UNIVERSITY OF ILLINOIS CONVOCATION

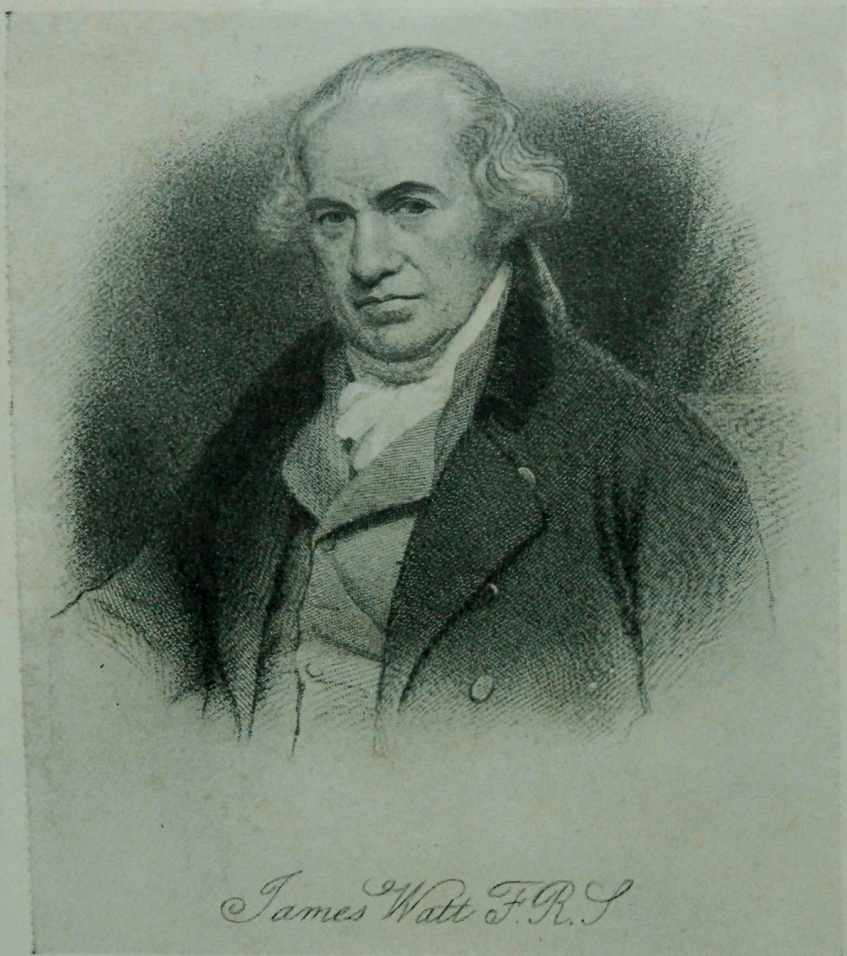
THE WATT CENTENARY

AND THE

COLLEGE OF ENGINEERING

OPEN HOUSE

MARCH 23, 1920



James Watt F.R.S

Inscription on the monument to
James Watt
in
Westminister Abbey, London

NOT TO PERPETUATE A NAME WHICH
MUST ENDURE WHILE THE PEACEFUL ARTS FLOURISH,
BUT TO SHEW
THAT MANKIND HAVE LEARNT TO HONOUR THOSE
WHO BEST DESERVE THEIR GRATITUDE,

THE KING

HIS MINISTERS, AND MANY OF THE NOBLES
AND COMMONERS OF THE REALM
RAISED THIS MONUMENT TO

JAMES WATT

WHO DIRECTING THE FORCE OF AN ORIGINAL GENIUS
EARLY EXERCISED IN PHILOSOPHIC RESEARCH
TO THE IMPROVEMENT OF
THE STEAM-ENGINE,
ENLARGED THE RESOURCES OF HIS COUNTRY
INCREASED THE POWER OF MAN,
AND ROSE TO AN EMINENT PLACE AMONG
THE MOST ILLUSTRIOUS FOLLOWERS OF SCIENCE
AND THE REAL BENEFACTORS OF THE WORLD

BORN AT GREENOCK MDCCXXXVI

DIED AT HEATHFIELD IN STAFFORDSHIRE MDCCCXIX

WATT CENTENARY CONVOCATION

under the auspices of the

COLLEGE OF ENGINEERING

INTRODUCTORY REMARKS

by

CHARLES RUSS RICHARDS

Dean of the College of Engineering

ADDRESS:

JAMES WATT, HIS LIFE AND ITS INFLUENCE UPON THE INDUSTRIAL DEVELOPMENT OF THE WORLD

by

LESTER PAIGE BRECKENRIDGE, PH.B., M.A., DR.ENG'G

Professor of Mechanical Engineering, University of Illinois, 1893-1909; Professor of Mechanical Engineering, Sheffield Scientific School, Yale University, 1909—

PROGRAM OF THE OPEN HOUSE OF THE COLLEGE OF ENGINEERING

The College of Engineering provides instruction in twelve four-year curriculums in the following branches of engineering.

Architecture	Mining Engineering
Architectural Engineering	Municipal and Sanitary Engineering
Ceramic Engineering	General Engineering Physics
Civil Engineering	Railway Civil Engineering
Electrical Engineering	Railway Electrical Engineering
Mechanical Engineering	Railway Mechanical Engineering

Besides its work of instruction, the College conducts an Engineering Experiment Station the object of which is to stimulate and to elevate engineering education and to investigate problems of special importance to professional engineers and to manufacturing and industrial interests of the State.

Fourteen main buildings comprise the engineering group.

More than seventeen hundred students are registered in the College.

The faculty and scientific staff number 120.

