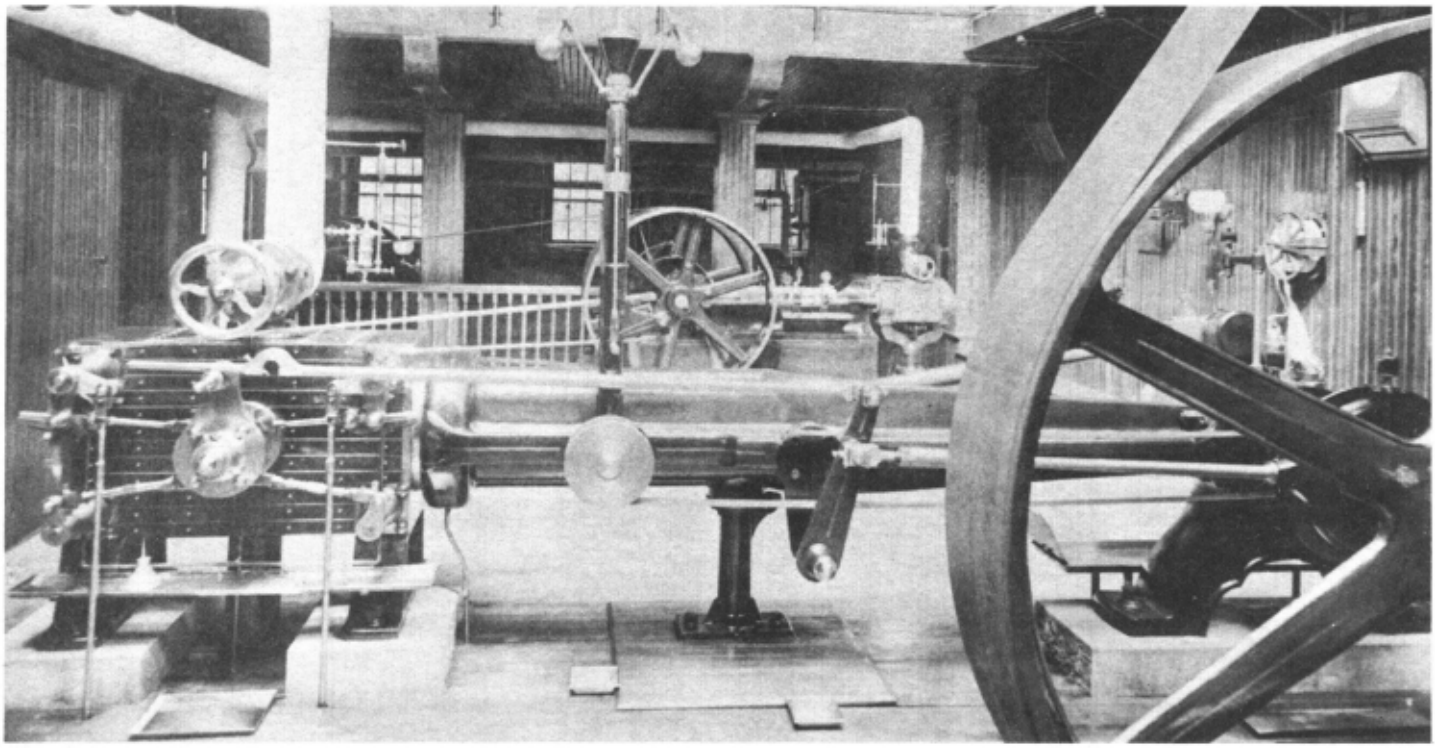
PRATT INSTITUTE
POWER GENERATING PLANT



1887-1900 Engine Room View West

A NATIONAL HISTORIC
MECHANICAL ENGINEERING LANDMARK

PRATT INSTITUTE

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

April 20, 1977

DEDICATION CEREMONY

Pratt Institute Power Generating Plant

6:00 p.m. - April 20, 1977

Opening Remarks	Maurice H. Angrist, Chairman Metropolitan Section, ASME
Introduction of Honored Guests	Robert A. Baker, Vice President Region II, ASME
ASME Landmark Program	Dr. R. Carson Dalzell, Secretary National History & Heritage Committee
History of the Power Generating Plant	Conrad Milster, Chief Engineer Pratt Institute
Presentation of Plaque	Earle C. Miller, President, ASME
Acceptance	Dean Arthur Seidman, Dean of Electrical Engineering, Pratt Institute
Tour & Inspection of Landmark	All Guests

ACKNOWLEDGEMENTS

The Metropolitan Section of The American Society of Mechanical Engineers gratefully acknowledges the efforts of all the people who cooperated to make the dedication of Pratt Institute a success.

THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

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Dr. Stothe P. Kezios	President-elect, 1977-78
Robert A. Baker	Vice President, Region II
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PRATT INSTITUTE

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Conrad Milster	Chief Engineer

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THE BROCHURE

The brochure was authored by Conrad Milster, Chief Engineer, Pratt Institute. It was edited and compiled at HQ by the ASME Public Relations staff.

I. The Construction of the Institute

Pratt Institute was founded by Charles Pratt, a Victorian industrialist, whose life was a textbook example of the rags-to-riches-through-hard-work ethic. Like other wealthy men of the period he used much of his fortune for "good works," one of which was the founding of a school for the practical training of young men and women.

Land for the Institute was purchased in 1885 in the Clinton area of Brooklyn. Bounded by Grand Avenue on the west side, at that period it still consisted largely of open fields. Three quarters of a mile to the north was the Brooklyn Navy Yard and an intervening belt of small shops, factories and tenements. To the west was the beginning of the brownstone building boom which soon earned the city of Brooklyn its reputation as the "bedroom" of New York City. The choice of land was a wise one, for on May 14, 1885 the Brooklyn Elevated Railroad had opened the second "E1" line in Brooklyn, and part of its route ran down Grand Avenue alongside Pratt's land. Thus, in June of 1888 advertisements placed in newspapers could claim that the Institute was only "16 minutes from City Hall, N.Y.," a time which today is not always possible to match, even by automobile.

The Institute's charter was granted by the N.Y. State Legislature on May 19, 1887, by which time construction was already underway. The first two buildings were known as "Main" and the "Mechanical Arts Building". The latter is known today as the East Building.

The Main Building, consisting of a basement, six stories of classrooms and a two-story tower, was designed by the New York architectural firm of Lamb and Rich.

Oddly enough, the East, or "Mechanical Arts Building," was designed by a different architect -- William Windrim of Philadelphia. The original drawings called for an "L" shaped building with a basement and two stories above grade, but an 1888 photo shows the North-South wing to have four stories and the East-West wing five stories above grade. At some period near the turn of the Century the North-South wing had an extra floor added to it.

A third building, single-storied and without a basement, was also built -- again with a different architect, W. B. Tubby -- and was called the Trade School Building. It had a wood truss room with a minimum internal height of about 30 feet, and the open area within was used for such diverse courses as bricklaying, plumbing and sign painting. It, too, is still standing although infrequently used this last year.

In order to protect his investment Pratt had the buildings designed on the standard mill construction of the period so that, should the school fail financially, he had a usable commercial property.

It was planned to equip the buildings with steam heat, both gas and electric lighting, and an elevator. Contracts were accordingly given to Rutzler and Blake for the heating, The Edison Electric Company for the electric lights and the Otis Elevator Company for a seven-story passenger car.

The Harris-Corliss Company of Providence, R. I. supplied a horizontal, 40-horsepower engine; its belt drove the machine shop equipment. Logan and Company installed two 110-HP boilers and associated piping, while the Worthington Company supplied fire and boiler feed pumps. The Custodis Chimney Company received the contract for a stack, 124 feet above grade, square at the base and octagonal from about one third its height up.

The usual construction problems seem to have been encountered, for on October 10, 1887 the trustees noted that, due to the scaffolding for the incomplete chimney, the engine and boiler rooms, as well as the fourth floor, were still exposed to the weather and therefore deficient.

The first registration for classes was held on October 3, 1887 -- only 15 registrants appeared. While at first this may have disconcerted school officials, it is doubtful they could have conveniently handled a greater number, for neither boilers nor generators were yet in operation. The boilers were at last functionable by late November. On the 14th the chimney had been completed, on the 21st the boilers were inspected and passed, and on the 22nd they were lit for the first time. This must have been welcomed by the Institute staff who up to this point had been using coal stoves for heat. The trustees officially postponed night classes until January 1, 1888 because of the delays in construction and in December noted, no doubt with some annoyance, that "The Edison Electric Company through their agent Mr. Chinnock have been very slow in getting the plant in order and it looks now as if there would be no light until January." Like the heat, the lighting up to now had been makeshift -- oil lamps which doubtless burned "Pratt's Astral Oil". One bright spot during December was the arrival and installation of the Harris-Corliss Engine.

An interesting point regarding fuel for the boilers: In October 1888 a statement was made to the effect that "Oil has proved cleaner and easier to handle but slightly more expensive than coal". It is believed that the conversion to oil fuel took place in late September 1888, but no certain details survive.

The use of oil fuel and electric lights would indicate that while Pratt had the typical Victorian businessman's cautiousness about protecting his investments, he nonetheless was willing to try new improvements if they seemed beneficial in nature.

The generating plant finally went "on stream" on January 4, 1888, and the Institute officials must have heaved a collective sigh of relief. Classes could now begin in earnest. The event was celebrated by the opening of the school's Free Library reading room, with 500 guests and visitors present the first day.

The Main Building's incandescent lights were supplied with power from a generating set consisting of an Armington and Sims horizontal engine belt driving an Edison bi-polar generator. There was also a 125-HP N.Y. Safety Steam Power

engine belt driving both a Sawyer-Man dynamo and a Western Electric arc lamp dynamo. These latter machines provided light for the East or Mechanical Arts Building and the Trade School Building. An interesting question which remains unanswered: "Who installed the Arc lighting?" Did the Edison Company install a rival firm's equipment or did someone else? And if so, who, for there is no record of any other electrical firm being used.

While construction was proceeding in the fall of 1887, Joseph Foster was engaged as Engineer with an assistant to act as fireman. Foster was to receive a salary of $15 per week. By mid-December this had been raised to $20 per week, and in July 1898 Foster was appointed Chief Engineer. The title appears to have been first used at this time and included an increase in responsibility, for the cleaning and maintenance staff as well as the power plant was now under the Chief Engineer's management.

Foster's exact length of service is unknown, but he was still employed until about July 1927. To this day there have been only four Chief Engineers employed in the 90 years of the Institute's operation.

