religious instruction is provided for them by their parents. The attendance of the students at church, as well as the performance of their other religious duties generally, is left wholly to the care of the parents and guardians, the school authorities assisting only by their frequent admonitions. The school exercises are always opened and closed with a short prayer from among those in use in the Greek church.

In the Hellenic schools, chrestomathies are used for instruction in Greek and Latin; but in the gymnasia generally only the works of the classic authors are selected for translation. Text-books have already been prepared in all the branches of study noted in the above tables, and improved ones are gradually introduced by the department, after examination and approval by the committee appointed for that purpose.

Two hours a week are devoted in the gymnasia to composition in ancient Greek, and one hour to composition in Latin. General exercises are also given to all the classes every week, both in Greek and Latin. In the Greek compositions not only correctness but even some degree of elegance is aimed at, while Latin composition is made use of mainly as an exercise in the application of the grammatical rules. No attention is paid to versification. The course of instruction in French embrace both exercises in grammar and composition, but the time allowed for t study is not sufficient for practice in conversation. The mathemati course includes the elements of geometry, algebra, and plain trigono try. Instruction in natural philosophy is, in most of the gymnasia, imperfect through want of the necessary apparatus, being limite short explanation of the general properties of bodies, the simplest theorems respecting equilibrium and motion, and an explanation of such natural phenomena as can be understood without the aid of apparatus.

The school ordinance to which we have referred, also contemplates instruction in the theory of the fine arts, which however receives but little attention, though as opportunity offers, the students are usually made acquainted with its most essential principles, especially as introductory to the study of an orator or poet, and in connection with the criticism and analysis of his writings.

The students receive instruction in penmanship only in the Hellenic schools,—but singing, drawing and gymnastics are nowhere as yet introduced.

In the Hellenic schools the system of class teachers is usual, while in the gymnasia the system of teaching by departments prevails to such an extent that, with the exception of Greek, and frequently also of geography and history, each of the remaining branches is taught to all the classes by a special professor. The teachers are permitted to give private instruction to their pupils out of school, for which they receive compensation as may be agreed upon between the parties.

There should be in each Hellenic school and gymnasium, a library for the use of the teachers, and also partially for the use of the students; but very little has hitherto been done towards this object, through scarcity of funds.

The standing of the students is only recorded in the school diaries, and is determined in the following manner: at the end of the month each teacher, according to his daily markings, determines the proper rank of each of his pupils, and from this determination of rank in the individual branches, combined with the numbers which have been fixed upon to represent the proportionate weight to be given to each study throughout the whole course, is calculated the correct monthly standing, and again from these the standing for the year. To prevent delinquencies, the parents or guardians are notified of their occurrence, and rebuke is administered to the offender. When these means, repeatedly employed, do not suffice, the student is duly warned and finally expelled. Though the laws made by the department to aid in the government of the schools, are intended to apply to the whole deportment of the students, not only at, but while away from school, yet the responsibility of their good behavior out of school is left with their parents and guardians. Consequently the students are punished only for negligence in school and for offenses committed within the institution. The penalties are, reprimand from the individual teachers or professors, separation from the other students during study hours, reprimand from the principal of the school or gymnasium, in private or before the faculty, detention in school for from an hour to a week, to which may also be added set tasks and diminution of food, and finally, sometimes, with the consent of the principal, expulsion from school, or exclusion from all the schools—the last, however, requires the assent not only of the faculty, but of the ephory, and appeal may be made from them to the department. Small books for the formal communication to the parents of the discipline received in school, are usual in some institutions. A student from abroad must be introduced to the principal by a respectable citizen as representative of the parent or guardian, who sees that he is provided with suitable accommodations and becomes responsible for his behavior out of school and for the proper performance of his religious duties.

The scholastic year, both in the Hellenic schools and in the gymnasia, begins on the fifteenth of September, and is divided into two semesters. Instruction in the first semester continues till the twenty-seventh of February, when there occurs an examination in presence only of the ephory. Several days after this examination, on the thirteenth of March, the second semester commences and extends to the middle of June, when the annual public examination is held before the ephory, the parents and guardians, and the public generally. After this public examination, early in July, the summer vacations commence and continue to the fifteenth of September.

The final examination of the course occurs either at the close of the scholastic year, or at the beginning of the following one, as may be at the time determined by the board of professors. It is conducted by the professors of the gymnasium in presence of the ephory, and is both oral and written. The oral exercises consist of a translation and grammatical analysis of extracts which have not been before read, taken from a somewhat difficult classic Greek prose writer or poet, and from a more easy Latin one—and of the solution of problems from some prescribed portion of the mathematics. The written examination embraces translations, in modern Greek, from ancient Greek and Latin authors—the first difficult, the latter more easy—and short compositions in classic Greek and Latin, of which the first must show both grammatical correctness and elegance of style.

The corps of instructors may be divided into professors, tutors (*Lehrer*,) and assistants. The title of professor is only given to those who teach in the gymnasia one of the above-mentioned obligatory branches, excepting the priests who give instruction in religion. The others, who hold permanently defined positions as instructors in the gymnasia or Hellenic schools, are styled tutors, (*Lehrer*,) while those are called assistants who are not permanently engaged, but have been employed provisionally in the Hellenic schools as instructors in some one branch, mainly for the purpose of their gaining experience in teaching. There are among the older teachers and gymnasial professors, some, often well qualified, who have studied at no university. But since the royal ordinance of 18th October, 1850, for engagement as teacher in a Hellenic school, it is made necessary, after a full gymnasial course, to have attended for at least two years the philosophical and philological lectures of the university, to have taken part sedulously in the exercises of the philological seminary, and then to have evinced a fitness for the position on an extended examination before a committee of professors of the philological faculty, especially in the two classic languages and their literature, in history, archæology and mathematics. For a situation as gymnasial professor, the same royal ordinance requires a doctor's degree, or licentiate's diploma. The first is obtained after a four years', the latter after a three years' course of philosophical or philological study at the university, upon examination, as provided by the laws of the university. Besides this examination no other trial is required, neither experimental nor with a view to promotion. The present scarcity of teachers and professors renders such examinations inadmissible—which scarcity is greatly owing to the fact that many young men, after finishing their studies at the university, are called away from Christian parishes to engage on more favorable terms as teachers in the Turkish cities.

In all the Hellenic schools and gymnasia which are supported by the state or the parishes, the teachers and professors are commissioned by royal patents and rank as civil officers. The right of appointment of teachers and professors belongs only to the government, except in some institutions sustained by endowment funds, (as in the Rhizarian Seminary,) whose founders have reserved to themselves and their administrators the right of electing the teachers.

In regard to salaries, the teachers in the Hellenic schools are divided into three classes, which receive respectively 100, 130 and 150 drachmas per month. The principals receive 200 drachmas monthly. In the gymnasia, the principal receives 300, and the professors 250 drachmas per month; this specified salary of the different teachers and professors may, after five years service, be increased one-fifth. They have the same claims, as respects pensions and distinctions, as other civil officers, and are liable to dismissal from service for the same reasons, as well as for immorality.

Among the intermediate schools should also be ranked the ecclesiastical schools, of which there are at this time three of subordinate and one of superior grade. It is the object of the subordinate schools, of which there should be one in each province, to educate village priests, and for that purpose to furnish the necessary instruction to young men who feel themselves called to the priestly office. The course of study differs from that of the Hellenic schools only in this, that in the course of Greek study the writings of the church fathers are used in connection with the classics—a larger catechism, a short, easily comprehended system of theology, and church history are taught, and the students are instructed in the duties of their future office, under the guidance of a priest. Lodging and board are furnished in the seminary itself, and the students are supported either at their own expense, or by the contributions of the higher clergy and the convents. There are at this time about eighty students in these three schools. The higher seminary, known as the Rhizarian school, was established at Athens sixteen years ago by the liberal endowments of the two lately deceased brothers Rhizaris. It includes five classes—the four lower corresponding to the four gymnasial classes, with the single difference that the fathers are read in place of the ancient classics and that in the fourth year some subjects of theological study are introduced. The fifth class is occupied entirely with a comprehensive course of instruction in the most essential departments of theology. The graduates of the seminary, on attaining the canonical age, are qualified for all church offices—but many of them seek at the university a more thorough philological and theological training. There are now about forty members of the seminary, of whom twenty are supported from the income of the seminary fund, and the remainder by the convents or from their own resources.

From what has been said, the improvement that has been effected in the intermediate schools of a country that twenty-six years ago came forth, utterly wasted, from a ten years' desolating war, will certainly not appear inconsiderable. There still exist, however, many deficiencies that can only be removed by degrees. The general desire so strongly expressed throughout the land, for a more thorough education, has necessitated on the part of the government the immediate establishment of a larger number of Hellenic schools and gymnasia than could be supplied with suitable teachers. The consequence has been that the instruction imparted is not every where equally good, and the course in many schools as well as in some gymnasia, is left incomplete. Especially is the instruction in Latin defective, for which there have hitherto been but few competent teachers. With the ancient Greek there is indeed more care taken, but in this the students are not allowed sufficient practice in composition. It is also evident that farther measures are required to be taken, both to prevent negligence in study and to maintain discipline beyond the school limits.

3. REAL SCHOOLS.

The place of the higher "burgher" schools of Germany is in Greece, in a measure, supplied by the Hellenic schools; for the subjects of study in the Hellenic schools are the same as those of the higher burgher schools, excepting the Latin language, which is, however, commenced only in the third class and is not obligatory, and also the ancient Greek language; but this is not for the native Greeks, altogether a foreign or dead language, such as is the Latin to the Germans, and an acquaintance with it, such as is attempted to be given in the Hellenic schools, is just as necessary to the Greek for a fundamental knowledge and correct use of the modern language, as the instruction in High German, that is given in the higher burgher schools, is found to be to the German. And on this principle, that the study of the ancient language is necessary to every educated Greek and is to be considered only as a more thorough study of his native tongue, the gymnasium at Syra where the study of Latin is not obligatory upon all, may be reckoned as a real school—for, thus looked upon, the peculiarity of classical schools is lost, and only the sciences remain as the principal branches of study. There are as yet only two institutions in Greece that can be considered strictly as real schools; one, a private school at Syra, where young men are fitted for a mercantile life, and a commercial school at Athens where from one hundred to one hundred and fifty young men have offered them a general knowledge of the elements of mathematics, natural philosophy and chemistry, and practical instruction in drawing, painting, modeling, engraving on wood and copper, and architecture. The military and naval schools at Athens, as well as a school of practical agriculture at Tiryuth, are not embraced in our plan.

4. HIGHER INSTITUTIONS FOR YOUNG LADIES.

Besides the elementary schools for girls, there are also, in the larger cities, higher schools for young ladies, which, however, are private institutions, with the exception of the Central School of the Society of the Friends of Education at Athens. There are at this time ten such schools, (three of which are at Athens,) in which about nine hundred young ladies are instructed in the branches of a higher education. The course of study continues three years, and does not differ from that of the Hellenic schools, except that in place of Latin, which is wholly omitted, the French language, and very frequently the English, is taught, more regard is also paid to æsthetic training, and consequently drawing and music are considered indespensable, and feminine domestic employments are not neglected. These seminaries are presided over by ladies, though male teachers also are engaged in giving instruction. They are subject to the supervision of government, under a special ephory, or board of inspectors, composed of respectable citizens.

The above-mentioned Central School is especially intended for the training of female teachers, both for the elementary and for the higher female schools. But many young ladies, belonging to the higher class of society, are admitted as private scholars on the payment of established annuities. This school has four classes instead of three. The young ladies who are desirous of becoming fitted for the office of teacher in the elementary schools, are required to pass through only the three lower classes, where they are taught the monitorial method of instruction, practice themselves in teaching in an elementary school connected with the central school, and are dismissed with a certificate after a successful examination. But the student who looks forward to the situation of teacher in the higher schools, must remain another year and pass through all the studies of the fourth class. This school is maintained by the contributions of the association, the annuities paid by the private scholars, the tuition fees, and in part also by an appropriation from government. There now number over one hundred students, the most of whom are beneficiaries either of government, the wealthy municipality, or of the association. The school building, one of the largest and finest edifices in Athens, was the gift of the liberality and patriotism of Arsakes, a wealthy and most worthy Greek physician, residing in Wallachia.—(Vid. Report in "Neue Jahr-Bücher f. Philol." 1860, vol. II. p. 154 and on.)

5. ORPHAN ASYLUMS.

Under the Turkish rule there was not in all Greece a single home for orphans. It was not till within a few years, under the reign of the King, that the design was entertained of establishing a philanthropical institution of this character. There have been as yet but three founded, two of which are at Athens. The one called the "Amalieum," after its most noble patroness, her majesty the queen, is an extensive and beautiful building, erected through the beneficence of their majesties and the contributions of ladies, (for the most part of Greece,) and is devoted wholly to orphan girls, and made their home, where, to the number of about sixty, they are instructed in reading, writing and arithmetic, and in religion, and various feminine occupations. Provision is made through a committee of ladies, presided over by the princess Hypsilanti, for the collection of contributions for the support of the institution. A fund of nearly 400,000 drachmas has already been accumulated. The foundation of the second institution is due principally to a legacy made by Georgios and Ækaterina Chanzi Konsta, and is devoted to the care of destitute orphan boys, who (about forty in number) are instructed in reading, writing, arithmetic and religion, and are also taught trades. The building was donated to the institution by the heir of M. Wrani of Vienna. A third orphan asylum has been established at Syra, sustained by the parish.

6. UNIVERSITY.

The Otho University, established at Athens in 1837, is organized after the plan of the German universities. It includes the faculties of philosophy, law, medicine and theology, of which, however, the theological is at present incomplete. The number of ordinary and extraordinary professors amounts to forty-two, and that of students averages about five hundred, of whom one half are native Greeks, the remainder being from the Turkish provinces.

We glean from an interesting article* upon Athens, by Pres. Felton, the additional information, that the University is admirably conducted, and that nothing can exceed the intellectual ardor of the young men in the several departments of study. The lecture rooms are daily crowded. The library now contains some 90,000 volumes, and is rapidly increasing, almost exclusively from the gifts which are continually made to it by Greeks in other countries. Like the other institutions for education, the university is an object of pride and favor to all of the nation, wherever settled, and large contributions are made towards their support, from all quarters. Half a million of francs was lately given by a wealthy Greek to found an academy of arts and sciences, and very recently, another Greek, a native of Thessaly, bequeathed 200,000 fr., ($40,000) to the university, and at about the same time, a humble knife-grinder even, who had accumulated 600 drachmas ($100) from his scanty earnings, bequeathed 100 dr. to the university.

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* Appleton's *New American Cyclopedia, Athens.*

Among the professors in the gymnasia and university, and the teachers in the schools, there are many who would do honor to the profession in any country in the world. Madame Manos, directress of the school for young ladies, at Athens, is a lady of the noblest character, as well as of the highest social position. Her associates are excellent and accomplished teachers. Among the women who teach in the common schools, are many whose self-sacrificing zeal and conscientious devotion are contributing powerfully to the moral and intellectual improvement of the rising generation. Of the professors in the university, the venerable Asopios expounds Homer with the life and fire of another Nestor. The lectures of Philippos Johannis—the author of the preceding article—on moral philosophy, are admirable for purity of style and clearness of method. Rangabes, who is also cabinet minister of foreign affairs, discourses upon the fine arts with acuteness, learning and taste. Manouses lectures eloquently on history, amidst the applause of a crowded audience. Pericles Argyropoulos, lately also a member of the cabinet, is a most able and distinguished professor of law. But these are far from being the only members of the professional body who are deserving of mention, and entitled to the admiration and gratitude of their countrymen.

A-B-C—BOOKS AND PRIMERS.

We propose in this paper to bring together various memoranda which we have made in our reading, respecting the books and mechanical contrivances, and to some extent the modes resorted to in different countries to introduce children to a knowledge of the elements of their mother tongue.

Anciently at the educational institutions of the Bramins in India, a peculiar symbolic use of the letters existed. The letter A, for instance, is represented as god among the letters.

Among the Chinese the first book is the *Pe-kia-sing*, or Primer, in which the names of the individuals of a hundred families (radicals of a hundred classes of words,) are given to be committed to memory by the pupils. The second book is the *Tsa-tse*, which contains many things which every body needs to know in everyday life. After this follows the *Tsien-tse-ouen*, a collection of a thousand letters. The fourth, *San-the-king*, contains trisyllabic verses, in which are taught the rudiments of morality and history.

In the schools of Persia, more than a thousand years ago, A B C tables came into use, in which A is the first and J the last letter.

In the Greek school the child first learned the letters in their order, each by its name, and not by its sound; that is, Alpha, Beta, &c., to Omega. The letters were probably hung upon a cord, and also described orally, and the scholars set to guessing them out in various ways, according to the inventiveness and animation of the teacher. After this came the special study of the vowels (φωναί,) and then the putting together of single letters (συλλαβίζειν,) which sounded very much like our old-fashioned spelling; Bet' Alpha, Ba; Bet' Epsilon, Be; Bet' Iota, Bi; Gamm' Alpha, Ga, &c. These short words were spelled until this A B Ab was well acquired.

There is not sufficient ground to decide whether there was any systematic method for dividing words into syllables. By this method of learning, it was some time, perhaps several years, before much facility in reading was acquired. The boys tried to distinguish between long and short syllables, to attend to the accent, which is so odd and difficult a matter for us, and especially to observe the musical variation of tone which characterizes the method of speaking and declaiming in vogue at Athens. Writing was not learned along with reading, but probably after some knowledge had been acquired of the latter.

While the intellectual training of the Spartans was confined to the narrow limits of music and sharpening the intellect, insomuch that they could hardly read or write at all, instruction and education were at Athens upon a very different footing. The demand there for a comprehensive education gave employment to a great number of teachers who instructed each in a separate and exclusive department.

The children learned to read and write in the syllabic method. Dionysius of Halicarnassus writes:

"We first learn the names of the letters, then their forms and length, then syllables and their usual variations. Then we begin to read and to write, but syllable-wise and slowly, until we have acquired some facility, and then connectedly and as we choose. Plato, (*Laws*, 7, 818,) puts reading and writing together; and he says that boys must study their letters until they can read and write."

The study of reading was a sort of musical instruction; for the children had to observe the longs and shorts, the raising and lowering of the voice at the syllables, and the greater or less volume of tone. That their reading was very far from being monotonous, and was really a kind of singing, is rendered probable from the general musical character of the Greeks, which would be likely to make their grammatists (teachers) teach and the pupils read more and more in that way, as time proceeded. The greatest speed in reading, writing, and music, was diligently sought.

Amongst the poetical works which were used for reading and memorizing, Homer's Iliad and Odyssey were preëminent, and were also highly esteemed by the Spartans. Æsop also served for a school reading book; and he who was not well acquainted with him, was thought but an ignorant fellow. His fables, however, were used for the smaller boys; the elder read chiefly in Simonides.

Among the various systematized helps was the following:—

The sophist Atticus Herodes, (as Philostratus says in his life of him) to assist his son, who had small intellectual endowments, and so poor a memory that he could not learn his letters, got together twenty-four boys of the same age, to whom he gave the names of the letters, and instructed them along with his son, that by calling his companions by name, he might learn the alphabet.

Among the early Romans there were no public schools, but children received their instruction from tutors or pedagogues. This pedagogue, who was usually an old slave, had often the duty not only of instructing (instituere) the boy to read, but of overseeing his behavior generally (monere.) Instruction was in strictness the duty of the father, and many eminent Romans did in fact teach their own children; Augustus, for instance, to some extent; Cato, altogether. Although the latter had a slave for the purpose of instructing his boys in grammar, he himself taught his son reading, swimming, and other exercises, on the principle that a father could manage a son better than a slave. Still, there were many teachers who instructed in reading, writing, and arithmetic, for which last the boys used small tablets. Such a teacher was called *ludimagister.* Every school was called *ludus*, but the reading-school, (διδασκαλεῖον) *ludus sive taberna literarum;* where there was often a booth, *pergula.* Quinctilian advised to furnish letters of bone or some suitable material, for children to use in learning to read, *quad tractare, intueri, nominare jucundum sit infantiae.*

In reading, which was usually commenced before the seventh year, the Romans as well as the Greeks appear to have used the syllabic method; for Quinctilian treats not only of the single letters, their characteristics and relations to each other, to syllables and words, but has many clear references to it as an established practice. "The smaller children strive to learn the elements and syllables; and one of the older ones repeats them to them, clearly, and one at a time; so that it is particularly necessary to have regard to the elocution of teachers and of the larger scholars." Evidently, a clear and correct elocution was reckoned of great importance. After single letters, syllables and words, they learned to write longer ones, and verses; which were perhaps repeated over by the older ones and spoken after them by the younger.*

The diffusion of books being so much more costly and difficult than in our days, the learned usually read very much less material than now, but learned more by hearing; and good readers were therefore more and more required in the schools. Longer extracts than are now made were dictated, and surprising quantities of them learned by heart and retained in the memory. The saying was universally received, that men must read much; not many books. According to Quinctilian's school dialogues, the rudiments of grammar were taught along with reading; etymology, definition, parts of speech, inflection, &c. The apparatus for writing was a wax tablet, written upon with a sharp-pointed stylus or pencil. Wax was used to facilitate corrections. Instruction in reading seems to have been given twice a day.†

* In the time of the Romans, there were schools of mutual instruction.

† See *Cramer's Hist. of Ed. and Instr. among the Ancients*, Vol. I, p. 433, &c., (1832)

The grammarian Kallias composed a theory of grammar in verse, or an A B C book in the form of a drama.*

The prologue, as the part first spoken by the chorus, gave the twenty-four letters in their order, and then the mode of using and combining them in words, which is their principal use. Then came a chorus of A B Ab, in verse, and to a melody which was the same to all the syllables; so that the seventeen consonants and seven vowels were figuratively represented as being paired together in a choral manner, or in antistrophic chanting.

After this followed a discourse relating to the vowels, in which, as was done for each letter in the prologue, each successive vowel was distinguished by a paragraph or sort of punctuation mark, so that it and its length were easily discernible.

After the vowels came the other divisions of the letters; the long and short vowels probably coming first, then the mutes, liquids, &c., apparently with a verse to each letter, as in the prologue. Interspersed with these exercises was given the practice in syllabizing, arranged according to the classes of consonants, or according to the place of the two consonants of a syllable, whether before, after, or on each side of the vowel, from Alpha to Omega; an extensive field for choral exercises.

That Kallias really arranged the A B C in a dramatic form, for use in the boys' schools, there seems to be sufficient reason for believing, when we consider how much of the life of the Greeks, and especially of the Athenians, was passed in entertainments, and how their lively plastic nature found its greatest pleasure in dramatic exhibitions. As with the old, so with the young; and the boys, by name and by a sort of flimsy imitation, probably brought the school into some similitude to the beloved theater. The author also knew the dryness of the fundamental principles of language, and sought to conceal it by an artistic treatment.

An especial reason for a dramatic presentation of the letters may be found in the fact that just about the time of Kallias, *i. e.*, A. C. 403, under the archon Euclides, the new or Ionic alphabet, which is that of our tragedy, was introduced, which added to that before in use, the Cadmean or Phœnician, two long vowels, three double consonants, and three aspirates. Archinus, who introduced the Ionic alphabet into Athens, procured a decree of the people that all teachers should teach it in their schools. Such being the case, it was not at all unreasonable that Kallias should seek an expeditious way of introducing the new alphabet amongst both old and young.

* See Welcker's *A-B-C—book of Kallias in the form of a chart* in the Rhenish Museum of Philology.

In the library at Muuich, there is an A-B-C-book (of a few leaves) of the fifteenth century, with illustrations, by a master-hand, and at Milan there is another adorned with miniatures by Leonardo da Vinci, in 1496.

When the Primer—(*Primareus*,) a little book containing the offices of the Roman Catholic Church, [which from its being the most common book in the monasteries, as well as because it contained prayers which the young and old were required to know, became the manual of the school as well as of the altar, and for this purpose was prefaced with a few leaves devoted to the Alphabet, and to words of one and two syllables]—came to be printed both in Latin and in German for religious instruction, its scholastic use was continued. The "Child's Little Primer" by Luther, with the Lord's Prayer, the Commandments, Creed, and Catechism, was one of the earliest and most popular school books in the Protestant schools. Several of the great educational reformers of a later day began at the beginning by improving the A-B-C-books. Basedow at Magdeburg, adopted a constructive method of teaching the letters, by presenting them made in gingerbread—then rewarding success in remembering the name by gift of the substance. This founder of Philanthropinism should be held in everlasting and grateful remembrance by A-b-c-darians. The earliest illustrated printed alphabet and Primer in German, dates back over two hundred years, and was composed by Bienrod, a school officer in Wernigerode. The letter A, symbolized by the Ape feeding on an Apple and rhymes thus,

> The Ape is then a funny beast
> When on an Apple he doth feast.

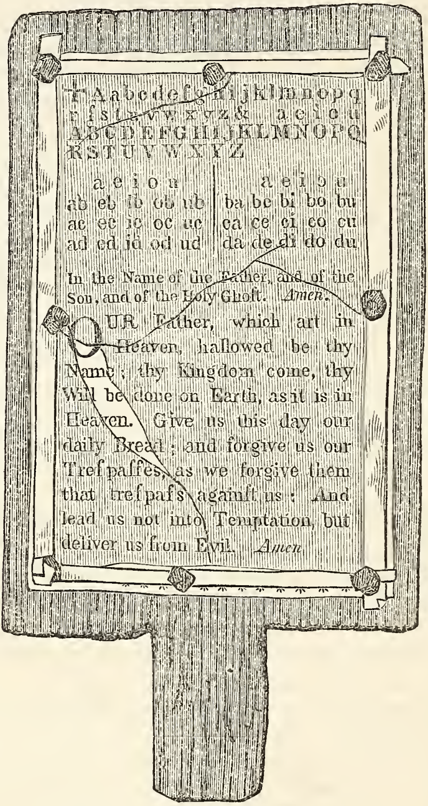
In England the ecclesiastical and royal gate to learning was by the Primer and the Horn-book—the latter being simply the first leaf of the Primer pasted on wood and protected by transparent horn. In 1534, a "Prymer in Englyshe with certain Prayers, and Goodly Meditations, *very necessary for all people* that understand not *the Latyne tongue*," was printed by John Byddell. In 1545, King Henry VIII. ordered an English "Form of Public Prayer," or "Prymer to be printed," "as set forth by the Kinge's Majestie and his Clergie, to be taught, lerned and red; and none other to be used throughout all his dominions." This little book, besides prayers, contains several psalms, with lessons and anthems in English. This Primer, with various additions, in some editions with the Catechism prepared by Cranmer "for the singular commoditie and profyte of Childe and Yong People" and in others, with a page or two devoted to the alphabet, and words of one and two syllables, was used in schools and families as the first book of instruction with children.

The Horn-book of Queen Elizabeth's time, according to a specimen in the British Museum, consisted of a single leaf about two inches long by one and a half wide, commencing with a cross, which thus serves to designate the first row, followed by the alphabet in small and large letters, which the vowels, and their combinations with the consonants, the Lord's Prayer, and the Roman (not the Arabic) numerals,—the whole covered with horn. Ben Johnson refers to this manual of children. Shakspeare in "*Love's Labors Lost*," describes the Schoolmaster Holafernes—"He teaches boys the Horn-books," and in Richard III., one of the characters,

> "—hearkens after prophecies and dreams,
> And from the cross-row plucks the letter G,
> And says a wizard told him that by G
> His issue disinherited should be."

Timbs in his "School Days," has the following paragraphs on the Horn-book.

Cotgrave has, "*La Croix de par Dieu*, the Christ's-crosse-rowe, or *horne-booke*, wherein a child learnes it;" and Florio, ed. 1611, p. 93, "*Centuruola*, a childes horne-booke hanging at his girdle."



HORNBOOK OF THE EIGHTEENTH CENTURY.

In the collection of Sir Thomas Phillipps, at Middlehill, are two genuine Hornbooks of the reigns of Charles I. and II. Locke, in his "*Thoughts on Education*," speaks of the "ordinary road of the Hornbook and Primer," and directs that "the Lord's Prayer, the Creed, and the Ten Commandments he should learn by heart, not by reading them himself in his Primer, but by somebody's repeating them before he can read."

Shenstone, who was taught to read at a dame-school, near Halesowen, in Shropshire, in his delightfully quaint poem of the *Schoolmistress*, commemorating his venerable preceptress, thus records the use of the Hornbook:—

"Lo; now with state she utters her command;
Eftsoons the urchins to their tasks repair;
Their books of stature small they take in hand,
Which with pellucid horn secured are
To save from finger wet the letters fair."

Cowper thus describes the Hornbook of his time:—

"Neatly secured from being soiled or torn
Beneath a pane of thin translucent horn,
A book (to please us at a tender age
'Tis called a book, though but a single page)
Presents the prayer the Saviour designed to teach,
Which children use, and parsons—when they preach."
Tirocinium, or a Review of Schools, 1784.

We have somewhere read a story of a mother tempting her son along the cross-row by giving him an apple for each letter he learnt. This brings us to the gingerbread alphabet of our own time, which appears to have been common a century and a half since.

"To master John the English maid
A Hornbook gives of gingerbread;
And, that the child may learn the better,
As he can name, he eats the letter."—*Prior.*

An anecdote illustrative of Lord Erskine's readiness is related—that, when asked by a judge if a single sheet could be called a book, he replied, "The common Hornbook, my lord."

In "*Specimens of West Country Dialect*," the use of the Hornbook is thus shown:—

"Commether, *Billy Chubb*, an breng the hornen book. Gee ma the vester in tha windor, you *Pal Came!*—what! be a sleepid—I'll wâke ye. Now, *Billy*, there's a good bway! Ston still there, and mind what I da zâ to ye, an whaur I da point. Now; criss-cross, girt â, little â—b—c—d. That's right *Billy;* you'll zoon lorn the criss-cross-lain—you'll zoon auvergit Bobby Jiffry—you'll zoon be *a scholard.* A's a pirty chubby bway—Lord love'n!"

John Britton, who was born in the parish of Kington St. Michael's Wilts, in 1771, tells us, in his "*Autobiography*," that he was placed with a schoolmistress. "Here," he writes, "I learnt 'the Christ-cross-row' from a Hornbook, on which were the alphabet in large and small letters, and the nine figures in Roman and Arabic numerals. The Hornbook is now a rarity." Such a Hornbook we have engraved. It was met with in the year 1850, among the old stock of a bookseller at Peterborough, in Lincolnshire, and is thus described: Its dimensions are 9 by 5 inches. The alphabet, &c., are printed upon white paper, which is laid upon a thin piece of oak, and is covered with a sheet of horn, secured in its place by eight tacks, driven through a border or mounting of brass; the object of this horn-covering being to keep the "book," or rather leaf, unsoiled. The first line is the cross-row; so named, says Johnson, "because a cross is placed at the beginning, to show that the end of learning is piety."

The Hornbook was not always mounted on a board; many were pasted on the back of the horn only.

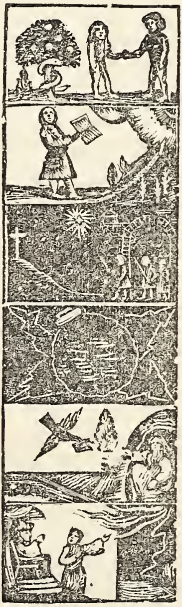
Such was the rudeness of the "dumb teacher" formerly employed at the dame-school, and elsewhere. It was, in all probability, superseded by Dr. Bell's sand-tray, upon which the children traced their own letters. Next came the "Battledore" and "Reading-made-Easy;" though the Spelling-book is considerably older than either. The Battledore, by the way, reminds us of a strategy of tuition mentioned by Locke: "By pasting the vowels and consonants on the sides of dice, he has made this a play for his children, whereby his eldest son in coats has played himself into spelling."—*Timb's* "*School Days*," *&c.*

The first book used in teaching the rudiments of learning in the English Colonies in America was doubtless the contemporary Primer of the mother country. The earliest notice we have met with of an indigenous production for this purpose, is in "An Almanack for the year of the Christian Empire, 1691," by "*Henry Newman*, Philomath," in which Benjamin Harris, at the *London Coffee House*, Boston, announces that

"There is now in the Press, and will suddenly be extant, a Second Impression of *the New England Primer enlarged*, to which is added, more *Directions for Spelling:* the *Prayer of* K. *Edward* the 6th. and *Verses made by Mr.* Rogers *the Martyr, left as a Legacy to his Children.*"

The "*New England Primer Englarged,*" the Second Impression of which became "suddenly extant" in or about 1691, gradually passed into the "New England Primer Improved, for the more easy attaining the true Reading of *English.*" Printed and Sold by William M'Alpine about Mid-way between the *Governor's* and Dr. *Gardiner's* in *Marlborough* Street, 1770."

At what date "The Young Infant's or Child's Morning, and Evening Prayer" from Dr. Watts, together with his *Cradle Hymn*, or the "*Spiritual Milk* for American *Babes*, Drawn out of the Breasts of both Testaments for their Souls Nourishment, By John Cotton," were first introduced, all of which are in the edition of 1770, now before us, we have no information. The most noticeable feature in this copy is the Illustrated Alphabet, of which we give a few specimens



A — In ADAM's Fall
We ſinned all.

B — Heaven to find,
The Bible Mind.

C — Chriſt crucify'd
For ſinners dy'd.

D — The Deluge drown'd
The Earth around.

E — ELIJAH hid
By Ravens fed.

F — The judgment made
FELIX afraid.

The original designs, together with the inimitable rhymes, are copied from "*A Guide for the Child and Youth.* By T. H." Printed in London by J. & J. Marsh, in 1761.

To this "Guide," and the "New Englangdar Primer Improved," we shall return in a future number. We conclude this article by a few pages on the methods of teaching the alphabet.

Outline of Methods of Teaching.

The following suggestions are taken from Prof. Sullivan's "*Outline of the Regulations and Methods of Teaching in the National Model Schools*" of Ireland:—

ALPHABET.*

As the Alphabet is the first, and, indeed, the most difficult lesson that children have to learn, the teacher should do every thing in his power to make it as easy and as interesting to them as possible. Pestalozzi has called it "the first torment of children," and with great truth, for, as it is usually taught, it is a difficult and perplexing task.

If we can not smooth the rugged path of learning for children, we should, at least, throw no unnecessary difficulties in their way. And to make them learn and recollect the names and forms of all the letters in the alphabet, LARGE and SMALL, before they are permitted to advance a step in a *practical* direction, is a great and unnecessary difficulty thrown in their way. The difficulty to a child must be great. If we doubt it, let us try what trouble it would cost ourselves to learn and recollect the names and forms of six-and-twenty characters or figures which we never saw before. And the difficulty is unnecessary, as far as regards the CAPITAL letters; for they are not required for the purpose of learning either to read or spell. It is of the small or *common* letters that words and sentences are composed. The CAPITALS occur only one at a time, and perhaps not more than two or three in a page; and the children will learn them as they proceed, without any formal teaching.

Till very lately, too, children were obliged to learn an additional character for the letter *s* (*ſ*); for no other purpose, it would seem, than to puzzle them between it and the letter *f*. to which it bears so close a resemblance. The *double* letters, too, as they were called, such as *ct*, *ſl*, *ſh*, &c., were considered till lately a necessary part of the alphabet; and the unfortunate tyros were consequently obliged to learn new and complicated characters for the same letter, before they were permitted to proceed to the simplest lesson in their primers.

But the difficulties which children encounter in learning the *names* and *forms* of the letters of the alphabet, are trivial when compared to the labor which it costs them to learn their *sounds* or *powers*.

If every distinct articulate *sound* had a different and distinct *sign* or character to represent it—or, in other words, if the *same sounds* were always expressed by the *same signs*, learning to read would cease to be a tedious and perplexing process; for in this case, it would, in a great measure, be reduced to a knowledge of the letters. But this is not the case in our, nor indeed in any alphabet. In some cases, we have distinct sounds without proper or *peculiar* signs to represent them, and in others, we have two or more different signs or characters for the same sound. Our alphabet is, therefore, both *defective* and *redundant*. The very first letter of the alphabet, for instance, represents, without alteration or external change, four different and distinct sounds; and with regard to all the other vowels, and several of the consonants, similar observations might be made.

We have nine simple vowel sounds, and only six signs or characters to express them—or rather only five, for *i* and *y* may be regarded as different forms of the same letter. We have also four consonants for which there are no proper or peculiar characters, namely, the initial consonant in the word *thin*, the initial con-

* The term Alphabet is derived from *Alpha*, *Beta*, the first two letters of the Greek Alphabet; just as we say the "A, B, C," for all the letters; and *Abecedarian*, for a teacher of the Alphabet.

The ORDER of the letters in the alphabet appears to have been a matter of chance; nor is it of much consequence how they are arranged. Some writers, however, have urged a new and philosophical arrangement. The VOWELS, they insist, should take precedence of the CONSONANTS, and be marshaled with regard to each other, according to the aperture which each demands of the mouth to give it due utterance: while the CONSONANTS should be arranged with reference to the *organs* to which they are chiefly indebted; as the *lip*, the *teeth*, the *throat*, &c.

This would certainly be a more rational arrangement of the letters; but it is now too late to make such alterations.

It is remarkable that the letter *A* holds the first place in every alphabet; perhaps because the *open* sound, as in the word *father*, is the simplest and easiest of all sounds. It is the first articulate sound which children make, as in the words *papa*, *mama*; and in almost every language except the English, this is the only sound of *a*.

sonant in *then*, the sibilating sound of *sh*, as in *shine*, and the final consonantal sound *ng*, as in the word *sing*.

But the redundancy of our alphabet is more apparent.

The letter *c*, for instance, has in every case the sound either of *k* or *s*.* It is, therefore, as far as the *pronunciation* is concerned, an unnecessary letter.

In *ch*, as in *chest*, the sound might be represented by *tsh;* and when it is hard, as in words like *chaos* and *mechanical*, by *k*. *Ch*, therefore, is redundant.

The letter *q*, also, is redundant, for in every case its sound might be represented by *k*; as in the words *quarter* (*kw*arter), *question* (*kw*estion), *quiet* *kw*iet, &c.

The letter *x*, too, is redundant, as its sound might be represented by *ks* or *z;* as in the words *exert*, *exist*, *Xenophon*.†

Ph is, in every case, equivalent to *f;* and is, therefore, a superfluous sign or character.

The vowel *y*, being another form of *i*, is redundant; and so also are the dipthongal forms *æ* and *œ;* as in the words *Cæsar* and *Crœsus*.‡

The difficulties which these alphabetical inconsistencies occasion children, in their first attempts at learning to read, have been so graphically described by the Edgeworths in their "*Practical Education*," that we shall transcribe the entire passage:

"As it is usually managed, it is a dreadful task indeed to learn, and if possible a more dreadful task to teach, to read; with the help of counters, and coaxing, and gingerbread, or by dint of reiterated pain and terror, the names of the four-and-twenty letters of the alphabet are, perhaps, in the course of some weeks, firmly fixed in the pupil's memory. So much the worse; all these names will disturb him if he have common sense, and at every step must stop his progress. To begin with the vowels: each of these has several different sounds, and consequently ought to have several names, or different signs to distinguish them in different circumstances. In the first lesson of the spelling-book, the child begins with a-b makes ab; b-a makes ba. The inference, if any general inference can be drawn from this lesson, is, that when *a* comes before *b* it has one sound, and after *b* it has another sound; but this is contradicted by-and-bye, and it appears that *a* after *b* has various sounds, as in *ball*, in *bat*, in *bare*. The letter *i* in *fire* is *i*, as we call it in the alphabet, but in *fir* it is changed, in *pin* it is changed again; so that the child, being ordered to affix to the same sign a variety of sounds and names, and not knowing in what circumstances to obey, and in what to disregard the contradictory injunctions imposed upon him, he pronounces sounds at hazard, and adheres positively to the last ruled case, or maintains an apparently sullen, or truly philosophic and skeptical silence. Must *e* in *pen*, and *e* in *where*, and *e* in *her*, and *e* in *fear*, all be called *e* alike? The child is patted on the head for reading *u* as it ought to be pronounced in *future;* but if, remembering this encouragement, the pupil should venture to pronounce *u* in *gun* and *bun* in the same manner, he will inevitably be disgraced. Pane and shame impress precepts upon the mind, the child therefore is intent upon remembering the new sound of *u* in *bun;* but when he comes to *busy*, and *burial*, and *prudence*, his last precedent will lead him fatally astray, and he will again be called *dunce*. *O* in the exclamation *Oh!* is happily called by its alphabetical name, but in *to* we can hardly know it again, and in *morning* and *wonder* it has a third and a fourth additional sound. The amphibious letter *y*, which is either a vowel or a consonant, has one sound in one character, and two sounds in the other; as a consonant, it is pronounced as in *yesterday;* in *try*, it is sounded as *i;* in any, and in the termination of many other words, it is sounded like *e*. Must a child know all this by intuition, or must it be whipt into him? But he must know a great deal more before he can read the most common words; what length of time should we allow him for learning when *c* is to be sounded like *k*, and when like *s?* And

* Before the vowels *a*, *o*, or *u*, *c* has the sound of *k*, as in *cat*, *cot*, *cut;* and before *e*, *i*, or *y*, it has the sound of *s*, as in *cell*, *city*, *cypress*.

