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The Wisconsin Engineer

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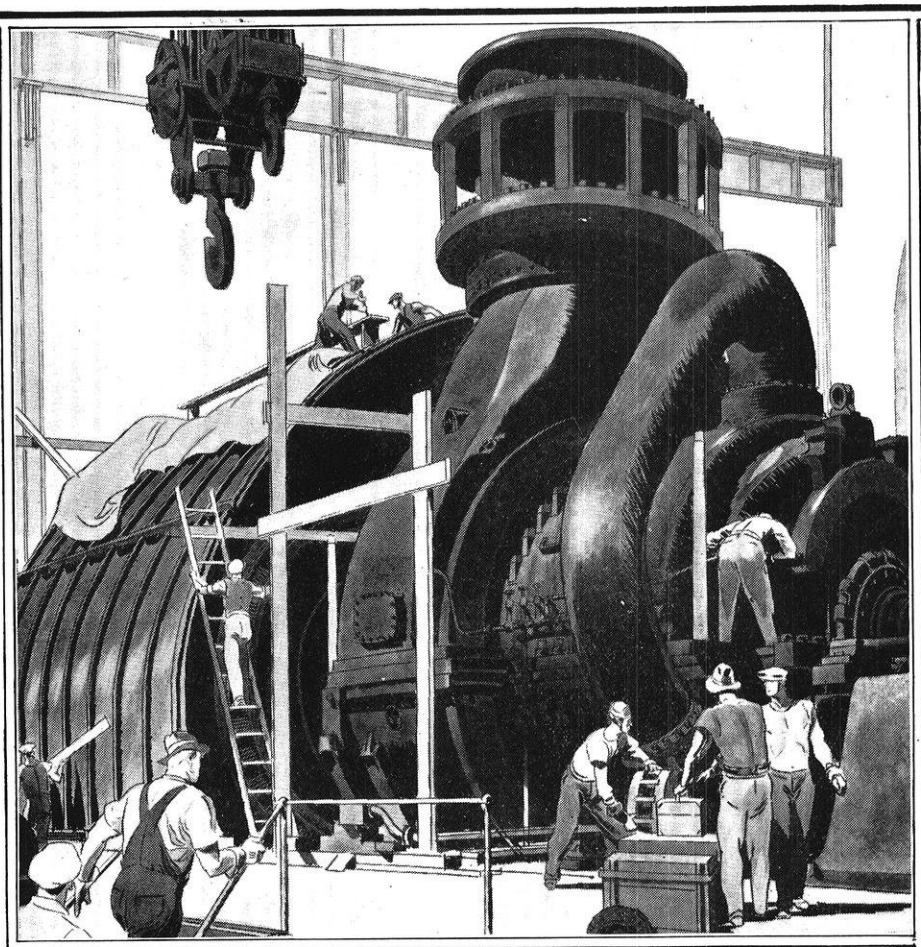
VOLUME XXXIII NUMBER VIII

BEGINNING OF WILLOW DRIVE

PUBLISHED BY THE ENGINEERING STUDENTS
of the UNIVERSITY OF WISCONSIN

May, 1929



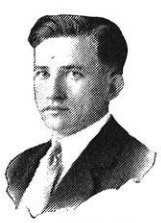
C. W. GUTH
Generator Installation Design
Colorado School of Mines, '22

