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Materials, elements, and methods of economical school construction are illustrated through explanatory outlines and accompany photographs and diagrams. Finishing elements covered include--(1) finished floorings, (2) ceilings and acoustical finishes, (3) carpentry and millwork, (4) chalkboards and tackboards, (5) toilet partitions, (6) finishing hardware, (7) ornamental and miscellaneous metal, (8) painting and finishing, (9) folding doors and partitions, and (10) miscellaneous equipment and accessories. (MH)

SCHOOL BUILDING FINISHING AND ECONOMY

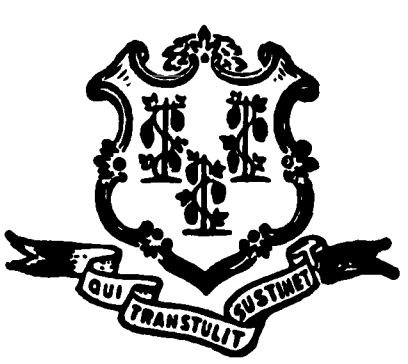
THE SCHOOL BUILDING

ECONOMY SERIES 6

STATE DEPARTMENT OF EDUCATION

Hartford, Connecticut June, 1966

SCHOOL BUILDING FINISHING AND ECONOMY



SCHOOL BUILDING ECONOMY SERIES — No. 6

State Department of Education
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CONTENTS

INTRODUCTION

With regard to the construction of school buildings by its municipalities, the State of Connecticut is more interested in rendering assistance than it is in exercising control. The only areas in which direct control is exercised involve the safety of school occupants from fire and health hazards.

First, the building must meet the safety requirements of the State Fire Safety Code, as interpreted by the State Fire Marshal.

Second, the building and its site must meet the health requirements of the State Sanitary Code, as interpreted by the State Department of Health.

For these purposes, the working drawings and specifications for all school construction must be filed with the State Department of Education for review before a construction contract is signed.

In addition to the above, the 1959 General Assembly enacted legislation requiring that the State Department of Education establish a School Construction Economy Service to assist local communities toward achieving economy in their school building projects. Each school project must be reviewed at both preliminary and final planning stages by this Service in order to qualify for a state construction grant.

Further responsibilities placed upon the Service include the publication and distribution of information pertinent to the school building process. To this end the Department publishes a series of booklets called "The School Building Economy Series."

This sixth booklet of the series directs attention to the finishing materials used in school buildings and the considerations which are important in selecting these materials.

While the booklet does not undertake to make experts of building committee members, it should provide a firmer ground of understanding between them and the architects whose professional services they have engaged. Better understanding, in turn, will foster economy of time and effort, more expeditious logical planning, and material selections most appropriate for long-range, true economy.

Richard L. Howland, Chief
Bureau of School Buildings

CHAPTER I

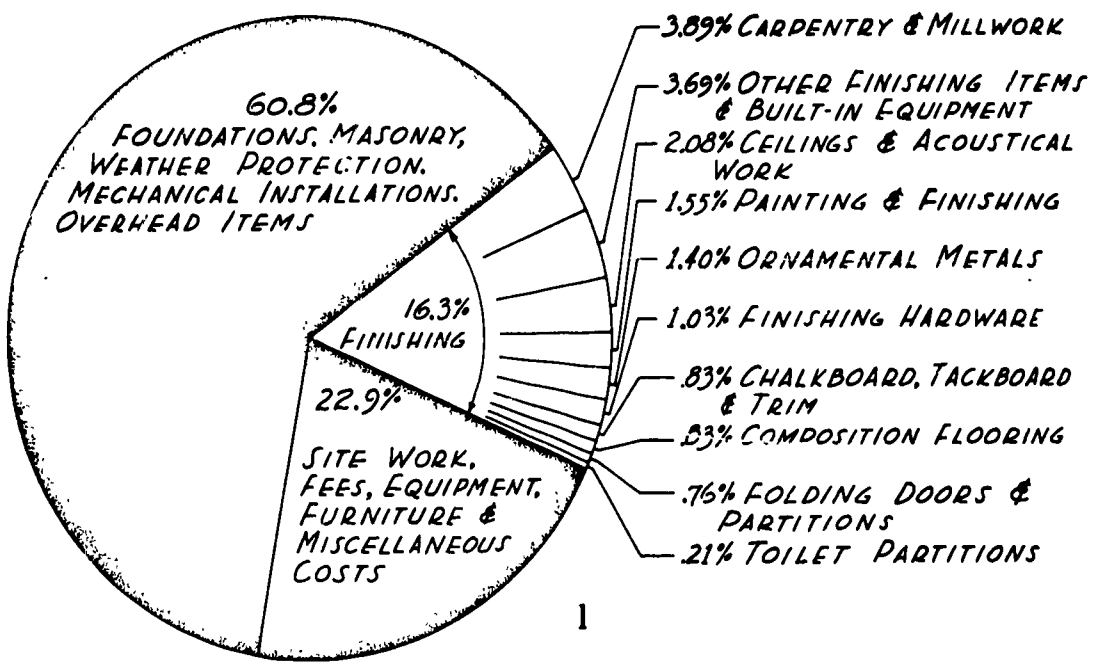
BASIC CONSIDERATIONS

Finishing items are distinguished from concealed structural members by the fact of their exposure to contact or view. For example, tradesmen refer to the "rough" floor, meaning the slab upon which the "finished" flooring material is installed. The same concept applies to walls, partitions, and ceilings. Also included are many other items which are installed last and exposed to view and use, not necessarily cover rough structural materials.

Since economy is our object, it will be helpful to gain some perspective on the cost of finishing items in relation to the entire project. Information filed with this department by school building architects and owners has revealed certain relationships between total project costs[1] and various finishing items.

Statistics on hand for the initial construction of 221 Connecticut school plants indicate that 22.9 percent of total costs was spent for items other than the building itself, such as site improvements, equipment, professional fees, furniture, and administrative expenses.

On 54 projects for which contracts were recently let, construction costs of the "building only" were proportioned as shown on the following "pie" chart. "Finishing" items are further subdivided into various items as shown:



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[1]Exclusive of site purchase or financing costs, such as bond expenses or interest on indebtedness.

Thus it appears that, on the average, for each $100,000 spent on total school plant costs, these finishing items account for the following amounts:

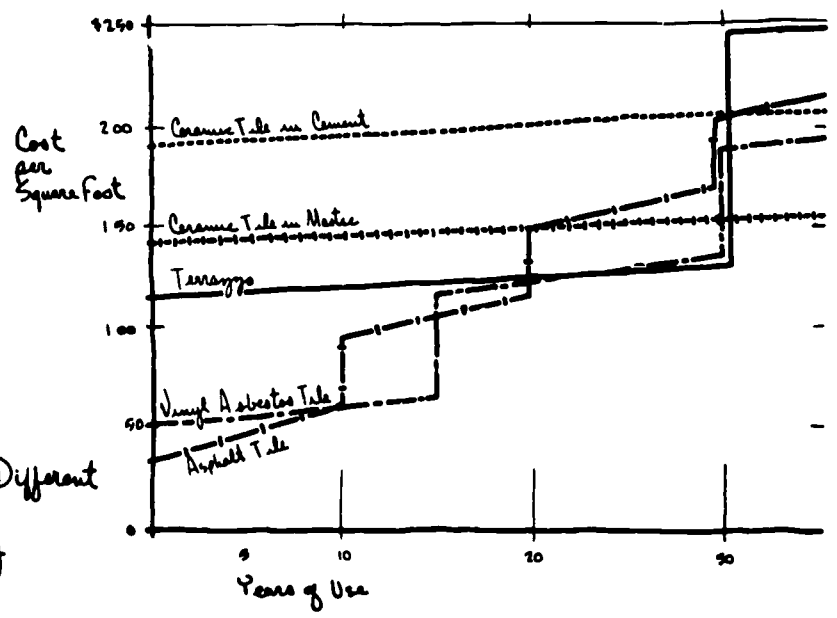
Percent	Item	Amt./$100M
3.89	Carpentry and Millwork	$ 3,888.08
2.08	Ceilings and Acoustical Work	2,082.32
1.55	Painting and Finishing	1,545.47
1.40	Ornamental Metals	1,399.06
1.03	Finishing Hardware	1,024.89
.83	Chalkboard, Tackboard and Trim	829.67
.83	Composition Flooring	829.67
.76	Folding Doors and Partitions	764.60
.21	Toilet Partitions	211.48
3.69	Other Finishing Items & Built-in Equipment[2]	3,692.86
16.27		$16,268.10

Import considerations in the selection of finishing materials include:

A. First-Cost vs. Long-Term Cost—While not always true, nor true of all items, materials which have a long life and require the least maintenance are generally the most costly to begin with. In any case, the best material is the one that costs the least over the entire period of its intended use. Consequently, it is usually true that the most expensive material initially is, in the long run, the most economical one to use, considering maintenance and operation.

In making selections for economy, therefore, the choice should come after considering the *total* cost over the assumed life of the building, which, in the case of a school, is usually anywhere from 30 to 50 years. Figure 2 graphically illustrates a comparison of finished floorings including initial, maintenance, and replacement costs.

2



The Cost of 5 Different Types of Flooring Over 30 Years

Starting point includes installation cost and vertical steps include replacement.

[2]Includes ceramic and similar tile, other wall finishes, kitchen equipment, venetian blinds and shades, folding bleachers and stages, fixed auditorium seating, laboratory furniture, lockers and wardrobes, and other miscellaneous equipment in general contract.

Clearly, if assumptions are correct in this case, the "cheap" flooring will prove eventually to be the more costly. The same reasoning applies to a great many finishes.

B. Associated Materials are frequently of great importance in the true cost of a given finish. Since many finishes necessitate specific methods of installation – fastening, protection and so forth – it is not wise to consider the cost of the finished material alone. Instead, where alternatives are being considered, the sum total of the costs of all associated items that differ with the change should be compared.

The layman should further bear in mind that the possible combinations of various materials, structural systems, orientation to climate, and finishes are so complex as to defy calculation. As a consequence, he is well advised to rely upon the training and skill of the architect in the final determination of these matters.

C. A Multiplicity of Finishes can easily lead away from economy. The greater the quantity of any particular finish, the lower the unit cost is likely to be on a particular project. And the reverse is true as well. Too many different finishes require more different skills, induce additional wastage, and increase overall costs.

D. "Factory Finished" items should be given serious consideration, as they need little or no further treatment beyond installation in the field. Finishes can usually be applied more economically under factory conditions and with better control of quality.

E. Local Finances, unfortunately, are sometimes handled in such a way as to preclude the possibility of long-range savings through the use of high-quality materials. Unrealistically low budgets, arbitrarily set before any real knowledge of probable cost exists, quite commonly force the use of "cheap" finishes which eventually prove to be quite expensive indeed.

F. Expansion deserves particular attention. All materials "move" variously with temperature changes and many also with changes in humidity. Consequently, permanent perfection of fit should not be expected. Instead, skill and foresight are needed to minimize such movements and to provide suitable places for them to occur without unsightly or unfortunate results.

G. Vandalism is a factor which, in some communities, forces additional spending for materials and finishes rugged enough to resist ingenious and determined efforts at destruction. The vast majority of school children are innocent of this behavior, which is more often due to older youths and social misfits. But where vandals can be expected to take a heavy toll each year, special precautions are indeed worthwhile. In addition to the use of damage-resistant materials and equipment of all kinds, the comparative cost of greater surveillance should be considered. Such measures include outside lighting, alarms of various kinds, and, in the case of larger plants, watchmen, guard dogs, and the like.

H. Fire Safety must be considered so that finishing materials are selected which will not contribute to the spread of fire or generate smoke or noxious fumes in case of fire. These matters are subject to minimal regulation of the State Fire Safety Code. Also, more stringent controls may be adopted by municipalities for administration by the local Fire Marshal or Building Inspector.

It should be reasonably clear from the foregoing that determining the most economical finish for a certain situation is not a simple matter. Expert advice should therefore be followed in making selections throughout.

While the above applies generally to finishing items throughout a school building, certain categories of materials and equipment will be discussed in more detail under separate headings in the chapters following.

CHAPTER II

FINISHED FLOORINGS

Finished floorings are subject to much scrutiny as to cost by laymen, perhaps because they are physically so located as to attract attention. In addition, their maintenance is one of the most obvious activitics of school custodians. While they represent something in the neighborhood of one percent of the total cost of an average school, replacement costs and routine maintenance over the years are far from insignificant.