† At the beginning of a word, *x* is pronounced *z*, as in Xenophon; in the middle or at the end, *ks*, as in Xerxes (Zer*k*ses), bo*x*es (bo*k*ses), box (bo*ks*). *X* is evidently compounded of *h* and *s*.

‡ But though these signs or letters are unnecessary, as far as the pronunciation and spelling of the words in which they occur are concerned, they are essential to their *etymology* and meaning, and must therefore be retained.

how much longer time shall we add for learning when *s* shall be pronounced *sh*, as in *sure*, or *z*, as in *has;* the sound of which last letter *z* he can not by any conjuration obtain from the name *zed*, the only name by which he has been taught to call it? How much time shall we allow a patient tutor for teaching a docile pupil, when *g* is to be pronounced soft, and when hard? There are many carefully-worded rules in the spelling-books, specifying before what letters, and in what situation, *g* shall vary in sound; but unfortunately these rules are difficult to be learned by heart, and still more difficult to understand. These laws, however positive, are not found to be of universal application, or at least a child has not always wit or time to apply them upon the spur of the occasion. In coming to the words *good gentleman*, *get an ingenious grammar*, he may be puzzled by the nice distinction he is to make in pronunciation in cases apparently similar: but he has not yet become acquainted with all the powers of this privileged letter; in company with *h*, it assumes the character of *f*, as in *tough;* the next time he meets it perhaps in the same company, in the same place, and as nearly as possible in the same circumstances, as in the word *though;* but now *g* is to become a silent letter, and is to pass incognito, and the child would commit an unpardonable error if he claimed the incognito as his late acquaintance *f*. Still all these are slight difficulties; a moment's reflection must convince us, that by teaching the common names of every consonant in the alphabet, we prepare a child for misery when he begins to spell or read. *A* consonant, as saith the spelling-book, is a letter which can not be pronounced without a vowel before or after it; for this reason *B* is called *be*, and *L el;* but why the vowel should come first in the one case, or last in the second, we are not informed; nor are we told why the names of some letters have no resemblance whatever to their sounds, either with a vowel before or after them. Suppose that after having learned the alphabet, a child was to attempt to read the words—

Here is some apple pye,

he would pronounce the letters thus—

Acheare ies esoeme apepeele pewie.

With this pronunciation the child could never decipher these simple words. It will be answered, perhaps, that no child is expected to read as soon as he has learnt his alphabet; a long initiation of monosyllabic, dissyllabic, trissyllabic, and polysyllabic words is previously to be submitted to, nor after this inauguration are the novices capable of performing with propriety the ceremony of reading whole words and sentences. By a different method of teaching, all his waste of labor and of time, all this confusion of rules and exceptions, and all the consequent confusion in the understanding of the pupil, may be avoided.

"In teaching a child to read, every letter should have a precise single sound annexed to its figure; this should never vary. Where two consonants are joined together, so as to have but one sound, as *ph*, *sh*, &c., the two letters should be coupled together by a distinct, invariable mark. Letters that are silent should be marked in such a manner as to point out to the child that they are not to be sounded. Upon these simple rules our method of teaching to read has been founded. The signs or marks, by which these distinctions are to be effected, are arbitrary, and may be varied as the teacher chooses; the addition of a single point above or below the common letters is sufficient to distinguish the different sounds that are given to the same letter, and a mark underneath such letters as are to be omitted, is the only apparatus necessary. These marks were employed by the author in 1776, before he had seen Sheridan's or any similar dictionary; he has found that they do not confuse children as much as figures, because when dots are used to distinguish sounds, there is only a change of place, and no change of form; but any person that chooses it, may substitute figures instead of dots. It should, however, be remembered, that children must learn to distinguish the figures before they can be useful in discriminating the words."

To the ingenious recommendations of the Edgeworths, there are strong practical objections. Children thus taught would find it difficult to read books printed in the ordinary way; and besides, the *upper*, *lower*, and *double* dots, and *horizontal* and *slanting* lines, would tend to confuse rather than to simplify.

Other plans for simplifying the study of the alphabet have been tried with more or less success by other educationists. Some have classed and taught the letters according to their *forms*, as Lancaster, who drilled and divided them into squadrons and groups, according to their resemblances, real or supposed, to geometric figures; others have classed them according to their resemblance in *sound*, as Professor Pillans, who recommends that they should be taught in brotherhoods, as they are pronounced by the several organs of the voice, as *dentals*, *labials*, &c.; while others, as Jacotot, have succeeded in teaching children to read without putting them through the routine of alphabetic teaching.*

Except in a few cases, there is no resemblance between the *names* and the *sounds* of the letters. Name, for instance, the letters in any word or syllable, and compare the sounds thus produced with the sound of the entire word or syllable, and the dissimilarity between the *names* and the *sounds* of the letters will be strikingly exemplified. What similarity, for instance, is there between the sounds *pee-aiche-wi-ess-i-see* and the word *physic?* Or, between the sounds *en-i-gee-aiche-tee* and the word *night?* Or, in short, between the *sound* or pronunciation of any word and the names of the letters which compose it? Even the simplest syllable, if resolved in this way, exhibits the dissimilarity between the *names* and the *sounds* of the letters. The syllable *ma*, for instance, if resolved into the *names* of the two letters which compose it—or, in other words, if SPELLED, is sounded or pronounced *em-ay*.

Hence it has been proposed (originally by the Port Royal Society) to change the *names* of the CONSONANTS, so as to make them expressive of their *sounds*. Thus, instead of calling them *bee*, *see*, *dee*, *ef*, *gee*, *aiche*, *kay*, *ell*, *em*, *en*, *pee*, *kew*, *err*, *ess*, *tee*, *vee*, *ecks*, *zed*, which names have little or no similarity with the sounds of the letters in composition, they are called according to the new nomenclature, *be*, *ce*, *de*, *ghe*, *he*, *le*, *me*, *ne*, *pe*, *ke*, *re*, *se*, *te*, *ve*, *xe*, *ze*. The difference between the *old* and the *new* names of the consonants is not so striking in our language as it is in French, in which the change was first made. It consists in this: in the one case, the consonants are pronounced fully, as *bee*, *dee*, &c.; while in the other, the *mute* or silent *e* added to each gives them a faint and echo-like sound. We have no open vowel which expresses the short and feeble sound of the French *e mute;* but the sound of the *e* in *battery* comes near it; also, the short *u*, as in *tub*, and *o* in the phrase, what *o*'clock is it?

The advantage of the new nomenclature of the consonants will strike us most in the case of *f*, *h*, *l*, *m*, *n*, *r*, and *s*. For if we join any of them to a sound or syllable beginning with a vowel, the correspondence between their sounds and their names will be evident: for instance, *l*, *m*, *n*, or *s*, joined to *et*, makes *let*, *met*, *net*, or *set*.

With this improvement, or innovation, in alphabetic teaching, there is another generally connected with it, called SYLLABIC SPELLING. That is, in learning to read, the pupil is not required to *spell* or name the letters in a syllable, as *a-b*, *ab*, *e-b*, *eb*, *b-i*, *bi*, &c.; but merely to pronounce the sound, or syllable, without decomposing it. A modification of this method has been introduced into this country by Mrs. Williams, in a publication called "*Syllabic Spelling*," or a summary method of teaching children to read; and the PHONIC method of teaching the alphabet, introduced by Mr. Kay Shuttleworth, under the auspices of the Committee of Council on Education, is the same in principle.

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* M. Jacotot would take up almost any book, say "*Paradise Lost.*" After directing them to fix their eyes on the first line, he would pronounce the word "*Of*," and desire them to repeat it after him. "This," he would observe, "is the first word in the line, and it is composd of the two first marks that you see there. Now observe their shape, for they will soon occur again, and, of course, you will like to recognize them. Can you describe them?" "Yes, Sir; the first is round, like a little ring or circle, and the second is a straight line curved or bent at the top, with a little cross line at the middle."

"Very well! Now let us take the next word—'*man's*.' How many marks or letters are there in this word?" "Four." "Are any of them like the first two?" (Here every eye will run from letter to letter for the purpose of comparison.) "No, Sir; they are different marks."

"Well, repeat these two words, and pass on to the next—'*first.*' Now, is there any mark or letter in this word which you have seen before?" "O yes, Sir! the first letter in this word is the same as the last letter of the first word." "Very well; repeat these three words, and proceed to the next—'*disobedience.*' This is a long word; you must take care to pronounce it distinctly. Now, do you recognize any marks or letters in it which you met with before?" "Yes. Here is one, and there is another: and here is the second mark again." "Very well; but would you not like to have some name to distinguish these marks, just as you do your school-fellows, instead of saying 'This letter and that letter,' or 'The first letter or the second letter?'" "O yes! we would, Sir."

Then he would *name* and make them *pronounce* the letter, &c.

XI. PRIMARY INSTRUCTION BY OBJECT LESSONS.

REPORT OF COMMITTEE ON THE PRIMARY SCHOOLS

OF THE CITY OF OSWEGO, IN NEW YORK.

The Committee selected by the Board of Education of the city of Oswego to attend an examination of the primary schools of that city, held on the 11th, 12th, and 13th days of February, 1862, with special reference to an investigation of the system of "Object Teaching" recently introduced into said schools, and to an expression of opinion thereon, beg leave respectfully to

REPORT,

That the system in question is designed and claimed to be in accordance with those principles so prominently exemplified by the great Swiss educator, Henry Pestalozzi, who lived and labored during the last half of the eighteenth century. Of him the Hon. Henry Barnard justly remarks that, "Although his personal labors were confined to his native country, and their immediate influence was weakened by many defects of character, still, his general views of education were so sound and just that they are now adopted by teachers who never read a word of his life or writings, and by many who never even heard his name. They have become the common property of teachers and educators throughout the world."

These principles lie down deep in the nature of man. They recognize the great truth that this nature is threefold—material, intellectual, moral, and that it has its laws of growth and development. Pestalozzi believed, as we believe and know, that human beings possess affections and a moral sense as well as reason, and intelligence, and sensation.

NATURE OF EDUCATION.

He therefore assumed *faith and love* as the only true foundation of a system of education. He asserts that education, in order to fit man for his destination, must proceed according to natural laws; that it should not act as an arbitrary mediator between the child and nature—between man and God—but that it should assist the course of natural development instead of doing it violence; that it should watch and follow its progress, instead of attempting to mark out a path agreeably to some vague preconceived system. He sought to develop and strengthen the faculties of the child by a steady course of excitement to self-activity, with a limited degree of assistance to his efforts.

He aimed to discover the proper point for commencing the education of the young, and then to proceed in a slow and gradual, but progressive and unbroken course from one step to another, always waiting until the preceding steps should have a certain degree of distinctness in the mind of the child before entering upon the presentation of a new step.

DISTINCTIVE PRINCIPLES.

Pestalozzi believed *that education in its essence consists in the harmonious and uniform development of every faculty, so that the body should not be in advance of the mind nor the mind of the body, nor should the affections be neglected; and that promptitude and skill in action should, as far as possible, keep pace with the acquisition of knowledge.* He required close attention and special reference to the individual peculiarities of each child and of each sex, as well as to the characteristics of the people among whom he lived, to the end that each might be educated for that sphere of activity and usefulness to which the Creator had destined him.

He regarded Form, Number, and Language as the essential condition of definite and distinct knowledge, and insisted that these elements should be taught with the utmost simplicity, comprehensiveness, and mutual connection.

Pestalozzi, as well as Basedow, desired that *instruction should begin with the simple perception of external objects and their relations.* He wished that the *art of observing* should be acquired. He thought the *thing perceived of less importance than the cultivation of the perceptive powers*, which should *enable the child to observe completely, and to exhaust as far as possible the subjects which should be brought before him.* He maintained that every subject of instruction should become an exercise of thought, and that lessons on *form, size, number, place*, etc., would give the best occasion for it.

He thought highly of arithmetic as a means of strengthening the mind, and he also introduced Geometry into the elementary schools, with the arts of drawing, designing, and modeling growing out of it.

He would *train the hand, the eye, the touch, and the senses generally*, without which there can be no high executive power in the arts of civilized life.

He was opposed to the lifeless repetition of the rules of grammar, but rather aimed at a *development of the laws of language from within*—at a knowledge of its internal nature, structure, and peculiar spirit—thus affording the means not only for cultivating the intellect, but for improving and elevating the affections. He, as well as other educators of his time, introduced vocal music into the circle of school studies on account of its powerful influence upon the heart. Not satisfied with singing by rote, he included in his course of instruction the elementary principles of music—Rhythm, Melody, and Dynamics.

He discouraged that abuse of the Socratic method which attempted to *draw something out of children before they had received any knowledge;* but, on the contrary, recommended in the earliest periods of instruction the established method of dictation by the teacher and reproduction by the pupil.

Pestalozzi strongly *repudiated the opinion that religious instruction should be exclusively addressed to the understanding.* He showed that religion lies deep in the hearts of men, and that it should not be so much enstamped from without as developed from within; *that the basis of religious emotion is to be found in the childish disposition to love, to gratitude, to veneration, to obedience and confidence toward parents; that these feelings should be cultivated, strengthened, and directed toward God;* and that religion should be formally treated of, at a later period, in connection with the feelings thus excited. As he required the mother to direct the first development of all the faculties of her child, he assigned to her especially the task of first cultivating the religious feelings. He thought that mutual affection ought to reign between the educator and the pupil, whether at the home or school, in order to render education effectual and useful. He was not, therefore, disposed to uphold school despotism, nor did he approve of special incentives addressed to emulation, preferring that the children should be taught to find their own highest and best reward in the delights of knowledge and in the consciousness of duty done.

THESE PRINCIPLES WORTHY OF ATTENTION.

Such were the leading views and principles of this truly great man; and, with all the faults in their practical application by himself in the eccentricity of his character, they are eminently worthy of the profound study alike of the parent, the teacher, the philanthropist, and the Christian. They constitute unquestionably the germs of that great system of means for the complete evolution of the varied and complex forces of our common nature which *is to be*—perchance which already is.

NATURAL ORDER OF DEVELOPMENT OF THE FACULTIES.

The Committee believe that these principles seem to imply the existence of a great comprehensive law or order of development of the human faculties, together with a corresponding order of succession and adaptation in the scheme of truth which must constitute the objects to which these expanding faculties must address themselves as the inexorable condition of their development and growth. Without stopping to argue this proposition, but desiring merely to suggest it, the Committee commend it to the profound consideration of their educational brethren every where. If this proposition be true, it lies at the basis of all educational inquiry, while its complete elucidation will essentially determine the character of all proper educational courses and methods of procedure.

What the character of the primary school should be, what its subjects and methods of instruction, depends upon the preliminary questions:

What is the character and destiny of the beings to be trained therein? What is the condition of their physical, mental, and emotional powers? and what kind of studies, what description of knowledge, what exercises are best suited to meet the wants and exigencies of their present, while having reference, also, to their future condition and circumstances?

SENSATION AND PERCEPTION.

The Committee believe it to be the generally received opinion that, in childhood, all positive knowledge comes through sensation and perception. Sensation arises from the contact of our senses with the outer material world. Perception is the reference of a sensation to its cause. Sensations lead, through observations, to conceptions. Conceptions form the basis of our reasoning, and, through reason, we are led to discover our relations to the material world, to our fellow-men, and to the Creator; and, finally, the will, as the executive power, enables us to act according to the dictates of reason, of conscience, and of duty.

We have thus hinted at what many believe to be the natural order of evolution of the faculties:

1st. Perception through sensation.

2d. Conception through observation.

3d. Reasoning upon the basis of our conceptions, ascending from the concrete to the abstract, from the simple to the complex, from the known to the unknown.

4th. Volition, according to the conclusion reached by reason, acting in harmony with the conscience and the nobler emotions and impulses of our nature.

TRUE ORDER OF STUDIES.

Is there now an order of succession of studies, or of the sciences, corresponding to the order of evolution of the faculties? This has been conclusively shown, we think, by President Hill, Professor Joseph Le Conte, and others, and endorsed by the highest scientific and literary authorities of the age. The question may be determined from at least three different stand-points:

1st. From the history of the rise and progress of knowledge among men.

2d. From a careful examination of the relations, connections, and dependencies of the different special sciences to each other.

3d. From an investigation of the adaptations of the different sciences to the progressive wants of the faculties in every stage of their development.

All these fields have been explored by able men, and, from whichever stand-point the investigation proceeds, the conclusions reached are essentially the same, and they seem strikingly to confirm each other. Without going farther into this question, it may be remarked that, while the perceptive faculties are the earliest to manifest themselves in the order of time, so those sciences which address themselves the most directly to these faculties, to wit, those which deal with ideas of space, form, size, number, place, weight, color, etc., are the simplest of all, lie at the basis of all, and are best adapted of all, as experience and reason alike show, to meet the demands of these early stages in the education of the young.

LAWS OF CHILDHOOD.

In childhood, all is activity; the senses are keenly alive to every impression made upon them; the spirit of inquiry is awake, and runs abroad in every direction in search of knowledge; the perceptive powers are at work—they must be directed, and, if possible, sharpened; the imagination riots wildly in childish dreams—it must be chastened and corrected by deliberate and sober appeals to facts, to actual things, and thus gradually enticed to its appropriate work of aiding in the formation of correct conceptions; the affections are fresh and warm; the confiding innocent desires to live and move in an atmosphere of kindness and love; the bodily powers, though comparatively weak, are restless, and ever panting for wholesome employment.

THE TRUE EDUCATIONAL METHOD.

The question is, How are these conditions, so perfectly normal, to be met? How shall the development of the child, heretofore assisted by Nature's own method, be continued and perfected? How shall his young nature, leaping and bounding in joyousness and love, reveling in the pleasure of knowledge, be preserved in its freshness, and vigor, and purity? Not, surely, by forced and unmeaning strifes with mere words and phrases, not by the mechanical drudgery of loading the memory with dry formulas and senseless rules, not by the mastication of rudimental books, nor by those endless stripes which have no healing power.

This question, in the opinion of the Committee, can be solved only by efforts in the direction to which these suggestions tend. Our subjects and methods of instruction must be naturalized. The course of true education is the course of nature. Man's method, to be effective, must follow God's method. As surely as our Divine Father has a plan in creation, so surely has he also a plan in education. By the light of history and revelation we see how he is guiding, instructing, educating the human race through the ages. Aided by the experiences, the discoveries, the inventions, the sufferings, the reverses of past generations, we have become exalted to Heaven in respect to our rights, our privileges, and blessings.

So children should be taught, as far as possible, by their own actual experience, and not so much by mere dicta, not so much by taking on trust what others say, and write, and print, but by more frequent and persistent intercourse, or experience, if you please, with those objects, qualities, and properties, the existence of which gives to language so much of its force and utility.

The Committee have thought it due, alike to the occasion which has called them together, as well as to the important movement which has here been inaugurated, to give expression somewhat at length to the foregoing views. They are too well aware of the obstacles which nearly every new enterprise, however noble, is doomed to encounter, not to embrace an opportunity so grave as the present to give it a substantial and hearty support.

AN IMPORTANT REVOLUTION AT HAND.

The examinations which it has been their high privilege to witness during the present week have impressed them with the conviction that we are on the eve of a great and important revolution in the education of our country. The system which has been developed from the principles herein before stated is yet essentially foreign. And as it was a doctrine of Pestalozzi himself that education, to be true, must have constant reference to the character of the people among whom it is to be dispensed, so it is evident that the system which has been exhibited before us is yet to be somewhat modified—Americanized—to meet the peculiar characteristics of our people and country. Systems and methods must change, "but principles are in their nature eternal," says Professor Crosby; "and it is their office to guide and direct amid all the vicissitudes of circumstance, condition, event, fortune." So, while adhering to the unchanging dicta of well-grounded principle, we would joyfully accept in the system of methods whatever is suited to our special wants, characteristics, and circumstances as a people.

SUCCESS OF THE EXPERIMENT AT OSWEGO.

How well the methods presented by the exhibitions from the Oswego primary schools are adapted to carry out the theory upon which these methods are based, the Committee have endeavored to give their professional brethren and fellow-citizens at a distance the means of judging, by presenting an abstract of each exercise, together with the precise aim of the teacher in each case. The ages of the children, together with the grades of the classes, will be found stated in the proper places. The number of classes presented will also be learned by an examination of the accompanying statement. It will be observed that a wide range of topics was developed by the classes, embracing lessons of various grades, on Form, Size, Weight, Color, Place, Number, Language, Objects, Plants, Animals, Shells, and including also exercises in Phonic Reading and Gymnastics.

The Committee are also most happy in bearing testimony to the universal fidelity of the teachers and superintendent to that cardinal principle of Faith and Love which the great Pestalozzi affirmed must be the basis of all true education. The evidences of mutual kindness, respect, and affection between teachers and taught have been too palpable to be questioned. Let these devoted teachers rest assured that they are laying up imperishable treasures of future joy and gladness, alike for themselves and the long procession of the generations which shall rise up to call them blessed.

[Previous to commencing the exercises of the examination, the Secretary of the Board of Education stated that the primary schools of Oswego are divided into three classes, called A, B, and C. The C class is the lowest, B next, and the A class the highest. The children, on entering school, are placed in the C class, where they remain under the same teacher for one year, near the end of which time an examination takes place, and those who are sufficiently advanced are promoted to the B class at the commencement of the succeeding term, where they remain another year; they are examined again, and promoted to the A class; toward the end of the third year they are examined for promotions to the junior schools.]

EXAMINATION EXERCISES.

The first exercise witnessed by the Committee was a review of the C class, primary. Ages of children, 6 to 7 years.

LESSON ON FORM.

The children stood in a semicircular line on one side of the table, on which were placed several of the more common solids, as a sphere, a cube, a cone, etc. The teacher called upon the children to distinguish different solids, as the sphere, hemisphere, cylinder, cone, and cube, and to give their names. Then, holding up a cylinder, she asked, "What is this called?"

Children. "A cylinder."

Teacher. "Yes, this is a cylinder; and when we see any object of this shape we say it is *cylindrical.* Now look about the room, and see if you can see any thing that is of this shape."

C. The stove-pipe—the post.

T. Yes; and because the stove-pipe and the post are of this shape, we call them—

C. "Cylindrical."

In this manner the terms spherical, conical, etc., were presented to the children.

The teacher placed a cube before the children, and requested them to name objects of that form; then a sphere, and to name objects of a spherical form, etc.

Several of the solids being placed on the table, the teacher naming objects, as orange, stick of candy, church spire, etc., the children would say which solid they resembled in shape.

To show that the children understood the terms *face* and *surface*, they were requested to touch the surface of a sphere, the outside of a sphere, the faces of a cube and of a cylinder; then to point out the plane and curved faces of different solids; then to take solids, and tell by what faces they were bounded.

The manner of conducting this exercise, and the familiarity manifested with the subject, gave evidence that the children possessed a knowledge of it other than that derived from the words themselves. The second exercise was a

LESSON ON SIZE.

Review of C class, primary. Ages of children, 5 to 7. They had attended school nine months; have had instruction in size during some eight weeks, about twenty minutes per day.

The children were requested to hold their forefingers one inch apart while the teacher measured the space between them.

Then children were required to draw lines on the blackboard an inch in length, and others to measure them, stating whether too long, too short, or correct.

Next they were required to tear papers an inch in length; then to tear them two inches in length; then to fold them three inches in length, and so on, the teacher measuring them meanwhile. At least two out of each three tore and folded their papers of the exact length named.

Then the children were requested to draw lines on the blackboard one foot in length, then to divide them into twelve inches.

They readily measured inches, and feet, and yards, both with the rule and with the eye, and drew lines representing them, showing that they understood the relations of these to each other, as well as the lengths of each.

FORM AND SIZE.

Review of A class, primary. Ages of children from 7 to 9.

Teacher. Find me a solid whose surface is not divided. The children took from the table spheres and spheroids.

Teacher. Find me a solid whose surface is divided into two parts or faces—one divided into three faces—one divided into six faces. Now a solid with one plane and one curved face.

In each case, the children selected the correct object.

The teacher then called upon one pupil to draw upon the blackboard the plane face of a square two inches on a side; another one of a square six inches on a side; another of a rhomb two inches on each side; an equal triangle one inch on a side; a plane face of a cylinder three inches in diameter; a square twelve inches on a side. The children then drew lines of various lengths, as called for by members of the Committee; also plane figures of various sizes, and, among others, circles two feet in diameter, then of two feet in circumference.

The teacher called upon the children, one at a time, to select laths of given lengths, and place them on the floor so as to represent the elevation of one end of a house. Another pupil drew each part of the house on the blackboard as it was represented by the laths.

TUESDAY AFTERNOON.

LESSON ON FORM.

Showing the transition from Form to Elementary Geometry. Review of C class, junior. Ages of children, 9 to 12.

The children drew lines on the blackboard, and described them. They represented, and then gave definitions of a point, straight line, length, direction, and of the distinction between different kinds of angles.

A pupil drew upon the blackboard a horizontal line, and an oblique one intersecting the first, and then proceeded to demonstrate that, "if two straight lines intersect each other, the opposite or vertical angles are equal." In giving the demonstration, the pupils used letters to designate the lines and angles. At the suggestion of one of the Committee, figures were substituted for the letters, and one of the same pupils called to demonstrate the proposition. The readiness with which the pupil went through with it, using figures in place of letters, was very satisfactory to the audience, their approbation being manifested by applause.

LESSON ON COLOR.

Review of C class. Ages of children, 6 to 8. Object of the lesson—to cultivate the perception of color.

Worsted, and cards of various colors, were placed upon the table. The teacher called upon one child to select all the reds, and place them together; another, to select all the yellows, and place them together; another, the blues; another, the greens, etc.

The children were then requested to name all the red objects that they could see in the room; then those of the other colors successively.

Next, one child was called upon to name a color, and another to name an object of the same color. Then one child would name an object, and another name its color.

DISTINGUISHING SHADES AND TINTS OF BLUE.

The teacher next proceeded to give a *new lesson* to the same class, the object of which was "to teach the children to distinguish blue, and its shades and tints."

The teacher requested the children to find the bluest of the blue objects on the table. They having selected cards which the teacher pronounced correct, she took the cards, told them all to close their eyes, then she placed the same cards upon the table again among the other blue ones, and requested the children to find them again. When they could readily select the bluest cards, the teacher told them that the bluest blue is called the *standard blue*. Then the children were exercised in finding the standard blue.

Next, two cards were held up, one dark blue and one light blue, and the children told that the light blue is called a *tint of blue*, and the dark blue a *shade of blue*—the *tint* is lighter than the standard blue, and the *shade* is darker than the standard blue. Then the children were exercised in finding *tints* and *shades* of blue.

LESSON IN MIXING COLORS.

Review of A class, primary. Children from 9 to 10 years of age.

The children were led to distinguish primary, secondary, and tertiary colors from mixing colors. The teacher held up vials containing liquids of red, yellow, and blue. She then mixed some of each of the *red* and *yellow* liquids, and the children said the color produced by the mixture is *orange*. She then mixed *yellow* and *blue*, and the children said that *green* had been produced. Then she mixed *blue* and *red*, and *purple* was the result.

The teacher printed the result of each mixture on the blackboard thus:

First Colors, or Primaries.		*Second Colors, or Secondaries.*
Red + Yellow	=	Orange.
Blue + Yellow	=	Green.
Blue + Red	=	Purple.

Next she proceeded to show how the idea and term *tertiary* is derived from the secondaries by mixing the secondaries, and printing the result on the board as before:

Secondaries.		*Third Colors, or Tertiaries.*
Green + Orange	=	Citrine.
Orange + Purple	=	Russet.
Purple + Green	=	Olive.

After the children had read over in concert what had been printed on the board, it was erased, and the pupils were required to state from memory what colors are produced by mixing primaries, with the names of each secondary; also, what by mixing the secondaries, and the name of each tertiary. An exercise on *Harmony of Colors* was then given to the same class of children. They were requested to select two colors that would look well together, and place them side by side; then two were placed together that do not harmonize. During these exercises, the teacher printed on the board,

Primary *yellow* harmonizes with secondary *purple*.
" *red* " " " *green*.
" *blue* " " " *orange*.

This was read by the pupils, then erased, and the individuals were called upon to state what color will harmonize with these several colors, as their names were respectively given.

TUESDAY EVENING.

The exercises were held in Doolittle Hall, and were witnessed by a large audience. First there was given a

LESSON ON OBJECTS—5th STEP,

to the B class, junior school, the aim of which was to lead the children to distinguish *acids* from *alkalies*, and to show some of the effects of each.

A class of boys and girls were arranged upon the stage so that they could observe the vials of liquids and solids upon the table in the centre. After introductory remarks by the teacher, alluding to the classification of children in school according to their knowledge, she requested one to arrange the vials upon the table into classes. He placed the vials containing solids in one group, and those containing liquids in another. The teacher remarked that, although that was one way to classify them, yet there was a better way, and that was by tasting, placing those which have a similar taste in the same class.

The children were each given some cream of tartar to taste; they pronounced the taste *sour*. The name of the substance was written on the blackboard. Then they were given some sal soda to taste, and they said it tasted "bitter and burning." The name of this was written on another part of the board. The teacher then told the children that we called those substances which taste sour *acids*, and wrote the word *acids* over cream of tartar. She then told them that the name for those substances which have a "bitter, burning taste," is *alkalies*.

This word was written over sal soda. Then the children were given some vinegar to taste, and required to tell in whieh column its name should be written. They gave "acids." The teaeher proceeded in a similar manner with *ley*; *pearlash*, *tartaric acid*, and *soda*, and the children designated the column in whieh the word should be placed. Some oxalic acid was produced, and the children told that it was poison, hence should not be tasted, but that it also was sour, and requested them to name the column in which its name should be written. The words on the blackboard were written thus:

ACIDS.	ALKALIES.
Cream of tartar.	Sal soda.
Vinegar.	Ley.
Tartaric acid.	Pearlash.
Oxalic acid.	Soda.

The children having learned a distinction between acids and alkalies, the teacher produced a vegetable dye, obtained by boiling a purple or red cabbage in water. She poured equal quantities into two glasses. Into one of these she poured some acid, and into the other a little alkali. The children were required to observe the effects of the acid and of the alkali upon the vegetable dye, and then to describe these effects.

Children. The acid turns the vegetable dye to a *red.* The alkali changes it to a *green.*

Teacher. Now what can you say of the *taste* of acids?

C. They taste sour.

The teacher now wrote on the board, "Acids have a sour taste"

T. What can you say of the effeet of acids upon a vegetable dye?

C. Acids turn vegetable dyes to red.

The teacher wrote this on the board also.

T. Now what can you say of the taste of alkalies?

C. They have a bitter, burning taste.

T. We call this bitter, burning taste of alkalies an *acrid* taste. What do we call the taste of alkalies?

C. An *acrid* taste.

The teacher wrote on the board, "Alkalies have an acrid taste."

T. What can you say of the effect of alkalies upon vegetable dyes?

C. Alkalies ehange vegetable dyes to green.

This was also written on the board.

Afterward the red and green dyes were mixed, when the whole assumed its original color. After trying similar examples with other aeids and alkalies upon the purple water or vegetable dye, the children were told that acids and alkalies *neutralize* or destroy each other. The teacher then wrote on the blackboard,

Acids and alkalies, when mixed together, neutralize each other.

Next a bottle partly filled with soft water was produced, and a little soft soap added, when it was given to the pupils to shake. Soapsuds were produced. A few drops of aeid were then added to the contents of this bottle, and on shaking it again the suds disappeared. Then a little ley was poured into it, and on being shaken suds were again produced. Then the children were led by another experiment to perceive that acids and alkalies neutralize each other when mixed.

A few other experiments were tried, illustrating in similar methods the processes of teaching children things and ideas before the words of description are given. Whenever the terms or words given by the pupils in describing what they saw were inappropriate, these were corrected by the teacher.*

WEDNESDAY MORNING.

LESSON ON ANIMALS.—THE SEAL.—3d STEP.

This was a *new* lesson, given to children of the average age of eight years, from the C class, primary school. The object of the lesson was to show the children how the parts of the animal are adapted to the habits of it.

The teacher held before the children a picture of the seal, upon land, by the side of open water.

T. Where, in this picture, do you see the animal?

C. On the land.

T. What do you see near it?

C. Water.

T. Where do you think it lives?

C. In the water.

T. Does it spend all of its time in the water?

C. No; it spends part of its time on land.

T. What other animals live in the water?

C. Fishes.

T. Fish breathe by taking the air from the water by means of their gills. The water and air passes into its mouth, and the water passes out through the gills. The seal breathes as we do, therefore he can not remain under the water as fish do. His head must be above the water to breathe. The seal feeds on fish. Now can you tell me why he goes into the water at all?

C. To catch fishes for food.

The teacher now printed upon the blackboard, "The seal can live in water and on land." This was read by the children. They now pointed out in the picture the parts of the seal, and described their shape. In developing the idea of round, the teacher showed the children a round and a flat object, and they named the one which most nearly resembled the shape of the body.

In developing the idea of tapering, the children were requested to point out the largest part of the body, and the smallest.

T. Why does the seal need a round, tapering body?

To develop this idea, they were asked which boat would move through the water most easily, one with a blunt end or one with a sharp end? Their attention was then called to the small head and tapering shoulders of the seal, and thus to its adaptation for moving through the water. The teacher then printed on the board,

The body of the seal is round and tapering.

This was read by the children in concert.

A picture of a fish was now shown, and the children requested to observe its shape. The teacher then led them to compare its organs of progressive motion

* At the close of this lesson, a paper, written by Miss Jones, of London, at present the principal of the Training School in Oswego, was read; also an address was delivered by N. A. Calkins, of New York. Both of these papers may be found at the close of this report.

with those of the seal, and to observe the adaptation of these organs to the special purposes for which they are designed.

C. The seal has broad, flat feet, which it uses to aid it in swimming.

This was printed on the blackboard.

T. Why would not fins suit the seal as well as they do the fishes?

C. Because the seal could not go on land with fins.

The children were then led to compare the covering of the seal with that of the fish, to show the adaptation of the warm fur to its mode of life. Their attention was also directed to the intelligence and docility of the seal, and the resemblance of its head, in shape, to that of the dog. His disposition was compared with that of the dog; humane feelings excited by describing the manner of hunting and killing the seals, and kindness inculcated.

As a summary, the children read what had been written on the board; then repeated it after it had been erased.

LESSON ON HORNS OF ANIMALS.—4th STEP.

A class, primary. Average ages 10 years.

The object of the lesson was to give a general idea of horns, their form, position, and uses.

Children were requested to name animals having horns. Afterward the teacher presented to them pictures of a cow, goat, and a deer, and the class were requested to observe them carefully, and to state how their horns differ.

C. The cow's horns have no branches; the goat's horns have no branches; the deer's horns have branches.

T. Look at the form of the horns.

C. The horns differ in form.

To lead the children to the idea of horns differing in position, lines were drawn upon the blackboard in different positions. When this idea had been gained, their attention was directed to the position of the horns of the cow. These were described as being *placed on each side of the head, and slanting upward and outward.*

The horns of the goat were described as *placed on the top of the head, and slant upward and backward.*

The horns of the deer are placed on the top of its head, and slant in different directions. These descriptions were printed on the blackboard.

To develop the idea of the shape of the cow's horns, a pair of horns was presented, and the children requested to describe them.

C. The horns of the cow are round, large at the base, and tapering.

The teacher not having a pair of goat's horns present, pointed to the picture, and told the children that the horns of the goat are more slender, and less curved than those of the cow.

Deer's horns were shown, and described as spreading out like the branches of a tree. The children were led to observe that the cow's horns are hollow, while those of the deer are solid. They were told that the goat's horns were also hollow; and that, while the cow's and goat's horns were fixed, or remained permanent upon the heads of these animals, the horns of the deer are shed every year, new ones growing each summer.

The attention of the children was called to the uses of horns to animals as weapons of defense, and of their uses to man in the manufacture of combs and various other articles.

LESSON ON SHELLS—3d STEP OF OBJECTS.

Given to a C class, primary; ages of children 5 to 6 years.

Object of the lesson was to lead the children to observe the parts of the shell, also to perceive the appropriateness of the names given to the parts.

The teacher, holding up a shell before the class, told them that an animal once lived in that shell, and then asked, "What do you live in?"

Children. Houses.

T. This was the house of an animal. Now I want you to look at it, and see if you can find different parts of this shell. James may point to some part of it.

The boy touched the small point at one end. The teacher said this part is called the *apex* of the shell. Now point to the apex of this cone; of the pyramid. The word *apex* was now printed on the blackboard.

Mary may touch some other part of the shell. She put her finger upon the largest part, or body of it; and the teacher said, this is called the *body* of the shell, and printed the word on the board.

Pointing to the whorl on the shell, the teacher said, "Look at this; see how it winds around the shell; this part looks as if it whirled around, so we call it the *whorl*." This word was also printed on the board.

The opening of the shell was pointed at, and the children asked to give it a name. No one replied, and the teacher requested a boy to open his mouth, and the other children to look at it, upon which several of them suggested the word *mouth* as a good name for the opening of the shell. This was printed on the board, and the children told that it is the name for that part of the shell.

Next the edges of the mouth were pointed at, and the children referred to parts of their own mouths for a name. *Lips* was readily given, and printed on the board.

The groove leading to the mouth was pointed at, and the children told to call it a *canal.* The word was then printed.

The attention of the children was directed to the lower part of the shell, containing the canal, and the children asked if they had ever seen any part of a bird that resembled it in shape. "The bird's beak," was the reply. "That is right; and we will call this the beak of the shell," said the teacher. This word was also printed on the board.

A child was now called to take the shell and point out the parts as the children named them. The teacher pointed out the parts, and the children named them.

LESSON ON SHELLS—4th STEP OF OBJECTS.

Given to an A class, primary, ten children. Ages 8 to 10.

Object of the lesson, to show the use of shells, their formation, and general classification.

The children were shown several shells, and asked where they are found.

Children. On the lake-shore, the sea-shore, and in rivers.

T. How are shells obtained from the sea?

C. The waves wash them on shore.

T. The creatures found inside of the shell are called mollusks. The word was written on the blackboard, and the children told that it means soft. To develop this idea, the children were directed to press their fingers upon their cheeks, then upon their forehead, and to tell how they feel. They were asked whether they had seen oysters, and how they feel; and why they feel soft? The answer obtained was that the oyster has no bones.

T. What can we say of the oyster because it has no bones?

C. It is boneless.

The teacher printed on the board, and the children repeated together,

Mollusks are soft and boneless.

The children were referred to the white cold fluid or blood of the oyster, and it was compared with their own red warm blood.

The teacher wrote on the blackboard,

The blood of the mollusk is cold and colorless,

and the children repeated it together.