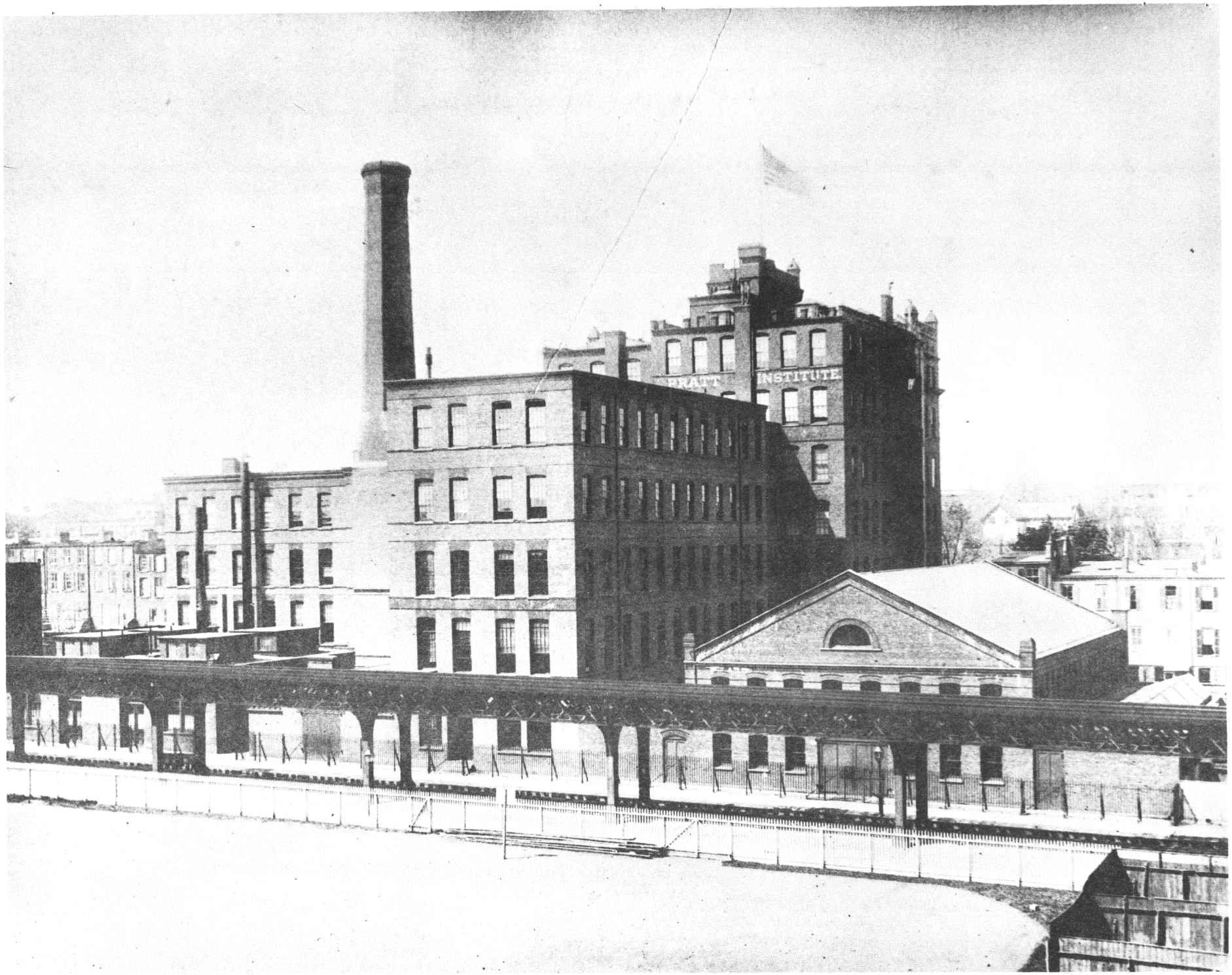
In 1889 a listing of mechanical equipment included a "Thompson-Houston" dynamo but made no mention of the Sawyer-Man machine, leading to the inference that it may have been replaced. Also included was a "Power Engine," a small horizontal steam engine located in an area adjacent to the Engine Room and used as an engineering lab.

During the summer of 1889 the heating system was remodeled "on the new exhaust plan," whereby exhaust steam from the steam engines was fed into the heating system as needed instead of being blown into the atmosphere. As this was already a well established custom (Edison planned to use exhaust steam from Pearl Street as a saleable by-product for district heating in 1882) it is surprising that the system was not installed originally.

The Edison Company must have made their peace with Institute officials, for in January 1888 they received a $692 contract for installing overhead shafting in the machine shop, a job completed by mid-March.

The day of the big blizzard of 1888 found two students in attendance -- it was decided to close for the next two days.

By 1896 the two boilers, although only nine years old, were in need of replacement, and in June of that year a third boiler, supplied by Babcock and Wilcox, was installed. Two more arrived in July, together with a new feed pump, forced draft fan and larger breeching for the flue gas uptakes. It was then decided to revert to coal for fuel.



The Institute in 1889 - buildings housing engines still remain.

II. The Institute Expands

In 1896 a new three-story Library Building was erected across from the Main Building, and shortly thereafter a Household Science and Arts Building was constructed on the south side of the Main Building. A new $1,125 switchboard was installed to meet these new loads.

The increased load brought to the fore the need for new generators. During the summer of 1900 the Ames Iron Works of Oswego, N.Y. provided three new machines which replaced the original engines, including the Corliss. The three steam engines -- Ames Iron Works serial numbers 18842, 18843 and 18844 -- have been in regular service ever since their 1900 installation. Each engine has a single cylinder 14" bore by 12" stroke, and all were originally designed for operation with steam at 100 PSI. Boiler operating pressure is now 120 PSI. They are directly connected to General Electric 75 KW generators turning about 270 RPM (actual speed varies slightly) and are controlled by inertia governors mounted in the flywheels. This type of governor is different from that usually shown in the early Ames drawings. Generator output is 120 volt DC and presently supplies about one third of the original campus buildings. As originally built, the engines had balanced slide valves, but at some time circa the 1920's they were converted to outside admission piston valves by using a Baker conversion "kit". The kit consists of a piston valve housing held against the original valve chest face by bolts, passing through the valve chest cover. Speed control is by means of inertia governors mounted in the flywheel which vary the valve travel, and therefore the steam admission opening, to maintain a constant RPM of about 270. At this time a new gray marble switchboard was provided against the north wall of the engine room.

The engines as built exactly match a description published in the October 12, 1893 issue of the "American Machinist", and, in fact, the magazine cuts have already been used for maintenance purposes as no other drawings of parts exist at Pratt.

By 1908 the addition of the Chemistry Building created the need for more capacity, and another radical departure was made with the installation of a General Electric turbine generator set.

The prime mover is a three-stage Curtiss turbine directly connected to a four-pole 150 KW generator turning at 2000 RPM. This unit has interpoles between the main field poles, but the reciprocating engine generators do not. An interesting feature of the unit is the split commutator on the electrical end with the armature mounted between the two halves of the commutator. This was an attempt to get the needed copper for load carrying without an excessively large diameter commutator. The first recorded log entry for the turbine is for the week ending September 19, 1908 showing 8¼ hours of operation. The last entry for the unit is the week ending April 9, 1949 showing a total of 18 3/4 hours. The unit has been out of service ever since.

The Machinery Building was constructed in 1912, and although the plant had

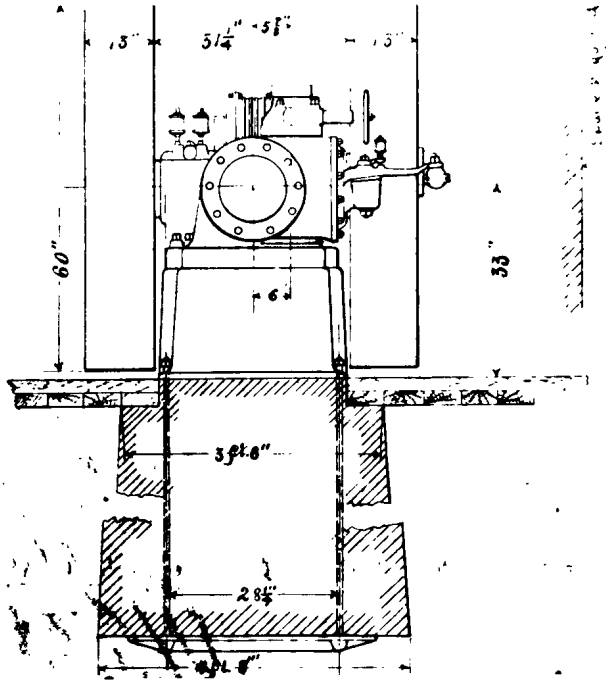
adequate electrical capacity it was limited in steam output. It was therefore decided to build a new boiler room under the area formerly occupied by the one-story forge and foundry shops on the ground between the Mechanical Arts Building and Grand Avenue. The original boiler room, somewhat enlarged, now became the coal bunker, and three 1896 boilers were reset in the new boiler room. Two additional Babcock and Wilcox water tube boilers were ordered, giving the plant a total of five. Steam pressure was 100 PSI. At the same time the top 80 feet of the stack were removed down to the gray capstones, and a new circular stack, also by Custodis, was built, making the total height 165 feet from the base.

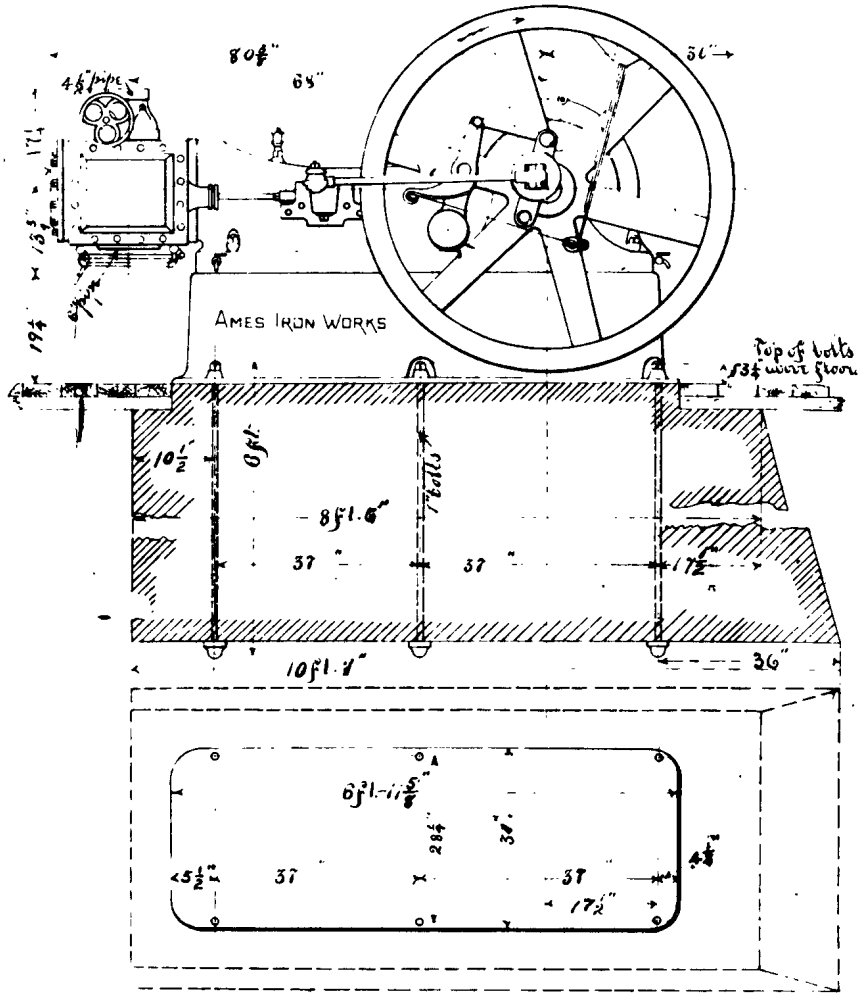
The expansion of the plant came at a fortunate time, for shortly afterward the U.S. was involved in World War II, and the Pratt Campus became an important mechanical training center for various Army repair operations.

In 927-29 the Engineering Complex and Auditorium Buildings were completed, bringing the Institute's original building programs to an end. The first use of three-phase 220 volt power was made at this time. Lines were run to supply the new engineering labs with AC, although a 230 volt three-wire DC connection had been made with the Edison network when the new switchboard was installed in 1900. This line (positive, negative, neutral) provided lights for use at night or on weekends when the regular plant was not running.

The Ames Iron Works of Oswego, N.Y. became noted for vertical uniflow engines (the Skinner Engine Company was championing the cause of horizontal uniflows), and in May of 1928 several proposals were prepared for the addition of two four-cylinder vertical uniflows with 12" x 14" cylinders powering 250 KW generators. The proposals were not acted upon.

Also at this time -- 1929 -- the Edison Company prepared a report on the economics of the Institute's power plant. It stated that, although still economical in operation, the engine/generator units were almost 30 years old "and nearing the end of their useful life"!!!!





Directions for setting Sub-base.

Level off foundation at floor line. Put on sub-base wedging it up 1/4" to 3/8", lining it up at the same time. Put nuts on foundation bolts and tighten the sub-base down on the wedges. Build up inside the sub-base with stone and cement a few inches high. Mix 2 parts sand, 1 part good cement with but little water making a mortar about as stiff as putty. Drive this under the flange of the sub-base with a stick, filling all crevices tightly. Then complete filling of sub-base.