It seems important here to point out that most finished floorings — especially wood and many of the "soft" tiles — require protection from dampness. Concrete slabs laid on the ground, without space beneath, are very prone to absorb moisture from the earth. It is essential with many finished floorings that a positive barrier be installed to prevent moisture migration upward through such slabs. Such barriers are usually either a felt and pitch membrane, or a fairly substantial film of plastic with carefully sealed joints situated beneath the slab.

Flooring Materials may be grouped as follows:

A. Monolithic

3

- *Concrete* is by far the most widely used flooring. When properly smoothed for interior use by trowelling and perhaps painted or integrally colored, it is not as inexpensive as one might think, due to the cost of labor invested in the inexpensive basic materials. Generally this finish is confined to storage and miscellaneous service areas, though occasionally it will be found in locker rooms, beneath fixed seating in auditoriums, and in unfinished areas. Shrinkage cracks are common, but may be controlled somewhat by reinforcement and suitable jointing.

• *Terrazzo* may be thought of as a highly refined type of concrete topping, composed of marble chips in a sand-cement matrix and machine-ground to a very smooth fi .sh. This flooring, often extended up a few inches on the wall as a base, is very durable and easy to maintain. In addition, by the use of variously colored marble chips, cement coloring, and metal divider strips, an infinite variety of patterns and special designs is readily available.

More recently, thin applications of terrazzo have been made practical by the use of a latex emulsion in the sand-cement matrix. This is claimed to reduce not only direct cost but also the waiting time between setting and grinding the surface to its final finish, as well as minimizing problems due to cracking.

• *Magnesite* is similar to a very fine colored cement finish in appearance, but has magnesium oxychloride as its principal ingredient. It can be laid as thin as terrazzo, and bases are formed in the same way. Installation requires specialized skills, and it is now seldom used in schools. This material would find its principal use for schools in kitchens, as it is grease-resistant and, with a copper admixture, has germicidal and fungicidal properties.

B. Sheet Floorings

4

• *Linoleum* was very popular for schools some years ago; but, currently, little is being installed in this area. It arrives on the job in rolls, usually six feet wide, and is available in various thicknesses, according to the severity of service expected. It basic ingredients are shredded cork and linseed oil, compressed and "cooked" into a durable and homogenous mass which is adhered to the smooth subsurface with specialized cements intended for this purpose.

• *Sheet Vinyl* flooring has been increasingly used in schools of late. Its composition is similar to pure vinyl tiles, and installation procedures are quite like those for linoleum. Many interesting colors and patterns are available in this material.

• *Sheet Rubber* is similar in appearance to the vinyl in most respects, but is composed of rubber compounds. It is usually a bit more resilient. All the above materials require protection from long-time concentrated loadings. Furniture therefore should be provided with suitable glides to spread concentrated weights, and permanently located heavy equipment should rest on metal slugs set into the material on the subsurface.

C. "Soft" Tiles

This category is intended to include those tiles which are resilient to some degree. It is by far the most used group of flooring materials — the one from which are selected the floors for the major areas of most new school buildings.

5

• *Asphalt Mastic* tiles are available in four groups of colors — A, B, C, and D — in ascending order of price. The brightest colors are the more expensive, due to the cost of coloring ingredients. Pieces are 1/8" or 3/16" thick and usually in 9" x 9" squares, though 12" x 12" squares are sometimes available. Also, 18" x 24" strips are made in some colors for border use. A premoulded base is produced for installation with this material. The material is adhered to the subsurface with a cement and must be installed at fairly warm temperatures.

This material is subject to serious damage from oily substances and most organic solvents, though a grease-resistant type is made in some colors for use in kitchens, cafeterias and similar locations.

• *Vinyl Asbestos* tiles are commonly 1/8" x 9" x 9" with all of the many clear, bright colors priced alike. Installation is similar to that for asphalt tiles. Maintenance, however, costs somewhat less.

• *Pure Vinyl* tiles are generally similar in appearance and dimensions to the vinyl-asbestos. But they are much more flexible, and have a finer, smoother original finish, calling for simple maintenance.

● *Cork* tiles are more soft and resilient than most of the others. They are usually 1/2" x 9" x 9" in size, and find their principal use in areas where quiet is particularly desired, such as libraries and offices. Because of their cost and special maintenance requirements, they are not frequently used in public school buildings.

● *Rubber* tiles are available in sizes and colors similar to pure vinyl, but usually in greater thickness. They are among the most resilient of the tile materials, along with cork. They are also quite durable and easy to maintain. They must not be used, however, where organic solvents are likely to be spilled.

● *Linoleum* tiles are simply the regular linoleum material cut into tiles, so that patterned installation is possible and damaged areas can be replaced without unsightly patching.

● *Wood* tiles are also available in sizes similar to cork for adhering to concrete or other subsurfaces by means of cement. Finished wood may be of several species, generally factory-finished.

All the "soft" tiles except wood require protection from concentrated loads in the same manner as sheet floorings.

D. Strip Flooring

The only material in this category finding significant use in school buildings is wood.

6

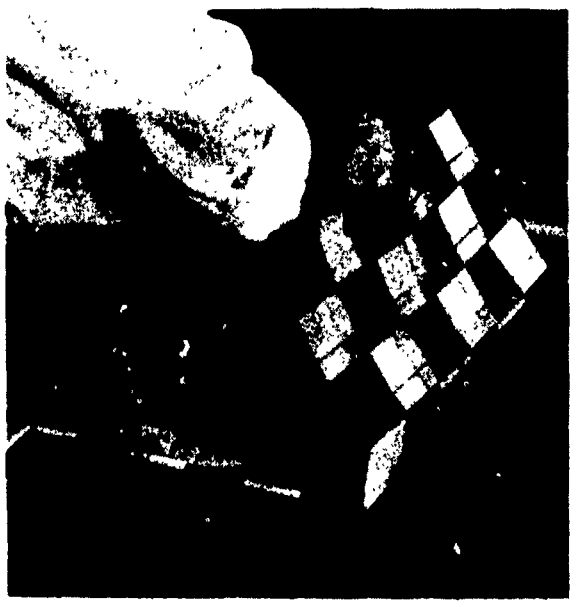
● *Hardwood* is widely used for the finest gymnasium floors. The material is available in several species, various widths and thicknesses, according to the severity of use expected. The three basic grades are based on variations in color and appearance. Hardwood is usually nailed down to a softwood subfloor, which, in turn, is attached to wood "sleepers" fastened to the rough floor below. Sleeper attachment to rough concrete floor is by various means, some patented, and designed to increase the resilience of the completed installation. In some systems, an underlayment of cork set in pitch or mastic is used to provide resilience. Strip wood floors require extensive sanding, sealing and finishing before being ready

for use. Also, considerable maintenance and care are necessary to keep them in first-class condition. There are also available — under various names — a number of specialized methods for utilizing relatively short lengths of strip flooring.

● *Softwood* flooring is similar to hardwood in general dimensions and methods of installation. But its use in schools is limited mainly to stages, where it permits temporary fastening of stage sets and associated items.

E. "Hard" Tiles

These are generally of clay origin, fired at high temperatures to produce very hard, durable pieces which are resistant to most solvents and mechanical damage. They are usually set in cement mortar. And they require that the subfloor be depressed 1½" or more to make room for the installation to come level with other types of floors in the building.



7

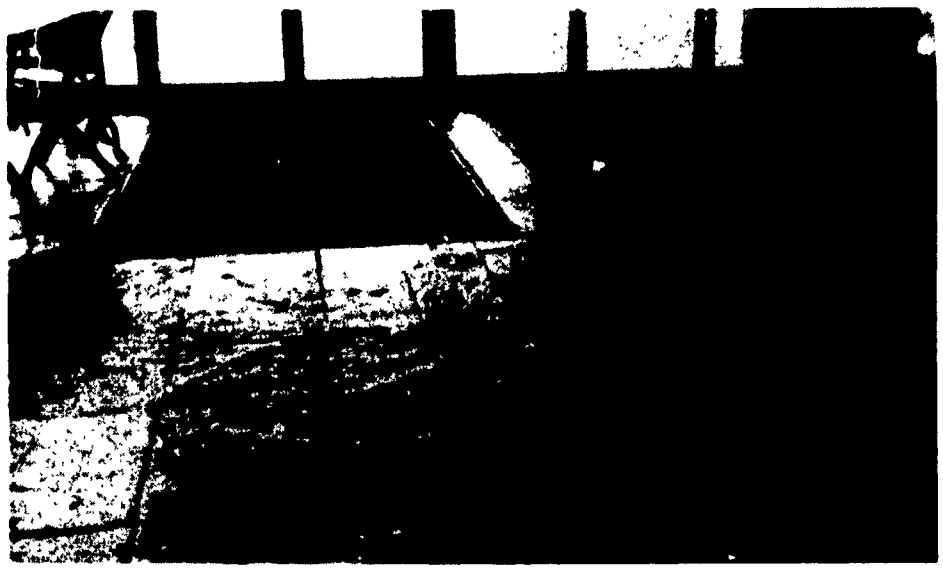
● *Vitreous* tiles are fired to a very fine, dense structure similar to porcelain, but without glaze, for flooring use. Individual pieces are factory-attached to sheets of paper to simplify installation. These tiles are ordinary small in size and ¼" to ⅜" in thickness — in squares or hexagons about an inch across. Their principal use is in toilet rooms, where their ease of cleaning, imperviousness to various agents and sanitary finish are particularly applicable.

● *Ceramic* tiles are "burned" less densely and are made of different materials, so that a great variety of colors and non-slip textures are available. Installation is similar to that for vitreous tiles. Their use in schools is extensive for toilets, locker and shower rooms, kitchens, entries, and other areas where wet conditions and hard use may be expected. Glazed ceramic tiles are commonly applied to walls of toilets, kitchens and similar situations. These are usually about 4" square and individually installed.

● *"Quarry"* tiles are available in larger sizes, such as 4" and 6" squares about ½" thick, and must be set in place individually. Commonly available in dull red, green and tan, they can be obtained also with carborundum grits embedded in the surface to minimize slipping hazards. Their principal school application is found in kitchens and entries, where they resistance to grease, food acids, and water make their use appropriate.

F. Stone

A certain amount of natural stone is used in schools for specialized flooring purposes:



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- *Bluestone* is a fine-grained blue-gray stone, finding its primary interior use for stair treads, where its non-slip properties and wear resistance make it eminently suitable. In this application, the surface is machine-finished flat for obvious reasons, rather than being left in its natural state.
- *Slate* is quite commonly used for window stools when machine-finished. It is occasionally used in flat, naturally-cleft pieces as finished flooring for variety of texture and to add interest to an entrance lobby or similar location.

G. Carpeting

Heavy-duty carpeting is increasingly receiving consideration for use in schools, following widespread commercial use in department stores, hotels, banks, and such.

While initial cost is fairly high, simplicity of maintenance is claimed to render it competitive or even advantageous over an extended period.

The principal advantage for carpeting is the resultant quiet, which is of obvious importance in most school areas. This is claimed to produce secondary benefits as well, such as better behavior on the part of pupils and the minimal need for specialized acoustical treatments.

9

CHAPTER III
CEILINGS AND ACOUSTICAL FINISHES

Ceilings form the upper limits of interior spaces. A ceiling may be simply the underside of the structural decking above. It can also be separate and attached to or suspended from the structural members, concealing them and various mechanical installations as well

Exposed structural ceilings obviously require less material and may permit reduced building height. These advantages may be offset by the problems of finding other locations for certain piping and ductwork, by exposed and sometimes ugly wiring and other piping overhead, and by the need for superior workmanship on items usually left "in the rough." In addition, exposed structural members and piping are frequently difficult to paint initially. Likewise, they provide dust-catching surfaces which increase both the frequency and cost of normal maintenance.

Separate ceilings, either attached directly to structural members or hung from them, will usually cost more initially than integral ceilings, but not as much as one might suppose. Because such a ceiling conceals the space above, structural finishes require no concern for appearance. Space is provided for piping, ductwork and such – none of which need fine finishes or "appearance grade" workmanship. In addition, the finished ceiling is relatively easy to paint or to treat acoustically and will minimize accumulation of dirt over the years.

- *Acoustical* finishes are primarily intended to absorb sound energy, so as to prevent garbling reverberations in larger spaces, high-noise levels, and interference with neighboring activities. These materials, however, are seldom efficient in reducing sound *transmission* from one space to another. In such cases, increased weight of materials and sealing of apertures is of major importance.