The shells were given to the children to examine, and see if they could tell of what materials they are made, and who made them. To develop the idea of their formation, a piece of chalk was shown, and the children told that one of the substances of which the shell is made was like that. They were asked if a shell made of so brittle a substance would be strong. The children were now told that the shell is made of lime which is obtained from the water, and this is mixed with a gluey substance, which the mollusk obtains from a portion of its own body, to stick it together. They were shown the smooth, polished outside of the shell, and told that the mantle which covers it deposits a substance which hardens and forms the beautiful polished surface. The children were also told how the little mollusk increases the size of its shell from year to year, as the animal itself grows larger, by making additions on the edge of the shell. Sometimes, when the shells are dashed against the rocks by the waves and broken, the mollusk repairs the broken part.

The idea that the shells are a means of defense for the mollusk was developed, and the teacher wrote on the board,

Shells serve as a house and armor to the mollusk,

and the children repeated it. Following this, the idea of God's wisdom and goodness was presented in providing every thing so wisely for these little animals.

The teacher also gave some exercise in the classification of shells into univalves, bivalves, and multivalves. And, as a summary, the pupils read from the blackboard,

Shells are inhabited by animals called mollusks.
Mollusks are soft and boneless.
The blood of the mollusk is cold and colorless.
Shells are composed of lime and a kind of gluey substance.
Shells serve as a house and armor to the mollusk.

WEDNESDAY AFTERNOON.

Exercises were held in the school-room.

LESSON ON PLACE.

A review of a C class, primary. Ages of children 6 to 7 years.

The Object of the lesson was to distinguish and define place, as nearer, farther, between, to the right, to the left.

2d. To represent objects in these relations.

3d. To distinguish the cardinal and semi-cardinal points.

First, objects were placed on a table, and the children requested to observe the position of each, after which the teacher would remove them, and call upon individuals to put them in the same position again. Then the position of these objects on the table were *represented* by drawing on a slate held in a horizontal position. Then the same positions were represented by drawings on the blackboard. Children were called upon to point with their fingers; also to walk in different directions; also to tell in what direction they must walk to go from their seat to some given part of the room. The teacher would name a point of compass, and request the children to point toward it, while she would point in some other direction. This made each pupil think and act for himself.

LESSON ON PLACE.

Given to the A Class, primary. A review. Children, average age 9 years.

An outline map of the city of Oswego was placed before the class, and the children were required to point out the various localities, tell the distance of one from another, the direction in which a person must go in proceeding from one place to the other. The outline map was drawn on a scale of one foot to the mile; the pupils ascertained distances, after estimating by the eye, by taking a tape measure and ascertaining the number of feet from one point to the other.

A drawing of the school-room made to a scale, previously placed upon the blackboard, was exhibited.

Rivers, lakes, canals, dams, locks in canals, etc., were described by the pupils in answer to questions by members of the Committee.

LESSON ON NUMBER.

A review of the C class, primary. Ages of children 6 to 7 years.

The object of this exercise was to show how addition, subtraction, and multiplication are worked out with objects.

The children were arranged in front of a shelf containing pebbles in boxes or compartments. The teacher said to the first pupil, "I will give you 1 pebble; how many must you add to it to make *ten?*"

To the next she said, "I will give you 3 pebbles; how many must you add to these to make ten?"

To the next, "I will give you 2 pebbles; how many must you add to make ten?"

The children would proceed to take other pebbles from the boxes, and counting, add enough to make ten. As each finished the number, the hand would be raised. When all had completed the number assigned, the teacher commenced by asking the first pupil, "How many did I give you?"

Child. "One."

T. "How many did you add to make ten?"

C. "Nine."

T. (To the next pupil.) "How many did I give you?"

C. "Three."

T. "How many did you add to make ten?"

C. "Seven."

In this manner the teacher kept all the pupils at work, and each at work on a separate problem. Subsequently the pupils were requested to see in how many ways they could arrange given numbers. One was to arrange the number *five* in as many ways as possible, as 4 and 1, 2 and 3, 2 and 2 and 1, 2 and 1 and 1 and 1, 1 and 3 and 1, etc. Another was told to arrange *six*, another *seven*, another *eight*, in as many ways as they could with the pebbles.

The teacher gave them numbers, and then told them to take away less numbers, as, "I give you 8 pebbles; take away 5, and tell me how many remain," etc.

The teacher having placed six marks on the board thus, | | | | | |, rubbed out *two*, and asked, "What have I done?"

C. "Rubbed out two marks."

T. "How many marks remain?"

C. "Four marks."

T. "What may you say, then?"

C. "*Two* from *six* leaves four."

Then seven and eight marks were treated in the same way.

Again, the teacher gave them 2 and 2 and 2, to state how many 3 twos are. Then she asked how many are 4 twos, 2 threes, 5 twos. In each instance the pupils represented the numbers by arranging pebbles in groups corresponding with these numbers.

This exercise was followed by a lesson to show how children were first taught multiplication. The teacher placed two pebbles on the table, then two more, and asked, "How many pebbles were on the table?"

C. "Four pebbles."

The teacher then made two marks on the board, then two more, thus: | | | |, and asked, "How many are two marks and two marks?"

C. "Four marks."

Then the teacher placed three pebbles on the table, then three more, and asked, "How many pebbles are on the table?"

C. "Six pebbles."

She then made three marks thus, | | | | | |, and asked, "*Three* marks and *three* marks are how many marks?"

C. "Six marks."

Subsequently the teacher would change the question by saying, "How many are two times two pebbles?" "How many are two times two marks?" etc.

LESSON ON NUMBERS.

Given to the A class, primary. Age of children 8 to 9 years.

The design of the lesson was to show the relations between addition, multiplication, and division.

The teacher wrote on the blackboard, and the children repeated the following:

$3+3=6$, $6+3=9$, $9+3=12$, $12+3=15$, etc., up to 99. Then the teacher wrote $99-3=96$, $96-3=93$, and so on down to $6-3=3$.

Then	$6+6=12$,	$12\div6=2$,
	$6+6+6=18$,	$18\div6=3$,
	$6+6+6+6=24$,	$24\div6=4$, and so on.

The children read $6+6=12$, two times 6 are 12, etc.

$7+7=14$,	$14\div7=2$,
$7+7+7=21$,	$21\div7=3$,
$7+7+7+7=28$,	$28\div7=4$, and so on to 100.

Children read $7+7=14$, two times 7 are 14. 14 divided by $7=2$. $7+7+7=21$, three times 7 are 21. 21 divided by $7=3$.

Such lessons as these the children placed upon their slates while at their seats between class exercises.

LESSON ON LANGUAGE.

Given to the C class, primary. Age of children 7 to 9 years.

The children were requested to name something that is *hard.* They mentioned, and the teacher wrote on the board the following:

Coal is hard.
Wood is hard.
Gold is hard.
Iron is hard.

The teacher inquired if any one in the class could tell her how to write the same in one sentence. Several hands were raised, and one pupil said, "Coal, wood, gold, and iron are hard." This was written upon the board.

Then the pupils were asked to tell some quality of glass. They repeated, and the teacher wrote upon the board,

Glass is colorless.
Glass is hard.
Glass is transparent.
Glass is brittle.
Glass is smooth.

Then the pupils were requested to tell how to write these qualities in one sentence. They said, "Glass is colorless, hard, transparent, brittle, and smooth." This sentence was placed on the board.

LESSON ON LANGUAGE.

Given to the A class, primary. Ages 9 to 10 years.

This lesson in language was designed to teach the pupils discrimination in the use of descriptive words.

The children were to give any term which may be used in describing a face, and the teacher wrote them on the board as mentioned. They gave *pretty*, *homely*, *white*, *rosy*, *freckled*, *wrinkled*, *blushing*, *happy*, *bashful*, *sad*, *pale*, *cheerful*, *thin*, *sorrowful*, *sour*, *ugly*.

When a sufficient number of words had been written upon the board, the teacher called up a pupil to mark each word that may be used to describe one face. The first pupil marked words making the following description: "Happy, thin, wrinkled, pleasant, pale, pretty, white, cheerful face."

Another marked "Ugly, freckled, homely, sour face."

When one of the pupils chanced to mark words that expressed opposite qualities, as pretty, homely, cheerful, sour, the others made the correction.

THURSDAY MORNING.

The exercises of this forenoon were held in the school-room. The opening exercise was a lesson in *Moral Instruction.* The teacher placed a colored engraving (representing Moses stretching his arm over the Red Sea, the children of Israel crossing over on dry land, and the pillar of fire) on a stand, in view of the entire school. The teacher read a simple description of this event from a little volume entitled "Line upon Line," then called upon several of the children to point out on the picture the objects mentioned in the lesson from the book, also to answer questions relative to the event. At the close of this exercise the school arose and repeated together the Lord's Prayer. The entire exercise seemed very interesting to the children, all of whom gave strict attention, and it was a beautiful sight to the observers.

OBJECT LESSON.—3d STEP.

Given to the C class, primary. Children 6 to 7 years of age.

The object of the lesson was to develop one quality—the idea of *malleability*, and give the term.

The children were shown pieces of lead, and asked to say something about it.

Children. Lead is heavy. Lead is gray. Lead shines when cut. Lead is opaque. Lead is tenacious.

The children handle the lead, passing it around. The teacher beats a piece of lead with a hammer, and having flattened it so that it is quite thin, she shows it to the children again. They say it has been flattened. The teacher then added, "Lead will flatten by being beaten, and because we can flatten it by beating it we say *lead is malleable.*" The children repeat this.

Next the teacher pounded a stone, and asked if it would flatten by beating it. She then asked, "Is the stone malleable?"

C. Stone is not malleable.

T. Why?

C. Because we can not flatten it by beating it.

The teacher then pounded a piece of chalk, that the children might see that we can not flatten it as we can lead, and hence that is not called malleable. The pupils were now requested to mention other objects that are malleable. They having named several, she inquired, "Why are these objects said to be malleable?"

C. Because we can flatten them by beating them.

The teacher and pupils then repeated together, *Any thing that can be flattened by beating it is said to be malleable.*

LESSON ON ANIMALS.—THE IBIS.—3d STEP.

Given to a C class, primary. Ages 7 to 8. The object of the lesson was to show parts, and the adaptation of these to the habits, mode of life, etc.

The teacher held the picture of the ibis before the children, and called upon one to come and point out some part of the bird. The child pointed to the head.

T. What can you say of the head of the ibis?

C. The ibis has a small head.

Another comes and points to the eyes, and says, "The ibis has small eyes." Another points to its beak, and says, "The ibis has a long, curved, tapering, sharp beak."

T. Why do you say the beak is tapering?

C. Because it is smaller at one end than it is at the other.

The children were requested to observe the neck, and one was called to point to it in the picture and describe it.

C. The ibis has a long, slender neck."

T. What can you say of its legs?
C. It has long slender legs.
T. Where do you think it lives?
C. In swampy places.
T. Why?
C. Because it has long legs.
T. Why does it need a long neck?
C. To reach down in the water and mud to get its food.
T. Why would not short legs do as well?
C. The waves would wash him away.
T. Why does he have a long beak?
C. So it can reach its food without putting its head under the water.

OBJECT LESSON.—PEPPER.

Given to an A class, primary. Ages of children 9 to 10.

Object of the lesson to develop qualities of the object. Grains of pepper are shown to the children. They say it is vegetable. The teacher prints on the board, *Pepper is a vegetable.*

The children say it is hard. One of them spells hard, while the teacher prints, *Pepper is hard.*

After tasting it, they say, "Pepper is biting—pungent." This is printed on the board as the children spell the words.

T. Why do you say pepper is pungent?
C. Because it has a burning taste.
T. Can you think of any thing else that can be said of pepper?
C. It is black. It is rough. It is spherical.

These sentences were placed on the board as the words were spelled. All-spice was shown them, and the two compared. They said, "Pepper is rough, and allspice is smooth."

T. What can you say of its uses?
C. It is used for preserving things.
T. What else may be said of it?
C. Pepper is stimulating, because it has a burning taste. It is wholesome.
T. It grows in very warm countries, hence we say it is *tropical.* It does not grow in our country, so we say it is *foreign.*

This was followed, as usual, with a brief summary of what had been gone over, to fix the important points in the memory.

A CLASS FROM A COUNTRY SCHOOL INTRODUCED.

In accordance with a request of the Committee of Examination, and that they might see the first steps in teaching children who have never had any instruction by the system of Object Lessons, a class of children was procured from a school outside of the city and placed before one of the teachers.

There was placed on the table before them cubes, spheres, cylinders, cones, and other solids.

The attention of the children was first called to a sphere. They were told to observe its shape; then its name was told them, and they required to repeat it. Then they were requested to select a sphere from the objects on the table; then to point to other objects having the same shape. The children having learned to distinguish this form, their attention was called to the cylinder, and they were led to select others like it. Then its name was told them. Afterward they were requested to look about the room and find something that had the shape of the cylinder. The children pointed to the stove-pipe, also to the pillars in the centre of the school-room. It was observed that the children distinguished resemblances in different objects much more readily at the close of the exercise than at its commencement.

The same class was next placed in charge of another teacher. She undertook to develop the idea of *vegetable.*

A small rose-bush was shown them, and they were asked if they had ever seen any thing like it before. Then they were requested to name some other plant which they had seen. They mentioned rose-bush, gooseberry, currant. They were asked what plants they eat which grow in the garden, and their reply was "Cabbage."

They were shown a picture of a leaf and a real leaf, and an effort was made to teach them to express a distinction between them; but it was discovered that they were German children, and had learned so little of our language that the teacher must explain new words which expressed qualities to them in German before they could comprehend them.

THURSDAY AFTERNOON.

Exercises were held in the Court-house, and devoted to

PHONETIC READING.

Exercises were given with a C class, primary, in the 1st, 2d, 3d, and 4th steps.

1*st Step.* Teaching letters by their *forms.*

I was described as one perpendicular line.

V " " " two slanting lines.

D " " " one perpendicular line, and one curved line on the right, touching the perpendicular line at the top and bottom.

B was described as one perpendicular line, and two curved lines on the right, touching the perpendicular line at the top, in the centre, and at the bottom.

The design of this exercise was, *first,* to secure accurate observation; *second,* to secure accurate expression. These were to constitute the foundation of subsequent teaching.

The children were also given slips of straight and curved pasteboard, from which to form these letters and then to tell their names.

2*d Step.* The sounds of the letters were repeated as simple vocal exercises, without referring them to the letters which represent them.

3*d Step.* Now initial consonants were combined with syllables consisting of a vowel followed by a consonant, as,

b—ud,	bud,	d—og,	dog,
c—ot,	cot,	c—at,	cat,

In this exercise, the powers or sounds of the letters only are used.

4*th Step.* Here two initial consonants were used, as,

bl—ack,	black,	br—ay,	bray,
cl—oth,	cloth,	br—ow,	brow,

The meaning of the words are given in this step.

The 5th and 6th Steps were illustrated with the A class, primary, children about 9 years of age.

Anomalous sounds were considered, and the same sounds represented by different characters, also the same characters representing different sounds.

5th Step. The three sounds of *ch*, also silent letters, initial, central, and terminal letters, were considered:

Ch has the English sound, as in church, chair, chap, chip, chin, chat.

Ch has a hard sound, as in chyme, churn, choir, etc.

Ch has a French sound, as in Chicago, charade, chaise, Chemung, etc.

The words showing examples of these different sounds were given by the pupils, while the teacher wrote them on the blackboard.

Initial silent Letters.—H is an initial silent letter in hour, honor.

Central silent Letters.—D and G are central silent letters in bridge, edge, sign, etc.

Terminal silent Letters.—B and N are terminal silent letters in thumb, plumb, autumn, hymn.

6th Step. Sounds expressed by ou; and long sound of o expressed by different letters; classification of letters, and rules of spelling.

The proper sound of o is expressed by ou in ground, found, round.				
" long	"	o	"	" " " soul, mould, court.
" broad	"	o	"	" " " sought, fought.
" close	"	u.	"	" " " couple.
" long	"	u	"	" " " croup.

The long sound of o is expressed by different letters, as in oat, boat, floor, doe, chateau, sew, coast, sorrow.

Classification of Letters.—Letters are classified, with reference to their sound, into

Vowels, a, e, o, u, and semi-vowels, w, y; liquids, l, m, n, r, ng; mutes, sharp, p, t, f, th, as in thin; mute flats, b, d, v, th, as in then; diphthongs, i, oi, oy, and aspirate h.

In addition to the foregoing exercises, a few simple rules for spelling were deduced from examples of words given, and the exercises of the examination closed.

CONCLUSIONS OF THE COMMITTEE.

In view of all they have witnessed in the exercises, of which the foregoing are brief sketches, and in the light of the best information which they have been able from various sources to obtain upon the subject of "Object Teaching," and what is known as the Pestalozzian system generally, they feel warranted in giving expression to the following conclusions:

1. That the principles of that system are philosophical and sound; that they are founded in, and are in harmony with the nature of man, and hence are best adapted to secure to him such an education as will conduce in the highest degree to his welfare and happiness, present and future.

2. That the particular methods of instruction presented in the

exercises before us as illustrative of those principles merit and receive our hearty approbation, subject to such modifications as experience and the characteristics of our people may determine to be wise and expedient.

In conclusion, the Committee beg leave to present in the form of resolutions the following recommendations:

Resolved, That in the opinion of your Committee, the System of Object Teaching is admirably adapted to cultivate the perceptive faculties of the child, to furnish him with clear conceptions and the power of accurate expression, and thus to prepare him for the prosecution of the sciences or the pursuits of active life; and that the Committee do recommend the adoption of the system in whole or in part, wherever such introduction is practicable.

Resolved, That this system of primary education, which substitutes in great measure the *teachers for the book*, demands in its instructors varied knowledge and thorough culture; and *that attempts to introduce it by those who do not clearly comprehend its principles, and who have not been trained in its methods, can result only in failure.*

All which is respectfully submitted.

(Signed) WM. F. PHELPS,
D. H. COCHRAN,
DAVID N. CAMP,
THOMAS F. HARRISON,
H. P. WILBUR,
GEO. L. FARNHAM,
W. NICOLL,
Special Committee on Report.

Approved by the General Committee, and read before the Convention, in Doolittle Hall, on Thursday evening, February 13th, 1862.

The following paper, written by Miss M. E. M. Jones, of London, was read on Tuesday evening by Mr. E. D. Weller.

THE LAWS OF CHILDHOOD.

The merit of the Pestalozzian system is that, recognizing the character of children, it adapts itself to this, doing invariably and systematically what all good parents and teachers do often and intuitively.

Pestalozzi recognized the nature of a child as threefold—physical, mental, and moral. He demanded that this nature should be aided in developing itself simultaneously, harmoniously, and progressively. He noted the threefold characteristics of this threefold nature, and said, "The chief characteristic of a child's physical nature is activity; of his intellectual nature, love of knowledge; of his moral nature, sympathy. No educational system can suit him unless it works by these."

I. Activity is a law of childhood. Its abuse produces restlessness, love of mischief, etc. It were not too much to demand that the number of hours devoted by growing boys and girls to physical exercise, in some shape or other, should equal those devoted to intellectual exercises. This the teacher can not secure. She can, however, insist (as a necessary condition of work) that her pupils shall have two recesses in the morning, and one in the afternoon, each twenty minutes long; that during the time of recess they be not constrained to quietude; for children, unless asleep, can not rest without they play, and they can not play without making a noise; that they shall sit and stand alternately; that they shall have physical exercise between each lesson, unless singing or recess intervene, and that the remainder of the time be honestly occupied in school work.

It is really a sad sight to see young children permitted neither to work nor play, but kept in their seats for two or three hours under pretense of studying. Were schools instituted for the purpose of training little ones to the love of mischief and to idleness, they could hardly adopt better means to secure such an end. To divide a school into two sections, to take *each* alternately, and, while teaching one, to provide the other with something to do (the doing of which is to be tested), as copying printed columns of words, arranging patterns of forms or colors, weighing, measuring, working number exercises on slates or blackboards, drawing the school-room to scale, reproducing on their own slates lessons in spelling or in language. All *this* requires not only the necessary apparatus, but *training*, *energy*, and moral influence on the part of the teacher. It *is* easier, to be sure, to remain in one's seat, calling up one class at a time, and hearing these read and spell in turn, while the rest are commanded "to keep studying."

Now that another method of keeping school is introduced consistently with the greater energy expended by teachers and children, the number of school hours ought to be diminished. It has been amply proved that the children of the Home and Colonial Schools, London, now attending school during five hours, make greater progress than they formerly did in six.

I shall not be surprised to find the number of hours reduced to four. Edwin Chadwick, J. Currie, and other educators, who can speak as having authority, declare that more than four hours in the day can not advantageously be spent in school by children less than eight years of age.

Even in the case of elder children, I should not be inclined to add to the four hours; but I would diminish, and at length dispense with the intervening physical exercises, recesses, etc. Gymnastics and drilling are good, but these can have another time set apart for them; and as soon as the scholar is able to work alone, he should be required to spend at first twenty minutes, and ultimately, perhaps, two hours in the performance of an appointed task, not merely in preparation for recitation, but in writing exercises, and in the reproduction of the oral lessons he receives from his teacher, etc.

To make these oral lessons worth recording, indeed to insure them as being of any value at all, they must be well prepared. Much, if not all the time gained by the teacher will be devoted to this. In Germany or England, a trained teacher (and untrained teachers are not recognized) would no more think of addressing her scholars without preparation, than a lecturer his audience, or a minister his congregation.

II. *Love of knowledge* is a law of childhood. The abuse of this produces idle and impertinent curiosity. It is a simple fact, that the appetite of a child for knowledge is as keen as his appetite for food. If we say we find it otherwise, it is because we give him words when he knows not what they express, signs when he knows not what they symbolize—the husk instead of the kernel; or if, indeed, the kernel is there, he can not get at it through the shell. The maxims laid down by Pestalozzi for the mental training of children are as follows:

"1*st.* Reduce every subject to its elements. One difficulty at a time is enough for the mind of a child, and the measure of information is not what you can give, but what he can receive.

"2*d.* Begin with the senses. Never tell a child what he can discover for himself.

"3*d.* Proceed step by step. Take not the order of the subject, but the order of nature.

"4*th.* Go from the known to the unknown, from the idea to the word, from the signification to the symbol, from the example to the rule, from the simple to the complex."

Formerly we reversed all these rules. Our usual plan of teaching children to read and spell is a good example of their violation. Let us, on the contrary, follow these rules, and we ascend

From *Form* to *Geometry;*
" *Place* to *Geography;*
" *Weight* to *Mechanics;*
" *Size* to *Proportion in Drawing and Architectural Designs;*
" *Number* to *Arithmetic and Algebra;*
" *Color* to *Chromatography;*
" *Plants* to *Botany;*
" *Animals* to *Zoology;*
" *Human Body* to *Physiology;*
" *Objects* to *Mineralogy, Chemistry, etc.;*
" *Actions* to *Arts and Manufactures;*
" *Language* to *Grammar.*

With reference to this ascent, Pestalozzi noted,

First, the order in which the faculties are developed with respect to one another; and,

Secondly, the order in which each develops itself with respect to its objects:

1. First, the perceptive Faculty;
   Secondly, the Conceptive Faculty;
   Thirdly, the Reasoning Faculty.
2. In the exercise of the Perceptive faculty, the *perception of likeness precedes the perception of difference,* and *the perception of difference perceptions of order and proportion.*

In the exercise of the Conceptive faculty, *concepts of things physical precede concepts of things imaginary*, and *concepts of things imaginary concepts of things metaphysical.*

In the exercise of the Reasoning faculty, *the power of tracing effect from cause is based, chiefly, on the perception of order; the power of tracing analogies on the perception of likeness; the judgment on the perception of difference.*

III. *Sympathy* is a law of childhood. Pestalozzi argued that *young children can not be governed by appeals to conscience, veneration*, or the love of the beautiful, because in them these sentiments are not yet developed. Still less are they to be governed by the excitements of emulation, as commonly understood, or of fear. True, the principle of emulation exists in the child, and a wise teacher will appeal to it, not with reference to his class-fellows, but to his task. The lesson, and not the schoolmate, is to be overcome. The latter is to be recognized not as an antagonist, but as a fellow-worker. The prize of success is not for *one*, but for *all.*

The principle of fear, too, exists in the child. It is right that he should be afraid to incur the displeasure of his teacher; but the fear of bodily pain merely is the lowest of all motives. It is hardly possible to cultivate the conscience of a child who is brought up under its influence; for, if he do right from fear alone, he will certainly do wrong whenever he judges he has a chance of doing it undetected. This every one knows.

Concerning fear and emulation, as employed by unwise teachers, Pestalozzi wrote, "Moral diseases are not to be counteracted by moral poisons." He maintained that very young children were to be governed by *sympathy;* that the teacher can, and does communicate her own spirit to the scholars. "Do and be," said he, "what you wish your children to do and be." "Work *with* the will, not against it."

Furthermore, he showed that this sympathy, as a motive to action, must be gradually superseded by the *rule of right*, so soon as the children are able to recognize and apply the latter; for all good government tends to self-government—all good education, in childhood, tends to self-education.

May the children of our schools progress from suitable impressions to befitting habits; from good feelings to right principles; from submission to the impulse of fear to obedience to the dictates of conscience; from love of friends to the love of God.

After the reading of the paper on the "Laws of Childhood," the following Address was delivered by Mr. N. A. Calkins, of New York, on

THE HISTORY OF OBJECT TEACHING.

History furnishes no records of attention to elementary education prior to the seventeenth century. The ancients *neglected* the instruction of their children, although they provided schools of philosophy for their young men. The prevailing idea on the subject of education appears to have been that knowledge consisted in the memory of rules and words rather than in things and thoughts. The practice of teaching by requiring the pupils to memorize all lessons, without regard to an understanding of their meaning, had come down from the monastic schools of earlier ages. The principles of development by primary education were then unknown in all the plans of teaching.

Just before the dawn of the seventeenth century, a keen observer of nature and men, having noticed that artisans worked out their results by inductive processes of reasoning, also that the arts and sciences were progressing, while philosophy and education remained stationary, borrowed the principle of utility and progress from the workshops of his time, applied it to philosophy and education, and the world was aroused by the triumphal progress of a new system of philosophy which immortalized the name of Francis Bacon.

This philosopher taught that the powers of memory alone can do but little toward the advancement of science or education. He classed those school achievements in mere memory with the physical achievements of the mountebanks: "The two performances are much of the same sort. The one is an abuse of the powers of the mind; the other is an abuse of the powers of the body. Both may excite our wonder, but neither is entitled to our respect."

Although Bacon's attention was chiefly confined to philosophy, yet he struck the key-note of those great principles of education which have become the foundation of the most philosophical methods of teaching now practiced throughout the civilized world. Said he, "Men read in books what authors say concerning stones, plants, animals, and the like, but to inspect these stones, plants, and animals with their own eyes is far enough from their thoughts; whereas we should fix the eyes of our mind upon things themselves, and thereby form a true conception of them." Little, however, was accomplished during Bacon's time in devising plans for the primary education of children.

Early in the seventeenth century the inductive system of Bacon attracted the attention of a thinking, earnest teacher of Austria—John Amos Comenius. He seems almost to have been endowed with an intuition which gave him, to a remarkable degree, a knowledge of the true principles of education. He saw more clearly than any of his predecessors what was necessary for the improvement of the methods of instruction, and he soon made an application of the principles of Bacon's inductive system to primary education. In 1657 he published the first school-book in which pictures were used to illustrate the various topics discussed in it. This work continued to be a text-book in the German schools for nearly two hundred years.

Comenius was an evangelical preacher as well as an educator, and on the issue of a decree in 1624 that all persons must leave the Austrian dominions who would not become Catholics, he took his departure for Poland with thirty thousand families, of whom five hundred were of noble blood. As he came upon the range of mountains at the boundary, he paused to look once more back to his native land, and, with his brethren, fell upon his knees and prayed, with many tears, that God would not suffer His Word to be entirely destroyed in that country, but would preserve some seed of it there.

Who will say that those prayers were not answered, when, within five years afterward, Comenius was himself permitted to return and labor for the improvement of the schools of Bohemia.

Subsequently he went to Lissa, Poland, where he became president of the school, and bishop of the Moravian brethren—a sect which has been distinguished for its good schools wherever its colonies have been planted. Here he published his first work, the *Janua Linguarum Reserata*—a new method of teaching languages, in connection with instruction in the elements of the sciences. This work soon carried his fame to other lands, and every where it developed the necessity of a reform in education.

By an Act of Parliament Comenius was invited to England in 1641, to undertake the reformation of their schools. His labors there were defeated by the disturbances in Ireland and the civil wars. A similar invitation having been extended to him by the government of Sweden, he left England and went to Stockholm in 1642. War again interrupting his labors, he returned to Lissa. Subsequently he visited Hungary and other places to prosecute his efforts in behalf of education. Again he returned to Lissa, but only to encounter greater misfortunes. Amid the disturbances between the Catholic Poles and the Moravian Protestants, the city was burned, and he lost his house, his library, and his manuscripts, the labors of many years. He subsequently went to Holland, and found an asylum in the city of Amsterdam, where he reproduced several of his lost works. He died in 1671, at the age of eighty.

Comenius was the great educator of the seventeenth century. Such was his enduring earnestness that, although exiled from his native land, wandering, persecuted, and homeless, during the desolating thirty-years' war of that period, still he continued to labor unweariedly in the cause of education, not only inspiring several countries of Europe with an enthusiastic desire for a better system of instruction, but introducing new principles of education, which greatly modified the practices in teaching, and prepared the way, by gradual changes, for the more thorough reformation of schools which followed under the labors of subsequent educators.

In his educational works may be found the first promulgation of the principles and plans of Object Teaching, and of a graduated system of instruction adapted to the wants of the age in which he lived.

Some of his leading ideas on the subject of education we will briefly state: "Since the beginning of knowledge must be with the senses, the beginning of teaching should be made by dealing with actual things. The object must be a real, useful thing, capable of making an impression upon the senses. To this end it must be brought into communication with them; if visible, with the eyes; if audible, with the ears; if tangible, with the touch; if odorous, with the nose; if sapid, with the taste. First the presentation of the thing itself, and the real intuition of it; then the oral explanation for the farther elucidation of it."

But inasmuch as the presentation of the thing itself is so frequently impossible, he advised the use of pictures as the representatives of things, that the words which related to them might be understood.

The course of instruction laid down by Comenius commenced with infancy. During the first six years the children were to learn to know animals, plants, stones, and the names and uses of the members of their own body. They were also to be led to distinguish colors, and to delight their eyes with beautiful things. They should begin Geography with the knowledge of the room, the streets, the fields, the farm—Arithmetic, with counting objects—Geometry, with understanding the ideas of lines, circles, angles, length, breadth, an inch, a foot, etc.—Music, with hearing singing—History, with a knowledge of what happened to them yesterday and the day before—Chronology, with the knowledge of day and night, hours, weeks, and festivals.

The views of Comenius are so completely in harmony with the natural means of acquiring knowledge through the exercise of the senses, and with the laws of mental development, and also with the observations and experiences of many succeeding educators, that we deem the presentation of a few of his thoughts, in language more literally his own, due even in this brief history of Object Teaching. For the following extracts from his writings we are indebted to that most valuable of all collections of educational literature, *Barnard's American Journal of Education.*

Said Comenius: "The best years of my own youth were wasted in useless school exercises. How often, since I have learned to know better, have I shed tears at the remembrance of lost hours. But grief is vain. Only one thing remains; only one thing is possible—to leave posterity what advice I can by showing the way in which our teachers have led us into errors, and the method of remedying these errors."

His practical views of education may be discerned in the succeeding quotations:

"Instruction will usually succeed if it follows the course of Nature. Whatever is natural goes forward of itself."

"The first education should be of the perceptions, then of the memory, then of the understanding, then of the judgment."

"Instruction must begin with actual inspection, not with verbal description of things."

"To learn is to proceed from something known to the knowledge of something unknown; in which there are three things, the known, the unknown, and the mental effort to reach the unknown from the known."

"We first proceed toward knowledge by the perception and understanding of the present; and afterward go on from the present to the absent by means of the information of others."

"The attention should be fixed upon only one object at a time; and upon the whole first, and the parts afterward."

"A second point should not be undertaken until the first is learned; and with the second, the first should be repeated."

"Sight will supply the place of demonstration. It is good to use several senses in understanding one thing."

"To know any thing is to be able to represent it, either by the mind, or the hand, or the tongue. We learn, not only in order to understand, but also to *express* and to *use* what we understand. As much as any one understands, so much ought he to accustom himself to express; and, on the other hand, he should understand whatever he says. Speech and knowledge should proceed with equal steps."

"Hitherto the schools have done nothing with the view of developing children, like young trees, from the growing impulse of their own roots, but only with that of hanging them over with twigs broken off elsewhere. They teach youth to adorn themselves with others' feathers, like the crow in Æsop's Fables. They do not show them things as they are, but tell them what one and another, and a third, and a tenth has thought and written about them; so that it is considered a mark of great wisdom for a man to know a great many opinions which contradict each other."

"The schools are wrong in first teaching language and then proceeding to things. The thing is the substance, and the word the accident; the thing is the body, and the word the clothing. Things and words should be studied together, but things especially, as the objects both of the understanding and of language."

"In God are the original ideas, which He impresses upon things; things, again, impress their representations upon the senses; the senses impart them to the mind; the mind to the tongue, and the tongue to the ears of others. The mind thinks—the tongue speaks—the hand makes; hence the arts of speaking and working, and the sciences of things."

Such are a few of the principles in education which Comenius taught—and they have since been confirmed by the experiences of two centuries.

It is difficult to judge to what extent the later educators—Lock, Rousseau, and Pestalozzi—were indebted to Comenius for those principles which they severally taught subsequently, but we find much in the writings of each that is entirely in accordance with the teachings of this great pioneer in educational reforms. It is not too much to say that a careful study of the history of education would result in the conviction that many of the best methods of instruction, and the principles of education on which are based so great a number of the modern improvements in modes of teaching, were conceived and taught by Comenius more than two hundred years ago. He planted the seeds which have germinated from time to time, under the fostering care of various educators, and to-day we behold their most vigorous growth.

The labors of Comenius were performed during the first two thirds of the seventeenth century. John Locke, the distinguished English philosopher, lived during the last two thirds of that century. He urged, as the chief business of primary education, the development of the faculties of the child; that as the first ideas of children are derived from sensation, so the perceptive faculties should be the first cultivated or developed. The main elements of his methods of education were attention to the physical wants of the child, and the development of the intellectual powers through the instrumentality of things.

Rousseau, who acknowledged his indebtedness to Locke, and who embodied ideas similar to those of that philosopher in a treatise on education called "Emile," lived during nearly three fourths of the eighteenth century.

Pestalozzi was born about the middle of the eighteenth, and died soon after the close of the first quarter of the nineteenth century. He said: "Observation is the absolute basis of all knowledge. The *first* object then, in education, must be to lead a child to *observe* with accuracy; the second, to *express with correctness* the result of his observations." "The development of man commences with natural perceptions through the senses. Its highest attainment, intellectually, is the exercise of reason." Although we find no direct acknowledgment of Pestalozzi's indebtedness to Comenius, as we do of the relation of the latter to Bacon, no one can examine the systems of these educators of the seventeenth and nineteenth centuries without discovering many remarkable similarities. It was doubtless owing to the general diffusion of the *principles* so widely taught by Comenius that the *methods* for applying them, which were subsequently devised by Pestalozzi, became at once so popular and widely successful.

The dawn of the present century beheld Pestalozzi at Bourgdorf, engaged with Krüsi in making a more detailed application of those principles of education which were disseminated by Comenius a century and a half before, in methods chiefly devised by himself. While there, Pestalozzi wrote that work—"How Gertrude teaches her Children"—which attracted so much attention to his system of education from all parts of Europe.

As early as 1807 we find him in charge of the institution at Yverdun, where he attained his highest renown, and where he remained for nearly a quarter of a century. So widely had his fame extended, that persons went thither from almost every country of Europe, and even from America; not merely those who were led by the impulses which inspired him, but by the agents of kings and noblemen, and of public institutions, who desired to make themselves acquainted with his methods of teaching, in order to their introduction into other countries. No similar institution has ever attained so great fame, and no other has exerted so wide an influence on the methods of teaching.

Just before Pestalozzi opened his institution at Yverdun, he received a request from a philanthropic society in Paris to send a teacher there who could introduce his system of instruction into France. Accordingly, he selected Mr. Joseph Neef, who had been associated with him as a teacher, and who possessed the additional qualifications of understanding both the German and French languages. Mr. Neef went to Paris, and remained some two years, laboring with a good degree of success.

During the summer of 1805, Mr. William Mac Clure, of Philadelphia, while traveling in Switzerland, visited Pestalozzi's school, and was so much pleased with the system of teaching that he resolved to introduce it into America. On returning to Paris he sought out Mr. Neef, and invited him to come to this country.

"On what terms," said Mr. Mac Clure, "would you go to my country and introduce your method of education? I have seen Pestalozzi; I know his system; my country wants it, and will receive it with enthusiasm. I will engage to pay your passage, also to secure your livelihood. Go, and be your master's apostle in the New World."

So generous an invitation awakened an earnest desire in Mr. Neef to visit this country. He would fain have accepted it, but he did not know our language. "Two years shall be allowed you for acquiring that language, during which time I will support you," said this noble benefactor. This generous proposition decided the mission. Mr. Neef came to Philadelphia, studied the language, and in 1809 published a small volume setting forth, somewhat in the style of an extended prospectus, the plans and principles of a new method of education which he proposed to introduce into a private school that he should establish in the suburbs of that city. He labored there for several years, but from some cause, probably owing to his inability to adapt himself to the American mind and habits, his enterprise failed. Judging from a second volume which he issued in 1813, on language, he must have been not only impractical, but also have failed to comprehend the necessity of Americanizing the system instead of merely transplanting it.

He probably sought—to quote his own words, uttered in view of the fate which might attend his school—"some obscure village whose hardy youth want a schoolmaster;" for, said he, "to become an obscure, useful country schoolmaster is the highest pitch of my worldly ambition."

Although Pestalozzi founded his system on correct principles, he frequently erred in his practice of teaching. Many of his expedients for Object Teaching were faulty, and not even in accordance with his own system. In his zeal for the improvement of the mind itself, and for methods of instruction which were calculated to invigorate its faculties, he forgot the necessity of positive knowledge as the materials for thought and practical use in future life. So frequently did he violate his own system in the exercises of the school-room, that one of his intimate friends and admirers said of him, "His province is to educate ideas, not children." Nevertheless, he succeeded in reviving the true principles of teaching, and instituting the greatest educational movement of the century. He had the good fortune to associate with him Neiderer, Krüsi, Schmid, Zeller, and Fellenberg, to whose systematic development of his methods, and their dissemination of them, the subsequent success of his system is largely due. Many of his teachers even resigned to him whatever of fame and profit might come from publishing the manuals which they compiled for their respective branches of study while engaged as instructers in his institution.

During the subjugation of Germany under Napoleon, the minds of the ablest Prussian statesmen were eagerly occupied in devising means for raising the moral, mental, and physical character of the nation to a standard of elevated development, which, although it might be of little immediate use in their struggle for independence, yet might insure the success of such a struggle in the future. Among the prominent instrumentalities sought for this purpose was an improvement in their schools, by the introduction of the Pestalozzian system of teaching. The king, the queen, and the ministry looked upon this movement with hopes of the happiest results. Accordingly, extensive measures were at once taken to test these plans.

Carl August Zeller, who had been one of Pestalozzi's teachers at Bourgdorf, also at Yverdun, was engaged by the government of Prussia to organize normal schools for training teachers in this system of instruction. In addition to this means, several young men were sent to Yverdun, also to other similar institutions, to acquire the best methods of teaching. Thus, in a comparatively short time, a large body of competent instructors were scattered among the Prussian schools.

Introduced as the system thus was under the most favorable auspices, yet with some modifications, its spirit proved satisfactory in meeting the needs of the people for a more thorough intellectual development of the nation. This introduction was commenced about 1810, and in 1825 it had possession of the entire common school system of that country.

