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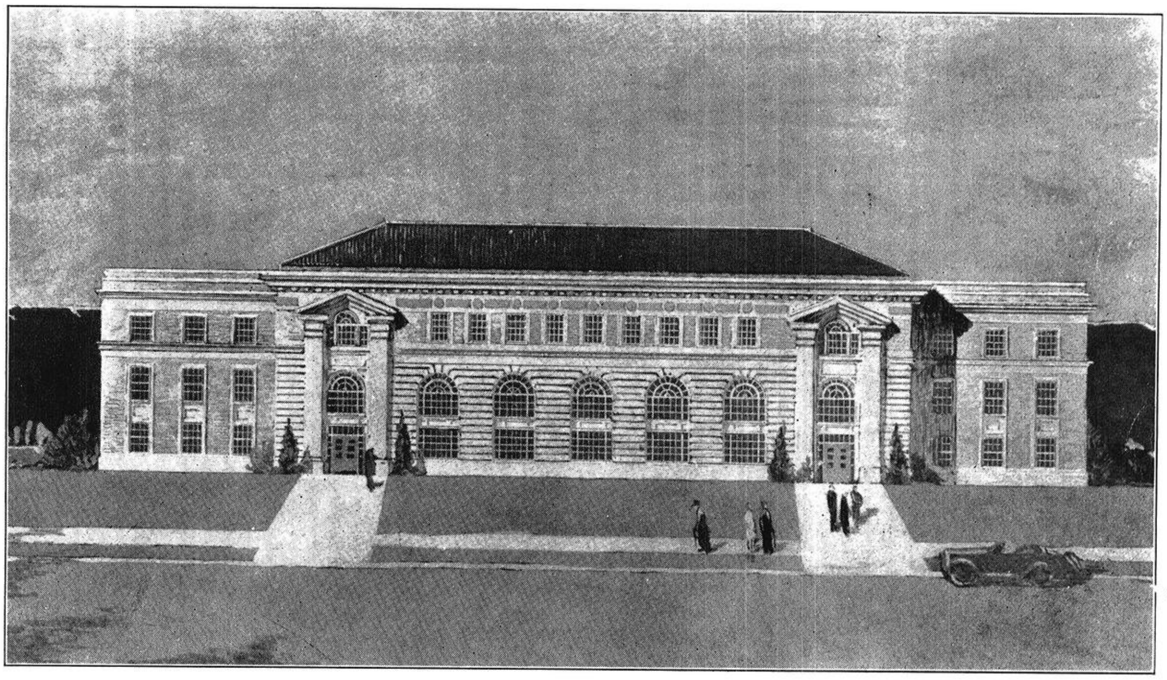
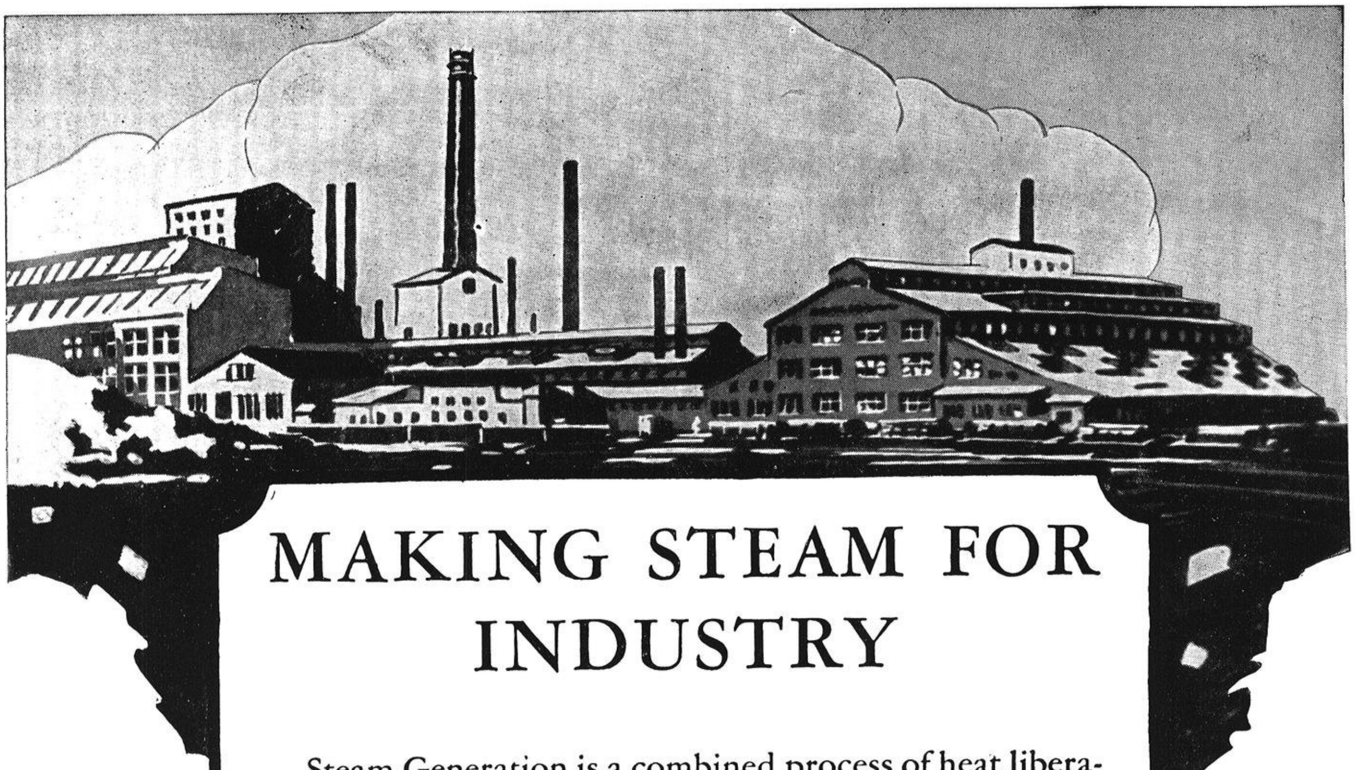


THE NEW MECHANICAL ENGINEERING BUILDING

PUBLISHED BY THE ENGINEERING STUDENTS
of the UNIVERSITY OF WISCONSIN

December, 1928



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The WISCONSIN ENGINEER

VOLUME 33, NO. 3 DECEMBER, 1928

The New Mechanical Engineering Building

By G. C. Wilson
Assistant Professor of Steam and Gas Engineering

THE need for larger space for the College of Engineering at the University has been apparent for some time, and Dean Turneaure has kept his building committees busy for the past fifteen years or more. The problems of enlargement have been carefully studied, but only recently funds have been made available for the work. Two years ago when Professor G. L. Larson approached the Dean with high hope and arguments for a new Mechanical Engineering Building, Dean Turneaure responded by making him chaiman of a new building committee. He went to work with so much enthusiasm that it became contagious, and his optimism seemed to rise above any discouragement. Things took on a very hopeful aspect, when President Frank's able presentation of the project to the Finance Committee of the Legislature was supported by a sincere endorsement from a large committee of Wisconsin Manufacturers. The last legislative obstacle was passed last summer, when Governor Zimmerman signed the release for the $577,000 which had been appropriated the summer before. The present schedule calls for the completion of plans by January, 1929, and completion of the building by September, 1930.

The first problem for the building committee was a consideration of the possibilities of developing the area surrounding the present Engineering buildings. It was estimated that this location would provide for only fifteen years expansion and such a plan did not go far enough into the future to satisfy the Board of Regents. Mr. Peabody, State Architect, had already foreseen this possibility and had reserved the University Avenue end of Camp Randall for a future Engineering Group of some eight or nine buildings. This location and Mr. Peabody's selections of a modernized Italian Renaissance style of architecture for the group has been approved by the Board of Regents. The complete transfer of the Engineering College is expected to require a period of ten to fifteen years.

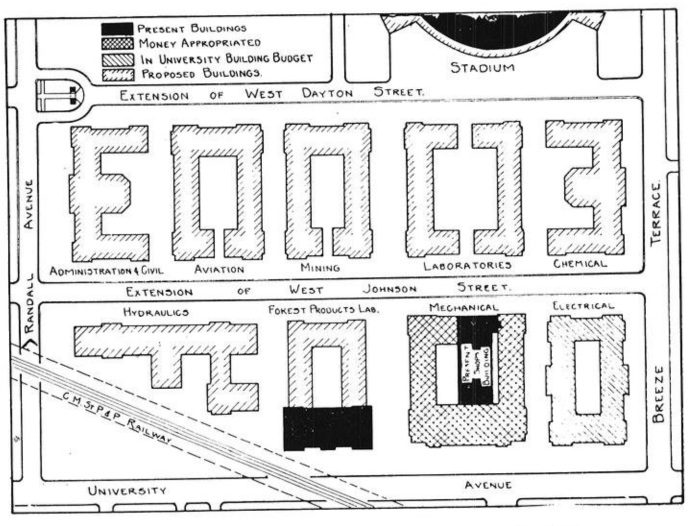

FIG. 1: Proposed layout of new engineering buildings at Camp Randall.

The Mechanical Engineering Building, which is the first in this new development, will front on University Avenue and will be built around the present one story Randall Shops Building. It will be three stories in height as shown on the cover by the artist's drawing of the front elevation. The building material will be Madison stone, except the central portion of the front which will be Bedford Limestone. Terra cotta will be used in connection with the architectural trimming.

The east wing of the building will be occupied by the Steam and Gas Engine Laboratories, while the west wing will house the Engineering Shop Laboratories. Drafting rooms for the Machine Design Department will be in the front of the building on the third floor. The main floor plan and section elevation are shown in the accompanying plate. The exhibit space shown in the front portion of the building will extend through two floors with a large balcony which will also be used for display purposes. This

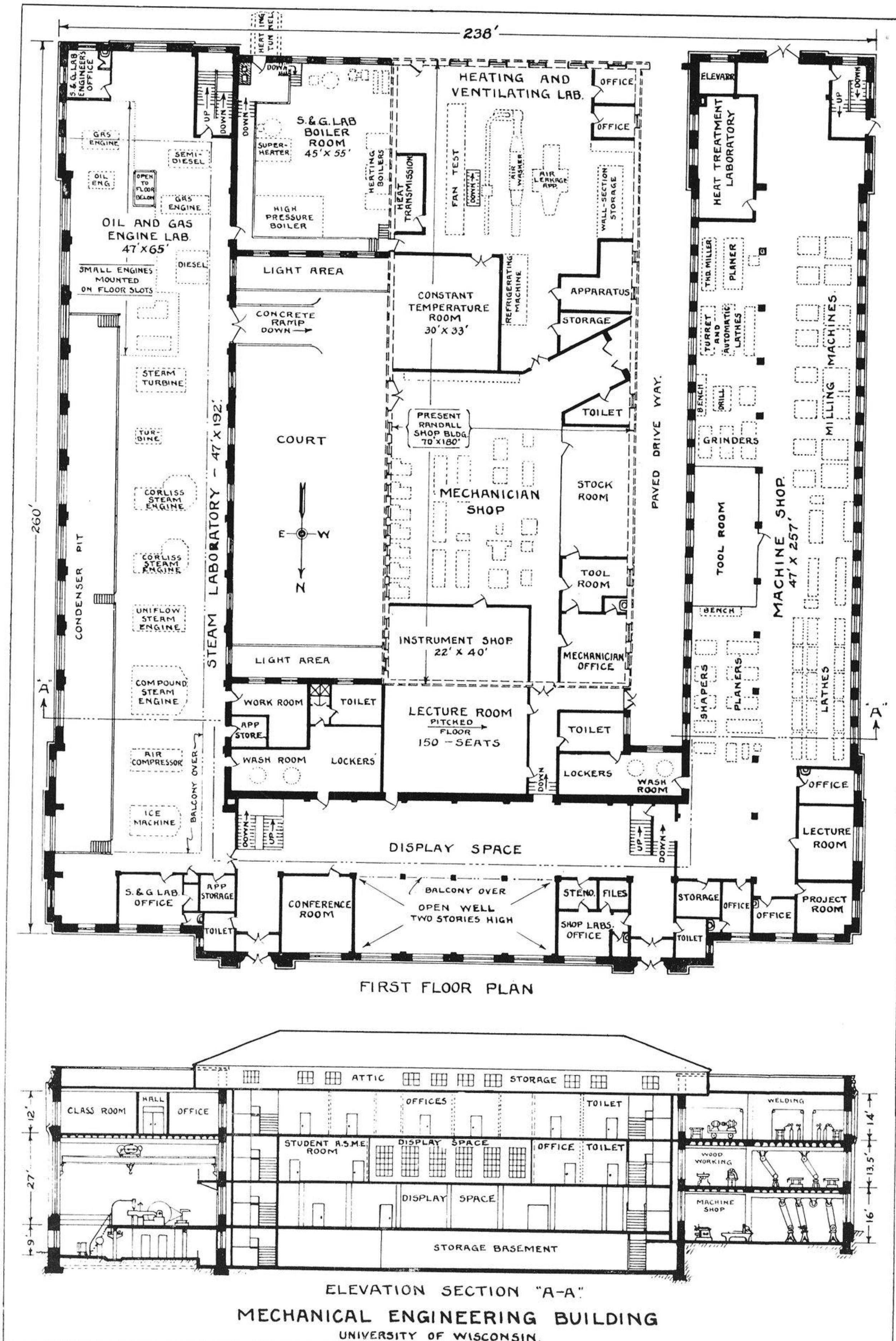

FIG. 2: Floor plan and cross-section of new Mechanical Engineering Building.

will afford ample room for showing models and sections of engineering apparatus. The wall space will be used for photographs and drawings. In the front of the building on the second floor, a space twenty-seven by thirty-four feet will be reserved for a library and lounging room. It will furnish a meeting place where students can spend an open hour between classes, discuss any points of interest, and become better acquainted with each other. The library features of this room will be very restricted; for the Engineering Library already meets the need for a complete library. There will be a room in this part of the building which will be used by the Student Branch of the American ociety of Mechanical Engineers.