The usual location for acoustical treatments in classrooms, cafeterias and the like is overhead. Hence, the ceiling is frequently composed of, or finished with, an acoustically absorbent material. Large spaces, especially auditoriums, are usually treated at the end opposite the sound source, so as to permit good sound projection but to prevent its return as reverberation.

Some care should be exercised lest *too much* acoustical absorption be provided. More absorption than necessary tends to render a space acoustically "dead" and thus to inhibit learning processes – and waste money as well.

When carpeting is used as a floor covering, further acoustical treatment for spaces of moderate size will usually be unnecessary.

- *Fire Resistivity* of ceilings and acoustical materials is a matter requiring serious consideration. Ceilings are often used to protect structural members above from failure resulting from excessive heat. In addition, ceiling surfaces in most schools are required to provide for very limited fire-spread ratings. Minimal requirements are set forth in the State Fire Safety Code for the fire ratings of structures and the rate of

flame-spread for finishes. Moreover, various municipal ordinances may provide for more stringent local regulations.

The general range of these materials may be conveniently subdivided into the following categories:

A. Integral Ceilings

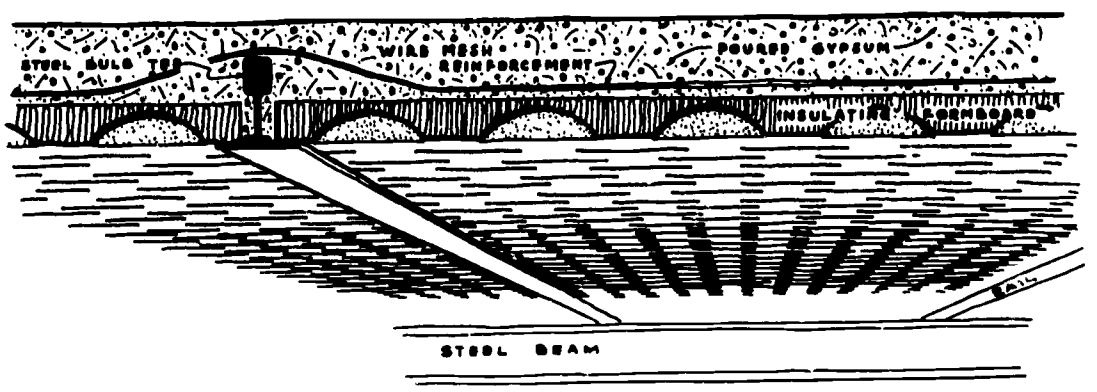
● *Exposed Slab* – Ordinarily, exposed cast-in-place concrete ceilings are used only for storage areas, vaults, and similar places not intended for continuous occupancy. Such surfaces can, by means of especially smooth forms and paint, be made to look quite presentable. They are highly sound-reflective, however, and are quite useless by themselves as acoustical treatment. Certain types of exposed concrete structure, however, can be acoustically treated and utilized as a part of the lighting installation as well, as illusrated below.

10

● *Precast Units* made from a variety of materials are used for structural roof decks, some being of such a character as to provide a useful measure of acoustical absorption. These, of course, rest on various kinds of structural members, which also must be left exposed when the decking is visible. See Figure 11, next page.

11

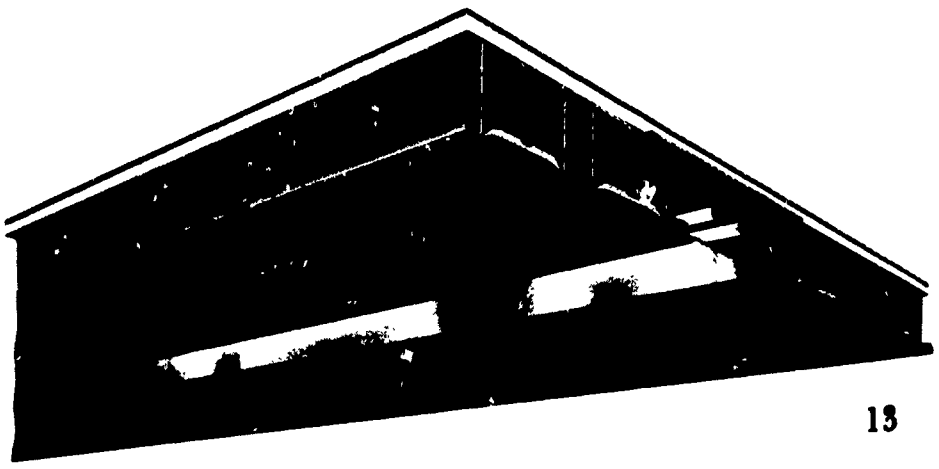
● *Slabs on Formboard* are usually of reinforced gypsum poured on "formboards" resting on "T" shaped rails, which in turn are supported ordinarily on steel beams. Formboards in use include asbestos-cement board, which is acoustically non-absorbent but highly water-resistant; fiberglass which has a fragile but acoustically absorbent surface; and various organic fiber boards, which may be surface treated to afford effective acoustical correction.



STRUCTURAL - INSULATING - ACOUSTICAL
EXPOSED ROOF DECK

12

● *Steel Deck* is in common use for school roof structures. One form is relatively thin, requires frequent supports, and provides no acoustical absorption. Another type is so formed as to provide much greater thickness and hence a relatively large span of space. This type is frequently perforated at the bottom, with absorbent inserts above to provide acoustical correction. Light sources are sometimes installed within the depth of such decking as shown in Figure 13, next page.



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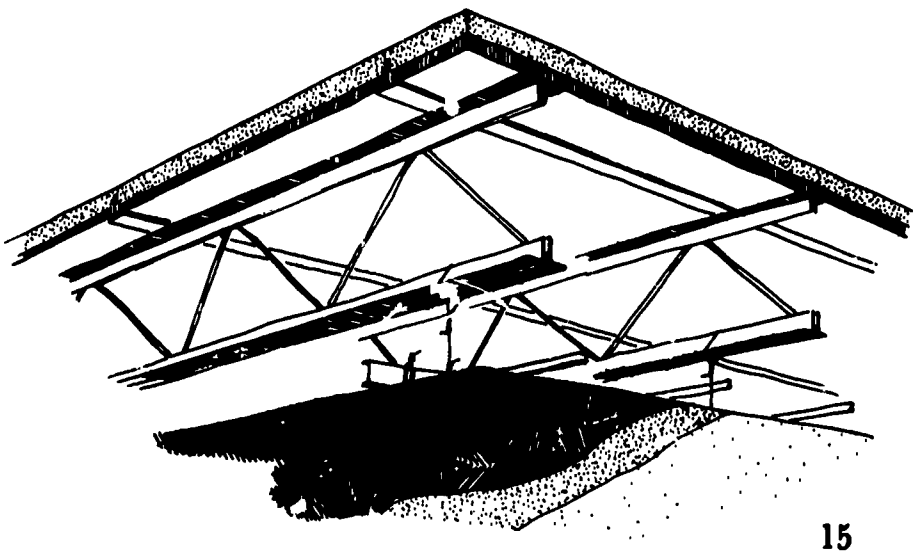
● *Wood Decking* is occasionally used in school buildings. The thicker, long-span plank decking may be purchased with a striated undersurface providing for some acoustical correction.

14

B. Attached or Hung Ceilings

● *Gypsium Plaster* is probably the oldest of these, with current technique calling for the use of metal lath wired to small steel channels hung from or attached to the structural members above. Smooth or textured finishes are available, but acoustical absorption requires a finish coat of soft, porous aggregate — such as vermiculite. The fire protection provided varies with details, materials and methods used, with excellent ratings possible.



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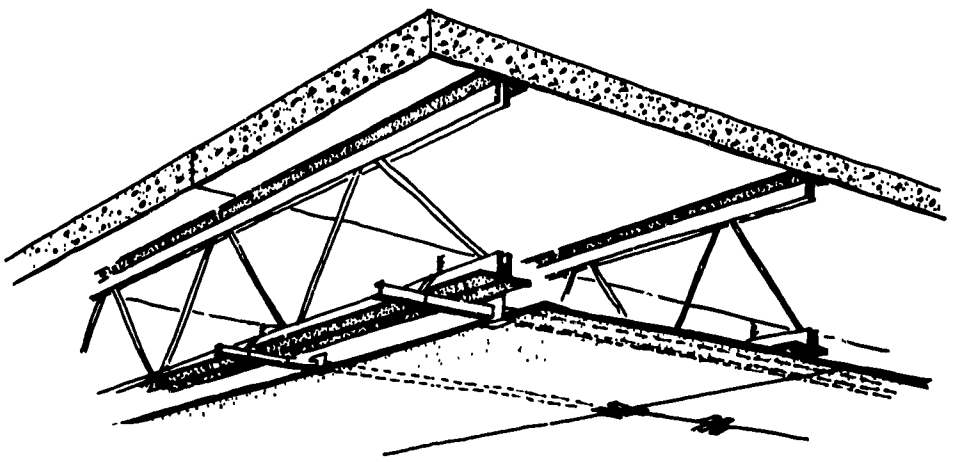
● *Plaster Board* consists of a thin sheet of fiber-reinforced gypsum plaster encased in cardboard. Large sheets are either nailed to wood runners or clipped to steel members attached to or suspended from the structural members above. Various modes of installation result in differing degrees of fire protection for the structure above. Plasterboard ceilings are seldom left "as is" in school occupancies, except for storage rooms and similar unfinished spaces. More often, they form the basis for applied acoustical treatment, as they are not effective alone. With appropriate installation methods, effective fire-protection for structural members can be provided with plasterboard.



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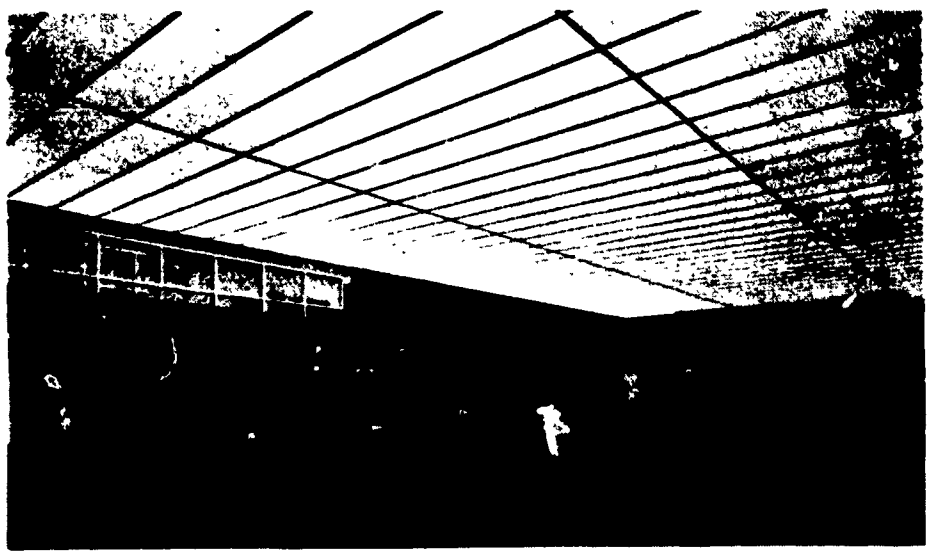
17

- *"Grid" Systems* are many, consisting basically of a slender steel framework attached to or suspended from the structural members above. This framework is variously designed to carry differing items with different purposes. Those systems most frequently in use include the following:

1. Acoustical panels are laid into the framework. Both combustible and non-combustible units are available, including metal. One of the great advantages of this system is that sections may be easily removed to gain access to mechanical installations concealed above.

2. Flush lighting fixtures can be neatly installed in many of these grid systems, should this be desired.

3. Translucent panels are laid into the grid members in other systems, to transmit light from "rough" lighting fixtures concealed in the space above. This is one form of "luminous ceiling" which, however, provides little in the nature of acoustical correction. Acoustical baffles are sometimes installed vertically from grid members to provide absorption.



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4. "Eggcrate" Ceilings are made of metal cells or other materials so designed as to shield the space and light sources above from view from most angles, though all can be seen from directly below. Acoustical absorption can be provided by means of suitable material concealed above.