FOUNDATION PLANS

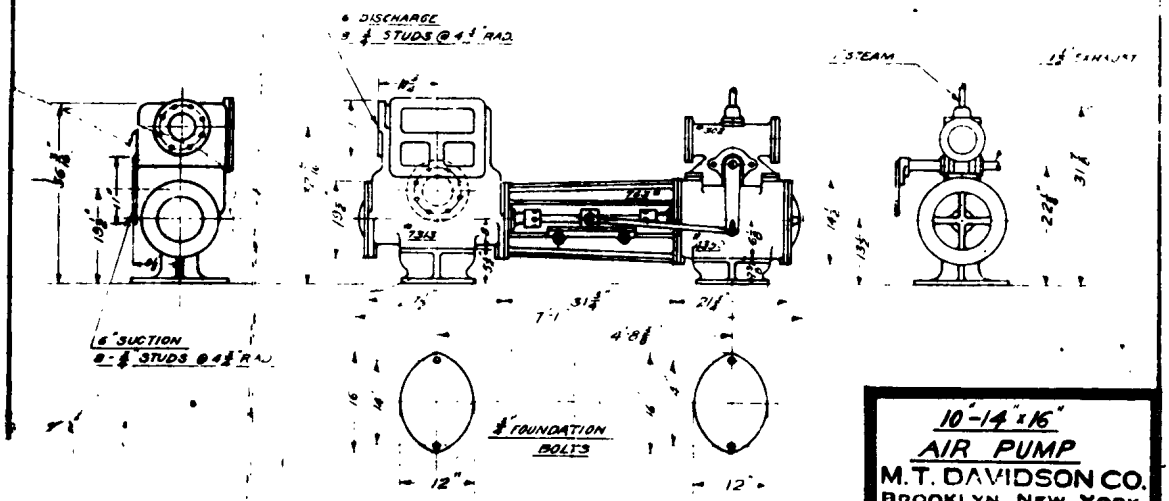
FOR

13" X 12" AUTOMATIC ENGINE.

AMES IRON WORKS, OSWEGO, N.Y.

1865

FS 112 163



10"-14"x16"
AIR PUMP
M. T. DAVIDSON CO.
BROOKLYN, NEW YORK.
DATE- DEC. 29-1920.
DRAWN BY [illegible] B-289
CHECKED BY L.T.R.

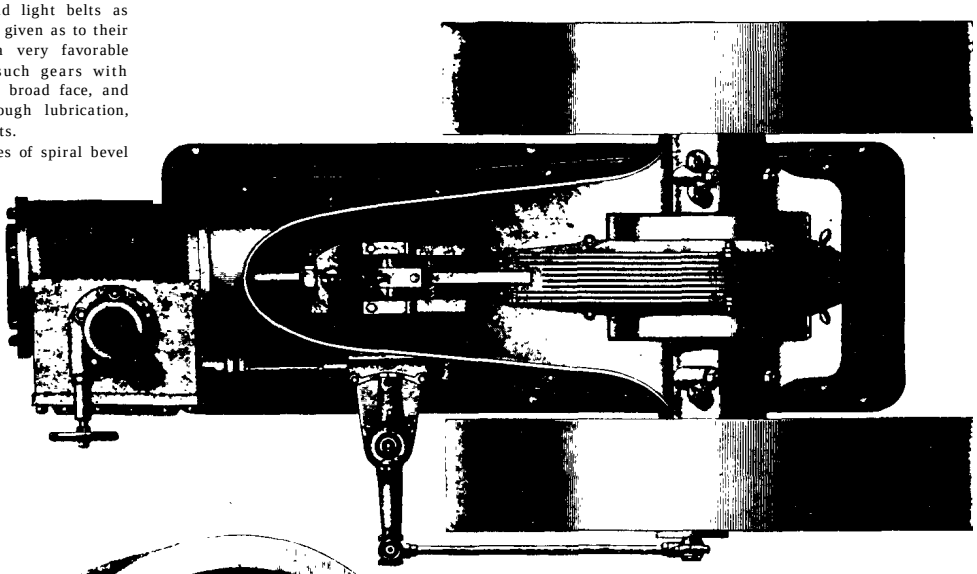
to each other, points in which the ordinary trans-fusion by bevel gears is lamentably deficient, as we all know. Several of these couplings are shown in operation, carrying very light loads, it is true, yet running at moderately high speeds, so quietly, and with such very narrow and light belts as drivers, that the impression given as to their smoothness of action is a very favorable one. Couplings made of such gears with their perfect form of teeth, broad face, and with such means of thorough lubrication, should give excellent results.

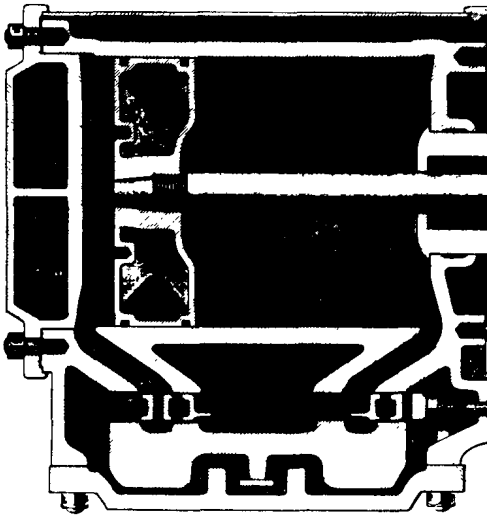
Some interesting examples of spiral bevel gears are also shown, some of these being illustrated in Figs. 82 and 83. (page 3) the first named being a pair of miter gears mounted on shafts at right angles to each other, and having teeth planed spirally. These gears work beautifully together and mounted as they are can be thoroughly tested. Speaking from memory of these gears I should say they were about 6" diameter and 4½" face. They have 40 teeth about 1 pitch. At Fig. 83 is another pair of gears in which the spiral principle has been carried still further. These have 18 teeth of about 1' pitch, have a face of about 2½", and the departure of the teeth from the straight line leading to the apex is about 1Y'S". These gears are planed in the machine illustrated and described in our issue of May 9, 1885, and are remarkable spacimens of gear making.

Still more remarkable, however, are the gears shown in Fig, 84, where we see accomplished what nearly erery machinist is in the habit of saying cannot be accomplished, i. *e.*, bevel pinions of varying sizes and numbers of teeth are made to work with a single bevel gear: the pinions all being of ? bafts placed at right angles to that spon which the gear is mounted

I'st abtedly the best man to explain how this is done is Mr. Bilgram himself, and at my request he does so as follows

"It is well understood that two bevel wheels cannot properly gear with each other unless the apices of their pitch cones coincide. The reason is obvious. The surfaces of two cones cannot roll upon each other without slip unless the apex of the one is in contact with that of the other.





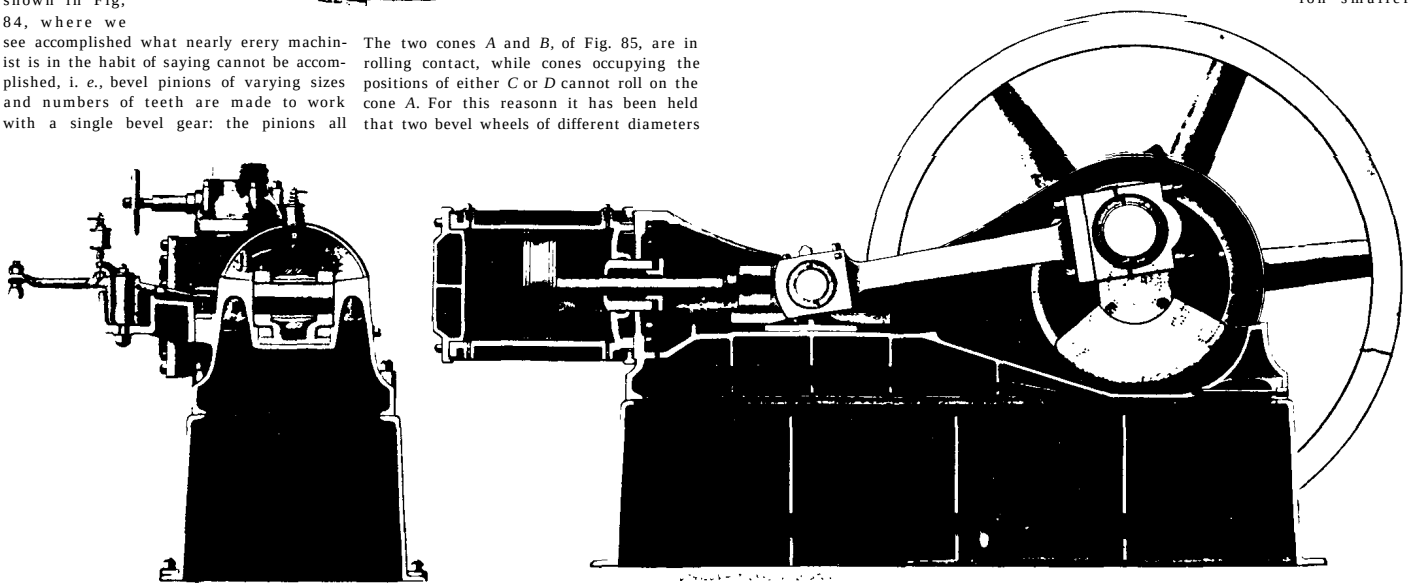
The two cones *A* and *B*, of Fig. 85, are in rolling contact, while cones occupying the positions of either *C* or *D* cannot roll on the cone *A*. For this reasonn it has been held that two bevel wheels of different diameters cannot be made to correctly gear with a third at right angles. That notwithstanding the production of such wheels is within the range of possibility, is illustrated by the exhibit of a set of four bevel wheels, consisting of a normal pair of 36 by 18 teeth, and two additional pinions of 12 and 24 teeth, both in gear with the 36 tooth wheel (Fig 84)

"A fair conception of the pecullar shape of the teeth of these abnormal pinions may be obtained by the following consideration.

"Although in practice the addenda of two spur gear wheels intended to work with each other are generally made equal, this is not an essential condition of correct gearing Departures from this practice are not rare. It follows then, that if a wheel were given with an excessive addendum and a correspondingly deficient dedendum, a pinion with conjugate teeth can be made having a deficient addendum and excessive dedendum. If, on the other hand, a wheel with deficient addendum and excessive dedendum were given, a conjugate pinion could be made adapted to those conditions.

"With this in view it is not difficult to show how it is possible to make bevel pinions of different diameters which will correctly gear with the same wheel. Let *A* and *B*, Fig. 86, be the section of a normal pair of bevel wheels. In order to make a pinion, *C*, smaller than *B*, to gear correctly with the bevel wheel *A*, a new pitch cone must be assigned to this wheel. In adapting the teeth of the new pinion *C*, to the existing teeth of the wheel *A*, it is found that at the large end the teeth of the wheel have a deficient addendum in relation to the new pitch line, and at that end the teeth of the pinion must be shaped to suit this condition. At the center of the teeth the addendum is normal, and there can be no difficulty in designing the porper form of the pinion teeth at that point. At the small end the addendum of the wheel is excessive, and the teeth of the pinion at that point must be made with a deficient addendum and a corresponding form.

"The solution of the problem of making a pinion smaller than the normal consists accordingly in giving the teeth of pinion a form conjugate to the form of the existing teeth of the wheel, a form which constantly changes, not only in size, but also in form in the sections from the large to the small end. At the large end the



A NEW AUOTOMATIC ENGINE — SEE PAGE 1.

