ANNUAL ANNOUNCEMENT

OF THE

STEVENS

INSTITUTE OF TECHNOLOGY:

A School of Mechanical Engineering.

FOUNDED BY

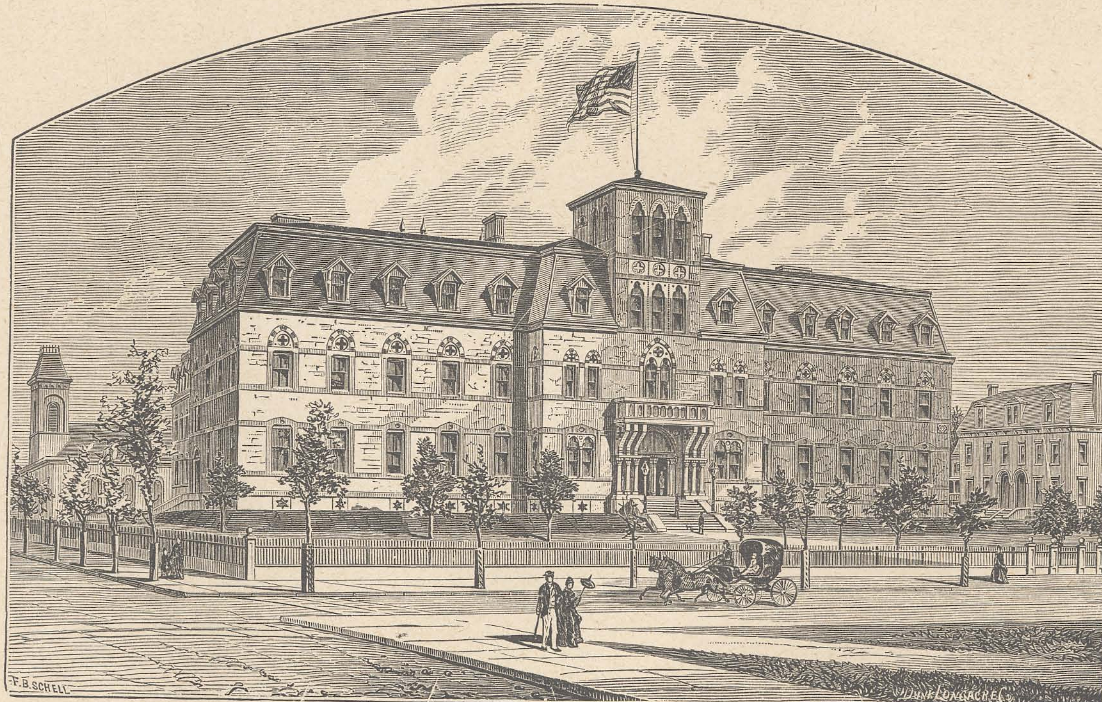
EDWIN A. STEVENS, Esq.,

HOBOKEN, NEW JERSEY.

1878.

Russell Brothers, Printers, 17, 19, 21, 23 Rose St., N. Y.

PLATE I.



FRONT VIEW.

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Faculty.

HENRY MORTON, PH. D. . . . . *President.*

ALFRED M. MAYER, PH. D. . . . . *Professor of Physics.*

ROBERT H. THURSTON, A. M., C. E. . . . . *Professor of Mechanical Engineering.*

DEVOLSON WOOD, A. M., C. E. . . . . *Professor of Mathematics and Mechanics.*

CHARLES W. MACCORD, A. M. . . . . *Professor of Mechanical Drawing.*

ALBERT R. LEEDS, PH. D. . . . . *Professor of Chemistry.*

CHARLES F. KRŒH, A. M. . . . . *Professor of Languages.*

REV. EDWARD WALL, A. M. . . . . *Professor of Belles-Lettres.*

General Introduction.

IN order to set before those interested in the matter a full and satisfactory view of the character and proposed work of this Institution, we present the history of the foundation, and the Charter of the Institute, give a general account of the course of instruction proposed, and point out the means, material and intellectual, which have been provided.

THE FOUNDATION.

In the will of Mr. Edwin A. Stevens, bearing date April 15, 1867, occurs the following bequest:

"And I do further give, devise and bequeath to my said wife, Martha B. Stevens, William W. Shippen, and Samuel Dod, and to their heirs and assigns, forever, to hold as joint tenants, and not as tenants in common, in trust, as hereinafter mentioned, all that block of land in Hoboken bounded by Hudson Street, River Street, and Fifth and Sixth Streets (excepting such interests therein, if any, as I may not own at my death), and one hundred and fifty thousand dollars in the stocks and bonds of the Morris and Essex Railroad Company, reckoning the same at par—that is to say, one-half of that sum in the first mortgage bonds of said company and one-half in the said stock.

"I direct and empower the acting trustees or trustee under this trust (whether the original trustees herein named or the survivors or survivor of them, or his, her, or their successor or successors), at any time or times when one or two shall be dead or have ceased to act, to appoint one or two new trustees in his, or her or their stead who shall have died or ceased to act; and by advice of counsel my trustee or trustees in whom the legal title shall be vested shall convey, assure to, and vest in said three trustees (the appointing as well as the new trustee or trustees) the said trust property in fee simple as joint tenants, and not as tenants in common, in trust. And this trust is this: that upon said land, at such time as the acting trustee or trustees shall think proper—certainly within two years after my death—he, she, or they shall, out of the proceeds of said personal property (to be procured by sale or other prudent disposition, investment, use, or appropriation thereof, in the discretion of the trustee or trustees for the time being), erect, of some substantial but economical material, as substantial and economical as trap rock, a plain building or buildings, suitable for the uses of an Institution of Learning, which I direct my acting trustee or trustees for the time being out of the means herein provided, and such as shall proceed therefrom, with all convenient speed, and within three years after my decease, to establish there—employing, paying, and discharging at his, her, or their discretion the officers, and tutors, and servants thereof—and forever to manage and control at his, her, or their discretion, but for the benefit, tuition, and advancement in learning of the youth residing, from time to time hereafter, within the State of New Jersey; but my said acting trustee or trustees shall, from time to time, decide who of said youth shall receive the benefit thereof, and direct the tuition in said institution, and make all proper By-Laws, Rules and Regulations for the management of the officers, tutors, servants, and scholars connected with said Institution.

"*The tuition is not to be wholly free, unless to such youth as said acting trustee or trustees shall direct; nor is it my intention that the cost of tuition of any youth shall be wholly paid by him or her. The proportion of payment by each youth I leave to the discretion of the acting trustee or trustees.* It is my intention that the Institution hereby directed and created shall be perpetual, and that the above-mentioned original trustees and their successors shall forever continue and be the governors thereof, and have the superintendence of the same; and it is my will and desire that, if it cannot be legally done according to my above intention by them without an Act of the Legislature of the State of New Jersey, they will, as soon as possible, and certainly within three years after my decease, apply for an Act of the Legislature to incorporate them for the purpose above specified, and to effectually provide for the establishment and maintenance of said Institution

with the means which I have devoted by this, my will and testament, to the said purpose; and I do further declare it to be my will and intention that the said real and personal property hereinbefore and hereinafter devised and bequeathed to my said trustees for said purposes shall, at all events, be applied for the uses and purposes above set forth; and it is my desire that all courts of law and equity will so construe this, my will, as to have the said property, real and personal, appropriated to the above uses, and that the same shall, in no case, for want of legal form or otherwise, be so construed as that my relations, heirs, devisees, or legatees, or any other persons, shall inherit, take, possess or enjoy said real and personal property hereinbefore and hereinafter devised and bequeathed for said purposes, except in the manner and for the uses hereinabove specified.

"I do, also, out of the said last mentioned residue of my estate (excluding Castle Point and the homestead lot, and the houses thereon) remaining after the payment of my debts, the said eight hundred thousand dollars in legacies, and the appropriation of so much of my estate as is necessary to answer the before-mentioned charitable bequests and devises, and the appropriation for the steam battery, give, devise and bequeath to my said trustees of said Institution of Learning, and direct my executors to pay to them, within five years after my decease, such sum of money, not exceeding five hundred thousand dollars, as the said trustees of said Institution of Learning, in their discretion, shall think necessary, to be set apart, invested, and appropriated to and for the purpose of forever maintaining the said Institution of Learning, for the purpose before described, so that the same be liberally maintained out of the income and interest of such sum, and said sum of money, and the income and interest thereof, shall be subject to all the trusts hereinbefore declared with respect to the said Institution of Learning, and the property appropriated hereinbefore for the erection, maintenance, and establishment thereof; and I do, with reference to the said sum, and interest and income thereof, declare my desire and intention to be the same as I have before fully expressed with reference to the property before devised and bequeathed for the same purposes."

From the above it will be seen that a sum of money which, at the discretion of the executors, might be as great in the aggregate as $650,000, and a lot of ground (425 by 200 feet) was left for the foundation and establishment of "An Institution of Learning."

The executors, in the first place, decided upon making an appropriation to this object of the maximum amount as named in the bequest, and then, in view of the existing needs of the country at large, and of the personal interest always manifested by Mr. Stevens in the development of the mechanic arts, they also determined that the "Institution of Learning" should be a school of Mechanical Engineering.

The reasons for this decision there is no need here to discuss, since it is believed that abundant and sound cause for this conclusion will appear to any one sufficiently familiar with its relations to take any interest in the matter.

Furthermore, for the more effectual fulfilment of the plans laid down by Mr. Stevens, and in pursuance of the suggestion to that effect already quoted in his will, a charter or act of incorporation was obtained from the State of New Jersey, of which we quote the enacting clause:

"*First. Be it enacted, by the Senate and General Assembly of the State of New Jersey,* That Martha B. Stevens, William W. Shippen, and Samuel B. Dod, and their successors, shall be, and they are hereby constituted a body politic and corporate, by the name of 'The Trustees of the Stevens Institute of Technology,' and by that name shall have perpetual succession, according to the provisions of said codicil, and may sue and be sued, implead and be impleaded, and may purchase and hold property, whether acquired by purchase, gift, or devise, and whether real, personal, or mixed, and may make and have a corporate seal, and the same break and alter at their pleasure, and shall have all other rights belonging to similar corporations by the laws of this State.

"*Second. And be it enacted,* That the entire management of the affairs and concerns of the said corporation, and all the corporate powers hereby granted, shall be and hereby are vested in the above-mentioned trustees, to manage and control the same, as in said codicil provided.

"*Third. And be it enacted,* That the trustees shall have power from time to time to enact by-laws, not repugnant to the Constitution or laws of the United States, or of this State, or to this Act, for the regulation and management of the said corporation or institution of learning; to fill up vacancies in the Board, and to prescribe the number and description, the duties and powers of the officers, the manner of their appointment and the term of their office, as in said codicil directed and empowered to do.

"*Fourth. And be it enacted,* That for the purpose of carrying out the object of this Act, the said corporation shall have power, from time to time, to purchase, take, and hold real and personal estate, and to sell, lease and dispose of the same; provided, that nothing contained in this Act shall empower the said corporation to sell, lease or dispose of that block of land in Hoboken bounded by Hudson Street, River Street, and Fifth and Sixth Streets, if at any time the title to the same shall become vested in the said corporation.

"*Fifth. And be it enacted,* That the said corporation shall have and possess the right and power of conferring the usual degrees appropriate to a school of technology.

"*Sixth. And be it enacted,* That this Act shall take effect immediately.

"Approved February 15, 1870."

Plan of the Institution.

IT was determined, as has been stated, to create a school of mechanical engineering, and as this was to be of a high educational order, and to involve a general and not a merely industrial training, it was thought best, in memory also of its munificent founder, to call the new school THE STEVENS INSTITUTE OF TECHNOLOGY.

The plan of instruction which has now been successfully pursued for seven years, is to be such as may best fit young men of ability for leading positions in the department of mechanical engineering, and in those scientific pursuits from which this and all the sister arts are daily deriving such incalculable benefits.

With this view there is afforded—

1. A thorough training in the elementary and advanced branches of Mathematics, and their application to mechanical constructions.

2. A department of Belles-Lettres furnishes the means of cultivating literary taste and a facility in the graceful use of language, both in speaking and writing, which are as desirable in the engineer and man of science as in the classical student.

3. The French and German languages form an essential part of the course of instruction, since they are indispensable to the engineer and man of science as the vehicles of a vast amount of information, and also as affording that kind of mental culture which mathematical and physical science, if followed exclusively, would fail to supply.

4. The subject of Chemistry is taught, chiefly by experimental work in the laboratory, with accompanying lectures and class-room instruction. It is believed that in this manner only can students be made thoroughly conversant with the subject.

5. Arrangements of an unusually perfect character have been made to give a thorough, practical course of instruction in Physics, by means of physical laboratories, in which the student is guided by the professor of Physics, in experimental researches bearing upon the subjects of his special study.

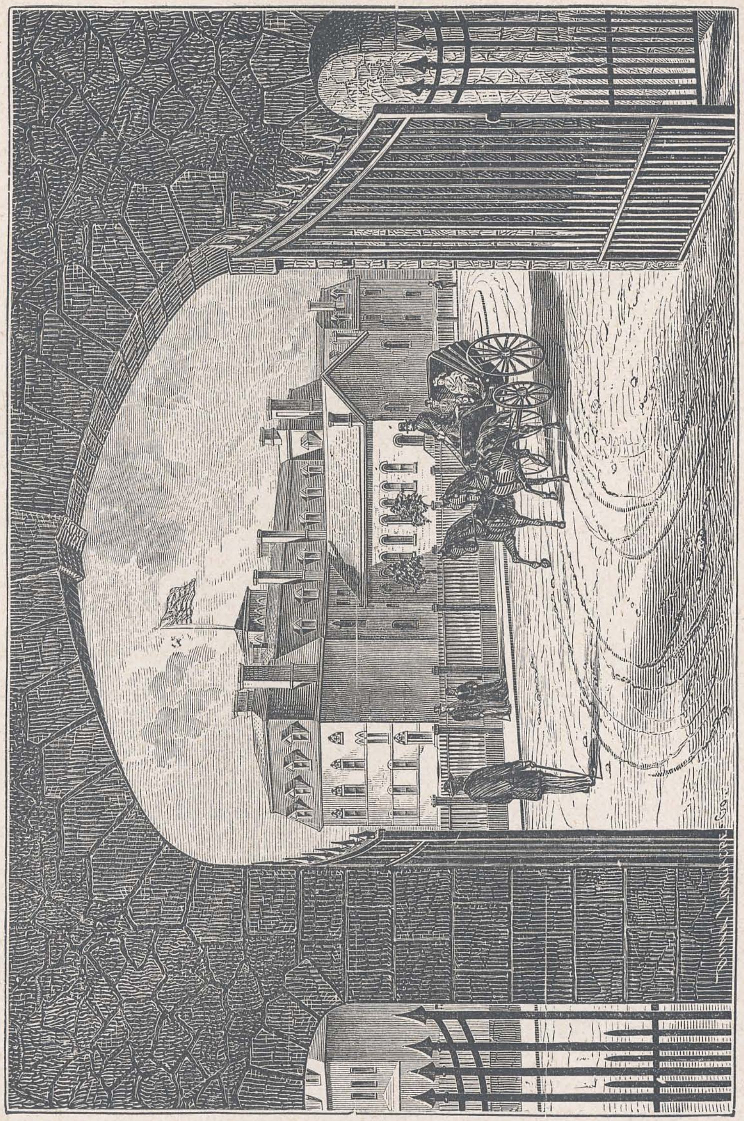


PLATE II.

REAR VIEW.

Thus the student will experimentally study those methods of making measures of precision which are used in all determinations in Physics; he will measure for himself the tension of steam at various temperatures, and construct the curve showing their relations; he will determine the electrical resistances of several conductors and insulators, and so on through the subjects of Physics.

By such means as these not only will facts and laws be impressed in a manner which no other process can approach, but a training will be given in methods of investigation which will be invaluable for the mastery of the always new and varied problems of actual work.

6. The subject of Mechanical Drawing (which may well be called the language of engineering) forms a separate department, to which much time and attention is devoted.

The course comprises the Use of Instruments and Colors, Descriptive Geometry, Shades, Shadows and Perspective, and the Analysis of Mechanical Movements—the principles involved being at once and continuously applied in the construction of working drawings from measurements of machines already built as well as in making original designs.

7. The subject of Mechanical Engineering, including theory and practice in the construction of machines, forms a distinct department, under the charge of a professor experienced in the practical relations of his subject, who will devote his entire attention to the branch.

The course includes the study of the character, methods of production, and the uses of the materials of construction, the principles of mathematical and physical science as applied in Mechanical Engineering, the theory and practice of the design and construction of machinery, and the methods of operation, preservation and repair.

A Mechanical Laboratory has been instituted as an adjunct to this department, in which students are permitted to study the materials of construction during the process of testing, which is at nearly all times in progress, and frequently to take part in such work. They are given opportunities to take part in tests of steam engines, boilers and other commercial operations carried on in this laboratory, and witness the construction of machinery and other work done in the workshop. Much of this work is made from designs produced by students, and some machines here used are the work of students entirely.

Description of Building.

THE south and west faces of the building are seen in the plate facing the title, and the rear view, as seen from the north-east, is shown in the plate facing page 9. These will give some idea of the general size and appearance of the edifice, which will be more fully understood when we add that the entire length of the front is 180 feet, depth of main building 44 feet. The depth of the west wing is 60 feet and its width is 30 feet, while the depth of the centre wing or gymnasium is 80 feet and its breadth 50 feet.

The main building and wings have three stories and a basement, while the lecture hall has but a single floor. Including halls and stairways, the aggregate floor space is a little more than one acre.

A detailed description of the arrangement of the several floors will be the best means of conveying a correct idea as to the character and extent of the various departments.

BASEMENT.

In the basement, on the west or Hudson Street side, there are under the wing three rooms assigned to various uses, as shown on the plan, *Plate III.*

Under the main building there is, first, a large room, in which are located the steam boilers, B′ (two Harrison boilers of 35 horse power each), for heating the building and supplying the steam machinery; here also are the various metallurgical furnaces.

Two small rooms give storage for fuel, while another is fitted up for emery grinding machinery, and another, B, is arranged for galvanic batteries, such as those operating the door bells, gongs for recitation hours, and local telegraph passing about the building and to the President's house, as well as the very large battery from which heavy conductors are permanently laid to the various lecture rooms.

A room under the main entrance is fitted up as a foundry, and at T, is a large room with non-conducting walls for experiments requiring a constant temperature.

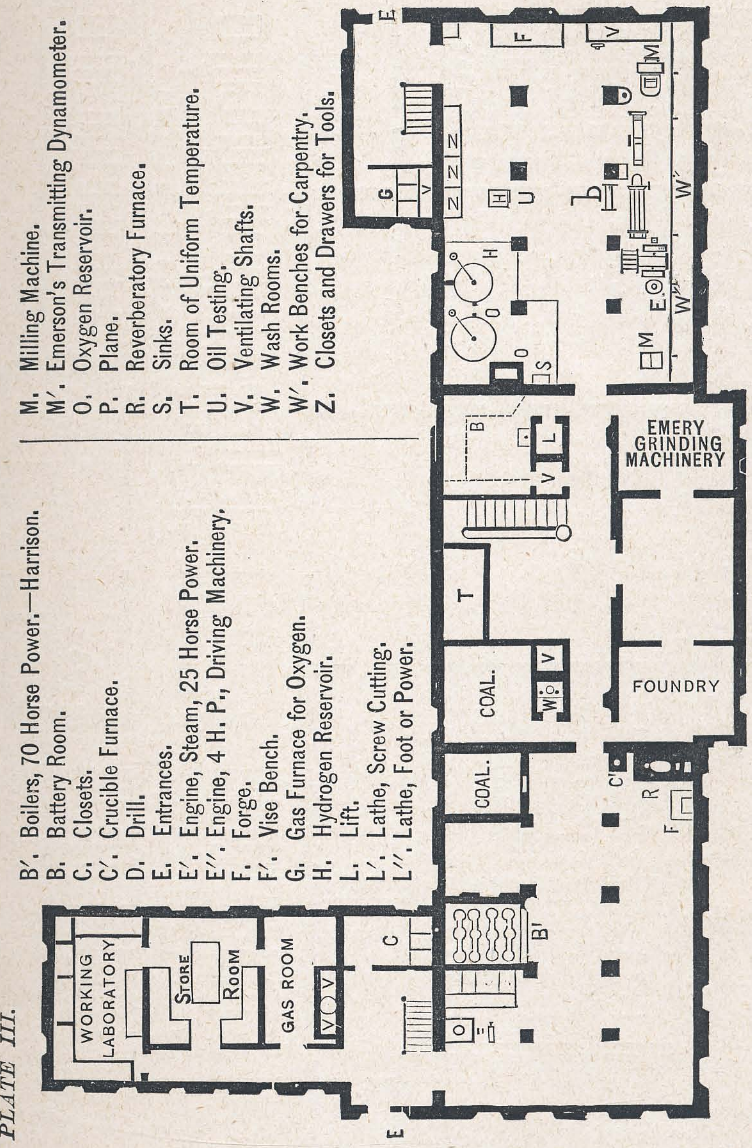


PLATE III. BASEMENT.

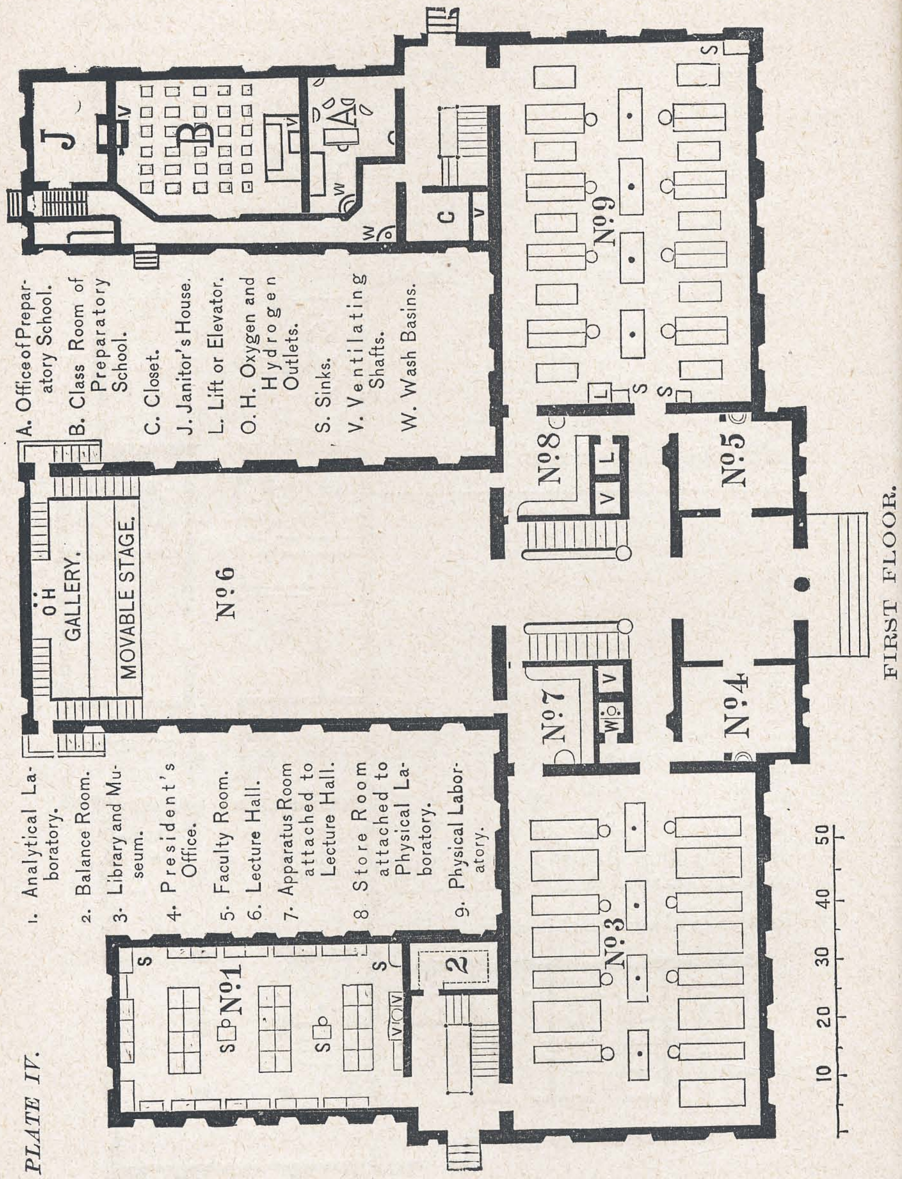


PLATE IV.