B. A. ROSE
Generator Design
Kansas State Agriculture College, '26

F. L. TARLETON
Control Engineering
North Carolina State College, '26

V. O. CLEMENTS
Generator Sales
Kansas State Agriculture College, '24

P. L. FETZER
Mgr. Condenser Sales
Kansas State College, '20



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ON RECENT WESTINGHOUSE JOBS

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CONTENTS

VOLUME 33 — MAY, 1929 — NO. 8

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The Wisconsin Engineer

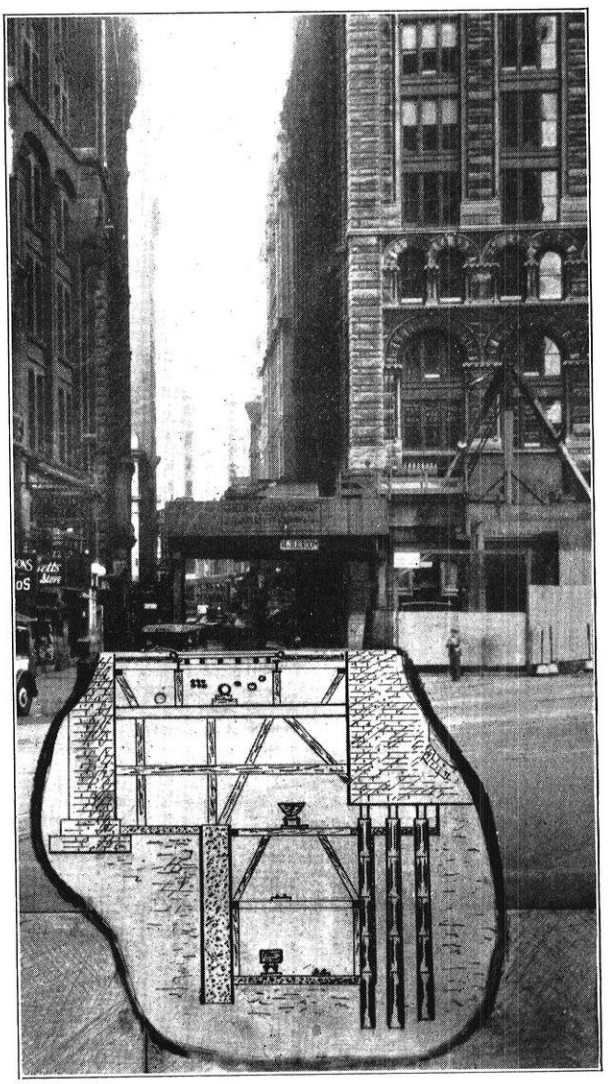
VOLUME 33, NO. 8 MAY, 1929

Underpinning *the* Mutual Life Insurance Building

By Mary O. Soroka

THE construction of the Nassau Street Subway in New York City necessitated the underpinning of many interesting buildings. A typical example of present day practice in underpinning tall buildings along the Route is that of the Mutual Life Insurance Building, designed in 1883, and occupying the entire block between Cedar and Liberty Streets. Rising straight from the street level, its walls present a fluted surface which relieves the monotony of the abrupt geometric faces of modern skyscrapers surrounding it. The solid brick piers below the street level conform with the wall surfaces above, receding or projecting meticulously with them.

The exterior walls and footings, of the sound and substantial construction of their period, have remained intact notwithstanding the deep caisson foundations of the Chase National Bank and the Equitable Building nearby. Street walls are brick faced with granite. Although the building is only 9 stories high, the pier loads average 400 tons, the center piers, about 565 tons each. If this building were of the steel skeleton type, the loads would be cut just about one-half.



Showing Underpinning under Times Building and protection wall under Tribune Building during Nassau Street Subway Construction.

Eleven feet below the street is the basement floor, which is surrounded by an areaway extending from the Building Line to the edge of the sidewalk and making an underground passageway around the three street faces of the building. It was possible through the use of this enclosed space to underpin entirely from the outside of the building. The entrance for workmen was through a sidewalk elevator opening on Nassau Street. Construction materials were delivered directly from the street almost daily. Pumps were installed here as well as a large settling tank used to filter the sand from the mud hog pump discharge. The areaway wall, two feet of solid brick, was left undisturbed throughout the underpinning, the subway heading to the south remaining in the vicinity of Wall Street, and that to the north, several feet away from the wall. Eventually it will be removed since the neat line

of the subway comes within two feet of the Building Line at the north end.

The Nassau Street face of the building is supported on eight brick piers which rest on a continuous concrete mat two feet thick. It was necessary to go through fine sand, with a small percentage of clay, to a depth of about 50 ft. below the street before hard pan was reached. With Mean High Water, which is Elevation 100, about 13 ft. above sub-grade, it was necessary to underpin with concrete filled steel tubes, concrete piers not being feasible. 90 Steel Pretest cylinders 16 in. outer diameter and 5/16 in. shell, filled with 1:2:3.85 concrete were used for the support of the Nassau Street front. These cylinders were assigned a load of 55 to 60 tons each and were spaced to insure adequate supporting area at the base. About one and one-half feet above the concrete foundation the brick piers start to corbel out, but the cylinders were placed under the main body of the piers, as far apart as possible.

EDITOR'S NOTE

Mary O. Soroka is now Research Assistant in Hydraulic and Sanitary Engineering at the University of Wisconsin. She graduated from the Civil Engineering course of the Massachusetts Institute of Technology in 1926. Since then Miss Soroka has been with the New Jersey Transit Commission, the Purdy and Henderson Company, and the Spencer, White and Prentis Company.

One or two approach pits, horizontal sheetings were sunk alongside each pier. Generally they were 5 ft. by 4 ft., large enough to permit the lowering of steel pipe and lumber, the removal of soil, etc., and sunk deeply enough below the concrete footing to permit a man to stand up comfortably. Leading from the approach pit was the working pit, made to enclose a single cylinder with a clearance of a few inches. Sheeting, consisting of 2 by 4 pit boards, was done very carefully. As the soil was dug away, the boards were fitted tightly in place, packing the sand in back. When the initial pile had been Pretested, the working pit was enlarged for the next pile. Screwjacks were used for temporary support occasionally when a corner of the concrete footing overhead was exposed.