C. Applied Acoustical Treatments

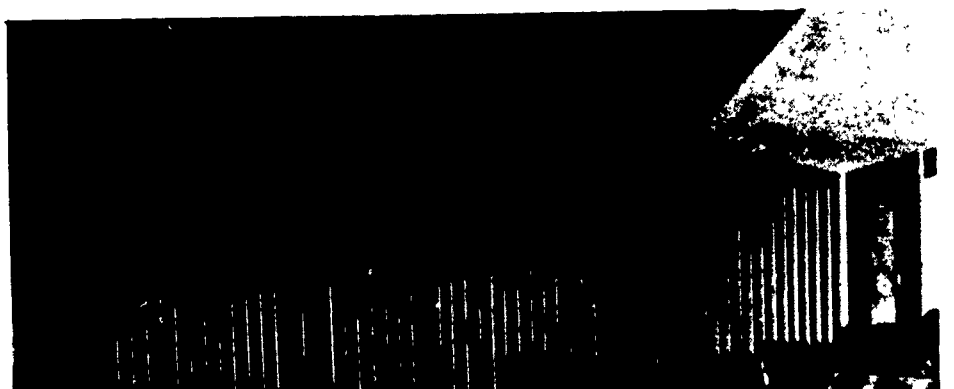
● *Acoustical Tile* makes up by far the largest portion of such treatments in school buildings. These are commonly made of vegetable fibers or from inert mineral materials, the latter, of course, being non-combustible. These are either attached mechanically or, as is more usual, adhered to the subsurface with a special cement. Some tiles have a thin plastic cover which does not defeat absorption, but permits washability when necessary, as well as the introduction of color.

● *Sprayed-on Materials* are only occasionally used in school buildings. These are usually mineral fibers mixed with an adhesive and sprayed onto areas to be treated, so as to build up a suitable thickness of soft, porous material. Due to fragility, it is easily damaged, yet unobtrusive repairs are difficult. Hence, its use is ordinarily restricted to higher ceilings in spaces not used for athletic activities and where its excellent absorptive qualities are particularly required.

D. Miscellaneous Methods

● *Baffles* of acoustically absorbent material are also hung in rows so as to screen low-angle view of light sources above, as well as to provide a quieting effect in the space so treated. Isolated absorbent units are also attached to walls or ceilings of larger spaces to provide some sound reduction.

- *Custom Designs* are often developed for specific locations, particularly in auditoriums. These generally take the form of some sort of visual screening behind which is placed a quantity of sound-absorbent material. These permit a high degree of absorbency, while meeting special needs for scale, durability, color, texture, and so forth.



CHAPTER IV
CARPENTRY AND MILLWORK

Carpentry has long been known as the trade which deals with working in wood. "Finished" carpentry and millwork are generally distinguished from "rough" carpentry through being exposed to view upon completion. It does not ordinarily include concealed structural members, blocking, formwork for concrete, or items of a similar nature.

Wood, being a product of nature, is of many varieties and qualities. Selecting the most appropriate species and qualities for specific applications is a matter requiring both experience and familiarity with the local market. Expert advice should be obtained and followed.

Wood boards have been known and used for centuries as building material and for cabinetwork. However, in more recent years, wood has been offered in modified forms, including the following:

Plywood: Thin slices (veneers) of wood are glued together to make large panels, usually 4′ x 8′, though other lengths may be obtained. Thicknesses commonly available range from ¼″ to 1⅛″; various qualities of glue are used for different applications. Face veneers may be obtained all the way from the unpatched "utility" grade for concealed uses to exotic and expensive woods for paneling the most elegant surroundings and for the manufacture of fine cabinetwork.

Presdwood: This is a mixture of shredded wood particles reconstituted under heat and pressure to make a smooth-faced, homogenous panel in plywood sizes and "planks" in ⅛″ and ¼″ thicknesses. It is also available plain or with factory-finished wood-grain appearance as well as perforated "pegboard" for hanging a variety of items from a wall surface.

Flakeboard: Somewhat similar to presdwood, flakeboards are made mostly from larger flakes and chips of wood under heat and pressure. Faces are smooth and sizes are also similar to those for plywood, with usual thicknesses being ¾″, ⅞″ and 1″. These are mostly used in cabinetwork for doors and as a base for plastic-finished counter tops.

Plastics: These hard finishes are only used over plywood, flakeboard and similar bases and are attached by means of cement. Thicknesses are usually 1/16″ for horizontal wearing surfaces and 1/32″ for vertical surfaces not subject to much abrasion. These materials are very resistant to most solvents and stains. They provide a wide range of colors and patterns, plus very realistic wood-grain effects as well. Principal uses in schools are for counter tops and cabinet work.

A. "On-the-job" finished carpentry work has greatly decreased during the postwar years, due not only to the outright elimination of much wood trim and finish, but also to the development of standardized, factory-finished cabinets and casework. However, the following items are to be found in most new school buildings:

- *Gymnasium flooring,* particularly in high schools where basketball is featured, is usually of hardwood strips as discussed in Chapter II. Normally, the installation is made by specialists, but the work is commonly classified with finished carpentry.

- *Paneling and Wainscoting* in auditoriums, lobbies, and similar locations are often of wood, and are installed by finishing carpenters.

- *Stages, Platforms and their Stairs* are usually unique to each project, and are constructed to suit on the job.

- *Storage Room Shelving* is frequently constructed of wood on the job, though "knocked-down" and adjustable steel shelving is increasingly used. In either case, the field work will be done as part of the carpentry work.

- *Miscellaneous Items* of finished carpentry include chair rails casings, wood bases, wood window stools and jamb liners, hookstrips, filler and cover pieces, soffits of exterior overhangs, shower room seats, and many other related items.

B. Much work classified as finished carpentry, however, actually involves the installation of items listed under other headings in specifications. As a result, finished carpentry and millwork remains the largest dollar-volume item in the finishing category. Installation work of this nature will include:

- *Millwork* consists of factory-made items of wood, such as counters, cabinets, display cases, and cubicles, known as casework, plus other wood items requiring factory finishing, such as mouldings, handrails and similar materials.

- *Doors and Frames,* whether of metal or of wood, are ordinarily installed by finishing carpenters.

- *Finishing Hardware,* generally purchased as a separate item, is usually installed as a part of the finished carpentry work. Finishing hardware is discussed more fully in Chapter VII.

- *Miscellaneous Items* of equipment, such as folding gates, fire-extinguisher cabinets, access doors, athletic equipment, and many others, are also installed by finishing carpenters.

CHAPTER V
CHALKBOARD, TACKBOARD, AND TRIM

Schoolroom partitions and walls are required to provide more than mere separation of spaces. Maximum utilization of wall surfaces for useful purposes is necessary. As a result, generous quantities of chalkboard and tackboard are ordinarily installed.

A. Chalkboard is furnished so as to provide a convenient surface for writing, intended to be seen by all in the room. There are several types of chalkboard, most of which are:

- *Slate* is the traditional chalkboard material which has been in use for a great many years. It is a natural product, dark gray in color, and very durable. Its surface is the standard by which other chalkwriting surfaces are judged. Properly installed and maintained, its useful life is indefinite.

- *Glass* has been available for this purpose since the late 1930's. Early glass boards were surfaced by sandblasting the exposed face, with colors introduced by applying pigment to the back. These were mainly satisfactory. But they have largely been replaced by firing vitreous enamel surfaces on the front of sections of heat-tempered glass.

- *Asbestos-cement* boards, with pigment and abrasive mixed integrally, are available as the nearest substitute for natural slate. They nearly share with the latter an ability to take repeated resurfacing treatments by sanding.

- *Combination* chalkboards are made up of several surfacings applied to a variety of backing materials. These surfacing materials include:

1. Baked enamels containing suitable pigments and fine abrasive rolled or sprayed onto the backing sheet and cured by baking.

2. Vitreous enamels are applied ordinarily to sheets of metal or glass and are fused at very high temperatures to become hard and glassy in nature, but with suitable abrasives included to give proper "tooth" for chalk.

3. Plastic sheeting has recently made its appearance as surfacing, being about 3/64" thick, with appropriate color and an abrasive texture. It is adhered to backing materials with a suitable cement.

- *Backings* for chalkboard surfacing materials include:

1. Asbestos-cement boards are inert, hard and stable. They are used as the basis for baked-enamel surfacing and for vitreous enameled metal sheets.

2. Tempered Hardboard is smooth, fairly hard, and is used for the same surfacing materials as asbestos-cement and plastic sheeting.

3. Plywood is primarily used as a base for vitreous enameled metal sheets, though it is sometimes used to reinforce thin sheets of hardboard with baked-enamel surfacing.

4. Metal, usually steel or aluminum, is backing for vitreous enamels. By means of small magnets, steel-backed boards can also be used for display.

5. Glass is used with the vitreous enameling technique, often being heat-treated for additional strength and to resist thermal cracking.

6. Plastered walls can be used for direct mounting of plastic sheeting or for vitreous enameled metal sheets.

7. Unplastered walls can be used for direct application of vitreous enameled sheets of metal.

B. Tackboard is intended as a means of displaying many sorts of items, such as posters, announcements, student work, charts, pertinent clippings, and the like. Paramount qualities include receptivity to thumbtacks, resistance to soil, and the ability to resist damage from tackholes. The principal materials in common use for these purposes are:

- *Cork,* shredded and reconstituted by heat and pressure into smooth sheets, usually about ¼" thick, is adhered to plywood or tempered hardboard for attachment in the same general manner as chalkboard. Some variations in color are obtainable. Also, certain makes include a surface treatment intended to improve the material's rather poor resistance to soiling.

- *Plastic* sheeting, embossed and colored to minimize soil and pinholing, is applied to both corkboard and pulpboard for this service. Washable and colorful, this material has been increasingly accepted in recent years. A low flame-spread rating is required for corridor installations, and is desirable anywhere.

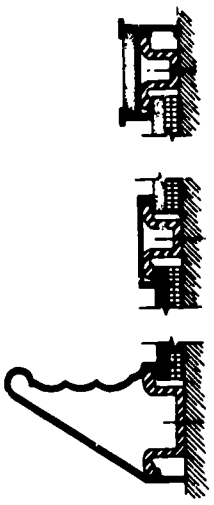
- *Burlap* or monkscloth mounted on pulpboard or wood has been used to some extent in recent years. Not as washable as plastic or cork, it conceals pinholes well and is relatively inexpensive compared with cork.

- *Softwood* boards, probably the original material used for this purpose, are used to some extent, being particularly well adapted to cases where an entire surface is to function as a tackboard.

C. Trim for chalkboard and tackboard is simply the materials necessary to cover the edges and fastenings of these installations. Ordinarily, they also serve as eraser-chalk trays, and provide a means for hanging charts, maps and screens. In years gone by, wood was universally used for trim. It is still used occasionally, but has been largely supplanted by metal—usually extruded aluminum.

- *Wood* trim is usually found installed in connection with plastered partitions.

- *Metal* trim is available for three basic types of installations:



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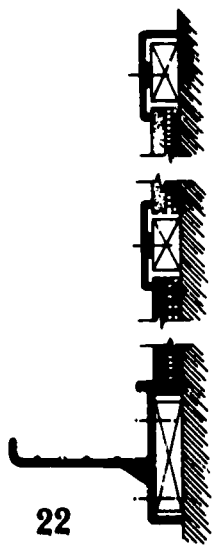
1. "Snap-On" trim is so designated as to show no fastenings, with finished members attached by means of concealed rough fastenings which also hold the materials in place.



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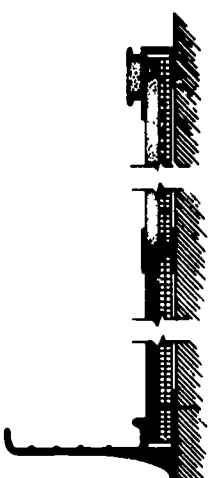
2. "Screwed-On" trim does not conceal fastenings and has fewer parts; hence, it is less expensive to install.



