# The Ampère House

The Ampère House and the Museum of Electricity, Poleymieux au Mont d'Or, France (Near Lyon).

# André-Marie Ampère (1775-1836)

Ampere at 21

Ampere at 39

Ampere at 55

# Location: Poleymieux  au Mont d'Or
# Compound of the Ampere Family

# Location: Poleymieux  au Mont d'Or Compound of the Ampere Family

- Educated based on Rousseau theories directly by his father, Jean-Jacques.
- Never went to school.
- A genius as soon as 13 years old.
- A "Prodigy child" learn Latin and other languages.
- Teach himself the works of Bernouilli and Euler in Latin.
- Professor of Mathematics, Italian, Chemistry, Mathematics and Physics at 22.
- Member of the Academy in 1814 (39 years old).

# Entrance room: History of the Museum

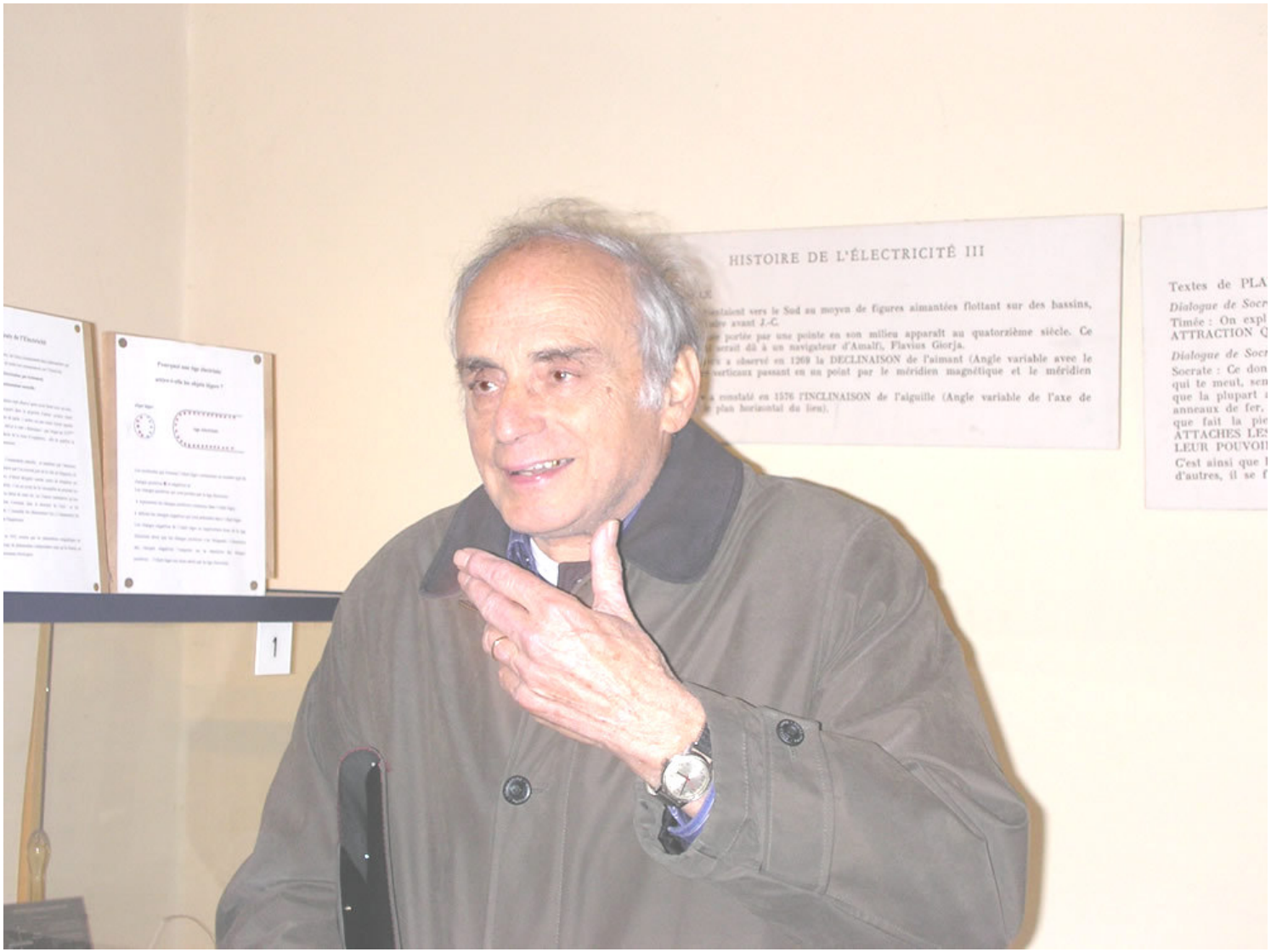
# Poleymieux  au Mont d'Or

- André-Marie lived there from 7 to 20 years old. His wife and his child stay there a few more years.
- Museum inaugurated on July 1, 1931.
- Picture of Hernand & Sosthenes Behn, re-purchased the house to make a museum (Founders of ITT in the USA in 1920). They were from a French Mother and Danish Father. Studied in France and emigrated to New York after graduation.
- Gave as a gift to the SFE (Société Française des Electriciens) in 1928.
- Hernand died in France in 1933 in a retirement villa.

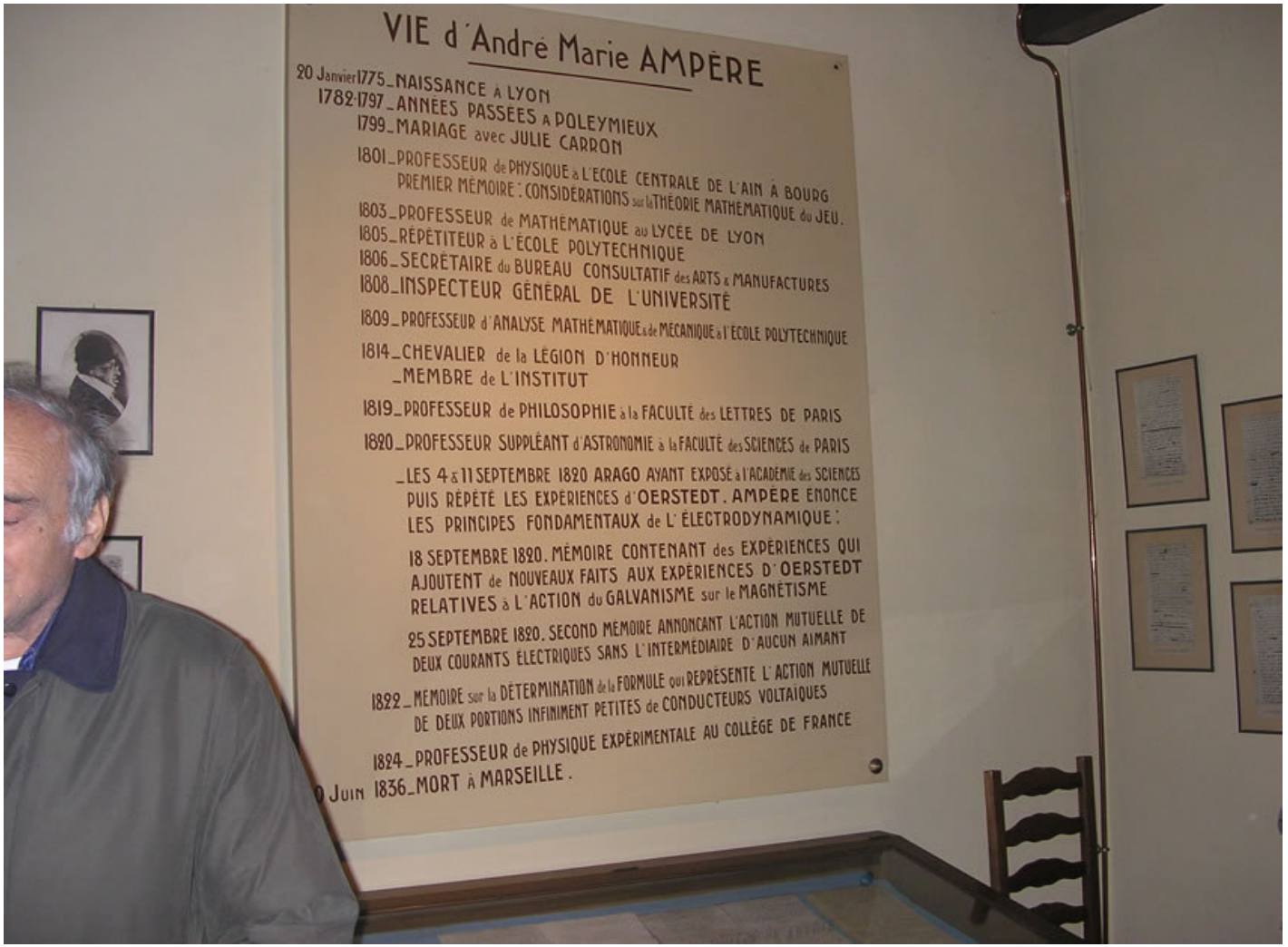
# Room of the Three Amperes.