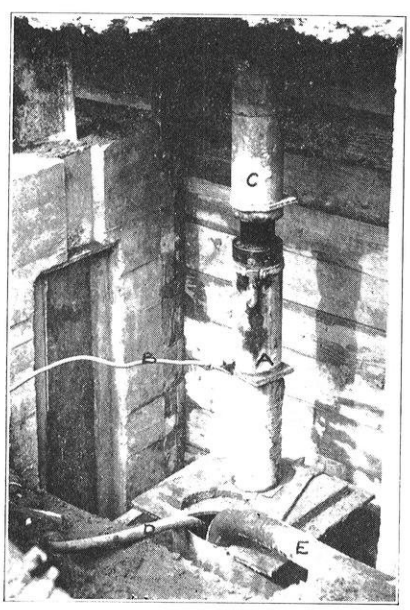


FIG. 1: Jacking down a Pretest Cylinder

We had occasion to observe a test of the security afforded by the sheeting when approximately one-half the underpinning of the south pier was complete. A water main outside the area-way wall burst one morning during a heavy storm. The wall stood up against the combination of earth and water pressure, but the water, seeking an outlet, forced its way under the wall and came up through the underpinning with the force of a small geyser. The approach pit and working pit were flooded. Several days later, when the water had subsided, the mud was dug out. Not a single board had been dislodged, furthermore level readings showed absolutely no settlement in that pier because of the flood.

Cylinders were jacked in sections ranging from 3 ft. to 6 ft. by means of a hydraulic jack which utilized the weight of the pier above for a reaction. That is, the pressure of the jack, inserted between a cylinder resting in soil and the footing above, forced the cylinder down as the piston was extended. The concrete foundation mat in the Mutual Life Insurance Building was in such good condition that it was possible to jack directly against the under surface without steel bearing plates. As a cylinder was being jacked, a jetting hose was used to loosen the soil inside, facilitating its removal by a mud hog pump (Patent applied for). The maximum extension of the jack piston is about 10 in. making it necessary to insert blocks, called jacking dice, after each full extension of the piston until the section of cylinder reached the bottom of the working pit. In Fig. 1, A — the hydraulic jack, B — flexible copper pipe, ½ in. supplying water under pressure; C — jacking dice, D — jetting hose, E — mud hog pump suction hose. Sections of cylinder were connected by means of "sleeves". The cylinders varied in length from 33 ft. to 48 ft. depending upon the location of hard pan.

When a cylinder reached hard pan, it was concreted, capped with a 2 in. steel plate and prepared for the Pretest. A pressure of 4200 lbs. per sq. in. was put in each of two hydraulic jacks placed on the pile cap, giving them a 50 per cent overload. The cylinders were then wedged by the Pretest Process. Wedging beams were 15 in. I beams between 4 and 5 ft. in length. Pressure from the wedging beam was transmitted to the footing by steel wedges and plates. Fig. 2, A — hydraulic jack, B — steel cap, C — wedging I beam, D — steel wedges and plates. Cylinders penetrated the hard pan under the Pretest from 2 to 3 in. as a rule.

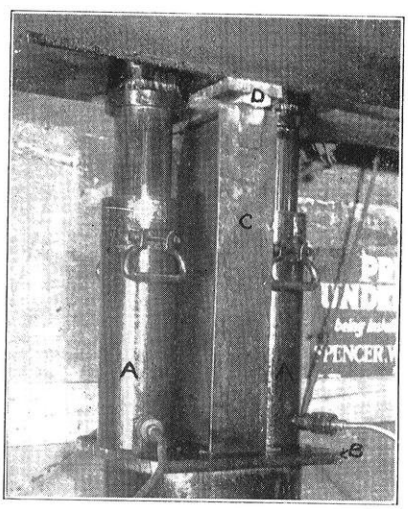


FIG. 2: Underpinning Cylinder under Approach Pier of Brooklyn Bridge.

The hydraulic pressure was obtained from a duplex pump connected to a hydro-pneumatic accumulator. In

(Continued on page 310)

Modern Industrial Research
Has Developed A Process For The

Manufacture *of* Paper *from* Cornstalks

By MAXWELL BOYCE, ch'31

EVER since paper and pulp manufacturing became such a successful world industry, and paper such an important part of our civilization, chemists and pulp technologists have anticipated the utilization of new sources for cellulose and the gradual banning of wood as too valuable and too expensive for pulp purposes. The latest evidence of this tendency is the recent development of a process by which cornstalks can be successfully converted into useful paper pulp.

The new process under which cornstalks are converted to pulp is known as the Dorner process for its originator, Dr. Bela Dorner, of Budapest Hungary. The basic experimentation took about a dozen years and was carried on while Dr. Dorner was technical director of the national laboratories of Hungary. Several years ago Dr. Dorner interested American capitalists in his work and came to this country to supervise the construction of test plants in New York City and in New Jersey. These plants seemed to show that the Dorner process was practical, and after further financing and the establishment of the Cornstalks Products Company, a pulp plant was built during the fall of 1927 at Danville, Illinois. This was designed to turn out pulp in large quantities and to supply the pulp for the first mill run of paper. The plant cost $750,000 to build and turns out pulp at the rate of ten tons a day. With the advent of a new water supply now considered, the output will be increased to forty tons a day.

In the manufacturing process, the shredded cornstalks is placed in a digester or cooking tank, together with cooking liquor. After the shredded cornstalk has passed through the cooking process the resultant pulp is a soft brownish material which is washed under reduced pressure and by methods quite new to the industry. After washing the pulp can be bleached to give it a white color.