From Prussia and the German states the system of Pestalozzi has been widely diffused in other countries by visitors who went there for the purpose of examining the workings of their schools. It was partially transferred to France by Cousin and Jullien. The principles of this system now prevail in the best schools of England, Denmark, Switzerland, Prussia, Germany, Sardinia, Greece, and many of the colonies of Great Britain. The methods of teaching which prevail in the United States have been materially influenced by the promulgation of these principles.

Some thirty years ago efforts were made in Boston, and other portions of New England, to introduce the system of Pestalozzi into their schools by Prof. William Russell, William C. Woodbridge, Carter, Gallaudet, Alcott, and Dr. Griscom. Able articles were published on this subject by Prof. Russell, in the "*Journal of Education*," as long ago as 1829. In 1830 and '31, William C. Woodbridge wrote a series of articles for the "*Annals of Education*," describing the principles of teaching in the institution of Fellenberg, at Hofwyl, where improved methods of Pestalozzi's system were practiced. These articles treated chiefly upon the principles of the system, without giving details of the methods. Notwithstanding the diffusion of the principles of *Object Teaching* in this country during that period, its practice *died out through the want of teachers trained in the system and its methods.*

The institution of Pestalozzi, at Yverdun, was visited in 1818 by Dr. Mayo, of London, and about the same period by Dr. Biber and Mr. Greaves. Through the efforts of these gentlemen the system taught there was introduced into England. The success of this introduction was secured through the organization, in 1836, of the "Home and Colonial School Society," and the subsequent establishment of Training and Model Schools in London, for instructing teachers in its principles and methods.

In this introduction of the system of Object Teaching into England, it was found necessary to greatly modify the plans of instruction to adapt them to the Anglo-Saxon mind and character. In the schools of this society the system of elementary instruction by object lessons has been brought to a much greater degree of perfection than it attained even under the immediate supervision of the celebrated Swiss educator.

The Training Institution of London usually has about two hundred student teachers in attendance; and about one hundred graduate annually. Up to the present time some 3000 teachers have been trained there, and by them the methods of Object Teaching are gradually being diffused throughout England.

Something has been done toward introducing the plans of Object Teaching into the best schools of Canada. Visitors from the United States to the celebrated Normal and Model Schools of Toronto have caught glimpses of the system from time to time, and brought away many suggestions for improvements in their own methods of teaching.

About two years since, one who had long been dissatisfied with the results of the usual methods of elementary instruction, and who had been endeavoring to devise some more common-sense methods for primary schools than those which consisted of mere memory of words, while visiting the Model School of Toronto, found the books published by the Home and Colonial Society on elementary instruction. He procured these, together with pictures and other apparatus for illustrating the lessons, and, returning to the schools under his supervision, prepared his programmes, called his teachers together, gave them instructions, and commenced in earnest the introduction of Object Teaching into all the primary schools under his charge.

Many were the difficulties encountered. The methods of teaching were new alike to superintendent, teachers, and pupils. No one was at hand, familiar with the system, to give instruction either in its principles or methods. As a substitute for this, and the guidance of one trained in the practice of Object Teaching, once during each week teachers and superintendent met to compare notes of lessons and notes of progress. The oldest teachers, as well as the youngest, studied in preparation for the work before them.

The teachers became more and more interested in the system as they saw its results in their pupils. The interest of the pupils grew stronger as the teachers learned to practice the system better. Such were the efforts for the first systematic introduction of Object Teaching into the United States; and the honor of this achievement is due to the city of Oswego, her earnest superintendent, E. A. Sheldon, Esq., and her progressive Board of Education.

During the regular annual examinations for promotions, about one year ago, the subject of Object Lessons was added to the list of studies in which examinations were to be made. It was my pleasure to be present for several days, and witness the exercises. Notes from parents requesting that Henry, William, and Mary might be allowed to remain in the primary school another term, "they are so much interested in their Object Lessons," told in unmistakable language of its appreciation by the parents. They found their children becoming unusually interested in school, and more attentive and observing at home; and their hearts were gladdened in view of the changes that were being wrought in their boys and girls.

My own gratification has since been repeatedly expressed in words similar to the following: "To any one who may desire to see the practical operations of Object Teaching, and the best system of elementary instruction to be found in this country, let me say, make a visit to Oswego."

It was at length discovered that to meet the wants of their schools, and secure the complete introduction and continued practice of the system, a Training School was needed. Accordingly, application was made to the "Home and Colonial School Society" of London for a training teacher. They responded by sending Miss M. E. M. Jones, who arrived here on the first of May last, and immediately entered upon her duties.

In response to an announcement that a few teachers would be admitted in the class besides those engaged in the public schools of Oswego, a dozen other ladies assembled there on the 6th of August last. Others were subsequently admitted. Several members of this training class have already left to engage in teaching.

Rooms have been fitted up in the New York State Normal School at Albany for a Model School in Object Teaching, where the future graduates from that institution will be instructed in this system. This Model Department will be under the charge of a lady who was trained in the class at Oswego.

The Board of Trustees of the New Jersey State Normal School, appreciating the advantages of the system, sent a lady teacher to attend this training class, and defrayed her expenses, to prepare herself for introducing it into their school at Trenton.

Some of the practices of Object Teaching have been introduced into the Normal School at Ypsilanti, Mich., by the principal of that institution.

Already several cities and many towns are taking steps preparatory to its introduction, and some have been practicing its lessons for several months. Among those thus actively interested, we may mention Syracuse, New York, Paterson, N. J., Chicago, Ill., Toledo and Cincinnati, Ohio, Rochester, N. Y., San Francisco, and might add a large number of smaller places.*

The great interest manifested in this system of instruction is shown by the numerous articles on the subject which appear in the educational journals of the country, and in the repeated and

* Note.—The author of this Address has omitted to state some facts, of a personal nature, which are important to an accurate history of the present movement in primary education in this country.

In the summer of 1860, Mr. Calkins commenced the active preparation of a work on "Object Lessons," which was published in July, 1861. Within six months from its first presentation to the public it had reached its fourth edition, and it is used wherever there is any interest in Object Teaching. In addition to this, and in response to numerous invitations from Teachers' Institutes and Teachers' Associations, he has delivered lectures on this subject in various parts of the states of New York, New Jersey, Connecticut, and in Massachusetts. Of his labors in the State of New York, the State Superintendent remarks in his last Annual Report:

"A large number of school commissioners, having interested themselves in the subject, secured the services of N. A. Calkins, Esq.—a gentleman who has given the system much attention and study—who visited and conducted quite a number of institutes, lecturing upon the principles, and giving instruction in the practice of 'Object Teaching.' In this way the attention of many hundreds of our teachers has been directed to definite aims in the elevation of the character of the educational work."—*Board of Education*, Oswego.

numerous inquiries relative to its plans. Amid this general interest in the system, and the popular excitement concerning it, there is great danger that the well-meaning, but *not* well-informed, may make fatal mistakes in attempting to practice it. Object Teaching is based on philosophical principles, and the teacher must know what those principles are before she can apply its methods successfully. The true system of teaching takes Nature for its guide; its dangers lie in the want of observation and conformity to the relations of knowledge and the laws of mental development.

During the time of Pestalozzi, Yverdun was the fountain from whence the teachers of Europe and America sought a new and better system of education. When, subsequently, the Prussian schools had been modified by the methods employed at Yverdun, educators journeyed thither to observe and to learn.

To-day educators and teachers from several states, and from various parts of our own state, have come up to Oswego to see with their own eyes what they have heard with their ears of the schools, and the system of instruction pursued here. Their hearts have been made glad by what has already been witnessed, and their longings for some sound philosophical improvement, for some means whereby more satisfactory and practical results in elementary education may be attained, has been gratified by the hope that the glorious day has already dawned on our shores when the *philosophy of Bacon*, *the principles of Comenius*, *the system of Pestalozzi*, *and the most practical methods of Object Teaching* shall be thoroughly incorporated into the system of instruction in all the schools of our country.

THE CLOSING EXERCISES OF THE CONVENTION

were held in Doolittle Hall, at 7½ o'clock on Thursday evening. After the reading of the Report of the Committee by Professor Phelps, the following resolutions were offered by E. B. Talcott, Esq., in behalf of the Board of Education, and were unanimously adopted by the audience.

Resolved, That the gentlemen and ladies who have visited this city on the invitation of the Board of Education, for the purpose of witnessing the practical operation of what is known as the Pestalozzian system of education, as now taught in our primary schools, coming as they do from different and remote parts of the Union, have evinced an interest in the educational progress of the country which entitles them to the gratitude of our citizens, and of all who feel interested in the prosperity of the schools of the country, and in the general adoption of the best and most efficient system of teaching in its primary schools.

Resolved, That this meeting tender its cordial thanks to Miss M. E. M. Jones and to N. A. Calkins, Esq., for their able, interesting, and instructive papers read in this hall on Tuesday evening last.

S. B. Woolworth, LL.D., Secretary of the Board of Regents, submitted, in behalf of the Committee of Examination, a resolution complimentary to the City Superintendent, E. A. Sheldon, to the Board of Education, and the citizens of Oswego, who encouraged and sustained these officers by a liberal public sentiment, which had enabled them to be so successful in their labors for the improvement of their public schools.

Dr. Woolworth spoke at some length on the subject of education, and in commendation of the schools of Oswego. He said that the looks of intelligence, and the expressions of happiness among the children, had been to him a source of great gratification. He believed that their education has been properly commenced.

Hon. David N. Camp, State Superintendent of Schools in Connecticut, was called to speak as a representative from New England. He remarked that the schools of the Eastern States were introduced with the log cabins, and were regarded by the people as necessary to the existence of free institutions. New England, he remarked, was deeply interested in common schools, and all improvements of the means of education. There the children of every nationality were freely taught, as education is regarded as the true foundation of virtue, freedom, and righteousness. He had visited schools in all of the Eastern States, also in the principal cities from Maine to Missouri. He had also visited the schools in Canada, and in all he had sought for something good to take back to his own state; but he added, "During all of these visits, I have never found the principles of education so simplified and systematized—crystallized, as it were—as in the schools of the city of Oswego. I came here to learn, and I shall go back to New England and tell with gladness what my eyes have seen and my ears heard."

Remarks were made by Rev. Dr. Ludlow, of Oswego, and others, and the Convention adjourned.

NOTE BY THE EDITOR.

Lord Bacon was doubtless the founder and originator of the method known in Germany as realism and of realistic principles of instruction, although he wrote but little which belongs strictly to the Literature of Pedagogy. The first teacher who imbibed the views of Bacon, and introduced them into Germany, was Ratich, who was in England at the time of the publication of the "*Instauratio Magna*," and cites many of Bacon's aphorisms in his "*Praxis*" and "*New Didactics*" in 1619. Comenius in 1627 was a student of Bacon's method, and in 1632, acknowledges his indebtedness to this "most admirable book," above named, as furnishing "the true key to nature." His visits and personal labors in England, Sweden, Holland, and Germany, and his many publications, several of which were translated into all the languages of Europe, disseminated the new views and methods, and introduced the study of real objects and the laws of nature into the elementary schools. Milton, Hartlib, Petty, Hoole, and Cowley, labored in the same direction in England, from 1621 to 1660. The following extracts from Hoole's Preface and translation of the "*Orbis Sensualium Pictus*" of Comenius, published in London in 1658, may interest our readers.

The Cultivation of Perception and Conception.—"The ground of this business is, that sensual objects may be rightly presented to the senses, for fear they may not be received. I say, and say it again aloud, that this last is the foundation of all the rest. Now there is nothing in the understanding which was not before in the sense; and therefore to exercise the senses well about the right perceiving the differences of things, will be to lay the grounds for all wisdom and all wise discourse; which, because it is commonly neglected in schools, and the things which are to be learned are offered to scholars without being understood or being rightly presented to the senses, it cometh to pass that the work of teaching and learning goeth heavily onward, and affordeth little benefit."

The Understanding to be cultivated as well as the Memory.—"For to pack up many words in memory, of things not conceived in the mind, is to fill the head with empty imaginations, and to make the learner more to admire the multitude and variety, and thereby to become discouraged, than to care to treasure them up, in hopes to gain more knowledge of what they mean. Descend to the very bottom of what is taught, and proceed as nature itself doth, in an orderly way; first to exercise the senses well, by representing their objects to them, and then to fasten upon the intellect, by impressing the first notions of things upon it, and linking them one to another by a rational discourse. Missing this way, we do teach children as we do parrots, to speak they know not what."

Lessons with real Objects.—"Since some things can not be *pictured out* with ink, for this reason it were to be wished, that things rare, and not easy to be met with withal at home, might be kept ready in every great school, that they may be showed also, as often as any words are to be made of them to the scholars. Thus at last this school would indeed become a school of things obvious to the senses, and an entrance to the school intellectual." Is not the germ of Pestalozzianism here? The words "pictured out" are put in italics by ourselves to call attention to the old use of this now popular phrase.

Use of Pictorial Illustrations.—"Pictures are the representations of all visible things of the whole world. Such a dress may entice witty children, that they may not conceit a torment to be in the school. For it is apparent that children, even from their infancy almost, are delighted with pictures. And it will be very well worth the pains to have brought to pass, that scare-crows may be taken away out of Wisdom's gardens."

Use of Blackboard.—But little is said on this piece of school apparatus. It is, however, interesting to know that in a description of a school, written two centuries since, this useful adjunct for illustration is noticed. Comenius says: "Some things are writ down before them with *chalk* on a table. This notice would not have been so satisfactory as it is, but there accompanies the description a "copper cut," and there we see upon the wall a blackboard, as large as a window, with a diagram chalked upon it.

On the point of *illustration* we may add, "The judgment of Mr. Hezekiah Woodward, sometime an eminent schoolmaster in London. Certainly the use of images or representations is great; if we could make our words as legible to children as pictures are, their information therefrom would be quickened and surer. But so we can not do, though we must do what we can."

Masters must have Sympathy with the capacities of the children under Instruction. "A schoolmaster had need to bend his wits to come within the compass of a child's capacities of six or seven years of age, and to make that they may learn with as much delight and willingness, as himself would teach with dexterity and ease. And because any good thing is the better, being the more communicated, I have herein *imitated a child*, who is forward to impart to others what himself has well liked."

Phonic Method of Teaching to Read.—"It will afford a device for learning to read more easily than heretofore, especially having a symbolical alphabet set before it, to wit, the characters of the several letters, with the image of that creature whose voice that letter goeth about to imitate, pictured by it. For the young *a b c* scholar will easily remember the *force* of every character by the very looking at the creature, till the imagination being strengthened by use, can readily afford all things."

It may be necessary to explain, that what Comenius calls the "force of every character" is obtained from *verbs* denoting the actions of animals, instead of from *nouns* as is now the general practice. A series of "copper cuts" is given for this purpose, called "A lively and vocal Alphabet."

Tasks and Training.—"Because the first tasks of learners ought to be little and single, we have filled this first book of *training* one up to see a thing of himself, with nothing but rudiments, that is, with the chief of things and words, or with the grounds of the whole world, and the whole language, and of all our understanding about things." The reader will observe that the word "training" is used in precisely the same sense as by modern educationists.

The Uselessness of bare Rules of Grammar.—"You that have the care of little children, do not trouble their thoughts and clog their memories with bare grammar rudiments, which to them are harsh in getting, and fluid in retaining; because, indeed, to them they signify nothing, but a mere swimming notion of a general term, which they know not what it meaneth, till they comprehend particulars. For rules, consisting of generalities, are delivered, as I may say, at the third hand, presuming first the things and then the words to be already apprehended, touching which they are made."

Teacher's entire Dependence upon God's Blessing.—"And I pray God, the fountain and giver of all wisdom, that hath bestowed upon us this gift of teaching so to inspire and direct us by his grace, that we may train up children in his fear, and in the knowledge of His Son Jesus Christ our Lord; and then, no doubt, our teaching, and their learning of other things subordinate to these, will by the assistance of His Blessed Spirit make them able and willing to do Him faithful service both in Church and Commonwealth, as long as they live here, that so they may be eternally blessed with Him hereafter. This I beseech you beg for me and mine, as I shall daily do for you and yours, at the throne of God's heavenly grace; and remain while I live ready to serve you, as I truly love and honor you, and labor willingly in the same profession with you.

From my school in Lothbury, London, Jan. 25th, 1658.

CHARLES HOOLE."

SAMUEL HARTLIB.

SAMUEL HARTLIB, to whom Milton addressed his "*Tractate on Education*," and who was thought worthy of an allowance from the treasury of the State by Cromwell, and the Parliament, for his services to practical science, and especially to agriculture, was the son of a Polish merchant at Elbing, in Bohemia. His mother was an English woman from London, rich and well connected, which will account for his appearance in that city as early as 1636; an active promoter of educational and agricultural improvement. According to a memorial by him to Lord Herbert in 1662, and another, a little later, to the House of Commons, in the darkened hour of his fortunes, "he had exerted himself for thirty years in procuring valuable treatises to be written, which he had freely printed and as freely sent to such as were most capable of making use of them; also the best experiments in husbandry and manufactures, to be tried and made known for the benefit of his age and posterity." "He erected a little academy for the education of the gentry of this nation, to advance piety, learning, morality and other exercises of industry not usual then in common schools." "As long as I have lived in England, I have spent yearly out of my own, between three and four hundred pounds sterling, and when I was brought to the public allowances, and had from the parliament and council of state a pension of three hundred pounds sterling, this also I have spent as freely for their service, and the good of many."

Among his publications is "*TheDiscourse on Flander's Husbandry*," a tract of 24 pages, written by Sir Richard Weston, who was embassador from England to Frederick V., Elector Palatine and King of Bohemia. This little treatise, first printed in 1645, was several times republished by him with additions and annotations by competent hands. The edition of 1652, with the title of his "*Legacy, or an Enlargement of the Discourse on Husbandry, &c.*," was revised by Robert Child and Dr. Arnold Beati. For this timely and valuable "Legacy," which, according to a paper published in the "Philosophical Transactions," has enriched England with improved culture adopted therefrom, to the amount of untold millions, Cromwell allowed a yearly pension of £100, which (the truth of history compels us to mention to the additional disgrace, if it is possible to add any thing to the humiliating record of the administration of Charles II.,) the kingly government of England disallowed, and from any thing we have been able to find in English literature, this public benefactor died in want, after having spent his substance "in the advancement of Husbandry-Learning" and of education generally—the great well-springs of a nation's civilization. It is not creditable to the historians of England, and especially to those who profess to see in the country homes and the schools of a people the causes, the evidence, and measure of the well-being of the state, that the name of Samuel Hartlib is not familiar as a household word to the farmers, the teachers, and the people generally of England.

Although the fact does not appear of record, it is probable, that John Amos Comenius first visited England on his suggestion, and was the recipient of his open hospitality. We know that other laborers in the field of educational and agricultural improvement were so. Speed composed his work on "Improvements in Husbandry," whilst lodging in Hartlib's house. Wherever Comenius may have resided in London, while negotiations were going on with a committee of Parliament, for his being employed in drawing up a plan of national education, we know that Hartlib caused to be printed, in 1654, an edition of his "*Janua Reserata Linguarum*," under the title of "*A true and ready way to learn the Latin Tongue*," and may have assisted Hoole in bringing out his translation of that other work of Comenius, the "*Orbis Pictus*," the school-book, which, with the other publications of Comenius and his followers, revolutionized the entire method of elementary teaching on the Continent, and which is just now being revived in the popular schools of Great Britain, under the name of Object Teaching. By acting on the suggestions made, or at least, made known by Hartlib, England might not only have improved, as she did, the implements and methods of agriculture, but she might have had in advance of any European nation the first Agricultural College, the first Trade or Polytechnic School, the earliest and fullest development of National Education and popular intelligence founded on the solid basis of science and human nature, of any European nation. In 1643, Hartlib published his plan of an "*Office of Public Address*," which he somewhat enlarged in a new edition in 1652—and which "Mr. W. P.," afterwards Sir William Petty, explained in an elaborate paper, as well deserving of parliamentary and associated aid. The idea was that of a sort of "Universal Intelligence Office" under parliamentary organization—for all sorts of wants and supplies—and which is finally realized in our day without government aid in the "Times," or any other great metropolitan newspaper. In 1651, he published his "*Proposition for the Erecting a College of Husbandry.*"

CHARLES HOOLE.

Charles Hoole, who helped to make known to English teachers the "*Orbus Sensualium Pictus*" of Comenius, and what is now known as "Object Teaching," was born at Wakefield, in Yorkshire, in 1616, was educated in the Free School there until he was eighteen, and afterwards at Lincoln College, Oxford. He taught school at Rotterham, and in London, where he published several school-books, in which he incorporated the methods set forth it what Milton calls the "*Modern Janua and Didactics*," the Janua Reserata of Comenius, and the Didactica of Ratichius. He died in 1666.

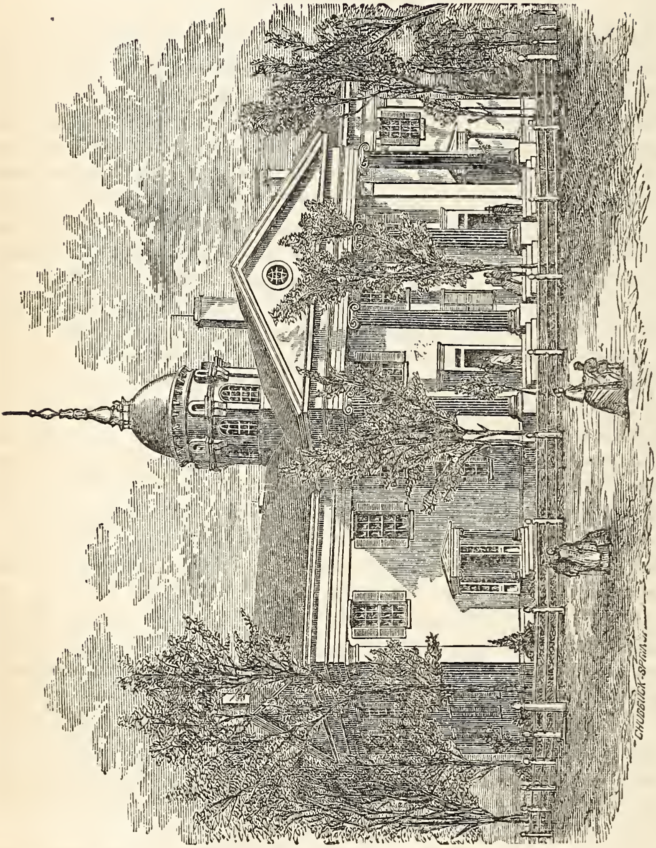
W. P., OR SIR WILLIAM PETTY.

W. P., or Sir William Petty, whose name should be associated with the promoters of practical science in the period of the English Commonwealth, was born May 16, 1623, at Rumsey, where his father was a clothier. After mastering the studies preparatory to the university, he resided at Caen, attending the lectures of the college there. At the age of twenty, he visited the principal cities of France and Holland, studying medicine and the mechanical arts. In 1647, he took out a patent for a method of short-hand writing, and was subsequently assistant professor of Anatomy at Oxford, and lecturer in the same department in Gresham College, London. In 1652, he was attached to the Army in Ireland under Lambert, and in 1655, was made Secretary to Henry Cromwell. In 1655, he was elected to Parliament, and on the restoration of the royal government, was elected Surveyor-General of Ireland. His mind was constantly occupied with mechanical inventions, with mathematical studies, and with the problems of political economy, of which he may be regarded as one of the founders in England. We republish his "Plan of a Trade School."

ABRAHAM COWLEY.

ABRAHAM COWLEY, whose plan of a "Philosophical College," or "*Proposition for the Advancement of Experimental Philosophy*," was preferred by Dr. Johnson, to that of Milton's Academy, was born in London, in 1618, and died in 1667. His early training was obtained as King's Scholar at Westminster School, whence he proceeded to Trinity College, Cambridge, in 1636. In 1643, he left the university, and for many years resided on the continent in some official relation to the Queen, and Lord Falkland. Soon after his return to England in 1656, he published a volume in which his plan of a College was made public. Among the noticeable features of his college are professors resident of "all sorts of Natural, Experimental Philosophy;" and among the studies, are enumerated "Agriculture, Architecture, Art, Military, Navigation, Gardening; the Mysteries of all Trades, and improvement of them, and briefly all things contained in the Catalogue of Natural Histories annexed to my Lord Bacon's *Organon*." The instruction was to be free—"that none, though never so rich, shall pay any thing for their teaching." The list of authors to be read closely resembles that of Milton, and such as serve "an apprenticeship in Natural Philosophy," "upon Festivals and Play-times, they should exercise themselves in the fields by Riding, Leaping, Fencing, Mustering and Training, after the manner of soldiers, &c." Four of the Professors are to be always traveling beyond seas, leaving a deputy to supply their duties, and one of the four "professors itinerate" is to be assigned "to each of the four great divisions of the globe, to reside there three years, and to give a constant account of all things that belong to the Learning, and especially the Natural Experimental Philosophy of those parts." They must take solemn oath to communicate what they "fully believe to be true, and to confess and recant it as soon as they find themselves in an error." The institution was to be furnished with suitable buildings and grounds—"Towers for the Observation of the Celestial Bodies"—"Laboratories for Chemical Operations"—"Gardens for all manner of experiments concerning Plants—and for the convenient receptacles of all sorts of creatures"—indeed, all the equipments which the great universities of Europe and the great cities of London and Paris now furnish for the illustration and advancement of Natural History, and Practical Science.

In his Essay on "Agriculture," Cowley expresses "the wish (but can not in these times much hope to see it,) that one college in each university were erected and appropriated to this study" with "four professors" to teach the four parts; 1. Aration; 2. Pasturage; 3. Gardens, Orchards, Vineyards and Woods; 4. Rural Economy, Bees, Swine, Poultry, Fish, and other Sports of the Field. Their business should not be "to read lectures, but to instruct their pupils in the whole method and course of this study," and "should be chosen for solid and experimental knowledge of the things they teach—so industrious and public spirited, as I conceive Mr. Hartlib to be, if the gentleman be yet alive."



EXTERIOR OF THE STATE NORMAL SCHOOL, AT WESTFIELD, MASS.

XII. THE STATE NORMAL SCHOOL AT WESTFIELD, MASS.

The State Normal School at Westfield, (Mass.,) was first opened at Barre, by an address from Hon. Edward Everett, on the 4th of September, 1839, and suspended in 1841, on its removal to Westfield. It was there re-opened on the 4th of September, 1844, by an address from Rev. Dr. Humphrey, President of Amherst College. In 1860 the building was enlarged by the addition of wings, and thoroughly repaired. From September, 1844, to the close of 1861, the aggregate attendance at the Westfield School was 1,633. It was under the Principalship of S. P. Newman, from September 4th, 1839, to February 10th, 1842; of E. Davis, from September 3d, 1844, to September 3d, 1846; of D. S. Rowe, from September 3d, 1846, to March, 1854; of W. H. Wells, from August 1854, to April, 1856; and of J. W. Dickinson, from April, 1856, to the present time. The following paragraphs are from the Annual Circular for 1862.

Male applicants for admission to the School must be at least seventeen years of age; female applicants, sixteen. There must be an explicit declaration that the applicant intends to become a teacher in the schools of Massachusetts. The applicant must give a pledge to remain in the School at least three terms, the first two of which shall be consecutive.

Candidates for admission must present themselves at the school-room on the first day of the term, at 9 o'clock A. M., and pass a satisfactory examination in Reading, Writing, Spelling, Defining, English Grammar, Geography, and Arithmetic. There will be an examination at no other time during the term, except for special reasons.

Each applicant must present a certificate of good intellectual and moral character, from some responsible person.

The following is the course of study, without regard to the order in which the branches will be pursued, or the length of time devoted to them:—

Geography, Physical and Political, with use of Globes and Outline Maps; Arithmetic; Grammar, and Analysis; Physiology; History of United States; General History, with Ancient Geography; Natural History; Algebra, Geometry; Natural Philosophy, with Experiments; Chemistry, with Experiments; Astronomy; History and Structure of the English Language, with Analysis of Milton and other Poets; School Laws of Massachusetts, and General Principles of Government; Theory and Art of Teaching, with Mental Philosophy; Rhetoric.

Reading, Writing, Elementary Sounds, Etymology, Spelling, Vocal Music, Composition, Recitations of Select Pieces, Extempore Speaking, Discussions, and Moral Philosophy, extend through the whole course.

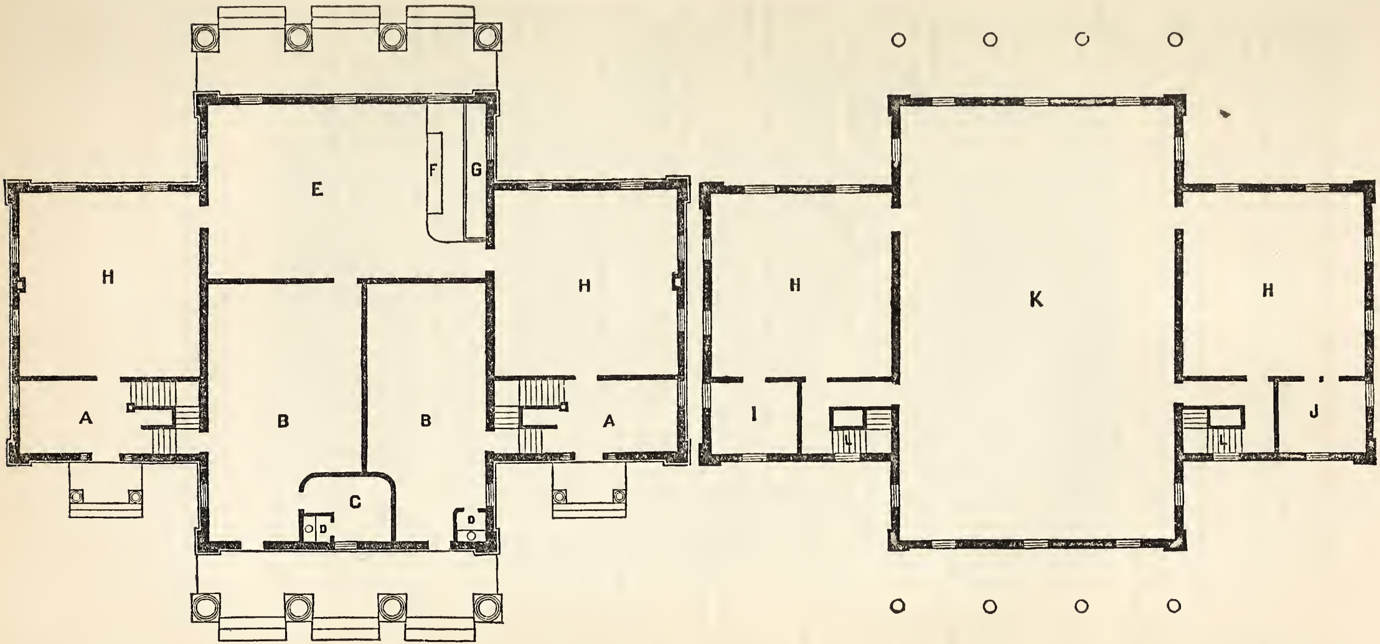
Botany, Drawing, Latin, and French are optional.

The pupils have daily teaching exercises in connection with the recitations, and the members of the Senior Class devote a large portion of their time to the Theory and Art of Teaching.

Every Wednesday afternoon is devoted to the exercises of the Lyceum conducted by the students.

Every pupil who honorably completes the Course of Study is entitled to the regular Diploma of the Institution, which does not hold itself responsible for any others, although they may have been members of the School.

There will be an advanced Class, which will enable the Graduates of the School to continue their studies beyond the prescribed course.



Plan of State Normal School at Westfield, Mass.—The main edifice is 60 by 40 feet, not including porticoes. The wings are 25 by 38 feet each.

A, A, Entrance Halls. B, B, Dressing-Rooms. C, Wash Room. D, D, Closets. E, Chemical Laboratory. F, Pneumatic Cistern. G, Closet for Chemical Apparatus. H, H, H, H, Recitation Rooms. I, Teachers' Room. J. Room for Philosophical Apparatus. K, Principal School-Room. L, L, Stairs.

ADDRESS

AT THE

DEDICATION OF THE WESTFIELD STATE NORMAL SCHOOL-HOUSE,

BY REV. HEMAN HUMPHREY, D. D.,

September 3, 1846.

Friends and Patrons of Popular Education:

UNDER the smiles of a beneficent Providence, this beautiful edifice has been reared and finished; and we are assembled to exchange our mutual congratulations upon the occasion. It is now ready for the reception of the Normal School, and it is fitting that, before its ample accommodations are thrown open, it should be dedicated to the cause for which its munificent benefactors designed it.

Next to the church, the school-house rose in the wildernesses of Plymouth and Massachusetts Bay, under the saws and hammers of those sturdy Christian adventurers, "of whom the world was not worthy." Their deep and far-reaching policy was to educate their children for both worlds; to prepare them, by early intellectual and moral training, to glorify God here, and to enjoy him forever in his kingdom. By providing every facility in our power for the extension and thoroughness of popular education, we are only following out the wise forecast of the men who scarcely waited for the thawing off of the icy mail with which they were clad when they landed, before they began to execute their purpose, that every child, however poor, in their infant Commonwealth, should receive at least what we now denominate a Common-School education.

Their school-houses, indeed, were cheap and humble structures, compared with the noble Grecian edifice which is henceforth to adorn this prosperous village, and open its doors indiscriminately to all the youth, far and near, who may wish to avail themselves of its advantages. They had no schools of a higher order for the training of their teachers; but they did what they could. It would be a shame and a sin, if, with all our wealth, and all the experience and advance of two such centuries as the past, we should content ourselves with the standard of popular education as they left it, or as our fathers of the last generation left it. It is our duty to leave the first principles, and go on unto perfection.

The instructions of those who taught us in the primary schools, when we sat with our feet dangling upon the four-legged slabs, just from the saw-mill, are not to be undervalued. Considering the disadvantages under which they labored, it is remarkable that they accomplished so much as many of them did. But the best of our primary teachers have felt and do feel the want of a suitable education for the discharge of their responsible duties; and there has for some time been a growing conviction in the public mind, that teaching ought to be elevated to the rank of a liberal profession, and that to meet the demand we must have a new class of professional seminaries. It is to supply this desideratum in our own State, that the Normal Schools of West Newton, Bridgewater, and Westfield have been established by individual and public munificence. It is confessedly an experiment of very great importance, and every facility ought to be afforded for testing its claims to public favor. In presenting my own thoughts on the subject to this enlightened audience, I shall touch

Upon the urgent demand for better qualified teachers in our Common Schools:

Upon the reasons why those who are to be teachers should be educated with special reference to the profession;

Upon what is embraced in a good professional teacher's education; and

Upon the adaptation of the Normal system of instruction to give such education.

Each of these topics affords ample scope for an opening discourse; and upon more than one of them I would gladly dwell much longer than my limits will allow.

To glance at the first. The proposition is that there is an urgent demand for better qualified teachers in our Common Schools. It is an axiom in every trade and profession, that a man must first learn the trade, must study his profession—in other words, must be *educated* for it before he commences. A blacksmith is no blacksmith at all until he has learned how to smite the anvil and shoe horses. Before a man sets up for a tailor, he must serve a regular apprenticeship. A cabinet-maker must learn the use of tools before he can make sofas and side-boards. The jeweler must know how to cut, and polish, and set precious stones. The physician, the lawyer, the clergyman, the college faculty, must all be educated for their respective professions, to entitle them to public confidence. This is the general rule. Is the schoolmaster an exception? Can he teach others what he has never learned himself? Is it safe to confide the education of our children to a mere tyro; to one who has never been trained himself in elementary studies? He may be very honest and very faithful; but can he teach reading, or grammar, or arithmetic, or surveying, if he is a poor reader of the plainest prose, and gets bewildered every day among the tenses, and is sure to lose the points of compass, and find himself a staring left-hand cipher at his wits' end, whenever he ventures into the regions of fractions?

I have no disposition to depreciate the talents or the labors of our primary teachers. In mental power and moral worth, they will not suffer in comparison with any equally numerous class of men and women in the community. The *material* is excellent. It is of the genuine Saxon growth. The world cannot furnish a better. As a class, our teachers are doing what they can to raise the standard of popular education. They work hard. They do as well as they know how. In these respects they are entitled to our confidence and our thanks. As a class, I honor, and so far as I am able, will defend them. They have laid the Commonwealth under lasting obligations of gratitude and encouragement; and if she had done more for them, they would have done more for her.

But it cannot be concealed or disputed, that our schools are suffering for want of better qualified instructors. Very few of our teachers have been systematically educated for the profession. By far the greater number have never enjoyed the advantages of thorough professional training at all. They have been left to educate themselves as best they could, and that mainly by the process of experience in teaching. It seems not, till lately, to have entered the minds of more than a few, even of the enlightened friends of our Common Schools, that teachers' seminaries are at all necessary. It had been taken for granted that the demand, as in political economy, would create a supply; and that any person who has received a good common education himself must be competent to teach little children in a district school. The consequence is, that while we have educated shoemakers, and carpenters, and goldsmiths enough—that is, men brought up to their business—we have but few educated schoolmasters. As juster views are now taken of the subject, and are extending among the people, the complaint is growing louder and louder, that nothing like a supply of competent teachers can be had. After the most diligent inquiry, they cannot be found. Respectable districts, by scores and hundreds, are obliged to take up with such as have no pretension to the requisite qualifications.

On this subject the annual reports of school committees, from all parts of the Commonwealth, are alarmingly instructive. I might quote their complaints till sunset, that it is impossible to have good schools for want of good teachers. Many who offer themselves for examination are deficient in every thing; in spelling, in reading, in penmanship, in geography, in grammar, in common arithmetic. There is not a single branch which they are capable of teaching promptly and correctly. Many others are but little better qualified; and the majority would be dismissed and advised to go back to their domestic and rural employments, if competent instructors could be had. The demand for such teachers is great, and it is increasing.

We will next inquire into the reasons why those who are to be teachers should be educated with special reference to the profession. Whatever a man undertakes, the importance of his knowing how to do it, rises in proportion to the magnitude of the interests involved and the difficulties to be overcome. In some cases, the first bungler that comes along may be employed, where no better man offers, because, if he fails, it is very little matter; but, in other cases, it would be madness to employ any but an experienced workman. You may let any body hoe your potato-patch who is willing to undertake it; but the ship in which you intend to circumnavigate the globe must be built by first-rate workmen.

When you bring a teacher into one of your primary schools of forty or fifty children, and put him in communication with their opening and ductile minds, what is the task which he has before him?

In the first place, what is the material upon which he is to exercise his skill; which he is to mold, and fashion, and polish? If it were a coarse and vulgar substance, it might go into rough hands, and take its chance. But it is something infinitely more precious and ductile than the finest gold. It is the intelligent, the immortal mind, or, rather, it is half a hundred such minds, sparkling around the teacher, and all opening to his plastic touch. It is—what shall I say? a substance of the finest mold, that can be fashioned and chiseled like the Grecian Apollo? No! it is a spiritual essence, fresh from the skies. It is a mysterious emanation from the infinite Source of being and intelligence, an immortal mind—ever present, though always invisible, in the school-room—seeing, hearing, thinking, expanding; always ready to take the slightest impression for good or for evil, and certain to be influenced every hour, one way or the other, by the teacher. What a responsibility! What a task!

Consider the kind of substance upon which the schoolmaster is either skillfully or unskillfully tracing the first lines that it receives, after the invisible cipher of the nursery, and what the sketching upon such a tablet ought to be. He might go down to the sea-shore, when the tide is out, and write as rudely as he pleased, and the first refluent wave would wash the surface just as smooth as the last ebb left it. He might draw his awkward diagrams upon the drifted snow-bank, and the first breath of air would whisk them away. He might write out his lessons like a wise man or a fool, and it would make no difference; the next hour would obliterate them all.