DESCRIPTION OF EXHIBITS

The program is arranged in the order of the itinerary.

A map showing the itinerary may be found at the center of the program.

Special attention is called to the fact that the exhibits noted in this program represent a small part, only, of the equipment of the College.

I. Engineering Hall

Used mainly for the administrative offices of the College, the Experiment Station, class rooms, drafting rooms, and libraries.

Important work of the College is carried on in the Engineering Library (first floor) and in the Ricker Library of Architecture (fourth floor).

Second Floor

Civil Engineering Department.

Offers instruction in surveying, mapping, steel and reinforced structures, drainage, irrigation, and road construction.

1. Structural engineering models and test pieces.
2. Bridge design drawings and pictures.
3. Drainage and irrigation maps and charts.

Third Floor

Machine Design of the Department of Mechanical Engineering.

Concerned with the design and construction of power plants, manufacturing plants, and individual machines.

1. Display of student work.
   Power plant designs, problem in balancing an automobile engine, etc.
2. Working models of machines.

Fourth Floor

Department of Architecture which gives training in the production of correct, thoughtful, and beautiful works of architecture; and the

Department of Architectural Engineering which gives a ground work in mathematics and mechanics and applies these fundamentals to building engineering and construction.

1. The Ricker Library—one of the two finest Architectural Libraries in this country.
2. Unusual Mosaic portrait of Dr. N. C. Ricker.
3. Display of books of special interest to women.
4. Drafting room equipped with artificial daylight.
5. Statute of Hermes by Praxiteles, 390 B. C.
6. Full size reproduction of a Capital from the Parthenon, Greece.
7. Display of Rookwood pottery.
8. Exhibition of student work.
9. Structural drawings made by students for a seventeen-story office building.

First Floor

Engineering Experiment Station.

About 2000 bulletins are distributed per month on special request. In addition, about 7000 per month are sent to addresses on the regular mailing list.

(See statements concerning cooperative investigations at the back of the program.)

Engineering Library is used by about 2500 students per week.

1. Large paintings showing the proposed development of the College of Engineering.

Surveying and hydrographic equipment of the Department of Civil Engineering.

1. Transits, levels, plane tables.
2. Surveying and mapping exhibits.
3. Current meters and other hydrographic equipment.

II. Laboratory of Physics

Equipped to give training to engineering students in the fundamentals of the physical sciences and to give advanced training to prepare specialists for the solution of research problems in connection with the technical industries. Research departments are rapidly becoming an important part of many industries.

Inspection of first floor only.

1. Electrical measurements laboratory.
2. Color exhibit with mercury arc.
3. Optical measurements.
4. Radio receiving station.
5. The new singing tube. (An experiment automatically demonstrated).
6. Mercury vapor pumps in the production of high vacua.
7. Rayleigh resonator. Wave motion.
8. Demonstration with liquid air.
9. Liquid air plant in operation.
10. Exhibit of physics apparatus constructed in department shop.

III. Ceramic Building

Built in response to demands from the Illinois Clay Workers' Association for a department devoted to the technology of the industries engaged in the manufacture of clay products, glass, cement, lime, gypsum, enameled iron, etc.

First Floor

1. Display panels showing different styles of face brick. Donated and erected by brick manufactureres of Illinois and Western Indiana.
2. Grinding and mixing equipment for preparing slips and glazes.
3. Laboratories for the preparation and study of glazes, bodies, and ceramic raw materials.
4. Concrete laboratory of the Department of Theoretical and Applied Mechanics.

   Devoted to investigations on concrete and reinforced concrete.

   a. Test of a large reinforced concrete beam.

Second Floor

(To be inspected after visiting the Locomotive Testing Laboratory)

1. Electric furnace laboratory for high temperature experiments.
2. Vacuum furnaces for the study of gases dissolved in glass.
3. Demonstration with apparatus for studying the dehydration of clay.
4. Silicate research laboratory. Investigations on the viscosity of glasses and on the manufacture of silica refractories from Illinois materials.
5. Demonstration with apparatus for determining melting points of refractory materials up to 5500° Fahrenheit.
6. Museum. Samples of different types of ceramic products.

IV. Locomotive Testing Laboratory

Designed to conduct tests on locomotives, of various types and sizes to determine the influence of important factors on locomotive operation and construction, such as the size of coal for best efficiency, economy of superheated steam, etc.

1. Locomotive testing and operation.
   Taking of indicator cards while locomotive is running to determine the power developed by the locomotive.
2. Steam railway test car.
   Test data recording apparatus.
3. Electric railway test car.
   Test data recording apparatus.
4. Equipment for treating timber to prevent decay.
5. The Master Car Builders' standard brake shoe testing machine. Demonstration of a wearing test on brake shoe and car wheel. (See statement at back of program concerning the cooperative investigation of car wheels).
6. The cinder separator which collects the cinders discharged from the locomotive stock.

(Return to Ceramics Building (2nd floor). For exhibits see above.)

V. Kiln Laboratory

(Of the Department of Ceramic Engineering)

1. Small experimental brick plant.
2. Grinding and crushing equipment and dry presses.
3. Gas producer which furnishes fuel for the kilns.
4. Various types of kilns for firing clay products, enameled wares, refractory shapes.

VI. Mining Engineering Laboratory

The Department of Mining Engineering offers courses of instruction in coal and ore mining and in metallurgy. A student may specialize in the geological phases of mining, including work in oil prospecting and development.

Illinois ranks third in the mineral products of the United States including coal, oil, lead, zinc, fluor spar, etc. Below the surface of the State there is approximately 36,800 square miles of coal in seams of sufficient thickness to justify mining operations. Of these coal resources only about one per cent has so far been mined.