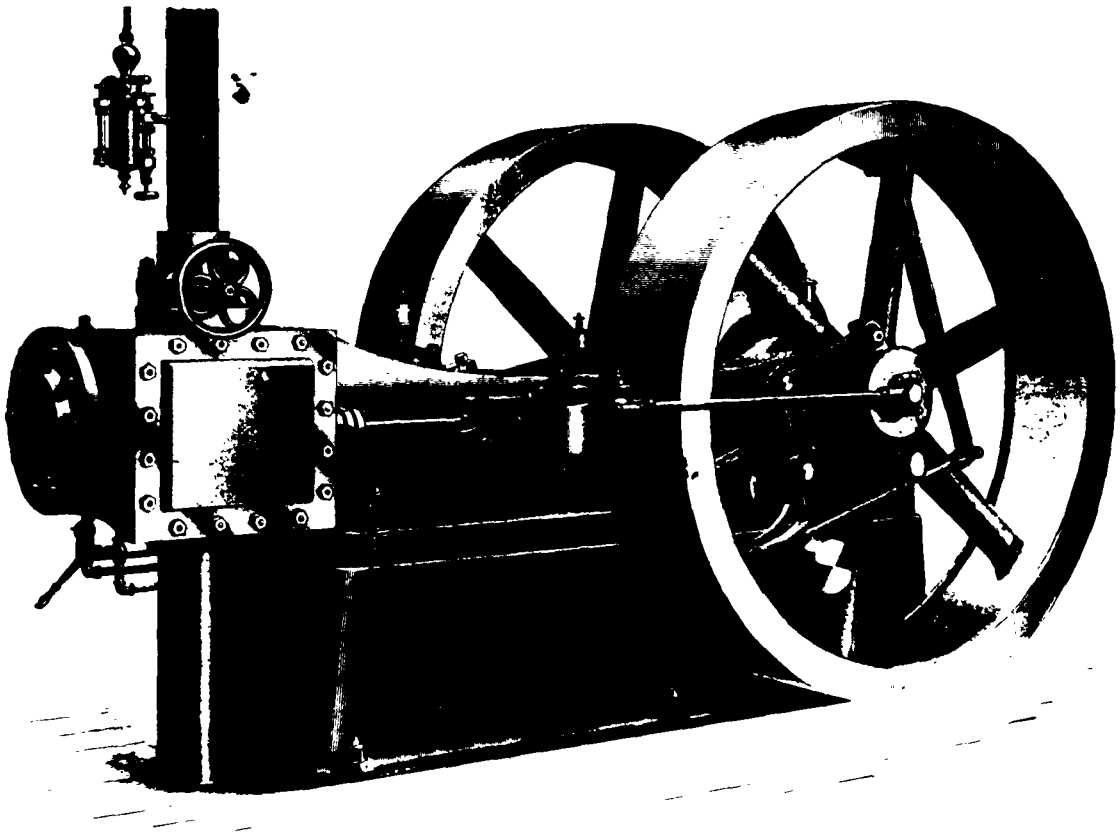


Fig 3078.

The valve, which is of the design patented by Professor John E. Sweet, of Syracuse, N. Y., and employed in the straight line engine, is a rectangular frame of the class that was shown cross sections of the cylinder, Figs. 3.81 and 3082, in which a represents the value and P a plate that excludes the steam from the back of the value. M and N are ??? ??? pieces made ???? ???

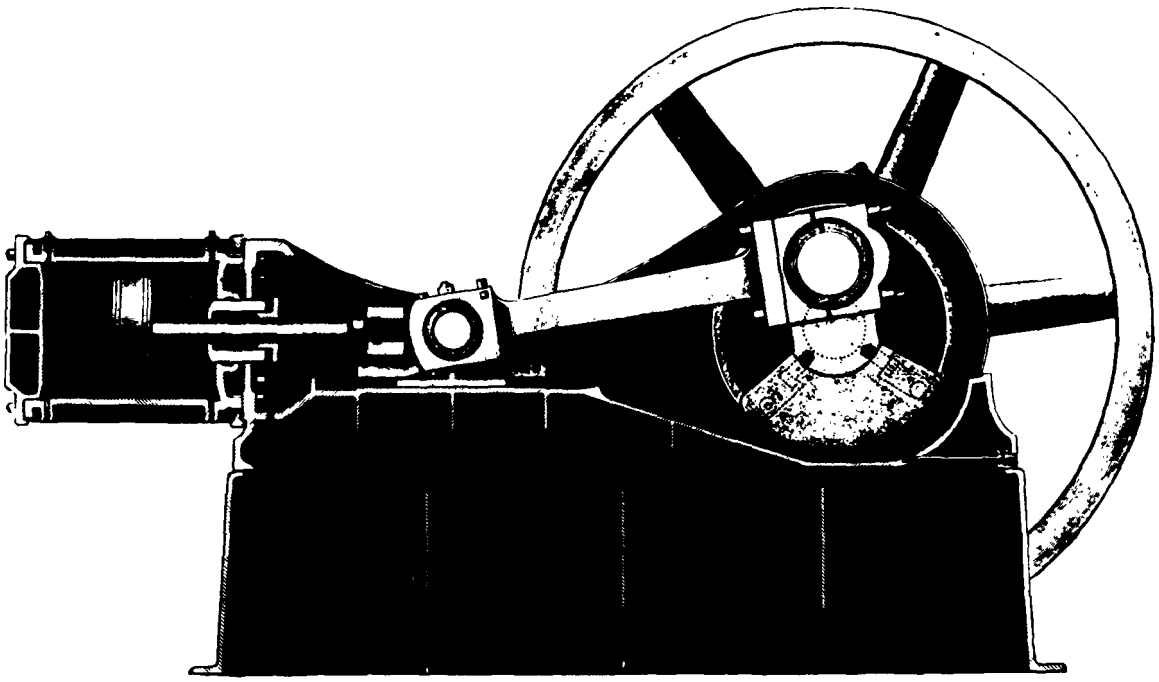


Fig. 3079.

in Fig. 2879, giving a double port opening for the admission The valve is balanced as shown in the horizontal and vertical thicker than the valve, and therefore receive the pressure of the plate P; and it is clear that the valve may slide freely to and fro

The connecting rod is of open-hearth forged steel; the crosshead end being solid, and the crank end of what is known as the marine engine type, as seen in Fig. 3085. The adjustment of the boves at the crosshead end is by a wedge moved by an adjusting screw on the top of the rod.

The adjustment of the crank end is secured by means of lock nuts; the outer one of each pair being of finer thread pitch than the inner, a construction which effectually prevents the nuts from working loose, as is apt to be the case when both nuts are of the same thread pitch.

The piston is made as light as is consistent with the necessary strength, and is maintained steam tight by means of two piston rings sprung into grooves in the piston.

The double disk crank, Fig. 3088, is a single forging of steel, cast-iron disks carrying the counterbalancing weights being firmly secured into the crank forging.

The cylinder and Valve are oiled by a sight-feed lubricator.

The main bearings and crank pin are oiled as follows: Sight-feed oil-cups are arranged over each main bearing, which feed oil directly to them. There is also a third sight-feed cup upon one of the bearings, which will, when desired, feed oil to the crank pin. A chamber, seen in Fig. 3088*a*, is provided under each of the main bearings, into which all oil, wasting from their outer end, drains. This oil is returned to the bearings by rings which, riding on the shafts and dipping into the chamber below, continualy carry up a stream of oil. All oil wasting from the inner ends of the main bearings is caught and carried to the crank pin. The holes through which the oil passes to the crank are one-half inch in diameter, so as not to be readily stopped up. They are also straight throughout their Iength, that they may be conveniently cleaned. lt is not always necessary to use the sight-feed cup provided to feed to the crank pin, as the oil wasting from the main bearings is usually sufficient.

In case of entire failure of the sight-feed cups, the oil chambers leterred to could be filled, and the oil rings would keep the main bearings and pin properly lubricated. The crosshead pin is oiled by a sight-feed cup, the oil being caught without waste by a very efficient wiper. The rocker-arm pivot works in a bath of oil, requiring no attention. Grease cups are fitted at each end of the eccentrie rod, and for the pivots in the governor, permitting an adjustment which provides efficient lubrication without waste.

Dram cocks are provided both for cylinder ends and for the steam chest. Much water may be drained from the steam chest in starting up without letting it get into the cylinder. The cylinder cocks are connected and arranged to be opened or closed by a single lever.