The larger room **I**, adjoining these, is the machine shop of the Mechanical Laboratory, containing the steam engine **E'** and a set of machine tools, including screw-cutting lathe, planer, gear-cutter, milling machine, drill, and also dynamometers and hand tools.

At **O** and **H** are gas tanks for oxygen and hydrogen, each supplying 100 cubic feet, under a pressure of three-quarters of a pound to the square inch. From these tanks pipes are laid to all the lecture-rooms in the building. A small furnace, for the manufacture of oxygen, is placed at **G**, and work benches at **WW**.

FIRST FLOOR.

No. 1. On the first floor, at the west side of the wing, we have (*Plate IV.*) the Chemical Laboratory, arranged with tables, and supplied with water, gas, sand-baths, drying closets, and filter-pumps, in the usual manner.

No. 2. The Balance Room, with a set of fine balances by Becker.

No. 3. The Library and Model Room, divided by cases into ten alcoves, which contain glass inclosures for large models and instruments. Reading tables are placed in the middle of the room.

No. 4. The President's Office.

No. 5. The Reception Room.

No. 6. The Gymnasium—Since last year the Lecture Hall, formerly used exclusively for public lectures, has been so modified as to convert it into a gymnasium, fitted up with every appliance and convenience requisite for a thorough course of gymnastic training.

By an ingenious contrivance, however, a stage which otherwise swings up against the wall, can be lowered into position in a few minutes and some other changes easily effected, and the room thus converted in an hour into a very convenient lecture room.

A number of public lectures have been delivered in this room since the change, while at the same time it has been in daily use as a gymnasium.

No. 7. Small Waiting Room connected with Lecture Room.

No. 8. Store Room connected with Lecture Room and Physical Laboratory.

No. 9. Physical Laboratory, divided by cases into ten alcoves, each devoted to some special subject of research, such as—1, Molecular Physics; 2, General Laws of Statics and Dynamics; 3, Hydrostatics and Hydrodynamics; 4, Pneumatics; 5, General Laws of Heat; 6, Special Relations of Heat to Steam; 7, Electrical Measurements; 8, Magnetism; 9, Sources of Electricity;

10, Light. Other departments of the Physical Laboratory have been placed in other rooms, as will be seen further on, and a more complete description of the entire Physical Department will be given subsequently. The east wing of the building, added in 1873, contains the office of the Director of the Preparatory School, General School Room, and first floor of Janitor's House.

SECOND FLOOR.

The Chemical Lecture Room is located in the wing, No. 10 (*Plate V.*), at the west end. It is provided with a lecture table with pneumatic tank and a wash-basin, and also with a glass closet having a downward draught, for escape of fumes. On this table are "laid," also, ordinary gas as well as oxygen and hydrogen under pressure (vacuum) from a Bunsen pump, compressed air from the same, steam and galvanic battery. Adjacent to this lecture-room is a small store-room (No. 10), fitted with closets for the various large pieces of apparatus required in the chemical lectures.

In the main building, next in order, is No. 11, devoted to the Mathematical Department, and fitted up with desks, blackboards, etc.

No. 12 is devoted to Mechanical Engineering, and is supplied with blackboards, tables, cases of models by Schröder, Salleron, and others, and a collection of working drawings and cases containing samples of the materials of engineering constructions, such as stone, natural and artificial, woods, ores, metals, fuels, and lubricants.

The testing machines and the more important apparatus of the Mechanical Laboratory are kept here.

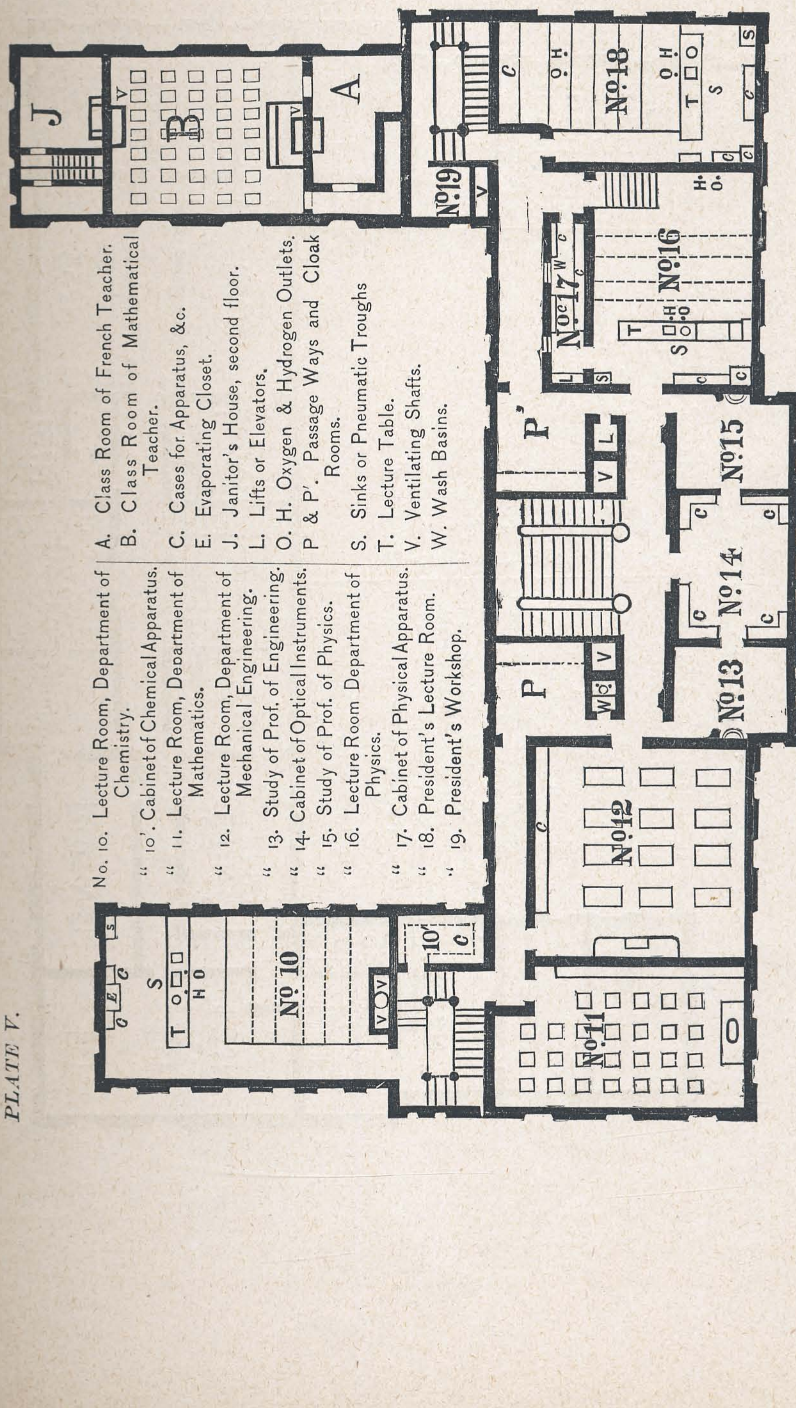
No. 13. Private Room or Study of the Professor of Mechanical Engineering.

No. 14. Museum or Cabinet of fine Optical Instruments, consisting in the first place of the entire optical collection made by Mr. Bancker, of Philadelphia, said by the Abbé Moigno (see Cosmos, 1859, p. 577) to be "the most numerous and brilliant that exists in the world," and supplemented by a great number of new instruments.

No. 15. Study of the Professor of Physics.

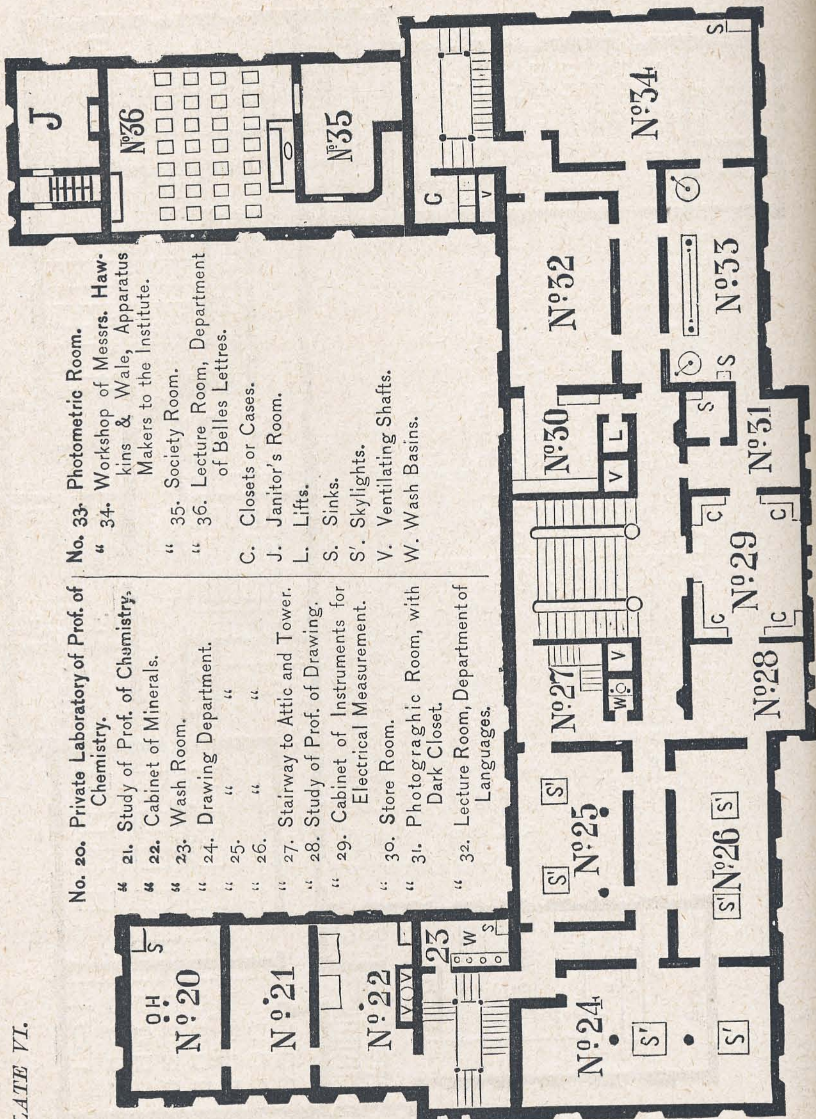
No. 16. Lecture Room of the Department of Physics. This is provided with a lecture table, having pneumatic tank and basin, and with ordinary gas, oxygen, and hydrogen, under pressure, steam, vacuum, compressed air, and galvanic battery connections; the seats are here arranged on inclined platforms, and there is a

PLATE V.



SECOND FLOOR.

PLATE VI.



THIRD FLOOR.

screen provided for optical experiments and projections, which can be lowered in front of the case for apparatus at the back of the table.

No. 17 is furnished with extensive cases for apparatus, and communicates by a special lift or dumb waiter with the Physical Laboratory below.

No. 18 is a Lecture Room, fitted up in all respects like the preceding, and used by the President for his lectures in the Department of Physics, and for his individual researches.

No. 19 is a small laboratory and store-room attached to the preceding.

The east wing on this floor contains Class Room of French Teacher, Class Room of Teacher of Mathematics, in the preparatory department, and another floor of the Janitor's House.

THIRD FLOOR.

Beginning again at the extremity of the west wing (*Plate VI.*):

No. 20 is a Laboratory devoted to the individual use of the Professor of Chemistry.

No. 21 is his Study and Library.

No. 22 contains the Cabinet of Minerals, and is fitted up for examination of new specimens.

No. 23 is the Wash Room.

Nos. 24, 25, and 26 are assigned to the Department of Drawing.

No. 27 contains the Stairway to the Tower.

No. 28 is the Study of the Professor of Drawing.

No. 29 is devoted to Electrical Measurement, and is supplied with a complete outfit of the most delicate instruments for this purpose, by Elliott & Co., of London.

No. 30. Store Room.

No. 31. Photographic Room, with dark closet, washing-trough, etc., etc.

No. 32 is assigned to the Department of Languages.

No. 33. Assigned to the Department of Drawing.

No. 34. Workshop of Messrs. George Wale & Co.

Arrangements have been made with this firm, by which a certain number of the students of the Institute receive from time to time, instruction in the manufacture of philosophical instruments, and employment in the construction of the same.

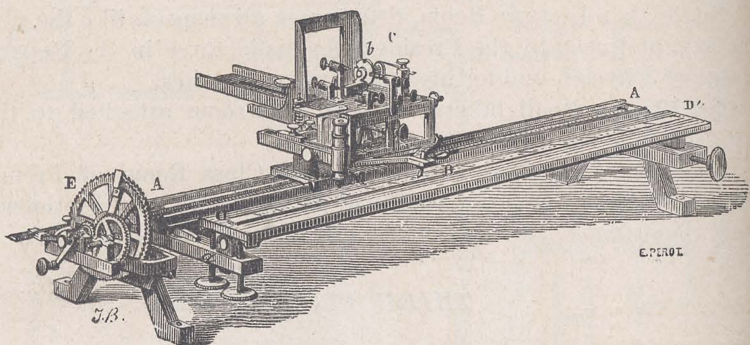
The east wing on this floor contains:

No. 36. Lecture Room of the Department of Belles-Lettres.

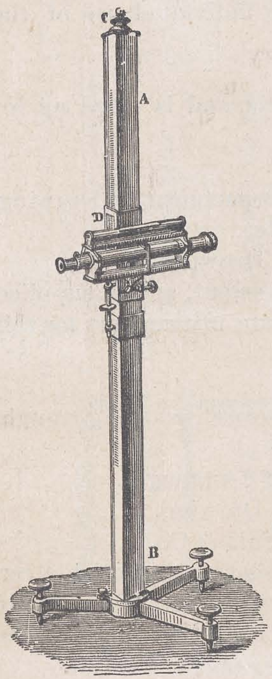
No. 37. Janitor's Apartments.

Collections.

COLLECTIONS IN THE DEPARTMENT OF PHYSICS.



DIVIDING ENGINE. BY J. SALLERON.



CATHETOMETER. BY J. SALLERON.

THE Collections of the Institute are so extensive that it is difficult, without occupying too much space, to make any detailed enumeration of them, but they may be described in classes, as follows:

APPARATUS FOR PRECISE MEASUREMENTS.

LINEAR MEASURE.

Linear Dividing Engine, of large size, dividing to millimetres, and Calibrating Engine, from Salleron, Paris.

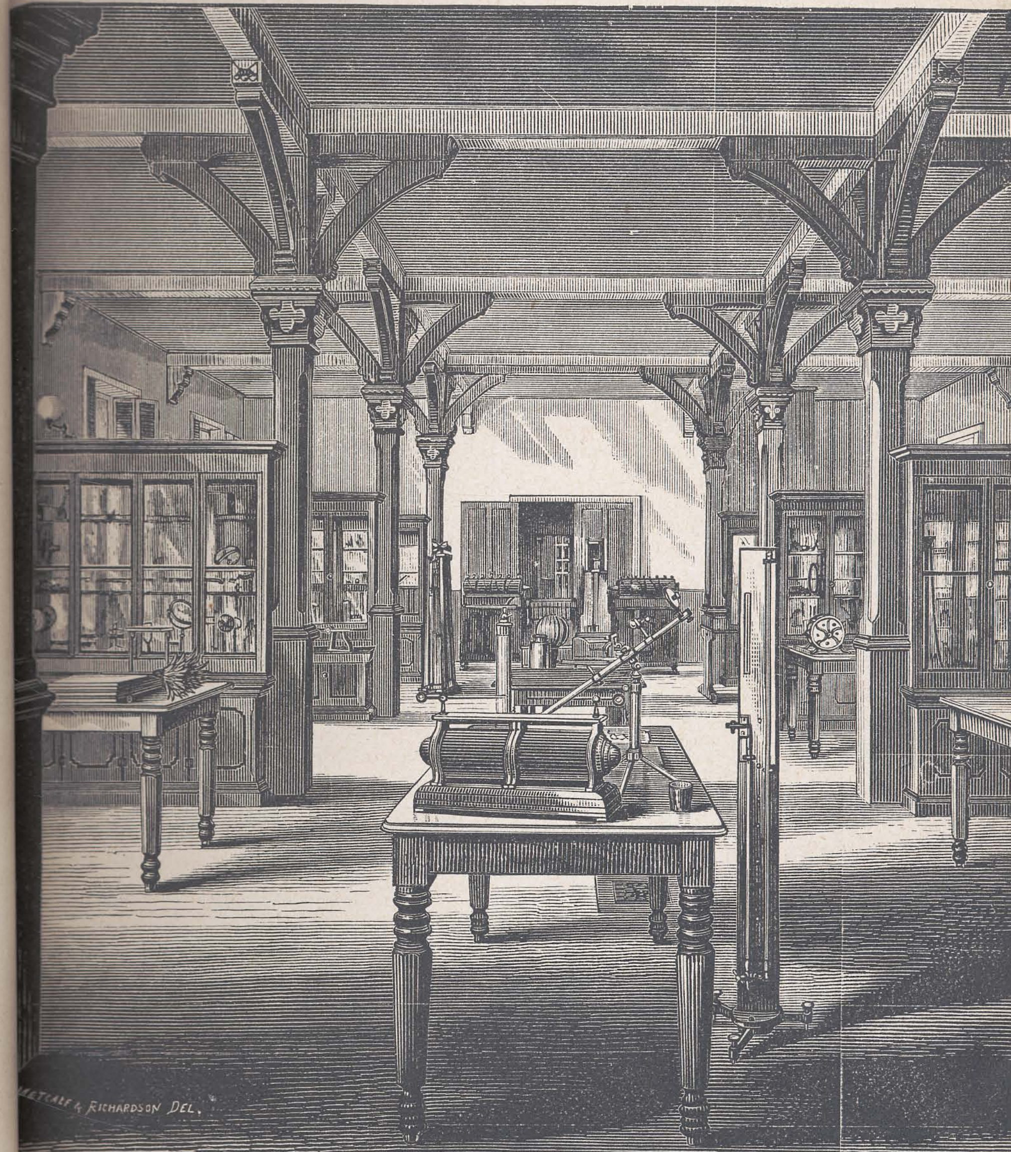
Dividing Engine, by Hawkins & Wale, dividing two feet to $\frac{1}{1000}$ of an inch.

Spherometer, by Duboscq, of Paris. Kater's Reversion Pendulum.

Set of Brown & Sharpe Scales, Squares, Gauges, Micrometer Screw, etc.

Saxton's Reflecting Comparator.

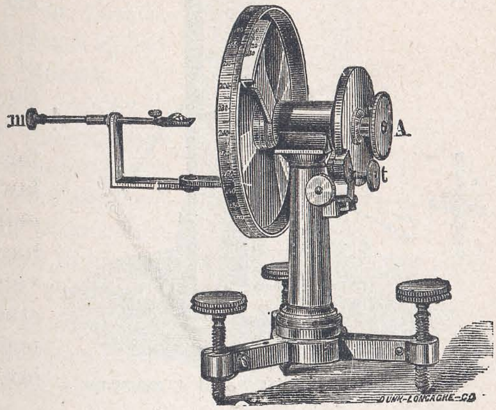
Comparator of Yard and Metre, of new form, constructed in the Coast Survey Office, under the direction of Prof. J. E. Hilgard, and provided with every refinement of adjustment.



INTERIOR OF PHYSICAL LABORATORY.

MEASUREMENT OF ANGLES.

A theodolite, a Wollaston's reflecting goniometer, a Babinet's reflecting goniometer, and a large reflecting goniometer by Elliott.



WOLLASTON'S GONIOMETER.

MEASUREMENT OF CAPACITIES.

Graduated vessels of various volumes, and divided into various measures, such as a litre, 500, 100, and 50 cubic centimetres, gallons, quarts, pints, ounces, and cubic inches.

MEASUREMENT OF WEIGHTS.

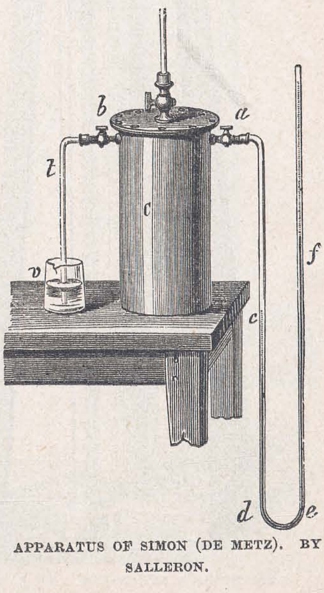
Standard balance, thirty-inch beam, carrying five kilogrammes in each pan, turning with one milligramme, and sets of accurately adjusted weights for both French and English standards.

MEASUREMENT OF TIME.

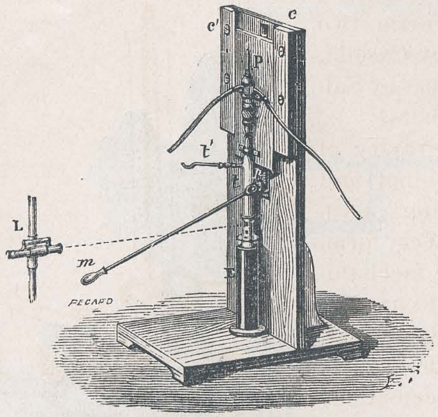
Chronoscope from Hipp, of Neufchatel; also, electric chronograph from the same maker, and recording chronograph of Casella.

MOLECULAR PHYSICS.

The various forms of apparatus for illustration of cohesion, capillarity, etc., devised by Simon, Béclard, Graham, Bunsen, and others, including Plateau's apparatus for the study of liquids freed from the action of gravity, and the various forms of diffusion apparatus devised by Graham and others. Also, instruments for measurement of elasticity in solids, the effects of torsional and other strains.

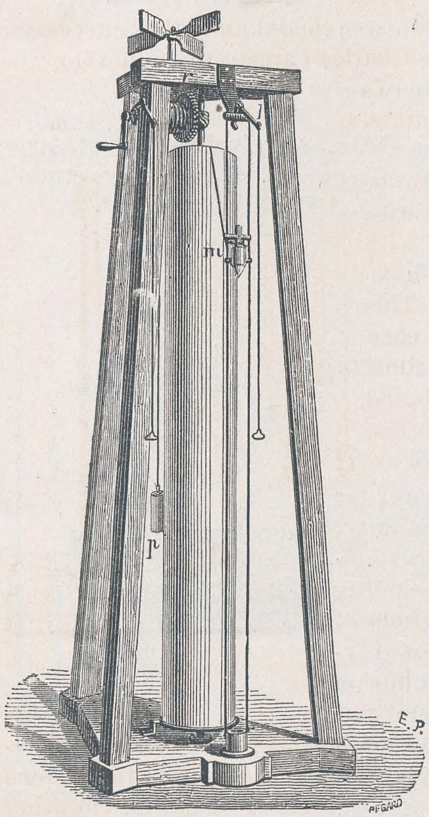


APPARATUS OF SIMON (DE METZ). BY SALLERON.



DIFFUSOMETER OF BUNSEN. BY J. SALLERON.

These instruments are exact duplicates of those used in the original investigations of the physicists by whom they were devised, and enable the student to verify for himself the important laws which they have been employed to evolve. It is hardly necessary to say how valuable such a mode of study proves in fixing permanently in the mind the laws and facts concerned.



GEN. MORIN'S APPARATUS. BY J. SALLERON.

ELEMENTARY MECHANICS.

All the apparatus which have been devised for the illustration of mechanical laws, such as the Atwood machine and that of General Morin; the whirling table; sets of mechanical powers; also, suspended ivory balls (several sets of different mass and with various attachments, illustrating different points); illustrations of hydrostatics, hydrodynamics, and pneumatics, including, beside all the simpler apparatus, several air-pumps of the most improved construction; working models of the hydraulic ram, hydrostatic press, water-wheels, pumps, steam-engine, and a Natterer's pump for liquefying gases, made by E. S. Ritchie.

Also various forms of barometer, such as the barometer of Fortin, two forms of aneroid barometer by Casella, various gauges and manometers by Salleron, Green, Ritchie, and others.