# The House of Ampère -Partners

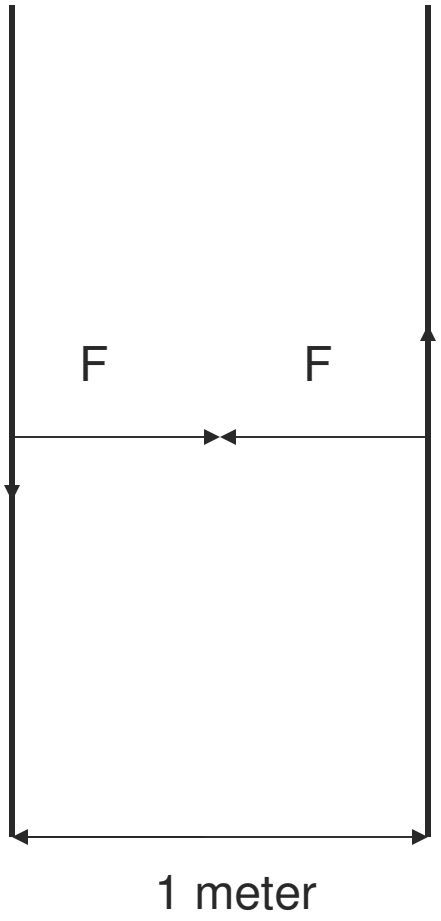
# Curator: Mr. Georges Asch



# Plate on the life of Ampere.

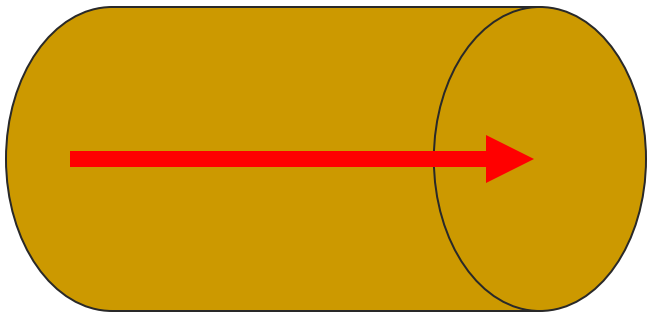


# Definitions (ANSI/IEEE Std 100)




**Ampere** (1) (metric practice). That constant current which, if maintained in two straight parallel conductors of infinite length, of negligible circular cross section, and placed at one meter apart in vacuum, would produce between these conductors a force equal to $2 \times 10^{-7}$ newton per meter of length (Adopted by the 9th General Conference on Weight and Measures in 1948).

# ANSI/IEEE Std 100



I coulomb / 1 second

- **Ampere** (2) (circuits and systems). A unit of electric current flow equivalent to the motion of 1 coulomb of charge passing any cross section in 1 second.
- 1 coulomb is the amount of electrical charge in $6.241 \times 10^{18}$ electrons or other elementary charged particles.

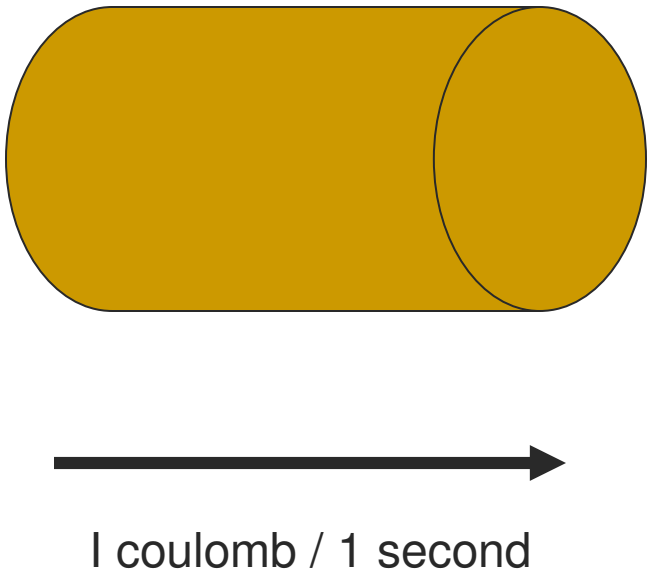
# André- Marie Ampere

- **Called the "Newton of Electricity".**
- **House changed to the "Museum of Electricity".**
- **Wikipedia: "André-Marie Ampère (January 20, 1775 – June 10, 1836), was a French physicist who is generally credited as one of the main discoverers of electromagnetism. The ampere unit of measurement of electric current is named after him. The Ampere's Museum is in Poleymieux-au-Mont-d'Or (near Lyon, France)."**

# When he became famous.

In 1881, the International Congress of Electricians gave the name of Ampere to the unit of intensity of electrical current, and this unit was first defined from the law of electrolysis. It was modified and defined directly from the electromagnetic forces between two parallel current such as described by Ampere.

# Other Definitions (Wikipedia)



I coulomb / 1 second

- **Ampere** “The **ampere** (symbol: A) is the SI base unit of electric current equal to one coulomb per second. It is named after André-Marie Ampère, one of the main discoverer of electromagnetism”.

# The man: André- Marie Ampère

•**Ampère's fame mainly rests on the service that he rendered to science in establishing the relations between electricity and magnetism, and in developing the science of electromagnetism, or, as he called it, electrodynamics. On September 11, 1820 he heard of H. C. Ørsted's discovery that a magnetic needle is acted on by a voltaic current. Only two weeks later, on September 25, he presented a paper to the Academy of Sciences attracts or repulses an other voltaic current. In the next months he established the laws of the phenomena.**

# Many other expressions…

Ampere-conductors (distributed winding) ( rotating machinery)

Ampere-turns

Ampere-hours capacity (storage battery)

Ampere-hour efficiency (storage cell) (storage battery)

Ampere-hour meter

Ampere's Law (Magnetic field strength produced by an electric current)

Ampere turn per meter

Ampere-turns (rotating machinery)

Ampere-conductors (asynchronous machine)

Ampacity = current carrying capacity expressed in amperes, of a wire or cable under stated thermal conditions.

# André- Marie Ampère.

Ampere was a scholar.

His interests were in:

Mechanical Arts, Chemical Engineering, Electricity, Mathematics, Philosophy and Theology, Physics & Astronomy, Poetry, and Natural Sciences.

Today, we list 168 publications from Ampere, from Poetry, to Mathematics and Electrodynamics !!!

# ESSAI

SUR

# LA PHILOSOPHIE

## DES SCIENCES,

OU

**EXPOSITION ANALYTIQUE D'UNE CLASSIFICATION NATURELLE DE TOUTES LES CONNAISSANCES HUMAINES;**

PAR

ANDRÉ-MARIE **AMPÈRE**,

De l'Académie royale des sciences, des Sociétés royales de Londres et d'Edimbourg, de la Société philomatique, de la Société helvétienne des scrutateurs de la nature, de la Société philosophique de Cambridge, de celle de physique et d'histoire naturelle de Genève, de la Société Italienne, de l'Académie royale des sciences et belles-lettres de Bruxelles, de l'Académie royale de Lisbonne, des Académies de Lyon, de Modène, de Lille, Correspondant de l'Académie des sciences de Berlin et de l'Institut de Bologne, Membre de plusieurs autres Sociétés savantes, Chevalier de la légion d'honneur, Inspecteur général des études, et Professeur au Collége de France.

**A PARIS,**

CHEZ BACHELIER, IMPRIMEUR-LIBRAIRE POUR LES SCIENCES,
Quai des Augustins, n° 55.

—

**1834.**

# André- Marie Ampère.

Academy session September 11, 1820. Arago presented the experiences of Oersted: action of a voltaic current on a magnetic needle.

Ampere chocked his audience by its findings in two weeks. At the Academy session September 25, 1820, Ampere presented the result of his analysis of the phenomena:

“New theory of Magnet, which in fact, bring back the phenomena to galvanism.”

# EXPERIMENTA

## CIRCA EFFECTUM

# CONFLICTUS ELECTRICI IN ACUM MAGNETICAM.

Prima experimenta circa rem, quam illustrare aggredior, in scholis de Electricitate, Galvanismo et Magnetismo proxime-superiori hieme a me habitis instituta sunt. His experimentis monstrari videbatur, acum magneticam ope apparatus galvanici e sitα moveri; idque circulo galvanico cluso, non aperto, ut frustra tentaverunt aliquot abhinc annis physici quidam celeberrimi. Cum autem hæc experimenta apparatu minus efficaci instituta essent, ideoque phænomena edita pro rei gravitate non satis luculenta viderentur, socium adscivi amicum Esmarch, regi a consiliis justitiæ, ut experimenta cum magno apparatu galvanico, a nobis conjunctim instructo, repeterentur et augerentur. Etiam vir egregius Wleugel, eques auratus ord. Dan. et apud nos præfectus rei gubernatoriæ, experimentis interfuit, nobis socius et testis. Præterea testes fuerunt horum experimentorum vir excellentissimus et a rege summis honoribus decoratus *Hauch*, cujus in rebus naturalibus scientia jam diu meiaruit, vir acutissimus Reinhardt, Historiæ naturalis Professor, vir in experimentis instituendis sagacissimus Jacobsen, Medicinæ Professor, et Chemicus experientissimus Zeise, Philosophiæ Doctor. Sæpius equidem solus experimenta circa materiam propositam instituι, quæ autem ita mihi contigit detegere phænomena, in conventu horum virorum doctissimorum repetivi.

In experimentis recensendis omnia præteribo, quæ ad rationem rei inveniendam quidem conduxerunt, hac autem inventa rem amplius illustrare nequeunt; in eis igitur, quæ rei rationem perspicue demonstrant, acquiescamus.

Apparatus galvanicus, quo usus summus, constat viginti receptaculis cupreis rectangularibus, quorum et longitudo et altitudo duodecim æqualiter est pollicum, latitudo autem duos pollices et dimidium vix excedit. Qvodvis receptaculum duabus laminis cupreis instructum est ita inclinatis, ut baculum cupreum, qui laminam zinceam in aqua receptaculi proximi sustentat, portare possint. Aqua receptaculorum $\frac{1}{12}$ sui ponderis acidi sulphurici et pariter $\frac{1}{12}$ acidi nitrici continet. Pars cujusque laminæ Zinceæ in aqua submersa Qvadratum est, cujus latus circiter longitudinem 10 pollicum habet. Etiam apparatus minores adhiberi possunt, si modo filum metallicum candefacere valeant.

# André- Marie Ampère.

Ampere said when asked about Electricity:

"Electricity is just a partial differential equation".

He was able to quantify and explain the phenomena, because of his strong background in Mathematics and partial differential equation.

# André- Marie Ampère.

Ampere made many experiments on it and invented:

-The solenoid.

-The electro-magnet (Arago – Ampere).

-The manufacture of permanent magnet.