In addition to the drafting rooms and offices on the third floor, the Machine Design Department will have a laboratory thirty by forty feet in the basement under the Steam Laboratory Work Room.

The present Randall Shop Building is shown in broken lines. The front half of this building will be given over to the Engineering Mechanician Department. This department does all the repair work for the College of Engineering and also makes a large amount of special apparatus.

The Heating and Ventilating Laboratory will be located in the rear portion of the present Randall Shop Building. This will furnish a good solid floor for moving heavy equipment such as brick or concrete wall sections which are used in connection with the test work on "The Infiltration of Air into Buildings". Fan testing, air measurement, heat transmission and refrigeration experimental and test work will also be carried on in this laboratory. In addition to the heating and ventilating apparatus in this laboratory, the building itself will be used for practical studies. A variety of systems and combinations of heating and ventilating equipment will be installed in different parts of the building.

A Boiler Room will join the Heating and Ventilating Laboratory to the Steam Laboratory. This room will extend two stories in height from the basement floor level. It will house both heating and power boilers for testing purposes. Many kinds and types of boiler plant auxiliaries will also be arranged for experimental and research work. Heat for the building will be supplied from the University Central Heating Plant and connection to the tunnel system will be made through the Laboratory Boiler Room.

A basement space, forty-six by seventy-five feet, under the Internal Combustion Engine Laboratory and adjoining the Boiler Room, will be occupied by the Automotive Laboratory. This will provide space for two electric-dynamometers which will be mounted on tracks for convenience in connecting to any of several "motor set-ups". A chassis testing dynamometer will be arranged so that an automobile may be tested by driving the mechanism with the rear wheels. Testing equipment will also be installed for airplane engine investigation. The laboratory will be well lighted by full height windows and a grade line low enough to expose a large portion of the outside walls.

The Steam and Internal Combustion Engine Laboratories are on the first floor of the east wing of the building. They will be served by a three motor, ten ton traveling crane. The outside doors are arranged so that a truck may enter this wing and be unloaded by means of the crane. The engines will be installed in these laboratories with ample clearance between machines so that experiments may be conducted simultaneously by several groups without any interference or crowding. In the Steam Laboratory, a special data table will be used for each large engine. There will be a locker in each end of these tables which will furnish convenient places for all the test apparatus needed by the class and all the special tools belonging to the engine. The engine laboratories will have a concrete floor and the main foundations will be separated from the rest of floor in order to minimize the amount of vibration transmitted to the building. The walls of these laboratories will be tan colored, smooth face-brick. Large power plant type windows will provide an abundance of light in the Steam Laboratory. A balcony at the front end of the Steam Laboratory will be used for the calibration of gages and engine indicators. A balcony at the rear end will provide research space and a laboratory for the study of lubricating oils and fuels. An observation balcony will connect these two end balconies which will be on the same level as the second floor. The third floor of the east wing will be divided into rooms for research, calculation, recitations and offices. With the exception of some of the laboratories, all the walls will be plastered and the floors will be hard maple.

In the west wing, a modern machine shop will occupy the first floor. The walls in this room, as in all the shop laboratories, will be common brick and painted with a good light reflecting paint. The floors will be heavy maple. The only elevator in the building will be locatd in this wing. It will serve both as a freight elevator for the building and as a service elevator for the foundry.

The foundry will be on the second floor at the rear of the west wing, and it will extend through the third floor to the roof of the building. Provision will be made for all modern equipment including a three ton electric crane, moulding machines, sand blasts, air hammers, a sand mixer, and an electric core oven. The melting of iron will be done in a cupola thirty-six inches in diameter. A carpenter shop will adjoin the foundry and a pattern making shop will be located in the front part of this wing. All woodworking machines are to be motor driven. The wood lathes will be arranged for group drive.

On the third floor of the west wing, at the rear of the building, the cupola charging platform for the foundry will be placed; and an eight foot balcony along one side of the foundry will permit passage from the elevator to the front of the building. This balcony will connect into the Forge room and from there into the welding Laboratory and hence into the Metal Working Laboratory. The welding department will be provided with equipment for instruction and research in various methods of welding

(Continued on page 118)

Municipal Ownership *and the* Cost *of* Electric Energy*

A Dialogue Between A Citizen And An Engineer

By Edward Bennett, *Professor of Electrical Engineering*

Citizen. Good morning, neighbor! I'm glad I have encountered you. We have been hearing quite a bit about municipal and governmental ownership in this campaign and I feel the need of inside information.

Engineer. The top of the morning to you, sir! Fire away. You have to dig for inside information.

FIG. 1: Sales girl measuring a K. W. H.

Cit. What is it an electric power company sells to its customers?

Eng. Electric energy. The purchaser uses the energy in electric appliances to drive machines and to do very definite lighting and heating jobs.

Cit. How is electric energy sold?

Eng. Cloth is sold by the yard, milk by the quart, and electric energy is sold by the kilowatt-hour.

Cit. I understand the measurement of cloth and milk, but what is a kilowatt-hour? How big is it?

Eng. I suppose the clearest way to answer is to tell you what work can be done with a kilowatt-hour of energy.

If used in a motor, a kilowatt-hour of energy will pump more water than a man will pump in 12 hours of steady pumping, or than 12 men will pump in one hour.

If used in a vacuum cleaner, it will, under ordinary household use, drive the cleaner for a week.

If used in a washing machine motor, it will drive the machine for one to two weekly washings.

If used in an incandescent lamp, it will light a study for 25 hours.

Cit. Are the meters of the electric company accurate and reliable?

Eng. Yes, the watt-hour meters in the residences measure and count the number of kilowatt-hours of energy taken by the customer as accurately as a clerk measures cloth or a quart bottle measures milk.

Cit. What does a kilowatt-hour of energy cost?

Eng. The average price paid in 1927 for a kilowatt-hour of energy by all residential users of energy in the U. S. was 6.8 cents per kilowatt-hour.

The average price paid by all users, both industrial and residental, was 2.68 cents per kilowatt hour. Many large purchasers, such as the electric railways, paid less than a cent per kilowatt-hour.

Cit. Do you mean to tell me that by using 6.8 cents work of electric energy I can pump as much water as can be pumped by man power in 12 hours!

Eng. Yes, 6.8 cents if you are a small user; less than a cent if you are a large user. The wages to do the job by man power would be from 100 to 700 times the cost of the electric energy to do it.

Cit. Now you bring up a matter I have never fully understood. Why does the small user have to pay so much more than the large user for a kilowatt-hour?

Eng. The cost per kilowatt-hour for delivering energy to the small user is far higher than the cost of delivering to the large user. But go ahead with your questions and you will unearth some very surprising facts about the costs.

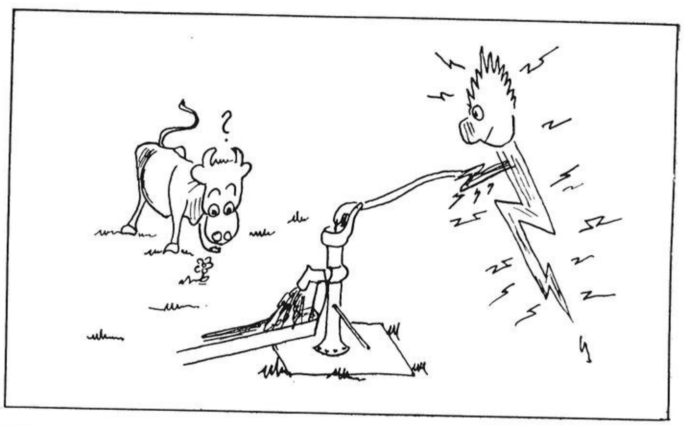

FIG. 2: Kilowatt-Hour pumping more water than twelve men.

Cit. How many kilowatt-hours are used by the small customer?

Eng. The average number of kilowatt-hours of energy used by each residential customer (in the U. S.) having electric service is

429. kilowatt-hours per years, or
36. kilowatt-hours per month, or
1.2 kilowatt-hours per day.

*Editor's Note: This is the first installment of the article on Municipal Ownership of Public Utilities. It will be concluded in the January, 1929, issue.

Cit. How much does this cost the household?

Eng. It costs the average household 8 cents per day.

Cit. What costs does the electric company incur in supplying electric energy?

Eng. The costs incurred in supplying electric energy fall under three divisions. They are:

The Costs of Generation; that is to say, the costs from the coal pile of the steam station, (or the reservoir of the water power) to the switchboard of the generating station.

The Costs of Transmission; that is, the costs in transmitting energy from the generating stations over the high-voltage lines to the substations in the cities and villages.

The Costs of Distribution; that is, the costs in distributing the energy from the substation in the city or village to the residences, the stores, the factories, and the farms.

Cit. Are there corresponding costs in other enterprises?

Eng. Yes, consider the enterprises of supplying potatoes. The cost of generation corresponds to the cost of growing, digging, and gathering potatoes.

The cost of transmission corresponds to the cost of hauling and of shipping in carload lots to the wholesaler.

The cost of distribution corresponds to the cost of distributing the potatoes to the grocer and from the grocer to the home.

The farm corresponds to the generating station; the wholesaler, to the city substation; and the grocer, to the pole top transformer which supplies the residences for several blocks around it.

COSTS OF GENERATION FROM COAL

Cit. What does it cost to build a steam power station to generate electric energy?

Eng. A representative cost for the modern large steam power station is $115 for each kilowatt of generating capacity.

Cit. What do you mean by a "kilowatt of generating capacity"?

Eng. The statement that a station has a generating capacity of 100,000 kilowatts means that in each hour of operation it can safely generate 100,000 units of energy, that is, 100,000 kilowatt-hours of electric energy.

Cit. How many kilowatt-hours of energy can a station furnish in a year?

Eng. If a station could be operated 24 hours a day and 365 days a year at its full capacity all the time, it could generate 365 times 24 or 8760 kilowatt-hours of energy for each kilowatt of generating capacity.

As a matter of actual practice over the entire U. S., the average number of kilowatt-hours of energy generated during the year for each kilowatt of generating capacity of the electric companies is only 34.4 per cent of 8760 or 3000 kilowatt-hours of energy.

Cit. Why only 3000 kilowatt-hours per year?

Eng. The generating capacity must be great enough to supply the demand for energy during the early evening peak demands in the winter, and then some of the generators must necessarily be shut down at night and at all other times when the customer demand for energy is less.

Cit. You mean that the generating capacity of the country is idle about two-thirds of the time?

Eng. Yes, but this situation is being improved by the extension and interconnection of the power systems which has been going on for some time past. This development has captured the public attention under the name "super power" development. Because of the greater diversity in time of the peak demands of the customers on a system serving a large territory, these large companies are able to keep their generators working frmo 40 to 50 per cent

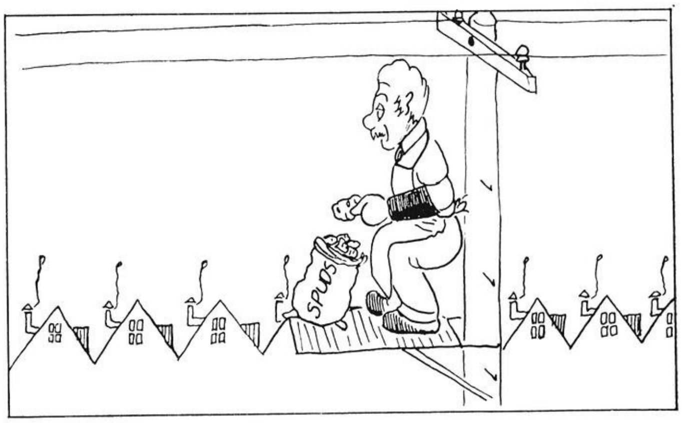

FIG. 3: The grocer corresponds to the pole-top transformer.

of the time and thus to generate say 4000 kilowatt hours of energy per year from each kilowatt of generating capacity.