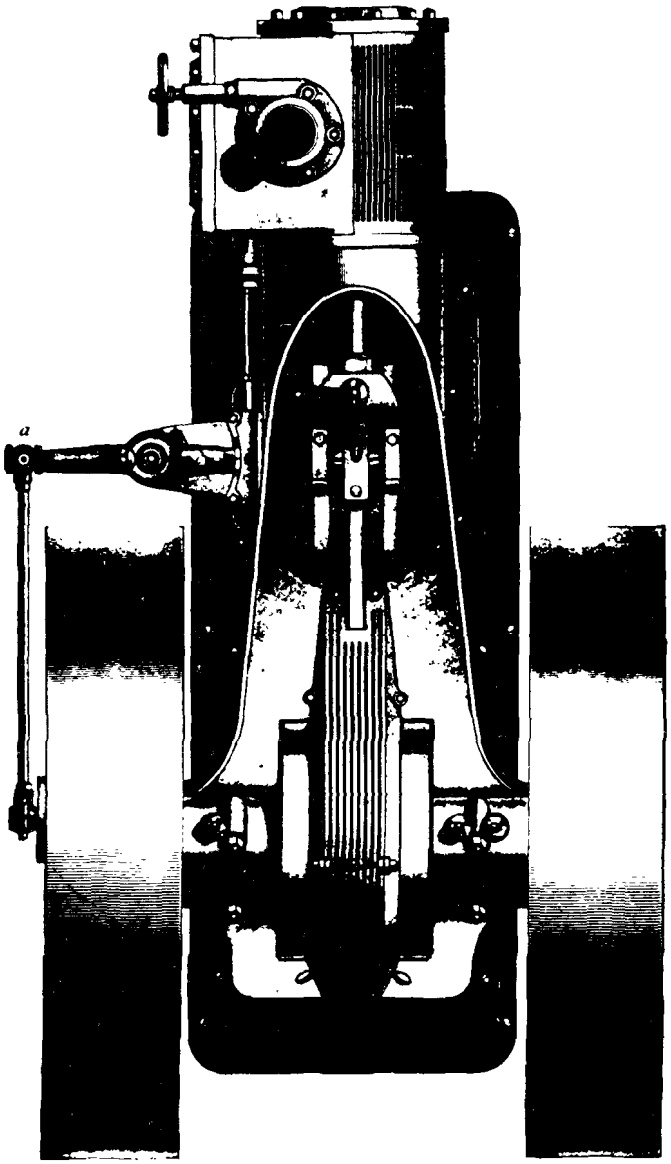
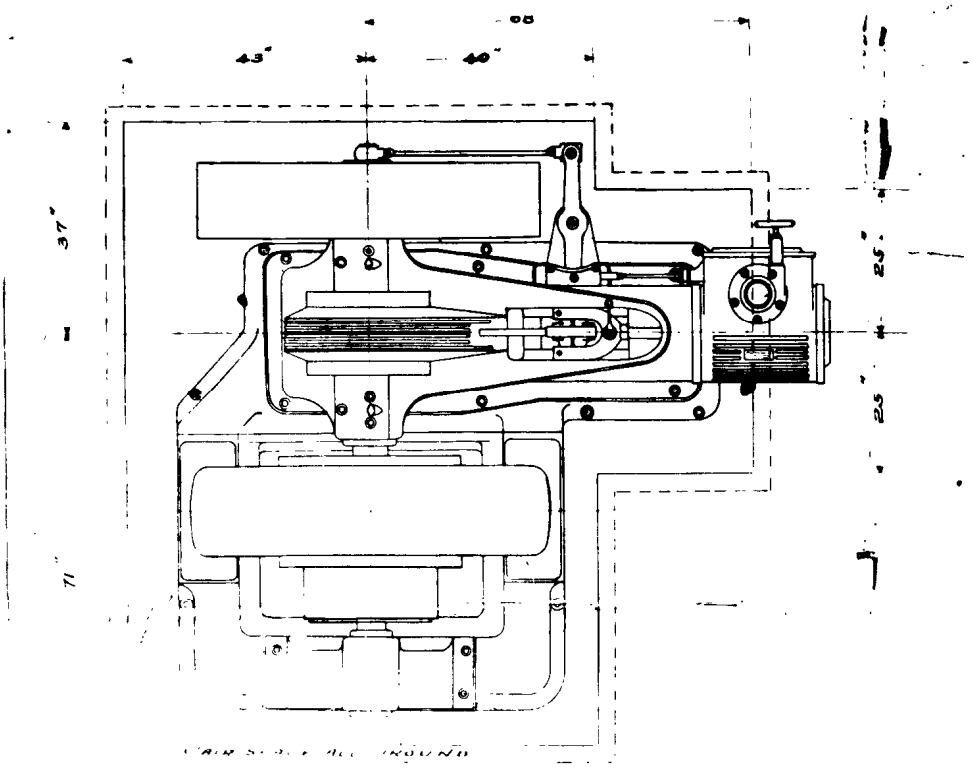
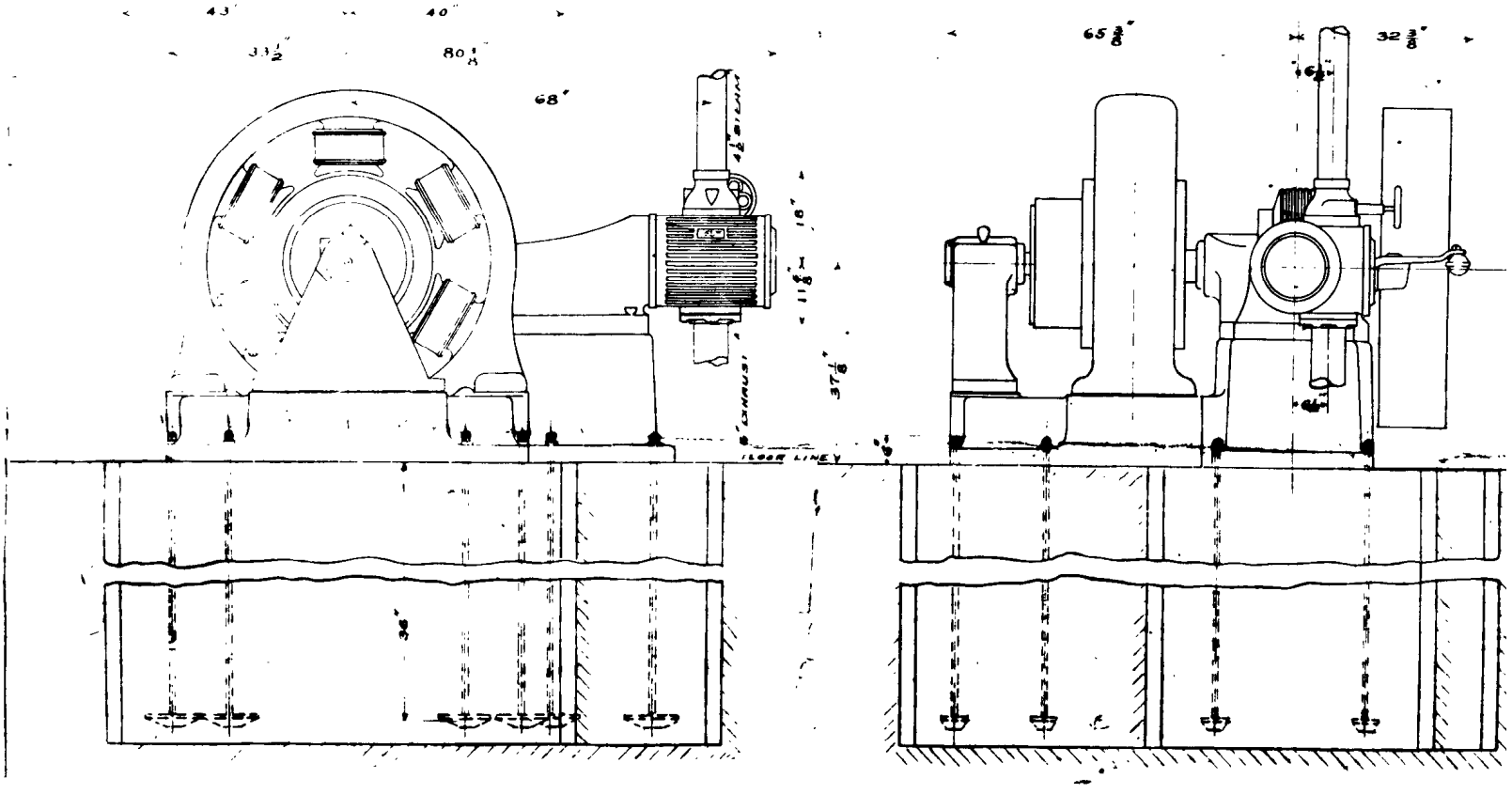


Fig 3088



FOUNDATION PLAN
14"x12" AUTOMATIC ENGINE
D.C. TO
75 K.W. GENERAL ELECT. GEN
AMES IRON WORKS
OSWEGO N.Y.
SCALE 3/4"=1'0"
5.5.1900
N.W.L.



Dated - May 8, 1900

III. Powering the Institute from 1930

The three original boilers were showing signs of wear, and by 1939 their steam pressure had been reduced to 90 PSI by the boiler inspectors. It was decided to replace them with two stoker-fired Combustion Engineering boilers of 210-HP each. The boilers were built for an operating pressure of 160 PSI but were operated at 120 PSI.

After the end of World War II, the Edison Company began to phase out its DC operations, and the Institute was faced with a problem of power supply. Practice at that time called for the sole use of Edison power during July and August when there were no classes. Running the boilers in the summer was expensive and undesirable.

Fortunately the answer came in the form of war surplus diesel generating sets, and three were installed: two 60 KW units and a 125 KW unit. These now provided power when no steam was available and also allowed retirement of the turbine, which by this time needed major repairs. Although officially retired in January of 1948 the turbine received a temporary lease on life when the #2 generator was put out of service from November 13, 1948 to April 23, 1949.

In 1954 the last of the 1914 boilers were taken out and a 220-HP packaged Foster Wheeler boiler installed. At the same time all of the 1914 steam auxiliary pumps were scrapped. The two 1939 boilers were converted to oil in 1949 and the coal bunker used for location of the fuel oil tank.

The increasing problems with the overloads of the Edison network have prompted the reinstallation of steam-powered auxiliary pumps in the boiler room, which not only act as back-up units for the electrically driven pumps, but which are also used when building heating loads require large volumes of low-pressure steam. Like the engine exhaust, all pump exhaust can be recovered in the heating system.

As originally laid out in 1887, the engine room was fitted with an observation balcony at street level, from which people could observe the plant in operation. The engineer’s office was located at the west end or inner courtyard of the engine room and covered the belt-driven generators. In 1908 this was changed and the office removed. At the same time new plate glass windows were installed in the building hallway, and a new entrance made onto the balcony. The area at the east or street end was floored over, thus covering the #3 engine, but the floor of the original office was removed, thereby opening up the engine room at the west end, where the turbine was now located. In effect, the balcony “hole” was shifted some 20 feet west.

The original boilers extended both below and above grade and were covered with a one-story boiler house which was removed in 1914. The marks of its peaked roof can still be traced on the brick smokestack.

The floored-over section at the east end of the engine room then became the chief engineer's office.

IV. A Brief Tour

Many artifacts from other power plants or buildings have been reused at Pratt. Following is a partial listing of some of these, as well as a number of the more interesting mechanical items in the power plant area.

Balcony. The cluster chandeliers at each end of the balcony formerly graced the Board of Directors Room in the Singer Building (many layers of "capitalistic cigar smoke" were removed during cleaning).

The three chandeliers in the middle are on loan from the Munaco clock company, which acquired them from the Marine Underwriters Association in New York.

The pendulum master clock was manufactured by the Self-Winding Clock Company which was originally located adjacent to the campus and was probably once part of the Pratt financial holdings. The clock and the "No Loafing" sign were rescued from the former Ruppert Brewery complex on Third Avenue and 90th Street, Manhattan.

The oval builder's plate came from a Corliss engine-driven ammonia compressor, located at the Standard Brands plant, Peekskill, N.Y. which was originally built for the Standard Oil Company. The Pratt Works referred to on the builder's plate was Charles Pratt's original Williamsburgh refinery, which became part of the Standard Oil complex.

The carbon arc lamp, hanging just inside the door, was found in a basement storeroom at the Brooklyn Academy of Music. The pear-shaped arc globe was "collected" at the Kirtland Park Pumping Station, Cleveland, Ohio.

The bi-polar generator on the balcony was found recently in Western Pennsylvania by Bruce Thain, of the Society for Industrial Archeology, on the site of an early private hydraulic generating plant. It is now awaiting restoration.

The Chief Engineer's office has been gradually "periodized" by the adoption of appropriate furniture. The desk is a cast-off of the Engineering School. The wall clock once served Pratt at an unknown location and was intercepted on its way to the trash pile.

The recording voltmeter in the corner by the left window served until 1969 in the Con Edison Crosby Street Substation, ca. 1910-15. The illuminated voltmeter is from the Columbia University Plant. The Venturi meter below it, which records boiler feed water flow, was installed during the boiler room renovation in 1915. The gauge board over the sink was assembled in 1965 and includes gauges from the Singer Building (top, indicating boiler pressure), a Pennsylvania Railroad tugboat (middle, showing boiler feed water pressure) and Pratt (two recorders, showing boiler pressure left, engine exhaust pressure right).

Engine Room. The three illuminated meters on the main switchboard are also from Columbia and indicate, top to bottom, bus bar voltage, lighting amperes and power amperes. They have been used to caver holes left by the removal of a modern circuit breaker which was installed with the large diesel generator in 1947. The diesel now feeds the board through the adjacent panel formerly used for the 1908 turbine generator.

The motor-generator set in the southwest corner can supply three-phase 220 volt power to the boiler room in an emergency. It came from Pratt's Electrical Engineering lab 10 years ago and was obviously a homemade set when installed there in 1927. The control panel contains parts from Columbia (voltmeters and rheostat hand wheels) and the City Investing Building (the marble panel formerly a gauge board and the ammeter).

The wood paneling in the lower Engine Room is the original paneling from 1887, with the exception of a corner, painted white, which was torn out in 1947 to aid installation of the diesel generators.

The three Ames Iron Works steam engines, mentioned previously, were installed during the summer of 1900 and have continued in regular service since then.

Pump Room. The Pump Room, located behind the Engine Room, was formerly part of the original boiler room. The rest was sealed off in 1915 when the old boiler room became the coal bunker for the new boiler room.

Two items of interest are found here: a duplex Worthington pump used as a standby fire standpipe, or roof tank supply unit; and an hydraulically operated pressure regulator mounted near the pump, used to control heating system pressure. It is believed that both pieces of equipment are original and date to 1887.

Assorted non-Pratt artifacts are also stored here. These items have been used for operating displays at various Pratt functions such as Alumni Day, Spring Festival, etc. The items include: D.P.D.T. knife switches from two approximately 250 KW Edison bi-polar generators used until 1970 (!) as a balancer set in the Crosby Street Substation; the wooden main engine room gauge board from the Beacon-Newburgh ferry "Orange" (1914); a cast iron gauge board from the Ruppert Brewery (ca. 1890); a turbine generator from the tugboat "G. M. McAllister" (1924); an Edison bi-polar motor/generator (late 1880's) from the Hebrew Technical School; an Eck bi-polar motor (ca. 1897-98); and one clock face from the Ruppert Brewery clock tower (1889-90).

Boiler Room. On the north wall are two Westinghouse simplex air compressors. The left one dates back to 1906 and the right one to 1896; both are from the Rogers Peet Building. The weight-driven mechanism for the Ruppert tower clock is stored adjacent to the compressors.

The steam fuel oil pump was originally installed in the City Investing Building in 1927, when their plant was converted from coal to oil. The pressure gauge above it is from the Ruppert Brewery. Note that its brass rim is spun from a single sheet of brass instead of cast as usual.

The two small vertical engines stored in the corner formerly drove circulating water pumps in the tug "G. M. McAllister" and the DL&W Railroad ferry "Binghamton" (1905).

The large outside plunger duplex pump against the far wall is used as the main plant boiler feed pump and was installed at Pratt in 1968. It was originally built in 1906 for the City Investing Building and ran until the plant closed in 1965.