A report submitted to the technical association of the pulp and paper industry by E. F. Hulbert of the Cornstalks Products Co. shows us what that company considers the Danville plant has definitely shown. Mr. Hulbert says, among other things, that: the plan has shown that cornstalks can be successfully gathered and delivered at the paper mill at a price which makes its commercial use as a substitute for wood an attractive venture; it is possible to produce a clean, high bleached, white pulp suitable to the paper maker for many grades of white finished papers at a price below that of chemical wood pulp; the weight of the finished pulp will be from 35 to 45% of the dry weight of the stalks used; a sufficient quantity of raw materials to operate a 100 ton daily capacity mill can be reproduced year after year within a ten mile radius of that mill; the blending of corn pulp with a small or large percentage of sulphite or sulphate pulp is perfectly practical, and a high grade white paper can be made from 10% sulphite pulp and 90% corn pulp, at a speed equal to that of straight wood pulp sheets; cornstalks can be made into finished pulp in 6 hours.

Mr. Hulbert is also of the opinion that newsprint equal in quality to that now in use could be made from a mixture of about 80% corn pulp and 20% sulphite. Other experts seem to doubt this somewhat.

Many of these facts were not known before this. There had been much speculation as to the costs that would be met in gathering the stalks and doubt expressed as to the practicability, from a cost standpoint, of the supply program. This problem proved to be one of organization and education among the farmers, along with the design of collection apparatus, and has been worked out very well at Danville. Special shredder and baler equipment was designed and the cornstalks taken directly from the field. The bales of cornstalks were then transported by truck and trailer to the plant. The company never expects to go farther away than a ten mile radius to obtain their raw materials.

The fact that the final finished corn pulp is cheaper than wood pulp is the factor which will cause its industrial use wherever it makes a satisfactory substitute. Later when our forests become even scarcer, the widespread use of corn-pulp or some other substitute will be necessary if the industry is to remain in this country.

Pulp made from cornstalks, bagasse, and similar fibrous plants has characteristics different from those of pulp made from wood. The cornstalk pulp has a shorter fiber and is much more easily hydrated than wood or rag pulps. This particular characteristic lends itself well to some grades of paper, such as glassine or other transparent or semitransparent papers. Papers made with certain proportions of cornstalk pulp tends to be stiff and brittle.

The Kalamazoo Vegetable Parchment Co. of Kalamazoo, Michigan, made the first mill test of the new pulp on December 10, 1928. A mixture of from 65 to 75% corn

(Continued on page 308)

Science Has Performed
Another Miracle—She Now Has Created

The Sharp Eyes of Electricity

By MARVIN M. MORACK, *General Electric Company*

LIKE the search of the ancient philosophers for the elixir of life, an electric eye has been, for years, the inspiring dream of scientific endeavor. Although the first results of experimental investigation on the photo-electric tube have been shown in the past few years, the principles demonstrated have long been known. Nor has the work of generations been in vain, for today photo-electric tubes control street lights, count automobiles, sort cigars, detect smoke, sort coffee beans, as well as extend our visual horizons by television. Photo-electric tubes are truly electrical eyes which never make an oversight, and no stimulus no matter how infinitesimal in duration can elude them.

FIG. 1: Photo-electric Cell used to count vehicles passing through a tunnel. The inset shows the desk counter used in connection with the apparatus.

While the odoriferous kerosene lamp still illuminated the great American home, and before Hertz performed his classic experiments, it was known that the "semi-metals" such as selenium, barium, strontium, and thalium, decreased their resistance to the flow of electric current when exposed to light. In 1873, Willoughby Smith was annoyed by the unstable resistance of a selenium conductor. He investigated the matter and found that the selenium had the property of varying its electrical conductivity with the intensity of the light which was allowed to fall on it. Light sensitive cells have been made from these rare substances, but are inadequate because of their property of lag or fatigue. Moreover, they reach maximum sensitivity only at low temperatures.

The photo-electric tube, however, is a vacuum tube device by means of which the flow of electric current can be controlled by light. The important step in the development of the modern tube was the discovery by Hallwachs in 1888, following the investigations made a year earlier by Horz. Hallwachs found that bodies charged to a negative potential lost their charge when exposed to ultra-violet light. Conversely, bodies having a positive charge did not lose their charge when so exposed.

This phenomenon observed by Hallwachs is explained by the fact that the light energy falling on the body causes photo-electrons to be emitted from the photo-sensitive surface. Of course when there are free electrons present, as in the case of a negatively charged body, electrons will be allowed to escape from the surface.

In one of the early experiments, Stoletow placed a metal net a few centimeters away from a polished metal plate which was connected to the negative terminal of a Voltaic cell. The net or grid was connected to the positive terminal and a sensitive galvanometer G inserted to measure the current. When light was allowed to shine on the plate, photo-electrons were emitted and a deflection of the galvanometer was noted.

As a result of this elementary work scientists made a study of the photo-electric effects and carried out experiments on vacuum and low pressure gas tubes. The photo-electric tube of today contains two electrodes insulated from each other, separated a short distance in an evacuated glass tube. The electrode (a) is called the anode and is usually a wire or grid. The electrode (b) is called the cathode and made from a photo-sensitive material. If the positive terminal of a battery is connected to the anode, while the negative terminal is connected to the cathode, photo-electrons will be emitted and attracted by the anode by virtue of its positive potential. Then current will flow in the external circuit.

