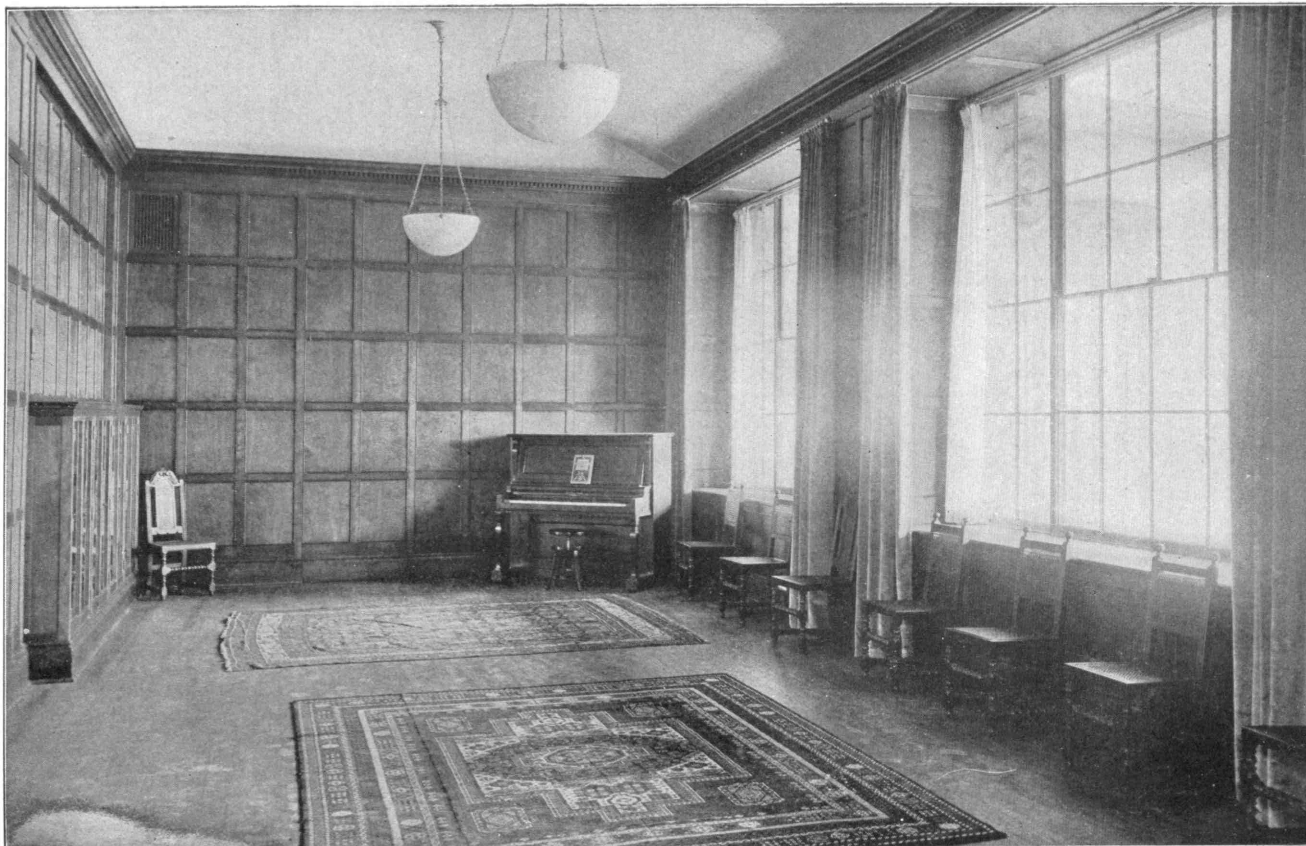

EMMA ROGERS ROOM

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THE NEW ENGINEERING LABORATORIES

The wonderful facilities they offer to the Tech Student of today. Expansion of department 300 per cent. Equipment modern and practical.