The gauge board above it has gauges from the Tribune Building (left) and City Investing Building (right).

The small steam pump is the standby boiler feed pump and came from the Figge Meat Packing Plant on West 40th Street in 1960.

The present boiler room contains two Combustion Engineering Company boilers of 210 HP each, built in 1941. They were converted from coal to oil in 1948. The third boiler was built by the Foster Wheeler Company and installed in 1953. It is rated at 240 HP.

When the last boiler was installed, all steam-powered auxiliary pumps were scrapped and electrically driven ones put in as replacements. The use of steam pumps is economically justified under certain operating conditions, and for emergency use; thus steam pumps have gradually been reinstalled during the last ten years.

National Historic Mechanical Engineering Landmark Program

In September 1971 the ASME Council reactivated the Society's History and Heritage program with the formation of a National History and Heritage Committee. The overall objective of the Committee is to promote a general awareness of our technological heritage among both engineers and the general public. A charge given the Committee is to gather data on all works and artifacts with a mechanical engineering connection which are historically significant to the profession. An ambitious goal, and one achieved largely through the volunteer efforts of the Section History and Heritage Committees and interested ASME members.

Accordingly, two major programs are carried out by the Sections under the direction of the National Committee: (1) a listing of industrial operations and related mechanical engineering artifacts in local Historic Engineering Records; and (2) a National Historic Mechanical Engineering Landmark program. The former is a record of detailed studies of sites in each local area; the latter is a demarcation of local sites which are of national significance -- people or events which have contributed to the general development of mankind.

In addition, the Society cooperates with the Smithsonian Institution on a joint project which provides contributions of historical material to the U.S. National Museum of History and Technology in Washington, D.C. The Institution's permanent exhibition of mechanical engineering memorabilia is under the direction of a curator, who also serves as an ex-officio member of the ASME National History and Heritage Committee.

The Pratt Institute is the twenty-third landmark to be designated since the program began in 1973. The others are:

Ferries and Cliff House Cable Railway Power House, San Francisco, CA - 1973
Leavitt Pumping Engine, Chestnut Hi11 Pumping Station, Brookline, MA - 1973
A. B. Wood Low-Head High-Volume Screw Pump, New Orleans, LA - 1974
Portsmouth-Kittery Naval Shipbuilding Activity, Portsmouth, NH - 1975
102-inch Boyden Hydraulic Turbines, Cohoes, NY - 1975
5000 KW Vertical Curtis Steam Turbine-Generator, Schenectady, NY - 1975
Saugus Iron Works, Saugus, MA - 1975
Pioneer Oil Refinery, Newhall, CA - 1975
Chesapeake & Delaware Canal, Scoop Wheel and Engines, Chesapeake City, MD - 1975
U.S.S. Texas, Reciprocating Steam Engines, Houston, TX - 1975
Childs-Irving Hydro Plant, Irving, AZ - 1976
Hanford B-Nuclear Reactor, Hanford, WA - 1976
First Air Conditioning, Magma Copper Mine, Superior, AZ - 1976
Manitou and Pike's Peak Cog Railway, Colorado Springs, CO - 1976
Edgar Steam-Electric Station, Weymouth, MA - 1976
Mt. Washington Cog Railway, Mt. Washington, NH - 1976
Folsom Power House #1, Folsom, CA - 1976
Crawler Transporters of Launch Complex 39, J.F.K. Space Center, FL - 1977
Fairmount Water Works, Philadelphia, PA - 1977
U.S.S. Olympia, Philadelphia, PA - 1977
5 Ton "Pit-Cast" Jib Crane, Birmingham, AL - 1977
State Line Generating Unit #1, Hammond, IN - 1977

SCIENTIFIC AMERICAN

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A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

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PRATT INSTITUTE FOR INDUSTRIAL EDUCATION, BROOKLYN, N. Y. -THE LARGEST INSTITUTION OF THE KIND IN THE WORLD. [See p. 210.]

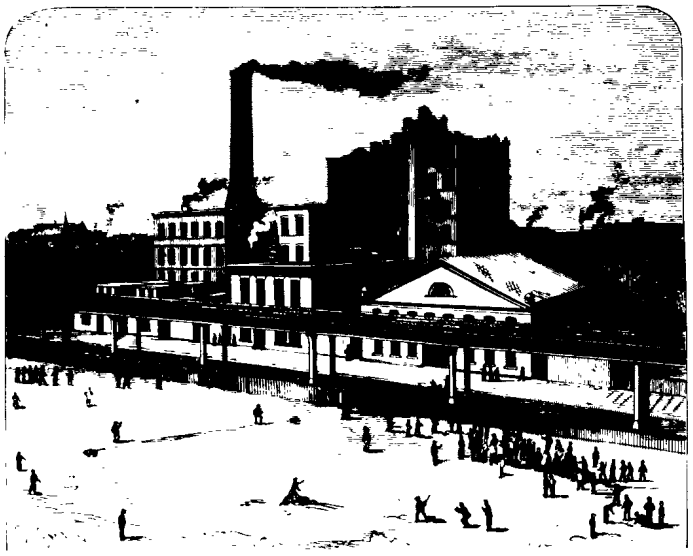
PRATT INSTITUTE, BROOKLYN, N. Y.

In matters of education, as well as in business and all modern enterprises, concentration in the order of the day. Specific courses of study for specific purposes have become an absolute necessity; and while a classical or scientific education is a necessary preliminary to professional occupations, it is no longer possible for a general education to covcr the great multitude of known subjects with sufficient completeness to render such an education of any practical value. A great majority of people are dependent upon trades, and these, in many cases, are quickly and imperfectly learned without even a rudimentary education as a basis. In most cases people are obliged to earn a livelihood while learning how to get a living. As a consequence, the time for learning a trade is made as short as possible. It is learned, it may be, from a master who is such only in name, and thus it is that the country possesses many workers who, for a lack of correct training in the beginning. make life a failure.

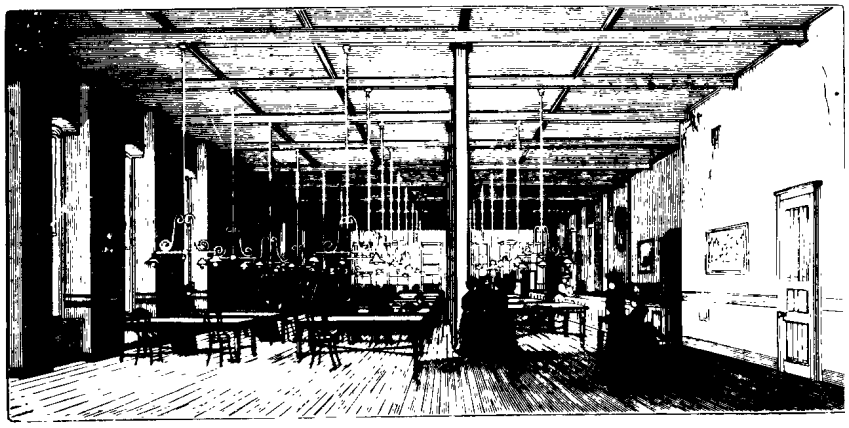
There are in this country several institutions for technical education which are practical, useful, and highly beneficial to those who avail themselves of their privileges, but there is nothing so good or so perfect that it cannot be improved upon. Of course, it is to be expected that every institution will—so far as practicable—keep up with the times, but an industrial institute starting to-day has the benefit of accumulated experience and of being imbued with the feeling and spirit of the present time. An institute having these advantages has grown in our vicinity to gigantic proportions in such a quiet/way that, notwithstanding it is more than a year old and has involved the expenditure of millions of dollars, it is scarcely known beyond its immediate locality. We refer to the Pratt Institute, of Brooklyn, N. Y. The present obscurity of this great enterprise is partly due to the innate modesty of its founder, Mr. Charlee Pratt, and partly to his cautious methods.

The philanthropic scheme which culminated in the founding of this remarkable institution was the dream of Mr. Pratt's youth. In early life he was forced to learn what it meant to economize in everything His education was secured through his own industry and perseverance. He learned the machinist's trade, and by hard work earned enough money to carry him through school. While in school he practiced the severest economy, boarding himself at the cost of a dollar a week. He kept his wants small and in every way husbanded his resources, so as to complete his education without taking upon himself the burden of debt. In these days of close calculation and denial he thought of others in conditions similar to his own, and conceived the idea of working out a scheme of some kind for the amelioration of the condition of other youth and of the world's workers generally. The idea assumed different forms at successive stages of his career, until at length it developed into a scheme for the founding of a great institute for technical education and manual training. This institute is no longer a faint conception or well-defined scheme, but is a substantial reality, a monument to the philanthropy and wisdom of its founder, an ornament to the city in which it is located, and a credit to the country at large. It is undoubtedly the most important enterprise of the kind in this country, if not in the world.

The buildings of the Pratt Institute in Brooklyn contain from three to four acres of floor space, and vary in height from one to six stories. They are located on a plot of land situated between Ryerson Street and Grand Avenue and between De Kalb and Willoughby Avenues, the main building fronting on Ryerson Street, and the buildings for the department of mechanic arts fronting on Grand Avenue. Across Ryerson Street, opposite the main building, is a plot of ground, 350 × 200 feet, extending through the block to St James' Place, the plot serving at present as a playground for the young ladies connected with the Institute. Across Grand Avenue, opposite the department of mechanic arts, is a plot 250×200 feet which serves as a playground for the boys.



THE PARTT INSTITUTE, BROOKLYN, N. Y.—VIEW FROM THE REAR PLAYGROUNDS.



THE PRATT INSTITUTE—THE FREE READING ROOM.

The main building of the Institute is a brick and terra cotta structure six stories high, 100 feet wide, 50 feet in depth, with an L 37X50 feet upon one side. In the rear of the Institute proper in the department of mechanic arts, covering an area 247×95 feet, these buildings varying from one to three stories in height.

A front view of the Institute buildings is presented in the upper central picture of our large engraving, and the rear, or Grand Avenue side, is shown in one of the smaller engravings. The buildings are provided with all the modern appliances for lighting, heating, ventilation, the prevention of fire, etc. In the main building is a large elevator running from the basement to the tower above, adapted for both passenger and freight service. The buildings are lighted throughout by a complete system of incandescent and are lamps, rendering evening work in the various classrooms and shops as practicable as that of the day. The buildings—as will be seen by reference to the engravings—are not wanting in external beauty, while they are constructed in the most substantial manner, being practically fireproof, and as strong as would be required for the heaviest kind of manufacturing

Land for the buildings was purchased in 1884. Contracts were made in the early part of 1885; the work of excavating began about July 1 of that year, and the construction was continued through 1886–87. May 19, 1887, the charter was granted, with power to confer degrees.

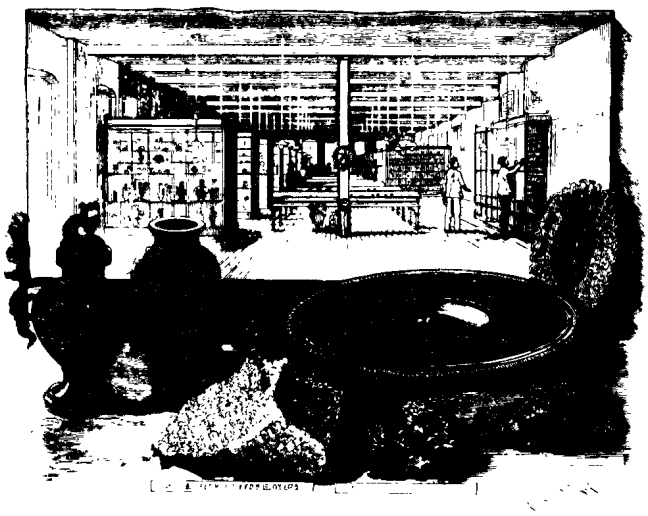
In addition to the facilities for technical education, which are designed exclusively for scholars, there are three features of interest to the general public: a free library containing several thousand choice books, to which additions are constantly being made; a free reading room provided with about 150 of the best American and foreign periodicals, and furnished with a library of reference books, such as encyclopedias, dictionaries, and other books often needed for consultation; and a technical museum containing specimens of manufactured articles, together with the crude materials from which they were made, the specimens being arranged to show the various processes through which the materials pass from their original state to the finished product.