In a more common type of the larger photo-electric tube, the whole inside of the tube with the exception of a small window for light entry, forms the cathode or sensitive surface. Usually the inner wall of the tube is

first silvered and then coated with one of the alkali materials. Contact with the cathode is made by a flush seal.

It has been found that the introduction of a small amount of an inert gas, gives the tube an internal amplification factor, i. e., an amplicication of the current. When a gas is present in the tube some of the photo-electrons traveling between the cathode and the anode collide with the gas molecules and cause ionization by collision. That is to say that the molecule will be broken up into a positive ion and a number of electrons. The free electrons will continue toward the anode with the original electron, while the positive ion will be attracted by the cathode. Now, in place of an electron traveling to the anode, we have a number of electrons, thus increasing the current. There might be two or three or even more depending on the kind of gas, the pressure, the construction of the tube, as well as the voltage applied to the electrodes.

When quantitive measurements are being made with the photo-tube, the voltage applied to the anode is of much importance. Of course the number of electrons emitted from the cathode is dependent on the incident light, but the number that reach the anode is a function of the anode voltage. If the voltage is low, only a few electrons will reach the anode and the photo-current will be small. As the voltage is increased, more and more electrons will reach the anode until finally all the electrons emitted will reach the anode. When this condition of saturation is reached further increment in the anode voltage will not increase the photo-current.

If a gas is introduced into the tube the result changes. When the anode voltage exceeds that necessary to ionize the gas, more curent results. As the voltage is still further increased, more ions are produced and the current still increases. Finally, a voltage is reached where glow discharge results and the photo-current is independent of the incident light. Obviously, the greatest sensitivity of the tube occurs just below the glow voltage.

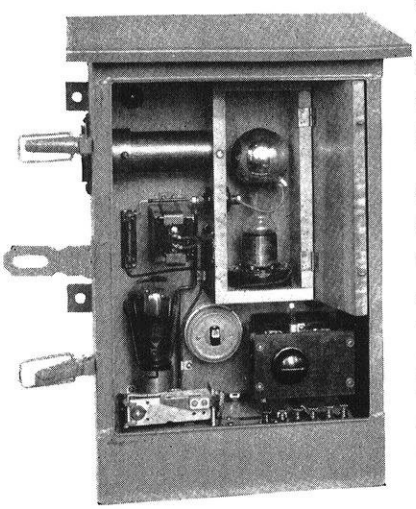


FIG. 1: Photo-electric Relay Unit.

The photo-electric tube finds application in industry because of the fact that the current which passes through it is directly proportional to the light flux actuating it, and can therefore be used as a means of measuring the quantity of light. This fact, we say, is connected with the quantum theory of light in which the quantum is the smallest possible unit of energy. One electron is emitted for each quantum absorbed. Some modification is necessary in the statement that the photo-current is directly proportional to the incident light, since photo-sensitive substances are not equally sensitive to all colors of light. The tube has maximum response for the blue portion of the spectrum, though the maximum sensitivity falls in different parts of the spectrum for different materials.

The relative sensitivity of the photo-electric tube is similar to that of the human eye. The average eye seems to be most sensitive to a yellow-green color to a wave-length of 5550Angstromes. Of all the alkali metals used as photo-electric tube cathodes, caesium most nearly approaches the sensitivity of the human eye.

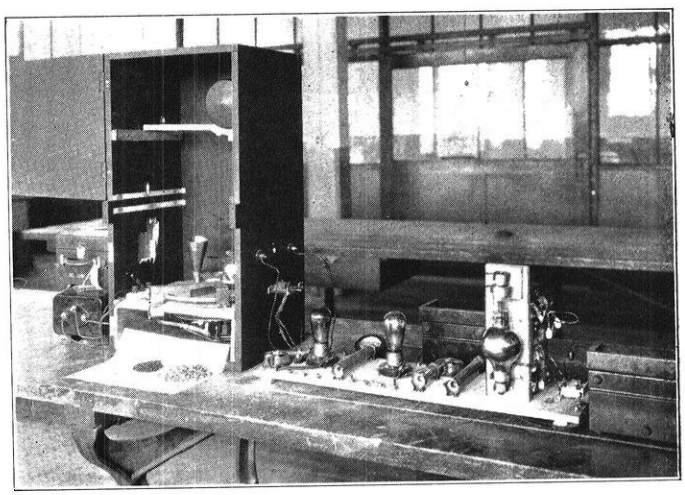


FIG. 2: Photo-electric Apparatus for Grading Coffee.

Let us consider what photo-electric tubes are doing in industry. We find them in the factory, we find them in the theatres, we find them on highways, in tunnels,—indeed we may soon find them doing the tedious task of sorting beans in South America.

Of the numerous counting devices using photo-electric tubes, in which the tube acts simply as an "on and off" relay, the vehicle counter is perhaps the most simple. The lamp, with its associated day light shield shown in Fig. 1, is mounted at a convenient height on one side of the highway. Directly across the roadway, and at the same height is another box containing a photo-electric tube, an amplifier, and a counter.