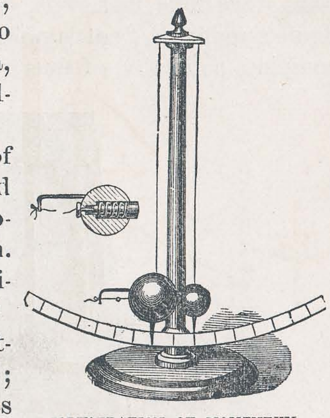


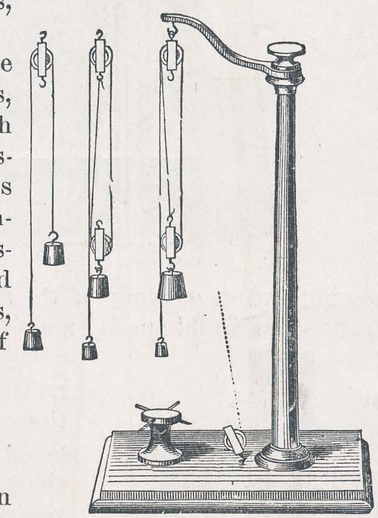
ILLUSTRATION OF MOMENTUM. BY E. S. RITCHIE.

Illustrations of specific gravity of liquids, such as those of Babinet and Boyle, together with hydrometers, aerometers, salinometers, etc., of every form.

Among the illustrations of mechanical principles it may be well to name:

The cycloidal pendulum, compensating pendulum, pendulum of Foucault; and various forms of escapement, as that of Graham, of Lepaute, the cylinder escapement, and that of Arnold.

Foucault's pendulum apparatus, cycloidal and other curves, for falling bodies, whirling tables, Charles's apparatus to develop the laws of the flow of liquids, Hiero's fountain, Barker's mill, aspirators, etc.

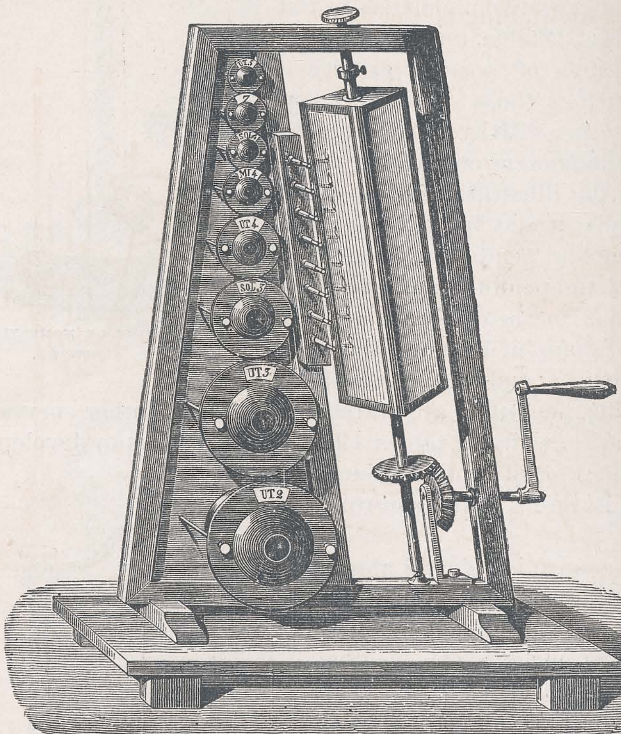


MODELS OF PULLEYS. BY E. S. RITCHIE.

In this connection should also be mentioned Bourdon's apparatus, consisting of air-chambers, with manometers, air-gun, etc., to illustrate the laws of *vis viva.* This division contains about 100 complete instruments or sets of illustrations, such as those included under the titles Mechanical Powers, Whirling Machine, or Centre of Gravity Illustrations.

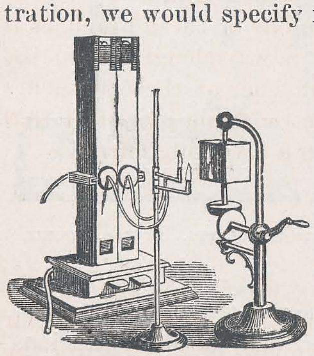
ACOUSTICS.

The apparatus in this division includes as one item the entire collection on this subject of the late Charles N. Bancker, of Philadelphia, and numbers among its objects numerous sets of organ pipes and tuning forks of every material, adapted to illustrate the various laws of sound, and also sonometers, sirens, resonators, vibrating rods of various materials, Schaffgotsch's apparatus, manometric flame apparatus, Scott's phonautograph, and, in fact, an unusually complete collection of every appliance that can be made useful in



RESONATORS AND MANOMETRIC FLAMES. FROM R. KŒNIG.

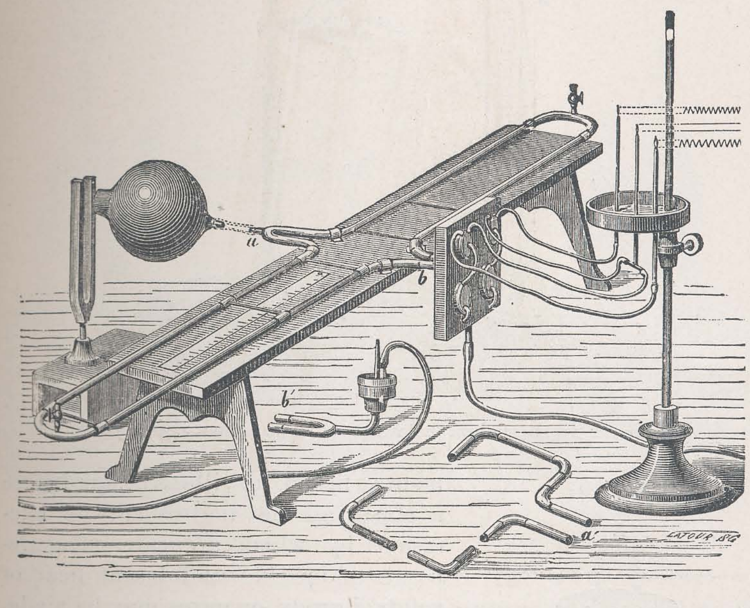
the illustration or study of the subject of Acoustics. As an illustration, we would specify more fully two examples, as follows:



ORGAN PIPE. WITH MANOMETRIC FLAMES. FROM R. KŒNIG.

Organ pipes, with Kœnig's manometric flames, for studying the vibrations of the air in the interior of the pipes. Circular holes are cut in the sides of the pipes at the nodal and ventral points, and these holes are closed by their membranes. Over these membranes are placed wooden capsules, into which illuminating gas enters by one tube and issues by another; the latter tube terminates in a small gas jet. This jet will jump up

and down as the membrane with which it is connected moves outwards or inwards; and if the vibrating flame be viewed in a revolving mirror it will appear as a series of teeth, formed by the rising and falling of the flame.

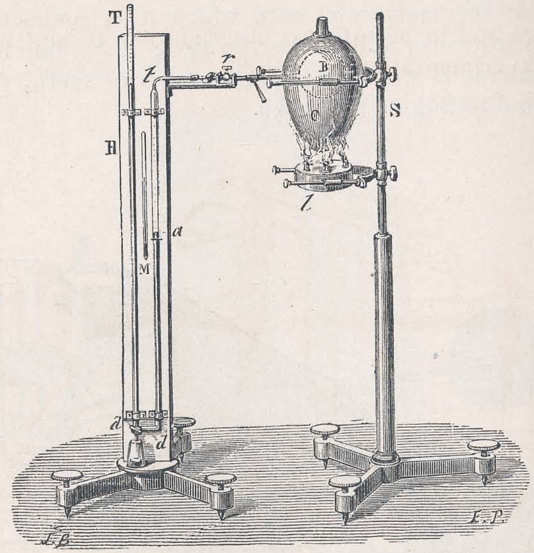


QUINCKE'S APPARATUS FOR MEASURING WAVE-LENGTHS. FROM R. KŒNIG.

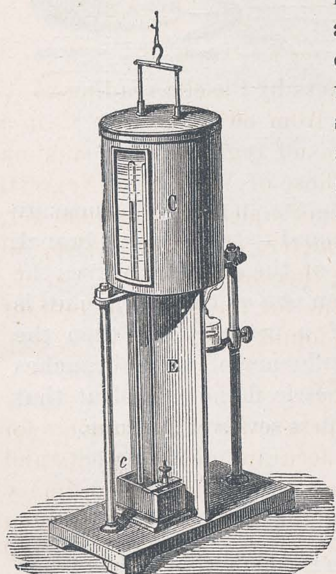
The apparatus for measuring wave-lengths, in which the measure is made by causing one half of a given sound to traverse one branch of a forked tube while the other half of the sound traverses the other branch of the forked tube. When one of these branches is longer than the other by one half of a wave-length, then the sonorous pulses which meet at the confluence of these branches will oppose each other, and a manometric flame placed at that point will appear at rest when viewed in a revolving mirror.

HEAT.

On account of the important bearing which this subject has on the professional work of the mechanical engineer, particular attention has been given to the completeness of this part of the collection, which comprises, in addition to all the usual instru-



REGNAULT'S APPARATUS FOR DILATATION OF GASES. FROM J. SALLERON.

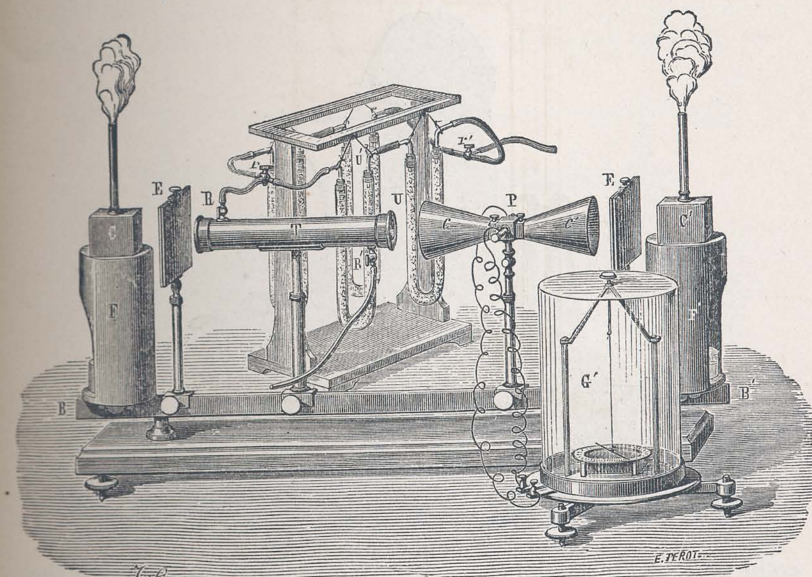


REGNAULT'S APPARATUS FOR TENSION OF VAPORS. FROM J. SALLERON.

ments fitted for illustration before a class, all the instruments of precision by which accurate measurements of specific and latent heat of solids, liquids, or gases may be made, as well as the relations between tension and temperature of vapor, the coefficients of expansion in all forms of matter, and the like. This part of the collection, in fact, includes all the instruments used in the classical researches of Dalton, Gay-Lussac, Dumas, and Regnault. Also, Ramsden's apparatus for determining the coefficient of dilatation of solids, that of Dulong and Petit for the dilatation of mercury, the apparatus of Pierre for determining the corresponding coefficient of liquids, and the like.

Here, also, will be found fine standard thermometers of every description and adapted to every use, vary-

ing in range and in minuteness of gradation to suit all requirements of experimentation.



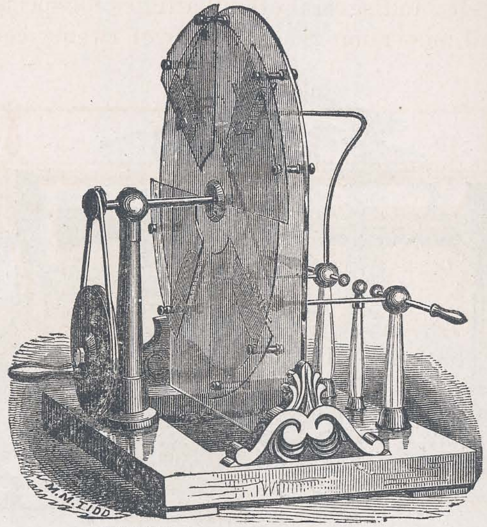
MELLONI-TYNDALL APPARATUS. FROM J. SALLERON.

Thus we may enumerate thermometers by Casella reading to $\frac{1}{10}$ of a degree Centigrade, and running from 30° C. to 320° C. in a series of instruments. Numerous forms of registering or maxima and minima thermometers, such as those of Walferdin, Negretti and Zambra, Casella and others, Breguet's metallic thermometer, the solar thermometer, the pyrheliometer, etc., etc. Also, all apparatus for making and graduating thermometers.

A complete set of Melloni's apparatus for the study of radiant heat, with Tyndall's additions, is also found here.

ELECTRICITY.

Under this head are included a complete series of instruments for class exhibition, as well as those for accurate measurements and investigation. Thus, in the first class are to be found the ordinary electrical machine, with all its attendant apparatus of Leyden jars, electroscopes, electrometers, bells, orreries, and the like; the Holtz machine, with various interchangeable plates and sectors, by means of which it can be combined in various ways so as to exhibit all the modifications and improvements which have from time to time been introduced in its form or construction by its inventor, and by Bertsch, Carré, Ritchie, Van Brunt, Poggendorff, and others. Also, various forms of the electrophorus, the



HOLTZ MACHINE. BY E. S. RITCHIE.

condenser of Epinus, and various instruments to illustrate the theory of induction, so important in its relations to submarine telegraphy, as well as in other subjects.

Three induction coils provide abundant means for illustration or research in cases where electricity of high tension is required. The largest of these contains fifty miles of fine wire in its secondary helix, throws a spark of twenty-one inches in the air, and pierces blocks of glass three inches thick.

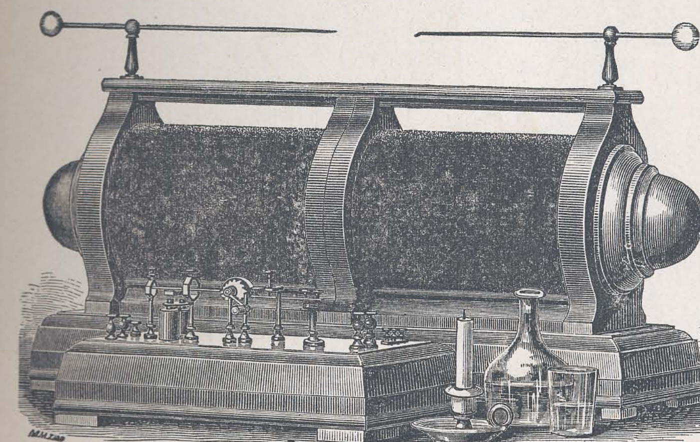
The second coil is one of Ritchie's upright form, and throws a spark of seven inches in the air.

The third is of French manufacture, of the horizontal pattern, 8 by 15 inches on the base.

A very extensive collection of Geissler tubes, including large globes filled with rarefied gases, to illustrate stratification in the electric discharge, numerous jacketed spirals for fluorescent liquids, large phosphorescent "garland" tubes, others containing solid phosphori "spectrum tubes," and others, numbering many hundreds in all, with various special pieces of apparatus, serve with these instruments to illustrate all the characteristics of electric discharge, etc.

A Grove battery of sixty couples, also a Bunsen battery of sixty couples for the electric light; another series of four immer-

sion batteries, each equal to fifteen Bunsen couples of more than a foot surface; a water battery of 550 cells; another water battery of 5,000 cells, and several other batteries for special purposes, such as a small immersion Smee battery of twenty cells for elec-



INDUCTION COIL. BY E. S. RITCHIE.

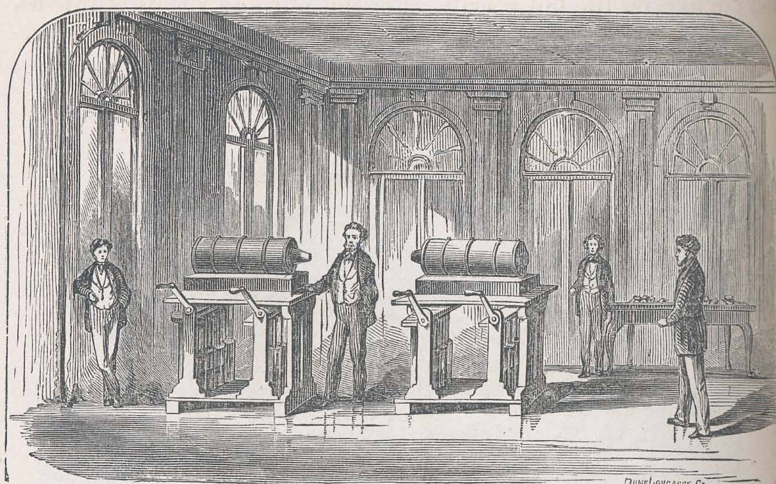
trical measurements, a Grove battery of twelve cells, a large Smee of eleven cells, a modified Daniell of seven cells, and many single cells, of the flask and other forms, afford an abundant supply of electric force for all purposes.

The largest electro-magnet yet constructed, weighing nearly a ton, containing in its eight spools some two thousand feet of wire, one fifth of an inch in diameter, and provided with all the attachments of experiments in diamagnetism, should be included here. With this instrument a number of outstanding problems in magnetism have been already solved, and its great power and efficiency will render it a valuable means of investigation in the future. It is so arranged as to be either used as represented in the woodcut, for illustration, or combined into other forms for experiments.

Among the instruments for electrical measurement are to be found every sort required for the most accurate and refined work in this department, and the various modifications of each instrument, which have been developed to fit it for a variety of work, some of these also being duplicated where extensively used. Thus, there will be found under the general class of galvanometers no less than ten distinct instruments, as follows:

1. A large tangent galvanometer of the simpler form, with two

circles of heavy copper, two feet in diameter, for measurement of heavy currents.



ELECTRO-MAGNET WEIGHING 1600 LBS. BY WILLIAM WALLACE & SONS.

2. The tangent galvanometer of Gaugain, with single cone containing two circuits. This instrument has a large needle, with long pointer of aluminum and a divided circle, reading to minutes, and is especially adapted to measurement of the internal resistance of batteries. It was made by Messrs. Knox & Shain, of Philadelphia.

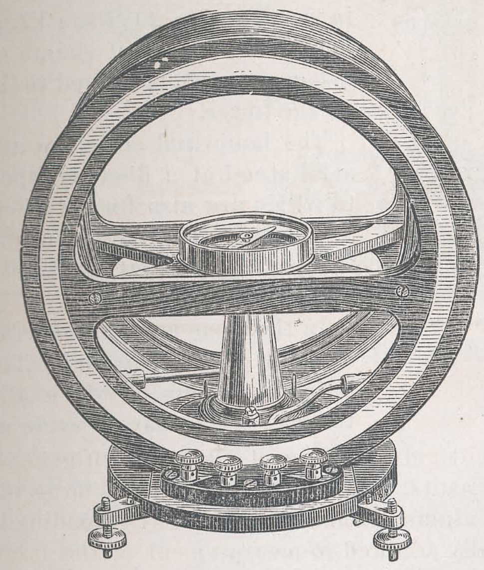
3. The tangent galvanometer of Gaugain, as modified by Elliott, of London. This instrument has two conical spirals, each containing three equal circuits, and is also provided with a double circle of heavy copper, to carry large currents. This instrument is adapted to a great variety of uses in connection with the measurement of currents and the resistance of circuits.

4. A small horizontal galvanometer, by C. T. Chester, of New York, very useful in measuring the resistance of ordinary circuits by the method known as "Wheatstone's bridge."

5. A Thomson reflecting galvanometer of low resistance, with lamp, scale, etc., by Elliott, of London. This is invaluable for accurate measurement of feeble currents and low resistances, and, in connection with a fine thermo-electric pile by the same maker, has already done good service in some important researches in heat.

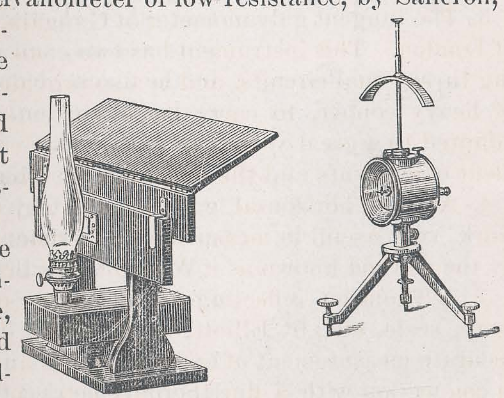
6. An astatic galvanometer of low resistance, by Elliott, of London. This instrument, shown in the adjacent figure, is exceedingly

sensitive, and, as modified by Prof. Mayer, exhibits with facility in the lantern all the most delicate experiments in thermo-electricity and the like, on the large scale. For this purpose a scale is drawn on the glass shade, and a pointer is carried by the suspended needle.



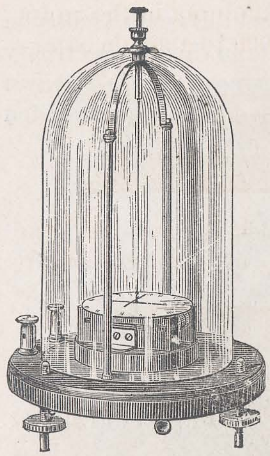
GAUGAIN'S TANGENT GALVANOMETER. FROM ELLIOTT & CO., LONDON.

7. Another astatic galvanometer of low resistance, by Salleron, of Paris. This is intended specially for use with the radiation apparatus of Melloni and Tyndall, with which it operates in a very satisfactory manner.



THOMSON'S REFLECTING GALVANOMETER.

8. Thomson's double coil astatic galvanometer of high resistance, with lamp, scale and set of shunts, by Elliott & Co., of London. This is the instrument used for transmitting messages on the Atlantic and other submarine cables, and also in many refined researches and determinations of very high resistances, such as those of glass, gutta-percha



ASTATIC GALVANOMETER.
FROM ELLIOTT & CO., LONDON.

and the like insulating substances. A set of micro farads also makes this instrument useful in measuring inductive capacity and electro-static charge.

This instrument is permanently located in the room No. 29 (*Plate VI.*), where it is fixed with its set of shunts of $\frac{1}{9}$, $\frac{1}{99}$, and $\frac{1}{999}$ on a bracket, secured to the main wall of the tower.

The lamp and scale are attached to a solid stand at a distance upon the floor, to which are also fixed various keys and switches for the different connections and reversals of current essential in making various measurements.

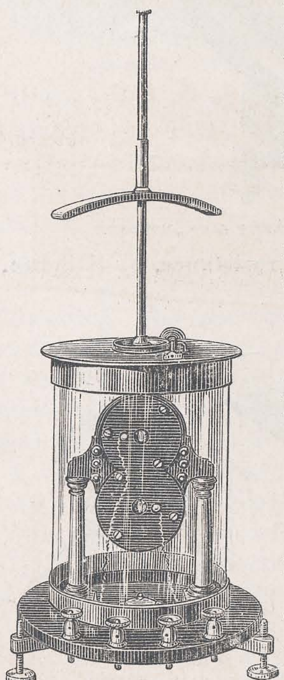
In the same room are several tanks with metallic connections and coils of insulated wire, by means of which all the conditions of a submarine cable are realized, and with which all the problems of determining a leak and localizing a "fault" are worked out exactly as with an ocean cable.

Cables measured at the Institute, with reference to their resistance, conductivity and other electrical relations, have been sent abroad, and subsequently measured by the ablest electricians of England, with entire agreement of results with those here obtained.

9. An adjustable astatic galvanometer, with coils of high and low resistance, for general experimentation.

10. A vertical galvanometer for class illustration.

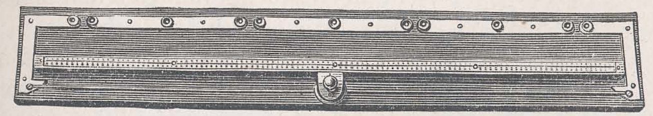
The above list of galvanometers, it will be seen, covers all requirements of the lecture room and the laboratory of physical research.



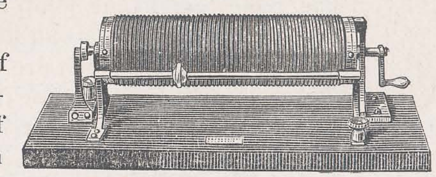
THOMSON'S ASTATIC GALVANOMETER.

For use with these, in the various problems of electrical measurement, are a Wheatstone's bridge, Poggendorff's rheocord, Wheatstone's rheo-

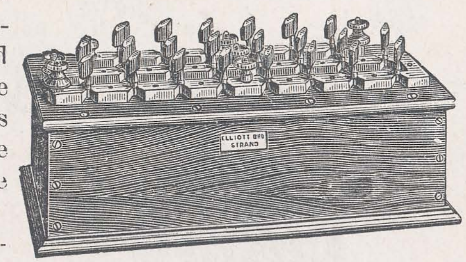
stat; an extensive set of resistance coils, containing in the aggregate some 10,000 ohms, and running from 5000 to a single ohm.