There are some especially fortunate plants at Niagara Falls supplying the unvarying load of the chemical industries which are enabled to generate about 8000 kilowatt-hours of energy per year for each kilowatt of generating capacity.

Cit. What annual payments must the Company owning and operating a generating station make because of its investment of $115 per kilowatt?

Eng. It must pay anuually to the bondholders and stockholders from whom it obtained the $115 an amount sufficient to pay 5 to 6 per cent interest to the non risk-bearing bond holders, and interest plus profit to the risk-bearing stockholders. Under commission regulation the total annual payment for interest and profit is limited to 7 to 8 per cent of the investment, say 7 per cent, or $8.05 per year.

It must pay annual taxes which on the average equal or exceed 2 per cent of the investment, or $2.30 per annum.

Finally, in order to protect the interests of its investors and its customers, it must carry insurance, and it must build up a "depreciation fund" which it can use to replace its structures and machinery as they become dangerously weak, or inefficient, or obsolete. To pay the insurance and to build up an adequate depreciation fund, the company will have to set aside from its earnings each year, a sum equal to 4 per cent of its investment in the plant, or $4.60 per annum.

Thus, the "fixed charges" which the company must pay annually on its investment of $115 for each kilowatt of capacity amount to 13 per cent of the investment, or to $14.95.

Cit. How much is this "fixed charge" on each kilowatt-hour of energy?

Eng. Since for each kilowatt of generating capacity the yearly fixed charges amount to $14.95, and for each kilowatt the utility generates 4000 kilowatt-hours during the year, the fixed charge is $14.95 divided by 4000 or 0.37 of a cent (3/8 of a cent) per kilowatt-hour.

Cit. How much coal is burned in generating a kilowatt-hour of energy in a modern station, and what does the coal cost?

Eng. The coal consumption is about 1.4 pounds per kilowatt-hour, and at $5 a ton this coal costs the company

FIG. 4: Municipal Ownership would save the average householder 5c a month.

0.35 of a cent (1/3 of a cent) per kilowatt-hour of energy generated. At some stations in the coal fields, the cost of coal is less than $1.00 a ton, and the cost of fuel is less than 0.07 of a cent per kilowatt-hour.

Cit. How much do all the other costs incurred in operating a modern steam electric generating station amount to?

Eng. The cost of all supplies and materials (exclusive of coal) and of all labor and superintendence necessary for operating and making minor repairs amounts to about 0.08 of a cent (1/12 of a cent) per kilowatt-hour of energy.

Cit. What is the total cost at the generating station switchboard of generating energy in a modern steam station?

Eng. The cost per kilowatt-hour of energy is

0.37 of a cent for fixed charges, plus
0.35 of a cent for coal, plus
0.08 of a cent for all other operating charges, or a total of

0.8 of a cent (4/5 of a cent) per kilowatt-hour.

COSTS OF GENERATION FROM WATER POWER

Cit. What does it cost to build an hydroelectric station to generate electric energy from water power?

Eng. The cost ranges from $80 to $300 per kilowatt of station capacity. The range is so great because some hydroelectric plants require the construction of expensive reservoirs and flow lines, while others do not.

Cit. What is a fair average figure for the cost of building hydroelectric stations on the undevoloped sites on the midwest rivers?

Eng. $200 per kilowatt (of station capacity).

Cit. How much will the fixed yearly charges against this investment amount to?

Eng. 7 per cent for return to security holders, plus
2 per cent for taxes, plus
2 per cent for depreciation and insurance, or a total of
11 per cent on the investment, or $22.00 per year per kilowatt of station capacity.

Cit. How much is the fixed charge on each kilowatt-hour generated in such a station?

Eng. If for each kilowatt of capacity, the yearly fixed charges amount to $22 and the utility generates 4000 kilowatt-hours during the year, the fixed charge on each kilowatt-hour of energy is $22 divided by 4000 or 0.55 of a cent.

Cit. How much will all the other costs incurred in operating the typical midwestern hydroelectric station amount to?

Eng. All materials and labor necessary for operating and making minor repairs will cost from 0.04 to 0.08 cents, say 0.05 of a cent per kilowatt-hour of energy generated.

Cit. What will be the total cost at the generating station switchboard of generating energy in such a typical hydroelectric station on midwestern rivers?

Eng. The approximate cost per kilowatt-hour of energy will be

0.55 of a cent for fixed charges plus
0.05 of a cent for operating expenses, or a total of

0.60 of a cent (3/5 of a cent).

Cit. Can't this cost be greatly reduced by municipal or governmental ownership and development of the undeveloped water powers?

Eng. There is one respect in which the municipally owned plant would be subject to a smaller expense than the privately owned. It is this. With the security of the municipality back of the bonds, the necessary money for building the plants could be borrowed by paying a 4.5 per cent return instead of a 7 per cent return on the investment. That is, the fixed charges on the $200 would be 8.5 per cent, or $17 per year. The fixed charge to the municipality on each kilowatt-hour of energy generated would be $17 divided by 4000 or 0.42 cents, as against 0.55 cents for the privately owned utility, — a reduction in cost of 0.13 of a cent per kilowatt-hour.

Cit. How much would this reduction in the cost of generation save the average household having electric service?

Eng. One-sixth of a cent a day, or 5 cents a month.

Eng. Let *me* ask *you* a question. Does the reduction in the electric bill of 5 cents a month, made possible by the lower rate of interest paid by the municipality, represent a real saving in the sense of conserving labor and

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New Developments in Diesel Engines

By H. E. BALSLEY, m'09
Manager, Machinery Department, Fairbanks, Morse & Co.

THE past few years have seen many interesting developments in Diesel engines and a rapid widening of the field of application for this type of prime mover. Thousands of interesting applications have been made which have demonstrated that the Diesel engine will produce a horsepower hour with a fuel and lubricating oil cost of approximately one-half cent or a kilowatt hour for approximately three-quarters of a cent. With labor and other charges added the total power cost seldom is more than 1½ cents per kilowatt hour.

Most of the developments in Diesel engines have been in connection with the larger sizes and not so much attention has been given the small units. In the past year, however, a number of higher speed, lighter weight Diesel engines have been brought out which places the Diesel engine on a competitive basis with the gasoline engine in these smaller sizes. There are so many places where the power problem can be solved by a self contained prime mover in ratings from about 30 hp. and up that these new developments are of decided interest.

The line of higher speed and lighter weight Diesels illustrates this new trend in the power field. The accompanynig cross section through one of these engines shows the simplicity of the modern Diesel engine in a very striking way. In this engine the fuel oil is injected into the combustion space above the cylinder proper by means of a plunger pump which is driven by a cam mounted on a shaft running along the side of the engine about half way up. This shaft is driven by means of gears from the main crank shaft. One of these plunger pumps is required for each cylinder.

The fuel is sprayed through a nozzle located at the top of the cylinder and the injection of the fuel is timed so that it enters the combustion chamber at about the time the piston reaches the top of its stroke.

Now, the big difference between the gasoline engine and the Diesel engine is the fact that the Diesel engine ignites the charge of fuel oil by the heat of compression. The compression pressure in a Diesel engine, that is the pressure of the air at the top of the cylinder when the piston is in its highest position, is about 500 pounds per square inch. In the gasoline engine this pressure is about 50 pounds per square inch. When the air is suddenly compressed to 500 pounds the temperature rises to approximately 1000 Degrees Fahrenheit.

When the fuel in the combustion chamber above the cylinder proper is ignited by the heat of the highly compressed air, the fuel charge begins to burn and the burning gases expand out into the cylinder driving the piston down. The combustion of the fuel is not rapid as it is in the case of the gasoline engine. There is no explosive action but rather a slow burning of the fuel so that the action is more nearly like that of steam in a steam engine. The piston moves down and first uncovers the edge of the exhaust port and the burned gases expand into the exhaust manifold. As the piston moves on a slight distance further it uncovers the air inlet port and the air in the crank case which has been slightly compressed by the downward movement of the piston now flows up through this air inlet port and blows out the remaining burned gases. The cylinder is now charged with a fresh supply of air, the piston begins to move upward closing the air inlet and exhaust ports and the cycle is repeated. As the piston moves up a new supply of fresh air is drawn through the valves in the crank case.

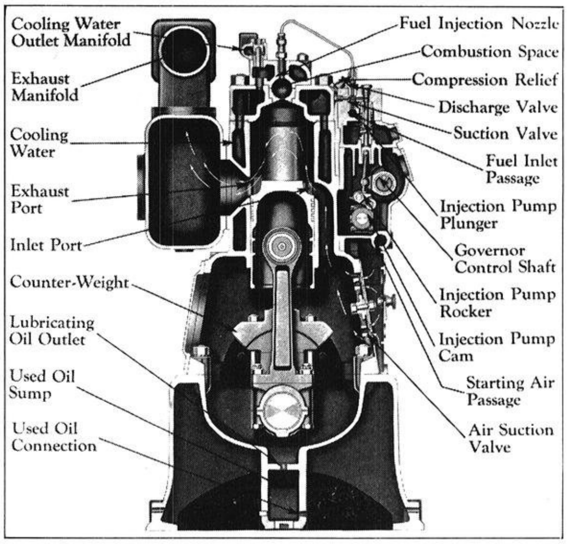

FIG. 1: Sectional view through a two-cycle airless injection Diesel engine of the block cylinder type designed for 800 r. p. m.

This is all there is to the operation of a modern two cycle, airless injection Diesel engine. There are, however, other types of Diesel engins, such as the 4 cycle air injection type. The 4 cycle engine requires both inlet and exhaust valves which require proper setting to produce the best efficiency and which must be frequently ground in order to keep the engine in good operating condition. The air injection Diesel requires the use of high pressure air for atomizing the fuel oil. That is, in this type of engine, air at about 1,000 to 1,200 pounds pressure is carried to the tip of the injection nozzle and the fuel is suddenly blown into the engine and atomized by this method. In this case the fuel is usually blown directly into the cylinder itself.

By using the combustion chamber just above the cylinder the same effect is obtained as when high pressure air is used but without having the added complication of a multi-stage air compressor.

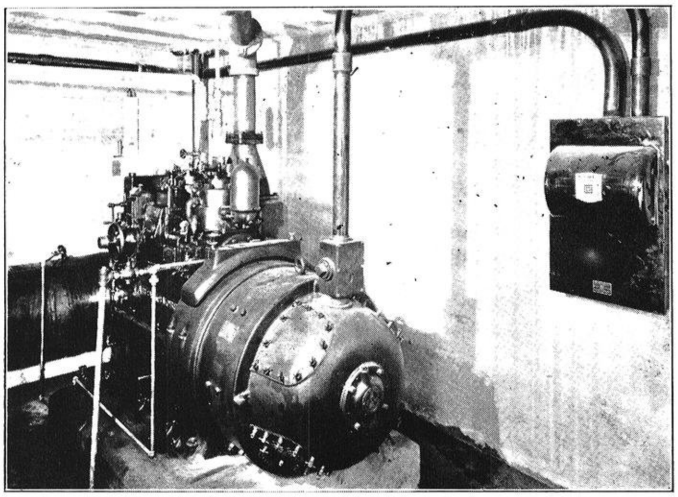

FIG. 2: An 18 K.W. Diesel engine generating set used for charging electric trucks.

Engines of the type shown in the accompanying illustrations are built in a number of modifications to meet practically every service requirement. For instance these engines can be equipped with radiator cooling and with a built in clutch of the automobile type, for such applications as dredges, power shovels, locomotive type cranes and similar service. This same type of unit can also be equipped with a pulley and used for conveyor drives or any application where it is desired to use a belt drive. Since the speed of units of this type matches up with many types of driven machinery such as centrifugal or screw pumps, it is also possible to direct connect this type of engine to the driven machinery.

In some cases these engines equipped with radiator cooling have been mounted on skids together with the necessary fuel and air tanks, switchboard and other small auxiliaries to make a semi-portable type power plant for use in construction operations and similar service.