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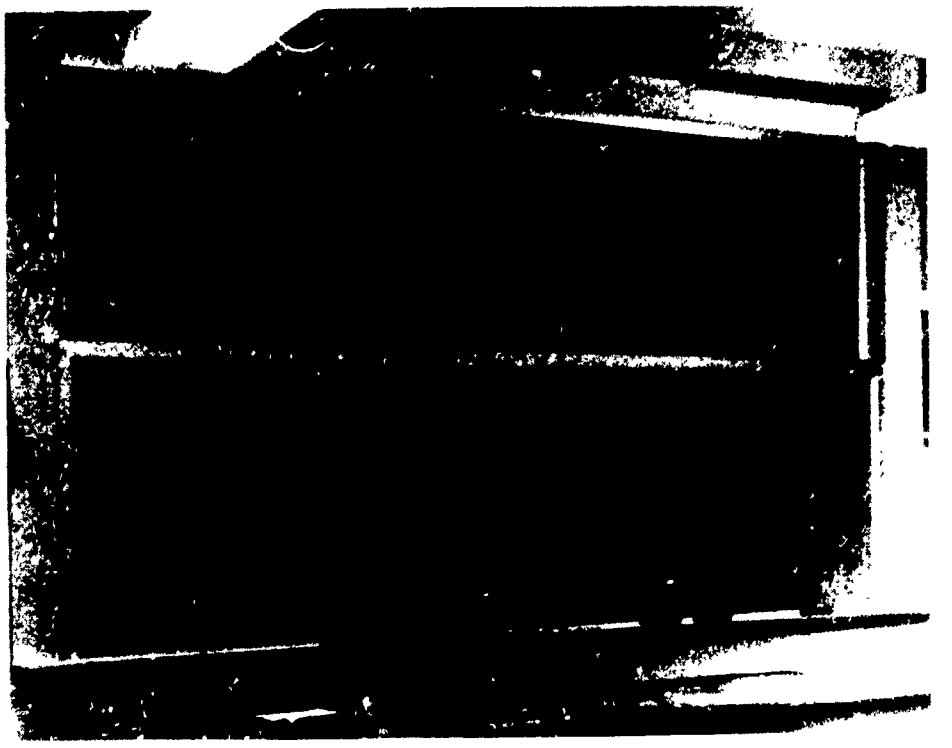
3. "Channel" trim is a sort of compromise in which finished members are used to hold the materials in place. No fastenings show, however.

D. "Peg-board" is a tempered pressed fiberboard, perforated with many round holes. It is installed with a space behind, so that a great variety of hangers can be attached for displaying all sorts of items, racking up tools, and so forth.

E. Specialties:

- *Movable* chalkboards and tackboards are often provided where wall space is at a premium, yet where considerable writing surface or pin-up space is needed. Vertically moving multiple leaves of chalkboard are often provided – for instance, behind a science demonstration table. "Book" style multiple leaves of tackboard may be provided in a home-making room or library to display an extensive collection of material on a particular subject. See Figure 24, next page.



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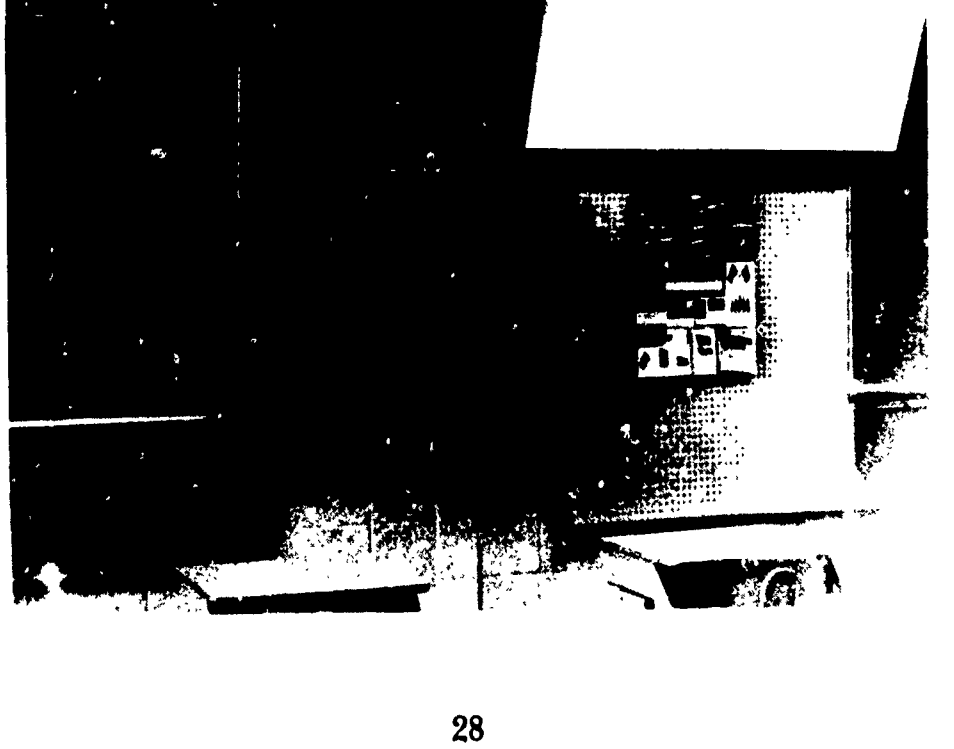
• *Systems* are available which are also intended to provide a maximum of flexibility in the use of wall surfaces. These usually involve a series of vertical tracks into which special attachments permit the interchangeable location almost anywhere on the treated surfaces of sections of chalkboard, tackboard, pegboard, flannel-board, or bookshelving. While such systems may be more expensive initially than fixed installations, they will prove to be extremely economical where flexibility of arrangement is necessary over a period of years.



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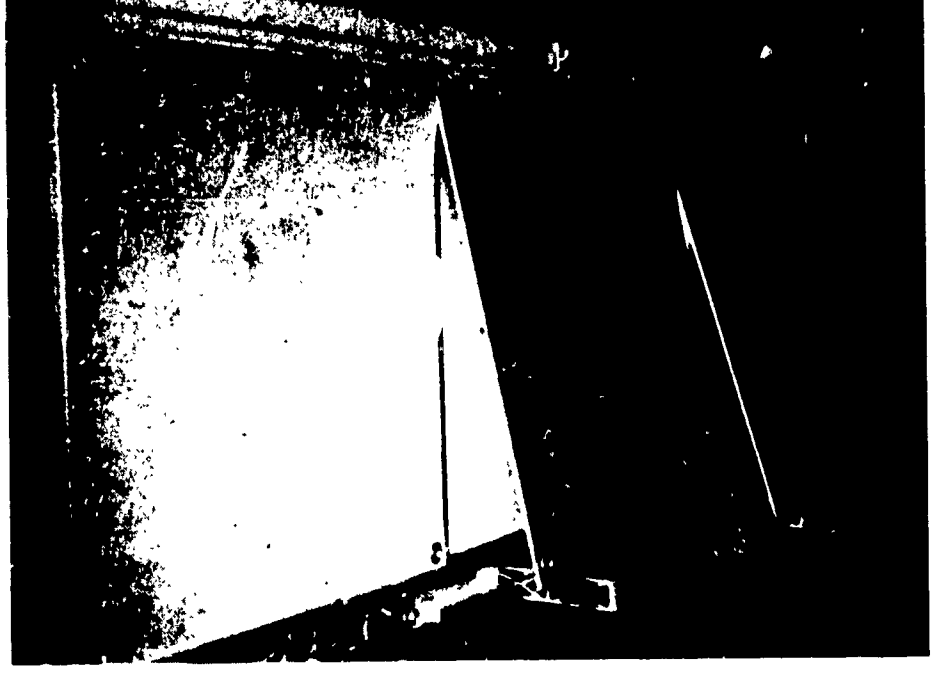
● *Reversible* chalkboard-tackboard sections are available from some manufacturers, so that portions of chalkboard may be turned over to make tackboard sections. These can be slanted at will for more convenient use as a stand-up easel for painting and drawing work.



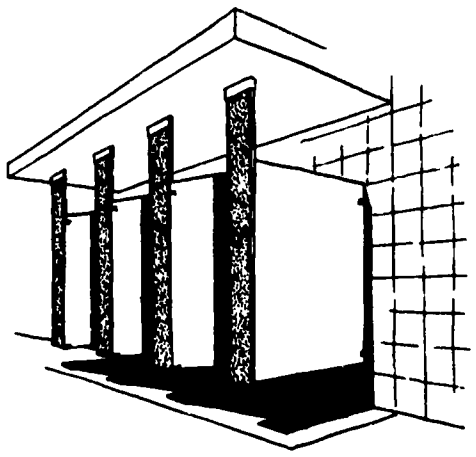
Also well worth consideration is the use of entire walls of tackboard or chalkboard, thus practically eliminating all special trim.

CHAPTER VI
TOILET PARTITIONS

Included here are not only the usual compartments for toilets, but also similar partitions and doors for shower areas, health unit booths, and screening partitions for entrances to such areas.

Partitioning is made available in several basic styles, as follows:

● *Ceiling hung* partitions are attached by means of concealed fastenings to the structure above and to the walls. The floor is thus entirely clear of partition work, providing maximum ease for cleaning.



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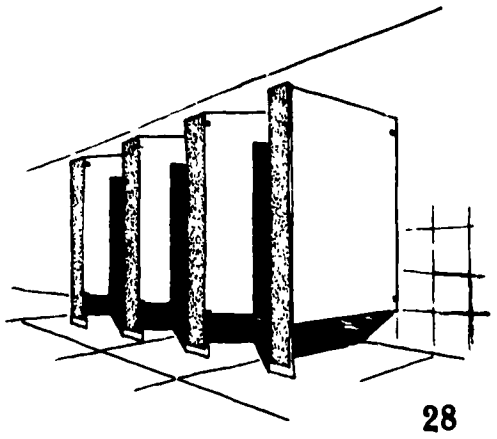

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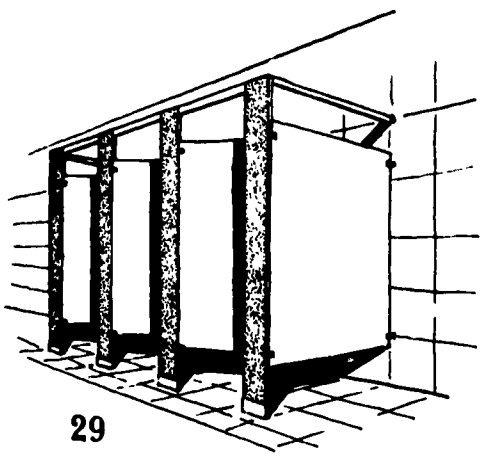
● *Floor-supported* partitions are anchored to the floor and braced back to adjoining walls only. They are neat, and provide no rails for toilet-room acrobats.

● *Headrail Braced* partitions are similar to the floor supported type, but have higher stiles tied together, with a headrail for additional bracing, simplifying anchorage (right).

● *Post Stile* partitions are occasionally used for lowest initial cost, and are of the headrail braced type but with simpler fabrication and details. They are less rugged and permit earlier deterioration than most other types.



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- *Cantilevered* partitions are not so common as the previously mentioned types and are attached only to walls or partitions at the rear of the compartments. They provide the cleaning advantages of the ceiling-hung type without the overhead structural complications. Their use in schools, however, is uncommon, since they are not as rugged in severe service as the other types.

- *Junior* partitions are usually of the floor supported type, but are lower overall to suit the needs of the youngest school children.

The **materials** of which partitioning is made need to be strong and easy to clean, with a durable, moisture-resistant finish. Commonly used materials include:

- *Enameled Steel* is most commonly used and consists of machine-leveled "furniture" steel sheets, preferably given a rust-resistant priming treatment and a finish of baked-on synthetic enamel after fabrication.

- *Porcelain Enameled Steel* is more expensive, being a glass-like porcelain finish over sheet steel. This finish is more durable and easier to keep clean than the synthetic-enamel finishes. The principal disadvantage of this finish is the difficulty of acceptably patching areas which become chipped in use.

- *Plastic Covered Steel* has a finish of vinyl sheeting bonded to the base metal instead of enamel. It provides for a great variety of surface patterns and colors in a finish highly resistant to scratching and abrasion but it is somewhat less easy to keep clean when embossed surface textures are used.

- *Marble* is used for partitions and stiles, together with flush doors of wood or metal in various finishes. Marble is extremely durable, easy to keep clean, and completely immune to ordinary corrosion.

- *Stainless Steel* in "satin" or "mill" or textured finished sheets is occasionally used where the extra original cost is justified by its long life. It is easy to clean, and there is no need for refinishing.

- *Plastic Laminates* have come into use recently for this service. These consist usually of hard plastic sheeting, similar to that used for counter tops, cemented to both sides, with the edges of marine plywood panels. This method provides for colorful, durable surfaces which are easily kept clean for extended periods. The initial cost is relatively modest.

The **hardware** accompanying a partition system should be subjected to critical review, to assure that it will be rugged, corrosion-resistant, and foolproof. The hinges should be permanently lubricated, self-closing, and capable of sustaining much abuse without failure. Latches and hooks are subjected to much abuse and should be extremely rugged if long trouble-free service is to be realized. Tamperproof fastenings for assembly of partitioning will usually be well worth any additional cost, because of their ability to inhibit the activities of mechanically inclined pupils.