Various methods of making connections, such as "switches" and "keys" of different forms and numbers of connections, are provided for convenient use with these instruments.

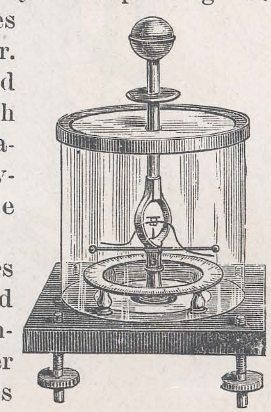


For the measurement of statical charge, there is provided an improved form of Coulomb's electrometer, in which the directive force of a small magnet is substituted for the torsion of a fibre, and the deflections are read by a graduated scale.



To avoid errors of "parallax" in reading this instrument a mirror is placed in the base, and when the reading is made the eye is so placed as to bring the rod and its reflected image into coincidence.

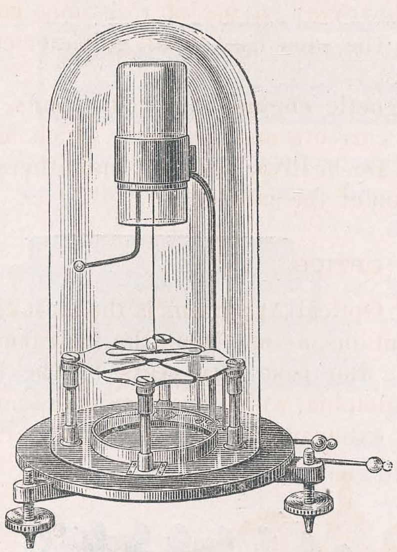
Also, a Thomson quadrant electroscope, in which a small Leyden jar gives permanent charge by the suspending wire to a light aluminum blade, which also carries a small magnet and a thin glass mirror. Alternate quadrants of metal, supported horizontally below this, are connected with the ground and the body under examination, and the blade is thus powerfully covered in a direction which indicates the nature of the charge to be studied.



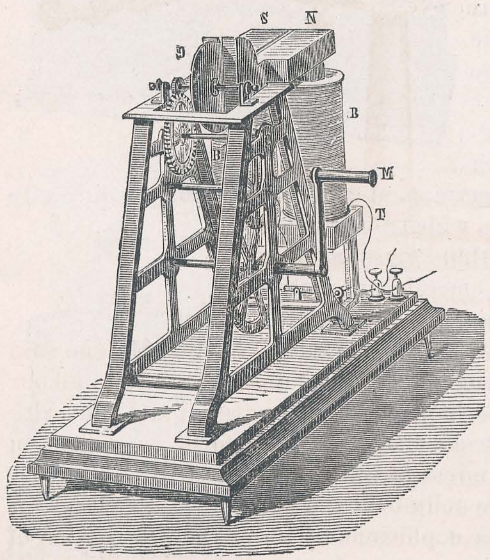
A condenser of standard micro-farads serves to measure the electric capacity of insulated conductors under various conditions of induction, and this last action may be further studied by numerous arrangements of spirals and coils, such as have been employed by DuBois-Reymond, and others. Thus one of these consist of two equal coils mounted parallel to each other on brass columns. Each coil is double, or made by winding two wires at once on the spool, and the terminals admit of various connections with battery and galvanometer. Thus, if these are so arranged that the induced currents will be thrown in opposite directions by the coils, the effects of different cores or different primary currents may be compared by balancing one against the other, either with or without shunts and other exterior resistance.

Another instrument for similar measurements consists of a primary spiral, supported horizontally by one end, so that a secondary spiral may be moved more or less over or away from it, the distances being measured by a graduated scale.

Yet another consists of movable flat spirals, with convenient mounting and graduated scale; also,



THOMSON'S ELECTROMETER. FROM ELLIOTT & CO., OF LONDON.



FOUCAULT'S APPARATUS. BY J. SALLERON.

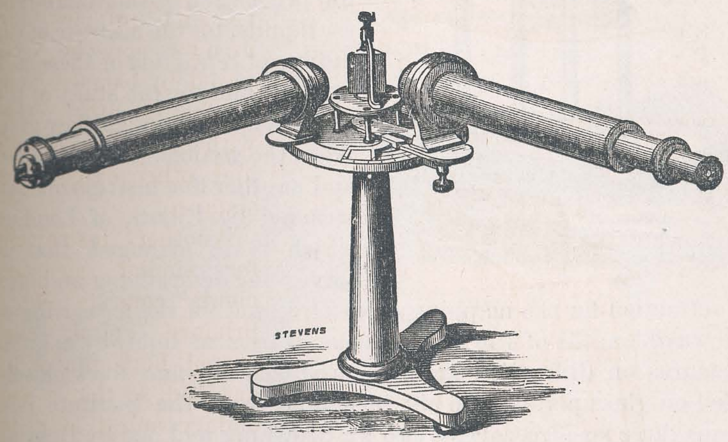
Delezenne's ring, for developing a galvanic current from the earth's magnetism; also, another instrument of the same sort, two and a half feet in diameter, for class illustration.

Also, from Chester, of New York, a set of resistance coils, bridge and galvanometer in the same case, small galvanometer, commutator, etc.

A large collection of magnetic engines and instruments, for illustrating the relations of currents and magnets, which have been developed by Ampère, De la Rive, Faraday, and others, is also to be found in this portion of the cabinet.

OPTICS.

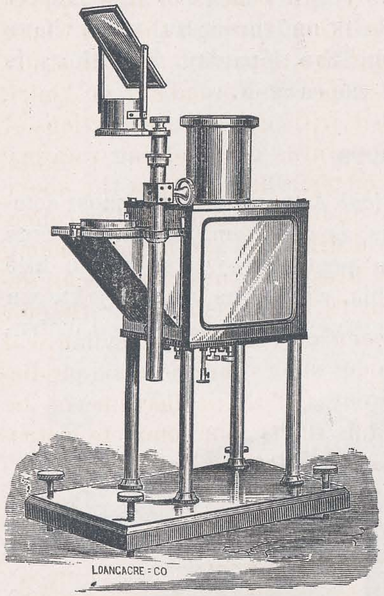
The Institute's Cabinet of Optical Apparatus is the most complete in the country. It contains, as one item, the instruments continuously collected during the past fifty years by the late Charles N. Bancker, of Philadelphia, which has been long known to men of science as the most extensive museum of optical instru-



SINGLE PRISM SPECTROSCOPE. BY J. BROWNING.

ments existing in any part of the world. The Abbé Moigno said of it, in the "Cosmos," that "it embraced more riches than all our cabinets of France, and perhaps of Europe united"; and this, with the additions made to it since its purchase, forms a collection illustrating the whole progress of optical discovery.

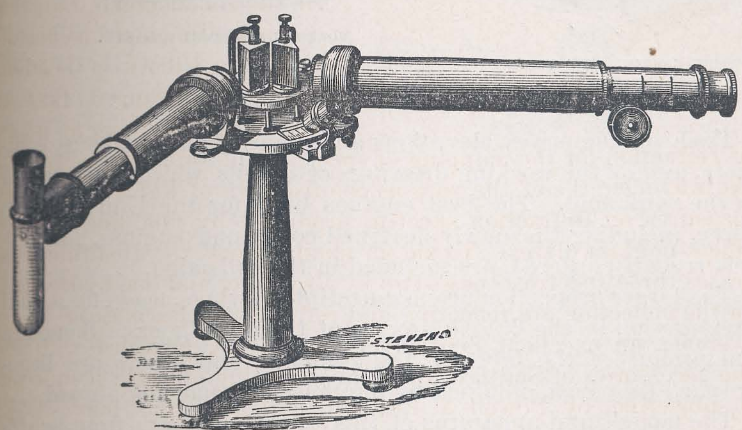
In this department are found all the aids necessary either for class illustrations of optical phenomena or for the prosecution of higher studies. Thus, there are here included electric and oxyhydrogen lanterns of various forms, fitted for the various requirements of projection, such as a large lantern with eight-inch condensers, for drawings, and other large objects—two with five-inch condensers, with vertical attachment, two with four and a half inch condensers, for use in different lecture-rooms, one for polarized light, one for the gas microscope, one for spectrum projections with lime light, one for the same with the electric light; porte-lumières and heliostats, for the introduction or direction of pencils of light to be experimented with; apparatus for illustrating the laws of reflection; prisms of all kinds of glass, quartz, fluor-spar, calc-spar, amber, and rock salt, as well as hollow prisms and prismatic troughs for liquids, for the measure of the indices of refraction of these substances, and for the study of the various spectra which they give. Also, the goniometer of Babinet, and another fine instrument constructed by Elliott, of London, which is so arranged that it serves for determining an index of refraction for the mapping of spectra, and for the measuring of the wave-lengths of the various colored rays of light, by angular measures on diffraction spectra, produced by fine lines closely ruled on glass plates. To aid in similar work the Institute possesses three spectroscopes—two by Browning and one by Desaga. In the collection are reflecting and refracting telescopes of every system; an excellent Zentmayer microscope, provided with all the accessories of Smith & Beck for mounting objects; a superior $\frac{1}{12}$ objective, by Powell & Lealand, and numerous microscopic objects, including a superb Müller diatomacean type plate.



COLLEGE LANTERN. GEO. WALE & CO.

Becquerel's phosphoroscope, and all of Stokes' apparatus for the study of fluorescence, including prisms, lenses, and tanks of quartz, a lens of fluor-spar, large blocks of uranium glass, and a very complete collection of fluorescent solids and liquids, furnish peculiar facilities for the exhibition and study of these interesting phenomena.

The instruments for elucidating the phenomena and laws of the diffraction, the interference, and the polarization of light are so numerous that we can particularly mention only a few of them—as the diffraction bench of Duboscq, and another of Babinet; a superb interferential refractometer of Fresnel and Arago, for measuring indices of refraction of gases by the displacement of the interference bands produced by two pencils of light, one of which has passed through air, the other through the gas whose index we would determine. Among the apparatus for the study of polarized light there are polariscopes of Noremberg, of Amici, of Airy, and of Dove—accompanied with complete collections of crystal sections; Biot's large apparatus for studying rotatory polarization, and Soleil's saccharimeter, which applies the above phenomena to the analyses of cane and grape sugars. The collection also contains a series of optical drawings and models, among which we may mention models of Fresnel's wave surface, as developed by Hamilton; with Lloyd's and Beer's apparatus for showing the remarkable phenomena of conical and cylindrical refraction, of which Hamilton's model shows the theoretic prediction. Some notion of the completeness of this collection can be formed from the fact that it contains thirty-four complete instruments for the study and application of polarized light alone.

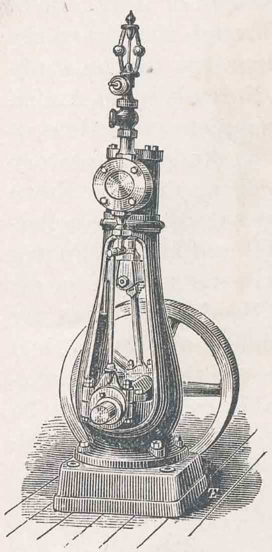


TWO PRISM SPECTROSCOPE. BY J. BROWNING.

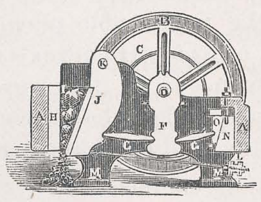
COLLECTIONS IN THE DEPARTMENT OF ENGINEERING.

The collections of drawings, apparatus, and models in the department of mechanical engineering, which are already quite extensive, are continually being enlarged, both by purchase and by contributions from manufacturers, engineers, and other friends of the Institute.

Among the drawings are complete sets representing the hulls and engines of steam vessels, locomotive and stationary engines, and machinery of various kinds.



DRIVING ENGINE. NEW YORK SAFETY POWER CO.



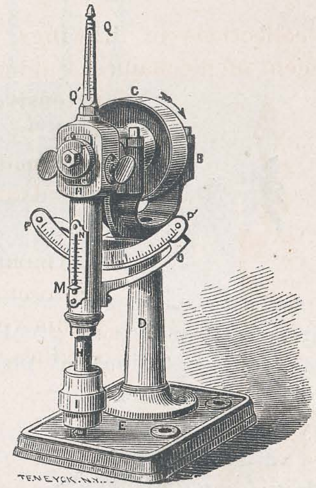
MODEL BLAKE STONE BREAKER.

Each set comprises elevations and plans of the machines complete, and of the working drawings of details which are required in the workshop. The best engines built for the United States Navy, including the newly designed compound engines, for vessels recently ordered, are included in the collection.

The larger proportion are manuscript drawings, made for actual construction in the drawing-rooms of their designers. Some are the product of the labor of the students, and others are lithographed drawings, obtained by purchase at home and abroad.

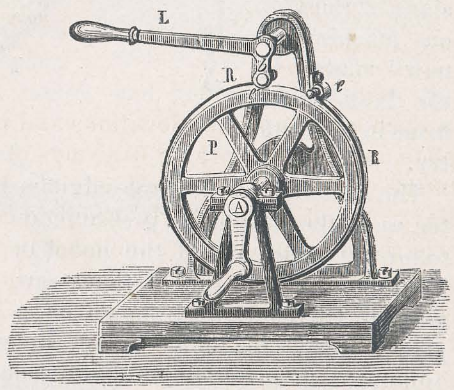
The models and apparatus of this department are from Schröder of Darmstadt, and Salleron of Paris; from the instrument makers of the Institute, and from the Patent Office at Washington. A considerable number are built in the workshops of the Institute, and the designs for others are in preparation by the students, under the direction of instructors.

The accompanying sketch* represents the machine for testing lubricants, referred to on page 85, invented by the Professor of Engineering, and planned in all its details by a pupil. Its purpose is to determine all the qualities of lubricants, and to ascertain their fitness for special uses.



MACHINE FOR TESTING LUBRICANTS.

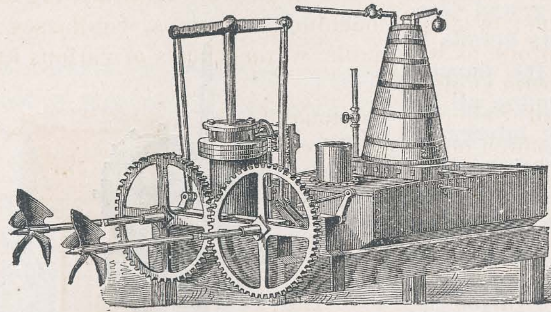
The collection of engineering relics is becoming very interesting, and includes the high-pressure condensing engine, and water tubular boiler, and screw which, in 1804, drove John Stevens's first steamboat eight miles an hour, on the Hudson, and also the twin screws used in 1805 by that engineer with the same engine. The steam boiler of an experimental locomotive built by Col. Stevens in the early part of the present century is also here. The patent certificate issued from the English Patent Office in 1805 on this boiler, and models of these boilers are preserved here. Autograph letters of Robert Fulton, of Robert Stephenson, and of Commodore Decatur, and autograph drawings by Robert Fulton of the engine of his first successful steamboat, the Clermont, and of the Chancellor Livingstone, are to be seen in



RIBBON BRAKE. BY J. SALLERON.

* From the Scientific American.

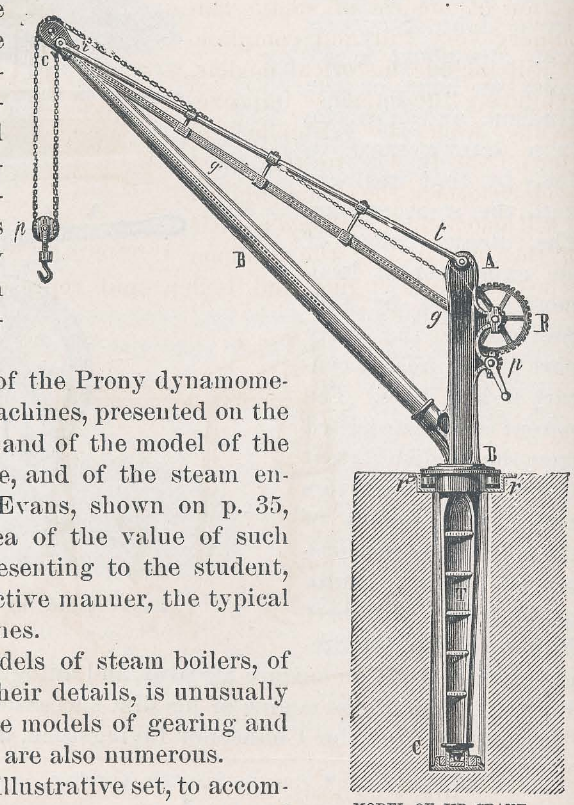
the lecture-room. Models of the earliest of iron-clads, and of the Stevens battery, are here also.



ENGINE, BOILER, AND SCREW PROPELLERS USED BY COL. STEVENS IN 1804.

Many specimens are of great interest historically, as well as valuable representations of peculiar forms of machines or of mechanical movements.

Many of the most valuable have been contributed by manufacturers, and exhibit the designs of the various machines as now made by the best known firms in the country.



MODEL OF JIB CRANE.
BY J. SALLERON.

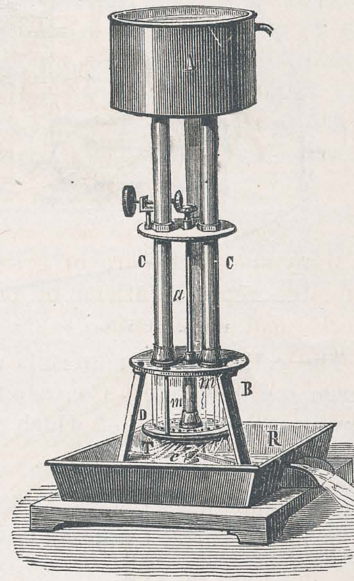
The sketches of the Prony dynamometer, and other machines, presented on the following pages, and of the model of the Fontaine Turbine, and of the steam engine of Oliver Evans, shown on p. 35, give a good idea of the value of such apparatus in presenting to the student, in the most effective manner, the typical classes of machines.

The list of models of steam boilers, of engines and of their details, is unusually complete, and the models of gearing and simple machines are also numerous.

There is a full illustrative set, to accompany the regular course, of models of

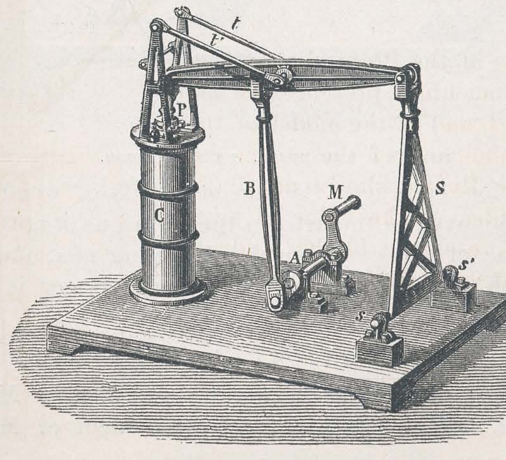
trusses and bridges; of the elements of machines, such as cams, gearing, and cranks, and other methods of transmitting and modifying motion; of simple machines, as pumps, windlasses, and pulleys; of motors, as wind-mills, water-wheels of various kinds, air, gas, and steam engines.

Several of Salleron's sectional models, of which one is exhibited on page 36, are among the last named, and are found to be of great value in teaching the student the nomenclature and functions of the various parts of the steam engine, in tracing the causes of derangement, and in exhibiting the method of repairing injuries.



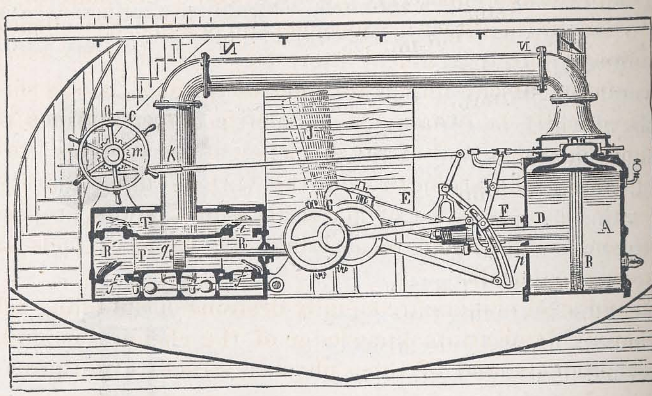
FONTAINE TURBINE. BY J. SALLERON.

It is intended to make the collection of models of steam machinery very full and complete. It will include historical models, exhibiting the immense improvements, from the "Ælopile" of Hero (250 B. C.) to the most modern form of the steam engine; it will also include *sectional* models of the principal of the common types of both engine and boiler, and representations of the



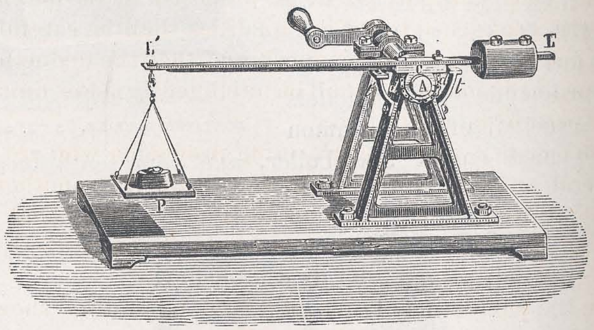
OLIVER EVANS' ENGINE AND PARALLEL MOTION. BY J. SALLERON.

usual modifications of their more important parts and appurtenances.



SECTIONAL MODEL OF A MARINE ENGINE. BY J. SALLERON.

The collection of materials of construction is becoming quite large and complete. Contributions are received from many different sources, some of which are of both scientific and practical interest.



PRONY'S DYNAMOMETER. BY J. SALLERON.

This collection embraces the various kinds of woods, stones, and metals employed in the arts, in their various stages of preparation for use; of the commercial lubricating oils, and of other materials, with the properties of which the engineer is expected to be familiar.

THE MECHANICAL LABORATORY.

The Trustees have been urged to establish a Mechanical Laboratory in connection with the department of Mechanical Engineering.

A Laboratory for Technical Research, or a "Testing Laboratory," as it was denominated, it was stated, if properly organized, well equipped, and effectively operated, could be made of exceptional value in the direct advancement of science, as well as in the promotion of purely technical interests.

The officers of our important lines of railroad, it was said, desired frequently to obtain dynamometric determinations of the resistance of trains, and of the efficiency of locomotives; to learn with precision the strength and the various other hardly less important characteristics of materials which it was proposed to use in construction; and to ascertain the value of fuels and of lubricating materials.

Iron and steel makers are equally desirous of obtaining reliable and thoroughly accurate knowledge of the chemical constitution of their products, and of their physical structure and properties, and such knowledge of the relations existing between these two sets of qualities as can only be secured by careful comparison of the results of skilful and systematic investigation.

Manufacturers of machinery, and constructors generally, are seriously in need of a recognized authority, to which they may send the materials purchased, or proposed to be purchased, by them, with confidence that their qualities shall be carefully determined, and their value ascertained, and that the deductions from experimental examination shall be intelligently made, uninfluenced by any private interest.

Those members of the engineering profession who are engaged in general practice were said to constitute still another class of business men to whom such an institution would lend valuable aid; and, in fact, every business would derive, directly or indirectly, great advantage from its establishment.

Were the foundation of this proposed laboratory shown to be practicable, it was thought that all would assist, and that the three classes first named would consider themselves justified in uniting to contribute to its creation and support; that business interests and a liberal policy would combine to secure its establishment, on such a basis as would insure every facility for the investigation of problems arising daily in practical work, in the systematic and thoroughly scientific and effective manner proposed.

It was considered that this laboratory, devoted to technical research and to the practical application of science in matters of business, should be under the charge of some scientific institution of acknowledged high character, in order that perfect reliability of its work should be secured. It should be conveniently located, in order that all of those who should aid in its establishment should find it readily accessible. It should be supplied with the most delicate instruments, the most powerful testing machines of all kinds, and a full supply of the best forms of dynamometric apparatus known to engineers.

It should have conveniently near a corps of scientific men, familiar with the practice of engineering, whose opinion could at any time be asked in matters with which they might be most familiar.

The best collections of physical and chemical apparatus should be within reach of its officers, in order that they might, in the hands of those directly responsible for them, be brought into use whenever work in progress should render special researches in pure science advisable.