But it is not so in the school-house. Every tablet there is more durable than brass. Every line that the teacher traces upon the mind of the scholar is, as it were, "graven with the point of a diamond." Rust will eat up the hardest metals; time and the elements will wear out the deepest chiseling in marble; and if the painter could dip his pencil in the rainbow, the colors would at length fade from the canvas. But the spirits, the impressible minds of that group of children, in however humble circumstances, are immortal. When they have outlived the stars, they will only have entered upon the infancy of their being. And there is reason to believe that no impression made upon them will ever be obliterated. Forgotten, during shorter or longer periods of time, many things may be; but the cipher, without the erasure of a single line, in all probability remains, to be brought out by the tests of a dying hour, or the trial of the last day. The schoolmaster literally speaks, writes, teaches, paints, for eternity. They are immortal beings, whose minds are as clay to the seal under his hand. And who is sufficient for these things?

Just look at the case in another light. They are the children of a hundred and thirty or forty thousand families, who, as they successively become old enough, are receiving their education in the Common Schools of Massachusetts. At present, they are under tutors and governors, and have no direct influence, one way or the other, upon the great interests of the Commonwealth. But who are they? Go with me from school to school, from town to town, and from county to county, and let us inquire. On that little form directly in front of the teacher, sits a distinguished and skillful physician. Just behind him you see one of the prominent members of the General Court. On another bench, behind the door, sits a professor of mathematics, biting his pencil and puzzling over the rule of three. On the other side of the room, that chubby boy is none other than the Secretary of State. In the next school we find here a governor of the Commonwealth, reading in tables of two syllables; there, from one of the poorest families of the district, an importing merchant, worth half a million of dollars; and close by his side one of the shrewdest lawyers in the county. Going on to the next school-house, in the remotest corner of the town, we find a selectman, a sheriff, a professor of languages, and, besides a number of enterprising and prosperous farmers and mechanics, perhaps a representative to Congress. But we must not be partial in our visits. Let us take the cars and go into another section of the State, and see what we can find there. The very first boy we over-take trudging along toward the village school-house, with his dinner-basket in one hand, and his skates in the other, is the chief-justice of the Commonwealth. We enter, and who should we find there but the president of a great railroad company; also one of the richest bankers in State-street; two or three clergymen, of as many different denominations; a chemist, a town clerk, a judge of probate, and a great civil engineer. In the next school we see a United States senator at the blackboard; a physician just getting out of his a-b-abs; a brigadier-general trying to make straight marks upon his pasteboard slate; an honorable counselor digging out his first sentence in parsing, and half a dozen school-teachers, some in "baker," some in "a-cat-may-look-on-a-king," and some in "a-i-l, to be troubled."

But we are not through yet. In the very next school we visit—it may be in Boston, it may be in the obscurest mountain town of the interior, it may be on the sea-board, or under the shadow of Wachusett—we find an associate judge of the Supreme Court, or an attorney-general, or a foreign embassador, or, speaking in the past tense, a president of the United States.

Thus, were we to visit all the primary schools of the Commonwealth, we should be sure to find nearly all the ministers, lawyers, physicians, judges, legislators, professors, and other teachers, merchants, manufacturers, and, in short, all the most intelligent, active, and useful men of the next generation in these schools. We cannot now point them out by name. We cannot tell who of them will be governors, and judges, and merchant princes; but in winter, or summer, or both, they are all there. They are receiving the rudiments of their education under such teachers as we provide for them, and in the period of life when the most lasting impressions are made. More, I will venture to say, is done during the first ten or twelve years, in the humble district school-house, to give tone and shape to the popular mind, than in all the years that follow. Bad habits of reading, or slovenly habits of writing, or loose habits of reciting and thinking, which are contracted there, will cling to most men as long as they live; while, on the contrary, the permanent advantages of a good beginning, under competent instructors, are witnessed and acknowledged by all. It has been so in Massachusetts from the beginning.

Her great men have commenced their education in the common school-house. And "the thing that hath been is that which shall be, and that which is done is that which shall be done, as one generation passeth and another cometh." In less than half a century, all the professions in our noble State will be filled, all the offices will be held, all the business will be done, and nearly all the property will be owned, by the boys who first graduate at our Common Schools, and whose parents are too poor to give them a better education. It will be so as long as these schools are sustained and open to all: and they will do more or less to elevate the moral and intellectual character of the people, as the teachers are thoroughly or superficially educated. Every faithful and well-qualified instructor in the humblest district school is a public benefactor. But where shall the school committees look for a sufficient number of such, till Teachers' Seminaries furnish them?

It is not so well considered as it should be, that education is both a science and an art. Though not one of the exact sciences, it rests on deep and complicated elementary principles, and calls for a more careful study of the early susceptibilities and operations of the human mind than any other science. Every child has, if I may so speak, *three* natures—a physical, a mental, and a moral, between which there are mysterious sympathies and connections, that reciprocally govern and are governed. He has organs of sense, which are the inlets of knowledge, and without which he could not learn any thing, however skillful the teacher. He would still have a mind, but it would be a prisoner, groping hopelessly in a dungeon. He has perception, reason, memory, and imagination. He can learn and apply rules, understand propositions, and in simple examples see the connection between premises and conclusions. He can be stimulated and swayed by motives, and is peculiarly alive to their influence. He is susceptible of a great variety of opposite emotions—of hope and fear; of joy and sorrow; of love and hatred. But I need not enumerate. Every child in the primary school has a moral as well as a rational nature—has a *conscience.* He can discern between good and evil. He knows the difference between right and wrong;

between truth and falsehood. In short, he has within him all the elements of high responsibility; all the noble faculties of an accountable and immortal being. But these faculties are yet to be unfolded, to be cultivated, to be *educated.* The understanding needs it. The memory needs it. The imagination needs it. The conscience and the heart need it.

This is what I mean by education as an *art;* and the art here, as in most other cases, is founded upon the science. It is seizing upon the elements and reducing them to order—it is arranging and applying fundamental principles. It is molding the mind, and stimulating it to high and noble aims. It is drawing out its powers, teaching it its own strength, and making it work, as the incumbent atmosphere does the steam-engine. In fine, it is the art of educating the whole man, of symmetrically cultivating all the powers and faculties of the pupil's mind, and training him up to the love and practice of all the virtues. In this view, education holds a high, if not the highest rank among the liberal and useful arts. But it is no more intuitive than any of them. The art of educating, as well as every other art, must be studied, must be learned. Though it be not essential that every schoolmaster should be a profound intellectual and moral philosopher, it is necessary that he should understand what the motive power in the child's mind is, and how to reach it.

It would be mere commonplace to add that no one can teach what he does not understand himself. He may try; and when he gets fairly swamped, he may look as wise as an owl upon a hollow tree. He may blunder along over the recitation like a bewildered militia-man in an enemy's country, and bless himself that he has got through some how or other; but this is not teaching. It is mumbling and hesitating; and, in the last resort, knocking a difficulty on the head as an impudent intruder, or shying round it as if it lay coiled and hissing in his path, like a serpent. It seems to be strangely overlooked, in many quarters, even to this day, that a competent education for teaching embraces a great deal more than a general and superficial knowledge of spelling, reading, writing, arithmetic, grammar, and geography. But really it is time for every body to understand the difference between smattering in school, six hours a day, and teaching thoroughly, accurately, in all the studies. Every branch should, if possible, be as familiar to the instructor as the first lessons in the child's reader. If it is not at his tongue's end, he labors under very great embarrassment. He has no time to study out the lessons as he goes along. He needs to be as sure and prompt as a percussion-lock. He *must* be, in order to do full justice to his school.

Just consider for a moment what is required of him, every day and every hour. In the first place, the school is to be brought under strict subordination before he can begin to teach. Half a hundred children, often more, of all ages, are to be *governed,* or they will soon govern him, as they do their parents at home. Even after his authority is established, it requires the eyes of an Argus to keep them in subjection and close to their studies. This, of itself, would be a laborious task. Let any one who doubts and theorizes, try it, and he will see. But it is a trifle compared with what the sole teacher of a large district school has to do. Look in upon him, and judge for yourselves. He must hear from five to ten classes in as many different branches before the clock strikes twelve, and must do it in the midst of constant interruptions. Mr. A., may I go to the fire—may I go out—may I get some snow and put into my ink—may I go home and get my slate? Mr. A., will you mend my pen—will you show me how to do this sum? I have worked upon it two hours, and it won't come right nohow. I wonder what such hard sums were made for. Mr. A., Sam pinched me. Mr. A., Ben keeps pulling my hair. Mr. A., Mr. A., Bill studies so loud that I can't get my lesson. Mr. A., what time is it? Mother says I must go home at three o'clock, and do the chores.

These are a few specimens of the thousand and one questions and other interruptions by which the teacher of a Common School is harassed from morning to night, till his patience is worn threadbare. What, then, in the mean time, is to become of his recitations? The classes must go on in spite of all this, if they are to read, and spell, and recite at all. The sun will not stop for the pens to be mended, nor for the tongues to cease. Woe to the master who cannot attend to more than one or two things at once! If, when a class gets up to read, he is obliged to take the book and follow them, line by line, to see whether they call the words right and mind the stops, as I have sometimes myself witnessed, who will keep the school in order, and all the rest of the machinery in gear and in motion? Poor man! how I pity him from the bottom of my heart! and how I pity the school too! So, when he calls up a class in grammar, or in arithmetic, if he is obliged to direct his whole attention to the lesson; if the slightest transposition or anomaly in the construction of a sentence sends him to his accidence to puzzle it out, while the whole class is waiting, dubious of his success; or if the nine digits, with their characteristic obstinacy, bring him to a dead stand in some of the common rules, and oblige him to adjourn the recitation over night, what, in the mean time, must become of all the other exercises and interests of the school? If any teacher in the world needs to have every thing by heart, it is the teacher of a common school. He has so many classes, so many branches, so many wheels to keep in motion, so many things to divide his attention, that, if he is not thoroughly educated himself, it is impossible for him to do justice to those who are committed to his care. It may be no fault of his that he is deficient in some, or even in all the branches of popular education. He may never have been thoroughly educated himself. Considering his limited advantages, he may do better than could have been expected; but such a man will feel his deficiencies, and the school will suffer in spite of his best endeavors.

What, then, is to be done? Where and how are our schoolmasters and schoolmistresses to be better educated? There is no want of the material. We have young men and young women enough in Massachusetts who would prove themselves worthy of the highest public confidence as teachers if they could but be regularly trained to the profession. But while all admit that there is a great demand for more thoroughly qualified teachers in the public schools, some suppose that it can be fully met by the colleges and academies of the State. I have no disposition to undervalue these seminaries. They are the glory of the Commonwealth. No one will dispute the ability of our colleges to give just such an education as every schoolmaster wants. They are furnished with the ablest instructors, and teach many things which are far in advance of what the public schools require. But the colleges have no teachers' department, and do not pretend to qualify their graduates and undergraduates for common schoolmasters. Some of them teach the winter schools, to be sure; and it seems to be taken for granted, that because they have studied Greek and Latin, and Conic Sections, they must know all about the branches of Common-School education. This is one of the best examples of *non sequitur* that I can think of. Because a young man can read Demosthenes and calculate eclipses, he must be eminently qualified to teach a primary school! It is no disparagement to some of the best classical scholars to say, that they are not fit for common schoolmasters. They are above the employment, but not equal to it. They can educate teachers a great deal better than they can teach the a-b-abs, and "When the sky falls, we shall catch larks." Experience abundantly proves that many who go from college halls to try their hand in district school-houses, are greatly surpassed by some who never saw a college in their lives; and if it were the main object of a collegiate education to furnish schoolmasters, every one must see how very inadequate would be the supply.

The academies can do more than the colleges in educating teachers, and they are entitled to a great deal of credit for what they have done; but something more is wanted. While I cannot agree with those, on the one hand, who speak disparagingly of our academies, as teachers' seminaries, I am equally unable, on the other, to coincide with those who think we need no other class of Teachers' Institutes. The truth, it seems to me, lies between these two extremes. Let the academies do what they can. There is room for their most strenuous endeavors, without interfering at all with the recent movement on the part of benevolent individuals and the State in the same direction. If a sufficient number of Teachers' Seminaries could be established to educate all the schoolmasters and mistresses that are wanted, the case would be different. But when we remember that there are more than *three thousand* school districts in Massachusetts, requiring almost double the number of teachers (including winter and summer schools), it seems as if every one must see that the agency of the academies in helping to furnish them cannot be dispensed with. Let those of them which already have teachers' departments, make them still more thorough, and let others come into the same arrangement. Still, there will be ample room for another class of seminaries, conveniently located in different parts of the Commonwealth, exclusively devoted to the education of teachers, both male and female.

Our three State Normal Schools are just these seminaries. Their sole object is to raise the standard of popular education by furnishing the Public Schools with abler teachers than they now have, or can have, without some such provision. Leaving to our excellent academies the task of fitting young men for college, and for the various departments of business, they propose to take as many promising youth of both sexes as they can accommodate, and qualify them thoroughly for teaching. This, and this only, is what the Normal Schools propose; and it is too plain to need argument, that, with good accommodations and able teachers, they can do more than the academies and high schools in this particular department. They must do more to entitle themselves to public confidence and patronage.

Are they, then, just such Teachers' Seminaries as we want? Let us visit them and see. The accommodations are ample, and all the arrangements highly convenient. The buildings are new and handsome. The grounds are inviting, and such ornaments as time alone can add, will make them still more so. The locations are healthful, and far removed from dangerous allurements. The principals are men who have distinguished themselves as able and successful teachers in the Common Schools, and their assistants are selected with special regard to the requisite qualifications. By the wise and liberal policy of the State, tuition is free. Every branch of Common-School education is taught, and much more thoroughly taught, than, for the want of time, any of these branches can be in our best academies. Let those who doubt it go into one of these Normal Schools, and witness the drilling, and listen to the recitations, for a single forenoon, and judge for themselves. No scholar escapes: no one can be superficial or hesitate without being made to feel it to the quick. The design is to make prompt and able teachers, by giving line upon line, and precept upon precept; to make them so familiar with the whole range of studies, that when they come to take charge of the schools, they shall never be at a loss, never keep a class waiting while they turn over books to refresh their own memories. The object is, as far as practicable, to make every teacher as true and quick as steel; and this cannot be done but by severe drilling, by waking up the mind to its best efforts, and keeping it wide awake from morning to night. To be a first-rate schoolmaster, a man must be able to attend to twenty things at once. To this end, he must be perfectly at home in all the studies, as I have before said; and I am satisfied there is no such place for getting armed and equipped at all points, as in a good Normal School. If any branch is superficially taught in these schools, it must be the fault of the principal or his assistants; and if any incompetent or unfaithful instructor should ever be retained, it will be the fault of the Board of Education.

But something more is necessary to furnish the best class of teachers, than the thorough instruction of which I have spoken, and much more is actually done in the Normal Schools. The best methods of teaching, and of the management and government of Common Schools, are made prominent topics of familiar lectures and conversation. And to make these instructions in the highest degree practical, each of our Normal Schools has what is called a Model Primary School attached to it, where, in turn, the Normal scholars have opportunity to try their skill in teaching and governing, under the general superintendence of the Principal. Besides all this, public sentiment demands that the Bible should be made a text-book: and every Principal is expected to give moral lectures and religious instruction, weekly, if not daily, in the school-room. While the Board, under whose control the State has placed this and the other Normal Schools, would not countenance any mere sectarian obtrusion on the part of instructors, they would not, I am persuaded, continue any one in his place who should reject the Christian Scriptures, or omit to inculcate their divine precepts upon those who are to be the future teachers of our Common Schools. Mere neutrality in religion on the part of any principal, were absolute neutrality possible, would not be tolerated, I am sure, by the present Board. And if I thought the day would ever come when the high and eternal sanctions of the Christian rel gion should no longer be held up in the Normal Schools, my fervent prayer would be, that then "one stone might not be left upon another."

I have spoken thus far upon the direct agency which well-managed Normal Schools must needs have in raising the standard of popular education through the teachers whom they educate; but if they succeed, there will be an *indirect* influence, equally auspicious, if not more so. The public expect, and have a right to expect, that they will send out *model teachers;* not that all will be superior to those who have gone before them; but that some, that *many* will excel, in proportion to their superior advantages; and that their better and more thorough methods of instruction will be copied by other teachers. This is the order of nature in the progress of all human improvements. The few who are most highly endowed, or best instructed, are looked up to as models by the masses in every community. The fortunate inventor of a labor-saving machine, or the discoverer of some new principle in physical science, is a public benefactor, even though he should not teach one in a thousand the use of the machine or the application of the principle. The man who invents a new and improved model of a steam-engine, or builds a better water-wheel than any before in use, or brings out from his power-looms a handsomer and more substantial fabric than any other manufacturer, or makes a cheaper and better button, while he fills his own pockets, virtually teaches a thousand others how to do the same thing. The model, or the article manufactured, is before them, and their own eyes and ingenuity do the rest. So it is in all the useful and ornamental arts; so it is in agriculture; so it is in building bridges and making roads. A single turnpike, passing through a section of country where the scraper had never been seen before, will, in a short time, wonderfully improve all the cross-roads for miles and miles on both sides of it. It is the model road for all the highway surveyors far and near. So with the agricultural school. Though the pupils may be few in number, yet when they come to be scattered abroad over the farming districts, they will not only teach others what they have been taught themselves, but thousands will watch their improved methods of cultivation, and profit by them.

The same thing is true in popular education. The public are benefited, both directly and indirectly, by every improved method of instruction. Though the teachers from the Normal Schools should, for some years to come, bear but a small proportion to the whole number of schoolmasters and mistresses in the Commonwealth, while they will be raising up a class of teachers under their own improved and thorough methods of instruction, just so far as they rise above the ordinary level, their schools will become model schools for all the neighboring districts. Every valuable improvement in teaching and governing will in time be copied, and thus the indirect agency of the Normal Schools, in raising the standard of general education, will be extended far beyond the limits of their direct and immediate influence.

I am aware that these anticipations may be regarded as quite too sanguine by some who take a deep interest in the improvement of our Public Schools. They may demand of us how much the Common Schools have yet been benefited by the Normal Seminaries, and, because their expectations have not been answered, may set down the experiment as but little short of a failure. But they ought in fairness to consider that there has not yet been time enough to test it. It was commenced but seven years ago, and under several disadvantages. We had no teachers who had themselves been trained up under the system. When they began, they had much to learn, as well as every thing to teach. And they had no suitable accommodations. It is only the last year that the first schoolhouse was built, and the other two are now just finished. Teachers cannot be thoroughly educated in a few months under the best system that ever was devised. A regular course requires two or three years of close study. But few have enjoyed the advantages of the system at all; and the most highly favored have not had time to show what they can do since they left the schools and began to teach. It would be quite unreasonable, therefore, to judge of the adaptation of the Normal system to the wants of our Public Schools, by what has already been accomplished. Give it a fair trial, and if it does not meet the reasonable expectations of an enlightened public, let it be abandoned.

The great difficulty hitherto has been to keep the pupils long enough in professional training. The Board have done what they could by their recommendations and by-laws. The secretary and the principals have exhausted their persuasions, I will not say in vain, but without any thing like that degree of success which they have fairly earned. We are obliged to confess, that in this respect we have been disappointed. We did suppose that fine accommodations, free tuition, and the best instruction, would be sufficient inducements, not only to fill up the schools, but to secure attendance for a reasonable length of time. In this, I say, we have been disappointed. Many have remained but a single term, but few have given themselves time for the whole course, and the Normal Schools have been held answerable for their deficiencies. This is unreasonable. Nobody ever pretended that the new system could work miracles—that coming in at one door and going out at the other would make good teachers. The Normal Schools claim no supernatural advantages over other seminaries. Thorough training for any profession is a slow and arduous process. The Board of Education are extending the time as fast as public sentiment will sustain them; and they hope to be able, within a reasonable period, to make it a condition that those who enter shall remain long enough to reap all the substantial advantages which the system offers.

But notwithstanding these disadvantages, those who have had the best opportunities for judging and comparing, will bear us out in claiming, that many of the teachers from the Normal Seminaries have distinguished themselves already in the primary schools, and are giving still brighter promise, from year to year, of what may be expected hereafter. Where they can be had, the normal trained teachers are generally preferred; and experience, with some exceptions, no doubt, justifies the preference.

Let it not be said or surmised that this is a scheme to drive other worthy teachers from the schools. It is rather to aid them and add to their numbers. They cannot be spared. Not one district in ten could obtain a teacher from a Normal School if ever so much disposed, and for a long time yet to come the great majority must be trained elsewhere. Let them be trained. Let the most strenuous efforts be made by other seminaries to raise the standard of popular education, by furnishing better qualified schoolmasters and mistresses than have yet been raised up, and we will rejoice in the highest measure of their success. Let a competent number of well-educated teachers be provided, through whatever agency, and the Board will mingle their congratulations with all who labor in the same noble cause.

Friends of popular education—as I am sure you all are—ministers, laymen, parents, teachers, school committees, let me stir you up to your duties. A nobler field for action, for educational labors and improvements than our own beloved Commonwealth furnishes, the sun does not shine upon. A richer legacy than our religious institutions and Common Schools never came down from a wise and pious ancestry. Some things can be done up, and then dismissed as requiring no further care or labor; but it is not so with education. Like household work, it is always returning and never done.

We have none the less to do because our fathers did so much, nor will our children be eased of the burden by our highest efforts to raise the standard. All the toil is to be gone over again by each successive generation. It is a circle which returns upon itself, and will continue to return to the end of time. The procession of children coming upon the stage has no end. Wait we ever so long, it will not pass by. When we depart, they will still be coming, and in closer ranks than ever. Those who are centuries behind will surely come, and the great business of every generation will be to educate the children of the next. What, therefore, our hands find to do, let us do it with our might.

Citizens of Westfield, we congratulate you upon your educational enterprise and privileges. Few towns in the Commonwealth have acted upon a wiser forecast. Besides your primary schools, with doors wide open to every child, however poor, you have one of the oldest and most flourishing academies in the State; not waxing and waning, as many do, but always flourishing under able teachers and a supervision which forbids its decline. With these high advantages you might have rested satisfied. But when the western Normal School was to be permanently located, you entered into an honorable competition for the additional facilities which it would bring to your doors. Favored by your natural advantages, and entitling yourselves by liberal subscriptions to the preference, you succeeded. The school which had been for some time suspended was brought here, and reopened with temporary accommodations, and now this new and beautiful edifice is to receive it. Much will it depend on your co-operation with the Board and with the teachers for its prosperity. Upon your aid in accommodating the scholars from abroad on reasonable terms, and guarding them against those moral dangers which so easily beset the young, we confidently rely. You will not disappoint this expectation. You will cherish this seminary as you do your schools and academy. To the cause of good learning we dedicate it. To the care and benediction of Heaven we commend it. May it more than answer the sanguine hopes of its projectors, in furnishing teachers of a high order for many generations.

XIII. THE NEW GYMNASTICS.

BY DIO LEWIS, M. D.

(Continued from Page 562, No. XXVII.)

In view of the general interest in Physical Culture, and of the favor which my own labors have enjoyed, I take the liberty to say a word of the history of my efforts in this important field.

Educated to the profession of medicine, and mingling for many years, principally with those classes who suffer most from non-observance of the laws of health, I came, many years ago, to think somewhat seriously of that ounce of prevention which is worth tons of cure. Want of muscular exercise was one of the most obvious defects in our physical life. It was not less obvious that the very structure of town and city society rendered the correction of the evil impracticable, except in the gymnasium.

I examined the German gymnasium, the one so much in vogue throughout the United States, with great care. Entering one of these Institutions as a pupil, I studied the anatomical and physiological bearings of its many exercises. I found that they were not well adapted to children, women, fat men or old men, and about eight years ago I began the attempt to devise something better. During this time, I have invented more than five hundred different exercises, of which a large experience has fully endorsed nearly three hundred.

I began with the Clubs, and for more than a year invented, experimented and classified the exercises with this important piece of apparatus. To this I added a somewhat elaborate series of Free Gymnastics, (exercises without apparatus) which were used in alternation with the clubs. At the same time Rubber Balls, and afterward Bean Bags became prominent. With the bags a large number of games were devised. Now more than forty have been invented, each of which has some peculiar interest and merit. Each brings into play new muscles, or compels new action of those which are exercised in other games. The Dumb Bell was early introduced, first large iron ones, then the small iron ones, and afterward those of wood, which for many reasons are better than iron bells. Several years ago the Wand was introduced, then came the Ring to which I have devoted much time, and which is the most valuable of all pieces of gymnastic apparatus yet devised. After this came the idea of the Iron Crown, the Pusher, the Puller, and some minor inventions.

I came to Boston nearly three years ago, to found a Normal Institute for Physical Education. After some difficulties were overcome, I succeeded in reaching the incorporation, and in engaging the active interest and co-operation of such men as the late Pres. FELTON, who became a constant adviser and most earnest friend. He readily consented to serve as the President of the Institution, and was an active officer up to the time of his lamented death. I felt, when he died, that the Normal Institute had suffered an irreparable loss.

Dr. WALTER CHANNING became a Professor in the Institute, and still sustains this relation to it.

Dr. THOMAS H. HOSKINS, an able and accurate thinker and writer, was elected to the chair of Anatomy by the trustees, and Prof. T. F. LEONARD, the accomplished elocutionist, was called to the department of Vocal Culture, in which he has labored with the greatest assiduity. Several others have served as teachers and lecturers. I have the honor to act as instructor in the department of Gymnastics.

The first class, which assembled on the 5th of July, 1861, graduated in the following September. Fourteen ladies and gentlemen received the Diploma of the Institute, and went forth to labor in the new profession.

The Second class gathered in our hall on the 2d of January, 1862, and graduated in the following March. Of the second class there were eighteen graduates.

The Third class assembled on the 5th of July, 1862, and graduated on the 15th of September ult. Of this class only twelve were deemed fit to receive the parchment of the Institute.

Of these forty-four graduates, about two-thirds are females. It is a work in which women may achieve a complete success.

Of these teachers, many are itinerating and doing remarkably well; a dozen are teaching in first class female seminaries; in brief, no medical college has ever, it is believed, sent out forty-four graduates who in the first few months have achieved a business success so large and completely satisfactory. Several of the graduates are quite young and inexperienced, but are doing well. Those who have had some business experience, and possess enterprise and capacity, have achieved a success which has more than realized their most sanguine expectations.

It now seems obvious that such an institution was a public necessity. Many of the prominent educators of New England have become warmly interested in the success of the movement, and it is now confidently believed that the Normal Institute of Physical Education will expand into a large and most useful institution.

I have published one book with three hundred cuts, illustrating the new gymnastics, and shall within three years publish five other works, all profusely illustrated, and each devoted to some particular department of the great field of physical culture.

I have thought it proper that I should say thus much of my own efforts in this work, and fear I have been encouraged to speak of myself, because of the undue importance which a generous and indulgent public has attached to those efforts. I can only say in return, that my life is consecrated to the cause of our physical redemption, and that whatever zeal, industry, and an honest purpose can accomplish, shall be given to the world.

I closed my first contribution to the American Journal of Education in the midst of the exercises with wands. I now proceed to finish this series.

No. 16. In concluding the last, when the arms are extended in front, bring the hands and wand to the position seen in *Fig.* 8. Carry it out diagonally, forward and upward on the left

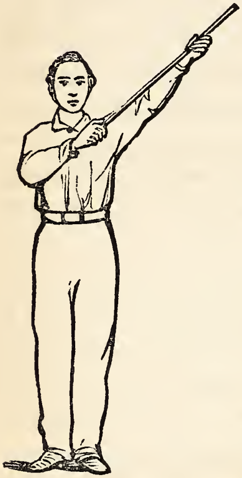


Figure 10.

Figure 11.

side, as seen in *Fig.* 10. Bring it back to the chest again, and thrust it out on the right side. Alternate twenty times.

No. 17. As you thrust out the wand on the right side, step out the foot in the same direction. Be sure it is neither forward or at the side, but diagonally forward. (*Fig.* 11.) Alternate between the right and left side, twenty times.

No. 18. Same as the last, except the wand goes to the right as the left foot charges to the left, and the left arm and wand to the left, while the right foot charges to the right.

No. 19. Same as the last, except when the right foot charges diagonally forward, the wand is made to point diagonally backwards, over the left shoulder, and vice versa.

No. 20. Same as the last, except when the right foot charges diagonally forward, the wand is made to point diagonally backward, over the right shoulder, and when the left foot charges diagonally forward, the wand is made to point diagonally backward, over the left shoulder.

No. 21. Same as the last, except the feet charge diagonally backward. As the left foot charges, thus, the wand is made to point diagonally forward on the right side, and vice versa. (*Fig.* 12.)

No. 22. Same as the last, except when the left foot charges diagonally backward, the wand is made to point diagonally forward on the left side, and when the right foot charges diagonally backward, the wand points diagonally forward on the right side.

No. 23. Same as the last, except when the left foot charges diagonally backward, the wand points diagonally backward on the same side. And when the right foot charges diagonally backward, the wand points diagonally backward on the same side.

Figure 12.

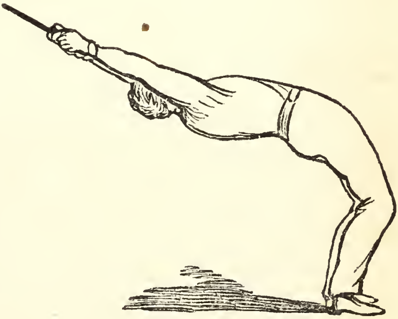


Figure 13.

No. 24. Same as the last, except when the left foot charges diagonally backward on its own side, the wand points diagonally backward on the right side, and vice versa.

It must not be forgotten that in all these compound exercises, involving the action of the arms and legs, the wand is always held at an angle of 45 degrees above the horizontal; and that in every case in passing from one charge to another, the wand is brought to the position represented in *Fig.* 8. Without this it would be impossible to keep time to the music. Let the steps be as long as possible.

No. 25. Wand horizontal over the head, as seen in *Fig.* 3. As in almost all the wand exercises, be careful not to bend the elbows. Turn the wand round, so that the right hand comes exactly in front and the left hand exactly behind. Bring the left in front and the right behind, so change twenty times.

No. 26. Hold the wand horizontal over the head, with the right hand in front and the left one behind. Make by the side of the body the motion seen in paddling a canoe. Each time carry the wand so far back that it shall be perpendicular. Do this ten times on the right side, then ten times on the left, then alternately ten times. Each time as the wand is brought over the head, it must be made horizontal, with one hand exactly in front and the other behind, and as it is brought behind the body it must be made perpendicular.

No. 27. Charge diagonally forward with the right foot; wand in the same direction. Left foot diagonally forward; wand the same. Left foot diagonally backward; wand the same. Right foot diagonally backward; wand the same. Having thus gone all around, begin again with the left foot and go round the other way in like manner.

No. 28. With both hands take hold at the end of the wand. Hold it horizontal in front. Carry it directly backward without bending the arms, as seen in *Fig.* 13. (I see the artist has tipped the figure so far that the centre of gravity is lost.)

No. 29. Heels together. Wand directly in front, resting on the floor, and perpendicular. Arm straight. Step the right foot forward to the wand, and back to the other foot, five times. Left foot the same.

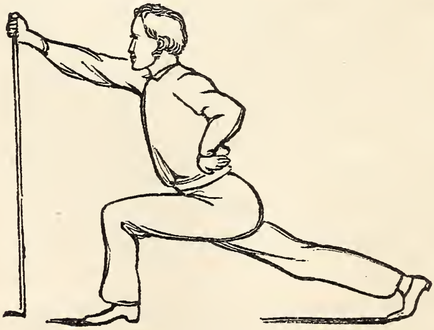


Figure 14.

No. 30. Step the right foot backward as far as you can reach, *(Fig. 14,)* and bring it back to the other foot, ten times. Same with the left foot.

No. 31. Carry the right foot forward to the wand. Returning, do not stop by the other foot, but carry it backward as far as you can reach. Now forward to the wand again. Make this long sweep ten times. Left foot the same.

No. 32. Seizing the upper end of the wand with both

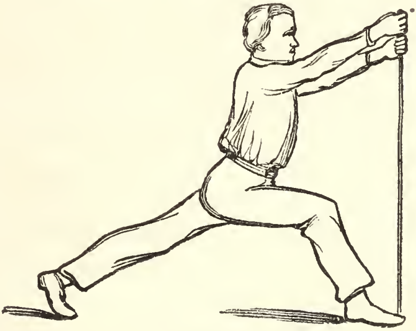


Figure 15.

hands, as seen in *Fig.* 15, carry the right foot forward to the wand, and the left foot back as far as you can reach. Change them at a single jump, and so continue ten times.

No. 33. Hold the wand in the position seen in *Fig.* 9, on the right side, with the right hand at the lower end and the left hand at the upper. Change it to the left side, with the left hand at the lower end and the right hand at the upper; so change from side to side, ten times.

No. 34. Begin the same as in the last, except the wand is held on the back of the right shoulder instead of the front. Carry it now to the back of the left, and so alternate ten times.

No. 35. Beginning at the front of the right shoulder, as in No. 32, carry it to the front of the left shoulder; then to the back of the left shoulder, and now to the back of the right shoulder. Go thus around the body five times.

No. 36. Begin at the front of the left shoulder, and go around the body the other way, five times.

No. 37. Hold the wand on the front of the right shoulder.

Carry it to the back of the left shoulder; back again to the front of the right shoulder. Repeat ten times.

No. 38 Begin at the front of the left shoulder, and alternate with the back of the right shoulder.

No. 39. Again putting the wand in front, on the floor, perpendicular, with the right hand seizing the upper extremity, and the arm straight, step the right foot forward to the wand. Bring it back to the other foot. Now step sideways to the right as far as you can reach. Bring it back to the other foot again. Now step backward as far as you can reach. Bring it back to the other foot. Still using the right foot, step sideways to the left as far as you can reach, passing it by the left leg behind;

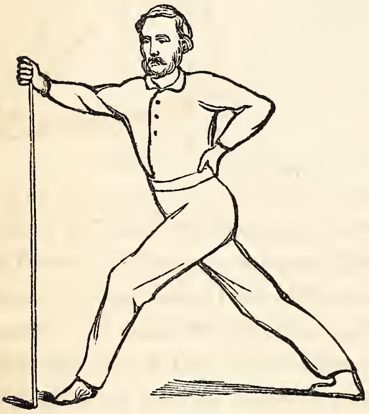


Figure 16.

Figure 17.

(*Fig.* 16.) now back to the other foot again. Pass it to the left again, in front of the left leg, (*Fig.* 17.) and bring it back to the other foot. Continue this round five times.

No. 40. Same with the left arm and leg, five times. In all this the wand must not loose its perpendicularity.

No. 41. Stand upright, with the heels together, seize the wand at its middle with the right hand, and hold the arm horizontal in front; wand perpendicular. Keeping the arm in the horizontal plane, whirl it round the body, making a complete circle, but do not stir the feet. Same with the left hand, ten times.

No. 42. Grasp the middle of the wand with both hands, and whirl, as in the last, as far as you can, ten times.

No. 43. Same as the last, except the wand is held horizontal instead of perpendicular.

Figure 18.

Figure 19.

No. 44. Seizing the wand as seen in *Fig.* 18, step backward and forward over it with the right and left foot, ten times.

No. 45. Stand upright, heels together, grasp the wand at the extreme ends and hold it behind the body, keeping the arms straight. The right hand high up and the left hand low down. Now swing the left hand high up and the right low down, and so continue to change the relative positions of the ends of the wand, without bending the elbows, ten times.

No. 46. Charge the right foot diagonally forward, as seen in *Fig.* 19, five times. Now the left foot with the left hand raised high, five times. Alternate five times.

No. 47. Same as the last, except that when charging with the right foot, you raise the left hand high, and vice versa.

The wand exercises from this point are performed in classes, and while marching.

No. 48. Marching as represented in *Fig.* 20, leap sideways as far as possible, first one foot and then the other, without loosing your relation to each other.

No. 49. Putting the two wands together, and holding them as represented in *Fig.* 21, leap sidewise as before, being sure to keep the shoulders back, and so leaping together that the two will move as one person. Be sure to keep the arms quite perpendicular over the shoulders.

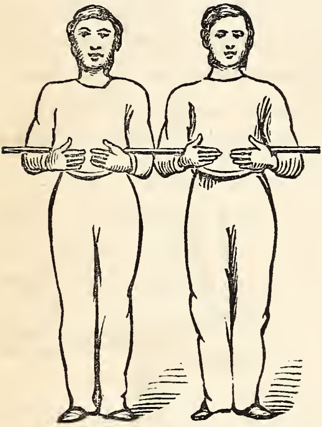


Figure 20.

Figure 21.

No. 50. One person walking directly behind the other, take hold of the extreme ends of the wands, and then allow the hands to rest on the shoulders. Marching in this way, at the word of command "Up," raise the wands as high as you can, and as the right foot goes forward, thrust the right hand as far forward as possible, the left one at the same time being pushed as far back as possible, (*Fig.* 22,) and as the left foot comes forward, reverse the hands.

No. 51. Same as the last, except the right hand goes forward with the left foot, and the left hand with the right foot. In all these you must not bend the elbows, except when you are told to bend them.

No. 52. Still keeping your arms perpendicular, carry both of your hands forward as far as you can reach with your right foot, and as you step your left foot forward, carry both hands as far back as you can reach, and thus continue for ten steps.

No. 53. Same as the last, except that the hands go forward with the left foot, and backward when the right foot goes forward.

No. 54. Bring the hands to the shoulders, and as the right foot steps forward, raise the right hands as high as you can reach. When the left foot goes forward, raise the left hands and bring down the right hands, and so continue to alternate ten times.

No. 55. Same as the last, except the right hands go up as the left feet go forward, and the left hands with the right feet.

No. 56. The two hands go up simultaneously with the stepping forward of the right feet, and come down as the left feet go forward.

No. 57. Same as the last, except the hands go up as the left feet go forward, and down as the right feet go forward. Be sure in the last four exercises that the arms go up and down quite vertically.

Figure 22.

Figure 23.

No. 58. Put the two wands together and take hold of them with one hand, as represented in *Fig.* 23, and marching side by side, leap sidewise right and left, keeping the wand as high as you can reach.

No. 59. Partners change sides and repeat the same.

No. 60. Carrying the wands as in *Fig*. 23, as you step forward with the right foot, bring the wand down so as to strike your right leg with the hand, and then as your left foot goes forward, carry the wand back to its vertical position, and so continue ten times.

No. 61. Change sides with your partner, and do the same again, only bringing your wand down as the left foot goes forward, and raising it as the right foot goes forward.

No. 62. Cross the hands on the two wands placed side by side, but instead of holding them over the head, as in *Fig*. 21, let them hang down in front, and carrying them thus, leap from side to side.

Figure 24.

Figure 25.

No. 63. Walking one in front of the other, and extending the arms horizontally, *being careful not to bend the elbows*, carry the right forward as far as possible with the right foot, as represented in *Fig*. 24, and simultaneously with this carry the left foot backward as far as possible. When the left foot comes forward let the left hand come forward too, and thus alternate.

No. 64. Same as the last, except that the right hand comes forward with the left foot, and vice versa.

No. 65. The same simultaneously with the right foot and with the left foot.

Be careful in the performance of the last four, that you keep the arms exactly horizontal from first to last.

No. 66. Walking one in front of the other, with the wands hanging in the hands on either side, carry one up as high as you can reach, as in *Fig.* 25, and then as the other foot goes forward, carry up the other while the first is brought down.

No. 67. Same as the last, except the right arms go up as the left foot goes forward, and vice versa.

No. 68. Simultaneously up with the right foot forward ten times, and the same with the left foot.

It is perhaps unnecessary to repeat that every motion with the wands is to be done to music. In making the changes from one exercise to another, this rule must not be forgotten.

It must not be forgotten that the feet, in every exercise, are to be kept at a right angle with each other.

EXERCISES WITH DUMB BELLS.