1. Demonstrations in mine ventilations and lighting.
2. Equipment for hydro-metallurgy and testing.
3. First aid and rescue work.
4. Explosives and methods of blasting.
5. Demonstration in ore dressing.
6. Demonstrations in coal washing and preparation.

VII. Mining and Railway Museum

(Between the Mining Laboratory and the Transportation Building)

1. Automatic mine door.
2. Facsimile of a section of early American railway using stone ties.
3. A cross section of a locomotive.
4. An early locomotive testing plant.

VIII. Transportation Building

Devoted largely to instruction in the different branches of railway engineering science, with curriculums in railway civil, railway electrical, and railway mechanical engineering. Part of the building is used by the Departments of Mining Engineering and General Engineering Drawing.

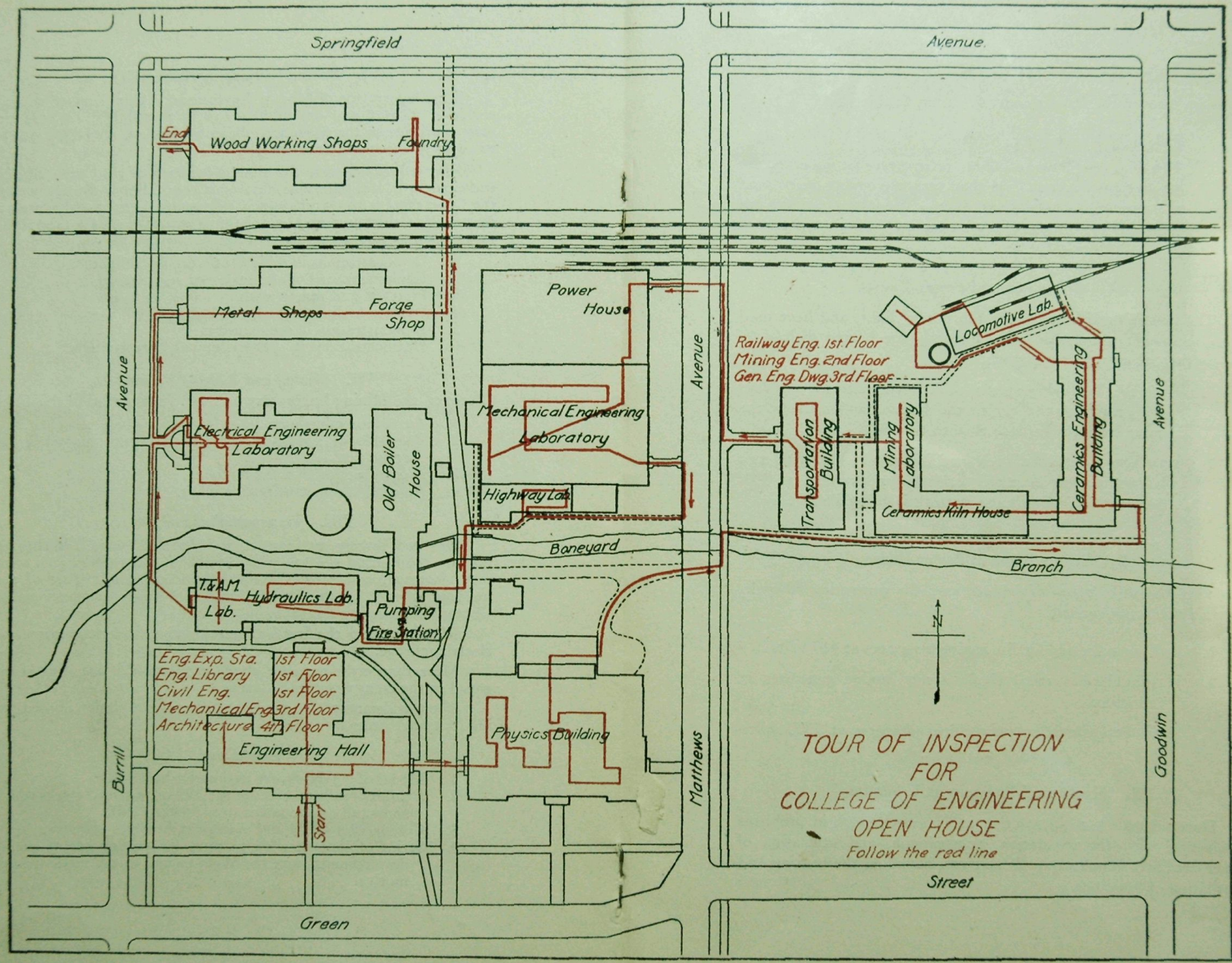
Illinois is one of the first four states having the largest steam and electric mileage.