The laboratory should be provided with well trained and educated experimenters, capable of making satisfactorily any series of investigations that might be called for.

It was urged that these requisites could probably be best secured by the establishment of the proposed Mechanical Laboratory in connection with this Institute.

Its central location, its special adaptation in plan and method of instruction as a School of Mechanical Engineering, its extensive collections and their unexceptional character, the completeness of its organization, and its thorough adaptation in all respects to this kind of work, seemed to indicate this as the best possible location for such a new department as that proposed.

It was considered that such a plan would give to the country an institution such as has never yet been organized, and one whose value would prove beyond estimation. That the accumulation of facts, the valuable application of science, and the directly practical bearing of the work which may be done, would in a comparatively short time be productive of rich results.

It was thought that it would do most effectually that work which has hitherto been too much neglected—the application of scientific knowledge to familiar work and matters of business. It would do much to close up the space which so widely separates the man of business from the man of science, and would lead to a far more perfect system of mutual aid than has yet existed.

It was urged that such an institution can do no nobler work than that which, by assisting in the improvement of technical

methods, and by the application of science to improvements in practical construction, aids in the development of the natural resources of our country, stimulates the growth, in extent and perfection, of its most important industries, and contributes in so many ways to the welfare of the people.

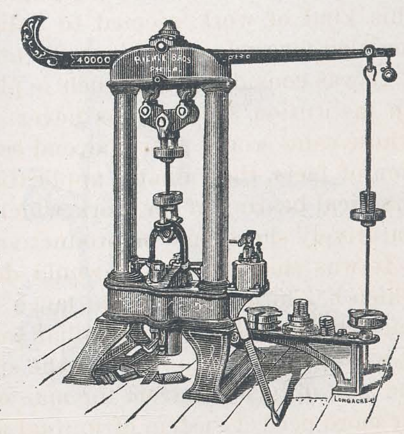
The Trustees recognize fully the importance of bringing into as close relations as possible the science and the industrial knowledge of the country, and understand the effectiveness with which the workers in the two fields may aid each other.

In establishing the Stevens Institute of Technology on its present plan, they felt that its success in the field of labor chosen would become an important element in securing this coöperation of science and labor, and of theory and practice, by giving to the world a class of men who should combine as effectively as possible these two important elements of successful training.

They recognize in the proposed plan a means of rendering the work of the college still more effective, and have accordingly directed the establishment of such a Mechanical Laboratory.

They have transferred to the Director, to be held and used for the benefit of the Laboratory, a small machine shop and tools, and a considerable amount of apparatus, including several testing-machines, steam-engine indicators, dynamometers, and other instruments, of a total value of about $5,000. They authorize the use of any available space within the buildings or upon the grounds, and set apart a strip of land adjacent to the buildings of the Institute, not exceeding 200 feet in length and 50 feet in breadth, upon which any new buildings required may be erected.

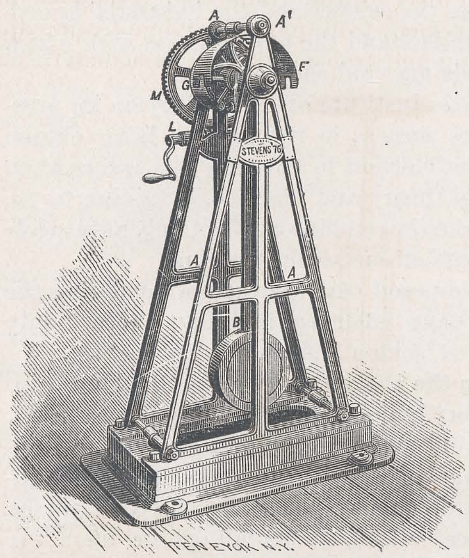
The Mechanical Laboratory now has one of Riehlé Bros. tensile testing machines, of a capacity of twenty tons, with which a considerable variety of materials has been tested. This machine was exhibited and tested at the exhibition of the Franklin Institute, at Philadelphia, in 1874. It is both delicate and accurate.



TENSILE TESTING MACHINE. 20 TONS CAPACITY.

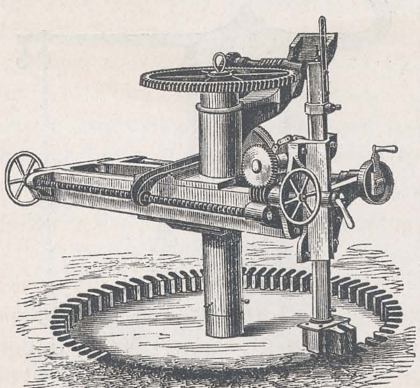
A sliding poise, not shown in the figure, has been added, which greatly facilitates the usual tedious process of testing, and other improvements, among them an attachment for transverse tests, have been introduced.

The Laboratory possesses two autographic testing machines, which were designed for the purpose of making unusually accurate and extended researches.



THE AUTOGRAPHIC TESTING MACHINE OF PROF. THURSTON.*

These machines automatically produce and record a strain-diagram, which exhibits the strength, ductility, homogeneousness, elasticity, the limit of elasticity, and the resilience or shock-resisting power of the metals tested in it. This record is examined, its indications entered in the record book, and the strain-diagram itself preserved for reference. The fractured surfaces or samples thus tested are exceptionally valuable as indicating the character of the material. One half is usually sent to the proprietor of the specimen, and the other half retained in the cabinet of the Laboratory. This method of test has been adopted very usually in the Laboratory, and some thousands of specimens are already (January, 1878) catalogued. The machine was examined by a special board of examination detailed by the Navy Department, and was commended by them. It has received the



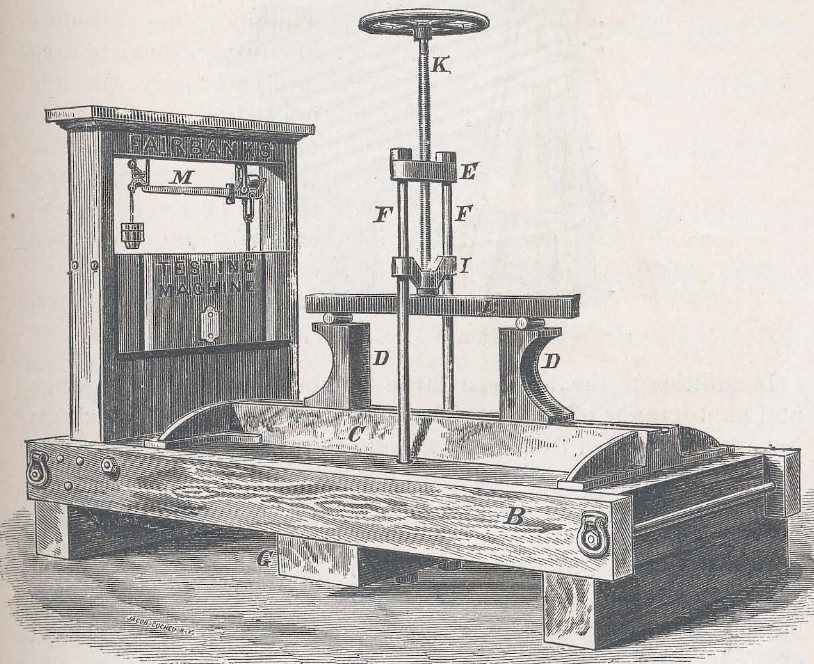
SCOTT'S GEAR MOULDING MACHINE.

* From the Scientific American.

gold medal of progress of the American Institute,* and medals of the Cincinnati Industrial Exhibition, and of the Centennial International Exhibition, 1876.

Some interesting scientific work and some important discoveries have been made with this machine.

The Laboratory possesses a machine constructed by the Messrs. Fairbanks especially for tests of the transverse resistance of materials of construction, cement testing, steam-gauge testing apparatus, and also recording and transmitting dynamometers, an



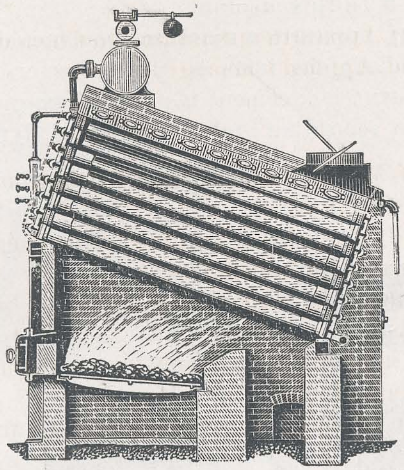
FAIRBANKS' TRANSVERSE TESTING MACHINE.

excellent set of steam-engine indicators, apparatus for testing fuels, lubricants, etc., and other valuable apparatus, with which much work has been done.

The machine shop is fitted up with one of Sellers' planers, a Sellers' lathe, a Star Tool Company's lathe, Brown & Sharpe universal milling machine, an upright drill, Tanite, Northumberland and Lehigh emery grinding machines, and other tools. The driving engine is from the New York Safety Power Co.

* See Journal of Franklin Institute, 1873; Van Nostrand's Eng. Mag., 1873; Lond. Engineering, 1873; Trans. Am Soc. C. E., 1874, et seq.; etc.

In the machine shop are built the autographic testing machines for metal, and the oil testing machines already illustrated, a variety of model work, and such work as is required for the Mechanical Laboratory.



SAFETY SECTIONAL BOILER. ROOT STEAM ENGINE CO.

In addition to the above, a large number of models, drawings and photographs of bridges, locomotives, and other constructions have been received from many friends of the Institute.

COLLECTIONS IN THE DEPARTMENT OF DRAWING.

A set of Models of Problems in Descriptive Geometry, of wood and metal, from Schröder, of Darmstadt. A set of Olivier's Models, with brass frames and silk cords, and a large collection of Model Drawings of subjects in Mechanical Engineering and Architecture, as also a large collection of all such drawing instruments as are desirable and not included in the simple sets required by each student.

COLLECTIONS IN THE DEPARTMENT OF CHEMISTRY.

The collections of the Chemical Department may conveniently be classified under four heads:

I. Cabinet of Minerals, Rocks, Fossils, Economic Minerals, and Models of Crystals.

II. Cabinet of Ores, Metallurgical Products, and Models of Furnaces.

III. Cabinet of Chemical Substances, arranged according to their chemical relationship, and Cabinets of Applied and Industrial Chemistry.

IV. Museum of Apparatus pertaining to Chemical Physics and to Theoretical and Applied Chemistry.

I.

The Cabinet of Minerals comprises 5,500 specimens. They are divided into six collections.

1. Systematically classified, according to the chemical and crystallographic nature of the substances.
2. Large specimens, showing the including rocks and the association of minerals.
3. Unclassified and unlabelled substances, for use by students in the determination of minerals.
4. Lithological: 100 specimens, systematically arranged, of the rocks of Europe.
5. Geological: 500 specimens, systematically arranged, of the characteristic fossils of the geological formations.
6. Building stones employed in the United States.

A sufficient number of models of crystals has been obtained to illustrate the crystalline form of the most important mineral species, and to elucidate the science of crystallography.

During the past year very extensive collections have been made in that district of New Jersey in which the Institute is located, and duplicates sent to many of the colleges in this country and in Europe.

II.

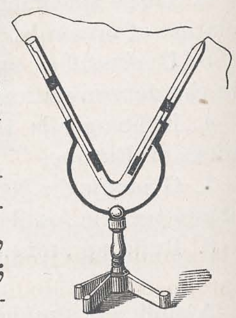
In process of formation.

III.

The Cabinet of Chemical Substances comprises specimens of barium, strontium, palladium, selenium, titanium and the rarer metals generally, in the elementary condition; also, all the common and many of the rare metallic salts. A sufficient number of specimens, illustrating the application of Chemistry to the arts, has been procured to lay the foundation of a Cabinet of Technical Chemistry, and the attention of manufacturers who may desire to deposit, in a public place devoted to Technical Science, specimens of their products, is particularly called to this important collection.

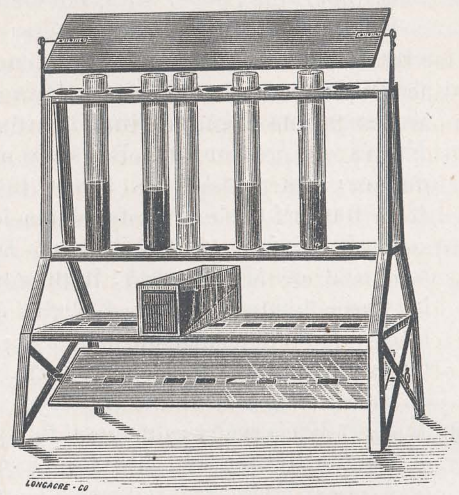
IV.

Apparatus for burning phosphorus in oxygen; acid and cobalt bottles for testing; liquefied carbonic acid in strong glass tubes; Scheibler's apparatus for determining the quantity of carbonic acid in bone-ash; carbonic acid generators; sulphuric acid desiccating pans; Hofmann's hydrochloric acid apparatus; acidimetry jars, graduated from 100 to 1,000 c.c.; sulphuric acid generators; phosphoric acid generator; phosphorous acid generator; pipettes and siphons of various sizes, for acids and alkaline liquids; adapters, straight and curved; alcoholometers of various standards, with jars and cases; alembics; carbonic acid apparatuses of Wetherill, Fresenius, Will, Berzelius, Rose, Mohr, Geissler, and Kipp; alkalimeters of Mohr, Leslie, Descroizillé and Gay-Lussac.

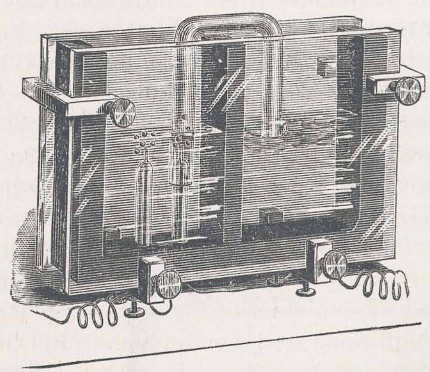

HOFMANN'S APPARATUS FOR DECOMPOSING AMMONIA.

Hofmann's apparatus for decomposing ammonia; ammonic chloride apparatus; blowpipe anvils; arsenic apparatuses of Marsh, Fresenius, and Mitscherlich; arsenic tubes; Becker's balances; scales of various sizes; collodion balloons; barometer tubes; beakers of Griffin's and of German form; bell jars; hand and foot bellows; blast-lamps; blowpipes; oxyhydrogen blowpipes; hydrogen blowpipes; boltheads; burettes of Gay-Lussac, Geissler, and Mohr; Erdmann's floats; burette holders and clamps; Warmbrunn and Quilitz's Bunsen burners; De Saga's Bunsen burners for spectroscopic work; Leppin and Mäsche's self regulating burner; compound and rose burners; Professor J. Lawrence Smith's burners; calorimeter; capsules of Berlin and Meissen porcelain; casseroles; Plattner's borers, various patterns; calcic chloride jars and tubes; chlorine generators; platinum and porcelain boats for ignitions and combustions; furnaces for organic combustion; combustion tubes; magnetized bars and compass for determination of minerals; Liebig's condensers of glass, tin, and brass; sulphurous acid condensers, straight and U-shaped, with stopcocks; generators of small quantities of gases; platinum cones for Bunsen's pump; connecting-tubes—straight, curved plain, bulbed—with safety tubes and T joints; cork borers, knives,

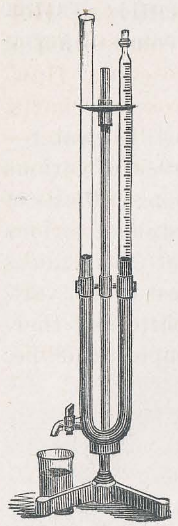
and presses; crucibles, Hessian, iron, plumbago, royal Berlin, Meissen, and platinum; crucible moulds and supports; crucible tongs; cryophori; crystal drainers; crystallizing dishes of porce-


COLOR COMPARATOR. LEEDS.

lain and glass; cupels; cupel moulds; cylinders, graduated and stoppered; collodion flasks; deflagrating covers; globes, jars,


OZONE BY ELECTROLYSIS. LEEDS.

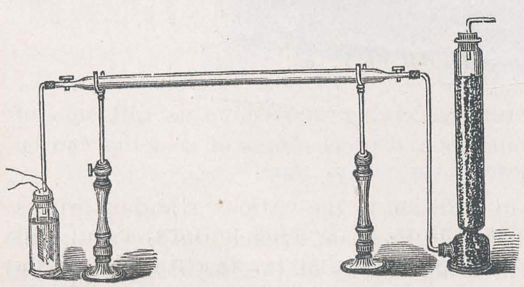
stands and holders; desiccators, of bell-jar pattern, Schrötter's pattern, and with ground-glass caps; dialyzer; cutting diamonds; diamond mortars for crushing minerals; digestors, royal Berlin and Meissen; iron dippers and ladles; displacement apparatus of various patterns; Döbereiner's lamp, dropping pipettes, drying baths and oven; elutriators; diffusion apparatus; ether still; eudiometers.



HOFMANN'S LECTURE EUDIOMETERS.

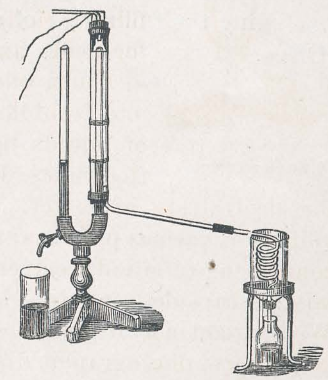
Hofmann's lecture eudiometers; assay flasks; round and flat-bottomed glass, copper and iron flasks; forceps, funnels, cupel furnaces, galvanic batteries, gas bags, pressure boards, gas bottles; Kipp's gas generators; Bunsen's mercurial gasometer; gas pistols, gas tubes, Geissler tubes; glassblowers' tables; glass plates for analysis of colored flames; goniometers of Haüy, Wollaston, and of Mitscherlich, improved by Groth; blowpipe hammers; Von Kobell's scales of fusibility; Mohr's scales of hardness; hydrometers for acids and alkalies, beer, wine, milk, ethers, alcohols, oils, and saline solutions; of Beaumé's and Twaddle's scales; universal for specific gravity of liquids lighter and heavier than water; ignition tubes; Hofmann's improved lecture apparatus for electrolysis of water, hydrochloric acid, etc.; jets of glass and brass, various patterns; platinum retort, with platinum funnel, condensing-tube and receiver; graduated flasks; mercury troughs; mixing capsules; agate, glass, and iron mortars and pestles; Wedgewood mortars; muffles; Will's nitrogen bulbs; nitrous oxide generators; photographic dishes and baths of glass, porcelain, and india rubber; nipper taps; pipettes, straight, bulbed, cylindrical, plain, graduated, and of constant volume.

Hofmann's apparatus for analysis of hydrochloric acid; platinum dishes; Sprengel's mercurial pump; pneumatic troughs, tin and glass; single barreled air-pump, for use in organic analysis; potash bulbs of Geissler, Liebig, Mitscherlich, and Mohr; precipitating glasses; bisulphide of carbon prisms; retorts, plain and tubulated; rings—straw, brass, iron, and glass of various sizes; rubber tubes, corks, sheets, cylinders, and cones of various description;



HOFMANN'S APPARATUS FOR ANALYSIS OF HYDROCHLORIC ACID.

sieves of hair, brass, bolting-cloth, etc.; spatulas of glass, horn, porcelain, and platinum, of various sizes and patterns; Hofmann's lecture apparatus for demonstrating the composition of hydrochloric acid; specific gravity bottles; spectroscopes (Hawkins & Wale) for direct vision, and De Saga's spectroscope, charts, and stands; stills (large) for the manufacture of distilled water—small, for special purposes; stop cocks, glass and brass, of various sizes and patterns; Hofmann's lecture apparatus for synthesis of carbonic and sulphurous acids; burette and pipette stands, various patterns; retort and apparatus stands, various patterns; tanks for absorbing media and lantern; cathetometer; test-tubes, various sizes; test-tube racks and holders, various patterns; thermometers, Fahrenheit and Centigrade; tongs—cupel, crucible, iron, German silver, and platinum; triangles—glass, iron, porcelain, fireclay, platinum; tripods—iron and brass; tourmaline pincers; various water-baths; washing-bottles, various patterns; water-bath at constant level; Jolly's spring-balances; Hofmann's apparatus for eudiometric analysis of water, marsh gas, and olefiant gas; Hofmann's apparatus for volumetric analysis of hydrochloric acid, water, and ammonia; Hofmann's apparatus to demonstrate the constancy of proportion between the elements of water.



HOFMANN'S APPARATUS FOR VOLUMETRIC COMPOSITION OF WATER.

Hofmann's apparatus to demonstrate the proportion between the volumes of hydrogen and oxygen in water; Hofmann's apparatus for demonstrating the equality of simple and compound gases under equal variations of temperature and pressure.

LIBRARY.

The library is constantly receiving accessions, as full sets of the various scientific journals and proceedings of societies can be obtained.

It already contains, in addition to the various standard works on science and engineering in English, French and German, full sets of the Philosophical Transactions of the Royal Society, The Proceedings of the Royal Institution, The Comptes Rendus of the

French Academy, and Transactions of various other societies. Also, the Philosophical Magazine, Taylor's Scientific Memoirs, Engineering, The Engineer, The Mechanic's Magazine, Iron, Cosmos, Les Mondes, Annales de Chimie et de Physique, Chemical News, Silliman's Journal, The Journal of the Franklin Institute, Nature, Poggendorff's Annalen der Physik und Chemie, Erdman's Journal für praktische Chemie, Proceedings of the Royal Society, Reports of the British Association for Advancement of Science, Dingler's polytechnisches Journal, Journal of the Chemical Society, London, Workshop (Gewerbehalle), Quarterly Journal of Science, and Karl's Repertorium. These are all in full sets to date, and new issues are regularly received, as also is the case with all the American publications bearing upon general science or the special subjects of Mechanical Engineering, including the full series of specifications published by the Patent Office.

Contributions to Science.

AN account of the Institute would be far from complete without some notice of the work which has been executed in the various departments in the direction of original investigation and contributions to the progress of scientific knowledge. We therefore subjoin a list of papers published by the various members of Faculty during the seven years of the existence of the Institute.

By PRESIDENT HENRY MORTON, Ph.D.

THE FLUORESCENT RELATIONS OF ANTHRACENE AND CHRYSOGEN. Chemical News, vol. 26, p. 199; Philosophical Magazine, vol. 44, p. 345; Poggendorff's Annalen, vol. 28, p. 292; Moniteur Scientifique, vol. 15, p. 353.

THE FLUORESCENT RELATIONS OF A NEW HYDROCARBON FOUND IN PETROLEUM DISTILLATES. Chemical News, vol. 26, p. 272; Phil. Mag., vol. 46, p. 89; Moniteur Scientifique, vol. 15, p. 356.

THE FLUORESCENT RELATIONS OF CHRYSENE AND PYRENE. Chemical News, vol. 31, pp. 35 and 45; Moniteur Scientifique, vol. 17, p. 132.

FLUORESCENZVERHÄLTNISSE GEWISSER KOHLENWASSERSTOFFVERBINDUNGEN IN DEN STEINKOHLEN UND PETROLEUM DESTILLATEN. Poggendorff's Annalen, vol. 155, p. 551.

THE FLUORESCENCE AND ABSORPTION SPECTRA OF THE URANIUM SALTS. In this research Dr. H. C. Bolton, of Columbia College, New York, was associated. Chemical News, vol. 28, pp. 47, 113, 164, 233, 244, 257, 268; Moniteur Scientifique, vol. 15, p. 963; vol. 16, pp. 24, 305.

ON CERTAIN BASIC SALTS OF URANIUM. Chemical News, vol. 29, p. 17; Moniteur Scientifique, vol. 16, p. 318.

APPARATUS AND METHODS OF OPTICAL PROJECTION. Scientific American, vol. 29, pp. 163, 184, 200; Chemical News, vol. 21, pp. 231, 245; vol. 24, p. 92; vol. 25, p. 251; Quarterly Journal of Science, No. 35; Poggendorff's Annalen, vol. 157, pp. 150, 396.—1872.

A NEW FORM OF THE BUNSEN BURNER. Chemical News, vol. 32, p. 251; Poggendorff's Annalen, vol. 156, p. 654.

THE TOXICAL EFFECTS OF CARBONIC OXIDE. Am. Gaslight Journal, March, 1878.

THE PARAFFINES IN COMMERCIAL "WATER-GAS." In conjunction with Mr. W. E. Geyer, B. S. Chemical News, May, 1878; Moniteur Scientifique, June, 1878.