CHAPTER VII
FINISHING HARDWARE

The items generally included under this heading include:

Locksets, latchsets and bolts	Door stops and catches
Butts (hinges)	Door closers
Panic Hardware	Metal letters and numbers
Push, pull and kickplates	Adjustable shelving hardware

The **quality** of finishing hardware used bears a direct relationship to the cost of maintenance later. Money "saved" by using inferior items is sure to be wasted again and again through the need for repeated adjustments, repairs, and replacements. Beyond this, of course, is the fact that many hardware items affect the safety of the building's occupants. No compromise is justified with the dependability of such items as locksets and panic hardware. They are required to function perfectly time after time, for a great many years.

Compatability is well worth considering in school systems. To achieve it, all buildings in a system should use interchangeable lock cylinders, locks and latchsets, and door closers. Thus, with a minimum of spare parts, and "down" time, any item can be quickly repaired or replaced, or cylinders changed for rekeying.

Keying Systems should receive careful thought by those who will use the school buildings. Keying can be arranged so that some doors have individual keys, others can be opened by means of a single key, groups of individually keyed locks can be opened by a sub-master key—all opened by a master key. In fact, several separate systems can be arranged to be subject to a grand master key. Thougthful consideration of the possibilities available in these systems may result in greatly enhanced convenience in the use of the building over a long period of time. However, these should be weighed with care against the advantages of a simple system, which include ease and speed of cylinder replacement and simple key control.

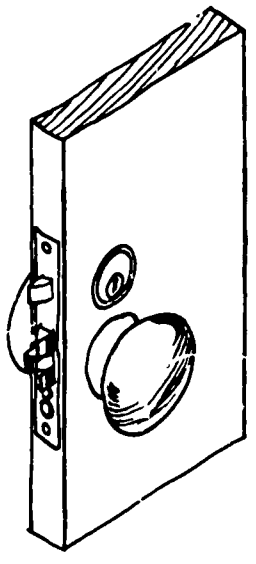
Finishes available include the following:

Brass: bright (US-3), dull (US-4) *Bronze:* Bright (US-9), dull (US-10)
Chrome: bright (US-26), dull (US-26D)
Aluminum: Anodized satin (US-28)
Stainless Steel: polished; satin

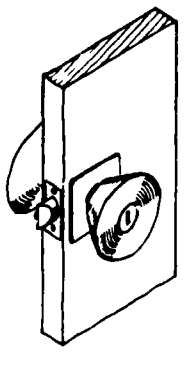
In addition, laminated plastics are much used for kickplates and push plates.

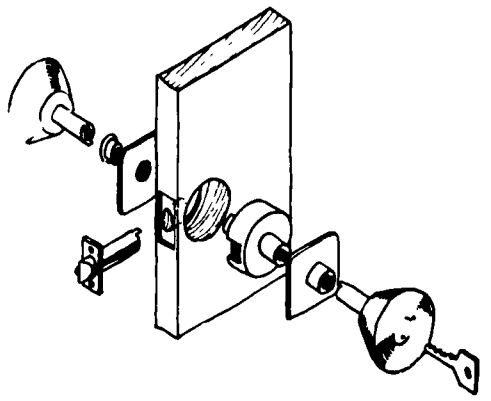
Basic types of locksets and latchsets are three in number:

1. Mortise locks are the earliest type, having box-like cases set within the door; installation requires considerable hand work on a wood door; metal doors come to the job prepared to receive them.



2. Bored-in locks are more recently developed and feature simpler installation procedure than required for mortise locks.





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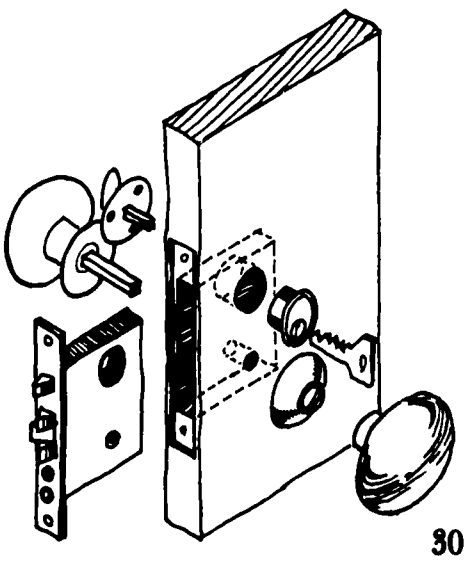

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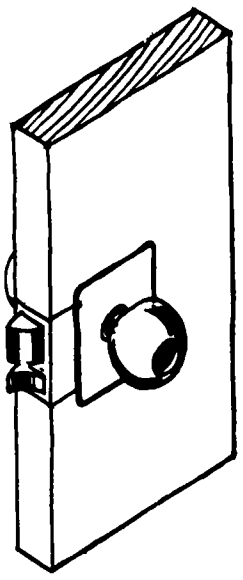
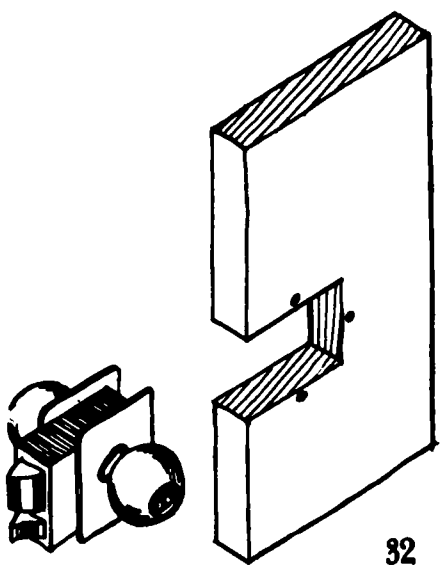
3. Unit locks are simple to install and are unique in that no disassembly is required for installation. See Figure 32, next page.





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Economy is not secured by choosing second-rate finishing hardward. Rather, it is to be attained through careful study of essential requirements and the elimination of non-essentials. This means a candid view of needs throughout the proposed school, considering such questions as these:

- If a classroom is to be assigned to one teacher, and the door itself has a lock, is there any need for locks on the classroom cabinetwork?

- If a wing can be secured after school hours by gates or doors from public access, is there any real need for locksets on classroom doors?

- Do interior doors from places of assembly need expensive panic hardware? Or will simple push and pull plates with closers suffice?

- Are exterior door closers and holders adequate for the exposure and wind conditions to be expected?

- Would not "schoolhouse" type locks be satisfactory in almost every situation on the project, instead of having a variety of functions requiring a corresponding variety of locks on hand for replacements when malfunction occurs?

In any project of consequence, these matters should be reviewed in advance with a qualified hardware consultant. Individual members of the Association of Hardware Consultants (A.H.C.) will be found the most fruitful source of assistance in these matters. Their participation is strongly recommended.

CHAPTER VIII
ORNAMENTAL AND MISCELLANEOUS METAL

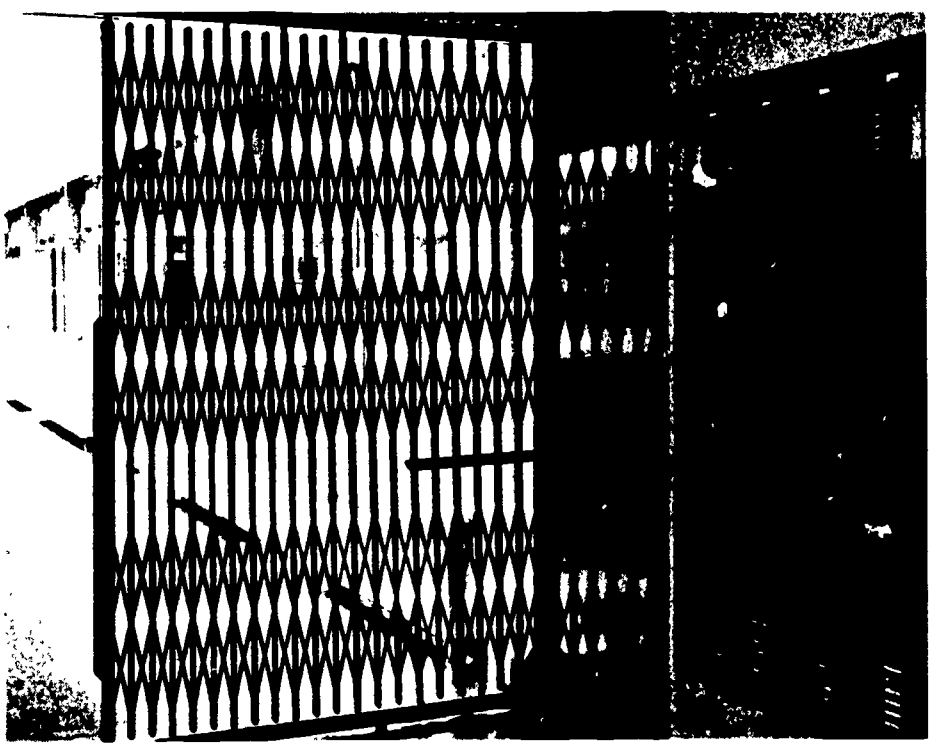
A. Tablets and Lettering

● *Tablets* of metal are commonly used to commemorate the occasion of a school's construction. These are generally cast in bronze or aluminum with appropriate text and arranged for permanent attachment to the building. The use of stock designs, simple text and non-special finish will ordinarily result in the lowest cost consistent with good quality. Laminated plastic is occasionally used for this purpose, and its use merits consideration on most projects.

● *Lettering* of cast or formed sheet metal is frequently used on the exterior of school buildings to note the name of the structure, and some times to identify certain parts of a large school plant. Stock designs of non-staining material requiring minimal maintenance will prove the most economical choice.

B. Gates and Shutters

● *Gates* in schools are usually for shutting off various parts of the building for after school activities, so as to minimize the need for supervision and custodial activity. These are usually so designed as to fold compactly and slide or swing out of sight into a lockable recessed cabinet when not in use. Material is usually painted steel, though recess door and trim may be of other materials to match adjacent finishes.



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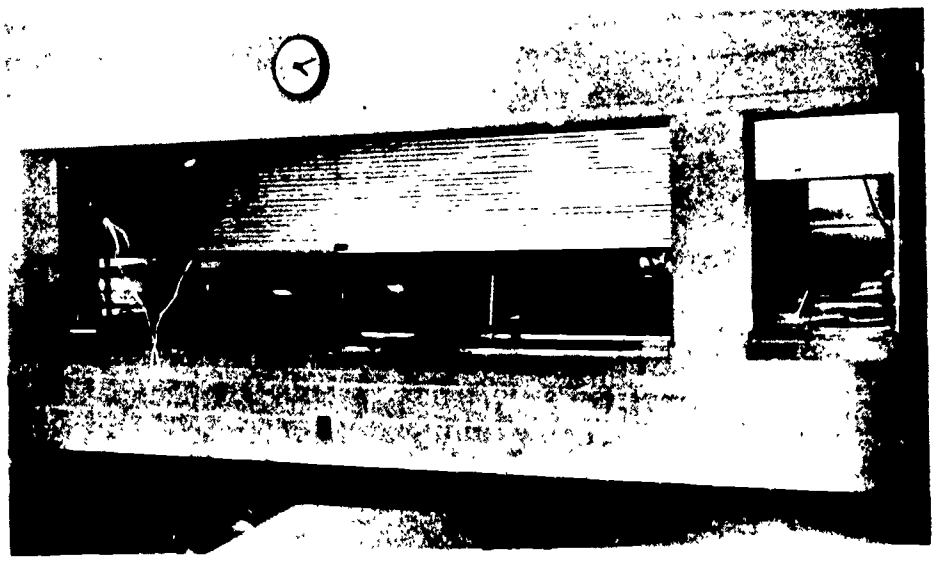
• *Rolling shutters* which slide upward for storage on a roller when open are sometimes found quite convenient as closures for pass openings at cafeteria kitchens and similar situations. The most widely used material for this use is aluminum, which is both light and corrosion-resistant.



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C. Stairs and Railings

• *Interior stairs* of steel are very common in schools, though reinforced concrete is occasionally used. Treads may be of natural or artificial stone, or "pans" of steel may be filled with concrete and topped with tile or other refinishing material – preferably with a non-slip surface.