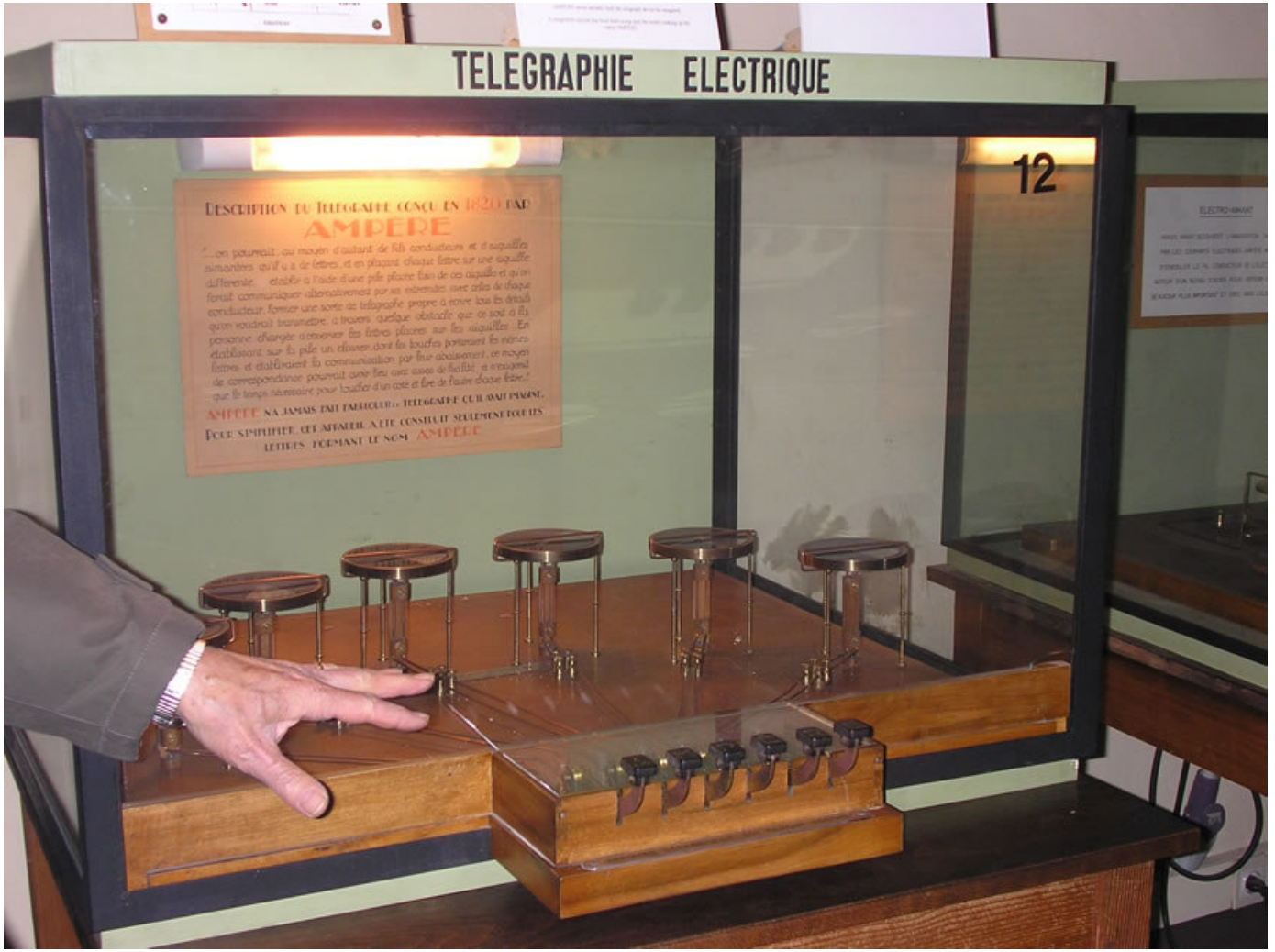
-A system to remove the natural earth magnetism.

-The galvanometer (To measure the intensity of current).

-The telegraph Electromagnetic.

-In about three months…….

# The Electric Telegraph of Ampere.



# André- Marie Ampère.

Ampere said in 1821 (he fought the subject for 5 years because the main stream of people did not understand his explanation).

"I always present the problem of a simple manner, and nobody want to understand."

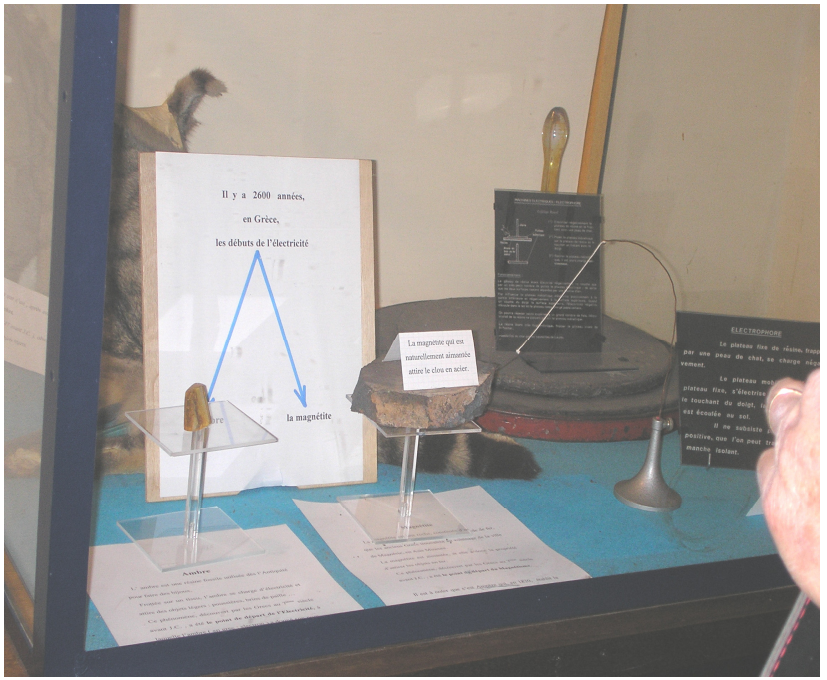
Ampere published in 1825:

"Theory of the electrodynamics phenomena deducted only from experience". This summarized all his experience and concepts.

It is the "bible" of the modern electrodynamics.

# Museum of Electricity

Two of the rooms of the museum are specialized in the tests that Amperes made. (Fundamental experiences of Electro-mechanism of the action of electricity on a magnet. Experiences showing the electro-dynamics actions of a current on an other current). Twelve others rooms are representative of the history of electricity from the Greeks to today.



# Museum of Electricity

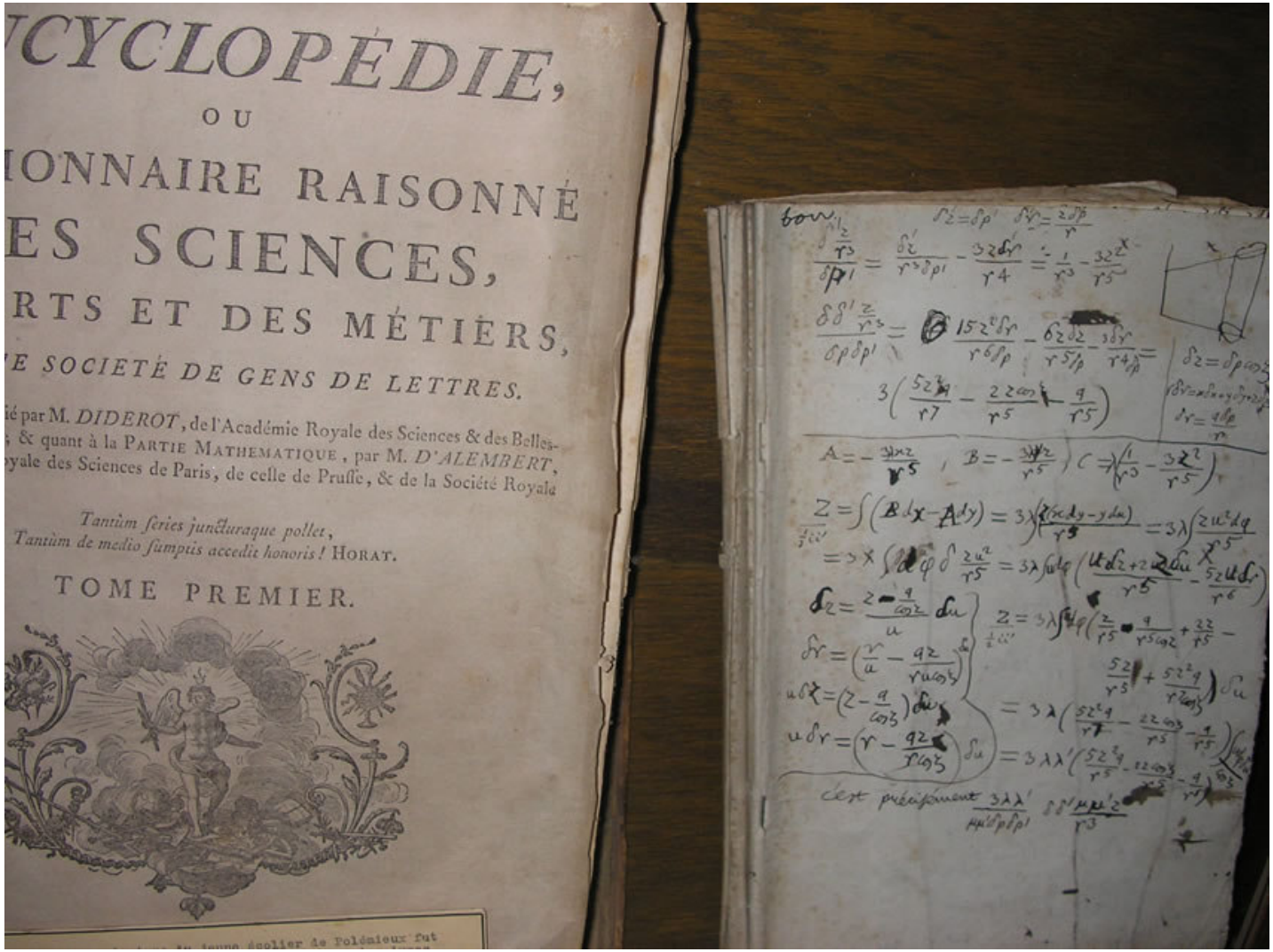
The galvanometer (To measure the intensity of current). Galvanometer According to Ampere design. 1826

# Before he became famous.

Ampere was a very good scholar (and a chemist).