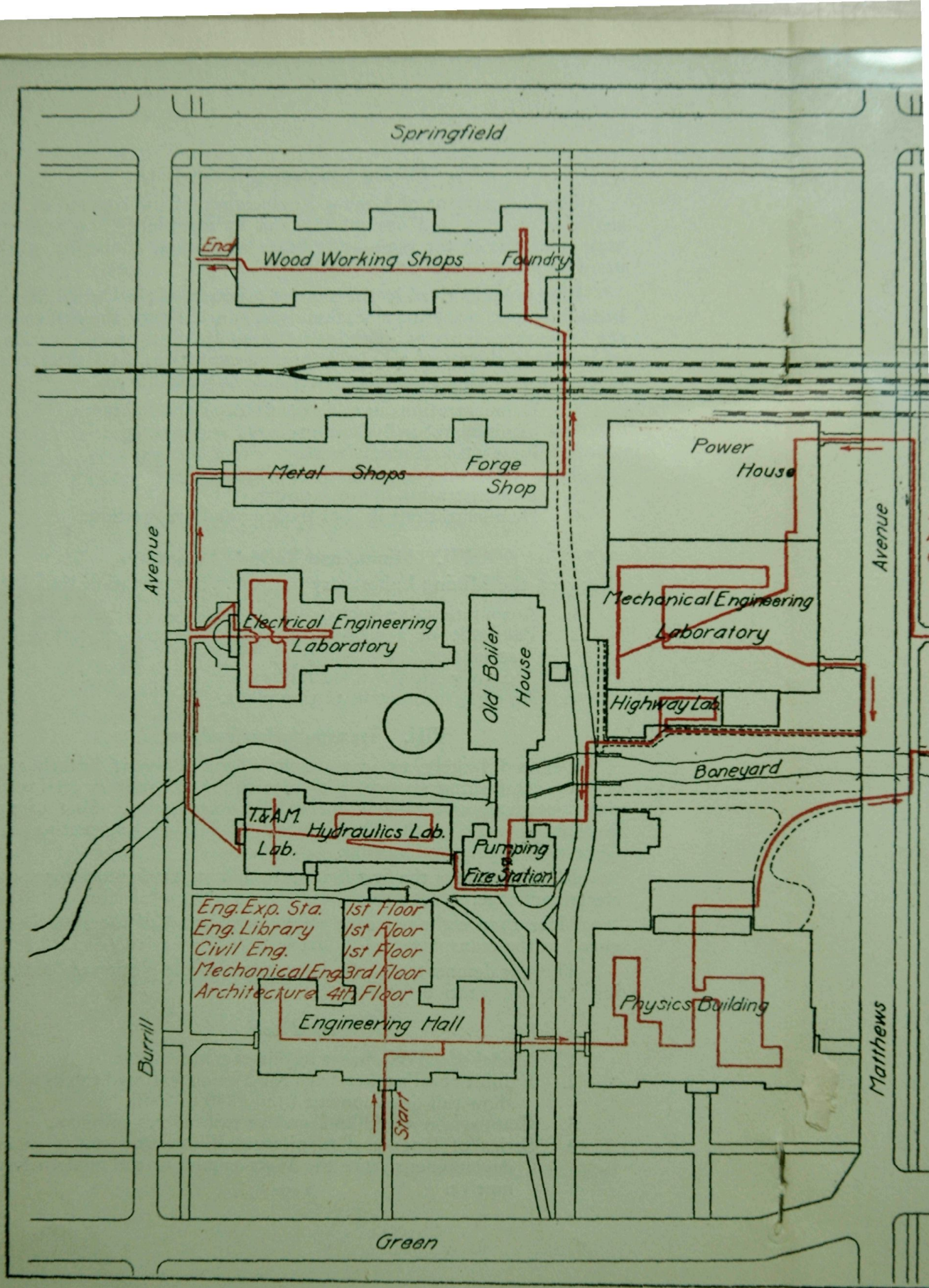
More than eight per cent of the population of the state is engaged in the transportation industries.

The war demonstrated the importance to the Nation of developing its transportation facilities.

First Floor

1. Model of a Walschaert locomotive valve gear.
2. Exhibit of rails taken from the Monon Railroad tracks which show rail development from 1840 to 1910.
3. Comparison of old and modern railway car couplers.
4. Series of lantern slide pictures illustrating steam engine development from the Watt engine to the modern locomotive.