BY PROF. A. M. MAYER, PH.D.

ACOUSTICAL EXPERIMENTS, showing that the Translation of a Vibrating Body causes it to give a Wave-Length Differing from that Produced by the same Vibrating Body when Stationary. American Journal of Science, April, 1872. Philosophical Magazine, vol. 43, p. 278. Poggendorff's Annalen, Bd. CXLVI. Comptes Rendus, March, 1872. Nature, May 9, 1872. Karl's Repertorium, vol. 8, p. 128.

ON A NEW FORM OF LANTERN GALVANOMETER. American Jour. of Science, June, 1872. Philosophical Magazine, vol. 44, p. 25. Karl's Repertorium, vol. 8, p. 133. Journal of the Franklin Institute, 1872.

ON A PRECISE METHOD OF TRACING THE PROGRESS AND OF DETERMINING THE BOUNDARY OF A WAVE OF CONDUCTED HEAT. American Journal of Science, July, 1872. Philosophical Magazine, vol. 44, p. 257. Abstract of the above in the Journal de Physique, 1872.

REMARKS ON DR. R. RADAU'S PAPER IN DR. KARL'S REPERTORIUM, entitled, "Remarks on the Influence of a Motion of Translation of a Sounding Body on the Pitch of the Sound." American Journal of Science, Sept., 1872. Karl's Repertorium, 1872.

ERRATUM OF THE ERRATA; or, "A Few Millions." Nature, Sept. 5, 1872. American Journal of Science, Oct., 1872.

ON A METHOD OF DETECTING THE PHASES OF VIBRATION IN THE AIR SURROUNDING A SOUNDING BODY; and thereby Measuring Directly in the Vibrating Air the Length of its Waves and Exploring the Form of its Wave-surface. American Journal of Science, Nov., 1872. Philosophical Magazine, vol. 44, p. 321. Poggendorff's Annalen, Bd. CXLVIII., p. 278.

THE MANOMETRIC FLAMES OF DR. R. KÖNIG. American Journal of Science, December, 1872.

ON A SIMPLE AND PRECISE METHOD OF MEASURING THE WAVE-LENGTHS AND VELOCITIES OF SOUND IN GASES; and on an Application of the Method in the Invention of an Acoustic Pyrometer. American Journal of Science, Dec., 1872. Philosophical Magazine, vol. 45, p. 18. Poggendorff's Annalen, Bd. CXLVIII., p. 287.

ON THE EXPERIMENTAL DETERMINATION OF THE RELATIVE INTENSITIES OF SOUND; and on the Measurement of the Powers of Various Substances to Reflect and to Transmit Sonorous Vibrations. American Journal of Science, Feb., 1873. Philosophical Magazine, vol. 45, p. 90. Journal de Physique, 1873.

ON THE EFFECTS OF MAGNETIZATION IN CHANGING THE DIMENSIONS OF IRON, STEEL, AND BISMUTH BARS; and in Increasing the Interior Capacity of Hollow Iron Cylinders. Part I. American Journal of Science, March, 1873. Philosophical Magazine, vol. 45, p. 350.

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Prof. Mayer wrote the following articles for Appleton's New Cyclopædia: Harmony, Microscope, Music, Sound, Spectrum, Stereoscope, and Pyrometer. For Johnson's Cyclopædia he contributed the articles Diamagnetism, Magnetism, and Radiometer.

In February, 1872, Prof. Mayer delivered a lecture, "The Earth a Great Magnet," before the Yale Scientific Club, which was subsequently published by C. C. Chatfield, New Haven, and by Van Nostrand, New York. This work was reviewed in the London Philosophical Magazine and in the New York Evening Post.

Prof. Mayer has also contributed reviews of books and accounts of scientific discoveries to the New York Evening Post, to the Popular Science Monthly, and to Baird's Annual Record of Science and Industry.

BY PROF. R. H. THURSTON, A. M., C. E.

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BY PROF. DE VOLSON WOOD.

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BY PROF. C. W. MACCORD, A. M.

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Elliptograph. A new instrument for drawing both ellipses and ovals, with an adjustment for varying the direction of the axes without moving the apparatus.

Instrument for Drawing Lemniscates. A combination of links and levers so arranged as to draw lemniscate curves of various proportions by continuous motion.

The Odontoscope. An instrument for testing the action of the teeth of wheels, detecting minute errors in their forms, and ascertaining the effect upon their movements of displacement of the axes.

Hoisting Machine. A compact and simple hoisting apparatus, with a new and improved arrangement of differential gearing.

Oblique Rack and Wheel. A new mechanical movement, in which the rack moves obliquely across the plane of rotation of the wheel with which it gears.

Elliptograph. A new instrument for drawing ellipses, in which the marking point is controlled by a bridle rod whose direction is always normal to the curve, thus guiding the pen so that its blades move in the direction of the tangent.

By PROF. A. R. LEEDS, Ph.D.

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Professor Leeds edited the articles on chemistry and mineralogy in the *Scientific American* during the years 1872–1876, and

contributed various papers to the *Popular Science Monthly*, the *Engineering and Mining Journal*, and other scientific periodicals during the same time.

By PROF. C. F. KROEH, A. M.

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UEBER DIE FLUORESCENZ EINIGER FESTEN KOHLENWASSERSTOFFVERBINDUNGEN IN STEINKOHLENTHEER UND PETROLEUM-RÜCKSTÄNDEN. Von Henry Morton, Ph. Dr. Into German. Published in Poggendorff's Annalen, Berlin, 1873, p. 292.

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ANALYTISCHE BEITRÄGE AUS DEM LABORATORIUM DES STEVENS INSTITUTE OF TECHNOLOGY. Von Prof. Albert R. Leeds. Into German. Poggendorff's Annalen.

TWO BEAUTIFUL OPTICAL EXPERIMENTS. By Prof. Ricco. From the Italian. Scientific American, March 2, 1878.

LA MACHINE PARLANTE DE M. EDISON. Prof. A. M. Mayer. Into French. Moniteur Scientifique.

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SUNLIGHT AND ITS SOURCE. Morton. Scientific American, and also American Artisan, May 3, 1873.

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HOW THE EARTH IS WEIGHED AND MEASURED. Young. Scientific American, April 15, 1876.

THE CORAL ISLANDS. Guyot. Scientific American, May 6, 1876.

THE DI CESNOLA COLLECTION. Goodyear. Scientific American, May 20, 1876.

THE MOON. Young. Scientific American, May 13, 1876.

NITRO-GLYCERINE. Mowbray. Scientific American, May 27, 1876.

INDUSTRIAL APPLICATIONS OF CARBONIC ACID. Leeds. Scientific American, June 17, 1876.

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HARMONY AND DISCORD. Brackett. Scientific American, July 15, 1876.

PORCELAIN AND POTTERY. Chandler. Scientific American, June 24, 1876.

OPTICS AND PHOTOGRAPHY. Morton. Scientific American, July 22, 1876.

PROCEEDINGS OF THE NEW YORK ACADEMY OF SCIENCES. Scientific American, Jan. 5 and Feb. 2, 1878.

Requirements for Admission.

NO applicant under the age of sixteen years will be admitted to the examination, unless the Faculty be satisfied that he is able to bear the burden of the Institute course without detriment to his health, nor will any applicant under the age of sixteen be allowed to enter his class unless his examination show proof of unusual proficiency.

The examinations will be on the following subjects:

Arithmetic.—The preparation should be especially thorough upon the properties of numbers, the operations in common and decimal fractions, the methods of finding the greatest common divisor, and the extraction of the roots of numbers.

Algebra.—The requirements include simple equations, equations of the second degree, and radicals of the second degree.

The attention of instructors is particularly called to the importance of thoroughness in the solution of literal equations, homogeneous equations of the second degree, and the multiplication and division of radicals. Previous examinations at the Institute indicate that sufficient time has not been given to these subjects.

Geometry.—The requirements include all of Plane Geometry (equivalent to six books of Davies' Legendre). Not only should the *facts* in the subject be committed to memory, but a thoroughly logical process of reasoning should be insisted upon.

Trigonometry.—The examinations will be confined to the definitions, the trigonometrical solutions of right-angled plane triangles, and the solution of oblique-angled triangles.

English Grammar.—The requirements are a practical acquaintance with the parts of speech, their relations, agreement, and government; the proper use of tenses and moods; the construction and arrangement of sentences. On all these points we desire

exact knowledge of the principles deduced from copious examples, and we attach no value to a minute knowledge of subtleties and exceptions. The latter properly belong to an advanced college course.

Geography.—The examination will be in the most important countries, cities, rivers, etc., most frequently occurring in the perusal of the daily newspaper and in general history.

Composition.—An Essay upon some topic assigned at the time of examination, and examined with reference to intelligible handwriting, correct spelling, punctuation, and proper expression.

Universal History.—In the examination in Universal History, such a knowledge of the great events of history will be required as will furnish a basis for subsequent instruction in Literature and the Philosophy of History.

Candidates for admission to the higher classes must be prepared to pass a satisfactory examination in the studies previously pursued by the class which they propose to enter.

Advanced students and men of science desiring to avail themselves of the appliances of the laboratories of the Stevens Institute, to carry on special investigations, may make arrangements to that end with the President.

The examination of applicants for admission, and the re-examination of students deficient at the end of the preceding college year, will be held between the hours of 10 A. M. and 2 P. M., on September 25th, 26th, 27th, 28th, and 30th, and October 1st, 1878.

Students will please present themselves as early as possible, so as not to be hurried in answering their questions.

EXAMINATIONS.

Examinations in each department will be held in public at the end of each term; and previous to graduation, a special examination, also in public, will be had of the graduating class, and from the combined results of all these examinations the questions of proficiency and qualification for degrees will be determined.

The transfer of a student from a lower to a higher class will depend in each case upon the result of the examination of the year preceding the time of transfer, so that no student can pass from a lower to a higher class until he has given satisfactory evidence of his proficiency in the studies of the former.

DEGREES.

The Stevens Institute of Technology, as will be seen from its secondary title, and from the account of its general scope and plan of studies already given, is essentially a School of Mechanical Engineering, and will therefore confer upon its regular graduates the degree of Mechanical Engineer when due evidence of proficiency has been afforded in the final examinations, and upon the presentation of theses, as described already.

Three years after graduation, an alumnus, who shall have creditably pursued the practice of the profession, may, upon producing satisfactory evidence of the fact, receive a post-graduate degree—the title and the conditions of the conferring of which have not been definitely determined.

Five years or more after graduation, a second and a higher degree may be conferred where evidence of good professional standing and of the performance of work of exceptional importance or excellence shall show the candidate to be entitled to such distinction.

In certain cases, however, graduates from other institutions or meritorious students, of at least two years' standing may pursue a special course, from which they may graduate, upon passing the requisite examinations, with the degree of Bachelor of Science; and such graduates, on presenting a thesis embodying the results of original investigation in the subjects of chemistry and physics, may receive a further degree of Doctor of Philosophy.

EXPENSES.

The fees for each year of the entire Course, for instruction and use of instruments, are one hundred and fifty dollars, for students at the time residing in the State of New Jersey. Those not so residing, (*i.e.*) coming across the river each day from New York or the like, are charged seventy-five dollars extra. This discrimination is made necessary by the clause in Mr. Stevens' will printed in italics, about the middle of p. 4.

In the Chemical Laboratory each student will be supplied with a set of reagent bottles; and an adequate quantity of chemicals and platinum vessels, agate, and steel mortars, etc., will be loaned to him from time to time, as his work may make their use necessary. With reference to other apparatus, he is at liberty to furnish himself from any dealer, or to borrow from the supplies of the school. At the end of each session he will be credited with those articles returned in good order, while the cost value of those destroyed will be deducted from his deposit.

In the Drawing Department each student will be expected to furnish his own instruments and materials.

The student is advised not to make his purchases before coming to the Institute, as arrangements have been made by which the best articles can be had on advantageous terms.

The fees are payable in advance, at the beginning of each term.

Lodging and commons will not be supplied in connection with the Institute; but board, on reasonable terms, may be readily secured in private families in the city, at a cost of about eight dollars a week.

Each student will be required on admission to make a deposit of $10 to meet incidental expenses, such as those for drawing materials or special chemical supplies. This deposit can only be withdrawn when he graduates or leaves the Institute.

SCHOLARSHIPS.

One scholarship each year is given to the graduate of the Stevens High School who passes the best examinations at the end of the Spring Term.

The candidates for these scholarships must have attended the regular course in the High School for at least one year and be in good standing.

Three scholarships each year are given to such graduates from the public schools of Hoboken as are recommended by the officers of the same, provided such candidates pass successfully the regular examinations for admission to the Stevens Institute of Technology.

A scholarship confers the privilege of attending the entire course of the Institute for four years, free of all charge for tuition, provided, of course, the student holding the scholarship keeps up in all cases with the standard of proficiency and good conduct required.

PRIZE.

A prize in Chemistry, known as the "Priestley Prize," in honor of the renowned discoverer of oxygen, was instituted in the year 1877 by means of funds contributed by Mr. William W. Shippen, Rev. S. B. Dod, President Henry Morton, and Prof. Leeds. The income, amounting to twenty-five dollars, is annually bestowed as a prize upon the student who has most distinguished himself in the department of chemistry during the current year. For the year 1877 it was awarded to Mr. John F. Kelly, of the class of 1878; and for the year 1878, to Mr. William E. Jacobs, of the class of 1879.

GYMNASIUM.

The large room formerly used as a lecture hall has been fitted up with all the appliances of a gymnasium, and is accessible to all students of the Institute. Regular training under an instructor can be secured by those desiring it.

The Course of Instruction.

THE full course of the Stevens Institute of Technology occupies the period of four years, each year being divided into three terms.

The next year begins Wednesday, October 2d, 1878.

First Term.

From the first Wednesday in October to the Saturday before Christmas.

Public examination on the work of the term begins Friday, December 13th, 1878.

Second Term.

From Monday, January 6th, 1879, to Wednesday, April 9th, 1879.

Public examination on the work of the term begins Wednesday, April 2d, 1879.

Third Term.

From Monday, April 21st, 1879, to the last Friday in June.

Public examination on the work of the term begins Wednesday, June 18th, 1879.

Commencement, Thursday, June 26th, 1879.

The following days will be observed as Holidays:

Thanksgiving Day (First Term), Washington's Birthday (Second Term), and Decoration Day (Third Term).

DEPARTMENT OF MATHEMATICS AND MECHANICS.

It is intended in this course to give the student such a thorough knowledge of the several branches of Mathematics as will enable him to use them advantageously in the investigation of Practical Problems.

The course is arranged as follows:

FIRST YEAR.

Review and conclusion of Algebra, review and conclusion of Geometry and Trigonometry, and Elementary Mechanics.

Text-Books.—Ray's Algebra, Part II.; Schuyler's Geometry; Olney's Trigonometry; and Wood's Elementary Mechanics.

SECOND YEAR.

Analytical Geometry and Differential and Integral Calculus.

Text-Books.—Wood's Analytical Geometry, and Courtenay's Calculus.

THIRD YEAR.

Analytical Mechanics and Resistance of Materials, and Theory of Bridge Building.

Text-Books.—Wood's Analytical Mechanics, and Wood's Resistance of Materials.

FOURTH YEAR.

First and Second Terms.—Theory of Bridges and Roofs, and Graphical Statics.

Text-Books.—Wood's Theory of Bridges and Roofs; DuBois' Graphical Statics.

DEPARTMENT OF BELLES-LETTRES.

The subjects included in this department will be presented under the general heads of Rhetoric, the English Language, English Literature, and History.

The time appropriated to these studies will be occupied, during the first year, with Rhetoric.

Text-Book.—Hart's Manual of Composition and Rhetoric.

The English Language will form the subject of the second year. It will be studied under the following heads: The historical elements and development of the English Language: its phonetic elements and logical forms.

Text-Book.—Fowler's English Language.

The third year will be occupied with English Literature.

Text-Book.—Shaw's Manual.

During the fourth year History will be studied.

Text-Book.—Guizot's History of Civilization in Europe.

Throughout the whole course original essays will also be required, embodying and illustrating the several subjects presented. Declamations, also, both original and selected, will be prepared to afford opportunities for practical lessons in elocution and oratory.

DEPARTMENT OF LANGUAGES.

The aim of this department is to enable our graduates, *First*, To understand the French and German Languages when spoken. *Second*, To avail themselves of the standard scientific and technical works in those languages. *Third*, To give them such elementary but practical acquaintance with literature, literary history and philology, as may be best calculated to engender that mental culture which marks the truly educated man.

Considering the limited time that could be spared for such instruction, the arrangement of the course became a task of some difficulty. After deducting Saturdays, holidays, and also ten days spent three times a year in reviews and examinations, the whole number of hours devoted per annum to languages was found to be 360. This makes 180 hours for each language to be divided among four classes. As there are also four years in the course, 180 represents the whole number of lessons had by every student in each language. This makes forty-five per annum, or not quite one a week, taking the whole year through.

It was apparent that such an arrangement rendered it impossible to acquire a practical speaking knowledge, as that necessitates uninterrupted daily practice. It was resolved, therefore, to do the next best thing, viz.: to train both tongue and ear to fluency, in connection with other, and for us, more important points of instruction, thus enabling the student readily to *understand* French and German when spoken, and to read them aloud with ease and correctness. The acquisition of a speaking knowledge will *then* be a mere matter of routine, easily accomplished by half a year's daily practice according to the Prendergast or the Heness-Sauveur method. Such connected practice would be feasible neither here nor in any other college where the alternation of classes and studies is a necessity, while it can be easily accomplished after graduation.

In accordance with the principle just stated, various text-books have been tested. Among them are Otto's French Grammar, Chapsal's Littérature Française, Collot's French Reader, Adler's German Reader, etc.

It was soon found that the study of French and German Grammar took up too much valuable time and yielded no adequate results. It was therefore rejected as impractical, and the instruction was made to begin directly with reading by the aid of a translation, according to Marcel's method, modified as experience suggested.

To avoid confusion, the French language alone is first taken up, the entering class beginning with Collot's Reader, which they learn with the help of another volume containing an interlinear translation and of a vocabulary of the conjunctions, prepositions, adverbs and other useful words occurring again and again on every page. The conjugations are learned according to a new plan, by which each separate word is impressed on the memory and promptly recalled. MSS. of this and other devices for aiding the study of languages have been multiplied by the aid of Edison's electric pen and distributed among the students.

Every effort has been made to facilitate study and impart a maximum of knowledge in a minimum of time; while on the other hand a thorough performance of the work has been rigorously required. In class, the books are kept closed by the students, and the lesson is read to them by sentences, which they must repeat fluently and translate orally. In this way ear and tongue are effectually trained. To avoid mistakes, which is better than to correct them, the lesson to be prepared is always read twice to the class. The first time they keep their books closed and listen; the second time, they follow the reading in the book. In both cases they repeat aloud after the reader.

Next, the same method is pursued with German. As no book well adapted to such a course existed, the "First German Reader," recently published by Appleton & Co., New York, has been prepared by the head of this department.

After these books, Roemer's Polyglot Readers are used for the present until something more suitable can be had. They consist of three volumes, the first containing a series of English extracts, the second their German, and the third their French translation.

As the practical work in the laboratories begins with the third year, it is necessary to teach scientific reading before that time, to enable the students to consult the foreign books, which their professors may indicate to them as sources of information on the problems in which they are engaged. In German, Blum's Grundriss der Physik und Mechanik, and in French, a series of MSS. containing extracts from scientific authors, are used for this purpose. The latter are multiplied with Edison's electric pen.

The recitations throughout the whole course are almost entirely conducted with closed books. The students listen, repeat, and translate. In all cases a good English idiomatic translation is insisted on, as it is believed that the study of foreign languages is thus made the most potent means of acquiring a good command of one's own. The recitations are regarded rather as opportunities for practice and instruction than as a device for ascertaining proficiency.

The construction of the German and French languages is explained by lecture and practised by translations. There is not time for much of this; yet enough to enable students in the last year to write weekly, in French and German, reports of their laboratory work.

The Senior Class of '76 and that of '77 read Souvestre's "Un Philosophe sous les Toits," and Eichendorff's "Aus dem Leben eines Taugenichts," by the aid of translations. A course of lectures was also delivered to them on the origin, progress, and decay of languages and literatures, in which the principal epochs of the world's history in their bearings on literature and civilization were discussed.

The new methods introduced have justified their permanent adoption, as they have enabled the class of '79 to read the whole of the "Roman d'un jeune homme pauvre" and half of Eichendorff's "Taugenichts" in their second year.

Finally, it is the practice of the department, whenever the time permits, to introduce topics of discussion arising out of the perusal of foreign books in class, and on which the course of the Institute affords no information.

FIRST YEAR.

Lectures on the Study of Languages. Reading with the aid of Translations. Collot's Pronouncing French Reader. Collot's Interlinear French Reader. Kroeh's First German Reader on a modification of the Marcel System. Training of the ear and tongue. Verbs.

SECOND YEAR.

Reading continued. Lectures on the Construction of French and German Sentences. First and Second Terms, Collot's French Readers and Roemer's Polyglots. Third Term, Scientific Reading from Blum's Grundriss der Physik and a Series of French Selections in MS.

THIRD YEAR.

Scientific Reading continued. Essays on Scientific and Technical subjects.

FOURTH YEAR.

Essays continued. Business Forms. German novel or play. French novel or play. Lectures on Foreign Literature.

DEPARTMENT OF CHEMISTRY.

SECOND YEAR.

Lectures upon Chemical Physics and General Chemistry, with recitations upon written Notes of Lectures and upon Fowne's Physical and Inorganic Chemistry.

Books of Reference.—Naquet's Principes de Chimie. Watt's Dictionary of Chemistry. Wurtz's Histoire des Doctrines Chimiques. Hofmann's Einleitung in die moderne Chemie. Eliot & Storer's Manual.

THIRD YEAR.

First Term.

Qualitative Analysis, with Laboratory Practice.

Text-Book.—Eliot & Storer's Manual of Qualitative Chemical Analysis.

Second Term.

Qualitative analysis, with Exercises in Blowpipe Analysis and the Determination of Minerals.

Text-Book.—Elderhorst's Manual of Blowpipe Analysis.

Third Term.

Metallurgy, with Quantitative Analyses of Ores, etc. Methods of Gravimetric and Volumetric Analysis.

Text-Books.—Greenwood's Manual of Metallurgy. Thorpe's Quantitative Chemical Analysis.

Books of Reference.—Will's Tables for Qualitative Chemical Analysis. Storer's Dictionary of Solubilities. Dana's System of Mineralogy. Dana's Manual of Geology. Cotta's Lithology. Cotta's Treatise on Ore Deposits, edited by Primo. Metallurgy, edited by Crookes and Röhrig. Knapp's Chemical Technology, edited by Ronalds, Richardson, and Watts. Crooke's Select Problems. Annales de Chimie. Annalen der Chemie. Full sets of these and all other important journals are provided for consultation in the Institute Library, and the student is referred to the original memoirs as the best sources of information.

ADVANCED STUDENTS.

Courses of study determined by special arrangement.

THE DEPARTMENT OF PHYSICS.

This department offers the students every facility for the acquisition of a thorough knowledge of Physics.

During *the first year* the first term is given to the study of the inductive method of research, to the general properties of matter, and to inductive mechanics; the second term, to pneumatics and to the laws of vibratory motions and acoustics; the third term, to heat.

In *the second year* the first term is occupied in the study of the applications of the laws of heat to the action of heat engines and to meteorology; the second term is spent in the study of light, and the third is devoted to magnetism and electricity.

During *the third year* the Professor of Physics delivers lectures on the modes of making precise measures. He shows application of these measures in the various departments of science, and explains the construction, the methods of adjustment, and the manner of using instruments in precise measurements.

The *fourth year* the student spends in the physical laboratories, pursuing experimental investigations, schedules of which are prepared for him by the Professor of Physics.

In the organization of the Department of Physics two objects were sought: *First*, to give thorough instruction to the students by means of lectures and recitations on general physics, aided by the most perfect illustrations, followed by practical experimental work in the physical laboratory; and *secondly*, to advance knowledge in this department of science by original researches, conducted by the Professor of Physics. This mode of work has been of eminent service to the student by causing a lively interest in his studies as he verifies and extends, by his laboratory experiments, the knowledge which he had previously derived from lectures and text-books; while, at the same time, the discoveries which have been made in this department by the Professor, have served as actual examples of the methods of conducting original investigations.