In a letter to Sir Humphry Davy (boss of Faraday), in 1810, at the Royal Academy of London, he said that he has some clues that he thinks that he discovered the "Phtore". The basic component was officially discovered in 1813 by Davy and it was called the Fluor.

# Young Ampere's Writing



# First Textbook of Ampere (C. 1720)

# Museum of Electricity

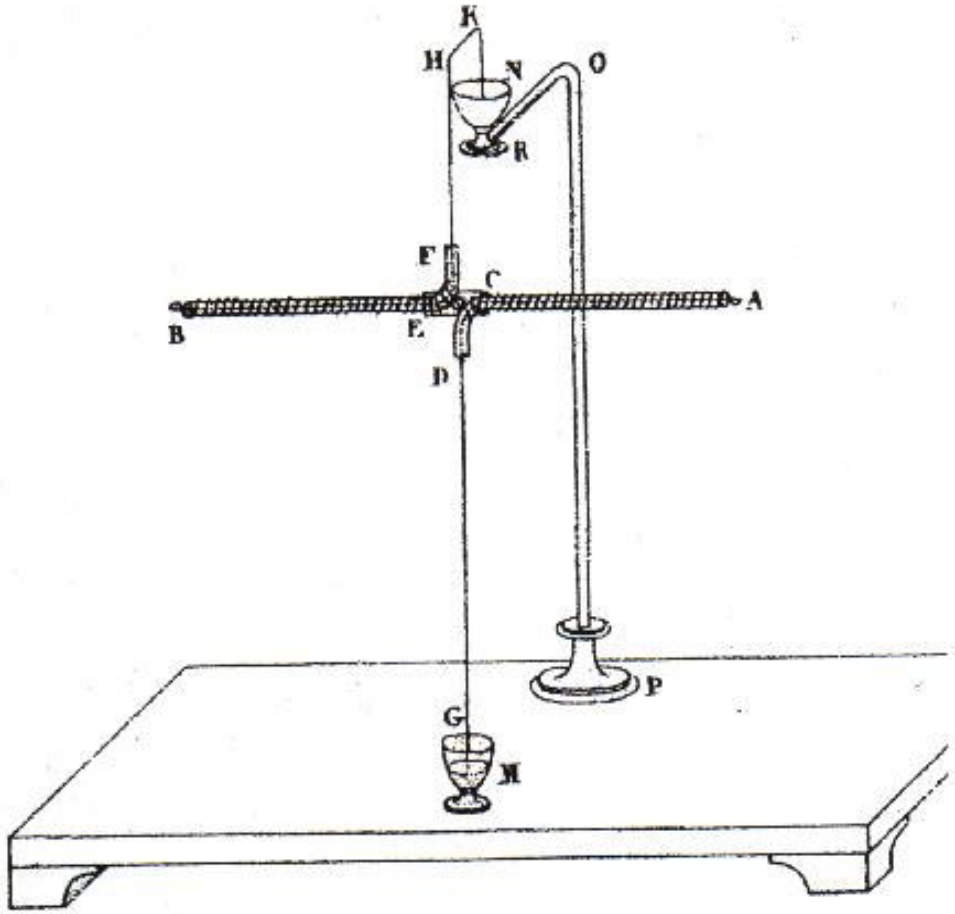
"The Decisive Experience: 25 September 1820."

"Attraction
&
Repulsion

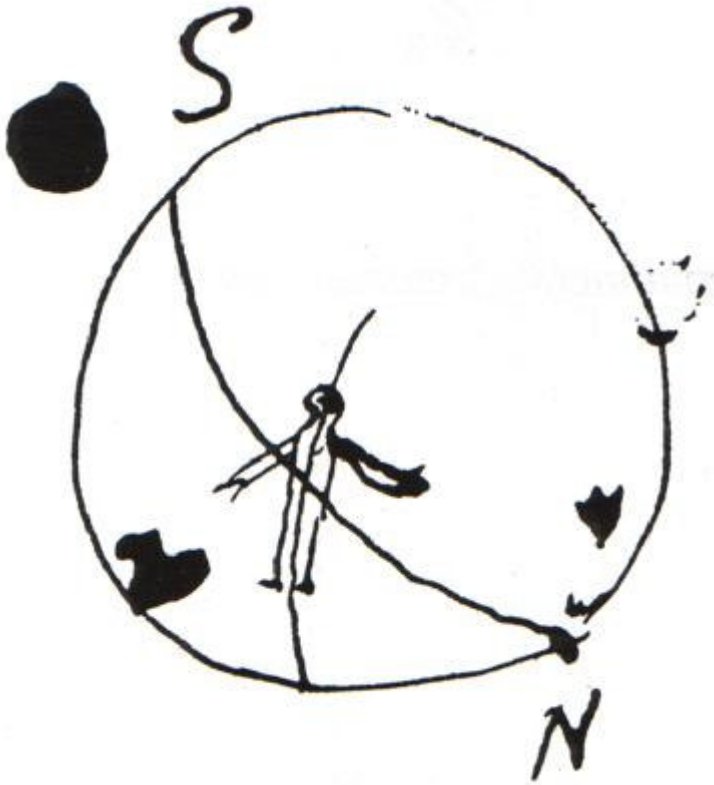
Between

Two

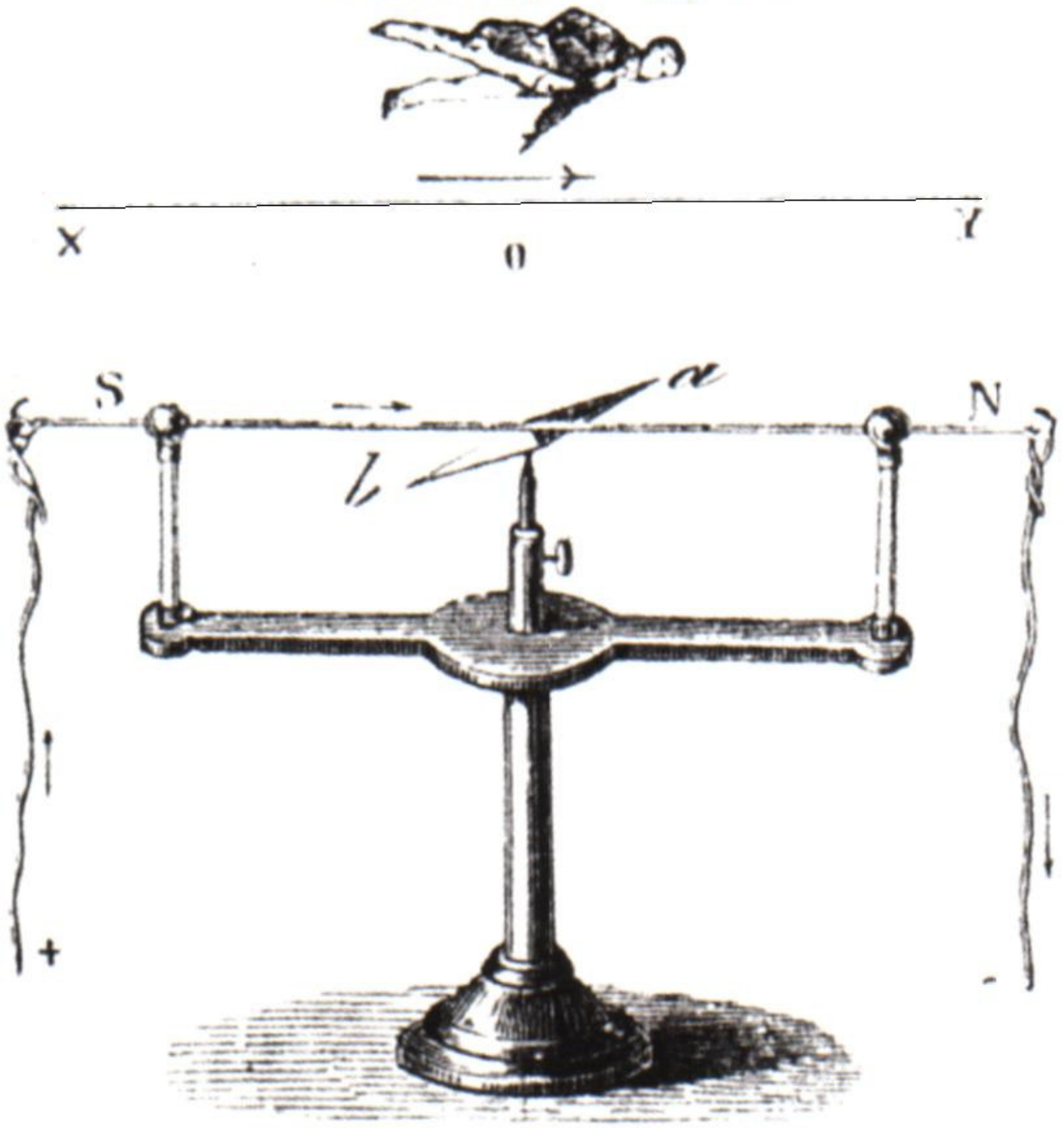
Windings"