Another modification of the unit is the direct connection of a small alternating current generator with direct connected exciter. This is the first time that a full Diesel engine alternating current generating set has been available in sizes as small as 36 kw. Since this small engine is just as efficient as the large Diesel engine, the small generating set makes it possible for the power user who has a comparatively small load to get the same economy as the largest users of power, and being a self contained unit its installation is as simple as that of a gasoline engine.

Where direct current is desired these engines are equipped with a ball bearing direct current generator. The resulting unit is very compact as shown by the fact that a 40 kw. generating set of this type requires a floor space of only 2 ft. 9 in. by 8 ft. 1⅝ in.

A Diesel engine of the type illustrated is almost automatic in its operation. The lubricating system is entirely automatic and requires practically no attention. Every part of the engine is lubricated by streams of oil forced under pressure by means of a pump or a mechanical lubricator.

The big advantage of the Diesel engine is the low fuel cost. The full Diesel, that is the high compression type, will burn very low grades of fuel and will burn them more efficiently than the lower compression or semi-Diesel types of engine. It is readily seen that the higher the compression, the higher the generating temperature and hence the more complete is the burning of the fuel. It is for this reason that the Diesel engine is so much more efficient than the gasoline engine. The gasoline engine not only requires a higher grade of fuel but since it burns it much less efficiently than does the Diesel engine, it requires a great deal more fuel. Fuel for Diesel engines can be purchased for from 3 to 8 cents per gallon, depending on the locality and the quantity which is bought.

At one time the Diesel engine was not as flexible in operation as was its competitor the gasoline engine. The latest Diesels are greatly improved in this respect until they will throttle down in much the same way that a gasoline engine will.

This particular feature is exceptionally important where the engine is used for such service as a power shovel but

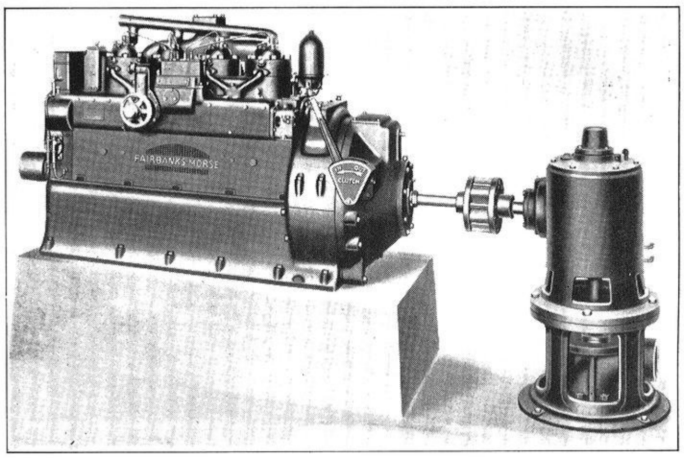

FIG. 3: A 60 h.p. block cylinder type Diesel engine operating at 800 r.p.m. and arranged for direct connection to a deep well turbine pump through a geared speed increaser.

it is also useful in varying the voltage or frequency on direct and alternating current generating sets.

These engines are started with compressed air at a pressure of about 250 pounds which is supplied by a small air compressor and stored in small tanks. The engines start instantly and the starting of the largest Diesel engine is easier than starting an automobile engine.

If there is any one feature that the operator of a Diesel engine demands, it is simplicity with reliable operation. The fewer parts there are on an engine, the less

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Does Business Want Scholars?

The Head of the Bell System Shatters A Myth

By Walter S. Gifford
President of the American Telephone and Telegraph Co.
Reprinted Through Courtesy of Harper's Magazine

THE other day a gentleman said to a New York friend of his who is a lawyer, "My son is going to graduate from the law school this year and is looking around for a place. Could I send him to see you?"

The lawyer replied, "Certainly, I'd be glad to see him," but there was no great enthusiasm in his tone.

The father continued, "He is on the *Law Review,* and several offices have spoken to him; but if you will tell me who in your office sees . . . . " He got no farther. "You send him right in to see me," answered the lawyer. "I'd like to talk to him."

The change had come over the lawyer when the father said, "He is on the *Law Review.*" That means he is a high-mark man.

The big law firms seek the high-mark men from the law schools. The profession believes that the man who stands well in his law studies will make a better lawyer than one who does not.

The hospitals take the same attitude toward medical students. A man with low marks in the medical school is not likely to get an appointment in the best hospitals, for it is the experience of the medical profession that those who stand well in the professional school are most likely to stand well in their profession later on.

But business, on the other hand, does not as a rule select men on the basis of their marks in college. Perhaps for this reason the undergraduate who intends to go into business does not always consider his scholastic standing in relation to his business career. He is somewhat apt to think of his college course as an era in itself, without influence on his life after graduation. If he does connect his college course with a business future at all, he is likely to think that his athletic or social activities, his work on college papers or in dramatic clubs, or similar extracurricular efforts, are better training for the future than his academic work. Some do the academic work merely in order that they may stay in college to do the other things. And in taking this attitude the boys reflect fairly accurately the opinion of many of their elders, under whom they are going to begin their working career.

I believe that this attitude of business toward the scholarship of college graduates differs from the attitude of the legal and medical professions toward scholarship in the graduate schools for one main reason: Business believes that a law school teaches a boy law but that a college does not teach a boy business. Consequently, a boy who stands high in the law school will possess knowledge more immediately useful than one who doesn't, while no matter how high a boy stands in college he will not

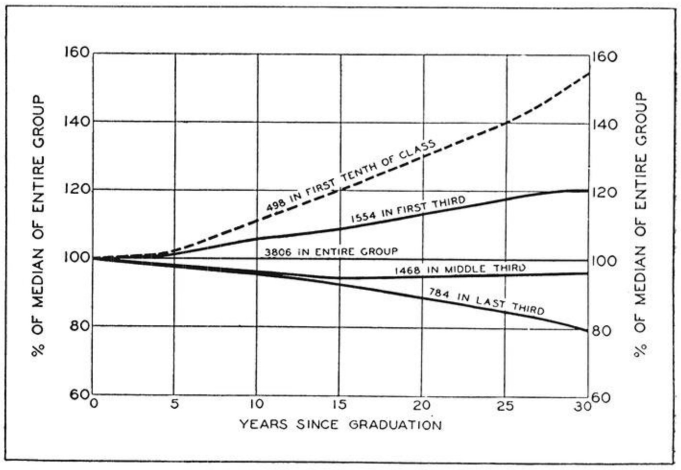


FIG. 1: MEDIAN SALARIES BY COLLEGE SCHOLARSHIP RANK.
The median salary of the entire group studied is shown by the horizontal 100 per cent line. Thirty years after graduation, the median salary of the men in the first tenth of their college classes is 155 per cent, that of the men in the lowest third of their classes is 79 per cent of this median.

have much, if any, knowledge immediately useful in business.

Clearly, to tell whether high scholarship has a direct relationship to success in business, comprehensive and rigorous evidence is needed. Business itself can most easily collect that evidence. Furthermore, it can hardly afford not to do so. Each year at least half of the 40,000 young men graduating from our colleges are entering its ranks. Their selection and training require an extremely large investment. One of the most readily available objective measures of their past achievement is their college scholastic record. It measures the results in what, after all, has been their major task for four years. Its value for indicating further achievement is surely worth determining.

With this point in view, the personnel department of the American Telephone and Telegraph Company, under the direction of Mr. E. K. Hall, for the past two years has been making such a study of the relation of college scholarship to success in the Bell System. A large part of the study, covering the record of 4,125 of the college graduates in the Bell System from 104 colleges is completed. Additional records from a number of other colleges are expected, but there is no reason to believe that these additional cases will alter materially the general results already obtained.

When this study of the relation of college scholarship to progress in the business has been completed it is proposed, if the necessary data are obtainable, to make a somewhat similar study of the relation between school record and progress in the business. A great many of the higher positions in the System are held by men who did not go to college, and the real picture of the relationship between scholarship and subsequent progress cannot be completed without some data as to the scholarship records of the men who did not have a college education The scholastic records of the college men were studied first.

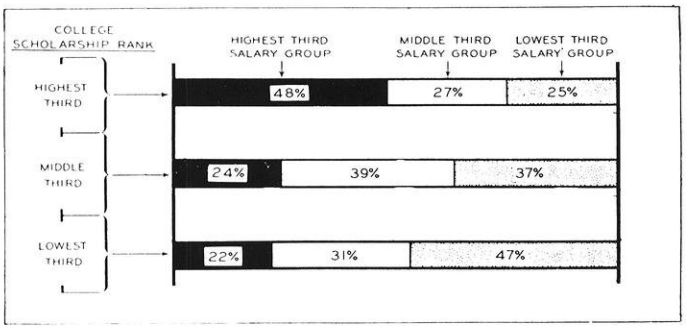


FIG. 2: DISTRIBUTION OF COLLEGE GRADUATES INTO SALARY GROUPS.

In general, men in the first third of their college classes are most likely to be found in the highest third of their group in salary, those of the middle third in scholarship to be in the middle third in salary, and those in the lowest third in scholarship to be in the lowest third in salary. The above chart is based on the record of 2,144 Bell System employees over five years out of college.

Of the 4,125 graduates, 319 were at once eliminated from the study because more than half of their business careers had been outside the Bell System. Of the 3,806 included, 1,662 were less than five years out of college, 2,144 were from five to thirty years out. In obtaining these men's records we asked the colleges to classify them in four groups:

1. Those graduating in the first tenth of their class;
2. Those graduating in the first third but not the first tenth;
3. Those graduating in the middle third of their class;
4. Those graduating in the lower third of their class.

Fig. 1 shows the median salaries of these men grouped in accordance with their scholarship rank at college. Each group's median is expressed as a percentage of the median of all the men included in the study. Median salaries, which show the salary of the man in the middle of his group, for example the fiftieth man in a group of ninety-nine, have been used instead of average salaries, which are sometimes greatly affected by one or two especially high salaries.

As is indicated on Fig. 2, of the 3,806 men studied, 498 had graduated in the first tenth of their respective classes. By about the fifth year of their employment this group began to earn more than the other college men. They continued to increase their advantage little by little until they were twenty-five years out of college. Then they began to go ahead still more rapidly. The line in the chart represents, of course, the median man in the group. Many individuals did better and many poorer than this man, but the group as a whole averaged substantially higher earnings than the rest of the 3,800.

Next to the men who graduated in the first tenth of their classes come those who were in the first third of their classes, including the first tenth, 1,554 men. Their average earnings in the Bell System are also in relation to their scholarship in college. They are lower than the earnings of the men in the first tenth of their classes, but better than any other group.

Of the 3,806 men studied, 1,468 graduated in the middle third of their classes and the median man's earnings in this group by the time they are thirty years out of college is somewhat less than two-thirds that of the median man among those in the first tenth of their classes.

The 784 men who graduated in the lowest third of their classes have earned the least, and the curve of the earnings of the median man in this group has exactly the opposite trend to that of the median man in the upper tenth of their classes: the longer the best students are in business, the more rapidly their earnings rise. The longer the poorer students are in business, the slower their earnings rise.

It cannot be stated too emphatically that these lines on the charts represent the averages of the performances of the men in the different groups and that the records of individuals in each group vary very widely from the averages. It is clear, however, that in the Bell System, on the average, men who were good students have done better than those who were not. There are, of course, exceptions — men who were poor students who are succeeding well and men who were good students succeeding less well — but on the whole the evidence is very striking that there is a direct relation between high marks in college and salaries afterward in the Bell System.

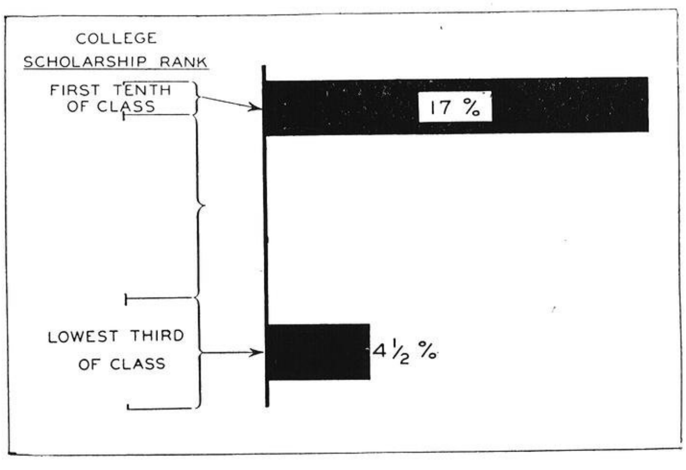


FIG. 3: PERCENTAGE OF SCHOLARSHIP GROUPS NOW IN HIGHEST TENTH SALARY GROUP.