The degree of Doctor of Philosophy will be obtained only after the laboratory work of the student has been approved of by the Professor of Physics, and a thesis, embracing an original investigation, has been laid before the Faculty.

The extensive cabinet of instruments which the Institute possesses, affords the student advantages which are nowhere equalled. It would be proper to state in this connection, that the facilities of the laboratories and cabinets of the Institute will be extended to advanced students who may wish to avail themselves of such means in carrying out their investigations, on such conditions as may be determined by arrangement in each special case.

DEPARTMENT OF MECHANICAL DRAWING.

In the organization of the Department of Mechanical Drawing, the object aimed at was to make the course of instruction thorough, practical, of direct utility, and comprehensive. The range of the subject is by no means narrow, for setting aside free hand drawing altogether, and considering only what can be drawn mechanically, that is, by means of instruments and according to rigid laws, this will be found to include a very large proportion of whatever can be drawn at all. Perhaps the simplest exercises in this direction that could be suggested are furnished by the elementary problems of plane geometry, from which naturally follow the more complex ones of solid geometry and trigonometry. These in their obvious applications to surveying and navigation, architecture and mechanism, lead by insensible degrees to the development of linear drawing as an exact science, which, under the general name of Descriptive Geometry, includes the recognized subdivisions of Architectural, Topographical and Mechanical Drawing, in the usual acceptation of the latter as relating to working plans of machinery, as well as the discussion of Shades, Shadows and Perspective.

On the other hand, the requirements of many of the industrial arts at the present day, are such as to necessitate the making of accurate representations, not only of what already exists, but of what is yet to be made. Both demand a knowledge of the principles of the science of drawing, and the latter especially involves a certain exercise of the imagination, in order to form clear physical conceptions of the particular design in contemplation, not only in regard to its appearance as a whole, but as to the relations and proportions of its parts.

This ability to form a vivid and distinct mental image, as well as to fix it permanently by accurate representations, though useful to all, is more emphatically so to the Mechanical Engineer than to one of any other profession. His path does not lie in a beaten track; new problems are presented, new combinations and expedients are to be devised, and he is daily called on, not to copy the works of his predecessors, but to do what they have failed in or have not attempted.

These considerations have been kept distinctly in sight in the conduct of this department from the first. The matter taught and the method of teaching have been selected with the view of giving the student a firm grasp of underlying principles, of developing and strengthening this imaginative power, and of giving him direct practice in the application of both. The course adopted to attain these ends may be briefly outlined as follows:

The foundation is laid by practice in the simple drawing of lines, for the purposes of acquiring facility in manipulation of the instruments. The first exercises are such geometrical constructions as will be of use in subsequent operations, arranged in a progressive order; attention to symmetry and proportions being enforced from the outset, as the diagrams are not copied, but constructed by each for himself from rough sketches.

This practice is confined to combinations of straight lines and circular arcs only, until a fair degree of skill has been gained, after which the training of hand and eye is continued by the drawing of various curves constructed by points and by tangent arcs; here again, those are selected which will be most frequently met with afterward, such as the ellipse, and parabola, the involute, the cycloid, etc.

At this stage some explanation of elementary projections is introduced. There are two modes in which this matter may be presented: One, which at first sight appears the more logical, is to begin by considering the projections of a point in space, then to take up in order those of straight lines, planes, curved lines and surfaces. The other is to begin by making the projections necessary to the complete representation of a solid object of simple form; as, for instance, a cube or a prism, bounded by plane surfaces, placing it in various positions in relation to the paper, and proceeding afterward to treat more complex objects in a similar manner. It is found preferable to employ the latter method first: the relation between the drawings and the thing drawn is more easily comprehended by the average mind when the latter is not a mere abstraction, like a line or plane in space, but a definite and tangible object; and the student, already familiar with the operations of drawing such solids as the prism and the pyramid, the cylinder and the cone, is the better prepared to deal with abstract considerations at a later period. When presented in this manner, no difficulty is experienced with the simpler problems of the intersections and development of these surfaces, and useful practice in line drawing is found in the construction of the various curves thus formed, while the imaginative faculty is brought into play by the very nature of these problems.

From the representation of these elementary forms as mere exercises, the next step is to the drawing of parts of machines from actual measurements. The student is at once set to work as a draughtsman; a model, or a part or the whole of some piece of mechanism is assigned to him, which he is to study, to measure, to sketch, and finally to draw; the requirement being, exactly as if he were employed in the Drawing Office of an engineering establishment, that he shall produce complete working plans, from which the original could be replaced were it destroyed. He thus acquires some knowledge of details, and is taught to observe closely, while at the same time his previously acquired skill and information are practically applied.

Simultaneously with this, the study of Descriptive Geometry is taken up as an abstract science, his previous acquaintance with projections facilitating his progress here. The study of this science is not made an ultimate object, but its practical applications being kept always in view, it is made a means to an end, and that end is the acquirement of such a mastery of the principles of drawing that the student shall be able to cope with any problem when it arises in the course of his practice. The identity of the operations of Descriptive Geometry with those of Mechanical Drawing is never lost sight of, and the problems are frequently put in a practical form. This is not done exclusively, however, because they afford, in their abstract study, the best possible exercise of that imaginative power, which, enabling its possessor to see mentally what as yet does not exist, gives him most efficient aid in planning new designs, facilitates the reading of drawings, gives solidity and relief to bare outlines, and serves as a mental stereoscope, of which the principles of Descriptive Geometry are the lenses. The study of these principles is continued in their applications to Shades and Shadows and to Linear Perspective; in connection with which the distribution of light and shade, and the principles of Aerial Perspective as applied to the shading of mechanical objects are explained, and a little time is given to practice in the execution of finished drawings. But the ability to make elaborately shaded pictures is regarded as the least valuable of the qualifications of a mechanical draughtsman. However great his skill in this way may be, the accomplishment will serve him but little in his professional career if it be acquired at the expense of accuracy, or facility in the construction of working drawings. For a machine must be planned in detail before finished drawings can be made of either the whole or the parts, the former evidently requiring a higher order of skill, while there is less of the latter to be done, especially since the advent of the photographer, with whom it is idle for the draughtsman to attempt to compete in the production of pictorial representations. Therefore, while it is designed to impart a thorough understanding of the principles involved in making such drawings, comparatively little time is devoted to their practical execution.

The Mechanical Engineer plans machines, and these move; consequently the study of the laws of their motions is an important branch of his education; and it it properly given a place in this Department, since to make the drawings of a piece of mechanism implies the making of them so that each part shall move in harmony with the rest, and the depth of engineering disgrace is reached when through any oversight one part interferes with another. This study might also, especially when the more complicated mechanical movements are considered, be regarded as a branch of applied mathematics of the higher order. But, however these laws may be investigated, this fact remains: that for the purposes of the draughtsman the results must be translated into his language and expressed in a graphic form—the ways of the analyst are not his ways, and the algebraic formula must be replaced by a diagram. Fortunately, however, these laws may be investigated, at least as applied to by far the larger and more important part of the movements with which he has to deal, in his own language and by his own methods. In this part of the course, therefore, the Geometry of Mechanism is taught by graphical construction alone, to the entire exclusion of algebraic analysis, practical exercises in the plotting of mechanical movements, the drawing of the various forms of spur, bevel, skew-bevel and screw gearing, the construction of curves representing varied motion and the like, being introduced from time to time for the purpose of insuring thorough familiarity with the laws and principles involved.

Further, the course includes some practice in actual planning. A subject being assigned to or selected by the student, he proceeds to work it up as though already engaged in the active pursuit of his profession; making first a skeleton diagram of the movement, and sketching in the proposed arrangement of parts, he calculates the strength and proportion of these, thus making the design an exercise in the Department of Engineering and Mathematics, modifying the original plan when it is found necessary to do so by the results of these calculations, then making drawings of each part in detail, and finally a general plan of the completed designs; a general supervision being exercised over the work while in progress, and hints and suggestions as to details and arrangement being made as occasion arises.

It should be stated in continuation, that much care is taken throughout the course to form the habit of correct judgment in determining what drawings to make of any subject in hand, and how to arrange them most advantageously. Written instructions in regard to this are exceedingly meagre, and yet it is a very important matter. The object of working plans is to show the workman what to make and how to make it; and experience proves that it is very easy to produce drawings which are perfectly correct, and yet do not clearly illustrate the objects represented. The plans of a given piece of machinery should be such as to show distinctly the form and dimensions of each part, as well as the general arrangement of the whole, and they should do this with the least possible expenditure of labor. The ability to decide, from a knowledge of the proposed design, just what drawings are best adapted to attain these ends, to select the views which will be most explanatory, and to arrange them in the most appropriate order and relations, constitutes a very valuable and a comparatively rare acquirement. Nothing facilitates the operations of the mechanic more than to have a set of working plans which are clear, easily read, and connectedly arranged, and it is almost as important that the draughtsman should know just what to draw, as that he should be able to draw it well. From the first to the last, therefore, the student is taught the necessity of exercising his judgment in this direction, as well as care and forethought in all that he does; in a word, he is led to put his brains into his fingers, and every precaution is taken to guard against the common and offensive heresy, founded on ignorance of the scope of the science in its entirety, that Mechanical Drawing is a simple matter of rote and routine, and the draughtsman a mere animated machine, to which a mind is superfluous, and having for its sole duty the duty of making marks.

Summarily, then, the object of the course is not merely to teach the student to read and write certain set phrases of the graphic language with ease and fluency, but to enable him to wield it with power and for a purpose. He is taught not so much to memorize as to compose; he studies the old masters, not to copy their works, but to learn their methods and profit by their experience; he is encouraged to think for himself, and to acquire vigor and facility by giving expression to new ideas, and to attain the greater and most direct utility of the whole, his practice during the course is made as nearly as possible to resemble that upon which he will enter at its close.

It would be impossible to state in detail all that has been done in carrying out the design above sketched; but it is proper, as illustrating the results that have been accomplished, to mention some of the more meritorious pieces of practical work in this Department, executed by the students since its organization in 1871. It was not, of course, to be expected that tangible results should manifest themselves immediately, as from the outline given some time was necessarily consumed in preliminary instruction, and the class of work here mentioned is that belonging to the last two years of the course. The fact, however, that some, coming well prepared from other Institutions to complete their studies here, were able to undertake work of this description from the outset, gave at once an opportunity to test the working of the system proposed; which has been such, we think, as to entitle it to be considered fairly successful.

J. A. HENDERSON, 1873.—*Thurston's Machine for Testing Lubricants.*
Complete and elegant design, with full set of working drawings, at once adopted in the manufacture of the machine.

P. P. POINIER, 1874.—*Friction Governor.*
Design complete in general and detail, with highly finished drawings.

F. S. THAYER, 1874.—*Anchor Hoister for Turret Ship.*
Complete and excellent design, from which detail drawings have been made since the death of the designer.

V. BACHMANN, 1875.—*Foot Lathe* (Original Invention).
Complete design, with full set of working plans.

V. BACHMANN, 1875.—*Models in Descriptive Geometry and Mechanism.*
Two beautiful models illustrating the Pitch Surfaces of Skew-bevel Wheels, and the Form and Action of the Epicycloidal Teeth of Spur-wheels. Made by the designer for the Institute.

J. E. DENTON, 1875.—*Wood's Rock Drill.*
Complete and accurate working plans, which were at once adopted in the manufacture, giving special satisfaction for their remarkable accuracy.

S. D. GRAYDON, 1875.
Drawings showing the difference between the True and Approximate Forms of the Teeth of Bevel Wheels.

T. F. KOEZLY, 1875.—*Design for Model in Mechanism.*
General and detail plan of model showing the Action of the Oblique Rack and Wheel.

I. N. KNAPP, 1875.—*Wood's Rock Drill.*
General and detail plans, adopted in the manufacture, and giving perfect satisfaction.

YOKICHI YAMADA, 1875.—*Model in Descriptive Geometry.*
Design and complete drawings of Model of Hyperboloids of Revolution, Tangent along Two Lines.

J. CREMER, 1876.—*Modification of Plan of Steam Engine.*
Design and detail drawings. A reversible full-stroke engine to be transformed into a non-reversible one with fixed cut-off.

H. DUANE, 1876.—*Model in Descriptive Geometry.*
Design and details of model illustrating the generation of Surfaces of Revolution with Right Line Elements.

B. P. DOW, 1876.—*Model in Mechanism.*
Design and details of model for drawing "Interval Curves" by continuous motion.

B. P. DOW, 1876.—*Screw Propeller.*
Working plan and a highly finished drawing of a four-bladed propeller, 18 feet diameter, 27 feet pitch.

J. KINGSLAND, 1876.—*Thurston's Machine for Testing Lubricants.*
New design and working drawings.

P. RAQUÉ, 1876.—*Elliptical Gearing.*
Accurately constructed, and finely executed, drawings of a pair of Elliptical Wheels.

A. RIESENBERGER, 1876.—*Velocity Diagram.*
Accurate Diagram and finely finished drawing, showing the action and the varying velocity in the "Whitworth Motion" for Shaping Machines.

A. W. STAHL, 1876.—*Anchor Hoister for Turret Ship.*
Detail drawings, and modifications of designs, for the Anchor Hoister commenced by Mr. F. S. Thayer.

A. W. STAHL, 1876.—*Wood's Rock Drill.*
Detail drawings of above for manufacture.

A. W. STAHL, 1876.—*Screw Force Pump.*
Design and working drawings for a Screw Force Pump, attached to the large Riehlé Testing Machine of the Institute; also finely executed drawing of the same.

E. B. WALL, 1876.—*Designs for Car Frames.*
Original designs and plans for Car Frames.

E. L. WILES, 1876.—*Model of Hoisting Apparatus.*
Design for Model of Differential Hoisting Gear.

E. L. WILES, 1876.—*Thurston's Torsion Machine.*
Working drawings for Machine built by the Class of 1876 for the Centennial Exhibition.

J. M. WALLIS, 1876.—*MacCord's Odontoscope.*
An instrument of which the object is to test the action of the teeth of gear-wheels. Design in general and detail, working plans and highly finished drawings.

A. R. WOLFF, 1876.—*Velocity Diagram.*
Curve showing the varying velocity in the Whitworth Shaping Machine Motion.

W. F. ZIMMERMANN, 1876.—*Wood's Rock Drill.*
Working drawings of above for manufacture.

A. G. BRINCKERHOFF, 1877.—*Construction of Elliptical Gearing.*

M. I. COSTER, 1877.—*Wood's Rock Drill.*
Working drawings.

L. H. NASH, 1877.—*Improved Foot Lathe* (Original Invention).
Design and working drawings in detail.

L. H. NASH, 1877.—*Screw Propeller with Increasing Pitch.*
Investigation and comparison of the developed curves in the cases of uniform and accelerated increase of Pitch.

J. RAPELJE, 1877.—*Thurston's Machine for Testing Lubricants.*
General plan and detail drawings of the machines built by the Class of 1877 for the Centennial Exhibition.

Very many of the drawings made from measurements of existing machines might justly be considered worthy of mention as being specimens of working plans that would be creditable to experienced draughtsmen. So many, indeed, that it is out of the question here to do more than to state the fact in a general way. Nor is it necessary, since, although in no sense copies, they are not examples of the kind of practical and original work which is the distinctive feature of this scheme of instruction.

In conclusion, it may be stated that in addition to all that has been alluded to, a great deal of miscellaneous work has been done, such as the making of tracings and detached working drawings for special purposes, the construction of curves for the graphic illustration of the results of researches in the Physical and Mechanical Laboratories, making drawings to be engraved by direct transfer, making drawings to be copied by photographic processes, and making illustrative plans and diagrams for lecture room use; no opportunity being lost to make direct and practical use of skill and knowledge already acquired.

TEXT-BOOKS.—Lessons in Mechanical Drawing......MacCord.
Descriptive Geometry..................Church.
Geometry of Mechanism..............Lectures.
Slide Valve and Eccentric...........MacCord.

DEPARTMENT OF MECHANICAL ENGINEERING.

At the close of the second year the student will be prepared to enter upon the studies of the Department of Mechanical Engineering, which will occupy the principal portion of his time during the remainder of his course.

The course of Instruction in Mechanical Engineering will commence with lectures upon the nature of materials used in constructing, locating, and operating machinery; and the methods of obtaining them and preparing them for use, so far as such instruction is not included in the Course in Technical Chemistry. The uses to which each material is specially adapted are stated, the methods of testing their quality and of preserving them from decay are described, while the principles and practical considerations involved in the application of tools to the working of each are exhibited in the workrooms of the Institute.

A Course of Instruction in the Strength of Materials follows, in which the laws determining the forms of greatest strength are deduced from experiment, and applied in the solution of such problems as arise daily in engineering practice.

In the illustration of this portion of the Course, samples exhibiting the various qualities of each material are placed before the student for his inspection; models and drawings illustrate the methods of their preparation; and specimens of materials, wrought into their strongest forms, impress upon him the principles already learned of the strength of materials, and their application in design.

The mathematical principles and the theory of the strength of materials are taught in the Department of Mathematics.

The course is continued by the study, from the text-book and lecture, of the Theory of Machinery, with detailed instructions in the use of tools and in designing machinery and mill work; care being taken to call the attention of the student to such modifications in design as are dictated by difficulties in forging, pattern-making, moulding, finishing, and "fitting up."

Finally, the course is completed by a series of lectures and lessons from text-books treating of the prime movers, accompanied by exercises in planning and estimating the cost of machinery, mills, and manufactories. While studying heat engines, the steam engine is made a subject of special and extended investigation in its principles, and in the details of design, construction, and management, according to the best and most recent practice.

Essays on professional subjects are written by the student at stated intervals during his course, in which he is expected to give concise and accurate statements of knowledge acquired by the course of reading accompanying his regular studies. In some instances, reports and opinions relating to the merits of mechanical devices or to the economical performance of machinery are demanded, as an exercise of essential importance.

Problems in design will be presented to the student at intervals during the course, which will be made, as far as possible, similar in character to those which meet the Mechanical Engineer most frequently in the practice of his profession.

The student will be informed of the exact result to be attained, and of the conditions necessary and means available for reaching it. He will then be expected to prepare his plans and to submit them to the Head of the Department, together with a report, oral or written, for criticism.

A "graduating thesis" will be demanded of the student at the close of his studies, in which he will be expected to exhibit his proficiency by designing and describing the construction and management of some machine, or in planning a manufacturing establishment, giving estimates of cost.

The originals of these theses will be retained at the Institute, and deposited among the manuscripts of its library.

The workshop, fitted up with hand and machine tools, enables the student to become practically acquainted with working machinery, and will be made useful to the Institute by adding new models to its collection.

These models, when well made, will be retained in the cabinets of the Department, as illustrative of the skill attainable by the students, as well as of the principles involved in their construction.

WORK IN DESIGNING MACHINERY.

During the year just closed the students of the Stevens Institute of Technology have done a considerable amount of work, under the direction of the Professor of Engineering, and under the immediate supervision of the Professor of Drawing, in designing apparatus and machinery, and in making general plans and detail drawing of bridge-work, etc., etc.

The design of a steam anchor hoisting apparatus for the Stevens Battery was intrusted to one student, who produced a most satisfactory plan and working drawings, laying out the work, and calculating the sizes of all its parts.

Work has been done upon the plans of machines with automatic registry, for testing the strength, stiffness, ductility, resilience, and the limits of elasticity of materials, and their homogeneity. The plans of a machine for determining the value of various lubricants by the use, simultaneously, of thermometrical and dynamometrical measurements of friction, and the measurement, at the same time, of the pressure upon the bearing, have been completed by advanced students, and the drawings of machines of different designs are in progress.

Another student has designed a peculiar form of steam engine governor, and others are at work upon steam steering apparatus.

PROFESSIONAL WORK AND VISITS OF INSPECTION.

The students being instructed in Engineering have received a considerable amount of instruction outside the class rooms.

During the important trial of competing steam boilers at the Annual Exhibition of the American Institute of the State of New York, 1871,* the log was kept by selected students, under the supervision of the Professor of Mechanical Engineering, who was Chairman of the Committee under whose charge was placed the management of the Machinery Department of the Exhibition.

The students pursuing the Course in Engineering were present at the trials of Road Locomotives and Steam Road Rollers, at South Orange, N. J., October, 1872,† keeping the log and assisting in the conduct of the trials.

The log of the trial of a new form of steam engine has been kept by the students of the Stevens Institute of Technology, indicator cards being taken and all data entered on the log each half hour.

They also attended the competitive trials of several forms of Centrifugal Pumps, keeping the log under the direction of Professor Wood, Chairman of the Committee of Judges.

During the year 1873 they also assisted at the trials of a new form of Gas Engine and of Air Compressing Machinery, and had other valuable opportunities of acquiring, by experience and observation, this most important kind of professional knowledge.

During the year 1874 opportunities occurred to test Rotary Engines,‡ Steam Pumps, Steam Boilers and Water Works Machinery.

During the year 1875 the mechanical laboratory was founded, and students thus became possessed of additional means of becoming acquainted with materials and apparatus, and with machinery and manufacturing establishments, which have proven of immense value.

The mechanical laboratory, during the year 1875, conducted ten test-trials of steam boilers of novel forms, and has since tested others, determining their economic efficiencies and steaming capacities, the character of fuel used, temperature of furnace, flues,

* Journal Franklin Institute, June, 1872.

† Journal Franklin Institute, January, 1873.

‡ London Engineering, December, 1874.

and chimney, and the condition—whether wet or dry—of the steam and the percentage of priming. The latter determination, which is of essential importance, was first practically introduced by the head of this department.

An extended series of trials of mechanically compressed dust fuel in stationary and locomotive boilers, in the shop and on the road, was made during the Spring Term of 1876.

During this year, steam engines were tested, large numbers of tests of lubricating materials were made, and several hundreds of samples of metals and materials of construction, embracing every quality known in the arts, were tested in the testing machines of the laboratory, in tension, by torsion, and by compressive and transverse stress.

The amount of experimental work completed during the year 1877 was greater than during any previous year, costing about $10,000, and including investigations of the strength of building materials and metals, of the value of lubricants, the composition of various commercial materials, test-trials of steam boilers, and various special investigations for both public and private work.

Students have spent several days on steamers driven by the largest class of beam engines, studying the operation and management of engines and boilers, taking indicator diagrams, examining the distribution of steam, and learning sizes and proportions of parts. Other students have paid especial attention to the subject of car framing, testing the strength of models of different types and testing frames of full size.

The Laboratory has done a large amount of work for the United States Board, appointed to test iron and steel, under the direction of the committees of which Professor Thurston is chairman.

Elaborate researches relating to the physical and mechanical properties of iron and steel and of alloys of the now important useful metals, of the effects of abrasion and wear of metals, and on the influence of temperature, have been made and projected.

An exhaustive series of experiments, including experiments upon the relative values of various lubricants, under pressures reaching as high as 1,500 lbs. per square inch, has been carried on in the laboratory with machines devised for that purpose, and other equally novel and important work has been done.*

Some investigations have been made of the composition and character of boiler feed-waters and incrustation, for the United States Commission appointed to investigate the causes of steam boiler explosions, and for private individuals.

* Railroad Gazette, 1878.

Dynamometrical determinations of power required for driving various kinds of machinery are made, and all kinds of work appropriate to such a laboratory are done by employees carefully trained under the eye of the head of the department.

The records of the mechanical laboratory are contained in ten large record books, and include a vast amount of useful data and valuable information accessible to all students.

The students are expected to take part in this work whenever an opportunity offers, and to transfer to their note-books such records as are valuable, where permissible. They are expected to take every opportunity to witness operations conducted in the mechanical laboratory, and to lose no opportunity to become familiar with this practical work, and with the knowledge to be gained while assisting in these experiments, of the methods of operation of machinery, and the processes of determining its efficiency, and with the nature and properties of the materials of construction.

Several thousand dollars' worth of apparatus were added to the mechanical laboratory during the years 1875–6–7, and further additions are proposed for the year 1877–8.

Visits of inspection have been made by students to the works of the Providence Steam Engine Co., the Corliss Steam Engine Co., the Root Steam Engine Co., the Morgan Iron Works, the Brown & Sharpe Manufacturing Co., the American Screw Co., and to various grain-elevators, mills, and manufactories in New York and other cities.

Visits have also been made to the steamers of the several trans-atlantic lines, to steamships building in New York to inspect their compound engines and other machinery, and to the Stevens Battery, to examine into the construction of the iron hull and the machinery of that powerful vessel.

Such use of time is considered to be as profitable as it is pleasant to both students and instructors.

TEXT-BOOKS AND BOOKS OF REFERENCE.