Many of the older alumni will recall the engineering laboratories when located in the basement of Rogers Building. In 1886 these laboratories contained a Harris Corliss engine, a Porter Allen engine, a calorimeter, a belt machine, two testing machines and some minor apparatus. When Engineering Building A was built on Trinity place, these laboratories were given a much larger floor space, occupying at that time about 16,000 square feet. This was increased later by the addition of Engineering Building B and the Pierce Building, until at the time of moving a total floor space of something over 25,000 square feet was available.

The engineering laboratories in the new Technology cover an area, exclusive of offices and corridors, of about 70,000 square feet. Before planning the laboratories a study was made of the equipments of the leading engineering schools both in this country and abroad. A number of the staff having had opportunity to inspect foreign schools were familiar with their equipment. Many of the leading steam, hydraulic, and refrigerating engineers were asked to criticise the preliminary plans and assistance of great value was obtained through this means.

The equipment of the laboratories was selected with the following objects in view: First, to give a student practice in such experimental work as an engineer in the pursuit of his profession is called upon to perform; and second, to provide ample facilities for original investigation and research in engineering subjects.

In order to develop these laboratories and in order to facilitate the carrying on of research work of a high order it seemed advisable that the laboratory should be divided into six branches, *i. e.*, material testing, steam and compressed air, hydraulics, power measurement, refrigeration and gas engine, and that there should be in immediate charge of each branch one who is an expert in the particular line of experimental work to be conducted in that branch. At the present time, the heads of the different branches of the laboratory, together with a director, constitute an administrative staff, responsible for the conduct of the regular class work, for the development of the laboratory as a whole, and for the apportionment among the different branches of any funds which may be available.

Throughout the basement of the steam, hydraulic and refrigerating laboratories canals have been constructed in the sub-basement. These canals which total about 700 feet in length vary in width from 2 to 8 feet and are 5 feet in depth. By means of stop logs different levels may be carried in different parts of the canals. Water from the river is supplied to these canals through two 14″ valves and a 30″ discharge pipe leads back to the river on the downstream side of the intake. The normal river level makes a depth of 14″ of water in these canals. Since no oily water can be returned to the river, separate provision had to be made to take care of the condensate from reciprocating engines and pumps. This condensate, after being weighed, is discharged into openings, one being provided in each bay, which connect with the sanitary sewer. Running throughout nearly the whole length of the steam laboratory there are two canals about 10′ apart and over these canals are suspended seven condensers used in connection with the experimental work. Water supplying these condensers is taken from one canal, pumped through the condenser and discharged into the other canal, this second canal being cut off from the first by stop logs and opened to the 30″ return leading back to the river.

The equipment of the laboratory as a whole may be best understood by taking up separately that of each of the six branches.

The material testing laboratory, having a floor space of about 16,000 square feet, occupies three floors and the basement of a building extending west from the southerly end of the long building which forms the westerly side of the main court. The basement of this building is given over largely to work on concrete.

It contains two motor-driven machine mixers, with necessary storage bins, used in the fabrication of large sized beams, a room of about 1,080 square feet area used for hand mixing and testing of cement, storage racks, damp closets, etc., also a brine cooled storage room.

About 670 square feet is occupied by the apparatus used in testing road materials; about 400 square feet is taken by hydraulic pumps working up to 10,000 pounds per square inch used in testing to destruction cylinders, etc., subjected to internal pressure.

On the first floor of this laboratory is a 300,000-pound Emery testing machine, taking a piece 12 feet long in tension and 18 feet long in compression; a 400,000-pound Riehlé machine; a 200,000-pound Olsen machine with outriggers; a beam testing machine of 100,000 pounds capacity in spans up to 26 feet; a 1,000,000 Amsler Laffon compression machine, now awaiting shipment from abroad; and a chain and rope testing machine of 100,000 pounds' capacity.

The second floor contains three testing machines of 100,000 pounds' capacity and one of 50,000 pounds; three torsion machines, the largest having a capacity of 154,000 inch-pounds and three wire testing machines.

On the third floor there are two more tension machines, one of 70,000 pounds' capacity and one of 60,000 pounds' capacity, this latter having automatic and autographic attachments; a bending machine and some repeated stress apparatus.

This floor contains also a laboratory completely equipped for research work on heat treatment of metals.