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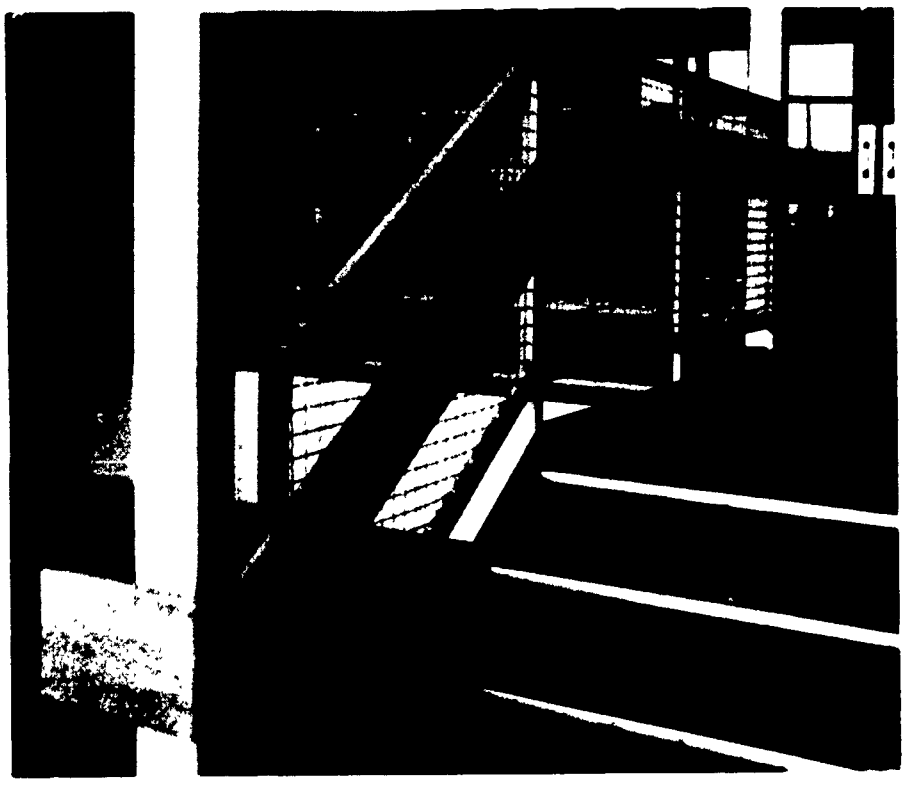
• *Railings* may range from a simple wood or iron pipe handrail to a complete balustrade of steel or aluminum and tempered glass, depending upon the needs of the situation involved. See Figure 36, next page.



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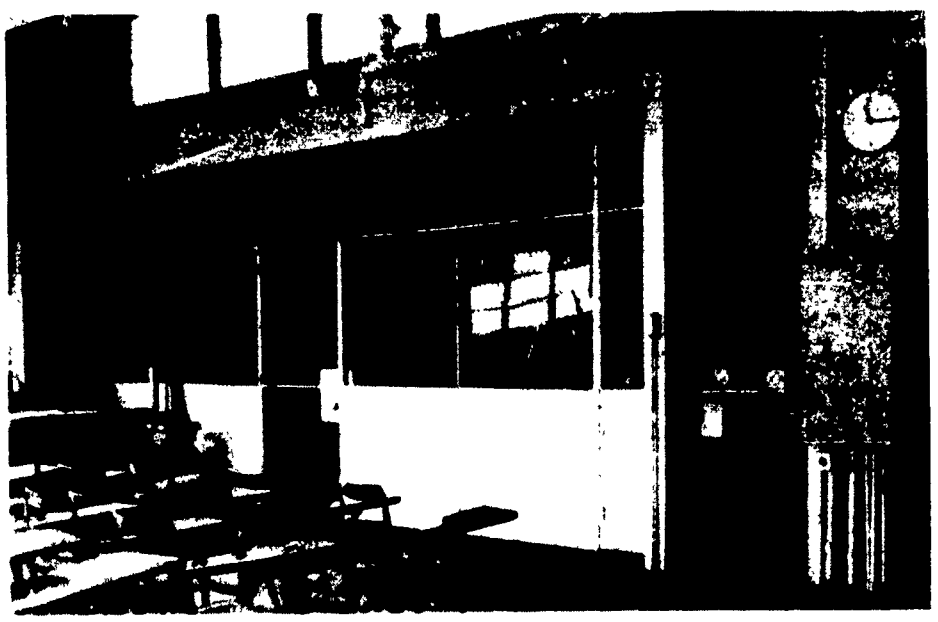
D. Wire-Mesh Partitioning is used to provide security without blocking vision or ventilation. It is often found in locker-room areas and in industrial arts shops.



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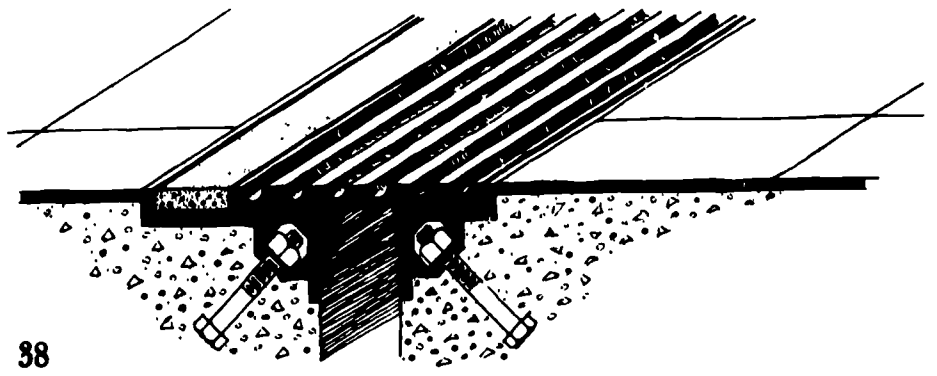
E. Saddles and Plates

● *Saddles* – usually of steel, brass, aluminum, marble or slate – are used to cover the juncture of dissimilar finished flooring materials, usually at doorways. They should be carefully beveled to minimize tripping hazards and avoided entirely where heavy rolling or sliding loads must pass, such as at gymnasium equipment storage rooms.

● *Expansion joint covers,* or plates, are used to cover gaps in construction caused by expansion joints. These are designed to slide in accordance with the opening or closing of the gap as it changes with temperature variations.



F. Roof Scuttles, Sidewalk and Access Doors

● *Roof scuttles* are now being made to stock sizes and details. These should be used wherever practical in order to avoid the additional cost of special design.

● *Sidewalk doors* have usually been used in schools only in connection with ash removal from coal-fired heating systems. Postwar schools in Connecticut have used other fuels almost entirely. Therefore, sidewalk doors are seldom included in new plants, except for special purposes.

G. Corner and Curb Guards are well worth the extra cost where traffic conditions warrant them, such as at locations where damage might otherwise make necessary difficult or expensive repairs. Landing docks, vehicular doorways, concrete stairs for heavy traffic, and similar situations should be reviewed carefully as to the need for these devices.

CHAPTER IX
PAINTING AND FINISHING

Paints and varnishes have been used for centuries to protect underlying materials from the ravages of weather extremes and to improve the appearance of surfaces exposed to view.

However, in recent years two basic changes have had a pronounced impact upon the painter's trade:

1. Many advances in paint technology have resulted in new materials with a wide variety of useful characteristics and possible applications.
2. Continued efforts to reduce initial and maintenance costs through elimination of on-the-job hand work have resulted in the greatly increased use of factory-finished materials of all kinds, as well as those which are intrinsically of satisfactory durability and appearance without further finishing.

As a consequence, most school buildings of today require less painting by far than was the case a generation ago. Nevertheless, painting and other finishing account for a significant portion of the overall cost of a school building and deserve attention accordingly.

Paints and Finishes are of many kinds. Here is a brief list of the major types:

- *Oil Paints* (solvent thinned)

Vegetable oil paints (based on linseed oil)
Oleoresinous paints (mixed vegetable oil and natural resins)
Alkyd paints (synthetic resins; when processed with vegetable oils, called oil modified. Superior to natural and oleoresins; odorless thinners are available)
Varnishes (no pigment; synthetic or natural resins in volatile solvents)

- *Latex or Resin-Emulsion Paints*

Styrene-butadiene (rubber base)
Polyvinyl acetate (PVA)
Acrylic

These are alkali-resistant, odorless, dry in 30 minutes, and are recoatable in a few hours. They are easily applied, durable, scrubbable, resistant to fading, chemicals, and permit subsurface breathing. Not usually good over glossy subsurfaces.

- *Cementitious Paints*

Basically portland or white cement and pigments, mixed with water. Inexpensive and suitable for masonry inside and out. With fillers and certain resins, used for some "liquid tile" finishes.

- *Epoxy Paints*

Relatively new, capable of forming a thick, hard, glossy film of great resistance to all normal hazards. Usually consists of two liquids to be mixed together for immediate use.

Specialized Paints

- *Fire Resistant* (intumescent) — These materials are so formulated as to expand into an insulating foamy crust when sufficiently heated, thus affording protection to the material covered. Not particularly resistant to normal wear, and tends to require replacement frequently in order to perform its function dependably.
- *Heat Resistant* paints are so made as to resist relatively high temperatures without visible change; used primarily for hot locations and equipment.
- *"Acoustical" paints* are claimed to provide a soft, sound absorbent surface; performance should be guaranteed effectively before depending upon it.

Miscellaneous

- *Stains* are pigments in water or oil and are used to alter the appearance of wood prior to the application of transparent finishes, such as varnish, lacquer or wax.
- *Waxes,* usually of vegetable origin, are used to protect wood, especially hardwood flooring, while providing a durable, transparent finish.
- *Sheet Wall Coverings* principally of heavy-gauge vinyl, can be adhered to wall surfaces and will provide long wear as well as a great variety of interesting colors and textures.

Color and Economy

In the minds of most people, one of the attributes of a high-quality building is good color. In fact, good color is so closely associated with luxury that more than one modest school with good color has been suspected of sinful waste by those unacquainted with the fiscal facts. But good color is not sought so that a building will look expensive. "Good" color is so because it improves the appearance of a building aesthetically — and makes it a pleasanter, more interesting place to look at and be in. In this way, it makes a real contribution to the educational processes, the basic purpose of the building.

Yet good color costs little or nothing more than very poor color — just the skill and effort of the designer involved, who is getting paid anyway.

For maintenance economy, however, the number of colors should be held to a reasonable figure. Otherwise labor time will increase, material waste becomes likely, and inventory investment will be larger. Therefore, the most value for the money spent will result from excellent color selections in minimum numbers. A balance is required so that good effect is secured without "going overboard" with too many different colors.

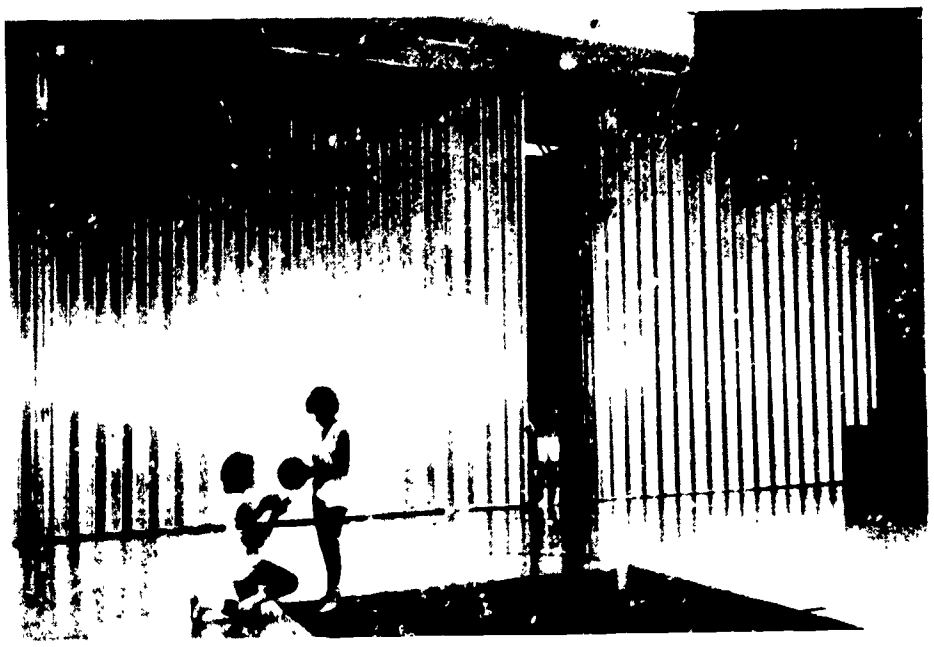
CHAPTER X
FOLDING DOORS AND PARTITIONS

Folding partitions have seen limited use in school buildings for many years and for a variety of purposes. However, during the last decade in particular, new demands for greatly increased flexibility of space use have caused much more extensive use of these devices. They are currently available from many manufacturers, generally falling into these six basic types:

1. Accordion doors and partitions ordinarily consist of flexible fabric or sheeting attached to both sides of a folding metal framework suspended from an overhead track. For best sound absorption, metal panels are incorporated with the sheeting with edge seals included all around. This type does not permit any practical use of the extended surface for chalkboard or tackboard.