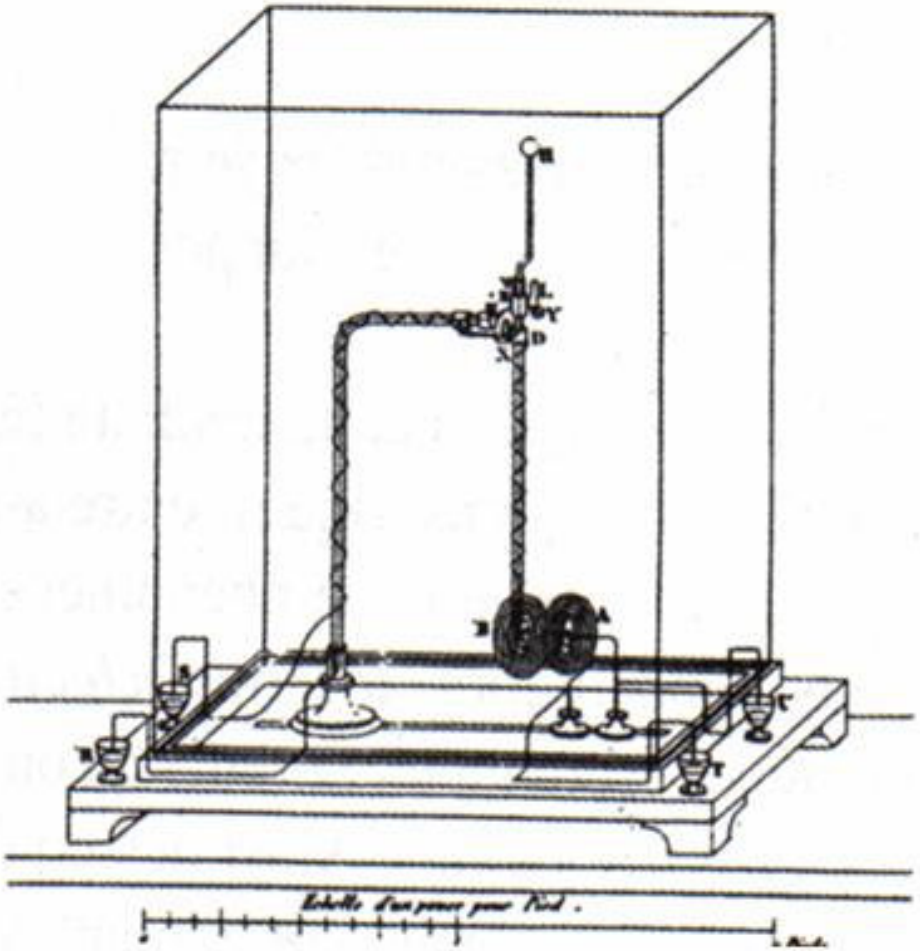
# Ampere first drawing



# The "Bonhomme" Ampere.



# Museum of Electricity

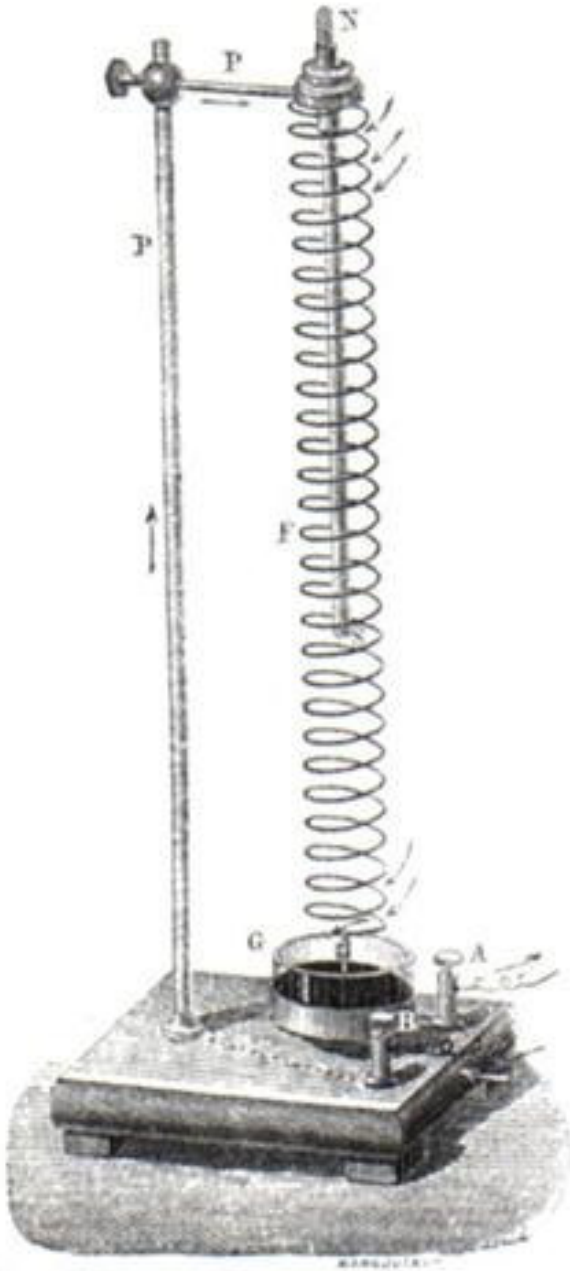


*A* = Fixed Solenoid

*B* = Moving Solenoid

Solenoid = solen = "Hose" in grec.

# Ampere tests




Attraction of the steel core of the contiguous spires by the current.

Leyden's jars = first batteries.

# Museum of Electricity


Leyden's jars = first batteries.

# The story of Electricity (Museum)

Where Ampere was performing his experimentations.

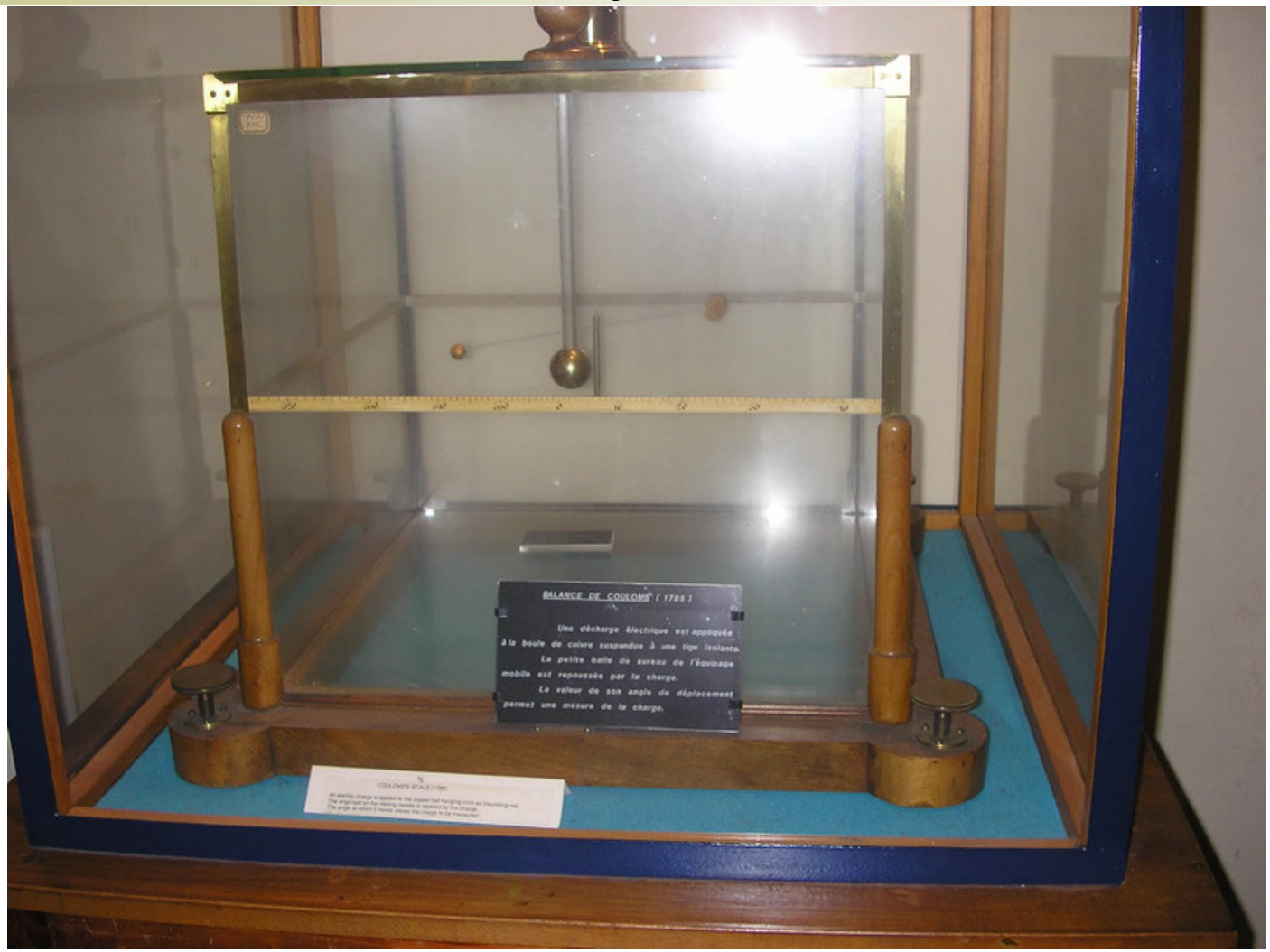
# Museum of Electricity

Experiments of Brandebourg, 1663 (Purpose: to demonstrate that the gravity is of electrical origin.)