Within a few years I have devised a series of new exercises with the dumb bell. The entire series includes more than fifty exercises. I now take the liberty to ask a careful, discriminating examination by the anatomist and physiologist. I have never given so much study with reference to a surgical operation, as to each and every part of the body in adapting these exercises to our physical wants.

Heretofore dumb bells have been made of metal. The weight in this country has usually been considerable. The general policy at present is to employ those as heavy as the health-seeker can "put up." In the great German gymnastic institutes dumb bells were formerly employed weighing from fifty to one hundred pounds; but now Kloss and other distinguished authors condemn such weights, and advocate those weighing from two to five pounds. I think those weighing two pounds are heavy enough for any man; and as it is important that they be of considerable size, I introduced, some years ago, dumb bells made of wood. Every year my faith grows stronger in their superiority.

Some years since, before I had seen the work of Prof. Kloss on the dumb bell, I published a paper upon the use of this piece of apparatus, in which I stated the best weight for men as from two to five pounds, and gave at length the reasons for the employment of such light weights, and the objections to heavy ones. I was filled, not with pride, but with profound satisfaction, while engaged in translating Kloss's work recently, to find, as fundamental with this great author, identically the same weights and reasons.

In my early experience as a teacher of gymnastics, I advocated the use of heavy dumb bells, prescribing those weighing one hundred pounds for persons, who, could put up that weight. As my success has always been with heavy weights, pride led me to continue their use long after I had begun to doubt the wisdom of such a course. I know it will be said that dumb bells of two pounds' weight will do for women and children, but cannot answer the requirements of strong men.

The weight of the dumb bell is to be determined entirely by the manner in which it is used. If only lifted over the head, one or two pounds would be absurdly light; but if used as we employ them, then one weighing ten pounds is beyond the strength of the strongest. No man can enter one of my classes of little girls even, and go through the exercises with dumb bells weighing ten pounds each.

We had a good opportunity to laugh at a class of young men, last year, who, upon entering the gymnasium, organized an insurrection against the wooden dumb bells, and through a committee asked me to procure iron ones; I ordered a quantity, weighing three pounds each; they used them part of one evening, and when asked the following evening which they would have, replied, "The wooden ones will do."

A just statement of the issue is this: If you only lift the dumb bell from the floor, put it up, and then put it down again, of course it should be heavy, or there is no exercise; but if you would use it in a great variety of ways, assuming a hundred graceful attitudes, and bringing the muscles into exercise in every direction, requiring skill and followed by an harmonious development, the dumb bell must be light.

There need be no controversy between the light-weight and the heavy-weight party on this point. We of the light-weight party agree, that, if the dumb bell is to be used as the heavy-weight party uses it, it must be heavy; but if as we use it, then it must be light. If they of the heavy-weight party think not, we ask them to try it.

The only remaining question is that which lies between all heavy and light gymnastics, namely, whether strength or flexibility is to be preferred. Without entering upon a discussion of the physiological principles underlying this subject, I will simply say that I prefer the latter. The Hanlon brothers and Heenan are, physiologically considered, greatly superior to heavy-lifters.

But here I ought to say that no man can be flexible without a good degree of strength. It is not, however, the kind of strength involved in heavy-lifting. Heenan is a very strong man, can strike a blow twice as hard as Windship, but cannot lift seven hundred pounds nor put up a ninety-pound dumb bell. William Hanlon, who is probably the finest gymnast, with the exception of Blondin, ever seen on this continent, cannot lift six hundred pounds. Such men have a great fear of lifting. They know, almost by instinct, that it spoils the muscles.

One of the finest gymnasts in the country told me that in several attempts to lift five hundred pounds he failed, and that he should never try it again. This same gymnast owns a fine horse. Ask him to lend that horse to draw before a cart and he will refuse, because such labor would make the animal stiff, and unfit him for light, graceful movements before the carriage.

The same physiological law holds true of man; lifting great weights affects him as drawing heavy loads affects the horse. So far from man's body being an exception to this law, it bears with peculiar force upon him. Moving great weights through small spaces produces a slow, inelastic, inflexible man. No matter how flexible a young man may be, let him join a circus company, and lift the cannon twice a day for two or three years, and he will become as inflexible as a cart-horse. No matter how elastic the colt is when first harnessed to the cart, he will soon become so inelastic as to be unfit to serve before the carriage.

If it be suspected that I have any personal feeling against Dr. Windship or other heavy-lifters, I will say that I regard all personal motives in a work of such magnitude and beneficence as simply contemptible. On the contrary, I am exceedingly grateful to this class of gymnasts for their noble illustration of the possibilities in one department of physical development.

Men, women, and children should be strong, but it should be the strength of grace, flexibility, agility, and endurance; it should not be the strength of a great lifter. I have alluded to the gymnastics of the circus. Let all who are curious in regard to the point I am discussing, visit it. Permit me to call special attention to three performers,—the man who lifts the cannon, to the India-rubber man, and to the general performer. The lifter and the India-rubber man constitute the two mischievous extremes. It is impossible that in either there should be the highest physiological conditions; but in the persons of the Hanlon brothers, who are general performers, are found the model gymnasts. They can neither lift great weights nor tie themselves into knots, but they occupy a position between these two extremes. They possess both strength and flexibility, and resemble fine, active, agile, vigorous carriage-horses, which stand intermediate between the slow cart-horse and the long-legged, loose-jointed animal.

"Strength is health" has become a favorite phrase. But, like many common saws, it is an error. Visit the first half-dozen circuses that may come to town, and ask the managers whether the cannon-lifter or the general performer has the better health.

You will find in every case it is the latter. Ask the doctors whether the cartmen, who are the strongest men in the city, have better health than other classes, who, like them, work in the open air, but with light and varied labor. You will not find that the measure of strength is the measure of health. Flexibility has far more to do with it.

Suppose we undertake the training of two persons, of average condition. They have equal strength,—can lift four hundred pounds. Each has the usual stiff shoulders, back and limbs. One lifts heavy weights until he can raise eight hundred pounds. Inevitably he has become still more inflexible. The other engages in such exercises as will remove all stiffness from every part of the body, attaining not only the greatest flexibility, but the most complete activity. Does any intelligent physiologist doubt that the latter will have done most for the promotion of his health? that he will have secured the most equable and complete circulation of the fluids, which is essentially what we mean by health, and have added most to the beauty and effectiveness of his physical action?

With heavy dumb bells the extent of motion is very limited, and of course the range and freedom of action will be correspondingly so. This is a point of great importance. The limbs, and indeed the entire body, should have the widest and freest range of motion. It is only thus that our performances in the business or pleasures of life become most effective.

A complete, equable circulation of the blood is thereby most perfectly secured. And this, I may remark, is in one aspect the physiological purpose of all exercise. The race-horse has a much more vigorous circulation than the cart-horse. It is a fact not unfamiliar to horsemen, that, when a horse is transferred from slow, heavy work, to the carriage, the surface-veins about the neck and legs begin at once to enlarge; when the change is made from the carriage to the cart, the reverse is the result.

And when we consider that the principal object of all physical training is an elastic, vigorous condition of the nervous system, the superiority of light gymnastics becomes still more obvious. The nervous system is the fundamental fact of our earthly life. All other parts of the organism exist and work for it. It controls all, and is the seat of pain and pleasure.—The impressions upon the stomach, for example, resulting in a better or worse digestion, must be made through the nerves. This supreme control of the nervous system is forcibly illustrated in the change made by joyful or sad tidings. The overdue ship is believed to have gone down with her valuable, uninsured cargo. Her owner paces the wharf, sallow and wan,—appetite and digestion gone. She heaves in sight! She lies at the wharf! The happy man goes aboard, hears all is safe, and, taking the officers to a hotel, devours with them a dozen monstrous compounds, with the keenest appetite, and without a subsequent pang.

I am confident that the loyal people of this country have eaten and digested since Roanoke and Donelson, as they had not before since Sumter.

Could we have an unbroken succession of good news, we should all have good digestion without a gymnasium. But in a world of vexation and disappointment, we are driven to the necessity of studied and unusual muscle-culture, and other hygienic expedients, to give the nervous system that support and vitality which our fitful surroundings deny.

If we would make our muscle-training contributive in the highest degree to the healthful elasticity of our nerves, the exercises must be such as will bring into varied combinations and play all our muscles and nerves. Those exercises which require great accuracy, skill, and dash, are just those which secure this happy and complete intermarriage of nerve and muscle. If any one doubts that boxing and small-sword will do more to give elasticity and tone to the nervous system than lifting kegs of nails, then I will give him over to the heavy-lifters.

Another point I take the liberty to urge. Without *accuracy* in the performance of the feats, the interest must be transient. This principle is strikingly exemplified in military training.—Those who have studied our infantry drill have been struck with its simplicity, and have wondered that men could go through with its details every day for years without disgust. If the drill-master permit carelessness, then, authority alone, can force the men through the evolutions; but if he insist on the greatest precision, they return to their task every morning, for twenty years, with fresh and increasing interest.

What precision, permit me to ask, is possible, in "putting up" a heavy dumb bell? But in the new dumb bell exercises there is opportunity and necessity for all the accuracy and skill which are found in the most elaborate military drills.

I have had experience in boxing and fencing, and I say with confidence, that in neither nor both is there such a field for fine posturing, wide, graceful action, and studied accuracy, as is to be found in the new series of dumb bell exercises.

But, it is said, if you use dumb bells weighing only two pounds, you must work an hour to obtain the exercise which the heavy ones would furnish in five minutes. I need not inform those who have practiced the new series with the light dumb bells that this objection is made in ignorance. If you simply "put up" the light implement it is true; but if you use it as in the new system, it is not true. On the contrary, in less than five minutes, legs, hips, back, arms, shoulders, neck, lungs and heart will each and all make the most emphatic remonstrance against even a quarter of an hour's practice of such feats.

At this point it may be urged that those exercises which quicken the action of the thoracic viscera, to any considerable degree, are simply exhaustive. This is another blunder of the "big-muscle" men. They seem to think you can determine every man's constitution and health by the tape-line; and that all exercises whose results are not determinable by measurement are worthless.

I need scarcely say, there are certain conditions of brain, muscle, and every other tissue, far more important than size; but what I desire to urge more particularly in this connection is the importance, the great physiological advantages of just those exercises in which the lungs and heart are brought into active play. These organs are no exceptions to the law that exercise is the principal condition of development. Their vigorous training adds more to the stock of vitality than that of other organs. A man may stand still and lift kegs of nails and heavy dumb bells until his shoulders and arms are Samsonian, it will contribute far less to his health and longevity than a daily run of a mile or two.

Speaking in a general way, those exercises in which the lungs and heart are made to go at a vigorous pace are to be ranked among the most useful. The "double-quick" of the soldier contributes more in five minutes to his digestion and endurance than the ordinary drill in two hours.

I have said, an elastic tone of the nervous system is the physiological purpose of all physical training. If one may be allowed such an analysis, I would add that we exercise our muscles to invigorate the thoracic and abdominal viscera. These in their turn support and invigorate the nervous system. All exercises which operate more directly upon these internal organs—as, for example, laughing, deep breathing, and running—contribute most effectively to the stamina of the brain and nerves. It is only the popular mania for monstrous arms and shoulders that could have misled the intelligent gymnast on this point.

But finally, it is said, you certainly cannot deny that rapid motions with great sweep exhaust more than slow motions through limited spaces. A great lifter said to me the other day,—

"Do you pretend to deny that a locomotive with a light train, flying at the rate of forty miles an hour, consumes more fuel than one with a heavy train, moving at the rate of five miles?"

I did not attempt to deny it.

"Well then," he added with an air of triumph, "what have you to say now about these great sweeping feats with your light dumb bells, as compared with the slow putting up of heavy ones?"

I replied by asking him another question.

"Do you pretend to deny, that, when you drive your horse ten miles within an hour, before a light carriage, he is more exhausted than by drawing a load two miles an hour?"

"That's my doctrine exactly," he said.

Then I asked,—"Why don't you always drive two miles an hour?"

"But my patients would all die," replied my friend.

I did not say aloud what was passing in my mind,—that the danger to his patients might be less than he imagined; but I suggested, that most men, as well as most horses, had duties in this life which involved the necessity of rapid and vigorous motions,—and that, were this slow movement generally adopted, every phase of human life would be stripped of progress, success and glory.

As our artificial training is designed to fit us for the more successful performance of the duties of life, I suggest that the training should be, in character, somewhat assimilated to those duties. If you would train a horse for the carriage, you would not prepare him for this work by driving at a slow pace before a heavy load. If you did, the first fast drive would go hard with him. Just so with a man. If he is to lift hogsheads of sugar, or kegs of nails, as a business, he may be trained by heavy-lifting; but if his business requires the average activity and free motions of human occupations, then, upon the basis of his heavy, slow training, he will find himself in actual life in the condition of the dray-horse who is pushed before the light carriage at a high speed.

Perhaps it is not improper to add, that all this talk about expenditure of vitality is full of sophistry. Lecturers and writers speak of our stock of vitality as if it were a vault of gold, upon which you cannot draw without lessening the quantity. Whereas, it is rather like the mind or heart, enlarging by action, gaining by expenditure.

When Daniel Boone was living alone in Kentucky, his intellectual exercises were doubtless of the quiet, slow, heavy character. Other white men joined him. Under the social stimulus, his thinking became more sprightly. Suppose that in time he had come to write vigorously, and to speak in the most eloquent, brilliant manner, does any one imagine that he would have lost in mental vigor by the process? Would not the brain, which had only slow exercise in his isolated life, become bold, brilliant, and dashing, by bold, brilliant and dashing efforts?

A farm boy has slow, heavy muscles. He has been accustomed to heavy exercises. He is transferred to the circus, and performs, after a few years' training, a hundred beautiful, splendid feats. He at length reaches the matchless Zampillærostation of Wm. Hanlon. Does any one think that his body has lost power in this brilliant education?

Is it true, either in intellectual or physical training, that great exertions, under proper conditions and limitations, exhaust the powers of life? On the contrary, is it not true that we find in vigorous, bold, dashing, brilliant efforts, the only source of vigorous, bold, dashing, and brilliant powers?

In this discussion I have not considered the treatment of invalids. The principles presented are applicable to the training of children and adults of average vitality.

I will rest upon the general statement, that all persons, of both sexes, and of every age, who are possessed of average vitality, should, in the department of physical education, employ light apparatus, and execute a great variety of feats which require skill, accuracy, courage, presence of mind, quickness of eye and hand,—in brief, which demand a vigorous and complete exercise of all the powers and faculties with which the Creator has endowed us; while deformed and diseased persons should be treated in consonance with the philosophy of the *Swedish Movement Cure*, in which the movements are slow and limited.

It must not be forgotten that in all the dumb bell exercises the pupil should, as a beginning position, stand with his heels together, the toes separated so as to make between the feet a right angle, and the arms hanging by the sides with the dumb bells horizontal.

Not only in all the exercies but in all the changes from one exercise to another, the pupil must keep time to the music. In the absence of other musical instruments a drum may be employed to mark the time; and even without this it may be kept by counting one, two; one, two; one, two.

It must be remembered that in no case should the pupil bend the legs at the knee, or his arms at the elbow, unless it is so directed. No rule in the dumb bell exercises is so important as this. If it be forgotten, exercises with dumb bells will loose more than half their value.

DESCRIPTION OF EXERCISES.

No. 1. The position is shown in *Fig.* 1. Thumbs outward. Bells *exactly horizontal.* Turn the thumb ends of the bells to the hips, and then back again to the position shown in the figure. Repeat ten times. Let the change be made with the greatest accuracy. When it is well done, no matter which end is at the hip, a straight rod run through one dumb bell, lengthwise, would at the same time run through the centre of the other.

In this and all subsequent dumb bell exercises, the pupil must be careful not to bend the elbows. When exceptions to this rule occur, they will be plainly indicated.

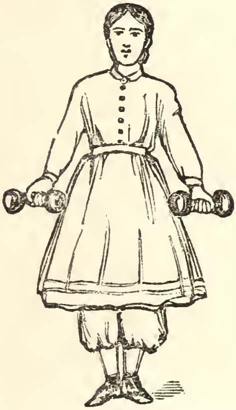


Figure 1.

Figure 2.

No. 2. Position seen in *Fig.* 2. Keep the elbows pressed against the sides, and twist the bells so the ends are exactly reversed. Be sure they are exactly in line with each other, and the forearms parallel. Repeat ten times.

No. 3. In passing from No. 2 to No. 3, bring the bells to the chest, and on the next beat to the position in *Fig.* 3. The palms of the hands are upward. Bells exactly horizontal and parallel to each other. Turn the hands over, knuckles upward. Now back again in the same position as before. Repeat ten times.

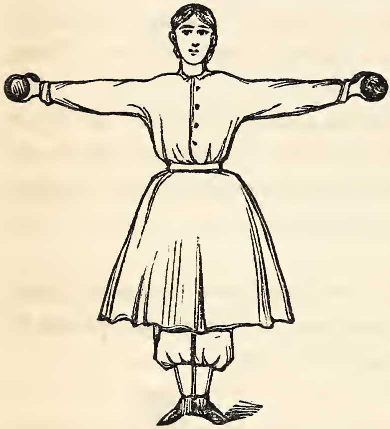


Figure 3.

Figure 4.

No. 4. In passing from No. 3 to No. 4, bring the bells to the chest, and on the next beat to the position in *Fig.* 4. The palms forward. Twist the bells so the knuckles are forward. Repeat ten times. Arms to be kept parallel from first to last.

Figure 5.

Figure 6.

No. 5. Position as in *Fig.* 5. In passing from No. 4 to

No. 5, bring the bells to the chest. Twist the arms so that the bells are exactly reversed.

It will be seen in the figure, the palms are upward. When the bells are reversed, the knuckles are upward. Keep the arms parallel. Repeat ten times.

In passing from one exercise to another, I have spoken of bringing the bells to the chest. They should strike the chest exactly at the point shown in *Fig.* 6.

No. 6. Thrust the two bells down by the side of the legs. Bring to the chest, and thrust them sidewise. Bring to the chest and thrust them upward. Bring to the chest and thrust them forward.

Repeat these four thrusts five times.

When the down thrust is made, the pupil must be careful that at the lowest point the bells are precisely horizontal, and parallel to each other. When the side thrust is made the arms must be horizontal, the bells perpendicular and parallel to each other.— When the upward thrust is made the arms must be accurately perpendicular, bells parallel and horizontal.

Figure 7.

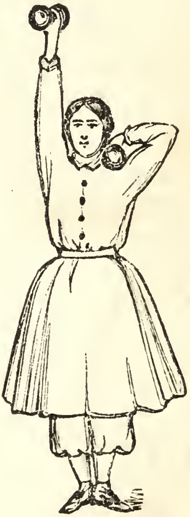


Figure 8.

When the forward thrust is executed the arms must be exactly horizontal, and the bells perpendicular and parallel.

No. 7. Raise the right hand bell from the side of the leg into the arm-pit, five times. *(Fig. 7.)* Left, five times. Alternately and simultaneously, five times.

Be sure that each time when the bells come into the arm-pits they are exactly horizontal.

No. 8. Passing from No. 7 to No. 8, bring the bells to the chest; on the next beat, to the top of the shoulders; on the next beat carry up the right, reaching accurately the position seen in *Fig.* 8. Repeat five times. Left, the same. Alternately and simultaneously, each five times.

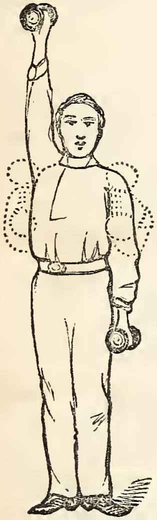


Figure 9.

Figure 10.

No. 9. Passing from No. 8 to No. 9, bring the bells to the chest, (the dotted lines in *Fig.* 9 show it) then down by the sides, in all, as usual, keeping good time to the music. Now carry the right bell to the chest, then up, reaching the position shown in *Fig.* 9. Return to the hip, marking one beat on the chest in going down. Repeat ten times. Left the same. Alternately and simultaneously, ten times.

No. 10. Bring the bells to the chest. Strike out the right one in front, arm precisely horizontal, bell perpendicular. (*Fig.* 10.) Repeat twenty times. Left the same. Alternately and simultaneously ,twenty times.

As usual, keep the chest well forward, and the shoulders drawn far back.

No. 11. Holding the bells in the position seen in *Fig.* 11, bring them with *great force* into the position seen in the dotted line, forty times. In beginning this elbow thrust backward, it is well to first raise the bells a foot, that they may be brought back with more force, and more directly into the position seen in the dotted lines. But in carrying them forward again, it should be first into the position seen in the figure.

Figure 11.

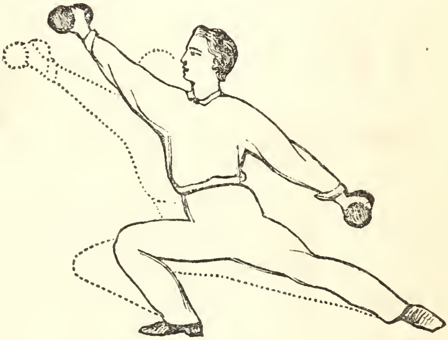


Figure 12.

No. 12. Stamp the left foot, then the right, then charge out into the position seen in *Fig.* 12. Making sure that the leg left behind, *in this and all subsequent charges*, is kept entirely straight, while the one forward is placed as shown in the figure. Holding the arms as illustrated, force the entire person into the position of the dotted lines, five times. *There should be no motion in the shoulder joints. The chest is pushed far forward, and the shoulders drawn well back.* These directions are applicable to all charging exercises, in which a different course is not plainly indicated.

It will be observed that the charge in No. 12 is exactly sidewise.

Rise to the perpendicular again, stamp the right foot, then the left, and lastly charge out on the left side, and repeat the performance of the right side, five times.

Figure 13.

Figure 14.

No. 13. Rise to the perpendicular, stamp with the left foot, then with the right, then charge out as shown in *Fig.* 13. Under the directions given in No. 12, sink five times.

Same on the left side, of course with the intermediate stamping.

No. 14. After the regular stamping, the pupil should charge in the manner illustrated in *Fig.* 14.

Sink five times. Same on the left side.

In this, as in *Figs.* 12 and 13, the charging is exactly sidewise.

No. 15. Stand upright, hands by the side. Raise the right hand as shown in *Fig.* 15, five times. Left the same. Alternately and simultaneously, five times.

In this the arm is carried up with a quick, strong effort, and arrested at the horizontal line, precisely as if it had struck a rock. When it is brought back to the side again, it is with the same force and sudden arrest. This and the next one are among the most severe of the dumb bell exercises.

No. 16. Assuming the position seen in *Fig.* 16, force back the right arm as seen in the dotted line, five times. Left the

Figure 15.

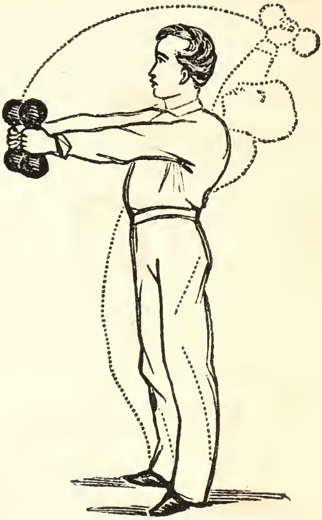


Figure 16.

same. Alternately and simultaneously, five times.

The arm must not be bent at the elbow.

Figure 17.

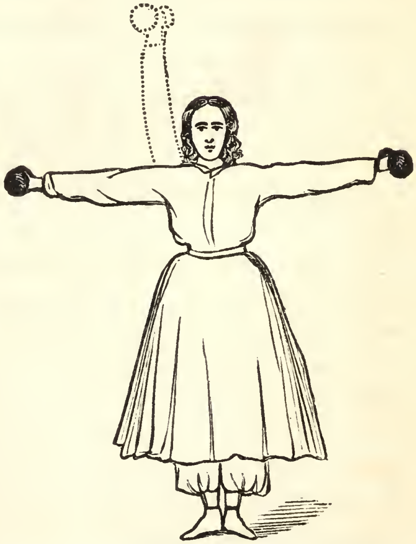


Figure 18.

The directions given in No. 15, in regard to force and sudden arrest, are applicable to this exercise.

No. 17. Beginning as in No. 15, with the arms hanging, combine the two exercises, Nos. 15 and 16, in one sweep, reaching the position of the dotted line in *Fig.* 16. Repeat five times. Left hand the same. Alternately and simultaneously, five times.

No. 18. Stand upright, arms hanging. Raise the right arm to the horizontal, at the side, with the palm up. Repeat five times. Left, the same. Alternately and simultaneously, five times. The position of one of the arms is seen in *Fig.* 17.

No. 19. Having the arms extended at the sides as shown in *Fig.* 18, raise the right arm to the position seen in the dotted line, five times. Left, the same. Alternately and simultaneously, five times.

In raising the dumb bells over the head, be careful that they are in such a position that when the two are up together, they are exactly horizontal and parallel to each other.

No. 20. Beginning as in No. 17, arms hanging, combine Nos. 18 and 19, in one sweep, each arm five times. Alternately and simultaneously, the same.

Figure 19.

No. 21. Standing upright, arms hanging, charge into the position shown in *Fig.* 19; remaining thus, thrust the arms in front in a horizontal line, five times, alternately and simultaneously. Rising to the perpendicular, stamp with the right foot, then the left, then charge out with the left foot, and repeat the exercises with the arms.

It will be seen by the figure, that the leg behind is kept entirely straight and rests on the toe. The special point in this exercise is to reach the dumb bells as far forward as possible.

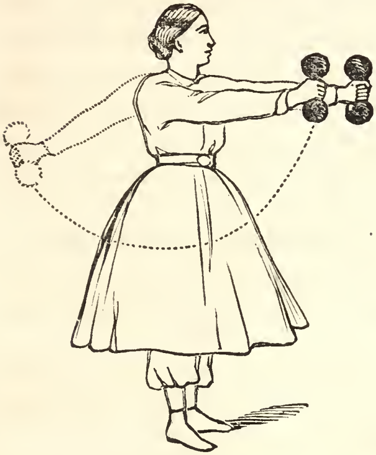


Figure 20.

Figure 21.

No. 22. Standing as represented in *Fig.* 20, force the right arm into the position shown in the dotted line, five times. Left the same. Alternately and simultaneously, five times.

In this exercise keep the body as erect as possible.

Figure 22.

Figure 23.

No. 23. Having the arms perpendicular over the head, perform the same exercise as in the last number, with right hand, left hand, then alternately and simultaneously.

No. 24. Placing the feet in the position of *Fig.* 21, raise the arms with great force from the hanging position to that seen in *Fig.* 21. On the next beat bring the arms to the position seen in *Fig.* 22; on the next to that seen in *Fig.* 23; on the next beat sweep back to the position seen in *Fig.* 22; then to the position seen in *Fig.* 21. *Repeat five times.* Stamp right and left, then step out with the left foot, then swing the arms over the head, performing the same exercise on the left side.

In this exercise, neither arms nor legs should be bent.

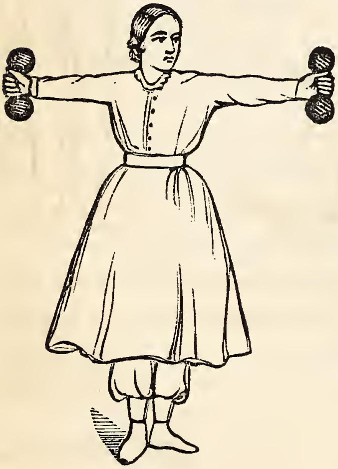


Figure 24.

Figure 25.

No. 25. Stand erect, arms horizontal in front and parallel to each other. Carry the right hand backward in the horizontal plane (*Fig.* 24.) as far as possible; return it. Repeat ten times. Left the same; alternately and simultaneously, ten times.

No. 26. Standing erect, arms hanging, stamp with the left foot; then with the right; then charge into the position seen in *Fig.* 25, and thrust the arms in a direct line upward, alternately and simultaneously, ten times. Assuming the erect position drop the arms by the side, stamp the right foot, then the left, and charge out on the left side; repeat the exercise with the arms.

In this exercise, it will be seen, the leg behind is straight, that charged forward, considerably bent.

Figure 26.

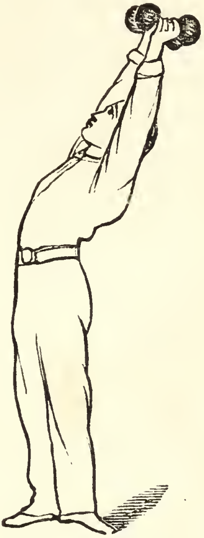


Figure 27.

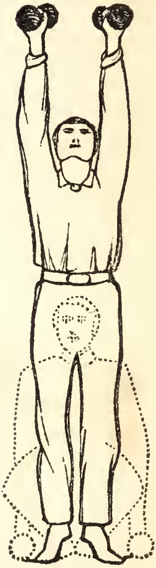


Figure 28.

No. 27. As in nearly all other exercises, begin with the heels together, body erect, chest forward, shoulders back, arms hanging, dumb bells horizontal and parallel to each other. Step diagonally backward with the right foot, as seen in *Fig.* 26, and repeat the exercises in No. 26. Same with the left foot.

In this exercise the forward leg is kept straight, that behind is bent as much as possible.

No. 28. Bells on the chest. Carry the right arm out at the side, thrusting it as far back as possible; suddenly bring it back to the chest in a circle as if grasping a large body standing in front. Repeat five times. Left hand, same. Alternately and simultaneously, the same.

In this exercise the arms should be kept in the horizontal plane, and should in the performance of the exercise enclose as large an armful of the imaginary objects as possible.

No. 29. Standing erect, arms hanging at the side, suddenly turning the body to one side, as far as you can twist it without moving the feet, carry the arms to the position seen in *Fig*. 27. Bring them back to the sides, while at the same time you bring the body to the first position. Swing the arms up on the other side, and so continue, alternating twenty times.

No. 30. Standing erect, arms hanging, bring the bells to the chest, then to the floor, as shown in the dotted line in *Fig*. 28; then rising, bring the dumb bells again to the chest, and on the next beat thrust them as far upward as possible, rising on the toes; then back to the chest. Repeat twenty times.

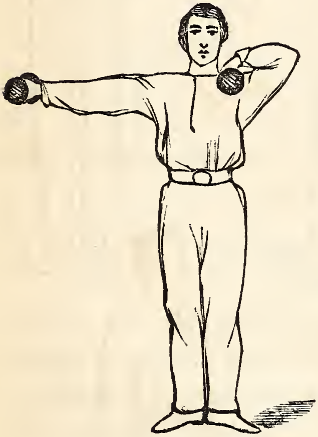


Figure 29.

Figure 30.

No. 31. Standing erect, dumb bells on the shoulders, (not on the chest) thrust the right arm out at the side as seen in *Fig*. 29, ten times. Left the same. Alternately and simultaneously the same.

No. 32. Standing erect, arms hanging, carry the arms to the horizontal in front; then to the position over the head seen in *Fig*. 30; now down to the horizontal again, and then to the floor as seen in the dotted line. Repeat ten times.

In this exercise there must be no bending at the knees or elbows.

No. 33. Standing erect, arms hanging, charge out with the right foot, and sweep the left arm as shown in *Fig.* 31 ; on the

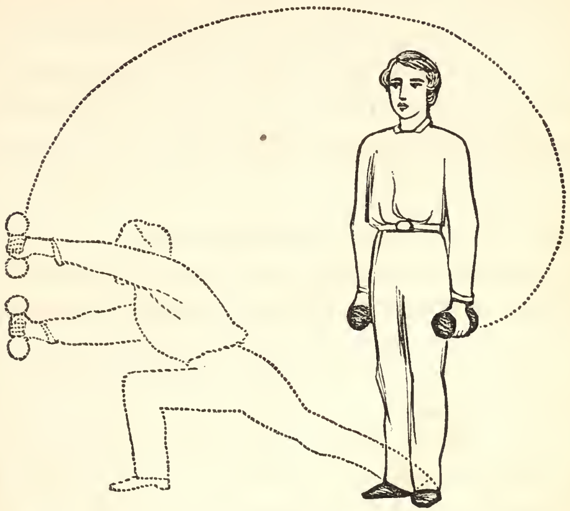


Figure 31.

next beat return to the first position. Repeat five times. Same on the left side. Alternately, five times.

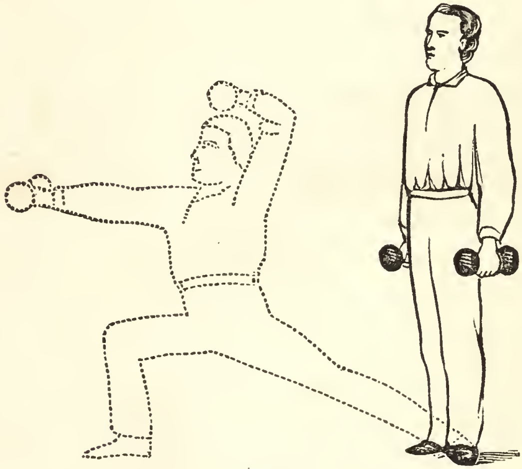


Figure 32.

No. 34. Standing erect, arms hanging, without moving the body, carry the right foot out sidewise, lifting it from the floor, and bringing it back to the other foot, without bending the knee, five times; then charge into the position seen in *Fig.* 32, and return to the first position, five times.

The arm which is brought over the head, must be carried in a direct line from the side to the position over the head, and not brought toward the front of the body in its passage up or down.

GENERAL DIRECTIONS.

The performers cannot be too careful to keep the feet at right angles with each other from first to last, and in no case to bend the elbows except where specific directions to bend them are given. The body is to be kept quite erect and the head drawn far back.

I may add that the dumb bells should be hung up on the walls on little bent wires, so that they are protected from the dust of the floor, and from being bruised against each other as when they are thrown into a box.

It is well, if the expense is not regarded, to make the dumb bells of rose-wood, box-wood, or other precious woods, and finish them beautifully. The interest of young ladies is thereby greatly enhanced.

I need scarcely say that the variety of exercises with dumb bells may easily be made much greater, but I believe those I have given are the best possible ones, and that the variety is sufficiently complete.

of Henry Barnard)

XIV. SCHOOL ARCHITECTURE.

PLANS FOR UNION AND GRADED SCHOOLS.

GRAMMAR SCHOOLS IN BOSTON.

In determining on the size, internal arrangements, and equipment of a School-house, regard must be had not only to the number of children to be accommodated, but to their age, studies, and classification, that is, to the character and aim of the school or schools to be provided for.

By a Union, or Graded School, was originally intended a school in which all the scholars of a given territory—usually a village, or other populous municipality—before accommodated in several small houses, were brought into one large building, and there distributed into different rooms, or grades according to attainments, so as to bring a large number of pupils of nearly the same age, and in a few and the same studies, under teachers having special qualifications for each grade—and especially to bring the young children by themselves under female teachers, and to facilitate the employment of the same class of teachers as assistants in schools designed for the older pupils. In the more populous districts the gradation was and still continues more minute, and by degrees, school-houses are now erected specially for at least three grades—although houses designed mainly for the youngest grade, embrace accommodations for the next highest, and houses designed for the oldest pupils and the highest grade not unfrequently include accommodation for the next lowest.

But in edifices designed for a particular grade, regard must be had in the internal arrangement to the different plan of classifying the school for the purposes of instruction and government—and particularly to this,—whether there shall be on each floor one large room, (or two, capable of being made into one when necessary,) where all the pupils shall be properly seated for study, supervision and general instruction under a principal teacher, with smaller room to which the several classes shall retire for purposes of recitation to assistants selected in reference to their special qualification in instruction; or whether the floor shall be divided into a certain number of rooms, each room to accommodate only as many pupils as can be profitably instructed by one and the same teacher—and each room to constitute a separate school, except that all are to be subject to the supervision, and, to some extent, the occasional visitation and instruction of the Principal teacher of the whole school.

In the Public Schools of Boston, the former plan prevailed generally in all the grammar schools—until the organization of the Quincy school in 1848. Since that date the size of the houses has been determined by the convenience of classifying the pupils into rooms, each capable of providing from fifty to sixty with separate desk and chair, and he school has been organized so as to have a special teacher for each room, all subordinate to the Principal—his room accommodating the same number of pupils, in which he is allowed an assistant, so as admit of his visiting from time to time the other rooms, or classes in the same building. There are many advantages in this arrangement, and under a Principal, disposed and at liberty by having assistants in his own room to make himself felt in government and instruction in each room—the disadvantages of not having all the pupils of the same school under the eye, voice and personal influence of the superior master, are in a measure obviated.

Plan and Description of Bowdoin Grammar School-House.

The new Bowdoin School-house, completed in 1848, is situated on Myrtle street, and with the yard occupies an area of about 75 feet by 68 feet, bounded on each of the four sides by a street. It is built of brick with a basement story of hammered granite, and measures 75 feet 9 inches extreme length by 54 feet 6 inches extreme breadth—having three stories, the first and second being 13 feet, and the third, 15 feet high in the clear. The ground descends rapidly from Myrtle street, thereby securing a basement of 15 feet in the rear. One third of which is finished into entries, or occupied by three furnaces, coal bins, pumps, &c., and the remaining two thirds is open to the yard, thereby affording a covered play-ground for the pupils.

The third story is finished into one hall 72 feet long by 38 feet wide, with seats and desks for 180 pupils. On the south side of this hall there are two recitation rooms, each 16 feet by 12 feet, and a room for a library, &c. There are three rooms of the same size on the two floors below.

The second story is divided into two rooms by a partition wall, each of which is 35 feet by 38, and accommodates 90 pupils, and so connected by sliding doors that all the pupils of both schools can be brought under the eye and voice of the teacher.

The first story corresponds to the second, except there are no sliding doors in the partition, and no connection between the room except through the front entry. The two rooms on this floor have each seats and desks for 100 pupils.

Each story is thoroughly ventilated, and warmed by one of Chilson's Furnaces. In each furnace the air chambers, the apertures for conducting the cold air into them, and the flues for constructing the heated air into the rooms in each story, being all large, a great quantity of warm air is constantly rushing into the rooms, and the ventilating flues or ventiducts being so constructed and arranged that the air of the rooms will be frequently changed, and that a pure and healthy atmosphere will at all times be found in each of these rooms, provided the furnaces are properly and judiciously managed. On the top of the building there are two of Emerson's large ventilators, connected with the attic and ventilating flues, through which the impure air passes out into the atmosphere above.

To accommodate pupils who come to school with wet feet or clothes, there is an open fire in a grate in one of the recitation rooms.

Each room is furnished with Wales' American School Chair, and Ross's Desk, and both desk and chair are in material, form and style, as described on page 202 and 205.

This is a school for girls only, and consists of two departments, one of which is called the Grammar department, and the other the Writing department; the master of each department being independent of the other.

The number of assistant female teachers in each department of this school, when full, will be four, the teachers in each department being independent of the master and teacher in the other.

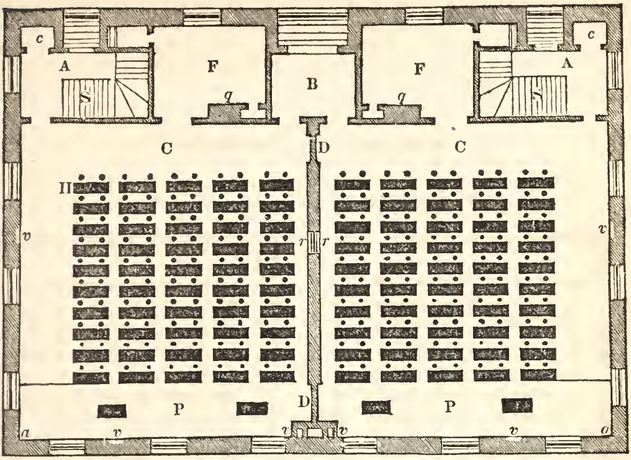
The master of the Grammar department and two of his assistants will occupy the large hall in the third story, and his other two assistants will occupy one of the rooms in the first story.