39

2. Narrow folding panels of wood or metal are used for another type of partition sliding on an overhead track. These strips fold in alternating directions on hinges of metal, pliable plastic or other material and are seldom provided with bottom seals. This type does not provide usable wall surface when in the extended position. See figure 40, next page.



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3. Wide hinged panels are used in a number of makes. They are relatively thick and rigid, usually hung from above, with a guide track provided at the bottom. The sections, which may be as wide as four feet, can then be provided with tackboard and chalkboard surfaces for use in an extended position.

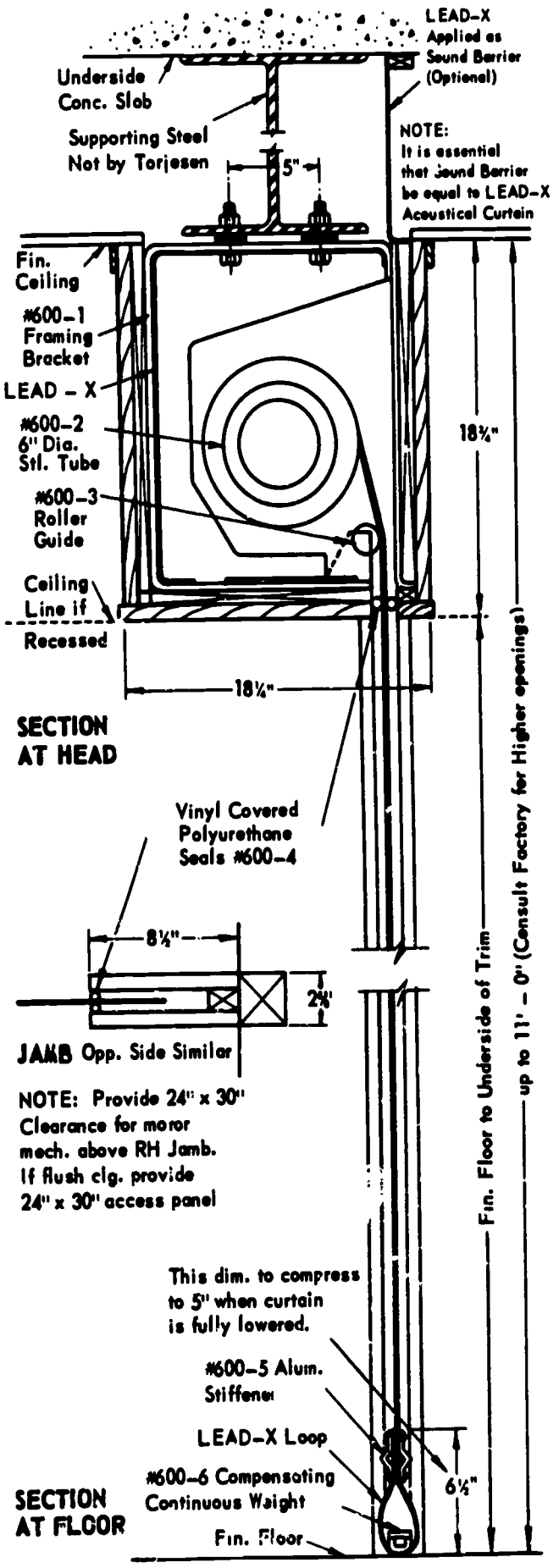
41

4. Wide separate panels are also used in a manner similar to the hinged panels discussed above. The principal advantage of separate panels appears to be the relative ease with which fairly large partitions may be manually operated, and the excellence of edge sealing possible by mechanical or pneumatic means.

42

5. Side-coiled partitions consisting of grooved, jointed, vertical wood slats have recently come into more general use. These can easily follow curved tracks at top and bottom and are stored on a vertical roller when in concealed position. These are available in heights up to thirty feet and widths of up to one hundred fifty feet. Double partitions can provide up to forty decibels sound reduction.

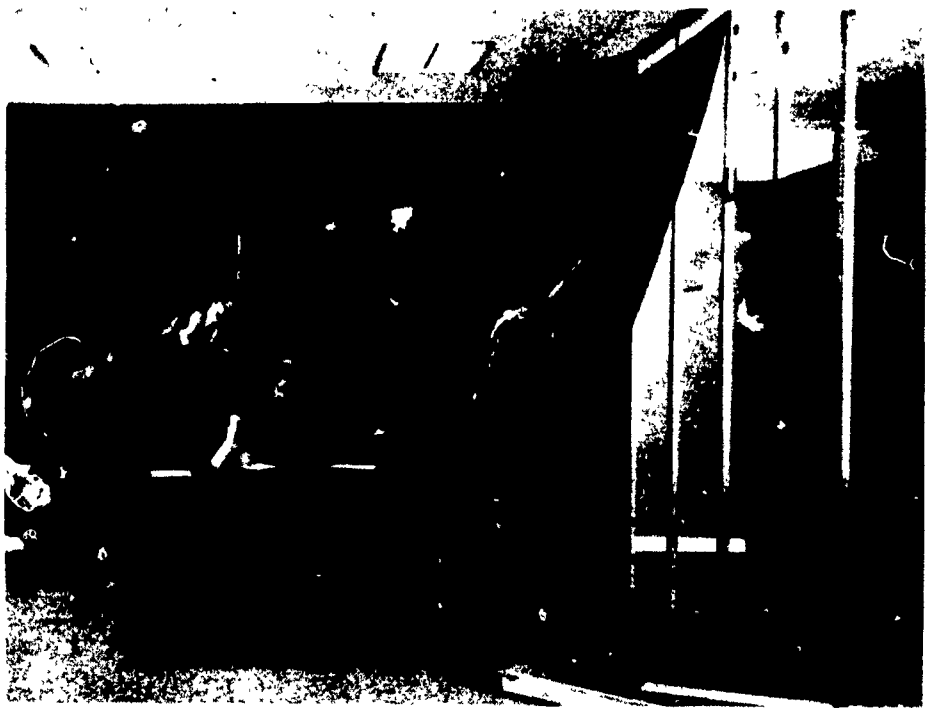
43



6. Curtain-type partitions of heavy, limp sheeting have been recently developed and marketed. These are designed for effective sound absorption, and include seals all around. Overhead storage on a roller is used in a manner similar to that of the familiar roller-curtain.

44

Demountable partitioning, while not strictly "folding," deserves mention at this point. This type of partitioning is closely related to the common demountable office partitioning. And it performs a similar function. It is not intended to provide daily or even weekly flexibility, but rather a long-term flexibility. While it costs more than many kinds of permanent partitions, it is quite probable that where partition locations will have to be changed two or three times in ten years, demountable partitioning should be very seriously considered.



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Quick-changeable partitions are now available which are similar in outward appearance to the wide-panel folding partitions. However, these sections do not slide in tracks, but can be individually locked into place and sealed together or rapidly removed and carried away for storage. These are well adapted to occasional changing by the custodial staff, and provide acoustical separation superior to most ordinary folding partitions.

46

Acoustical separation is one of the major functions of a successful folding partition. The folding partitions now on the market range all the way from being almost completely useless to fairly good, as compared with a good masonry partition of substantial mass.

A partition's effectiveness as a sound barrier results from the characteristics of the materials used and the methods of assembly. Generally, increased mass and lack of stiffness will improve sound absorption. However, leaks through apertures or cracks at the edges can go far toward nullifying the effectiveness of the best partition. A method has been developed for laboratory testing partitions as they are intended to be installed. Hence, the noise-reduction qualities wanted in a given case should be specified in accordance with this standard, known as ASTM E90-61T.

It should also be pointed out that even a good partition with proper edge sealing can be circumvented by sounds going over the top or around the ends through the building construction. Ceiling spaces, in particular, should be carefully blocked off over folding partitions to prevent sounds from by passing the intended barrier.

The amount of sound absorption required in a given case depends upon the sound levels expected in each of the separated spaces. Determination of these amounts is a matter deserving the attention of a skilled technician in the field.

The *ruggedness* needed for folding partitions varies with the location involved. For example, the thick and rigid wide-panel type is commonly used for subdividing physical education spaces. These provide flat surfaces for bouncing balls and are unharmed by the violent activities sometimes encountered. On the other hand, the accordion and curtain types are more appropriate for areas where activities are less vigorous.

Power operation is available for most of the partitions mentioned. Ordinarily, the smaller partitions between classrooms and in similar locations are hand operated. However, the larger and heavier ones which separate parts of gymnasiums and close similarly large openings are usually operated by remotely controlled electric motors. Hand operation is possible through a crank and gear-reduction mechanism. But the motor drive is usually justified for these larger openings.

CHAPTER XI
MISCELLANEOUS EQUIPMENT AND ACCESSORIES

Vault doors are frequently provided for the protection of school records. In most cases, where protection from fire is the only need, an ordinary fire door of suitable fire-resistance rating and with an ordinary lockset will suffice. This is substantially less costly than the multiple-bolt type of "safe" door frequently used. Security for valuables can be economically provided by means of a small wall safe or similar item.

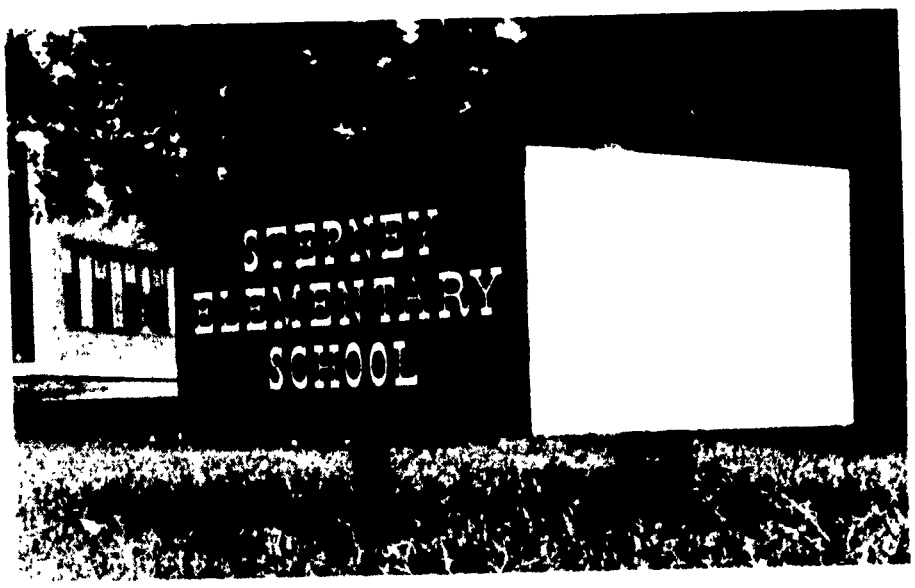
Dispensers for soap, towels and the like should be selected for ruggedness and long-term operation at little maintenance expense. The availability and cost of the items must also be considered. Tamper-proof attachments are almost mandatory in most school situations.

Fire extinguishers must be of the types called for in state and local codes, and located accordingly. Generally, the dry chemical type is to be preferred because of its versatility and effectiveness, as well as the ease with which the gauge can be checked for reassurance that the charge is ready for action. However, at kitchens and laboratories, the carbon-dioxide type is suggested, as it produces no residue after use, will not contaminate foodstuffs, and is chemically rather inactive.

Lettering and signs for interior locations should preferably be chosen so as to be legible and durable, and also so designed and installed as to permit removal when later redecoration will be necessary. In the past, letters and numbers have usually been of cast metal attached with screws. More recently, these have become available at less cost, very neatly executed in panels of clear or laminated opaque plastic.

Exterior lettering and signs, besides the initial requirement of legibility, should be of such nature as to resist successfully the effects of the weather, youthful tampering, and, in some areas, even vandalism.

The practice of affixing the name of a school directly to the structure or even carving it into the materials thereof has been followed for many years. However, these are often difficult to integrate into the building's design, and they constitute a real problem if the school should be renamed, as sometimes occurs. Increasingly, separate signs closer to the ground and near the approaches to the school are being used. These can be tastefully designed, relatively inexpensively, are more useful in identifying the school to the stranger. They are also easy to replace if a change is necessary.



48

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In addition, we greatly appreciate the willing cooperation of the following firms and organizations in permitting the reproduction herein of certain illustrations, as listed below:

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