# Museum of Electricity

Scale of Coulomb

1785



# Museum of Electricity

Static Electricity

# Museum of Electricity

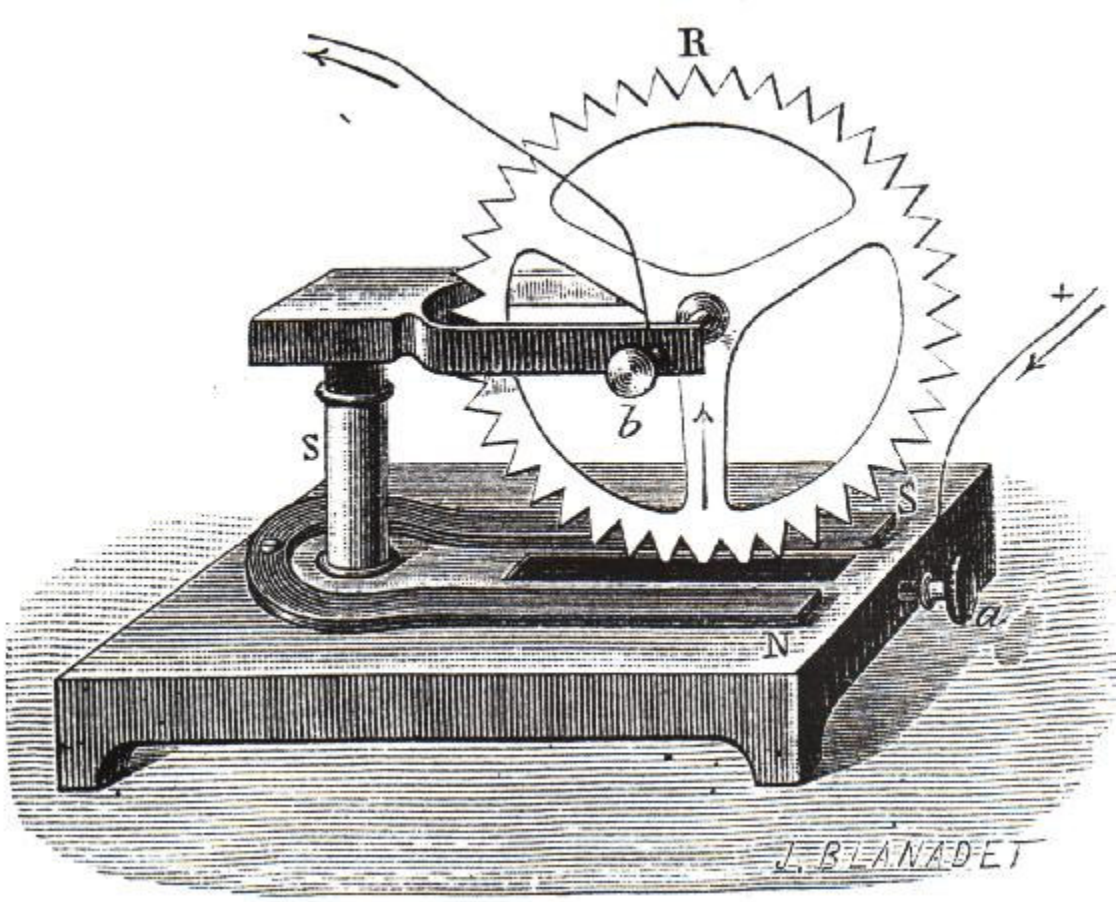
First battery by Volta.

Early 1800's.

*Volta (1745-1827)*

# Museum of Electricity

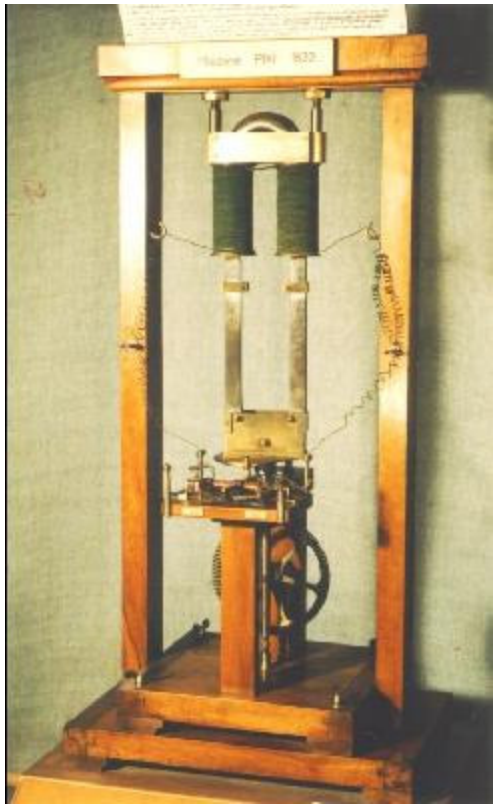
First modern electrical motor: Wheel of Barlow - 1822



# Museum of Electricity

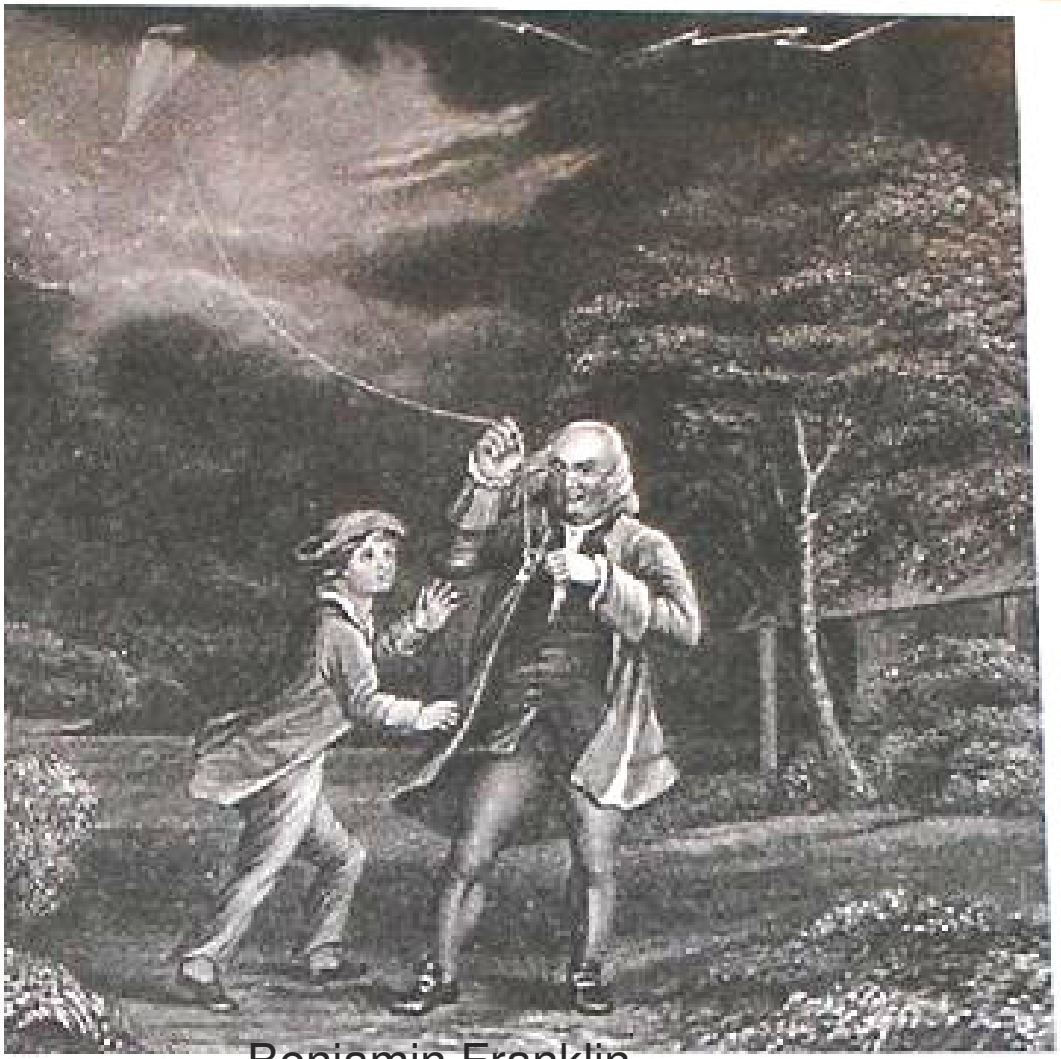
Machine Hydro-Electric of Amstrong. In 1840 in which small drops of water electrically charged were send as steam.

# Museum of Electricity



Generator of Pixii – 1832 – With a mechanical system transforming AC to DC with the Ampere Balance.