The master of the writing department and two of his assistants will occupy the rooms in the second story, and his other two assistants will occupy the other room in the first story, each master being the superintendence of his own department.

The school, when full, will be divided into five classes, and each class into two divisions, nearly equal in numbers. The first week after the vacation in August, the first division of each class will attend in the grammar department in the morning, and the second division of each class will attend in the writing department; and in the afternoon, the second division of each class will attend in the grammar department, and the first, in the writing department. The next week, this order of attendance is to be reversed, and this alteration is to continue through the year, the weeks of vacation not being counted.

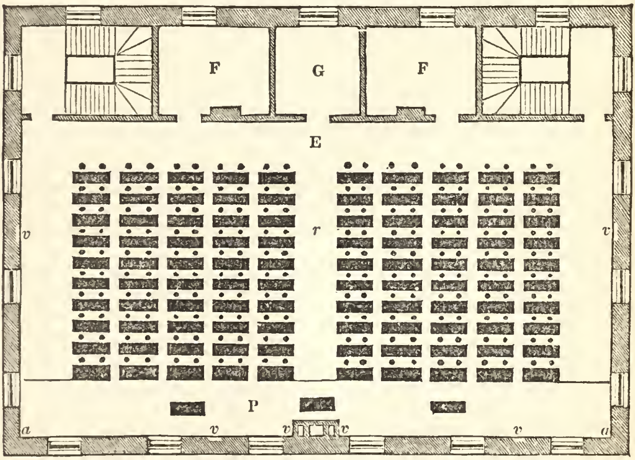
This house and the Quincy Grammar School-house are built after designs by Mr. Bryant.

PLAN OF FIRST AND SECOND FLOOR.

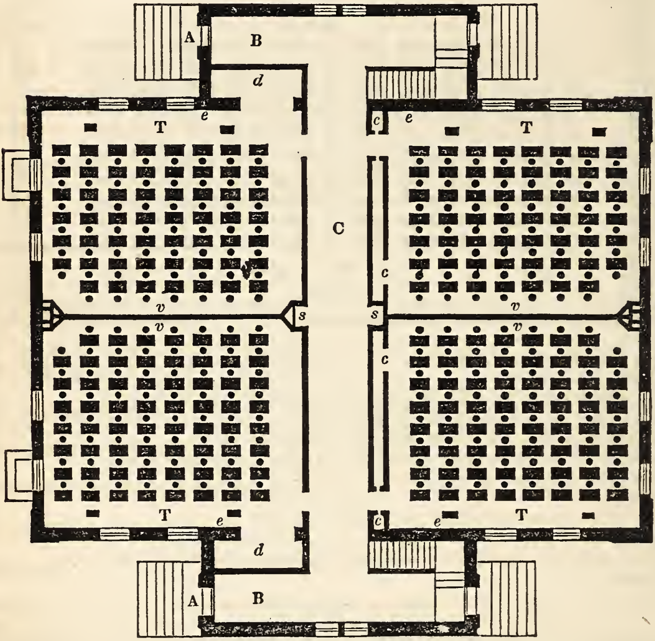


A, A, Entrance for Pupils.
B, Ditto for Teacher.
C, C, Study halls, each 35 by 38 feet; with seats and desks for 100 pupils.
D, Sliding door, by which the two rooms on the second floor are thrown into one.
E, Study hall, 72 feet by 38.
F, F, Two recitation rooms on each floor, 16 feet by 12.
G, Room 10 feet by 12, for library, apparatus, &c.
H, Ross' desk, and Wales' chair.
P, Teacher's platform with desk for teacher and assistants.
S, S, Staircase leading to second and third floors.
a, Case with glass doors for apparatus.
c, Closet for Teacher.
q, Grate.
r, Hot air register.
v, Flues for ventilation.

PLAN OF THIRD FLOOR.



the Principal, and the several divisions of the 2d class instructed by assistants; On the 2d floor is the 2d division of the 1st class instructed by the sub-master, with the several divisions of the 3d class under assistants; and the usher takes the 3rd division of the 1st class, with the several divisions of the 4th class on the 1st floor. By this arrangement the government is rendered comparatively easy. The whole school is brought together in the hall for devotional services, and other general exercises.



Plan of First Floor.

A, A, Front Door.
B, B, Entries.
C, Corridor or Hall.
T, T, T, T, Teachers' Platform 24 feet by 5½.
r, *r*, *r*, *r*, Hot-air flues.
v, *v*, *v*, *v*, Preston's Ventilators for controlling the flues in the partition wall, which communicate with the iron smoke pipes near the top of the building. This plan is adopted in the first story only.
e, *e*, *e*, *e*, Indicates the location of the flues of Emerson's Ventilators in the second, third and fourth stories.
s, Sink.
c, *c*. *c*, *c*, Closets.
d, *d*, Closets 10 feet by 11 feet.

Plan and Description of Quincy Grammar School-House, Boston.

This building, which was commenced in 1847, and dedicated on the 26th of June, 1848, is situated on a lot 90 feet by 130 feet, extending from Tyler street to Hudson street.

The ground plan is in the form of a cross, the exterior dimensions of the body being 80 feet by 58 feet, the end fronting on Tyler street. The wings are 12 feet in front by 36 feet deep. It is four stories high, with a basement 8 feet in the clear, for the furnaces and fuel, and an attic for gymnastic exercises.

Each wing contains a front and back entrance, a flight of stairs from the basement to the attic, and a room on each floor 10 feet by 11 feet, connected with a school-room.

The fourth story of the body is finished in one spacious hall, 16 feet high in the clear, with centre-pieces and a cornice, and a platform at each end 22 feet by 11 feet, and 22 inches high. It is furnished with settees arranged in 4 rows, sufficient to accommodate 700 children.

The third floor is divided by a corridor 8 feet wide, extending across the main body from one wing to the other, having 2 school-rooms on each side.

These four school-rooms are of nearly the same size, averaging about 31½ feet by 26½ feet, and 13 feet high. Each room is lighted by 2 windows at the side, and 2 at the end, and has a platform for the teacher 24 feet by about 5½, with one end towards the entrance from the corridor, and on the other end is placed a book-case of cherry, 3½ feet by 8 feet, with glazed doors, facing the entrance.

The scholars' desks front the platform and the windows on the side of the building, and are separated by aisles 1 foot and 4 inches wide. They are 2 feet in length, made of cherry-wood, and varnished and supported by cast iron stands. J. L. Ross, maker. Each scholar has a desk by himself.

The chair is made by Mr. Wales, of Boston. It has a scroll back and cast iron support.

Each room accommodates 56 pupils, one desk and chair being placed on a small movable platform for a monitor.

The rooms are lined with composition blackboards 3½ feet wide, 2 feet from the floor.

The school-rooms which have not small rooms attached, are provided with closets for the children's clothes. There are 2 sinks in the corridor, with conveniences for introducing Cochituate water. The description of this story will answer for the two below it, as the first three are essentially the same.

The windows are furnished with inside blinds, having revolving slats, so that the light may be regulated with great ease.

The building is warmed by 4 furnaces placed in the basement, 2 being placed at the middle of each end, each being intended to warm the three rooms immediately over it, the cast iron chimnies being relied upon for heating the hall.

Emerson's system of ventilation has been introduced since the building was finished, each room having a separate air-duct to the roof, 14 inches by 14 inches.

The apparatus consists of the Boston Philosophical set, by J. M. Wightman, Eayrs and Fairbanks' globe, 2 sets of Pelton's Outline Maps, and one of Mitchell's.

A library costing $200 has been furnished by the donation of Mayor Quincy.

To protect the desks from injury, the slate-frames are all required to be covered with cloth, and each scholar is to provide himself with a convenient box to contain his pen, pen-wiper, pencils, rubber, &c. Each desk has an inkstand sunk into the right-hand corner, with a revolving metalic cover.

The building is calculated for but one school, and is at present occupied by but one, the organization of which is adapted to the arrangement and construction of the house. When the organization is complete, the school will be divided into 4 classes, each class containing 168 scholars, and each class into 3 divisions. At present the 3 lower classes contain two divisions each, and the first class 3.

On the 3rd floor are the first division of the first class under the instruction of

It is to be feared there are not many communities, even in New England, where the Chief Magistrate, elected annually by the people, would have the courage to utter the following noble sentiments, spoken by Mayor Quincy, at the dedication of the Quincy Grammar School-house, June 26, 1848.

As Chairman of the "City Fathers," e did not hesitate to stand there and tell the tax-paying community that they had, in this manner, just expended $200,000 of their money; and he was confident the question would not be asked, Why spend so much? Why spend more for popular education in the city of Boston, than is expended in the whole of Great-Britain?

He said, if but once in a century, a little being should be sent into this world, of most delicate and beautiful structure, and we were told that a wonderful principle pervaded every part of it, capable of unlimited expansion and happiness, capable of being fitted to associate with angels and becoming the friend of God: or if it should receive a wrong bias, of growing up in enmity against him, and incurring everlasting misery, could any expense of education which would contribute to save from such misery and elevate to such happiness, be too much? But, instead of one such little being, 24,000 were now entrusted to the care of the "City Fathers," and their education, in this world, will determine their future destiny,—of companionship with angels, or with the degraded wretched, enemies of God.

If the community had no responsibility in the matter, how, he asked, could it spend money better than in educating these children? But they would soon control the affairs of Boston, and, to a great extent, of the Commonwealth. Nor would their influence stop here. "No man liveth for himself" Each of these children would form a centre of widening influence, whose circumference might yet embrace millions of minds, and extend through unnumbered centuries.

Here, unlike other countries, every restraint to individual elevation is thrown off. All have the most perfect liberty that can be enjoyed, without infringing upon the rights of others. How important then, that each child should be educated to understand his rights, and the principles and habits of *self-Government.*

We are all, said he, in a partnership, and if one of these little partners suffers in his character, the whole community suffer in consequence.

He believed that nearly half of the 400 boys in that school were not Americans. Many of their parents were not fitted for the duties of a Republic. But these children, educated side by side with our own, would learn self-government, and be trained to become worthy citizens of this free country.

It seemed, he said, the design of Providence to mix races; and this influx of foreigners might constitute the very elements necessary to give to American character its highest excellence. Standing on such a moral elevation, as Boston did, they felt it a duty to provide for the education of all, and thus present to the whole country, *models* of popular education.

These schools are justly the pride and boast of the city; and the sentiment with which they are universally regarded is beautifully embodied in the following extract from an address by George S. Hillard, Esq.

The schools of Boston are the best jewels in her crown. If I were asked by an intelligent stranger to point out to him our most valued possessions, I would show to him—not our railroads, our warehouses, filled with the wealth of all the earth, our ships, our busy wharves and marts, where the car of commerce is ever "thundering loud with her ten thousand wheels," but I would carry him to one of our public schools, would show him its happy and intelligent children, hushed into reverent silence at their teacher's word, or humming over their tasks with a sound like that of bees in June. I would tell him that here was the foundation on which our material prosperity was reared, that here were the elements from which we constructed the State.

Here are the fountains from which flow those streams which make glad our land. The schools of Boston are dear to my heart. Though I can have no personal and immediate interest in them; though no child on earth calls me father; yet most gladly do I contribute to their support, according to my substance; and when I see a father's eyes filled with pleasant tears as he hears the music of his child's voice linked to some strain of poetry or burst of eloquence, I can sympathize in the feeling in which I cannot share. May the blessing of Heaven rest upon our schools. They are an object worthy of all efforts and sacrifices. We should leave nothing undone which may tend to make them more excellent and more useful. For this, we should gather into our own stores all the harvest of experience which have been reaped from other soils. The present is an age of progress. The claims of humanity are now beginning to be heard as they never were before. The movements in favor of Peace, of Anti-Slavery, of Temperance, of Education, of Prison Discipline, all spring from the same root—a sense of sympathy and brotherhood. Is it too much to say that the dawn of a new day is reddening the tops of the mountains? Higher yet may that light ascend, till its golden shafts have pierced the deepest valleys of ignorance and sin! Let us not stand idly on the brink, while the tide of improvement sweeps by us, but boldly launch our bark upon the stream.

We live in a community ready to discern and to do that which is right. It should be a source of gratitude to us that our lot is cast on a spot, where every good and worthy faculty may find appropriate work to do. When I behold this city that we love, seated upon her triple throne of hills with her mural crown of spires and domes glittering in the smokeless air, when I remember how much of that which embellishes and dignifies life is gathered under those roofs, I feel that he has not lived in vain who has contributed, even in the smallest measure, to the happiness and prosperity of Boston. And how can we do this more effectually than by watching over her schools,—by making them as nearly perfect as human institutions can be? For this object let neither wealth nor toil be spared. Here are fountains of life; as they are, so will its issues be. The child is father to the man. Make our schools all that they can be, and all that they should be, and we shall give to the prosperity of our beloved city a permanence like that of moral truth. It will become an inevitable necessity, like that which compels the heart of man to love what is lovely, and venerate what is venerable.

The following statistics are taken from the "*Third Annual Report of the Superintendent of Public Schools*, (*Nathan Bishop, Esq.*,) *of the City of Boston*," submitted Dec. 29, 1853.

Estimated cost of all the Public School Estates to May 1st, 1853.

1. Cost of the Latin and English High School Estate, and of the improvements on the same,	$82,151.51
2. Cost of all the Grammar School Estates, and of the improvements on the same,	797,848.49
3. Cost of all the Primary School Estates, and of the improvements on the same,	448,500.00
Total cost of all the Public School Estates,	$1,358,500.00

Means and Cost of supporting Public Schools.

The City receives annually, from the State School Fund, about,	$5,500.00
The remainder of the means for supporting the Public Schools is drawn from the City Treasury, which is replenished by the annual tax and by other sources of income. During the last twelve years, 21 per cent. of the ordinary city expenditures has been appropriated to the Public Schools.	
In the year 1853, the expenses of the School Department amounted to,	329,800.20
Viz., for Grammar Schools—salaries of teachers,	130,531.18
" " " " incidental expenses,	35,849.82
" " " " new buildings and alterations,	42,991.00
" " Primary Schools—salaries of teachers,	62,508.33
" " " " incidental expenses,	22,231.46
" " " " buildings,	35,823.09

After a variety of experiments in school architecture, the School Committee of Boston have adopted the internal arrangements of the Quincy Grammar School, as the best adapted to that organization which affords the greatest facilities of instruction and government in this class of schools. Although we are not prepared to adopt without qualification the views taken of the subject, we give below extracts from the First Semi-Annual Report of the Superintendent of Public Schools, (Nathan Bishop, Esq.) in which the grounds of this preference are set forth.

The proper size of a school-house in a large city, where the population is dense, must be determined by the number of pupils required in one building in order to make the *best classification.* By classification is meant, the putting together of as many scholars as one teacher can instruct well into one division or group. Experience has shown that between fifty and sixty, all being about equally advanced in their several studies, can be well taught by one teacher. The best classification of pupils in schools is nothing more than a wise application of the principle of the division of labor, which has done so much to advance and to perfect the various branches of industry. A division of labor, made on the right principle, always increases the facilities of performing the process, or improves the quality of the article made, and not unfrequently accomplishes both these objects at the same time. It must constantly be borne in mind, that it is not simply a division of labor which has effected such wonderful improvements in every department of business carried on in the civilized world; but it is a division of a particular kind of labor, on such a principle as will enable the persons engaged in it to perform more of it in a given time without additional effort, and to do it as well as they could before, or even better.

Actual experience has shown, in many instances, that a school containing eight hundred pupils can be classified to better advantage than one containing any smaller number. A school of this size can be managed with but little more labor on the part of the principal than is required for one only half as large. If the difference in the attainments of the children in each division be so small that they can with advantage study the same lessons, then the teacher may instruct them altogether in some recitations and exercises, and, for the others, he may separate them into two sections; and, while he is hearing one recite a lesson, the other may be preparing for the next recitation; and so on, for every school-day in the year, the teacher can give *one half of his time* to one section, and one half to the other; and in this way each pupil will receive a greater amount of personal instruction and assistance from his teacher than on any other plan of dividing the labor of teaching a large school.

The teacher, having but few branches pursued in his division, has ample time to make thorough preparation to explain and illustrate all difficult points in every lesson. Having sufficient time, also, for hearing the recitations of his pupils, a good teacher can awaken in his class a degree of mental activity in the pursuit of knowledge, which will lend to their intellects the best discipline, while it enlarges the fields of their vision on the different branches of study. He will also have time to throw around the more important facts and principles in the text-books such remarks and illustrations as will attract and secure the attention of his scholars, and impress upon their minds a well-defined idea of each leading fact or principle by itself; and then he may group them together into one larger view, showing their connection with the general subject, and making them throw some light on what has gone before, or prepare the way for what comes after, in the study under examination.

The following "Specification of materials to be provided, and labor performed, in the erection of a Grammar School-house," drawn up by Joseph R. Richards, architect, embodies the latest improvements adopted by the School Committee of Boston.

Specifications for a Grammar School.

Description.

The building is to be of brick, it is to measure sixty feet by eighty feet above the underpinning, and to contain three finished stories; the first and second each twelve feet high, and the third story fourteen feet high, in the clear. The roof is to have an inclination of twenty-nine degrees from each side of the building, intersecting in a ridge; there is to be an observatory or belfry immediately upon the center of the ridge 9½ by 9½ feet octagonal form, and thirteen feet in height to top of roof; the cellar will be eight feet deep in the clear. The lot of land is to be inclosed with a brick wall on two sides, and with an iron fence on the front end; the space in the rear is to be divided into yards by board fences, and to contain a block of privies against the rear line of the estate. The first floor of the buiding is to set four feet above the level of the street sidewalk. The building is to set back from the front line of the lot of land ten feet.

Excavating.

The dirt and rubbish is to be dug out for the cellar and cellar walls, and all trenches and footings for the vaults and the drains and cesspools, as required; and all that is not required for grading up the lot, is to be removed from the premises. The yards are all to be filled and graded up to the level of the cellar flooring, with good gravel, where below the same.

Granite Foundations.

Each of the walls are to have a bottom course, three feet long, eighteen inches deep, and two feet wide, laid crosswise of the trenches; upon the same is to be laid a stone wall, eighteen inches thick, built with square split granite blocks, laid in cement mortar, faced on the inside, and thoroughly whitewashed. Good and sufficient foundations are to be laid for the steps, coal hoals, walls of the privies, and furnaces.

The underpinning of the four walls of the building, the steps, platforms and thresholds, gate thresholds, and fence stones, caps and sills to cellar windows, privy thresholds, curbs to vaults, covers to yard cesspools, are all to be of even colored granite, free from rust, sap, or flaws; fine hammered where directed; and set in lime mortar, cramped, leaded, and pointed, as required and directed. Iron strainers are to be fitted to the cesspool covers, with a movable cover, and three stone movable covers are to be fitted to the vaults, having strong iron rings fitted thereto. Properly fit a cold air box to the outside wall, with a grating on the outside thereof.

Sandstone.

There are to be caps and sills to all the windows of the building, and caps to the privy doors, of freestone, rubbed on the three fronts, and tooled on the rear front; the first and second story caps are to be moulded according to the full size drawing.

Brickwork.

Back up the underpinning of the four walls, so as to make a total thickness of twenty inches to the same. The four exterior walls, are to be in two thicknesses, of eight inches each, with an air space of four inches between them, built up the whole height of the building to the roof boarding; and a neat facia fitted to the cornice. The outside facing of three side walls are to be laid with the first quality of pressed bricks, properly tied to the walls every seventh course by "angular brick ties." The interior walls are each to be twelve inches thick, laid from the bottom course to the under side of the attic flooring. The outside walls of the privies, are to be laid eight inches thick each, and seven and a half feet high, and the partition walls four inches thick. The yard walls are each to be twelve inches thick, and eight feet high above the sidewalk level, commenced on solid stone foundations below ground. The above are all to be laid in the best lime mortar. The vaults to be laid in cesspool form, and the drains, cesspools are to be laid in cement mortar of the best quality. The cellars are to be paved with uniform hard bricks all over their surfaces. The exterior walls are to be tied together at suitable distances; the ventilators are to be laid partly in the wall, fourteen by eighteen inches each, smoothly plastered; the iron chimneys are to be recessed in the entry walls and connected therewith; the vaults are to be six feet deep; the yard walls are to be capped with stone, set in cement. All the brickwork is to be built with the best hard burnt brick.

Lathing and Plastering.

The ceilings of the three stories are to be lathed and plastered; the several walls are to be plastered on the walls without lathings, with a stout coat of lime and hair mortar, and finished smoothly with lime putty; the whole work to be done neat and true; a coat of lime and hair mortar is to finish on the walls of the privies and the ceilings also.

Slating.

The roof of the building is to be slated with the best of wide ladies slates, laid not exceeding 6¾ inches to the weather, put on with composition nails, and properly secured with flashings of lead, $3\frac{1}{2}$ lbs. to the square foot; fit heavy zinc, strapped with irons, to the ridges, and warrant the whole perfectly tight.

Iron works and Incidentals.

There is to be an upright, twisted, diamond formed, wrought iron grating to each of the cellar windows, with a heavy frame attached. There are to be two stout iron scrapers at each door. There is to be a stout iron snow fender running around the building on the roof, costing 50 cents per foot. An iron fence, to cost $3 per lineal foot, is to be made and set up complete, with two gates hung and fastened across the front end of the lot with four iron posts, securely set, leaded, and fastened; the gates are each to have a lock. The ends of the fence are to be fastened to a stone post, placed at the ends of the side walls.

The building committee will provide for the furnaces, iron smoke pipes, ventilators, and furnace registers, and hot air pipes complete; set the same as directed. Set and introduce such water pipes in the building as may be required, the building committee furnishing such, and all the furnaces. The committee will also provide such drains and cause such cesspools to be laid as may be required.

An iron cornice with modillions is to be set entirely around the building, costing $2.50 per lineal foot; the gutter of the building is to be made therein; the whole to be braced and properly fastened to the wall. There are to be four conductors to the building, each four inches in diameter, of 18 oz. cold rolled copper, put up, connected with the gutters, and led off in a proper manner with heavy goose necks, and $3\frac{1}{2}$ inch pipes at the bottom to lead water into the drain. To be two copper conductors and a copper gutter to the block of privies. The roof of the privies and observatory are to be covered with sheet X X tin, lapped, soldered and finished in the best possible manner and warranted tight.

Carpentry and Framing.

The roofs and floors are to be framed in the manner indicated by the drawings, with good sound lumber, and timber of the following dimensions. Principal floor joists, of spruce, 3×15 inches; trimmers and headers, of spruce, 6×15 inches; privy floor joists, of spruce, 3×6 inches; attic ceiling joists, of spruce, between tresses, 2×6 inches; tie beams of roof, of pine, 9×12 inches; truss rafters of pine, 9×12 inches; purlines of spruce, 8×8 inches; small rafters of spruce, 20 inches apart, 3×5 inches; wall plates, of spruce, 3×9 inches; ridge plank, 2×10. The floor joists are to be worked to a mould crowning 1 inch, they are to have a fair bearing of 4 inches on the walls, at each end, and to be placed not exceeding 15 inches apart, from center to center of each, and bridged with two rows of cross bridging. The roof tresses are to be fitted with wrought iron bolts, 1 inch in diameter, with heads, screws, washer and nuts, and footings, bolts also of same size. There is to be a lintal 4×8 inches over every opening in the walls that require it, and under the "withs" of the privies, having a fair bearing of eight inches at the end.

Boarding and Furring.

The under floors of the rooms, entries, and platforms, and privies and the roofs, are to be laid with No. 3 pine boards, machine planed, matched, and well nailed.

The ceilings and stairways of the three stories are to be furred with three inch furrings, of sound seasoned, dry pine boards, spaced for five nailings to a lathe. Nail them with tenpennies. Put on three-fourth inch grounds for finish, and irons for corners and angles. There are to be two strips of furring for hanging charts thereto, extending entirely round each of the school-rooms, as directed.

Cold Air Boxes and Ventilating Flues.

There is to be a separate flue for each furnace, 12×20 inches clear, made of thoroughly seasoned pine boards, smoothed on the inside and put together with two inch screws; there is to be a valve and handle to each. The ventilating flues are to have a valve and a handle; they are to be made of thoroughly seasoned pine boards, smoothed inside and outside and put together with screws. There is to be a separate one for each school-room, and each block of ten privies; fitted with blind openings or registers at the floor and ceiling, arranged as shown upon plans, and as now completed in most of the school-houses recently erected by the City of Boston. The ventilating flues are to be connected with two roof ventilators, largest size, arranged as directed. There are to be two roof ventilators over the privies.

Windows and Blinds.

All the windows of the three stories are to have double box frames, hard pine pulley stiles, &c. The sashes are to be made of pine $1\frac{3}{4}$ inches thick, moulded, coped, and lipped. They are all to be double hung with the best of white window lines, iron pulleys, steel pintels and round iron weights of accurate balance. All the sashes are to be fastened with strong bronzed sash fastenings to cost $4.50 per dozen. All the windows of the three stories are to be fitted with $1\frac{1}{4}$ inch framed blinds, eight parts to each window, hung and fastened complete with iron butt hinges and bronze hooks, staples, and rosewood knobs, and to fold into flat boxings. They are all to finish with 1¼ inch moulded architraves, 8 inches wide, plain jambs, sofits, and stools. The cellar windows are to be made with plank frames rebated for the sashes, and to have double sashes hung to the tops of the frames, fastened with strong iron buttons and fitted with catches to hold them open when desired. Each privy is to have a movable window in its door. The observatory windows are to be double hung and fastened.

Doors.

The outside doors are to be 2¼ inches thick, all other doors in the building are to be two inches thick, made with four panels each, hung with two four inch butt hinges, and fastened with mortice locks and knobs, to cost $2.50 each, and with catches, bolts, mineral knobs, bronze trimmings, and small duplicate keys. The outside doors are to be fastened with lever locks of the best quality, with mineral knobs and small duplicate keys. The privy doors are to be two feet by six feet one and one half inches thick, four paneled, hung with iron butt hinges, fastened with good knob locks, having duplicate small keys; they are to have two inch rebated and beaded frames, hard pine thresholds, and architraves, as described for the windows, with plinths. Properly hang the outside doors to three inch Southern pine plank frames, properly dogged to the threshold and wall.

Stairs.

The several flights of stairs are to be square frames, with four deep plank stringers; they are to be finished with hard pine risers one inch thick, and treads one and one-fourth inches thick, with moulded nosings. The cellar stairs are to be finished with plain pine risers and treads, and close partitions one and one-half inches thick, matched and planed. There is to be a neat flight of portable steps to ascend to the attic and observatory, and to the roof scuttle, which is to be made and hung complete. All the flights are to have cherry wood hand rail, moulded, three by two and three-fourth inches; turned cherry wood posts, five inches in diameter, at the head and foot and each landing of the flights, and hard pine balusters, one and one-fourth inches diameter, three to each stair tread; the top of the rail is to be three feet above the nosing of the stair tread; the whole to be made and finished in a perfect manner. All the well rooms are to be properly cased and finished.

Skirting

The rooms, closets, entries, and stairways, are to be skirted up as high as the window stools, in the respective stories, with narrow, beaded, matched lining, guaged to a width not exceeding seven inches, and the joints to butt even in every case; cap the same to correspond with the window stools; the lining is to be of clear white pine. One side of the wall of each room is to be fitted for the slates with frames, as directed.

Floorings.

The platforms are to be furred up, as shown by the drawing, and the stairways, platforms, and privies are to be boarded, and the several floorings to be laid with narrow hard pine clear boards, perfectly jointed and thoroughly nailed. The strips are to be guaged to a width respectively, and the joints broken at least three feet, and in no case are strips of a different width to butt on to each other. The entry and privy floors are all to be of hard pine.

Cabinets, &c.

There is to be a cabinet at the wall end of each platform, with shelves and small closets below, and a sash door. There are to be sixty-five clothes hooks hung on strips of pine, as directed, to each room. There are to be two umbrella stands in each entry. To be six sinks placed where directed. To be four coal bins, and two closets for kindlings, in the cellar. Finish the privy seats as directed, complete in every particular. Put up three bells where directed, with "pulls" and tubes complete.

Painting and Glazing.

Oil all the hard wood finish, except floorings. All the outside wood work is to be prepared and painted in imitation of free stone. The outside doors are to be painted bronze. The blinds are to be painted, four coats of Paris green, and varnished. The rest of the inside finish is to be primed, painted, and grained, in imitation of oak, maple, or other color, as directed by the committee, and varnished twice. Paint all the iron work, three coats best black and one coat varnish. All the sashes are to be glazed with the very best quality of German glass, of double thickness, and finish the same complete in every particular, with the sizes of glass as marked upon plans.

Memorandum.

All the timber and lumber is to well seasoned, and all that is in sight is to be entirely free from sap, shakes, and large knots; the finish stock of every kind must be perfectly kiln dried; the labor is to be done in the most faithful manner.

The Quincy School-house was destroyed by fire on the 17th of December, 1858. It was rebuilt on the original foundation, and on nearly the same plan—the difference consisting in appropriating a part of the fourth story to two school-rooms, instead of devoting the whole of it to a hall—thereby securing fourteen school-rooms with the requisite ante-rooms and clothes room. It was dedicated on the 28th of December, 1859, by appropriate exercises and addresses, in which the Mayor, (Mr. Lincoln,) Rev. Dr. Kirk, Rev. Dr. Ellis, Hon. Josiah Quincy, Jr., George B. Emerson, the Superintendent, (J. D. Philbrick, its first Principal,) and Dr. T. M. Brewer took part. From these addresses we select a few paragraphs.

Rev. Dr. Ellis, Chairman of the District Committee. "It will be our care to guard this house for its appointed uses; and now that it has risen again from its ashes, we trust that, with the blessing of a kind Providence upon our efforts, it may be a house of industry, of success, and of happiness, gathering in and sending forth every year its troops of contented, earnest learners. Grateful to a city that so abundantly, and with such motherly care provides for her own children, and even for the children of the strangers that are within her gates, we shall hope to prove by our fidelity that we are not practically thankless.

This designation, "Grammar School," has been materially changed in meaning since our laws were first written, and since provision was first made for popular education at the public charge. Grammar meant then Latin and Greek Grammar,—and a Grammar School was a classical school. Now, as I hardly need say, the words denote a school, the purpose of which is to impart that plain elementary instruction which the great mass of society need, and which supplies at once a satisfactory basis for any thing that may afterwards be done in the way of self-education, and answers all the common exigences of our every-day world. If I had not virtually promised not to inflict upon you any theories, I should say that my plan in conducting this school would be to emphasize the elementary and the directly practical, steadily resisting every demand for things more showy and more run after. Our business here is not with the superstructure,—certainly not with pinnacles and spires, but with the underpinning; we would make sure of that. Reading, Writing, Orthography, Arithmetic, Geography, and the elements of language,—these are what we ask of our Grammar School teachers and pupils; these we would secure at the cost of never so much drilling, and reviewing, and repetitions of all sorts. Good readers, good writers, good spellers, good accountants, good geographers, and correct talkers,—these we ask; beyond this we do not care to go in a Grammar School; for any thing beyond this we must look to our Latin and High schools and to our colleges, or to our admirable Public Library and useful public lectures."

Hon. Josiah Quincy, Jr.,—"Declared that he felt a great interest in this school, outside of that occasioned by the name it bore. He was one of the City Fathers, in fact *the* City Father, when the old school-house was dedicated, and he could claim to be at least the nurse of this part of the city. The land of the part of the city now occupied by the Western Depot, the United States Hotel, and a population of many thousands, was literally *made* by the South Cove Corporation while he was its treasurer and principal agent. It is not many years since the very site of this noble edifice was inhabited by flounders and eels. He had always advocated a generous, liberal, and judicious expenditure of the public money for the cause of public education. He believed that nothing was so well calculated to assimilate the different races making up our American population as the common school. He also favored the teaching of boys and girls together."

Hon. John D. Philbrick, Superintendent of Public Schools,—"He felt a peculiar interest in this school. He never could be indifferent to its history, its reputation, or its welfare. It had been his fortune to be selected on the 6th of September, 1847, to organize this school, and preside over it as its first Principal. It was then called "the experiment." It turned out to be the inauguration of the system of Grammar School organization which now prevails throughout the city. When established, it differed in its plan from the other schools in having only one head master instead of two, a larger number of pupils, so as to afford the best facilities for classification, a separate school-room for each teacher, a separate desk for each pupil, and a larger proportion of female teachers than had before been employed in boys' schools. These were important elements of progress, and their general adoption has tended both to increase the efficiency and diminish the expense of our schools. But there is danger of pushing these changes to injurious extremes. Some of our schools are now too large for the best good of the pupils."

Dr. T. M. Brewer, who was Chairman of the District Committee twelve years before,—"The dedication of the Quincy School-house, twelve years ago next June, marks an important era in the history of the Boston Public Schools. This school, with the Mayhew, organized contemporaneously on the same system, was the first single-headed school, with graded divisions of classes, from the lowest to the highest, successfully organized in Boston. It was spoken of as an 'experiment,' as an 'innovation of doubtful advantage,' by its opponents. Yet, within the seven years immediately following its dedication, every grammar school in Boston was re-organized on substantially the same plan. The very member, now no more, who most earnestly resisted the change, six years after made a report in favor of the re-organization on the single-headed system, of the last of the double-headed schools left in Boston. The Quincy School-house, with the Hancock, was the first erected upon the plan of a separate room for each division, with one large hall for the assembling of the school. The pioneer of the noble school edifices that adorn our city, that house has been constructed with such liberality, with so much wise forethought and discriminating judgment, on the part of the City Government, that, in my opinion, subsequent structures have not been in any essential respects improvements upon the original plan. For many of the advantages of the new plan the city was indebted to Hon. John H. Wilkins, Chairman of the Public Building Committee, and to George B. Emerson, Esq., Chairman of the Conference Committee on the part of the School Board. With the latter it was my privilege to be associated. Not the least of the advantages over every previous school-house was the isolation of each seat and desk. This innovation was warmly opposed by the gentleman at the head of the Building Committee. Though afterwards denied to the Bowdoin School, it has since become the universal privilege of other schools. Less than twelve years ago the Quincy and the Hancock were the only school-houses in the city upon this plan. Now there are no less than fourteen, all but five, and another has been commenced, upon the same plan of liberal munificence.

Mr. Chairman, when this school was organized, twelve years since, under the charge of its master, now our excellent Superintendent, it labored under very many disadvantages. To a large extent, it was composed of the overflowing of three other grammar schools, who, being permitted to retain their advanced pupils, left this school without any first class. For nearly a year it was kept in three or four scattered groups, in apartments having none of the equipments or advantages of a well-ordered school-room. To some extent these were compensated for by its efficient and experienced corps of teachers, under whose diligent and faithful services it soon rose to distinction, and its success gave to it its present solid reputation. Mr. Valentine, now the master, was then its sub-master; our present sub-master was an usher, and only two ladies, one of them our invaluable head-assistant, of those now in the service, took part in the earlier labors of the school. Here, too, was first tried the experiment of female instruction for boys of a higher grade than those just admitted from primary schools. With the practical evidences all around me, in every boys' school in the city, of the superiority of female instruction, I need not dwell upon the success of this experiment.

But, Mr. Chairman, I will not detain you with reminiscences already in part anticipated. Twelve years have brought with them surprising changes, all of them first initiated within these walls. We have lived to see its house the model for Boston School-houses, and the plan of its school made the universal system throughout the city. I will only add the expression of the hope that this school may continue ever to deserve its substantial reputation, and that, long after you and I have passed away, it may continue to exemplify the language of Solomon, and remain a place wherein "the rich and the poor meet together," for "the Lord is the maker of them all."

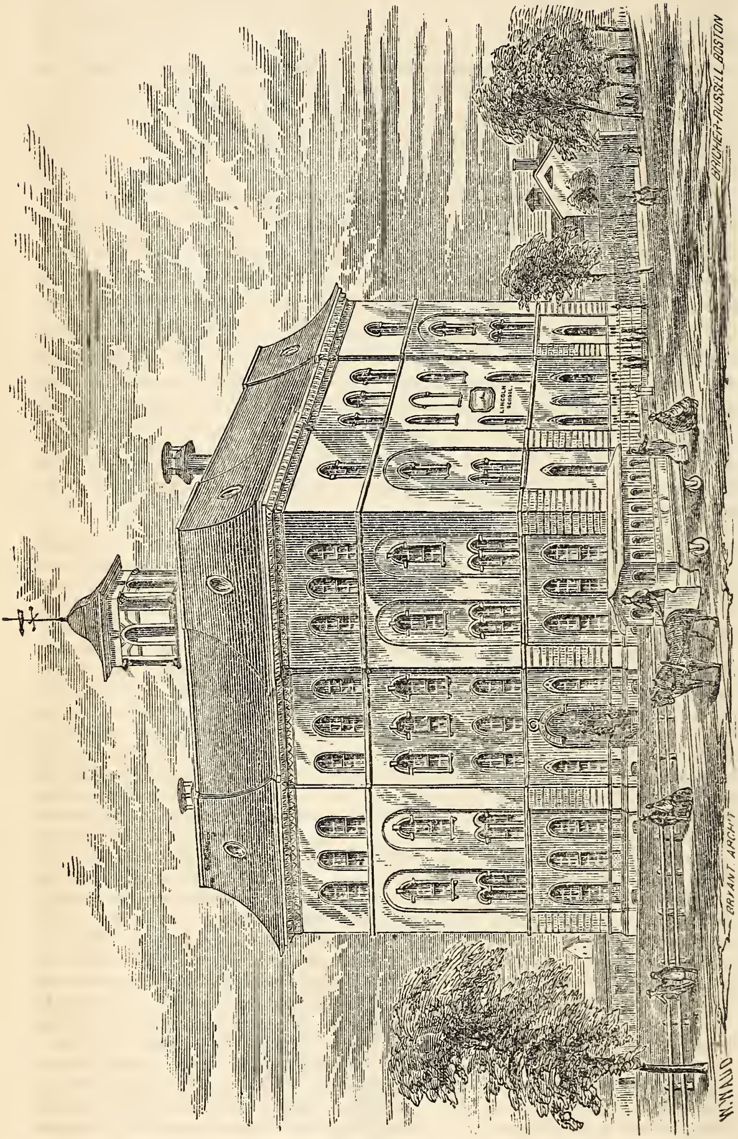


Fig. 1. Perspective View.

Plans of Lincoln Grammar School-House, Boston.

The following description of the Lincoln Grammar School-House is taken from the annual report of the school committee for 1859 :—

" In the design of the Lincoln School-House, which is located on Broadway, near K st., South Boston, it was the intention of the accomplished architect, J. F. G. Bryant, Esq., to combine all the advantages of the interior plan of the best buildings, with an effective and tasteful exterior, without any material *increase of expense.*

" There seems to be no good reason for perpetuating that baldness and almost primitive simplicity of style which have characterized most of the school edifices of the city. It can scarcely be deemed too much to demand, that the building which is the daily resort of our children and youth, and in which their mental and moral faculties are to be trained and unfolded, should be designed with careful reference to the rules of proportion, and even, in no small degree, of beauty. Certainly it would be well to keep this object in view, so far as it is consistent with a wise and proper economy. Harmony of style, and propriety and elegance of detail, will never be without their refining influences upon the mind of the pupil.

" The following mechanical description, extracted from the ' specifications ' of the architect, will illustrate the interior conveniences of the building and its adjuncts, as well as the manner of construction and the formation of the exterior."