Adjacent to this laboratory are rooms for preparing specimens for etching; for taking and developing photomicrographs and for making tests on hardness and on the machining hardness of metals.

The hydraulic laboratory with a floor space of about 24,700 square feet occupies three floors at the southerly end of the long building forming the west boundary of the main court. Nearly all of the main equipment in this branch is new.

The largest piece of apparatus is a complete plant for testing water wheels. Wheels using up to 50 cubic feet per second can be tested under heads of 38 feet. A Worthington centrifugal pump, with 36″ suction, driven by an angle compound engine of 350 horse power draws water from the canals in the basement and discharges it through a 30″ Venturi meter into a steel canal 5 feet wide, 5 feet deep and 135 feet long, located on the second floor. This steel canal discharges into a steel penstock 12 feet in diameter supported on I beams spanning a tail race 10 feet wide and 90 feet long, the bottom of this tail race being about two feet below the basement floor.

The water wheel to be tested is submerged in the penstock and attached to a casting bolted to the steel plate which forms the bottom of the penstock; this plate resting on the I beams which span this end of the tail race. A draft tube is attached to the bottom of this same casting.

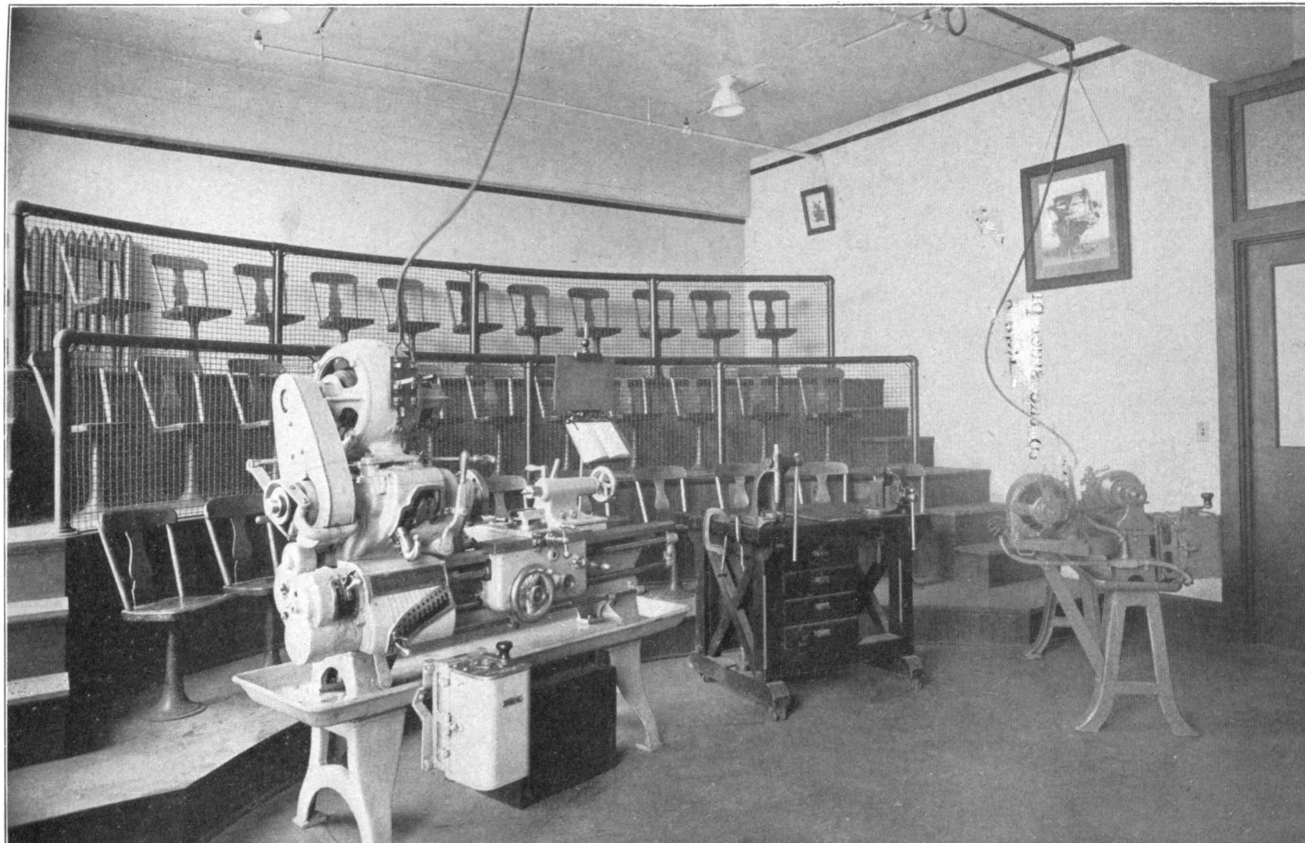
The back end of the tail race is built up 16 feet above the floor. A main hydraulic gate 10 feet wide and 10 feet deep, provided with grid openings controlled by a second grid gate sliding on the main gate may be operated from the first floor, so as to hold any level desired in the pit under the draft tube and thus vary the effective length of the draft tube. This gate with grid gate weighs 10 tons, its bearing surface being composition covered, to prevent corrosion.