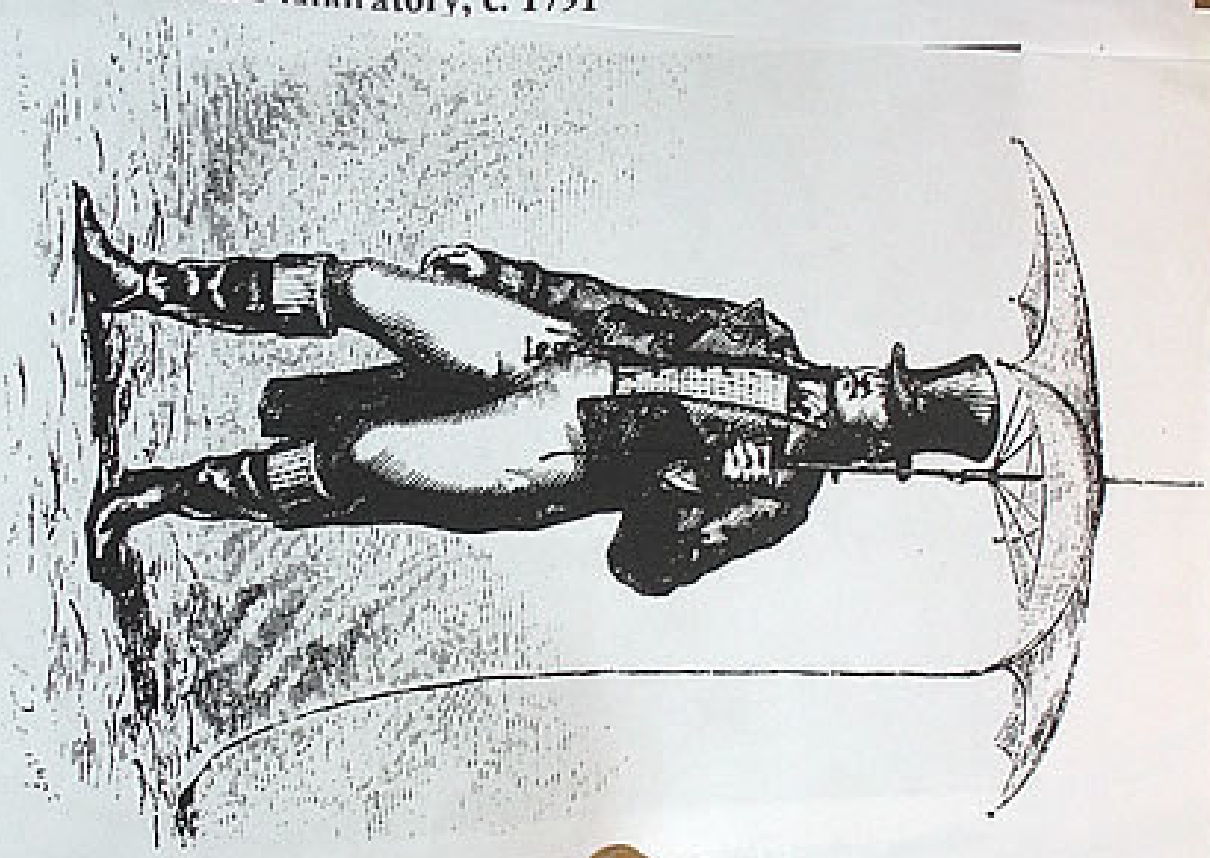
# Museum of Electricity



Benjamin Franklin

Physician Richmann

laboratory, c. 1791



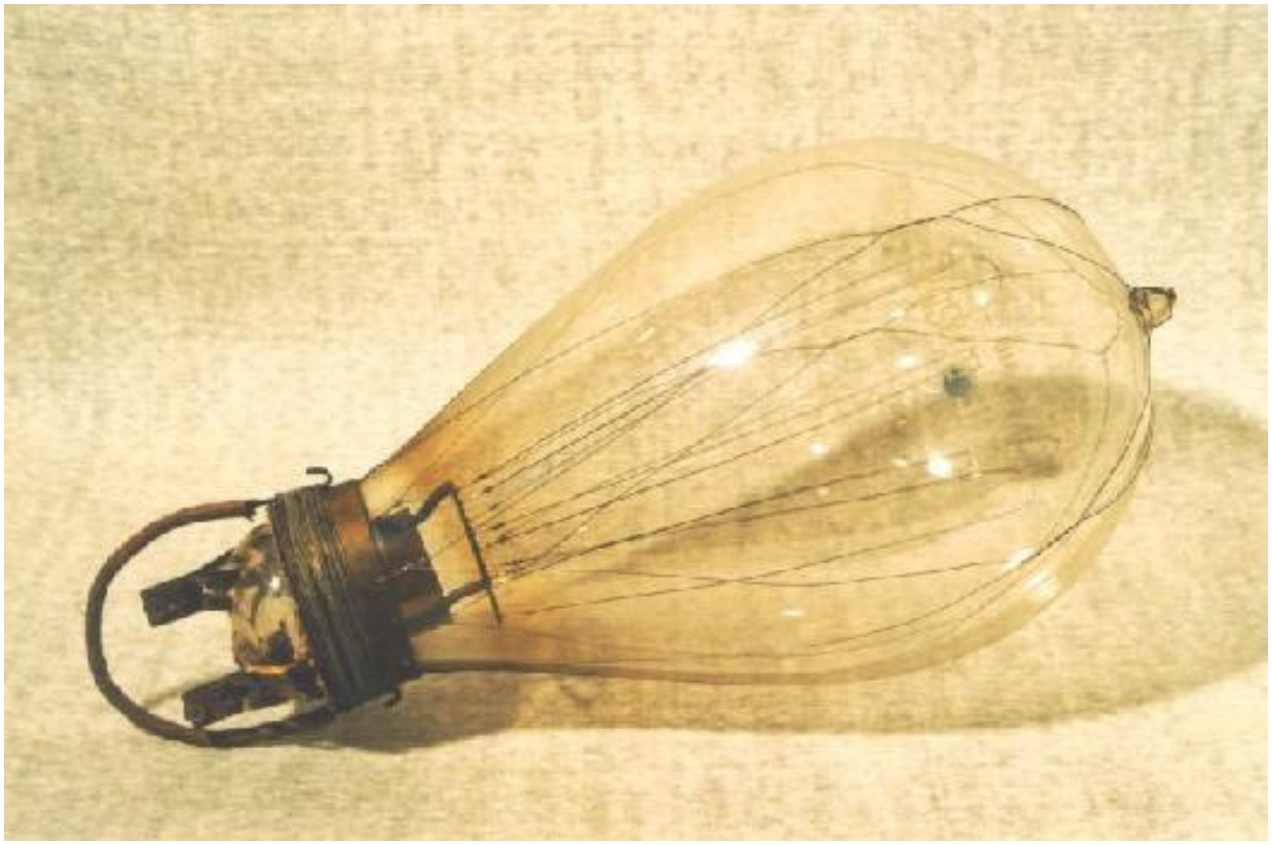
Visible in this engraving is the electrical apparatus
with the fluids extracted from the body of a frog.

# Museum of Electricity

DC Generator of Gramme

1873

# Museum of Electricity



Light bulb of 1889, lighted the main square in Lyon.

Thomas Edison light bulb.

# Museum of Electricity

Amplifier Low Frequency 1916

# The fathers of Electromagnetism

*Volta (1745-1827)*

Italian

*Ampère (1775-1836).*

French

*Faraday (1777-1851)*

British

*Oersted (1791-1867),*

Danish

# The fathers of Electromagnetism

**Joseph Henry**

(1797-1878)

(Build & experiment the first large electromagnet, discovered self inductance)

American (from Scottish parents)

# The fathers of Electricity

**From Wikipedia:**

**Base units**

**Coulomb, electric charge – Charles-Augustin de Coulomb**

**Ampere, electric current – André-Marie Ampère**

**Volt, electric potential, electromotive force – Alessandro Volta**

**Ohm, electrical resistance – Georg Ohm**

**Farad, capacitance – Michael Faraday**

**Hertz, frequency – Heinrich Rudolf Hertz**

**Henry, inductance – Joseph Henry**

**Siemens, electrical conductance – Werner von Siemens**

**Tesla, magnetic flux density – Nikola Tesla**

**Watt, power, radiant flux – James Watt**

**Weber, magnetic flux – Wilhelm Eduard Weber**

# The fathers of Inventions

**Other units:**

**Kelvin, thermodynamic temperature – Lord Kelvin**
**Degree Celsius, temperature – Anders Celsius**
**Becquerel, radioactivity – Henri Becquerel**
**Gray, absorbed dose of radiation - Louis Harold Gray**
**Joule, energy, work, heat – James Prescott Joule**
**Newton, force – Isaac Newton**
**Pascal, pressure – Blaise Pascal**
**Sievert, radiation dose equivalent – Rolf Sievert**

# The fathers of Inventions

**Derived units:**
**Centimeter-gram-second system of units**

**Biot, electric current; Jean-Baptiste Biot**
**Debye, electric dipole moment; Peter Debye**
**Gauss, magnetic induction – Carl Friedrich Gauss**
**Maxwell, magnetic flux – James Clerk Maxwell**
**Oersted, magnetic field strength – Hans Christian Ørsted**
**Galileo, acceleration; Galileo Galilei**
**Eotvos, gravitational gradient; Loránd Eötvös**

**No longer in use:**
**Franklin, electric charge – Benjamin Franklin**

# The fathers of Inventions

**Others Derived units:**

**Angstrom, distance – Anders Jonas Ångström**
**Curie, radioactivity – Marie and Pierre Curie**
**Decibel (i.e. tenths of Bels) dimensionless proportions and ratios, e.g. relative power levels – Alexander Graham Bell**
**Degree Fahrenheit, temperature – Daniel Gabriel Fahrenheit**
**Jansky, flux density – Karl Jansky**
**Neper, relative power level – John Napier**
**Poise, viscosity – Jean Louis Marie Poiseuille**
**Röntgen, dosage of X-rays or gamma radiation – Wilhelm Röntgen**
**Richter scale, earthquake – Charles Francis Richter**
**Stokes, viscosity – George Gabriel Stokes**
**Sverberg, sedimentation rate – Theodor Svedberg**

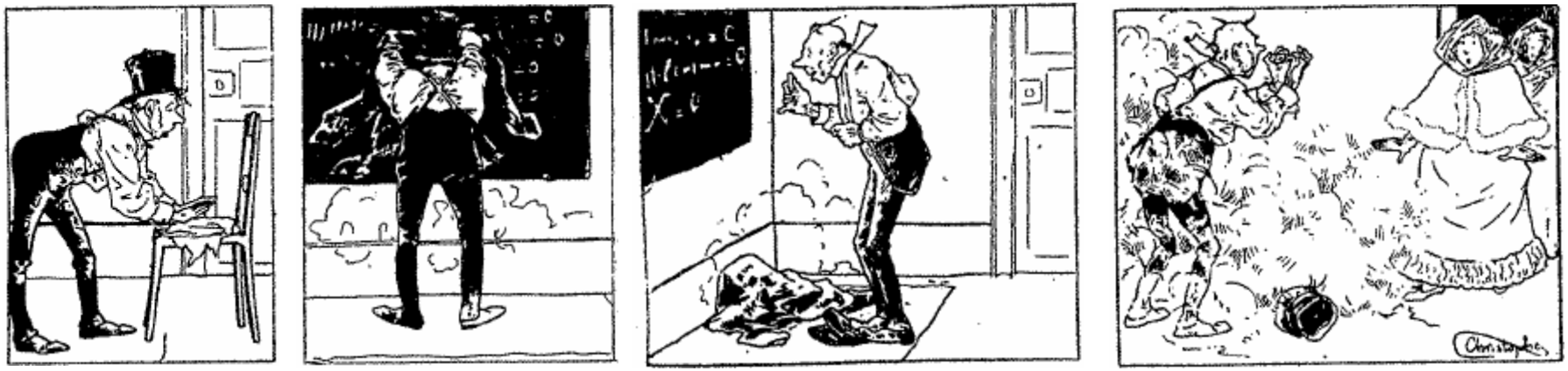
# Ampère was the example (1).

*Vie et mésaventures du savant Cosinus*
*Le Petit Français Illustré 27 janvier 1894*

Stories of absent minded professor.

# Ampère was the example (2).

*Vie et mésaventures du savant Cosinus*
*Le Petit Français Illustré 27 janvier 1894*



Stories of absent minded professor.