The Institute will accommodate several thousand students, who will be charged for the privileges of the Institution, but the amount is very low, and all the revenues are to be devoted to the support of the Institute. In addition to this source of revenue, Mr. Pratt has built in Greenpoint, L. I., an apartment building known as the "Astral," the rental of which goes to the support of the Institute. This building cost about $400,000. It is one of the most complete and perfectly arranged apartment houses ever constructed. We doubt the existence of its equal. It is a little city of itself, with every modern appliance for the comfort of its inmates. Still, the rentals are easily within the means of mechanics and laboring men. These apartments, we are informed, are to be deeded to the Pratt Institute.

Part of the basement of the main building of the Institute will be utilized for a lunch room. Upon the first floor of the man building are the library and reading room. A portion of the second floor is set apart for the general offices of the Institute, the remainder being arranged as a lecture hall, in which lec-

THE PRATT INSTITUTE–THE FREE LIRBARY.

tures upon various subjects are to be delivered from time to time. It is intended that these lectures shall bear directly upon the work of the Institute in all its phases, and shall thus include practical instruction upon those matters which pertain to right modes of living, the problems of political and social life, domestic economy, sanitary science, literary culture, ethics, etc. Whlie many of these lectures may be given as a part of the regular work of the Institute to pupils only, yet many others will be so arranged as to meet the wants of those not directly connected with the Institute, but who wish an opportunity of obtaining systematic instruction upon subjects of interest and importance. The third floor is devoted to sewing, dressmaking, millinery, and art embroidery. In the sewing department instruction is given in all kinds of hand sewing, in machine sewing, and in cutting and making plain garments from patterns. In the dressmaking department a systematic course in dressmaking is given. Each pupil, under the guidance of a competent teacher, learns to fit from measure, make and drape an entire dress for herself or others. In the department of millinery each pupil makes during the course an entire hat or bonnet, combining good taste and good workmanship. The department of art embroidery is intended to train women in designing, due attention being paid to harmony of colors and symmetry of forms.



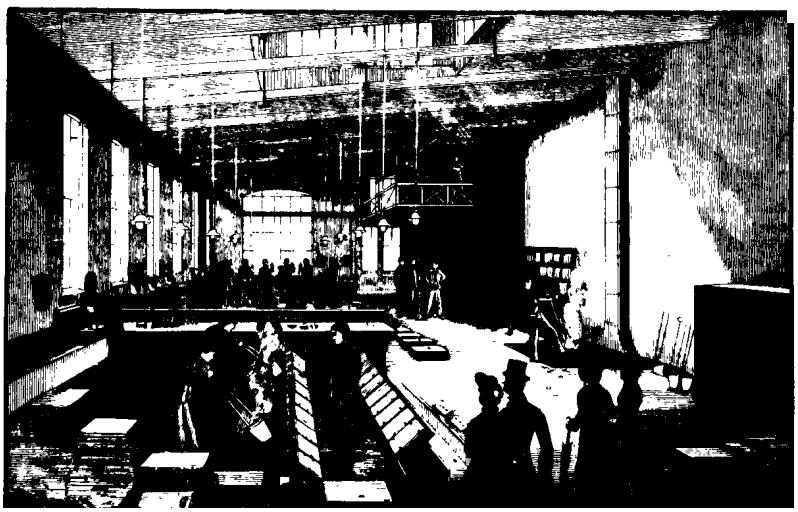
THE PRATT INSTITUTE–THE MUSEUM.

One of the helpful departments of the institution is the school of shorthand and typewriting, located on the third floor. The work done in this department is thorough and practical.

The entire fourth floor of the main building and the art hall of the sixth floor are occupied by the school of art and design. A great deal of attention has been given to the arrangement of the various rooms of this department, and to the selection of examples for drawing, casts and photographs in large numbers having been purchased in Europe for the use of the students. Every facility is provided for thorough and systematic work, and pupils may here pursue regular courses in drawing and painting, design, clay modeling, wood carving, architectural and mechanical drawing. In connection with the courses, lectures are given on architecture, historic ornament, perspective, design, theory of color, mythology, and artistic anatomy. As drawing is the basis of all constructive industries, pictorial art, and decorative design, this is one of the most important departments of the institution. Particular attention will be given to instruction in sculpture and wood carving, with special reference to the development of a high class of art work in bronze, copper, and stone. This department will be instituted for the purpose of encouraging ladies desiring to become proficient in these branches of art.

THE PRATT INSTITUTE-THE WOODWORKING SHOP.

The fifth floor of the main building is set apart for the technical museum. The museum hall proper is provided with rows of substantial oak cases of two classes, vertical and horizontal, all the cases being provided with air tight plate glass doors. In these cases are arranged various wares in different states of completion; some of the finest specimens of glassware, ceramics, bronzes, iron and brass work to be obtained in Europe are shown in these cases. The collection of specimens was begun in Europe in the summer of 1887. At present, the museum contains about 4,000 specimens, being most complete in the department of ceramics. There are specimens of the raw material used in the manufacture of earthenware, faicnce, porcelain, and various samples from the celebrated manufactories of Berlin, Dresden, Vienna, Sevres, Limoges. Worcester, Derby, and from the Staffordshire potteries of Wedgwood, Minton, Copeland, Doulton, etc. Switzerland, Sweden, Denmark, Russia, and Italy are also represented, the last country by many fine pieces of faience, from Nove, Milan, Bologna, Paroes, Rome, and Naples In antique pottery there are specimens of Græco-Etruscan and Flemish stoneware, of German and Roman earthenware, and also of pottery from the mounds of the Mississippi Valley, with some pieces of modern clay work by the Indians of Mexico.



THE PRATT INSTITUTE–THE FOUNDRY.

Glass is exhibited in various forms, blown, cut, engraved, etched, enameled, and ornamented in many colors, from the works in Austria, Bohemia, Germany, and France, also many pieces of beautiful cameo glass from Messrs. Webb, at Stourbridge, England. Venetian glass also is shown in great variety of modern and mediæval designs, rich in color and unique in form. There are also specimens of Roman, Florentine, and Venetian mosaic work from the laboratory of Dr. A Salviati.

A set of models from Germany, showing the enamel work of various countries, is represented. Cooper, iron, tin, zinc, and other metals, with their alloys, are exhibited in solid, filigree, inlaid, engraved, and repousse work, together with a few choice pieces of Venetian, French, Russian, and American bronze. A large number of ores are exhibited to show the material from which the metals have been derived, and these are placed in close proximity to the artistic and skillfully worked metal. The collection of American materials and manufactures is being rapidly made. It will soon be possible for a visitor to compare the finest specimens of handicraft from both hemispheres.

A part of the collection consists of many species of minerals, and a large number of crystal models in wood and glass, arranged to give an insight into the science of mineralogy. The celebrated diamonds and other gems of the world are represented by handsomely cut facsimiles. A series of rocks, arranged according to Rosenbusch, contains about 600 European specimens, and near these are placed the same number of American specimens. Although the collection is not complete, it shows what may be brought out of the earth by intelligence, labor, and skill.

Upon the sixth floor of the main building is the art hall, provided with a large skylight. It is used for advanced free hand drawing and painting, and for the exhibition of art collections. Upon this floor also are two cooking schools, provided with all the appointments of a well ordered kitchen, including a superb range, gas stoves, galvanized iron sinks, hot and cold water faucets, closets, dressers, refrigerators, etc. Under the skylight, in the central portion of the rooms, are arranged large cooking tables, each furnished with gas burners for cooking and drawers with shelves below. Every drawer and set of shelves is supplied with a complete assortment of cooking utensils, so that twenty people can work at the same time in each room. There are three courses in cooking, of twelve lessons each, advancing regularly from the simplest to the more elaborate dishes. Every pupil is required to give evidence of her thorough acquaintance with the elements of cooking before passing to the higher course. Each pupil is required to work out with her own hands the recipe given her. The instruction comprises lessons on building and taking care of a fire, the proper modes of measuring liquids and solids, of boiling meats, eggs, vegetables, broiling and roasting meats, making soups, puddings, and—most important of all—bread. In connetion with every lesson a brief lecture of explanation is given by the teacher on the chemical and nutritive properties of the materials used, the changes produced by cooking, etc.

(*Continued on page* 214.)

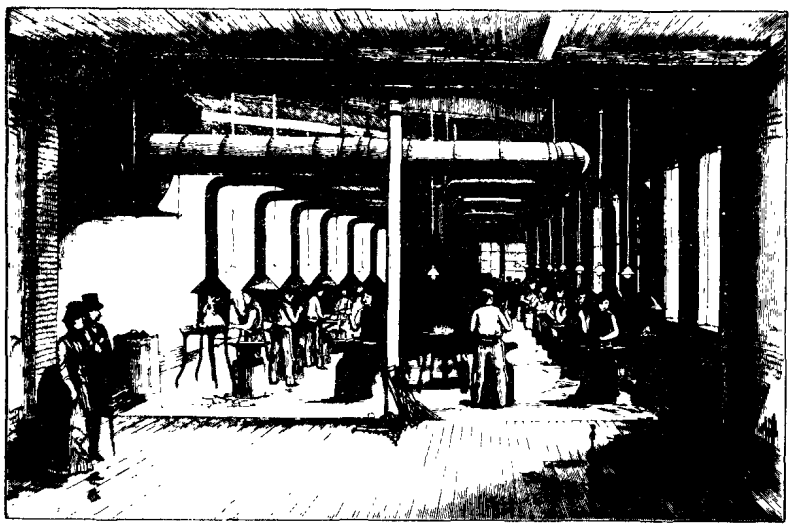
PRATT INSTITUTE, BROOKLYN, N. Y.

(*Continued from page* 211

In front of the cooking rooms is a lunch room, where a simple meal well served is furnished at noon and at evening for a small sum This is intended particularly for the teachers and students connected with the Institute Communicating with the lunch room is a well equipped kitchen where the meals will be prepared for the lunch room on this floor and also for the large lunch room soon to be placed in the basement of the main building.

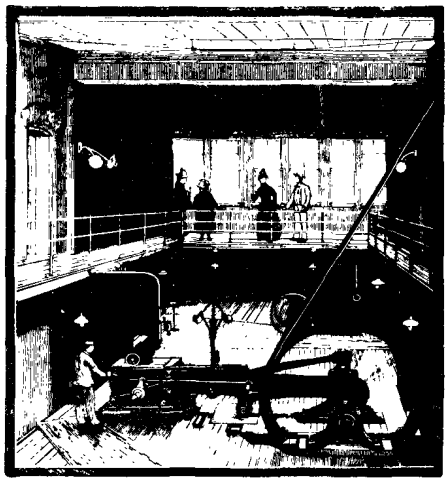
The department of mechanic arts is designed for the instruction of three classes of pupils. First, members of the regular three years' course, who, in connection with their studies, science, mathematics, language, and drawing, will be given courses in wood and iron work, joinery, pattern making, wood turning, moulding, casting, forging, etc. For the girl students in this course, decorative work in wood and metals, cooking, sewing, dressmaking, etc., will be substituted for advanced shop work. Second, pupils from other schools who wish to supplement their studies with manu al work Third, those who are employed during the day, but wish to utilize their evenings in acquiring a thorough knowledge of the methods and proecesses of the industrial arts.

The buildings devoted to this department cover a ground space of 250X100 feet. They are of substantial construction, of brick with bluestone trimmings, and vary in height from one to four stories. A brigde from the third story connects these buildings with the second story of the main building. The basement contains two boilers of 100 horse power each, which furnish steam for heating all the buildings, and supply power for the engines, elevators, electric lights, fire pump, etc. In the engine room adjoining the boiler room is a fine Harris-Corlise engine of 40 horse power for operating the machinery of the institution, and an Armington & Sims high-speed engine, whcih drives an Edison dynamo for supplying the incandescent lamps in the main building. An 800 light Sawyer-Man dynamo and an are machine of the Western Electric Co's system supply the shops and trade school buildings with light. Both of these machines are driven by a 125 H. P. engine from the N. Y. Safety Steam Power Co. The remainder of the basement of the buildings of this department is used for storage. On the first floor is the smith shop, a room 73x29 feet, and 18 feet high, provided with ventilating skylights. The room is furnished with forges and anvils, and is planned to accomodate twenty-five pupils. Pipes laid under the floor carry the blast of the forges, and an exhaust fan takes away the fumes and smoke. In this department the forging of tools and various kinds of iron work, including art forgings, is carried on.