Men from the first tenth of their college classes have four times the chance of those from the lowest third to stand in the highest tenth salary group.

In general the normal expectation is that any college graduate entering business has one chance in three of standing in salary among the highest third of all the

(Continued on page 110)

The Senior Electricals Go on Inspection Trip

The Trip as Recorded in the Columns of THE DAILY GRUNT, Newspaper Extraordinary, Published During the Trip

By A. H. TOEPFER, e'29

THE DAILY GRUNT was a miniature newspaper that attempted to keep a record of the deeds and misdeeds of everyone who went on the eastern electrical engineers' inspection trip.

NOVEMBER 11, EN ROUTE TO CHICAGO

"Twenty-four electrical engineers and two instructors, in various stages of mental and physical lassitude, due to Homecoming, boarded the C. & N. W. Engineers' Special Car after tearful farewells by fond relatives and sundry women.

No sooner had Madison and the fiancees been left behind when the Chief Sheik made the rounds of the neighboring parlor cars and collected a nurse from Chicago.

Two souvenir-seekers from Gary mistook our palatial car for the smoker. The chief sheik amused them while the rest of us amused ourselves; some at bridge; others otherwise.

At Beloit Adolph hopped off the train to telephone and showed a little speed to avoid being left on the platform.

The two Gary souvenir-seekers took our sign. After twenty engineers failed to recover it, Cappa secured it all by himself.

EN ROUTE. CHICAGO TO NIAGARA FALLS

"After dinner in Chicago, we boarded the train for Buffalo. Bob Pratt mailed a long special to his girl and grabbed the observation car as the train pulled out.

A hot game of hearts took place in the club car and Goldstein and Phelps won all the swats.

In the morning we discovered that we had been in Canada all night. As the train neared our destination a couple of custom inspectors went through the train. One of the boys nearly had apoplexy. He was unlucky enough to escape. The boys had played a trick on him and filled the bottle with water."

NIAGARA FALLS. NOVEMBER 12th AND 13th

"We found the rain that greeted us in the U. S. A. was just as wet as the Canadian rain.

We threw our luggage into a sedan and walked to the Hotel Niagara. A chartered bus hauled us around the city to show us several old power plants where we could watch 140 feet of vertical shafting turn lazily around. The machines were just loafing on the line, letting a young power plant do all the work while they merely hung on in case they were needed.

Before lunch we took a damp look at the Falls from Goat island. We went to the Schoelkopf plant to make ourselves presentable. We used all the washrooms in the place.

We had lunch at the Y. W. C. A. but as far as news value went we might as well have eaten at the Y. M. Drake, Pratt, and Toepfer bought two cigars in a cigar store and came out with more than two cigars. Pictures like that should not be left lying around. The arrival of the bus was timely.

In the afternoon the Niagara Power Co.'s representative showed us that by judiciously guiding the water, the falls could be twice as beautiful, much more durable, and incidentally the power company could use twice as much water as they are now permitted to use. Some of the boys had difficulty in watching the demonstration and the girls in the stands. Some were not bothered, they just looked at the girls.

In the evening Mr. Bennett, and Mr. Larson disappeared and, in spite of extensive investigations, the editor of *The Daily Grunt* and his assistants were unable to learn where they went. Some of the investigators went over to Canada and they reported that the missing instructors were not there.

An admiring throng of engineers, speaking through Bob Pratt, presented the most garrulous member of the party with a muzzle. Goldstein was presented with a 4¾ jewel watch to remind him that he should not keep busses waiting.

We lack all the details for this story, but four of the crowd had dates which they took to the Prince of Wales. The mayor of Niagara Falls, Canada, nearly broke up the party when he came around looking for his daughter. The boys must have been able to give a good account of themselves.

And then one of the boys was disappointed in Niagara Falls because there were no oil circuit-breakers as large as some in Chippewa Falls.

Cappa, Hanson, Schugt, Foss, and Jautz must have wanted watches like Goldstein's. They merely receive honorable mention for keeping the car waiting Tuesday morning. The stories conflict, one says it was because of a slow waiter, the other has something about a blonde in it.

There was a hardboiled theater manager in a burlesque show in Buffalo who stopped the boys' attempt at whoopee

(Continued on page 108)

Campus Notes

BANQUET TO BE GIVEN IN HONOR OF DEAN TURNEAURE

On Dec. 11, many of the faculty of the engineering school and of other colleges will meet at a banquet given in honor of Dean F. E. Turneaure, who this year completes his 25th year as dean of the engineering college.

Prof. E. R. Maurer, head of the department of mechanics and also a faculty member for a number of years, will preside at the dinner. Prof. D. W. Mead, head of the hydraulics department, will be the principal speaker.

FACULTY ENTERS BOWLING LEAGUE

The engineering faculty members have again set their sails for the rest of the professors. Dean Millar swells with pride when anyone reminds him that he is a member of the leading team. Although the teams are not organized so that the engineers as a group can compete with the faculty of other colleges of the University, the engineering professors have upheld their standards well.

Members of the engineering school entered in the Faculty Bowling League are: Dean A. V. Millar, Prof. G. L. Larson, Prof. G. J. Barker, Prof. K. G. Shiels, Prof. L. W. McNaul, Prof. J. D. Livermore, H. B. Doke, B. B. Bridge, R. R. Worsencroft, and R. A. Trotter.

NECKING?

He was an engineering student and left blueprints on her neck.

JUNIOR CIVILS, ATTENTION!

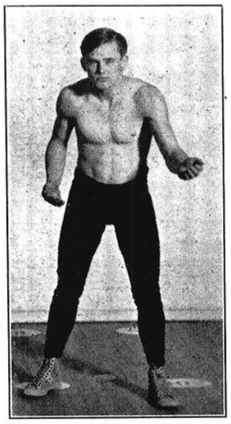
This department is offering a rubber medal to the Junior civil who, on a recent quiz, was able to get a discharge of 17,000,000 gallons per second through a two-inch orifice.

A. S. C. E. HEARS KESSLER

Prof. L. H. Kessler of the Hydraulics department gave an interesting talk before the local chapter of A. S. C. E. His subject was "Something for Nothing". It dealt with the various means men had devised in an effort to obtain perpetual motion.

WRESTLING TEAM CAPTAINED BY STETSON

It appears that the wrestling team, which is usually composed of a majority of engineers, this year boasts only two. However, one of these is none other than Captain George L. Stetson, m'30, and the other is F. Mennerick, ch'31. Two freshmen engineers, R. W. Noack, e'32, and T. N. Racheff, e'32, are also out for practice.



G. L. STETSON

George's prowess is a discovery of Coach Hitchcock. He had never engaged in any wrestling before arriving at Wisconsin. Since then, his ardour in training and his aid to the team has been matched only by his success. Last year he came within a few seconds of being conference champion in his class, and this year greater things are expected.

KOMMERS ELECTED SCRIBE

Prof. J. B. Kommers of the Mechanic's department has been elected secretary of the University Club for the ensuing term.

IT MIGHT FIT

Freshie (after receiving a bolt from the supply room): "Shall I put it on myself?"

Soph: "Naw, on the machine."

"FATIGUE OF METALS" IS TRANSLATED

The book "The Fatigue of Metals", written by Prof. H. F. Moore of the University of Illinois, and Prof. J. B. Kommers, Mechanics department, University of Wisconsin, has been translated into Russian, and negotiations are going forward to have it translated into German soon.

RICHTMANN AND ANDERSON LEAVE

Wm. Richtman, who was instructor in the Steam and Gas laboratory up to the end of last year, is now with the Bayley Blower Co. of Milwaukee. He is conducting research in ventilation.

Ed. Anderson, also formerly of the staff of instructors in the Steam and Gas laboratory, left in August for the University of Nebraska where he has the ranking of assistant professor in the mechanical engineering department. He gives his address as 2010 South 26th Street, Lincoln, Nebraska.

FOUR ENGINEERS ON FOOTBALL TEAM

This year's highly successful grid team numbers four engineers on its roster: Stan Binish, c'29; Cliff Conry, m'29; "Whitey" Ketelaar, ch'30; and Roger Stevens, c'30.

Binish, Conry, and Ketelaar have been regulars all season while Stevens has seen little service in the big games. Conry started the season with but an outside chance for the center berth but trained so heartily and fought so well that he soon became varsity center and held down that position so well that nothing but praise has been heard for him. He handled the passing with but few faults throughout the entire season. Binish and Ketelaar are both veterans and W men. It was through their rushing the line and blocking of punts that Wisconsin was

(Continued on page 104)

Alumni Notes

DURING the past month the following engineering alumni were visitors to their old haunts; the Engineering Building, Camp Randall, and "Petes". All were enthused by the decisive victory of the "Fighting Badgers" over the "Maroons".

Following are those who were present on "Homecoming":

Niles, Thomas M., c'23
Zermueller, Herman W., m'28
Jones, E. W., min'23
Stein, E. A., m'26
Carter, A. R., e'26
McCoy, R. C., e'27
Pitz, A. H., c'08
Schaefer, C. E., m'24
Mueller, Emmet J., m'19
Dresser, W. H., e'26
Christensen, R., m'27
Burmeister, R. A., c'28
Kincannon, Leo T., m'25
Bagnall, Vernon B., e'27
Dyer, Vernon H., e'27
Naujoks, Waldemar, m'26
Wicker, Kenneth R., c'23
Bundok, M. G., c'28
Bisserdich, A. C., m'25
Finkle, T. H., e'24
Sackerson, A. E., c'15
Logrman, R. T., c'99
Tschudy, L. C., c'23
Nelson, W. F., e'27
Liddle, George, F., c'27
Phillips, R. S., m'23; MS'27
Pornig, Paul W., e'21
Scherer, A. C., c'09
Krohn, H. G., e'24
DeHorn, C. E., e'27
Peterson, L. J., m'23
Field, George, c'25
Hansen, R. E., ch'26
Bishop, P. W., c'26
Bemm, H. F., m'26
Richtmann, W. M., m'25; MS'27
Waffle, Nathann L., e'25
Peters, N. J., m'27
Warren, Nat S., m'27
Fisher, R. R., e'25
Brackett, Max A., e'27
Held, Wilmer O., m'28
Edwards, Arthur W., m'25
Ostrander, S. B., m'23
Vergin, Charles J., m'23
Piltz, John S., c'26
Schudt, Joseph, A., c'24
Bartleson, G. S., c'25
Smith, Robert M., c'13
Saari, Leonard V., m'28
Arnold, Arthur, m'26
Sherman, L. C., m'24, MS'26
Kunz, C. A., m'28
Alfery, H. F., e'24
Birkenwald, Edward, c'27
Traiser, L. M., e'23
Fleishauer, Wayne R., e'25
Buttles, Earle T., e'27
Peter, A. G., m'13
Wolf, Albert M., c'09; CE'13
Dick, W. E., e'22
Leach, R. W., e'28
Vallee, John W., e'27
Davis, E. L., m'27

On November 24, "Dad's Day", the following alumni were visitors:

Crothers, H. M., EE'13; PhD'20
Johnson, E. E., e'24
Damerow, W. G., e'27
Alk, L. C., c'25
George, M. W., m'13
Brandenburg, W. C., c'27
Johnson, F. E., EE'09
Kenzler, F. W., e'10
Schwada, J. P., c'11, CE'26
Warren, W. E., e'06
Findeisen, C. R., e'13
Schwartz, E. H., min'18
Behrens, R. E., c'19
Goss, W. A., c'15
Shafer, S. P., c'27
Zelande, E. E., e'26

ELECTRICALS

Biegler, Phillip S., e'05, EE'15, who is a professor of Electrical Engineering at the University of Southern California, is at present acting dean of the Engineering college. Recently he was present at the convention of the American Society of Electrical Engineers as Counsellor. His home address is 1272 W. Vernon Avenue, Los Angeles, Calif.

Burkett, M. W., e'08, vice president of the Washington Water Power Company, represented his company at the Pacific Coast convention of the American Institute of Electrical Engineers. He was accompanied by **Greisser, V. H.**, e'02, who is also employed by the same company.

Davis, Robert J., e'27, who is at present with the Southern Radio Corporation at Room 508, 26 Broadway, New York City, New York, has left for South America. Mail addressed to him at the above address will be promptly forwarded to him.

Fisher, R. R., e'25, is now working out of the Madison district office as Transmission man number one for the Wisconsin Telephone Company. His address is Oregon, Wisconsin.

> We wish to thank all of the alumni who have cooperated with us in securing information about our engineering graduates. We hope that you will continue to write us concerning your work and notify us when you change your address.
>
> —*Alumni Editors.*

Johnson, J. H., e'11, Professor of Electrical Engineering with the University of Idaho was a Counsellor at the recent convention of the American Society of Electrical Engineers.