Springfield
Avenue
Wood Working Shops
Foundry
Metal Shops
Forge Shop
Power House
Locomotive Lab.
Railway Eng. 1st Floor
Mining Eng. 2nd Floor
Gen. Eng. Dwg. 3rd Floor
Electrical Engineering Laboratory
Old Boiler House
Mechanical Engineering Laboratory
Highway Lab.
Transportation Building
Mining Laboratory
Ceramics Engineering Building
Ceramics Kiln House
Boneyard
Branch
T. & A.M. Lab.
Hydraulics Lab.
Pumping Station
Fire Station
Eng. Exp. Sta. 1st Floor
Eng. Library 1st Floor
Civil Eng. 1st Floor
Mechanical Eng. 3rd Floor
Architecture 4th Floor
Engineering Hall
Physics Building
Start
Burrill
Matthews
Goodwin
Green
Street
N
TOUR OF INSPECTION
FOR
COLLEGE OF ENGINEERING
OPEN HOUSE
Follow the red line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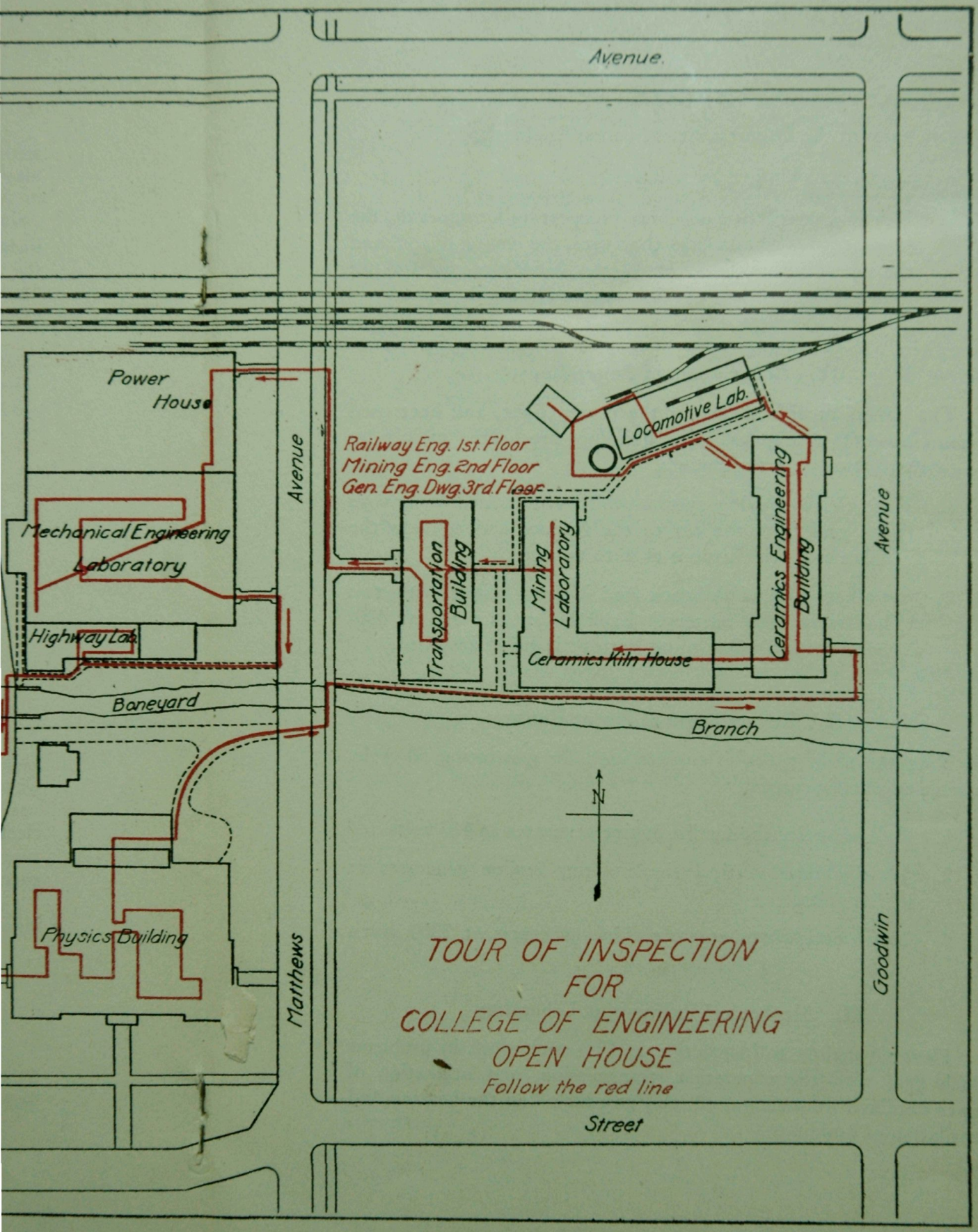
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TOUR OF INSPECTION
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Follow the red line
Matthews
Goodwin
Street

Second Floor

Museum cases of the Department of Mining Engineering.

Appliances used in connection with:

Blasting, ventilation of mines, prospecting for minerals, the separation of metals from their ores, the coking of coal and the separation of the by-products. Models of coal and ore mines. Stereoscopes of mining scenes in South Africa.

IX. Boiler Room of Power House

The boilers furnish steam for the power, light, and heat used in the University Buildings. The buildings are heated mainly by the exhaust steam from the engines.

1. Note the conveying system which automatically conveys the coal from the car to the furnace and conveys the ashes from the furnace to auto trucks.
2. Two batteries of Babcock and Wilcox boilers with two boilers in each battery. Each boiler is rated at 500-horse power. One more battery is being installed.

X. Engine Room of Power House

Note the three types of engines used for generating 60-cycle, alternating electric current.

1. Ball non-releasing Corliss engine generates at 440 volts.
2. Westinghouse vertical single acting engine generates at 440 volts.
3. Horizontal Curtis steam turbine generates at 2300 volts.

XI. Mechanical Engineering Laboratory

Devoted mainly to instruction and research work in problems which deal with the generation, transmission, and utilization of power obtained from steam, oil, and gas, including the heating and ventilation of buildings.

This laboratory has been materially increased in size and entirely remodeled so as to provide two floors, each nearly 120 ft. by 125 ft. in area.

1. Double flume for measuring large quantities of water, such as circulating water for condensers, discharge of pumps, etc.
2. Peerless 6-cylinder automobile engine in operation. Engine develops 70-brake horse power.
3. Two Chandler and Taylor simple throttling engines operated together as a cross compound engine.
4. Allis-Chalmers 12″x24″ Corliss engine equipped with a variable speed governor giving a range from 20 to 130 revolutions per minute.
5. Southwark 400-horse power, 3-cylinder, triple expansion, vertical steam engine donated by Commonwealth Edison Company. A large unit which was discarded because of the rapid advance in steam engineering.
6. Fairbanks-Morse double-acting, underwriters pump driven by a direct-connected, tandem-compound, steam engine in operation.
7. Ingersoll-Sergeant two-stage air compressor driven by a direct-connected, cross-compound, steam engine in operation.
8. Bogart single-acting, four-cycle illuminating gas or gasoline engine in operation.
9. An experimental warm-air furnace heating plant.

   (See note on cooperative investigation of warm-air furnaces, etc., at back of program.)

XII. Highway Laboratory

(Of the Department of Civil Engineering)

Inspection of first floor.

Equipped for testing gravel, stone, and paving brick.

1. Apparatus for testing road materials.
2. Exhibit of road materials.
3. Models, charts, and views illustrating good and bad road construction.

The laboratories for testing Portland cement, road oil, tars, and asphalts are located on the second floor and may be visited by those interested.

XIII. Pumping Station

The University owns and operates its own water supply system. The water is pumped from six deep wells, which are located among the group of engineering buildings. The water is raised from a body of sand, the mean depth of which is about 140 feet below the ground surface.