Water after passing the main gate flows over a submerged weir and finally over a standard crest 10 feet wide.

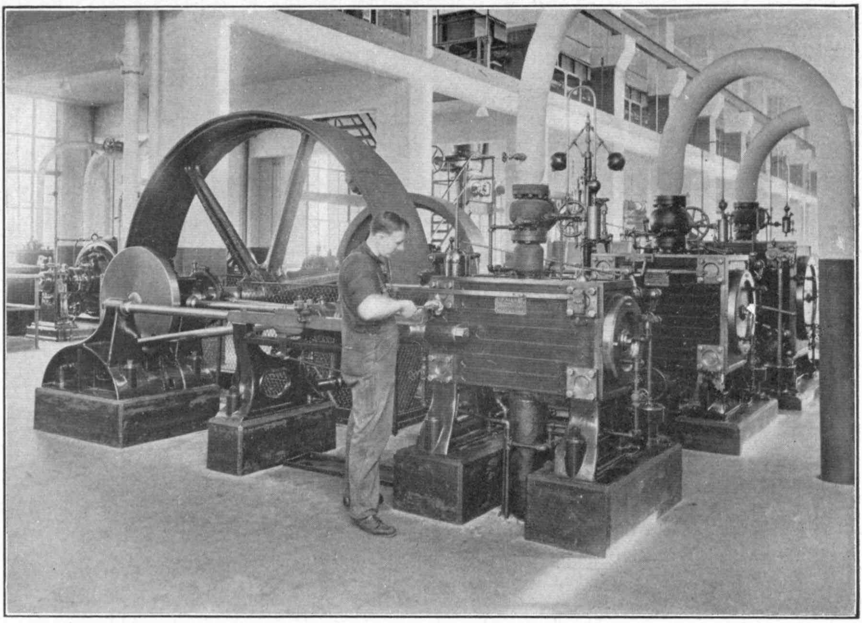
In order to test weirs of moderate size and to measure with accuracy quantities of water under 1000 cubic feet per minute a trough 3 feet square and 100 feet in length has been constructed to discharge into four large tanks, two 10 feet in diameter and 10 feet tall and two 6 feet in diameter and 10 feet tall, supplied with gage glasses for measuring levels. These tanks are filled and discharged alternately through large valves operated by hydraulic cylinders.

Water under static heads up to 500 feet is obtained in quantities up to 1500 gallons per minute by pumping water into, and compressing the air in a closed cylinder 5 feet diameter, 30 feet tall, made of $\frac{7}{8}''$ steel plate. A second closed cylinder of the same diameter but only 20 feet tall gives a head of 150 feet. These closed cylinders supply three water wheels of the impulse type and also offer facilities for experiments on the flow through orifices.