Mahan, ... *Civil Engineering.*	Rankine, *Mill Work and Machinery.*
Mosely, . . . *Mechanics of Engineering.*	Rankine, . . *Steam Engine and other Prime Movers.*
Weisbach, . . " "	Gruner, ... *On Steel.*
Van Buren, *Strength of Iron Parts of Machinery.*	Fairbairn, . . . *Mills and Mill Work.*
Shelley, ... *Workshop Appliances.*	Knight, *Mechanician and Constructor.*
Wilson, ... *Steam Boilers.*	Tredgold, ... *Carpentry.*
Trowbridge, ... " "	Bourne, *Treatise on the Steam Engine.*
Vose. . . *Manual for Railroad Engineers.*	Clark, *Manual for Mechanical Engineers.*

List of Students.

STUDENTS OF FIRST CLASS.

CLASS OF 1881.

Arroyo, Augustine C.	Mexico.
Aspinwall, John	New York.
Breath, William L.	New Jersey.
Cronise, Ernest L.	New York.
Dilworth, Frank	New Jersey.
Dixon, Robert	New Jersey.
Gifford, Charles A.	New Jersey.
Haff, Henry G.	New Jersey.
Häussling, Ferd. M.	New York.
Hernz, Louis M.	New York.
Humphreys, Alex. C.	New Jersey.
Hyslop, Frank	New York.
Jardine, David H.	New York.
Ladd, James B.	New York.
Lederle, Frank	Michigan.
Magruder, William T.	New York.
Martinez, Emanuel J.	New York.
McGovern, Edward	New Jersey.
Merritt, Robert N., Jr.	New Jersey.
Miller, Samuel A.	New Jersey.
Mills, Frank P., Jr.	Michigan.
Moore, Enos L.	Ohio.
Moore, J.	Ohio.
Morton, George	New Jersey.
Ogden, Henry F.	New Jersey.
Pope, Henry S.	New Jersey.
Pracy, Joseph	California.
Putnam, John C.	Iowa.
Riddle, Robert M.	Pennsylvania.
Rosenberg, Frederic, Jr.	New York.
Rüdiger, J. M., Jr.	New York.
Spies, Albert	New Jersey.
Sprague, W. T.	New York.
Stockwell, Nath. S.	New Jersey.
Tatham, Edwin	New York.
Vanatta, Henry	New Jersey.

STUDENTS OF SECOND CLASS.

CLASS OF 1880.

BOND, GEORGE M. . . . . Michigan.
BORCHARDT, JOHN. . . . . New Jersey.
BROWN, WILBUR V. . . . . New Jersey.
DASHIELL, WILLIAM W. . . . . Maryland.
ELLIOTT, THEODORE A. . . . . New Jersey.
EWEN, JOHN M. . . . . Louisiana.
FREYGANG, HENRY J. . . . . New Jersey.
JOBBINS, WILLIAM E. . . . . New York.
KURSHEEDT, ROLAND S. . . . . New York.
LEIB, JOHN W., Jr. . . . . New Jersey.
PARSONS, WILLARD P. . . . . New York.
WHITE, HENRY C. . . . . New York.
WILCOX, FRANK. . . . . Pennsylvania.
WOODMAN, DURAND. . . . . New Jersey.

STUDENTS OF THIRD CLASS.

CLASS OF 1879.

AIKIN, A. CLAUDE. . . . . Maryland.
COOKE, JOHN S. . . . . New Jersey.
CURRIER, FRANK S. . . . . New Jersey.
DAWES HENRY F. . . . . New Jersey.
DILWORTH, WALTER G. . . . . New Jersey.
HEGER, WILLIAM S. . . . . New York.
JACOBS, WILLIAM E. . . . . New Jersey.
JÁUREGUI, LEOPOLDO. . . . . Mexico.
KELLY, JAMES. . . . . New Jersey.
KINGSLAND, CHAS. S. . . . . New Jersey.
LANGLEY, WILLIAM L. . . . . Maryland.
LONGSTREET, JOHN H. . . . . New Jersey.
RAMIREZ, J. B. . . . . New York.
ROBBINS, EDWARD P. . . . . Ohio.
SMITH, WILFRED C. . . . . Ohio.
WALLIS, PHILIP. . . . . Louisiana.
WHITE, MAUNSEL. . . . . Louisiana.

STUDENTS OF FOURTH CLASS.

CLASS OF 1878.

ANTZ, OSCAR. . . . . New Jersey.
AYRES, BROWN. . . . . Louisiana.
BAIRD, WILLIAM R. . . . . New Jersey.
BIRCHARD, PLINY T. . . . . Iowa.

BONN, HILLRIC J. . . . . New Jersey.
BRÜCK, HENRY T. . . . . New Jersey.
DE BONNEVILLE, ARTHUR. . . . . New Jersey.
DOUGHERTY, WILLIAM M. . . . . New Jersey.
GERNER, RICHARD. . . . . New Jersey.
GIBBS, ALFRED W. . . . . New Jersey.
GSANTNER, OTTO C. . . . . New Jersey.
HAZARD, HENRY W. . . . . New Jersey.
JONES, FRANK P. . . . . Maryland.
KELLY, JOHN F. . . . . New Jersey.
MYERS, EDWIN L. . . . . New York.
NICHOLS, FRANK B. . . . . New Jersey.
SHELDON, WILLIAM H. . . . . New Jersey.
STEPHENS, JOHN R. . . . . Pennsylvania.
SUYDAM, HENRY. . . . . New Jersey.
THOMPSON, EDWARD P. . . . . New Jersey.
VILLA, JOSÉ MARIA. . . . . U. S. Colombia.
ZAHNER, ROBERT . . . . Ohio.

ASSISTANTS IN MECHANICAL LABORATORY.

JAMES E. DENTON, M.E., '75.
EDWARD A. UEHLING, M.E., '77.
FRANK E. IDELL, M.E., '77.
ADAM RIESENBERGER, M.E., '76.

ASSISTANT IN PHYSICAL LABORATORY.

H. E. RICHARDS, A.M., M.D.

SUPERINTENDENT OF WORKSHOP.

SAMUEL HAWKRIDGE.

ALUMNI.

CLASS OF 1877.

BRINCKERHOFF, ALEX. G., M.E. . . . . New York.

Thesis: Design for a Telescopic Hydraulic Elevator.
Location: Wyllys H. Warner, Steam Heating and Ventilating, New York City.

COSTER, MAURICE I., M.E. . . . . New York.

Thesis: On the Alloys of Copper, Tin, and Zinc.
Location: Erie Division, Michigan Southern R. R., Cleveland, O.

GEYER, WILLIAM E., A.B., B.S. . . . . New Jersey.

Location: Stevens Institute of Technology.

IDELL, FRANK E., M.E. . . . . New Jersey.

Thesis: The Compound Engine.
Location: Mechanical Laboratory, Stevens Institute.

NASH, LEWIS H., M.E. .... Connecticut.

Thesis: Design for a Side-wheel Steamer.
Location: National Meter Co., Williamsburgh, L. I.

PIERCE, JAMES B., M.E. .... Pennsylvania.

Thesis: Project for the Erection of a Bessemer Steel Plant.
Location: Sharpsville, Pa.

RAPELJE, JOHN, M.E. .... New York.

Thesis: Design for a Bridge across the Hudson at Poughkeepsie.
Location: Hopewell Junction, N. Y.

ROBERTS, EDWARD P., M.E. .... New Jersey.

Thesis: Direct Acting Steam Pumps.
Location: Thos. S. Crane, Consulting Engineer, Newark, N. J.

UEHLING, EDWARD A., M.E. .... Wisconsin.

Thesis: Harvesting Machines.
Location: Mechanical Laboratory, Stevens Institute.

VAN WINKLE, FRANKLIN, M.E. .... New Jersey.

Thesis: Plans for an American Silk Factory.
Location: Consulting Engineer, Paterson, N. J.

CLASS OF 1876.

BREWER, SAMUEL B., M.E. .... New Jersey.

Thesis: On Centrifugal Pumps.
Location: Cranbury, N. J.

BUERK, JOHN O., M.E. .... Indiana.

Thesis: Design for a Fifty Ton Overhead Travelling Crane.
Location: Light House, New London, Conn., 1876.

CREMER, JAMES MORTIMER, M.E. .... Pennsylvania.

Thesis: Review of Pumping Engines.
Location: Midvale Steel Works, Philadelphia, Pa.

HENNING, GUSTAVUS C., M.E. .... New Jersey.

Thesis: Suspension Cables of Brooklyn Bridge.
Location: Deltoid Compound Steam Pumping Engine Co.'s Works, Brooklyn, L. I., 1876; Edgemoor Iron Works, 1877; Brooklyn Bridge, 1878.

KENT, WILLIAM, M.E. .... New Jersey.

Thesis: Project for the Erection of Two Blast Furnaces.
Location: Mechanical Laboratory, Stevens Institute, 1876-77; Assistant Editor *American Manufacturer and Iron World*, Pittsburgh, Pa.

KINGSLAND, JOSEPH, M.E. .... New Jersey.

Thesis: Designs for a Paper Mill.
Location: Franklin Paper Mills, Franklin, N. J.

RAQUÉ, PHILIP E., M.E. .... New Jersey.

Thesis: Design for an Iron Foundry.
Location: Twenty-third Street R. R., New York City.

RIESENBERGER, ADAM, M.E. .... New Jersey.

Thesis: The Screw Propeller, Principles and Practice.
Location: Mechanical Laboratory, Stevens Institute.

STAHL, ALBERT W., M.E., U.S.N. .... New York.

Thesis: Transmission of Power by Wire Ropes.
Location: Engineer Corps, United States Navy.

TRAUTWEIN, ALFRED P., M.E. .... New Jersey.

Thesis: The Manufacture of Coal Illuminating Gas.
Location: Continental Iron Works, Greenpoint, L. I.

VAIL, EUGENE L., M.E. .... New Jersey.

Thesis: On Apparatus for Extinguishing Fires.
Location: U. S. Geol. and Geog. Survey of the Territories, 1877.

WALL, EDWARD B., M.E. .... New Jersey.

Thesis: The Principles of Car Framing.
Location: Penn. R. R. Car Shops, Altoona, Pa.

WALLIS, J. MATHER, M.E. .... Louisiana.

Thesis: The American Beam Engine.
Location: Baltimore and Ohio R.R., Baltimore, Md.

WILES, EDWIN L., M.E. .... New York.

Thesis: Design for a Fifteen Ton Steam Hammer.
Location: Manufactory of Brick Machinery, Stony Point, N. Y.

WOLFF, ALFRED R., M.E., U.S.R.M. .... New York.

Thesis: The Theory of Windmills.
Location: Asst. Engineer, United States Revenue Marine.

ZIMMERMAN, WILLIAM F., M.E. .... New Jersey.

Thesis: Design for a Dredging Machine.
Location: Rogers Locomotive Works, Paterson, N. J., 1876-77; Mechanical Laboratory, Stevens Institute, 1877; New York and Oswego Midland R.R., Middletown, N. Y.

CLASS OF 1875.

BACHMANN, VALENTINE, M.E. .... Kentucky.

Thesis: Flouring Mills.
Location: Mill Wright and Hydraulic Engineer, Indianapolis, Ind.

DENTON, JAMES E., M.E. .... New Jersey.

Thesis: Theory of the Tractive Power of Locomotives.
Location: Assistant-in-charge of Mechanical Laboratory, Stevens Institute.

FEZANDIÉ, J. HECTOR, M.E. .... New York.

Thesis: Heating and Ventilation of the New York Post-office.
Location: Instructor of Mathematics, Fezandié Inst., New York City, 1877; Paris Exposition Correspondent of the *Iron Age*.

KOEZLY, THEO. F., M.E. .... New York.

Thesis: Sugar Refining Machinery.
Location: Mechanical Laboratory, Stevens Institute, 1875-7; Gillis & Geoghegan, Steam Heating and Ventilating, New York City.

SORGE, ADOLPH, M.E. .... New Jersey.

Thesis: Design for a Fifty Ton Floating Derrick.
Location: West Point Iron Foundry, New York, 1876-7. Gliss & Williams, Presses and Dies, Brooklyn, N. Y., 1878.

WALL, GEORGE B., M.E. .... New Jersey.

Thesis: Wire Rod Rolling and Wire Drawing.
Location: Patent Lawyer, New York City.

YAMADA, YOKICHI, M.E. .... Japan.

Thesis: Design for a Turbine Water Wheel.
Location: Professor of Engineering, Yeddo, Japan.

CLASS OF 1874.

HEWITT, WILLIAM, M.E. .... New Jersey.

Thesis: Construction and Management of Roll Trains.
Location: Trenton Iron Company, Trenton, N. J.

POINIER, P. P., M.E.* .... New Jersey.

Thesis: Efficiency of Direct Combustion Engines.

POST, HENRY W., M.E. .... New Jersey.

Thesis: Plans and Estimates for the Construction of a Machine Shop for the Manufacture of Stationary and Marine Engines.
Location: Watson Manufacturing Co., Paterson, N. J., 1876.

CLASS OF 1873.

HENDERSON, J. AUGUSTUS, M.E., U.S.N. .... New York.

Thesis: Aero-steam Engines and their Utilization of the Total Heat of Combustion.
Location: Delaware River Iron Shipbuilding and Engine Works, Chester, Pa., 1873-74; Baltic Iron Shipbuilding Works, St. Petersburg, Russia, 1874-75; Engineer Corps, United States Navy.

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* Deceased, 1876.

THE STEVENS HIGH SCHOOL,

OR

ACADEMICAL DEPARTMENT

OF

THE STEVENS INSTITUTE OF TECHNOLOGY

Trustees.

Instructors.

REV. EDWARD WALL, A.M., PRINCIPAL,
Latin, Greek, Rhetoric, and History.

CHARLES F. KROEH, A.M.,
English Studies and German.

JOHN R. PADDOCK, PH.B.,
Physiology, Natural History, Latin, and English.

JAMES E. DENTON, M.E,
Mathematics and Mechanical Drawing.

WM. ERNEST GEYER, B.S.,
Chemistry and Natural Philosophy.

DANIEL DE LAMENON,
French.

ARTHUR F. EWELL,
Free-Hand Drawing.

B. B. BROWN,
Penmanship and Book-keeping.

Stevens High School.

THE Stevens High School is the Academical Department of the Stevens Institute of Technology, and its graduates are prepared for admission to the latter. Pupils are also fitted for College, and for commercial pursuits, instruction being given in all the branches taught in Classical and Commercial Academies. Its relations with the Stevens Institute give it peculiar advantages in making use of science in the education of youth. The apparatus, and all the facilities of the Institute, are used in illustrating the elementary instruction given in Natural Philosophy and Chemistry. The Students in the High School are also admitted to all the courses of popular lectures delivered in the Stevens Institute.

All the instruction in the Physical Sciences, being illustrated with experiments, the information is conveyed in a form which fixes the attention, and develops the power of observation. The facts and laws of Physical Science are embodied in the experiments, as well as narrated and interpreted by the instructor, so that the apprehension of them is more complete. So simple and easy of comprehension are many of the most important truths of Science that, even at an early age, much of the greatest value may be acquired, and, being then thoroughly assimilated, will defend the Student from the false theories and deceptions to which all not sufficiently informed are now so frequently exposed in various business relations.

It has been also proved by experience that such instruction develops a taste for refining and beneficial home employments, which are of incalculable value in the moral training of the young.

The branches taught in the several classes, and the order in which they are studied, are exhibited in the following pages:

COURSE OF STUDY.

FIRST CLASS.

Reading and Definition; Spelling, Dictation exercises; English Grammar; Declamation and Composition, biweekly exercises; Written Arithmetic; Mental Arithmetic; Geography; History of the United States; Natural History; Elements of Book-keeping; Penmanship, English and German; Free-hand Drawing.

ANCIENT AND MODERN LANGUAGES.

Latin.—New Latin Method. French.—Fasquelle's Introductory French Course; Collot's Reader. German.

SECOND CLASS.

Reading and Definition; Spelling, Dictation exercises; English Grammar; Composition and Declamation, biweekly exercises; Written Arithmetic; Mental Arithmetic; Book-keeping; Geography, with Map-Drawing; English History; Algebra; Penmanship; Free-hand Drawing; Natural History.

ANCIENT AND MODERN LANGUAGES.

Latin.—Latin Lessons and Latin Grammar; Smith's Smaller History of Rome. French.—Otto's Grammar; Collot's Reader; Translations, French into English, English into French. German.

THIRD CLASS.

Reading and Dictation Exercises; English Grammar; Physical Geography; Composition and Declamation, biweekly exercises; Universal History; Penmanship; Book-keeping; Natural Philosophy and Chemistry, Lectures and Recitations; Higher Arithmetic; Algebra; Geometry; Mechanical Drawing.

ANCIENT AND MODERN LANGUAGES AND LITERATURE.

Latin.—Cæsar's Commentaries; Virgil; Latin Prosody; Ancient Geography. Greek.—White's First Lessons in Greek; Goodwin's Greek Grammar; Smith's Smaller History of Greece. French.—Otto's Grammar; Sadler's Course of Versions; Roemer's Polyglot Reader (French); Conversation. German.

FOURTH CLASS.

English Grammar; Dictation exercises; Composition and Declamation, biweekly exercises; Universal History; Natural Philosophy and Chemistry, Lectures and Recitations; Physiology and Hygiene; Astronomy; Algebra; Geometry; Elements of Trigonometry; Higher Arithmetic; Rhetoric; Mechanical Drawing.

ANCIENT AND MODERN LANGUAGES AND LITERATURE.

Latin.—Cicero's Orations; Sallust; Ancient Geography. Greek.—Anabasis: Homer's Iliad, two books; Smith's Smaller History of Greece. French.—Noel and Chapsal's French Grammar; Roemer's Polyglot Reader (French); Composition; Elements of Literature; Conversation. German.—Language and Literature.

GOVERNMENT AND DISCIPLINE.

In the government of the students, reliance is placed exclusively on moral means. The punishments are *demerits*, *admonition by the Principal*, *suspension*, and *dismissal*.

A copy of the Rules of Order is placed in the hands of each pupil when admitted to the school.

REPORTS.

Among the means for securing order, punctuality and diligence, great reliance is placed on a thorough and carefully administered system of grading. The attendance, the deportment and the recitations of each student are daily recorded. These records furnish the materials for the monthly report to parents.

The Monthly Report is designed to give parents a comprehensive view of the scholarship, deportment and punctuality in attendance of their children. They are earnestly requested to make it the subject of a careful examination, and of remark in the family circle. They will thus stimulate their children to greater diligence, and strengthen the moral force by which the school is governed.

EXCUSES.

All excuses must be in writing from parents or a proper authority at home. They are in all cases submitted to the Principal, and returned with the Monthly Reports. No excuses are valid for absence from a class exercise, or a failure to recite, except sickness or absence from the city.

ACADEMIC YEAR.

The Academic Year, from the beginning of the Autumn Term of 1878, will be divided into three terms, as follows:

Autumn Term—From the first Wednesday in October to the Saturday before Christmas.

Winter Term—From Monday, January 6th, 1879, to Wednesday, April 9th, 1879.

Spring Term—From Monday, April 21st, 1879, to the last Friday in June.

The next Academic Year commences Wednesday, October 2d, 1878.

The advantages to those who enter at the beginning of the school year are obvious. Pupils are received, however, at any time, if found qualified to join the classes in progress.

RATE OF TUITION.

The rate of Tuition is $150 per year, or $50 per term for pupils in the Third and Fourth Classes, and $100 per year, or $33.33 per term, for pupils in the First and Second Classes.

There are no extras of any kind whatever. The charge per term covers all the expenses of all branches taught in the school

Payments invariably in advance. Pupils entering at any time within four weeks from the beginning of a term are charged the full price. No deduction made for absence, unless on account of sickness; and only in such instances when the absence has continued for half a term. In such cases the loss is divided between the school and the parents of the pupil.

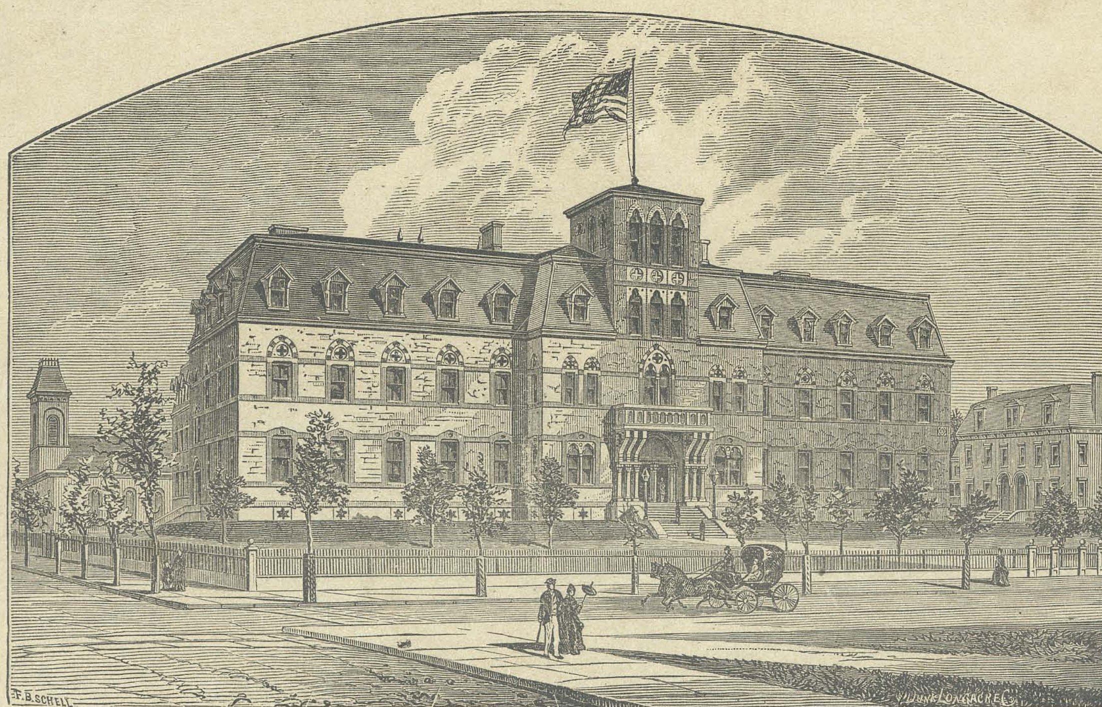
FREE SCHOLARSHIPS.

Four free scholarships in the Stevens Institute of Technology are open to the competition of the graduates of the Stevens High School.

List of Students

IN THE ACADEMICAL DEPARTMENT.

ALLEN, ROBERT B.	Baltimore, Md.
BONN, FRITZ.	Weehawken, N. J.
BIRDSEYE, CHAS. E.	Montclair, N. J.
BODKIN, JOHN S	Hoboken.
BARNARD, JOHN H.	New York City.
BARRY, DENIS W.	New York City.
COOKE, FREDERICK W.	Paterson, N. J.
CLARK, WILLIAM F.	Chatham, N. J.
COE, LOUIS STEVENSON.	Englewood, N. J.
CRANE, BENJAMIN.	Morristown, N. J.
DILWORTH, WILLIAM.	Hoboken.
FRAENTZEL, FREDERICK.	Newark, N. J.
GELLATLY, W. B.	Orange, N. J.
GUDEWILL, HERMANN.	Hoboken.
HOWES, ROBERT C.	East Orange, N. J.
HACKETT, GEORGE F.	Jersey City Heights.
HODGSON, JOHN H. P.	Hoboken.
HUDNUT, FRANK P.	Orange, N. J.
JENKINS, FREDERICK.	Hoboken.
JOHNSON, A. H. W.	Jersey City Heights.
MARTIN, EDWIN R.	Hoboken.
MONROE, ANDREW FULLER.	Jersey City Heights.
MEAD, MORRIS B.	South Orange, N. J.
MOORE, ALEX. T.	Orange, N. J.
POPE, JAMES E.	Jersey City Heights.
PARSONS, HINSDILL.	Hoosac Falls, N. J.
RUTHERFURD, R. A.	New York City.
SCHALK, RUDOLPH E.	Newark, N. J.
SEYFRIED, R. E. VON.	Newark, N. J.
STEVENS, ALEX. B.	Hoboken.
SCHULTZE, EMIL, Jr.	Hoboken.
SPRAGUE, WILLIAM B.	Hoboken.
WALL, ALBERT C.	Hoboken.
WATKINS, WM. H.	South Orange, N. J.
ZIMMERMAN, GEORGE DE L.	East Orange, N. J.



FRONT VIEW.