1. Large air tanks for equalizing the pressure in the water mains.
2. Two underwriter pumps to be used in case of fire to incresae the water pressure—capable of supplying six large fire streams.
3. Two motor-driven centrifugal pumps used for pumping the ordinary University water supply. These pumps run day and night and may also be used in case of fire.

XIV. Hydraulic Laboratory

(Of the Departments of Municipal and Sanitary Engineering and Theoretical and Applied Mechanics.)

Equipped to give instruction in and to investigate problems connected with water supply engineering, water power engineering, the pumping and distributing of water for manufacturing plants, such as paper mills, chemical and other industrial works, for fire protection, drainage, etc., sewerage and sanitary engineering.

1. Three-stage centrifugal pump driven by a variable speed induction motor in operation. This pump is capable of raising 175 gallons of water per minute a height of 460 feet.
2. Leffel reaction turbine in operation. A type of turbine used for low heads.
3. Duplex direct-acting steam pumps in operation. Used for pumping water into a 60-foot stand pipe.
4. Demonstration on a water meter testing apparatus. A type used in city water departments for calibrating meters.
5. Demonstration with a fire stream under high pressure.
6. Demonstration on a motor-driven centrifugal pump.
7. Demonstration on a Doble Tangential Water Wheel. Wheels of this type are used in hydro-electric power plants which operate at a high head (500 ft. or more).
8. Demonstration of various methods of measuring water: Weir, vertical orifice, vertical jet, etc.
9. A miniature water filtration plant, in operation.
10. A miniature sewage treatment plant, in operation.

XV. Materials Testing Laboratory

(Of the Department of Theoretical and Applied Mechanics.)

Equipped to give instruction in, and to investigate problems dealing with the action of various materials, such as, steel, cast iron, bronze, timber, concrete, etc., when subjected to various kinds of loads such as occur in buildings, locomotives, bridges, ships, machines, etc. The manufacture of and specifications for engineering materials are also considered.

1. Demonstration of a compression test of concrete with the 600,000-lb. testing machine.
2. Demonstration of a tension test of steel with a 100,000-lb. testing machine.
3. Demonstration of a bending test of a steel girder with a 200,000-lb. testing machine.
4. Machines in operation showing tests to determine the fatigue-resisting qualities of steel. (See note on Joint Investigation of Fatigue of Metals under Repeated Stress in back of program.)
5. Apparatus used in the investigation on stresses in railroad track. (See explanatory note at the back of the program.)
6. For exhibits in the Concrete Laboratory see **Ceramics Building.**

XVI. Electrical Engineering Laboratory

Equipped to give instruction in, and to investigate problems dealing with the design, installation, and operation of electric machinery in connection with the generation, distribution, and use of electrical energy.

The phenomenal development of electrical science is creating a constant demand for experts in the field of electrical engineering

1. Methods of charging automobile storage batteries. Their comparative cost and efficiency.
2. An electric furnace.
3. Radio, telegraphy, and telephony exhibit.
4. Ladder spark. The high tension transformer used for insulator breakdown tests is used to make a spark jump a horn-gap.
5. Why electricity costs money. A practical demonstration of the power required to produce electric light.
6. Rotating sign. Two three-phase generators running slightly out of synchronism cause the lights to run around the sign.
7. Demonstration of the comparative costs of common electric household appliances.

XVII. Shop Laboratories

Organized to give instruction in the fundamental methods of manufacturing, including factory organization, operation, and management. The courses deal with methods of cost accounting as well as with the purely engineering features of manufacturing.

With one exception (Texas) the states which have shown the largest percentage of growth in population are those in which manufacturing plays the most important part.

About one-third of the people of the State are engaged in manufacturing.

The Shop Laboratories consist of four divisions as noted below:

I. Machine Department—Demonstrations in:

1. Production of duplicate parts of modern production methods.
2. Inspection and testing of parts.
3. Operation of automatic, semi-automatic, and hand operated machinery.
4. Methods of routing, dispatching, and production control of a manufacturing plant.

II. Forge Department—Demonstrations in:

1. Heat treatment and tempering of steel.
2. Case carbonizing and hardening of metals.
3. Welding by oxy-acetylene, by thermit and by open fire.
4. Forging by power and by hand.
5. Methods of shop production.

III. Foundry Department—Demonstrations in:

1. Methods of controlling the production of standard parts.
2. Modern shop practices in molding and core making.
3. Pouring molten brass and aluminum.
4. Exhibits showing consecutive steps in process of making castings.

IV. Pattern Department—Demonstrations in:

1. Typical gas engine and miscellaneous patterns.
2. Shop methods of producing patterns.
3. Executive control methods for production of patterns.
4. Methods of making preliminary analysis and of planning work.

INVESTIGATIONS CARRIED ON BY THE ENGINEERING EXPERIMENT STATION IN COOPERATION WITH TECHNICAL INDUSTRIES

Car Wheel Investigation

The Railway Engineering Department, under a cooperative agreement between the Association of Manufacturers of Chilled Car Wheels and the Engineering Experiment Station is carrying on a series of experiments upon car wheels. The investigation has been in progress for about three years. The experiments are for the purpose of obtaining information concerning the strength, wearing qualities, and design of car wheels. It is hoped that the results will assist in making stronger, safer, and cheaper car wheels. 25,000,000 of these wheels worth about $400,000,000 are in use in the United States and Canada. About 3,000,000 wheels worth about $50,000,000 have to be produced each year.