Krippner, A. F., e'04, is now living at 760 Downing Street, Denver, Colorado.

Lardner, Henry A., e'93, EE'95, who is vice president of the J. G. White Engineering Corporation of New York, has recently completed a four year term as Mayor of Montclair, New Jersey, and has been appointed a member of the school board by his successor.

Loew, E. A., e'06, Professor of Electrical Engineering at the University of Washington, spoke before the convention of the American Society of Electrical Engineers on the subject "Economy in the Choice of Line Voltages and Conductor Sizes for Transmission Lines".

Magnussen, C. E., EE'00, who is dean of the College of Engineering at the University of Washington, addressed

(Continued on page 104)

Editorials

WHY ARE YOU HERE? What good are you deriving from the time you are spending in the Engineering College? This is a question that may be answered in many ways, but most strikingly it may be met by cold mathematical figures.

In the engineering school you are paying for board, room, and tuition; your income is nil. If you held a job, you would be paying for room and board, but would be receiving about a thousand dollars for the average college year. By attending college you are gaining no practical experience, you are learning no special trade, and moreover you are losing about four-thousand dollars.

If you are not developing an ability which will enable you to make up for this loss of money, and the other benefits which the men who are not attending college are enjoying, your time at college is a decided loss.

BEAUTIFYING THE HIGHWAYS A new branch of highway engineering is appearing in other countries, - - the beautifying of important roads by landscape gardening.

The Province of Quebec, which seems to have inaugurated this idea, has already planted 175,000 trees along the arterial highways, and has held competitions to promote neat appearing farm houses and yards. England has followed this up and is urging similar action on the part of its road commissions.

A few lines of sugar maples, and lombardy poplars along rural roads in New England are the only vestiges of a practise which died out when gasoline replaced hay. In place of trim farmyards we find weatherbeaten barns, and slouchy dwellings. In place of trees we find signboards and tourists' lodging signs.

The United States may not adopt this idea again, but there is certainly a vast field of opportunity for such work.

A SOURCE OF WEAKNESS Writing in the *Professional Engineer* for November, President-elect Herbert Hoover discusses the engineer's public duties and power. "It is possible," he writes, "for 200,000 trained and professional engineers of America to exert the dominant thought of these questions without outside dictates if they will." He dwells upon the need for quantitative rather than the usual qualitative thought in dealing with economic problems such as the so-called power trust.

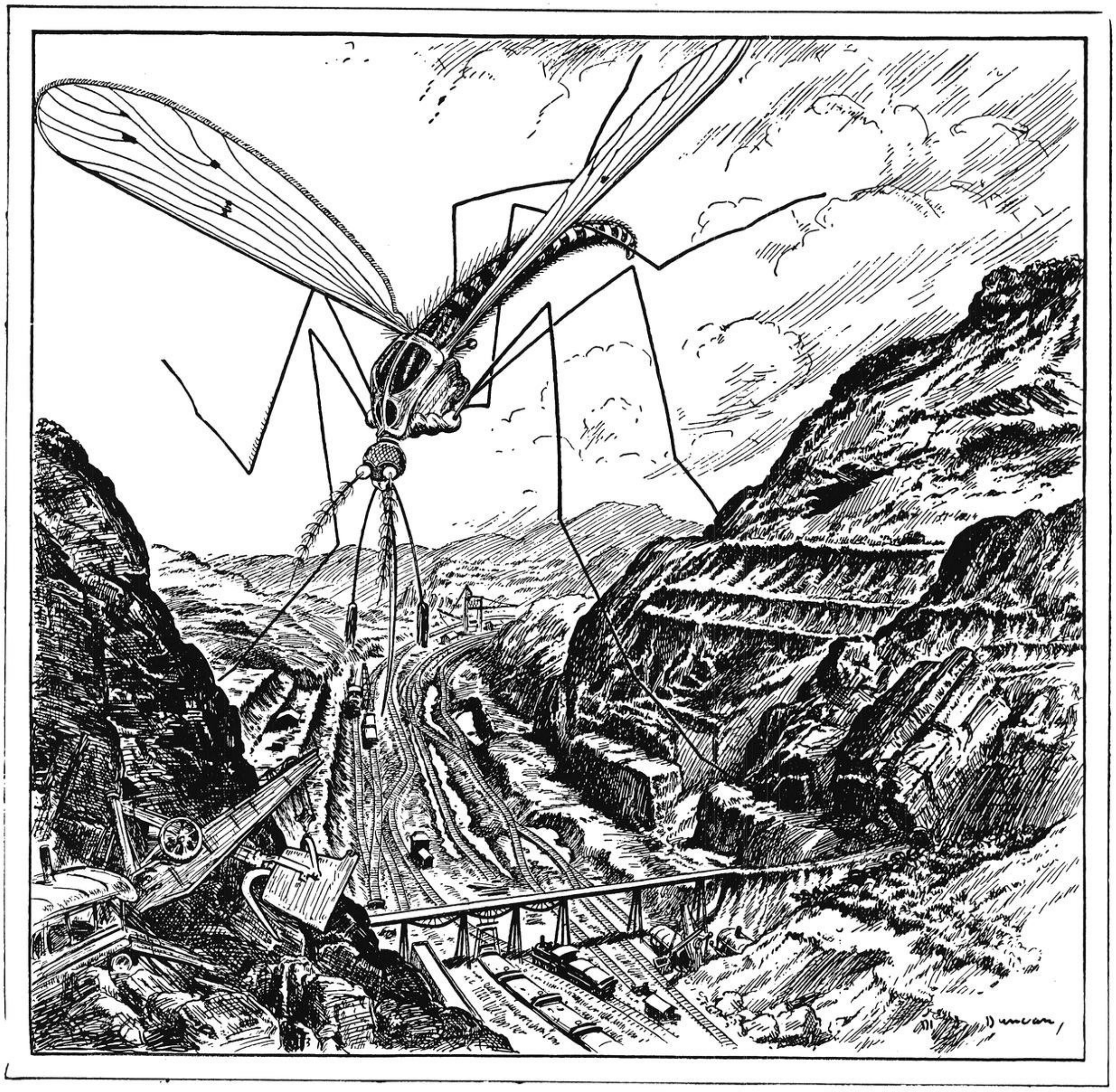
There is no doubt about the power that the engineering opinion would have if it were a united opinion. Unfortunately it is not united. Engineering training up to the present time has ignored the field of applied economics. Some schools of engineering have introduced courses in the qualitative economics which Mr. Hoover raps, but it has been found that students after taking such courses are still helpless in the face of problems that call for quantitative treatment. They can talk glibly of the *entre-preneur,* but cannot reach a sound conclusion about whether a certain bridge should be built of steel or of wood, or whether it should be built at all. The result of ignoring applied economics is that many of our trained engineers reach unsound conclusions upon public questions, and engineering opinion is, therefore, divided.

Engineering training today lacks two educational vitamins: first, courses in applied, or quantitative, economics; second, courses in applied psychology or human nature.

TWENTY-FIVE YEARS AS DEAN

TWENTY-FIVE YEARS ago, on January 19, 1904, the regents of the university appointed Frederick E. Turneaure dean of the College of Engineering. He had been acting dean since June, 1902. So long a period of service as dean is rare in the annals of American colleges; we look upon it with pride. This past quarter of a century has been a period of activity and accomplishment for us. Courses in mining and chemical engineering have been established, the engineering building has been enlarged, the hydraulic laboratory and the Randall shops have been built, and a new mechanical engineering building is soon to be added to the plant. Hundreds of engineering students have been trained, research has been stimulated, and a close entente with the industry of the state has been established. Over these multifarious activities the dean has presided wisely and well, maintaining an excellent spirit of friendliness and co-operation throughout the college. In addition, he has taken an active part in the work of various national engineering societies. Faculty, alumni, and students unite in congratulating Dean Turneaure upon his achievements and in wishing him many more years of active service.

WHEN TESTERS LACK INTELLIGENCE The fundamental philosophy which is expressed in the saying that the person who attempts to teach a dog tricks must know more than the dog, finds unexpected exemplification in the experience of Professor Janda with an intelligence tester. Faced with the momentous question of deciding whether the statement, — "The sun rises in the East," is right or wrong, Mr. Janda answered that it was wrong, and he defends his stand by explaining that the sun only *appeared* to rise because of the revolution of the earth. The tester blinked his eyes in a dazed way, but ruled that Mr. Janda had missed the question. Another question read: "The word stanchion is connected with what industry?" Mr. Janda answered correctly, "Marine construction." That answer was also ruled incorrect, because the tester had never heard of a stanchion used in any connection except fastening cattle in their stalls.



Engineering Review

NEW GERMAN COKE CAR

A new type of coke car is now used for heavy duty carriage in the Ruhr district by the German Railroad Company (Deutsche Reichsbahn Gesellschaft), according to the Department of Commerce. These cars are of the automatic side-hopper unloading type, specially designed for carrying coke, and were developed by increasing the length of the standard coal car constructed by the Krupp Works, from 10 to 12 meters (32.8 to 39.4 feet).

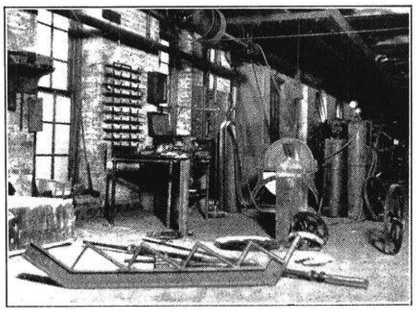
These coke cars, constructed of silicon steel, have a carrying capacity of 92 cubic meters, or 55 metric tons (121,250 lbs.) weighing when empty 21 metric tons (46,300 lbs.). The wheels, equipped with roller bearings, have a diameter of 940 mm. (37 inches). Particular attention was paid to the springs, which are constructed of high grade steel, to prevent unnecessary wear to tracks and car. The 16 brake blocks on each car are controlled by compressed air, the pressure of each block being automatically balanced by an adjustment device in the brake rods. The cars also have automatic couplers, and haulage friction is reduced by special shock absorbing springs in the bumpers.

—*The Iron Age*

CENTRAL WELDING SHOP

Today, modern plants have come to rely upon the oxy-acetylene process in a measure undreamed of a few years ago. Uses of welding can readily be classified under two headings, that of the manufacture, and that of maintenance and repair. Whether a plant is concerned with producing a product where metal plays an important part, or whether it finds use for the oxy-acetylene process merely as a means of maintenance and repair, most progressive factory managers are agreed that the oxy-acetylene welding process will save them money or will increase their production.

The average new user of welding, or sometimes even the experienced user of an oxy-acetylene outfit is not familiar enough with the potentialities of the oxy-acetylene process to realize fully all the uses to which it can be put. A sheet metal working company might purchase oxywelding equipment to weld a particular lot of tanks and fail to realize, when a punch frame



cracks under overload, that they have already on hand a means of speedy and economical repair. Again, a manufacturing plant might buy an outfit solely for repair work, never realizing that their welders could take an important place in direct production by oxywelding some part of their metal product. Or, a company might use its outfits for both repair and production work without knowing that they could also be used to install a shop or yard pipe line, or to cut up scrap.

Conditions of this sort are not conducive to true economy because all available resources are not being utilized. But on the other hand, it probably would not pay to employ a man solely to look for places to use the cutting and welding blowpipes. The best procedure is to let new applications come to light naturally.

This is often done quite readily by establishing a central welding department. It is not necessary that all oxy-acetylene operations be carried on in a special building, but rather that they be organized and assigned a definite headquarters in a certain shop. If the machine shop wants a foot treadle repaired let them have a place to take it. Or, if the men tearing down old equipment want some steel cut away, let them have a definite place where they can locate a "cutter", with the necessary equipment.

A true central welding shop accomplishes several things; operators know where to find apparatus; shop foremen know where to go to have cutting and welding jobs done; it is possible to have a welding foreman of more than ordinary ability; and executives have a means of keeping track of welding costs.

When one considers the number and diversity of jobs which can be done by such a department it can readily be appreciated that the shop need never be without work of some kind. If there are no production jobs the operators can always reduce the plant's scrap pile either by reclaiming material or by cutting up worthless junk to handling size. Thus managed, a central welding shop will prove a real boon to any plant. It can be a self contained organization, always busy and always assisting in cutting down operating expenses.