The building is a " parallelogram " in outline of ground plan, measuring ninety-three and four-twelfths feet in length, and sixty-one and two-twelfths feet in width, outside of its base or underpinning course, at the ground or sidewalk level in front of the building. It is four finished stories in hight, with an " unfinished " cellar story over the whole area, which is partially above and partially beneath ground. The cellar is nine feet high. The first, second, and third stories, respectively, twelve and one-half feet high, and the fourth story fifteen feet high. The top of the gutter of the outside walls is located four and two-twelfths feet above the ceiling of the fourth story, which ceiling is formed immediately upon the undersides of the tie-beams of the roof framing, or attic flooring. The roof is " hipped " from each of the four corners of the building, and is made a " Mansard," with curved sides and a " flat " top ; the hight above the top of cornice to the top of the curve of the roof is fourteen feet ; its " flat " is located in the center of the length and width thereof, and it measures eighty-six and one-half feet in length, and fifty-one and one-half feet in width, and has a pitch over its surface of one and one-half inches to a foot. The four corners of the roof are formed as projections ; the spaces between the projections over all four sides of the building are recessed to intersect with recesses in the faces of the four exterior walls ; said projections are hipped over the inner corner of each, in imitation of the hip over the outer corner thereof—being the corner hips of the building. The recesses in the faces of the four exterior walls aforesaid are located in the center of the length of each wall, and reach the whole hight of said walls, to meet the roof recesses abovenamed. The recesses in the front and rear end walls each measure twenty-one and five-twelfths feet in width, and those in the two side walls twenty-three feet in width. Besides the four recesses aforesaid, there are recesses in the faces of the projections, or corners, which are formed to each exterior wall, beneath the roof projections ; these recesses reach from the ground level up to the top of the third story, where they are formed with semicircular heads. The recesses in the corner projections of the front and rear ends of the house measure eleven feet and three and one-half inches wide, and four inches deep, and are single recesses ; and the recesses in the corner projections of the two side walls of the house are eleven feet and three and one-half inches wide, and four inches deep, and are double recesses, with a dividing pilaster located in the center of the width of each of the same, and double semicircular heads to each recess, springing from said pilasters. The four exterior walls are crowned with a cornice, the upper portion of which is formed as a gutter.

The interior arrangement of the first, second, and third stories is similar: each containing four apartments, located in the four corners of the house, measuring thirty-two and three-twelfths feet by twenty-seven and ten-twelfths feet each; a clothes closet to each room, measuring fifteen feet by five and ten-twelfths feet each; two staircases, measuring fifteen and eight-twelfths feet by ten feet each; and a hall, measuring twenty-four and eight-twelfths feet by twenty-two and four-twelfths feet. Said rooms, closets, staircases, and halls are twelve and one-half feet high, in the clear, in each story. The interior of the fourth or upper story is arranged with two rooms in the two front end corners of the house, each measuring thirty-two and three-twelfths feet by twenty-seven and ten-twelfths feet; an exhibition hall, measuring thirty-eight and nine-twelfths feet by fifty-six and eight-twelfths feet, across the rear end of the house. There are two stairways, measuring five feet by ten feet; a clothes closet for each of the two rooms aforesaid, measuring five and ten-twelfths feet by fifteen feet each; two teachers' rooms (of L form,) measuring five feet by twenty-five feet each; and a hall, connecting with the exhibition hall, measuring twenty-two and four-twelfths feet by twenty-four and eight-twelfths feet. All the apartments, halls, closets, and staircases aforesaid in the four stories are "finished." The cellar story is subdivided into four apartments, in the four corners of the house, two staircases, and six closets. The apartments in the cellar are each to contain a furnace, and the closets are used for fuel. None of the cellar apartments or closets are "finished." There is also a hall in the center, of the length and width of the cellar story, into which the mouths of the four furnaces, the landing of the staircases, and the doors of the six fuel-closets all open.

All the apartments, halls, and closets in the fouth story are fifteen feet high. The teachers' rooms in this story have their floors located two feet above the floors of the other apartments. Each story is lighted by windows in the exterior walls. There are floor-lights in the hall of each story, immediately beneath the cupola or bell-tower, which crowns the roof of the house, in the center of its length and width. The four sides of the base or plinth of this cupola (above the roof level,) contain each an upright skylight. The attic or area beneath the roof is lighted by light stationary circular or "bull's-eye" windows, inserted in the upright circular sides of the "Mansard" roof. There are no chimneys, other than metal pipes, in any part of the building, excepting one brick chimney located over the wall which forms the inside end of the exhibition hall. There are two entrances to the building in the first story, in the two sides of the same.

The lot measures one hundred feet in front by one hundred and seventy-five in depth, and contains seventeen thousand five hundred square feet. It is inclosed on the sides and rear end by a substantial brick wall, and in front by a granite foundation, surmounted by an ornamental iron fence. The rear portion of the yard is divided into two equal parts, by a brick wall running from the center of the building to the rear boundary.

The building is warmed by Chilson's cone furnaces, four in number, located in the center apartment of the basement. The cast-iron smoke pipes pass up through and warm the corridors.

The ventilating apparatus consists of a separate ventiduct of wood, leading from each school room to the roof. Here they are brought into two groups, at the opposite ends of the building, each of which is surmounted with one of Emerson's ejectors, of a large size. The transverse section of each ventiduct is about fourteen inches square. In each room there is a sliding register near the ceiling, and another near the floor, opening into its ventiduct.

A. A., &c., School rooms, twenty-three by twenty-seven feet.

C. C., Closets for clothes.

B., Exhibition hall, two-hundred and thirty-eight by fifty-six feet.

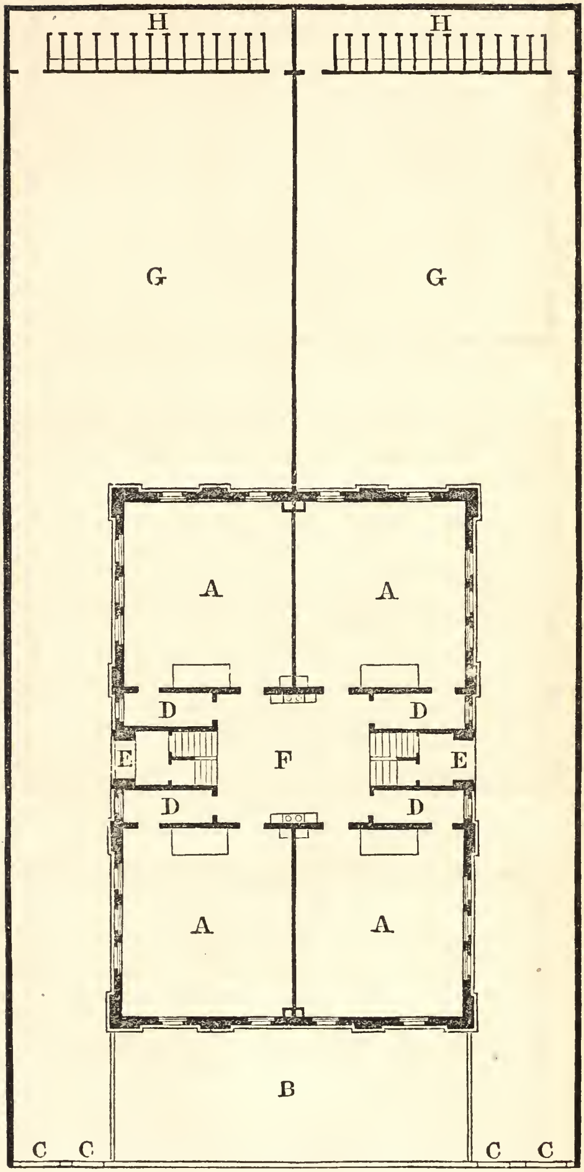


Fig. 2. Ground Plan.

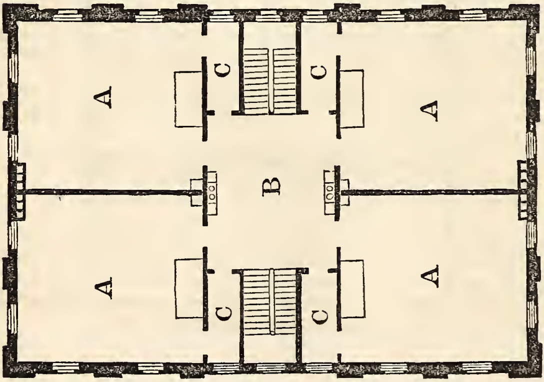


Fig. 3. Second Story.

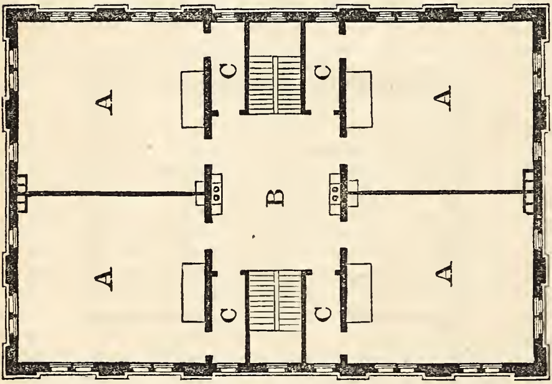


Fig. 4. Third Story.

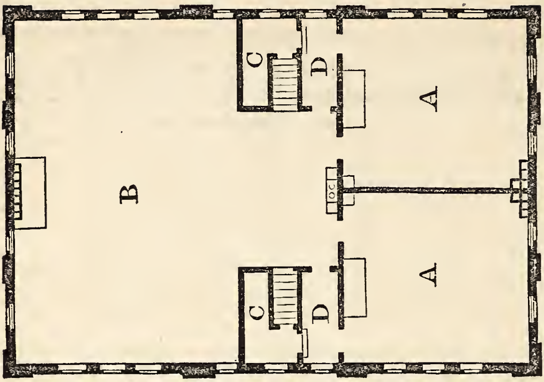


Fig. 5. Fourth Story.

The Lincoln Grammar School-house was dedicated on the 17th of September, 1859,—the day on which the Statue of Daniel Webster, in the State-House Grounds, was inaugurated by appropriate exercises. From the address of the Mayor, Mr. Lincoln, (after whom this spacious and commodious structure was named,) we give the following extracts:—

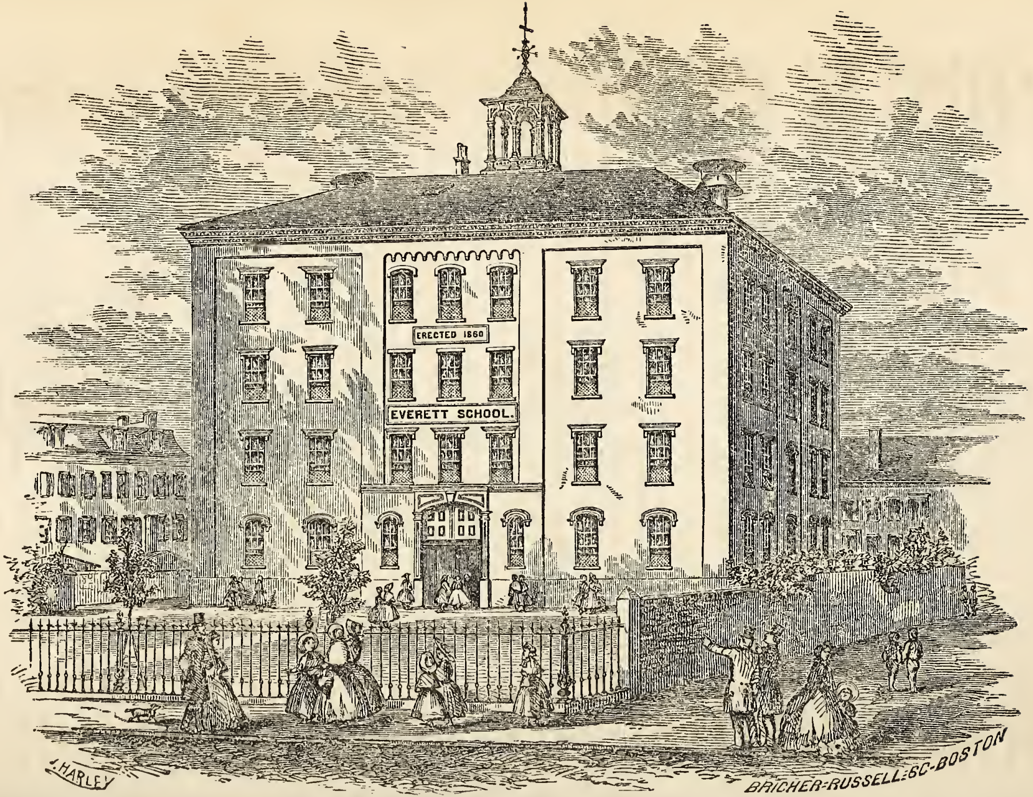
Boston, through its whole history, has regarded this as one of its dearest interests, from that April 13th, 1635, when "it was agreed upon that our Brother Philemon Purmont, shall be intreated to become a schoolmaster for teaching and nurturing of children with us," to this day, the two hundred and twenty-ninth anniversary of its settlement, when we are assembled to dedicate the most elegant edifice yet erected within our limits to be devoted to this great cause.

The School-house and the Church have stood by the side of each other as the two main pillars which support our social fabric, and when either of them goes to decay, fallen will be our fortunes, and the days of our prosperity will be numbered and gone.

A few years since an intelligent foreigner visited all parts of the Union, and without prejudice or favor examined the condition of every community. He was struck with the industry, thrift, and general culture of the people of New England. He went into a thorough examination of the primary cause of this state of things. It could not be, he thought, our climate or the nature of our soil, for Providence had more richly endowed other portions of the land; it could not be our ancestors, for they were from the same stock as some other portions of the Union, coming from every county of old England, with representatives also from every nation of the European world; it could not be a special form or system of religious faith, for all sects had their disciples, and universal toleration gave no one a supremacy over the others; it could not be political institutions, for we were all alike under the Republic; and he finally came to the conclusion that the problem could only be solved by the fact that we had enjoyed for upwards of two centuries the benefits of free public schools.

In this connection, associated as this very day will be in our memories by the erection of a statue in our city, of the great statesman, Daniel Webster, I can not forbear to quote some of his own language in regard to this subject. He said, in a communication addressed to the Hon. Mr. Twistleton, of England, which was afterwards laid before a committee of the House of Commons: "I have been familiar with the New England system of free schools for above fifty years, and I heartily approve of it. I owe to it my early training. In my own recollection of these schools, there exists to this moment a fresh feeling of the sobriety of the teachers, the good order of the school, the reverence with which the Scriptures were read, and the strictness with which all moral duties were enjoyed and enforced. In these schools, or it may be partly by my mother's care, I was taught the elements of letters so early that I never have been able to remember a time when I could not read the New Testament, and did not read it. Many moral tales and instructive and well-contrived fables, always so alluring to childhood, learned by heart in these schools, are still perfectly preserved in my memory. And, in my own case, I can say that without these early means of instruction ordained by law, and brought home to the small villages and hamlets for the use of all their children equally, I do not see how I should have been able to become so far instructed in the elements of knowledge as to be fit for higher schools.

"In my opinion, the instruction communicated in the free schools of New England has a direct effect for good on the morals of youth. It represses vicious inclinations, it inspires love of character, and it awakens honorable aspirations. In short, I have no conception of any manner in which the popular republican institutions under which we live could possibly be preserved if early education were not freely furnished to all, by public law, in such forms that all shall gladly avail themselves of it. As the present tendency of things is to extend popular power, the peace and well-being of society required at the same time a corresponding extension of popular knowledge."



EVERETT GRAMMAR SCHOOL, BOSTON. Erected, 1860.

DEDICATION OF THE EVERETT SCHOOL-HOUSE.

The new school-building erected on Northampton street, named the Everett School-house, in honor of that distinguished orator and friend of education, was formally dedicated on the 17th of September, by the usual exercises, which took place in the large upper hall of the building. This building, which is erected on a plan which does not differ materially from the other school-buildings, is finished and furnished throughout in the most perfect manner, and in all respects may be regarded as a model Boston school-house. The first floor over the heating apparatus is fire-proof, an improvement which will be adopted in regard to the houses hereafter constructed.

The platform was occupied by His Honor Mayor Lincoln and the members of the City Government, Hon. Edward Everett, President Felton, Hon. Robert C. Winthrop, Rev. Dr. Putnam, Hon. J. D. Philbrick, and others.

The exercises commenced with chanting "The Lord's Prayer," by the pupils. Rev. D. C. Eddy then read selections from the Scriptures, after which a prayer was offered by Rev. Dr. Burroughs. A commemorative song, written for the occasion by Mr. Rufus Leighton, was sung. Alderman Bailey, Chairman of the Building Committee, then delivered the keys of the school-house to Mayor Lincoln, who responded briefly to the remarks of Alderman Bailey, and then handed the keys to Mr. E. F. Thayer, Chairman of the local School Committee. Mr. Thayer made a few remarks and presented the keys to Mr. George B. Hyde, Principal of the Everett School. A dedicatory hymn, written for the occasion by Mr. Wm. T. Adams, was sung by the pupils. Mr. Everett was then introduced by the Chairman, and made the following address:—

ADDRESS OF EDWARD EVERETT.

Mr. Chairman:—You will easily believe that I feel a peculiar interest in the occasion that has called us together. The dedication of a new first class school-house is at all times an event of far greater importance to the welfare of the community than many of the occurrences which at the time attract much more of the public attention, and fill a larger space in the pages of history. The house which we this day dedicate is to be occupied by a school which had already, as the Dwight school for girls, established an enviable reputation among the sister institutions. It is now, in consequence of the rapid growth of this part of the city, transferred, with the happiest prospects, to this new, spacious and admirably arranged building—a model school-house, fit for the reception of a model school. I hope, as a friend to education from my youth up, I should duly appreciate the importance of such an event; but you have kindly given me a reason—to the strength of which it would be affectation to seem insensible—for taking a peculiar interest in this day's ceremonial.

One of the highest honors which can be paid to an individual—one of the most enviable tokens of the good opinion of the community in which he lives—is to connect his name with some permanent material object, some scientific discovery, some achievement in art, some beneficent institution, with reference to which, by word or by deed, he may be thought to have deserved well of his fellow-men. Hundreds of towns and cities on the continent recall the memory of the great and good men, who, in peace and in war, founded and sustained the liberties and rights of the country. Science gives the name of the astronomer to the comet, whose periodical return he has ascertained. Botany commemorates her votaries, in the flowers, and the trees—the Kalmias, the Dahlias, the Robinias—which they first discovered and described. The fossil relics of the elder world are designated by the names of the geologists who first exhumed them from their adamantine graves; and we can not but feel that one of the strongest instincts of our nature is gratified by these associations.

But what are these lifeless, soulless substances, these mute, inanimate bodies in the heavens above, or the earth beneath—the vaporous comet, the fading flower, the extinct animal, whose very skeleton is turned into stone—compared with an institution like this—a living fountain of eternal light, a flower garden planted in each succeeding year, with germs of undying growth; a nursery, beneath whose fostering wings so many immortal spirits shall be trained up in the paths of duty, usefulness, and happiness; and in which you permit me to hope that my poor name will be kindly remembered, as long as the schools of Boston shall retain their name and their praise in the land; and that I am well aware will be as long as Boston herself shall retain her place on the earth's surface; for as long as there is a city council to appropriate a dollar, or a treasurer to pay it, I am sure it will be voted and paid for the support of the schools. Devoted for a pretty long life to the public service, in a variety of pursuits and occupations, laboring, I know I may say diligently, and I hope I may add, though sometimes with erring judgment, yet always with honest purpose, for the public good, at home and abroad, I frankly own, sir, that no public honor, compliment, or reward, which has ever fallen to my lot, has given me greater pleasure than the association of my name with one of these noble public schools of Boston.

They are indeed, sir, the just pride and boast of our ancient metropolis, and it is with great propriety that you select the 17th of September for the dedication of a new school-house. As the corporate existence of the city dates from that day, so nothing can contribute more to its continued prosperous growth—to its perpetuated life—than the organization of one of these admirable institutions. What offering to our beloved city, on this its two hundred and thirtieth birthday, can we present to her more appropriate, more welcome, more auspices of good, than the means of educating eight hundred of her daughters? Nor is it the birthday of our city alone. On this day, seventy-three years ago, the Constitution of the United States went forth to the people from the hand of the peerless chief, who, whether in war or in peace, commanded all their respect and united all their affection. The best, the only hope under Providence, that we may long enjoy, we and our children, the blessing which it secures to us as a united, happy, and prosperous people, is in the intelligence, virtue, and enlightened patriotism of which these free schools are the great living fountain.

We are accused sometimes by our brethren in other parts of the country, and by our friends on the other side of the water, with being a little given to self-laudation. I don't think that the worst fault of a community, though it may be carried too far for good taste. But it implies at least the possession of something, which we not only ourselves think worthy of praise, but which we have reason to believe is held in esteem by others. For I really do not think we habitually over-praise the common schools of Boston. Not that they are perfect; nothing human is perfect. but I must think it as liberal, comprehensive and efficient a system, as the imperfection of human affairs admits. It aims to give to the entire population of both sexes a thorough education in all the useful branches of knowledge. If there is a class in the community so low that the system does not go down to them, it is for causes which no system, established by municipal authority in a free country, can overcome. In all cities as large as Boston, there must be some hundreds of unhappy children, such as those to whom I alluded last Saturday, (it makes one's heart bleed to see them,) whose wretched parents prefer sending them into the streets to beg, to gather chips, to peddle lozenges and newspapers, rather than to send them to school. But with reasonable coöperation on the part of the parents, the city does certainly, as I have said, provide the means by which a thorough education, in all the elementary branches of useful knowledge, may be attained by all her children.

The cost at which this end is obtained, bears witness to the liberality of the city. I perceive by the Auditor's report, that, for the last financial year, the expenditure on the schools, exclusive of school-houses, amounted to $373,668.61; for school-houses, $144,202.67, making a total of $517,371.28—$17,371 over a half a million of dollars for a single year, which I am inclined to think is, in proportion to our population, a larger expenditure for the purposes of education than is made by any city or people on the face of the globe.

The school-house, whose dedication we are assembled to witness, is for the accommodation of a girl's school; and this circumstance seems to invite a few words on female education.

FEMALE EDUCATION.

There is a good deal of discussion at the present day on the subject of Women's Rights and her education. No one would be willing to allow that he wished to deprive them of their rights, and the only difficulty seems to be to settle what their rights are. The citizens of Boston, acting by their municipal representatives, have long since undertaken to answer this question in a practical way, as far as a city government can do it, by admitting the right of the girls to have, at the public expense, as good an education as the boys. It is not in the power of the city to amend our constitutions, so as to extend political privileges to the gentler sex, nor to alter the legislation which regulates the rights of property. But it was in the power of the city to withhold or to grant equal privileges of education; and it has decided that the free grammar schools of Boston should be open alike to boys and girls. This seems to me not only a recognition at the outset of the most important of Women's Rights, viz., equal participation in these institutions, but the best guaranty that if in any thing else the sex is unjustly or unfairly dealt with, the remedy will come in due time. With the acknowledged equality of woman in general intellectual endowments, though tending in either sex to an appropriate development, with her admitted superiority to man in tact, sensibility, physical and moral endurance, quickness of perception, and power of accommodation to circumstances, give her for two or three generations equal advantages of mental culture, and the lords of creation will have to carry more guns than they do at present, to keep her out of the enjoyment of any thing which sound reasoning and fair experiment shall show to be of her rights.

I have, however, strong doubts whether, tried by this test, the result would be a participation in the performance of the political duties which the experience of the human race, in all ages, has nearly confined to the coarser sex. I do not rest this opinion solely on the fact that these duties do not seem congenial with the superior delicacy of woman, or compatible with the occupations which nature assigns to her in the domestic sphere. I think it would be found, on trial, that nothing would be gained—nothing changed for the better—by putting the sexes on the same footing, with respect, for instance, to the right of suffrage. Whether the wives and sisters agreed with the husbands and brothers, or differed from them—as this agreement or difference would, in the long run, exist equally in all parties—the result would be the same as at present. So, too, whether the wife or the husband had the stronger will, and so dictated the other's vote, as this, also, would be the same on all sides, the result would not be affected. So that it would be likely to turn out that the present arrangement, by which the men do the electioneering and the voting for both sexes, is a species of representation which promotes the convenience of all and does injustice to none.

Meantime for all the great desirable objects of life, the possession of equal advantages for the improvement of the mind, is of vastly greater importance than the participation of political power. There are three great objects of pursuit on earth—well-being, or happiness for ourselves and families; influence and control over others; and a good name with our fellow-men, while we live and when we are gone. Who needs be told, that, in the present state of the world, a good education is not indeed a sure, but by far the most likely means of obtaining all the ends which constitute material prosperity, competence, position, establishment in life; and that it also opens the purest sources of enjoyment. The happiest condition of human existence is unquestionably to be found in the domestic circle of what may be called the middle condition of society, in a family harmoniously united in the cultivation and enjoyment of the innocent and rational pleasures of literature, art and refined intercourse, equally removed from the grandeurs and the straits of society. These innocent and rational pleasures, and this solid happiness, are made equally accessible to both sexes by our admirable school system.

Then for influence over others, as it depends much more on personal qualities than on official prerogative, equality of education furnishes the amplest means of equal ascendency. It is the mental and moral forces, not political power, which mainly govern the world. It is but a few years since the three greatest powers in Europe, two on one side and one on the other, engaged in a deadly struggle with each other to decide the fate of the Turkish empire; three Christian powers straining every nerve, the one to overthrow, the two others to uphold the once great and formidable, but now decaying and effete Mohammedan despotism of Western Asia. Not less than half a million of men were concentrated in the Crimea, and all the military talent of the age was called forth in the contest? And who bore off the acknowledged palm of energy, usefulness and real power in that tremendous contest. Not emperors and kings, not generals, admirals or engineers, launching from impregnable fortresses and blazing intrenchments, the three-bolted thunders of war. No, but an English girl, bred up in the privacy of domestic life, and appearing on that dread stage of human action and suffering, in no higher character than that of a nurse.

And then for fame, to which, by a natural instinct, the ingenuous soul aspires:

> "—— The spur which the clear spirit doth raise,
> (The last infirmity of noble mind,)
> To scorn delights and live laborious days"—

need I say, that the surest path to a reputation for the mass of mankind is by intellectual improvement; and that in this respect, therefore, our school system places the sexes on an equality. Consider for a moment the spectacle presented by the reign of Louis XIV., the Augustan age of France, rich in the brightest names of her literature, philosophy, politics and war—Pascal, Descartes, Corneille, Racine, Lafontaine, Moliere, Bossuet, Fenelon, Bourdaloue, Massillon, Colbert, Conde, Turenne, Catinat. Among all these illustrious names there is not one that shines with a brighter or purer ray than Madame de Sevigne; not one whose writings are more extensively read by posterity; not one in whose domestic life and personal character all future ages will probably take a deeper interest. The other distinguished individuals whom I have mentioned, we regard with cold admiration, as personages in the great drama of history. We feel as if Madame de Sevigne belonged to our own families. The familiar letters principally to her daughter, written by this virtuous and accomplished woman, who preserved her purity in a licentious court, who thought with vigor and wrote with simplicity, earnestness, and true wit in a pedantic and affected age, have given her a place among the celebrities of France, which the most distinguished of them might envy.

Apart then, girls, from a preparation for the pursuits, duties, and enjoyments of life, which more especially pertain to your sex, in the present organization of society, you possess in these advantages of education the means of usefulness and (if that be an object) of reputation, which, without these, would be, in a great degree, monopolized by the stronger sex. The keys of knowledge are placed in your hands, from its elemental principles up to the higher branches of useful learning. These, however, are topics too familiar on these occasions to be dwelt upon, and I will conclude by offering you my best wishes, that the reputation already acquired by the Dwight School for girls may be maintained under the new organization; that your improvement may be proportioned to your advantages; that your progress may equal the warmest wishes of your teachers, parents, and friends; and that you may grow up to the enjoyment of the best blessings of this world, and the brightest and highest hopes of the world to come.

The lot on which the Everett School-house is built, is the largest devoted to school purposes in the city. It is adorned with grass-plots, flower-borders, and shade-trees.

The building, is in size, and internal arrangement, a copy of the Lincoln School-house, having fourteen school-rooms, furnished with fifty-seven single desks and chairs. So much of the basement as may be in any way exposed to fire, is constructed of fire-proof materials. The building and furniture, apart from the lot, cost $52,000.

XV. EDUCATIONAL MOVEMENTS AND INTELLIGENCE.

RUSSIA.

The Emperor of Russia, as a Supplement to his Ordinance for the Liberation of the Serfs, appointed a Special Commission to digest a system of National Education with special reference to the poor, and the newly liberated peasantry, but embracing in its full development every grade of instruction, and all classes of that vast empire. We give a brief outline of the new System reported, by the Commission in 1861, from the "*Educational Times.*"

The scheme proposed by the Special Commission embraces—1. Common or National Schools for the poor—male and female. 2. Progymnasiums and Female Schools of the Second Degree. 3. Gymnasiums and Female Schools of the First or Highest Class. 4. Private Educational Establishments and Private Teaching. 5. Universities.

For the general regulation of these Institutions, the empire is divided into "Educational Circles," each of which embraces the educational establishments of several provinces, and is placed under the authority of a Curator, subordinate to the Minister of Public Instruction. Under the immediate authority of the Curator of the Educational Circle, are placed in each province a Director of National Schools, a Director of Gymnasiums, an Inspector of Progymnasiums, and Directors of the Female Schools of the First and Second Categories. Under the authority of the Director of the National Schools in each Province, are placed all the National Schools in his District, male as well as female; the Normal or Training Schools, all the private schools, and all the private tutors, governesses, masters and mistresses in any way employed in education.

Lastly, in order to maintain the connection and unity of these various educational establishments, and for the development and dissemination of sound principles and methods of instruction, Deliberative Boards are established in each province, under the designation of the "School Council of the Province," in which all these functionaries meet, and which are in direct communication with the Minister of Public Instruction.

National Schools.

The National Schools have a course of education determined by the Ministry of Public Instruction, such as is best calculated to secure the object aimed at in their establishment, which is described to be "the moral and intellectual education of the nation, to such a degree that every one shall be able to understand his rights and to fulfill his duties reasonably, as every man ought to do."

The course of instruction begins with Object-Lessons, which are to be followed by—1. Religious Knowledge; 2. The Vernacular Language, Reading and

Writing; 3. Arithmetic; and 4. Singing. The principles which have guided the Commissioners in their selection of these subjects are thus explained:—

"The Object-Lessons are intended to serve as a transition from the natural method of education, which commences from the very birth of the child, to the artificial instruction which begins at school. The chief aim of these Object-Lessons is to teach the child, under the guidance of the master, to examine from every point of view, and with exactness and attention, those objects upon which he previously looked alone, and saw superficially; to point out the relations between these objects and others, and define their immediate use, and thus to develop in the pupil the power of distinguishing in such objects all their various characteristics, and consequently to accustom him to form well-grounded conceptions on every subject.

"The instruction in religion is intended to develop in the children the sentiment of piety, to root firmly in their hearts love of God and love of their neighbor, and to elevate their minds to every thing that is good and noble. With this intention, explanations will be given in the National Schools of the principal prayers, and the Shorter Catechism and a short Bible History is explained. To this course will be added the reading of the Gospel and the Epistles in the Russian language, and the explanation of the Liturgy and the signification of the most important festivals. During the reading of the Gospel, the attention of the pupils will be principally directed to the most important features of the earthly career of the Saviour.

"The immediate aim which must absolutely be attained in the teaching of the vernacular language in the National Schools, consists; (*a*) in the current reading of written and printed matter with appropriate expression, the correct accentuation of the words, and a pure pronunciation, free from local and provincial peculiarities; and (*b*) in the acquisition by the pupils of the habit of correct oral and written expression of their thoughts, without gross orthographical errors. Pupils belonging to the orthodox persuasion are bound also to undergo instruction in the reading of books printed in the Slavonic character. The phonetic mode of teaching reading, as possessing an indisputable superiority in an educational point of view, is considered preferable to the syllabic method. In order to habituate the children to understand what they read, they are exercised, under the guidance of the master, in the explanation of a particular book, containing, among other things, the most indispensable information respecting natural objects and phenomena, and the principal facts of the history and geography of their country. With this reading must be constantly combined, as far as circumstances will allow, a detailed but elementary commentary, familiarizing the pupils with the local situation of their native region, with its natural productions and phenomena, and in general with the mode of life existing there, and tending to clear their minds of prejudice and superstition.

"In writing, the pupils are practiced till they attain a clear, legible, regular, and rapid hand, in doing which, independently of the due gradation and regularity in the lessons, particular attention must be paid to the attitude of the writer, and the proper mode of holding the pen or slate-pencil. Together with the writing lessons are carried on exercises in orthography, and instruction in the most indispensable portions of grammar.

"Arithmetic commences with numeration, the first exercises in which should be made by means of tangible objects perceptible to the bodily senses, and also by means of the *abacus;* and not until these have become familiar to him will the pupil make acquaintance with the signs of numbers, *i. e.*, with ciphers and calculation by figures. The instruction in arithmetic, properly so called, will be confined to the four rules as applied to simple numbers, denominations, and fractions. The method of instruction to be employed is strictly practical, and the pupils must be accustomed from particular examples to deduce such general applications as may afterwards, when adapted to any similar case, serve them as a universal rule.

"Instruction in church chanting, while contributing to the formation of a musical ear in the children, will become, on the one hand, a means of exciting feelings of religion and piety; and, on the other, will give the possibility of forming, from among the pupils, good singers for the services of the church. In order to develop the children's taste, and to accustom them to an intellectual and elegant mode of passing their leisure time, they may be exercised in the singing of secular music, such songs being selected as by their subjects and sentiment correspond with the educational aims of the school"

In the National Schools for girls, the same subjects are to be gone through, and to the same extent, as in the schools for boys; but in addition to the former, sewing will also be taught, and such kinds of needlework as are most indispensable in domestic life. In schools for both sexes, girls may receive instruction till they attain the age of thirteen years; after which they must be removed to a separate school. The number of schools in each Province of the Empire is fixed by the mutual consent of the Provincial Director of Schools and the community of the district; but in so doing, it must be kept in view that for every 1,000 male there should not be less than one National School.

Private individuals or associations may establish National Schools, which must, however, be subject, like other schools, to the control of the Minister of Public Instruction; or they may add, at their own expense, complementary courses of instruction in schools already existing, in such branches of education as may be considered to correspond with the local wants and requirements of the population. Schools for the poor are to be maintained by a tax on the population of the district, and each school must be provided with a teacher of religion from the local clergy, and a teacher for secular subjects, who must have completed a course of training in a Normal School or Teachers' Institute. The salary of such teachers must be guaranteed by the community, and must not be under 250 rubles per annum in towns, 200 rubles in villages, for secular teachers, and 80 rubles in towns, and 50 rubles in villages, for religious teachers.

Teachers' Institutes.

Normal Schools or Teachers' Institutes are established at the expense of the State for the training and instruction of teachers for National Schools. The course of education extends over three sessions of six months each. The subjects of instruction are—Religion, Pedagogy, the Vernacular Language, History, Geography combined with Statics, Physics and Natural History, Arithmetic and Geometry, Writing and Geometrical Drawing, Singing, Gymnastics, and Agriculture and Horticulture.

Progymnasiums.

These institutions, to which there are no precise equivalents in this country, representing the second degree in the system of general education, are designed to afford a more complete and varied course of instruction than the National Schools, and at the same time to serve as institutions forming a transition between them and the gymnasiums. In each progymnasium there must be seven teachers, exclusive of the masters for singing and gymnastics. The subjects of instruction comprise—Religion, the Russian Language, Mathematics, the Natural Sciences, Geography, History, the German Language, the French Language, Writing, Geometrical and other Drawing, and Singing. The subjects of study are obligatory on all the pupils, excepting the foreign languages, which are learned by such only as desire to do so.

Gymnasiums.

The Gymnasiums, the third and highest grade of schools, and serving, like our grammar and foundation schools, mainly as preparatory institutions to the universities, are divided into two classes—*Philological* and *Real.* In addition to the subjects common to both classes and to the progymnasiums, there is given in the latter a more complete and detailed course of Natural Science and Mathematics; and in the former the Greek language and a more detailed course in Latin. Supplementary courses may be opened in the gymnasiums and progymnasiums, according to local requirements, in any of the following subjects:—Law, Technology, Agricultural Economy, the Art of Construction, the Method of distinguishing the quality of Goods, Book-keeping, Hygienics, Foreign Languages other than those taught in the regular course; and in general all applications of science to manufactures, trade and commerce.

Both the Gymnasiums and Progymnasiums are supported by the State, but the education is not gratuitous—each pupil paying a fixed fee, according to a regulated scale of payment approved by the Minister of Public Instruction.

Female Schools.

Female Schools are divided into three categories: (1.) National Schools; (2.) Schools of the Second Category, corresponding to the Progymnasium for boys; and (3.) Schools of the First Category, corresponding to the Gymnasium. Differing from each other only in the extent of the course of instruction given in them, all these schools have, nevertheless, one and the same object—that of "communicating to their pupils such a religious, moral and intellectual education as may be required from every woman, and especially from one destined to become a wife and a mother."

Female National Schools are founded and directed on precisely similar principles with National Schools destined for the education of children of the male sex. Schools of the Second and First Category are placed under the supreme authority of the Curators of Educational Circles, and are established in such towns and places only where there may appear a reasonable probability of guaranteeing their existence by means of the sums paid for tuition only.

Private Schools and Private Teaching.

The right of opening a private Day or Boarding School is open to all subjects of the Russian Empire enjoying the confidence of the community, and holding a certificate entitling them at least to the designation of domestic tutors or governesses. All such schools are, however, to be subject to the supervision of the Directors of Schools for each Province.

Persons opening Private Boarding or Day Schools without the permission of the School authorities, or teaching in them without the proper certificates giving them the right to do so, are liable, for the first offense, to a pecuniary fine—in the former case of 150 rubles, and in the latter of 75 rubles—the amount to go to a fund in aid of domestic tutors and governesses. The Directors of Schools in the respective Provinces are bound, so far as circumstances will permit, to visit all private schools within their district, and report upon their management.

The right of giving instruction in private houses is open to all persons without distinction who possess the confidence of parents. The designation of domestic *Tutor*, and the privileges attaching thereto, are exclusively reserved to those persons who possess a testimonial certifying that they have completed the course of a recognized university—Russian or foreign.

The designation of domestic *Teacher* is given to such persons only as have completed the full course of instruction in a gymnasium, or who have undergone in the gymnasium the examination corresponding to that course.

Universities.

The Universities embrace the usual course of studies in institutions of a similar character in this country, with some additional chairs for special subjects—among which may be mentioned Pedagogy, or the Theory and Practice of Education, Geography, and Archæology and the History of the Arts. The Teachers are divided on the plan of the German Universities into Professors, Ordinary and Extraordinary; Docents, Senior and Junior; Lecturers, Private-Docents, and Teachers of the Arts. The Degrees conferred are those of Candidate, Master, and Doctor.

Rights and Privileges of Teachers.

All persons serving in National Schools, Teachers' Institutes, and Gymnasiums, and all persons holding a diploma entitling them to the designation of Domestic Tutor or Teacher, of either sex, are considered in the service of the State. They have a right to a pension after serving a certain period, and may receive medals, pecuniary rewards, and orders for distinguished services, in conformity with the regulations laid down for the government of the Civil Service generally.

Directors of gymnasiums, and Inspectors of boarding-houses in gymnasiums, of separate progymnasiums and Teachers' Institutes, as well as all the teachers in these scholastic institutions, including among them also the religious instructor, and the teacher of ordinary and geometrical drawing and writing, and all the ushers and inspectors of day scholars, likewise Directors and Inspectors of National Schools, are rewarded, on their retirement from their functions after twenty years of irreproachable service, with pensions amounting to one-half; and after twenty-five years, amounting to the whole salary received by them.

The teachers and religious instructors of National Schools, after completing twenty-five years' service, receive, in the form of pension, two-thirds of the annual amount of their salaries; and this pension is paid them independent of their salary, if they continue in the service.

The families of deceased Teachers, entitled to a pension by right of service, receive the full pension, one-half going to the widow as long as she remains unmarried, and the other half to the children.

Domestic Tutors, Governesses, and Private Teachers of both sexes, holding diplomas, are entitled to pension after twenty-five years of service, the amount of which is fixed by the Minister of Public Instruction.

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