Cooperative Mine Investigations

The Engineering Experiment Station through the Department of Mining Engineering cooperates with the State Geological Survey and the U. S. Bureau of Mines in carrying on investigations, and in disseminating information based upon these investigations with a view of improving conditions in the mining, quarrying, metallurgical and other mineral industries; in safeguarding the lives of the employees; in preventing unnecessary waste of resources.

A general survey has been made of the geological and mining conditions throughout the State. Investigations are now in progress which deal with problems connected with the methods of mining, with the percentage of extraction of coal, with the subsidence of the surface and with the manufacture of illuminating gas.

Investigation of Warm-Air Furnaces and Furnace Heating Systems

This work is being conducted in the Mechanical Engineering Laboratory under a cooperative agreement between the National Warm Air Heating and Ventilating Association and the Engineering Experiment Station. The determination of the efficiences and capacities of warm-air furnaces, as well as proper conditions of installation and operation, is necessary to secure accurate ratings and to guide in the selection of equipment which will give desired results. The two most important problems involved in the investigation are the accurate determination of the amount of air flowing through the system when the furnace is operating under its own motive head as in an actual installation, and the correct measurement of the air temperatures throughout such a system.

This investigation has been in active progress since October, 1918. The experimental furnace plant is the equivalent of a three story house equipped with a complete furnace heating system. The furnace manufacturers of the country contribute liberally toward the work.

Investigation of Stresses in Railroad Track

The investigation was undertaken to learn the way the rails, ties, ballast, and roadway act under the load of locomotives and cars. Most engineering structures have been designed with a knowledge of the action of the component parts and of the structure as a whole obtained from tests or in other ways, but, strange to say, very little was known of the amount and nature of the stresses developed in track until this series of tests was begun five years ago. Engineers in charge of railroads felt that the increasing size of locomotives and cars and the difficulties found in constructing and maintaining track of adequate strength and durability made it highly desirable that a comprehensive investigation be carried out. The tests have given results of much value to engineers interested in railroad work. With a poorly counterbalanced locomotive, stresses in the rail as great as 50,000 lb. per sq. in. have been measured. The stresses in the cross ties are found to vary greatly with the conditions of the tamping.

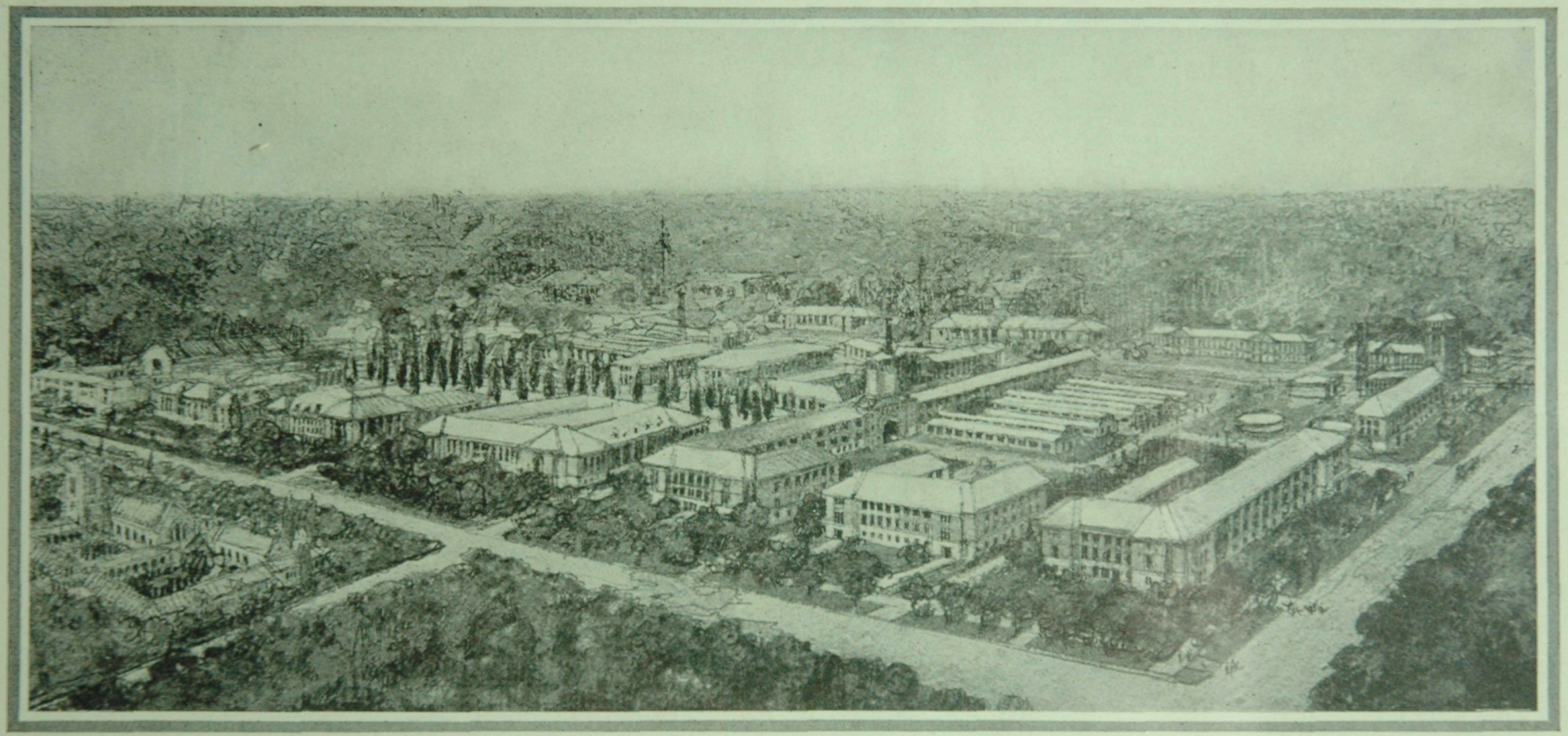
The field tests have been conducted on the Illinois Central Railroad and other important lines. The laboratory tests have been carried on in the laboratories of the University. The work is under the charge of a joint committee of the American Society of Civil Engineers and the American Railway Engineering Association, with the cooperation of the Engineering Experiment Station. A leading engineering journal says of the preliminary report: "The investigation is a classic. A new page in the book of engineering has been written."