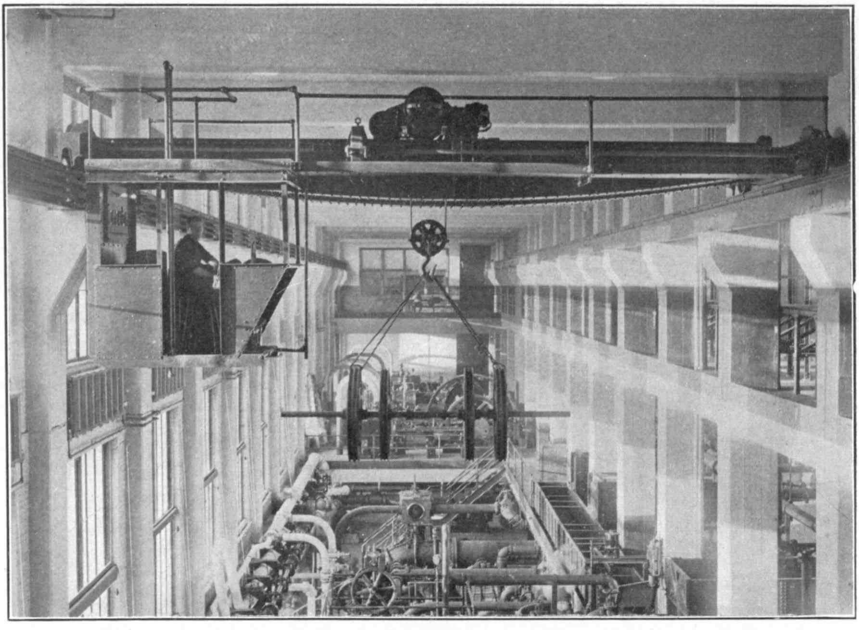
Water under pressures up to 250 pounds is supplied by either a steam driven outside packed Warren pot valve pump of a capacity of 1500 gallons per minute, by a 100 horse power Terry turbine driving a four-stage Janesville centrifugal, or by a rotary pump of large size. Water under pressures up to 150 pounds is supplied by two $16''-10\frac{1}{2}'' \times 12''$ duplex pumps, by a 150 horse power De Laval



DEMONSTRATION ROOM—MACHINE TOOL LABORATORY



MECHANICAL ENGINEERING LABORATORY—150 H. P. CORLISS ENGINE



MECHANICAL ENGINEERING LABORATORY—TRAVELING CRANE OVER LARGE UNITS IN STEAM AND HYDRAULIC LABORATORY turbine with two stage centrifugal, by a Gould or a Davis triplex pump, by a large Emerson pump and by two pulsometers.

In order to test reciprocating pumps with varying suction lifts, two wells each 10 feet long and 5 feet wide extend 26 feet below the basement floor; water being supplied from the canal system to these wells by 16″ valves operated from the floor; the level being maintained by the amount of opening given these valves which have been designed in the form of a cone having a very small taper so as to make accurate regulation possible.

A raised platform about 15 feet x 15 feet has been built up over these deep wells. This platform, which is about 42 feet above the bottom of the well and 16 feet above the basement floor, serves as the operating platform for a Luitweiler deep well pump, for a 4″ Pohlé Air Lift pump, for a Weber subterranean pump, for an Emerson steam pump and for a pulsometer.

A Rife hydraulic ram with 4″ drive pipe and a Gould double ram with two 3″ drive pipes have been installed on the second floor; the water discharged and the overflow being weighed in the basement.

The steam and compressed air laboratory, occupying about 16,300 square feet, is in the northerly end of the building containing the hydraulic laboratory.

On the second floor six small engines, including the old Harris Corliss engine, have been set up side by side. These engines are used for instruction in valve setting. Most of these engines are connected with surface condensers in the basement. There is, also, on this floor equipment for testing steam injectors under suction lifts varying from 0 to 26 feet.

On the first floor of this laboratory are a number of engines and steam driven compressors all arranged for test, the steam end of each machine being connected with one or more condensers.

The engines are enumerated below:

A 9″–18″–24″ x 30″ triple expansion Reynolds Corliss engine.
A 11″–19″ x 15″ McIntosh & Seymour tandem compound engine.
A 14″–16″ x 23″ McEwen tandem compound engine.
A 12″–20″ x 12″ Westinghouse compound engine.
An $8\frac{1}{2}$″ x 8″ Westinghouse simple engine.
A 11″ x 30″ Brown engine.
A high speed yacht engine.
A 75 K. W. Curtis turbine.