The beam of light projected across the road causes the photo-electric tube to pass current which in turn holds the grids of the amplifier tubes biased negatively so that no current flows in the relay coil. When a vehicle traveling in either direction along the highway intercepts the beam of light, (Fig. 1) the photo-electric tube is shut off and the amplifier is full on. The plunger is thus pulled down and the counter registers the passing of the vehicle. As soon as the vehicle has passed, the bias is again placed on the amplifier and the stage is set for another count.

The apparatus described above is very simple in operation but its application need not be confined to counting vehicles. In our modern industry, boxes, apparatus, or numerous other articles, traveling on belt conveyors, may be counted in the same manner.

In order to show how the development of the photo-electric tube centers upon our every-day life, let us select

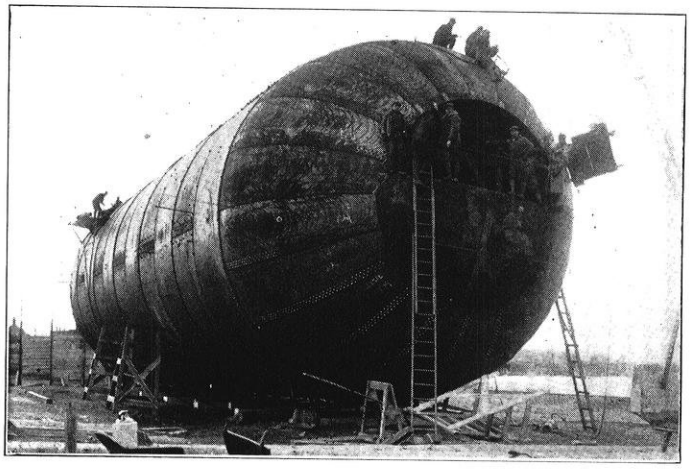
(Continued on page 308)

A Solution Of The Problem Of Transportation In The Natural Gas Industry Is

High Pressure Gas Distribution

By FRED W. HAINER, *Wisconsin Power and Light Co.*

THE initial reason for the transmission of gas by means of high pressure pipe lines was the economical traversing of distance in the natural gas field. It was found necessary to transport to the market large quantities of gas from isolated and established sources of supply, and it is safe to say that long distance transmission is an essential part of the natural gas industry. The United States produces 95% of the world's supply of natural gas and operates a total of 75,000 miles of high pressure lines, 30,000 miles being interconnection lines and 45,000 miles transportation lines.



Constructing one of the Large Bullet-shaped Pressure Holders which are becoming popular with the Pressure Gas Industry.

Application of high pressure distribution in the manufactured gas industry is justified because it enables us, first, to centralize production in economical plants which are favorably located with respect to existing markets and, secondly, to provide a means of extending service to small communities which could not be served as economically by individual gas plants.

With due allowance for distance limitations, the transmission of gas for either of the above reasons is feasible. As Mr. Samuel Insull has said, "It is simply a matter of applying competent engineering and accurate arithmetic; engineering to provide adquate production and transmission facilities, arithmetic to uncover and prove the economic factors." We must realize that the justification of a high pressure system in any given locality depends entirely on an engineering and economic study applied to the specific conditions.

There may be some value in considering briefly the progress of high pressure practice in the past. Early developments in the natural gas fields of Pennsylvania finally brought natural gas to many great industrial centers such as: Buffalo, Pittsburgh, Cleveland, Youngstown, Cincinnati and Toledo. According to Mr. Howell C. Cooper of the Hope Natural Gas Company, Pittsburgh, the first pipe line was laid in 1872 and consisted of 5½ miles of 2″ line serving Titusville, Pa. In 1891, Mr. Howell states that two 8″ lines were laid a distance of 120 miles from gas wells in Greentown, Indiana, to Chicago, Ill. Gas was transmitted to an initial pressure of 525 lbs. and mechanical compression was used. This enterprise marked the beginning of long distance high pressure transmission in the United States.

In more recent years large fields of natural gas have been discovered in the southern states, particularly Louisiana and Texas; and today natural gas is being transmitted in pipe lines up to 24″ in diameter and at higher pressure than formerly used. Transmission systems from the gas field to distant markets are over 400 miles in length. One of the more recent projects was the construction of 340 miles of 20″ and 22″ pipe line from Amarillo, Texas, to Denver, Colorado, providing a capacity of 125,000,000 cubic feet per day, or more than enough to supply the entire state of Colorado.

While application of high pressure transmission in the manufactured gas business is comparatively new, we find many pipe line systems which are extending every year.

In our own state of Wisconsin we find that the total length of high pressure mains approximates 475 miles. Pipe line sizes range from 3″ to 10″. The total number of gas production plants in Wisconsin is 30, while the number of communities served with gas by means of high pressure systems from these 30 producing centers is 102. Ten of the production plants are applying high pressure distribution to a certain extent.