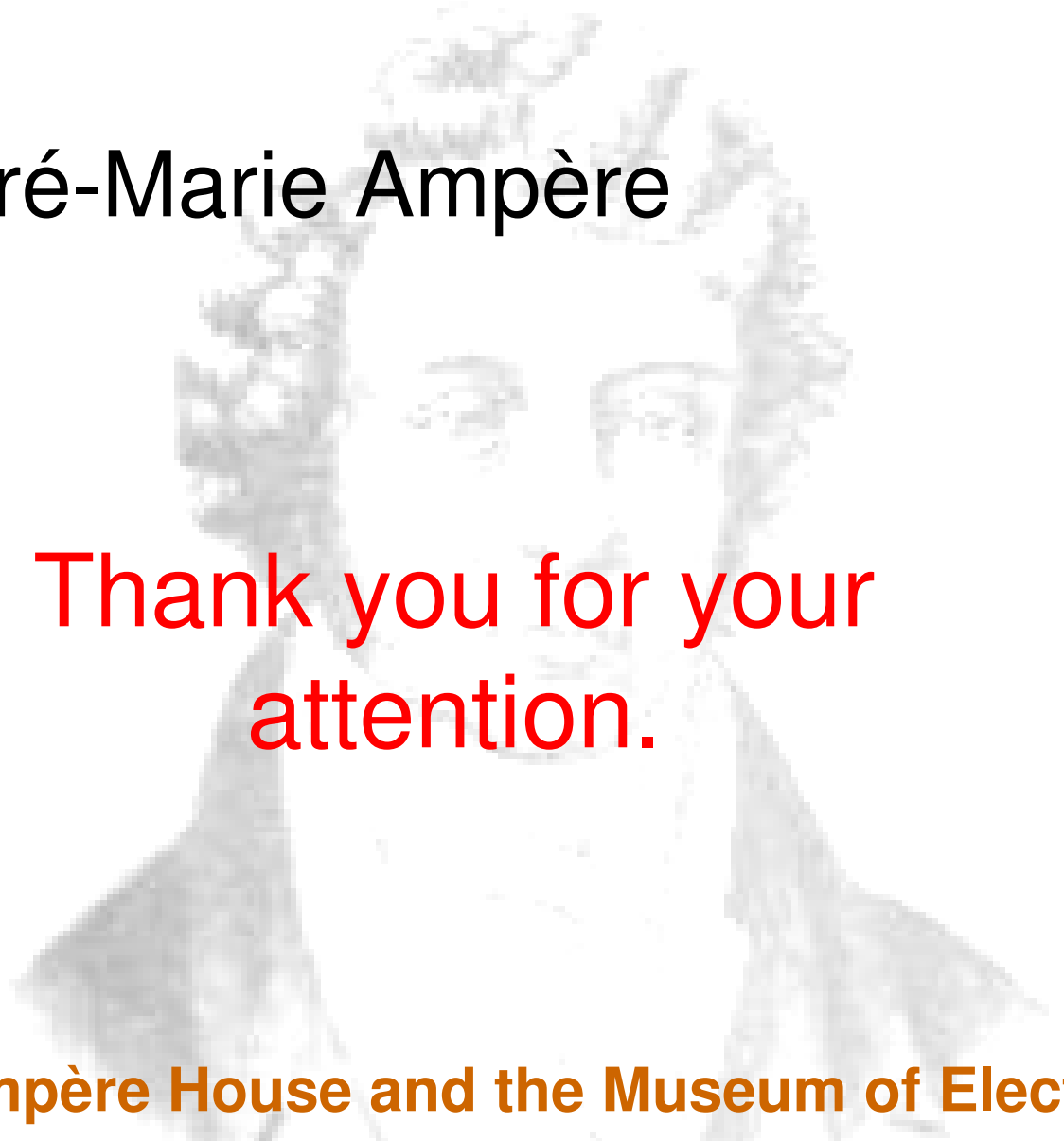
# André-Marie Ampère–1836-End

**Legacy and final days**

He developed a whole field because he explored with very good care, and developed a mathematical theory which not only explained the electromagnetic phenomena already observed but also predicted many new ones.

He died in Marseille and is buried in the Cemetery in Montmartre, Paris with his son. The great amiability and childlike simplicity of Ampère's character are well brought out in his "*Journal et correspondance*" (Paris, in 1872).

# André-Marie Ampère



Thank you for your attention.

**The Ampère House and the Museum of Electricity, Poleymieux au Mont d'Or, France (Near Lyon).**

Ampère experiment (circa 1820)

## Access sketch to the Ampère's House:

*Open every day, except Tuesday,*
*from 10:00am to 12:00pm and from 2:00pm to 6:00pm*

## Ampère's House and Museum of Electricity

69250 Poleymieux au Mont d'Or
Tel (International): 011-33-4-78-91-90-77
Internet: http://musee-ampere.univ-lyon1.fr


**Distance Lyon-Poleymieux:**
*Estimated 20 km.*

**Follow the directions indicated on the road:**
*"Poleymieux", or "Musée de l'Electricité" or "Maison d'Ampère".*

*Partners of the "Maison d'Ampère"*

amec spie
Electrabel
AREVA
Schneider Electric
EDF Electricité de France
RTE
SIEMENS
sogedo

André-Marie Ampère

1775-1836

# Ampère's House
## Museum of Electricity

In Poleymieux, only 20 km from Lyon, in the center of the Mont's d'Or mountains, is the house where Andre-Marie Ampere spent his youth and shaped his genius. In this house is located the Museum of Electricity that gathers:

- precious documents on the life of the scholar and his family
- the fundamental experiments of Ampere.
- an important collection of static electrical machines.
- numerous equipments from the beginning of the 20th century.

*A multimedia spectacle illustrates the life of Ampere.*

*Ramsden's machine*

Electricity before Ampere's time is represented by an exceptional collection of machines from the XVIII century: electrostatic machines, Leyden's jar and Coulomb's scale.

*Lyon's machine. First rotating generator based on electrical magnetic theory*

Hippolyte Pixii an "Engineer in Physics Instrumentation" in Paris, France, worked with Ampere. As he just learned about the new discovery of Faraday on induction, he invented and manufactured in 1832 the first generator.

*Siemens' magneto*

The first industrial applications of electricity are shown: the generators and their evolution, the first motors, and the measuring instruments. A large space is devoted to the history of the telegraph and of the telephone. Finally, we can see a complete room dedicated to electrical lighting.

Room called "The Three Amperes" where there are mainly manuscript documents on the life of Ampere. In this room there is a library that groups the scientific and philosophic publications at the time of Ampere.


*Electricity and Magnetism book by Ampere and Refouvel*

Armstrong (1840) hydro-electric machine - (from the Museum of the "Arts & Métiers" of Paris).

*Hydro electric machine*

# Home School Helps Ampère Electrify Europe Scholars

The fate of the brilliant French scientist André-Marie Ampère was probably fixed at an early age, along with subsequent advances in the development of electrical theory. In fact, the ampere—the unit of electric current—is named after him. Ampère was credited with the invention of the astatic needle, making possible the modern astatic galvanometer. He was the first to show that two parallel conductors carrying currents travelling in the same direction attract each other and, if travelling in the opposite direction, repel. He studied metaphysics, physics, and chemistry, and worked on the theory of light. He was a child prodigy who it was claimed, with probable exaggeration, had mastered all known mathematics by the age of 12. His mathematical dexterity no doubt aided him in his later work on electromagnetism and analysis, in addition to his contributions to line geometry.

Ampère's obvious brilliance notwithstanding, he might very well have languished away learning his arts and letters in a typical 18th century school had it not been for his father. In fact, the young Ampère never attended school.

Born in Lyon, France in 1775, he was provided a home education under the careful tutelage of his prosperous father. He chose to raise his son in the peaceful solitude of the Polymieux countryside and inspired in the young boy an intense desire to learn.

At the age of 13, Ampère submitted his first paper to the Académie de Lyon. In it, he attempted to solve the problem of constructing a line of the same length as an area of a circle. It was his first of many experiments in line geometry. About ten years later, he began tutoring mathematics in Lyon, which prepared him for a later professorship there. All the while, he was making significant contributions to chemistry, suggesting that an anhydrous acid prepared two years earlier was a compound of hydrogen with an unknown element, analogous to chlorine—he suggested the name fluorine—and he later produced a classification of elements in 1816.

Ampère's study of the theory of light yielded published work on the refraction of light and his strong advocacy on the wave theory of light. But some of his most interesting work involved his attempt to produce a combined theory of electricity and magnetism after hearing about experimental results by a little-known Danish physicist named Hans Christian Orsted. Orsted had noticed by chance that a compass needle was deflected when brought close to a wire carrying an electric current. It was the first suggestion between magnetism and electricity.

Ampère immediately repeated this experiment under carefully controlled conditions. He worked out a rule relating the direction in which the compass needle was deflected to the direction in which the electric current flowed along the wire, and soon formulated a circuit force law and created magnetism by postulating small closed circuits inside the magnetized substance. With great speed and seemingly scant effort, he demonstrated various magnetic/electrical effects to professors at the Académie. He discovered electrodynamical forces between linear wires only a few months later. He built an instrument to measure the flow using a free-moving needle—an early version of the instrument later called the galvanometer. It was the first device for detecting and measuring a small electric current.

His most important publication on electricity and magnetism, "Memoir on the Mathematical Theory of Electrodynamic Phenomena, Uniquely Deduced from Experience," was published in 1826 and contained a mathematical derivation of the electrodynamic force law. Ampère's theory became fundamental for 19th century developments in electricity and magnetism. Despite all his discoveries and abilities, Ampère does not get credit for the discovery of induced electricity. Michael Faraday discovered electromagnetic induction in 1831. Ampère initially believed that he had discovered the effect in 1822, but later agreed that full credit for discovery should go to Faraday.

This in no way diminishes Ampère's contribution to the field. His unquenchable thirst for knowledge and the values instilled in the young Frenchman by his father combined to make him one of the giants of electrical theory, who was once dubbed the "Newton of electricity." ■