In addition to the above there are in the basement the following, each connected to a condenser and available for testing:—a 150 horse power De Laval turbine; a 100 horse power Terry turbine; two 16–10½ x 12 duplex steam pumps, an angle compound engine, referred to in the description of the hydraulic laboratory; a direct connected Sturtevant generator set; two dry air pumps, a small Kerr turbine circulating set and a similar De Laval circulating set.

An independently fired superheater capable of superheating 20,000 pounds of steam per hour to a temperature of 1000° F. is located in the basement, within a short distance of a cast iron test block 10′ x 20′ to which steam machinery brought in for tests may be strapped.

The surface condensers are located in the basement as has been previously stated. Tests of steam calorimeters, experiments on the flow of steam or air through orifices and tests on vacuum sweeping outfits are carried on in the basement.

One corner of the first floor of this laboratory is occupied by air compressors which when not under test may be used for furnishing air for building service. These compressors comprise:—a three stage Norwalk compressor with cylinders 8″–4⅝″–1⅞″ x 12″ compressing air to 2500 pounds per square inch; an Ingersoll-Rand two-stage compressor; an 8″ x 8″ Chicago Pneumatic Tool compressor; a large machine built by the Sullivan Machinery Company, and one or two small machines.

The refrigerating laboratory occupies a part of the basement and a part of the first floor of a building running easterly from the building containing the steam and hydraulic laboratory. About 4600 square feet have been allotted to this branch. The Institute has never had any facilities for experimental work in this line and in the past such work as has been done has been carried on at the Quincy Market Cold Storage & Warehouse Company's plants, where every courtesy has been extended. The machines have not as yet been erected in this laboratory.

A 5-ton ammonia compression machine; a 3-ton CO_2 machine and six special condensers, brine coolers, etc., to be used in experiments on interchange of heat are on the ground ready for erection. A 5-ton absorption machine has been donated by the Carbondale Company.

The power measurement laboratory occupies 2600 square feet on the third floor of this same building.

While in the past a student has had an opportunity to become familiar during his laboratory course with the different methods of measuring power, he has had no chance to study the accuracy of the different methods. The work in this branch is to include tests on power scales, dynamometers, torsion dynamometers, transmission of power by belts and by silent chains, balancing, critical speed of shafting, variable speed transmissions, efficiency of fans, etc.

The gas laboratory is located on Vassar street east of the power house, in a two-story building 40 x 80. On account of the danger of fire, on account of the noise due to unmuffled exhaust, on account of the poisonous fumes coming from the exhaust it seemed wise to separate this building from the main educational group.

A part of the second floor is cut away so that a 5-ton crane may serve a certain area of the lower floor and so that vertical engines extending above the second floor level may be erected.

This laboratory contains a 60 horse power suction producer, a four-cycle gas engine 16″ x 24″ of 60 horse power, a 50 horse power Diesel engine, a four-cycle gas engine 11″ x 18″ of 36 horse power, two smaller gas engines of 12 and 4 horse power, respectively, a two-cycle oil engine of 6 horse power, two four-cycle oil engines of 20 and 30 horse power, respectively; three four-cylinder automobile engines, two single cylinder two-cycle motor boat engines, two hot air engines, a small gasoline engine and air compressor for starting the larger gas engines, two test blocks for temporary tests of automobile engines and a cast iron bed plate for tests of large gasoline engines.

This laboratory also contains a cast iron bed plate 5′ x 9′ so mounted that rotating-cylinder engines can be tested and full sized propellers used for loading the engines.

Throughout the material testing laboratory, cranes of from 2 to 5 tons' capacity have been installed over every large machine and in the steam and hydraulic laboratory a 10-ton Shepard electric crane suspended under the ceiling of the second floor covers practically all of the heavy machinery. All heavy machinery is lifted by this crane from trucks which back into the laboratory through a receiving door located on the Massachusetts avenue side of the building.

Throughout the laboratory the pipes have been painted with colors which designate what the pipe carries. This method of