A typical high pressure system comprises one or more centrally located production centers, with compressor units feeding into a network of transmission lines. These lines run to outside communities where the gas is distributed after reduction in pressure. Storage facilities are provided

(Continued on page 304)

Being The True And Complete

Confessions of A Chemical Weed Killer

(NOT A MACFADDEN PRODUCT)

By JACK H. LACHER, ch'30

TO begin with, it was rather surprising and inspiring to say the least; here I was being sent out to Aberdeen, S. D., to start working on one of our outfits and I had never even seen anything but a picture of one. I might add, that up to the time I got the job I was unaware of the fact that there was such a thing as a chemical weed killing outfit, and that railroads ever bothered about keeping their ballast free from vegetation. My utter ignorance was comparatively short-lived, but it was a good two weeks before I understood all the work connected with keeping the outfit in condition and running.

EDITOR'S NOTE

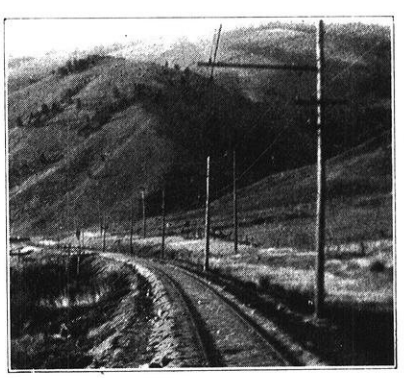
This article, written by a student in the College of Engineering, is an account of the work done by him during the summer vacation of 1928. It is that type of summer vacation work which is of especial benefit to professional students; giving them a running start in the practice of their profession as graduates.

We (we refers to Vic and myself. I was very fortunate in being broken in by a man as capable as Vic was in this line of work.) arrived at Aberdeen in time for breakfast, and after locating a hotel, and changing clothes we spent half the morning locating a flat car in the yard, and getting the yard master to move the car to the freight house so we could load on our equipment. The rest of the morning was utilized in moving the equipment onto the car, and in waiting for the car to be moved to a siding where there was plenty of room to put on the booms. We hadn't more than gotten the header brackets symmetrically located when we were hit by an all afternoon rain. The next day with an early start and the help of three men from the car department we practically completed the setup.

Chemical weed killing for the removal of vegetation from road-beds has been used by railroads for a number of years. It is far superior to mechanical methods such as the burner or steamer because it has no harmful effects upon the rails, ties, or ballast; if anything, it is a preserver of ties (there is an arsenical tie preserver on the market today). The chemical killer not only removes the tops of the weeds but destroys the roots as well, thus stopping any further growth. For a little more information I might add that a clean road bed lowers maintenance and renewal costs. Weed roots prevent a ballast from draining properly, and a heavy top growth keeps a ballast from drying between rains; this causes tie rotting, rough track, and rails are soon hammered out of alinement.

The Spray method of applying poison has been highly perfected, and consists briefly as follows. The arsenical weed killer is forced, under train line air pressure, from the tank cars, forward to the flat car on which the spraying apparatus is mounted. Here it is distributed to the different nozzles across the front and to the nozzles on the side arms, or booms, which swing out on either side to cover double track work or sidings. To cover a regular ballast width and still enable the outfit to pass cattle guards, switch stands, and narrow bridges, the outside nozzles on each side may be raised to a vertical position to give clearance. The illustrations show how the double and multiple track equipments have lowered the application costs by increasing the covering area available to one forward motion of the train.

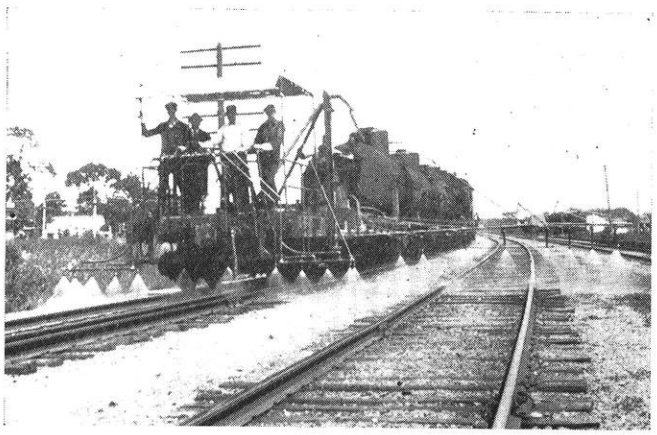
The amount of chemical used per mile varies between wide limits depending chiefly upon the extent of the vegetation and also upon how closely the train is held down to the proper speed of 10 m. p. h. On unkept sidings we used as high as 100 gals. per mile; while on well kept main line we used as low as 15-20 gals. per mile. There is considerable reason to believe that the arsenic in the ballast is accumulative, and that the number of gallons used per mile decreases with subsequent years of application has been shown by records for track over a number of years. The number of miles of track which can be sprayed in a day depends largely upon the traffic; we traveled as few as 45 miles on some short working days and as high as 100 miles on several long days. These figures would, of course, be doubled on double track work.



A view from the engine in Western Montana.