ANOTHER "TEST TO DESTRUCTION"

An undertaking that should be both extremely valuable, and fascinatingly interesting is to be undertaken by the North Carolina State Highway Commission and the U. S. Bureau of Public Roads. Across the Yadkin River, between Albemarle and Mt. Gilead, is a three span bridge constructed in 1922. A large dam is now under construction a few miles below the bridge which, when completed will completely submerge the existing bridge structure, necessitating its abandonment and the construction of a new bridge in another location to replace it. The situation has provided an unusual opportunity for an investigation of stress distribution in a full size structure and, eventually, for its complete destruction. The work is

to be carried on by the Highway Commission, the Bureau of Public Roads, and an Advisory Committee, made up of representatives of all interested organizations.

—*Proceedings of the A. S. C. E.*

CAMPUS NOTES

(Continued from page 96)

often able to get the ball deep in the enemy's territory. Both have done exceptionally good work at tackle.

Conry will be back for another semester as pivot man. His work the past season has been of such a high value, being of all conference calibre, that he looms as a prospect for next year's grid captain. Here's luck, Cliff.

ALUMNI NOTES

(Continued from page 98)

the Pacific Coast Convention of the American Society of Electrical Engineers. His topic was "Lichtenburg Figures".

McMullen, C. A., e'18, has left the Wisconsin Power and Light Company and is now in Burlington, Iowa.

Miller, B. E., e'11, recently talked before the Public Relations meeting of the Portage District of the Wisconsin Power and Light Company.

Outzen, Andrew N., e'10, superintendant of the River Rouge Company at 415 Cliford Street, Detroit, Michigan, was recently elected to full membership in the American Society of Mechanical Engineers, the American Institute of Chemical Engineers, and the Western Society of Engineers.

Plumb, H. T., e'01, local engineer with the General Electric Company at Salt Lake City, Utah, was a representative of his company at the convention of the American Institute of Electrical Engineers in Spokane, Washington.

Rabbe, John A., e'26, is doing study work with the Buckeye Cotton Oil Company, a subsidiary of Proctor and Gamble Company, for which he is Assistant Plant Engineer. His Memphis, Tennessee, address is 1880 Vinton Avenue.

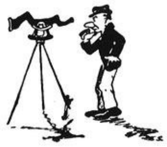
CIVILS

Fensel, Alden C., c'23, acting director of the Municipal Research Bureau of Cleveland, Ohio, is the proud father of a fine husky baby boy.

Hayden, Leland H., c'28, is working with the Wisconsin Highway Commission, Division 8, with offices at Superior. His address is care of Wisconsin Highway Commission, Telegram Building, Superior, Wis.

Koebke, E. J., m'25, has been transferred from the Harrison Works of the Wirthington Pump and Machinery Corporation to the Diesel Sales Department of the same corporation. His mailing address is 45 West Mohawk Street, Buffalo, New York.

Bamberry, James E., c'28, is at present in Manistique, Michigan, in charge of a survey party on the Manistique River. This survey is being made as a part of the water power development work of the United States Engineering department.



Boeck, Ralph, c'27, who obtained his masters degree in structures at the Massachusetts Institute of Technology last year, is at present employed by the Warden-Allen Company of Milwaukee.

Lidicker, William Z., c'27, has been located at Sturgeon Bay for the past month with the job of clearing the canal of boulders and other obstructions. In a letter to Professor Van Hagan he writes referring to his work, "It reminds me of Devils Lake in some respects. We have to get up at 5:30; work all day; and write reports at night."

McLeish, K. C., c'25, is now installing the water wheels at the Necdah hydro-station of the Wisconsin Power and Light Company.

Markwardt, L. J., c'12, is president and Professor **L. H. Kessler**, c'22, is secretary-treasurer of the Technical Club of Madison.

Mead, Warren J., gen'06, Professor of Geology in the University, is at present occupied as a member of government commission to investigate the Boulder Dam project.

Mickle, C. T., c'26, is at present employed on the new west side sewage treatment works in Chicago. His address is 214 N. Mayfield Avenue, Chicago, Illinois.

Saunders, Henry J., c'03, CE'10, has opened an office as Consulting Engineer at 643 Transportation Building, Washington, D. C. He is a specialist in valuations, reports, appraisals, and expert testimonies relating to railroads and public utilities.

Shore, Franklin K., c'25, who is a designing engineer with the Purdy and Hendenson Company of New York, has recently finished the design for the George A. Fuller building at Madison Avenue and 57, New York. The tower portion of the building is forty-two stories high and some of the columns take as high as three million pounds of dead and live loads alone. The lower fifteen stories are designed to take 120 pounds per square foot live load. Shore's address is Apartment 1 — 419 W. 115th Street, New York City, New York.

Schuman, E. C., c'24, is at present Assistant Research Engineer with the Portland Cement Association of Chicago,

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Pneumatic Tools
Without the riveting hammer, or "gun," as it is sometimes called, we should have no towering skyscrapers—none of the massive structures that characterize our modern industrial life.
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Illinois. Schuman is a former instructor in Mechanics at the University. His present business address is 33 W. Grand Avenue, Chicago, Illinois.

Sogard, Lawrence T., c'24, is, according to latest reports, acquiring "owl's eyes" as tunnel expert for the Chicago Sanitary District. His latest acquisition is a new Ford car from which he is reputed to get ninety-three miles on a quart of oil.

Trayer, George W., c'12, CE'22, who is employed at the Forest Products Laboratory, recently visited the Florida hurricane area to study the storm resistance of various types of frame building construction.

Trestor, A. M., c'06; **Whitney, Edward N.**, c'13; and **Landwehr, Waldemar J.**, c'25, have just completed a water power survey on the Wolf river. All are employees of Mead and Seastone.

Tschudy, Lionel C., c'23, is Designing Engineer with **L. F. Harza**, e'06, CE'08, Consulting Hydro-Electric Engineer at 205 Wacker Drive, Chicago, Illinois .

Zola, Stanley P., c'27, has been assigned to the Madison division of the Wisconsin State Highway Commission.

CHEMICALS

Drew, Everett G., ch'22, is now sales agent for J. O. Ross Engineering Corporation for the Pacific Coast. His address is 519 American Bank Bldg., Portland, Oregon.

Kubista, William R., ch'26, formerly gas engineer with the Wisconsin Light, Heat and Power Company, has left the employ of that company to accept a position in Tulsa, Oklahoma.

MECHANICALS

Anderson, Edward, m'18, who has been, for the past nine years, instructor in the Steam and Gas Department

A Hercules Glazier Entering Top of Glaze Mill with Car of Green Grain.

The Powder Maker

Considering how important his work is to the public, it is fitting that more should be known about the powder maker and his job.

The characteristics which fit him for his work are as largely mental as physical, and the work itself develops his acuteness of mind—his powers of observation, judgment, and decision.

The powder worker trained in the school of the Hercules plants learns to take in all his surroundings at a glance. If he enters one of the small buildings on a dynamite or black powder line nothing escapes him. He sees instantly many things which by the ordinary observer would be unnoticed.

A large part of the explosives used in the United States is made by the men in Hercules plants.

Behind all our manufacturing industries and our railroads, behind all the useful and beautiful objects fashioned out of metals stands the powder worker. Without the explosives he supplies—hundreds of millions of pounds annually—the miner's efforts to move the vast inert bodies of ore and coal would be as futile as the scratching of hands.

HERCULES POWDER COMPANY

(INCORPORATED)

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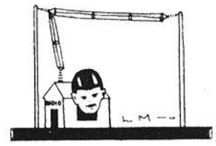
Sign and mail this coupon for a free sample copy of The Explosives Engineer—the only magazine devoted to promoting safe and efficient methods of blasting about which every engineer should know something.

Name ______________________ *College* ______________________

Street ______________ *City* ______________ *State* ______________ 2397 of the University of Wisconsin, is now Professor of Mechanical Engineering at the University of Nebraska.



Hanson, Malcolm P., m ex'24, who designed and installed the radio apparatus on the 'America' in which Commander Richard E. Byrd flew to Europe, is now Chief Radio Engineer on Byrd's expedition to the Antarctic regions. During Hanson's years in the University, he, with the help of Prof. E. M. Terry, designed and built the University station WHA.

Jahn, Carl W., m'27, is now in the Eue Works of General Electric in Pennsylvania. He is living at 2709 Bird Drive, Wesleyville, Pa.

Lange, H. W., m'26, who is Assistant Engineer in the Gas and Oils department of the Underwriters Laboratories of Chicago, is a member of the World's Champion Bowling team, the 'Oh Henrys of Chicago'.

Richtman, W. M., m'25; and **Braatz, Chester**, m'27, have published, through the University of Wisconsin Engineering Experiment Station, a bulletin entitled "Effect of Frame Calking and Storm Windows on Infiltration Around and Through Windows."

Schmidt, Chester J., m'23, is Sales Engineer for Armstrong Cork and Insulating Co. He lives at 439 S. Kenilworth Ave., Oak Park, Ill.

Thorkelson, Halsten J., m'98, ME'01, who was Director of College and University education on the General Education Board of New York City, has become assistant to the president of the Kohler company. Thorkelson was Professor of Steam and Gas Engineering at the University prior to 1914 when he was appointed the first business manager of the institution. Due to the duties of the governorship, Walter J. Kohler, president of the firm, will probably act only in an advisory capacity while Mr. Thorkelson will act as executive.

Williams, M. J., m'27, has been with the Worthington Pump and Machinery Corporation since graduation. He has recently been transferred to their Detroit office, at 1219 Book Bldg., Detroit, Michigan.

MINERS

Levering, Lee F., min'27, who since graduation has been connected with the Oil Well Supply Company of Pittsburgh, Pennsylvania, was recently married to Miss Dorothy Moor, a graduate of Denison University in Granville, Ohio. Mr. and Mrs. Levering are now at home at the La Salle Hotel, Beaumont, Texas, where Mr. Levering is working in the gulf coast oil district as field engineer for the Oil Well Supply Company.

Siren, Edward R., min'25, has been appointed Mining Engineer at the Townsite Mine of the Republic Iron and Steel Company at Ironwood, Michigan. Siren goes to the Republic Company from Esmeralda Coahuila, Mexico, where he was employed as Mining Engineer with the Cia Minera Penoles.

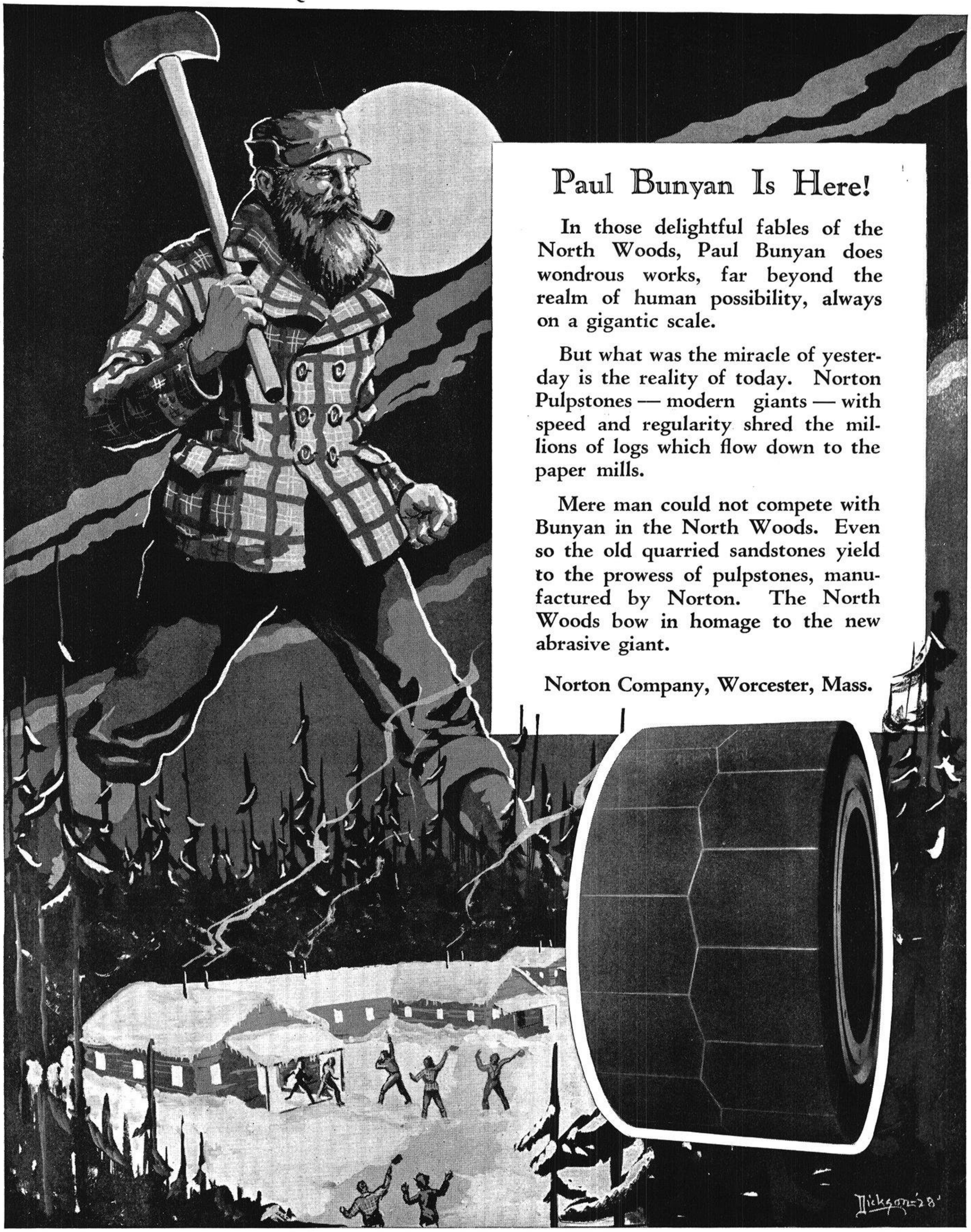
SENIOR ELECTRICALS GO ON INSPECTION TRIP

(Continued from page 95)

as soon as they started."