Investigation of Fatigue of Metals Under Repeated Stress

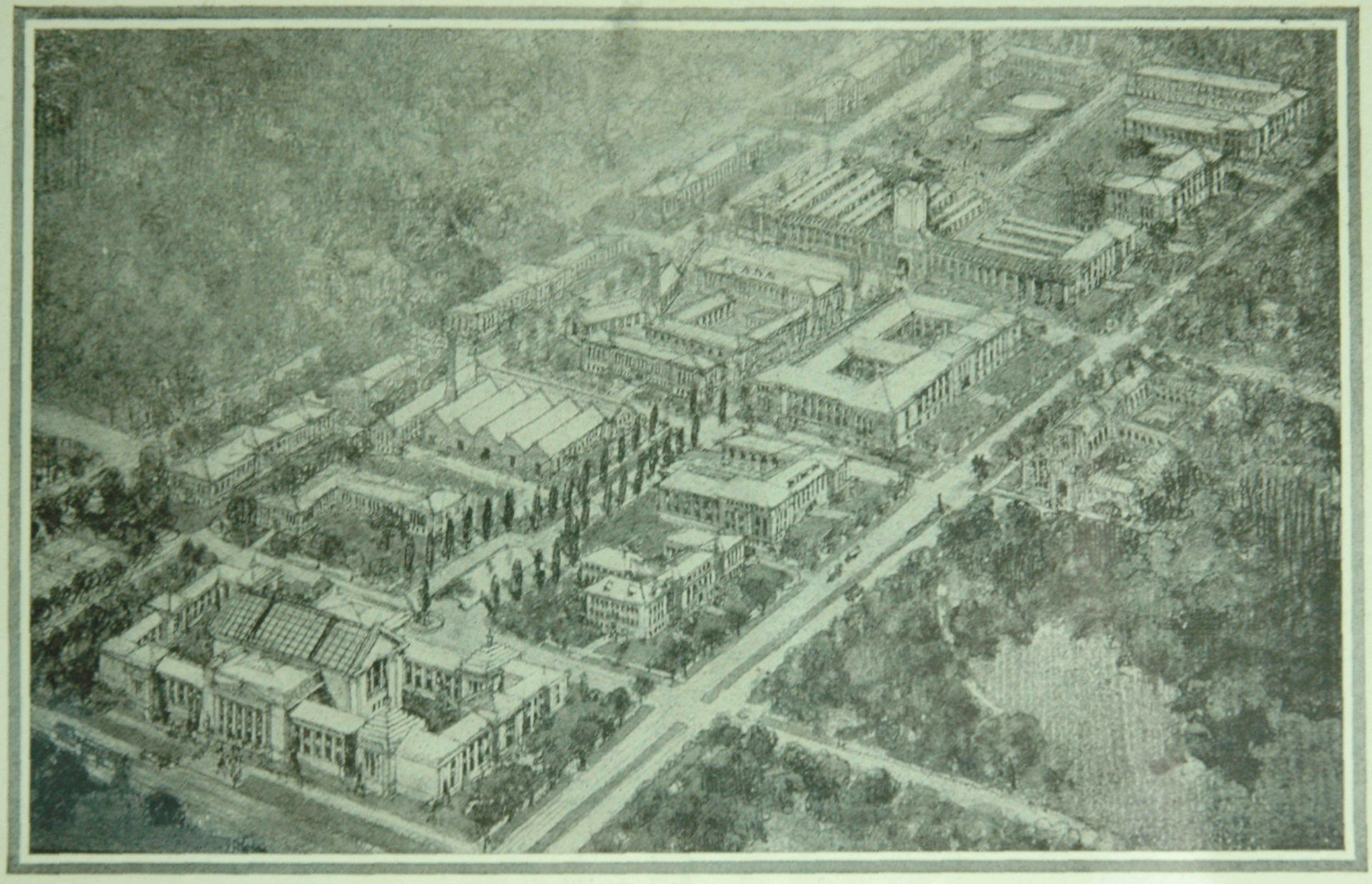
An investigation of the resistance of metals to breakdown under repeated loading is being carried on in the Materials Testing Laboratories of the University. There occasionally occur failures in automobile springs, crankshafts, car axles, and in other machine parts which are subjected to millions of loadings in their daily use. Occasionally, too, cracks develop and spread in steel bridges and elevated railroad structures. Such gradual breakdown of metal is a subject of great interest to all who use machinery, and became of acute moment in connection with the airplane during the war. A of committee the National Research Council was formed to study this phenomenon and the work of that committee is being continued under a joint arrangement between the Engineering Foundation, which finances the work, the National Research Council, and the Engineering Experiment Station.

Investigation of the Coking of Coal

An investigation of the coking of coal, in cooperation with Mr. A. T. Hert of the American Creosoting Company, has been completed recently. A new process developed during the investigation may revolutionize the coking industry.



A Study for the Extension of the Campus of the College of Engineering, Looking Northwest.
Prepared by the Staff of the Department of Architecture



A Study for the Extension of the Campus of the College of Engineering, Looking Northeast.
Prepared by the Staff of the Department of Architecture