THE PRATT INSTITUTE. THE SMITH'S SHOP.

Adjoining the smith shop is the foundry, 66 by 29 feet, with an 18 foot ceiling, provided with two skylights. The foundry equipment includes a 20 inch iron melting cupola, two brass furnaces, a white metal gas furnace, and core oven. Practice is given in green sand, dry sand, and loam moulding, and in core making. Swept-up work is illustrated, and particular attention given to the production of art castings in iron and bronze. Upon the same floor is the machine shop, which is fitted with benches with sufficient room for forty-eight pupils to work at the vise. It is furnished with a full complement of engine lathes, drilling machines, and planers, being, in fact, a fully equipped machine shop.

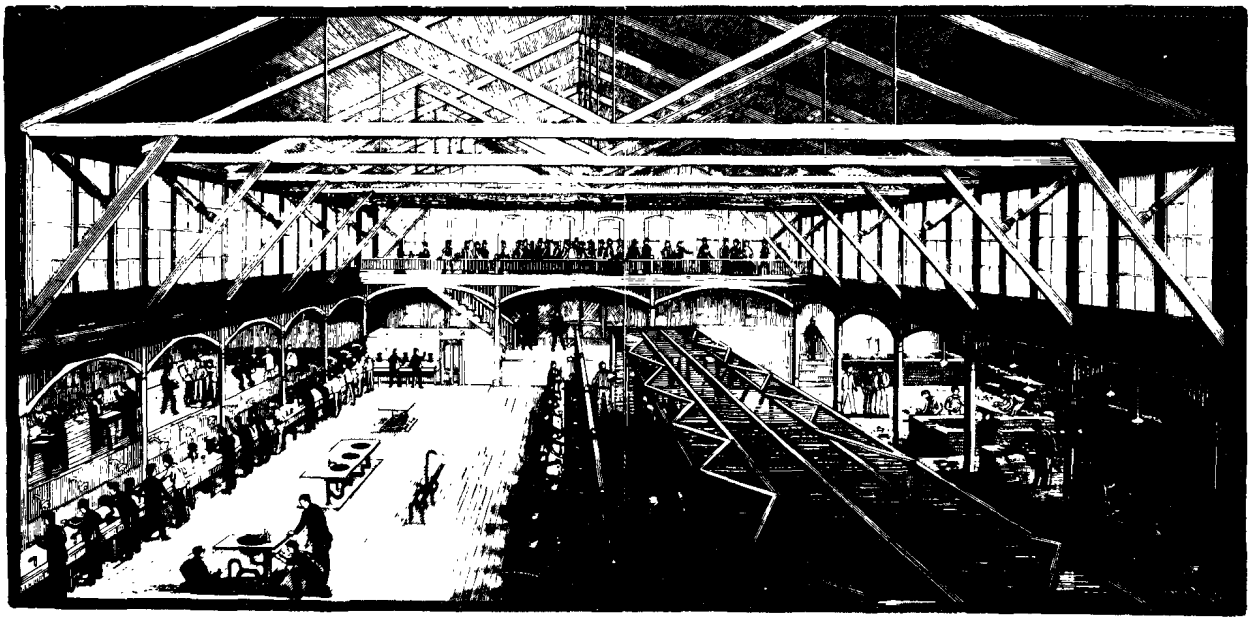


THE ENGINE ROOM.

The wood-working department, which occupies the second floor of the same building, is provided with 150 feet of wall benches and 36 single benches, all supplied with the latest and most approved wood-working tools. The floor also contains a number of wood-turning lathes, a large pattern making lathe, a buzz planer, a surfacer, and circular and scroll saws. Adjoining the wood-working department is a lumber and tool room for the storage of tools and lumber used in the wood-working shop

The third floor of this building is devoted to laboratories and class rooms, and the fourth to advanced art work in metals, engravings, etc. This last department is not yet organized.

The department of building trades, occupying the remaining buildings of the Institute, is designed for the instruction of pupils in bricklaying, modeling, stone carving, the building of frame buildings, plumbing, etc. In bricklaying, the pupils are first taught to handle the trowel and spread the mortar properly, they are then put to work upon 8 inch walls until they can carry the corners plumb and lay the courses level. Proper care is taken that the joints should be thoroughly struck and pointed. When the student can do this perfectly, he is taught the construction of arches and ornamental brick work. In stone carving the pupils are taught to work out forms illustrating the different styles of orna-

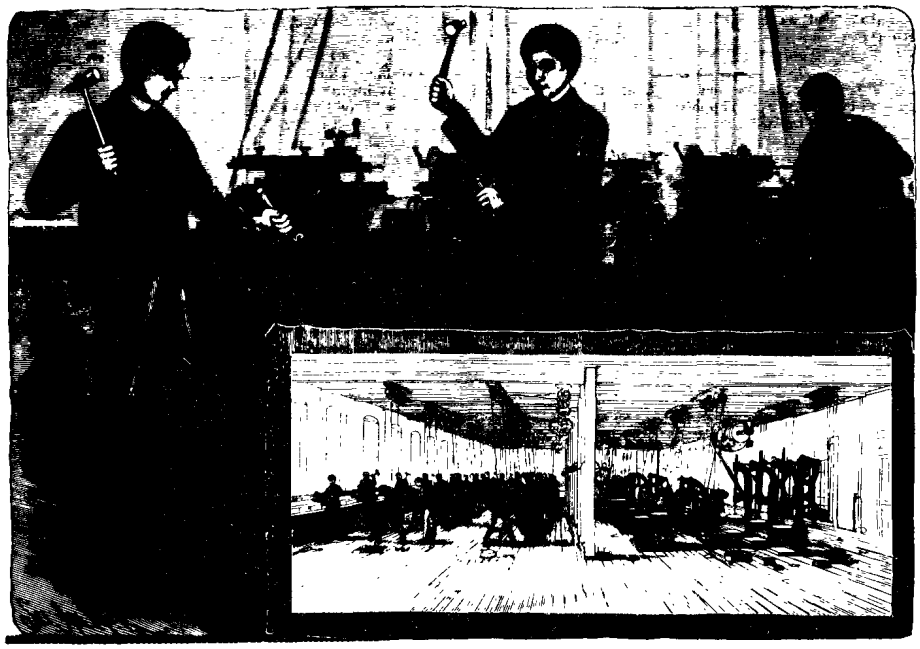


THE PRATT INSTITUTE BROOKLYN N. Y.—THE TRADES SCHOOL.

ment in architecture. All the students are required to sketch their designs and model them in clay before cutting them in stone.

The plumbing section can accommodate 54 pupils, all of the necessary tools and benches being provided for carrying on the work in the most approved manner. The course of study includes the making of lead seams, all kinds of wiped joints, and sand bends. Instruction is also given in the working of sheet, metal, in the erection of sewer pipes, etc. The instructions in plumbing amount to a course in sanitary engineering, as the principles of drainage, sewerage, and ventilation are thoroughly considered.

A department of electrical engineering is soon to be inaugurated. This will afford to students of electricity rare opportunity to perfect themselves in this science. Other departments will be added from time to time, as circumstances may require.



THE PRATT INSTITUTE—THE MACHINE SHOP.

Our engravings truthfully represent many of the departments of this great institution, and give an excellent idea of the activity prevailing there. There is no longer an excuse for artists or artisans or students of the fine or mechanic arts for lack of proficiency in their particular departments, for persons without some ability cannot enter this institution, and when once entered they are taken in hand by a corps of competent professors and teachers, who will carry them forward rapidly and thoroughly through the various courses of study, enabling them to graduate with honor to themselves and credit to the institution. In bestowing this great gift upon the publication the prime of his life, Mr. Pratt has enriched the world with something more valuable than gold or silver. He has set an example which might be followed by other wealthy men to the great benefit of the country at large. Such institutions elevate the dignity of labor, raise the tone of society, improve the quality of work, and contribute to the happiness and comfort of wage earners.

Man's War with Creeping Things.

The Philadelphia *Inquirer* asks: What shall be done with the pests? What brings them? How shall they be exterminated? Year by year they seem to increase. More locusts, more grasshoppers, more chinch bugs, more potato bugs, more cut worms, more weevil, more mosquitoes, more flies, more what not? In the struggle to maintain our lordship over all creeping and crawling things we are already having to resort to desperate remedies. In Illinois the farmers of several counties have resolved not to raise any wheat, barley, or rye for three years in order to starve out the chinch bugs. This looks almost like a victory for the chinch bugs, and it becomes an interesting question, moreover, whether such a lockout would exterminate them; whether they could not worry along without wheat, barley, and rye for three years about as well as the farmers by changing their diet to something else. It is evident that man has a great deal to learn yet. He has to learn how to till the earth so that it will yield up more grain and less bugs. The pests would appear to represent a vast amount of misdirected energy. If the inventive mind of man can discover some way to make the life and energy of the pests materialize in the shape of wheat, barley, rye, potatoes, etc., his crops would be immense.

AN ELECTRIC CARRIAGE.

Trial was made recently at the skating rink, St. Paul's Road, camden Town, of an electric dog cart, built by Messrs. Immisch, of London, for the Sultan of Turkey. In appearance the vehicle does not differ from an ordinary four-wheeled dog cart with the shafts removed, and in this respect the design is perhaps open to criticism, as something might have been done to take off the uncompromising squareness presented by the splash board, and so give the appearance of a carriage specially adapted for the new mode of propulsion. The motor, which is placed in the center of the body of the vehicle, is of Messrs. Immisch & Co.'s 1 horse power type, a current of 20 amperes with an electromotive force of 48 volts being used. Motion is communicated to one of the hind wheels by means of a small pinion on the main shaft of the motor working into a pitch chain, which passes over a series L shaped plates attached at intervals to the inner face of the rim of the wheel, so as to constitute in effect a driving pulley for the pitched chain to act upon. It was stated that the motor could be reversed so as to back the vehicle. The power is stored in twenty-four small accumulators of special type, occupying the space under the seats, and said to be sufficient to propel the vehicle at a speed of about ten miles per hour for five hours; but at the trail nothing more than a few runs round the rink was attempted, sufficient to afford the visitors present the opportunity of having a ride, and no great speed could be attained, on account of the confined space and the consequent necessity for freqnent sharp turns. The steering is effected by a shaft projecting through the footboard, and furnished with a hand-wheel. On the lower end of the shaft is a pinion which takes into a ring of teeeth on the fore carriage. The brake is actuated by a lever, placed in a convenient position for the driver's foot, and the switch for turning on the power is attached to the splash board. The total weight of the vehicle, all complete, is about 11 cwt., the accumulators weighing about 7 cwt. The carriage appeared to run very smoothly, and to be under perfect control, although the operation of backing was not shown during the time of our visit.—*The Engineer.*

AN ELECTRIC CARRIAGE.

Colored Leather.

Modern leather manufacturers, says the *Shoe and Leather Reporter,* are surpassing the ancients in the diversity and beauty of the colors they are introducing. Many of the shades produced in upper leather are highly attractive. The Thebans were thought to have attained great proficiency in this art, but the variety of colors they are credited with was meager compared with the iridescent display of our epoch. Remnants of leather found in Theban tombs reveal the use of acacia and other trees in the tanning process. The Jews, after the exodus, probably put into practice the knowledge obtained of this art under the Pharaohs, in preparing rams' skins dyed red for the service of the Tabernacle.

The love of colors is as old as the human race. The art of dyeing leather, so long practiced on the Mediterranean, was afterward attained with difficulty by other European countries. But we need no longer to go to Egypt or the Mediterranean for instruction concerning it.