PITTSBURG, WEDNESDAY

"Carnegie steel was interesting. We want to know why we were showered with white hot slag.



NORTON

Grinding Wheels
Grinding Machines

Refractories-Floor
and Stair Tiles

Larson was going to a movie show in Pittsburg but he did not show up. Zastrow and Drake went someplace and Larson went with them.

When Jewell opened his bag in Pittsburg he was much astounded to find a pint bottle (full) near the bottom. Immediate investigation revealed that its only contents were water.

More baggage left Niagara than the boys arrived with. One of the party carried his bathrobe in a paper sack because he could not get it in his bag. Maybe they had some souvenirs.

Zastrow was the only man in the crowd who could sit between seats in a bus."

PITTSBURG, THURSDAY

"The radio inspection party secured a special permit and climbed 99 steps and a mile uphill to see the famous KDKA. In their dash to catch the train Roser was leading at the end of the first mile with Daters, Phelps, Drake, and Toepfer right behind. Roser lost his head at the close of the second mile. Several cross country records were broken.

A couple of our gang took two chorus girls from "Whoopee" to their theatre after dinner. It was too bad that our train pulled out that night.

In the station someone was asking who we were.

We proudly answered, "Wisconsin Engineers."

"Where is that railroad?" our interrogator asked.

The chorus girls asked what state the University of Wisconsin was in.

CLEVELAND, FRIDAY

In Cleveland we were requested not to speak to the machine operators. Some of the boys would be talking to machine operators yet, if they were given a chance.

Goldstein held a transfer in his hand and stalled the crowd as he searched his pockets for it. Even then he did not find it until he left the car. He may be a professor yet.

The boys were real free about using taxis in Cleveland.

One waitress tried to spill water on an engineer but he showed that he was not too tired to jump. Then she showed that she was not fussed by serving both milk and coffee to Zastrow.

We took Mr. Bennett to a show and one of the titles of the movie was, "In the spring when the faculty raises the war-cry, 'They shall not pass'." We hope that Wisconsin's faculty does not adopt the slogan.

The Daily Grunt ceased publication with Roser yelling up from Lower 10, "Fold up that typewriter and let me go to sleep before I * * * *."

DOES BUSINESS WANT SCHOLARS?

(Continued from page 94)

college graduate in his company. From this study, as illustrated by the chart, it appears that the man in the first third in scholarship at college five years or more after graduation, has not merely one chance in three, but about one in two of standing in the first third in salary.

On the other hand, the man in the lowest third in scholarship has, instead of one chance in three, only about one in five of standing in the highest third in salary. There is also nearly one chance in two that he will stand in the lowest third in salary.

In the same way, as shown by Fig. 3, the man in the highest tenth in scholarship at college has not one chance in ten, but nearly two chances in ten of standing in the highest tenth in salary. The man in the lowest third in salary, on the other hand, has instead of one chance in ten, only one in twenty-two of standing in the first tenth in salary.

Strikingly enough, almost exactly the same results as those just given were obtained separately for the engineering graduates and the graduates in arts and business who together make up the whole group united.

This analysis may not answer Doctor Foster's academic question, "Should Students Study?" but it has some bearing upon whether industry should seek students who had studied. I hope it has bearing enough on the subject to lead other companies, associations, trades, and industries to make studies along similar lines. It would undoubtedly be helpful if such studies could cover men who did not go to college as well as college graduates.

In this particular study made by the Bell System salary has been used as a measure of success. While I do not believe that success in life can be rated by income, I do believe that as between one man and another working in the same business organization, success and salary — while not the same thing — will, generally speaking, parallel each other.

In studying the relationship between success in scholarship and in business it is necessary, therefore, to study the results of good and poor scholars in the same line of work, or perhaps even within one company; for general comparisons of men under different conditions in different businesses will not produce very valuable results. For instance, if scholarship were an exact measure of business ability, it would not mean that a fine scholar who had entered the cotton mill business recently would have made as much money as if he had been in the automobile business. He might have been as great a success, however. He might achieve what he set out to do equally well. At certain times some businesses make more money than other and, as Mr. Julius Rosenwald has said, luck has a great deal to do with the making of money.

By organizations, by the power to use nature which science has provided, industry has shortened the hours and eased the burden of making a living. Men work eight hours where they used to work twelve and fourteen. Vacations are longer and more frequent. Success in life, both for the individual and for the nation, depends on the use of this leisure time just as it does on the use of the business time. Perhaps a mind trained to scholarship in youth may more easily find success and happiness in that leisure than one untrained.

If studies by others corroborate the results of this study in the Bell System and it becomes clear that the mind

well trained in youth has the best chance to scucceed in any business it may choose, then scholarship as a measure of mental equipment is of importance both to business and to business men. Business will have a surer guide to the selection of able young men than it has used in the past, and the young men who train the muscle of their brains can feel reasonably certain that such training will add to their success in business and, in all probability, to the fruitful and happy use of the leisure which success in business will give them.

NEW DEVELOPMENTS IN DIESEL ENGINES

(Continued from page 92)

possibility there is for trouble. The two cycle, airiess injection Diesel engine, as illustrated, is as simple an engine as it is possible to build.

The reliability of Diesel engines has been greatly improved in the past few years by improved manufacturing methods. There has been as much progress made in the building of Diesel engines as there has been in the building of automobile engines. In fact the modern Diesel engine is as well built as the engine in the highest priced automobile. This holds true not only in the small Diesel engines but also for the larger sizes as well.

MUNICIPAL OWNERSHIP AND THE COST OF ELECTRICAL ENERGY

(Continued from page 90)

material for the community at large, or is it a purely paper saving?

Cit. Well! now that you raise the question, I can see that this reduction in price is not to be classified as a real saving in the sense in which you engineers make savings by enabling a man to do in a day what it formerly took him a week or a month to do. I can readily see that it is going to take the same amount of labor and material to produce a kilowatt-hour of energy in a municipally owned plant as in a privately owned plant. This possible reduction of a nickel a month is a reduction in the price of energy to the user of energy; but it is not a saving of goods for the community.

Eng. Quite true, and in-so-far as the user of energy may hold stock in the electric enterprise which serves him, or may be a policy holder in a mutual life insurance company which holds such securities, or in-so-far as the greater profit under private ownership goes back into other useful enterprises which serve the user of energy, the possible reduction of 5 cents a month under municipal ownership of a water power may mean little or no net saving to him.

Cit. This hadn't occurred to me.

Eng. This trying to think only in terms of dollars and cents, instead of in terms of labor, materials, machinery, and management, is bad medicine.

Cit. Isn't it possible under municipal ownership to make a further reduction in the cost of energy to the public by using this 2.5 per cent on the investment which is saved in interest charges each year to buy up the 4.5 per cent bonds which were sold to build the plant? After

the bonds have all been retired, the municipality will be relieved of even the 4.5 per cent interest charge.

Eng. Your expression "a *further* reduction in the cost of energy" leads me to wonder whether, by any chance, you may have slipped into the common error of counting the same thing twice. The word "*further*" looks as though you may be proposing "to eat your cake and to have it too". Under municipal ownership, the annual saving of 2.5 per cent on the investment in the hydroelectric station may be used in one of two ways, but having been used in one of these ways it cannot be used in the other.

First, it may be used to reduce the price of energy (by 0.16 of a cent per kilowatt-hour) to the existing customers. Having applied it in this way it is not available to the municipality to buy the bonds on the plant, and so there is no *further* reduction possible.

Second, the existing customers may be charged the same rate for energy as under private ownership. The greater *net* earnings of the municipality-owned plant may then be used to retire the bonds. In this case municipal ownership makes no reduction whatsoever in the price of energy to existing customers but the reduction is deferred until the bonds have been retired. This saving of 2½ per cent of the investment per annum, if applied to the purchase of the 4½ per cent bonds, will serve to retire the bond issue in 23 years. During all this 23 year period there is no reduction in the price of energy to the existing consumers, but they are paying the same price as under private ownership. However, at the end of the 23 year period, the bonds are all retired, and the price charged for energy may then be decreased by 0.4 of a cent per kilowatt-hour.

Cit. I hadn't thought the matter through in this clear-cut way before, and I suppose your surmise that I was hazily thinking to materially reduce the price of energy and at the same time to rapidly retire the bonds, is not far from the mark. But say! this plan of making no reduction in the price of energy until the bonds have all been retired looks good to me. It looks like a sort of an enforced saving scheme, which will eventually enable me, or my children, to buy energy at a much lower rate.

Eng. Now I wonder whether you are again making bad medicine by thinking about the cost of energy entirely in terms of dollars. Let us think about it in terms of labor, materials, and machinery. Regardless of the amount of bonds outstanding against a generating station, it is going to take identically the same amount of labor, material, and machinery to produce a million kilowatt-hours, is it not? Bonds have nothing to do with what it really costs society to provide itself with a million kilowatt-hours of energy, do they? If this is the case, what basis is there for expecting to make electric energy more abundantly or easily available to the public by the expedient of retiring bonds?

Cit. What you say seems sound, but I can't get away from the fact that I will have to pay more for electric energy from a plant which has bonds outstanding than for energy from a plant for which all bonds have been retired. How do you reconcile the apparent contradiction?

Eng. It seems to me that your difficulty may be due to the fact that you see clearly enough that the public will have to pay a greater number of paper dollars for a given amount of energy to bonded plants than to the same plants after the bonds have been retired, but you are ignoring the effect which the retiring of the bonds has upon the number of paper dollars which the public receives (from itself) each year to exchange for the real things, namely, food, clothing, transportation, electric energy, etc. Isn't it clear that when you destroy the bonds on the generating stations, thereby terminating the annual payment by the companies to the public of so many paper dollars for interest, you reduce by an equal amount the capacity of the public to pay paper dollars to the companies for energy? The destroying of the bonds has no influence on real costs to the community-at-large.

Cit. Well, I'll be switched! Then in the long run, municipal or state ownership of the utilities can effect no economies whatsoever for the country-at-large.

Eng. Now you're straight, and only this remains to be said. Of two undeveloped raw communities, in which the new productive agencies, such as the electric utilities, are being financed from outside the communities, that community which, by public ownership of the productive agencies, obtains the use of outside capital at the lower interest rate obtains some advantage over the other.

Cit. Would not municipal ownership effect another saving of 2 per cent in the fixed charges, since the municipalities would not pay the 2 per cent taxes which the privately owned utilities would pay?

Eng. Taxes may be shifted but not escaped. Municipal ownership of waterpowers would mean a slight shift of taxes from the communities enjoying the benefits of electric service to those not enjoying these benefits. It would mean no additional saving to the citizens as a whole, and no appreciable net saving to the users of electric energy. *(Continued in the January, 1929, issue.)*

THE NEW MECHANICAL ENGINEERING BUILDING

(Continued from page 87)

such as electric, acetylene, and city gas. The foundry and forge rooms will have concrete floors, and the wood working, welding and metal working rooms will have heavy maple floors. Special exhaust systems will be employed in the wood-working and metal-working departments in order to pick up dust, fumes, and smoke as near their source as is possible. Wash and locker rooms will adjoin each of the shop laboratories to save time and confusion. Duplicate machines will be installed in places where students might otherwise be obliged to wait their turn. The arrangement of machinery has been carefully planned with regard to safety.

The whole scheme has been worked out to obtain a building of excellent appearance and extraordinary utility. Its completion will furnish the University and the State with one of the finest Mechanical Engineering Buildings in the world.