There are always railroad officials on the outfit with us; generally a roadmaster and a man from the division

engineering department. Occasionally we have a train master, or general roadmaster along. The first morning out, I was such a greenhorn that I was quite embarrassed; to have those men around when I had never operated a valve or even seen how a nozzle worked was rather disconcerting. Fortunately I managed to grab the wings up without hitting any cattle guards or switch stands that day, but I did miss several of the meter readings at the mile



The Complete Chemical Weed Spraying Apparatus at Work.

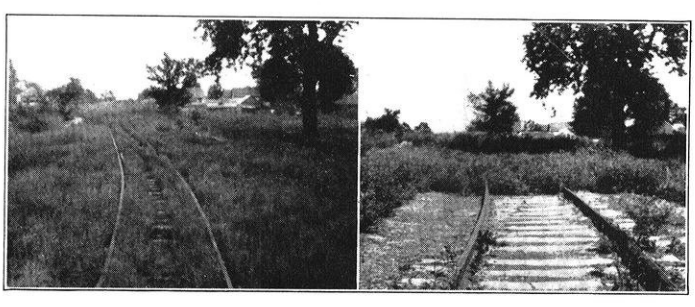
posts. By noon of the second day I felt like I was pretty much of a veteran, but I wasn't.

One noon about a week and a half after I had been on the outfit, we were trying to make up some time, so we ate in two shifts; while Vic and the roadmaster were back in the rear eating, the engineer and I did the spraying. The chemical tank "blew" indicating that it was empty, so I went back, turned the air on a full tank and opened the drain valve to the pipe line and we went on spraying. About a half hour later the nozzles started behaving just as though the tank was empty, and sure enough in a few minutes we were hardly getting any poison out. I thought surely the tank was empty although I didn't see how it could be. Vic went back to see what the trouble was, he returned shortly saying that I had forgotten to close the valve under the empty tank, and of course the air had forced the chemical back as there was less resistance in that direction than toward the nozzles. For a few minutes there it looked as if I had mysteriously lost about 5000 gals. of chemical; we were all rather worried. The worst part of this was the fact that two days later I had to run the outfit alone and the trainmaster and engineer present were a little dubious as to whether I was capable enough.

The first night out the train crew didn't use the caboose, or "way-car" as I learned to say, so we slept there with Slim, the brakeman. Other times we stayed at whatever hotel the town offered; quite frequently it was the best they had, and it was often none too good. In large towns we chose our hotel with greater care so as not to embarrass our pocketbooks, the hotel management, or ourselves. We did dress fairly respectfully when off the outfit, but sometimes we decided our none-too-well-pressed suits would not stand the gaff so we patronized a cheaper hotel. One time we stayed in a private home at Pacific Junction, Iowa, at 75c for two; the room was so small only one of us could stand up at a time. Later in the summer when I was working on the outfit alone I always passed as a railroad man, and several times I passed the night in railroad hotels at 35 and 50c a bed. Hotel rooms were generally $1.25 to $1.75 a night. Most of them gave excellent service, but the desk clerk at Hettinger, S.D., overslept and forgot to call us, consequently we kept the train crew waiting that morning.

Meals on the whole were very good, especially so out in the northwest, but in the northwestern part of Missouri people didn't seem to care for fresh vegetables and seldom wanted fruit. On two occasions we had to go for over a day without fresh fruit or vegetables. While we were on one division in Montana the superintendent gave us the use of his business car a courtesy which we greatly appreciated. For more than a week then we ate and slept in splendid style. Andy, the cook, certainly knew what hungry men like to eat. The prize meal of the summer came on the only Sunday I worked. We were spraying a branch line southeast of Des Moines and the crew wired ahead to the hotel saying that we would be there for dinner. We received a wonderfully cooked, many coursed, chicken dinner for the munificent sum of forty cents.

I had always thought a roadmaster was a pretty high "mogul" in railroad officialdom, and at first I was rather surprised to find how familiar they were with all the different section foremen; I was even more surprised to find that most of them chewed tobacco. All of the roadmasters help regulate the spraying valves, and most of them are very good at it. A few of them are 'goat getters' however, there was one fellow that insisted in spraying on freshly laid chatt. Another time we were spraying poison on a siding; I was managing the boom and having a little trouble in keeping the nozzles from striking the rails because the main line and sidings varied considerably in level. The roadmaster was so worried about whether it was going to clear that he completely forgot his own



Before — and After the Chemical Treatment.

job, and the wing on his side crashed into a box car, snapping off a piece of piping. Fortunately we were going through a town at the time, but even at that we lost about an hour in repairing it.

The train crews were in general a splendid bunch to get along with. They didn't mind helping us out with anything because we were a veritable gold mine to them, in that they got so much overtime while they were on our

(Continued on page 300)

Current Research *in the* Hydraulic Laboratory

By The Hydraulics Staff

THE Hydraulic and Sanitary Engineering Laboratory of the University of Wisconsin is unusually well equipped for certain types of Hydraulic and Sanitary Engineering tests. It is housed in a three and one-half story building, approximately 98x48 ft., on the shores of Lake Mendota. In addition a reinforced concrete reservoir holding 220 thousand gallons, on the top of the bluff near the laboratory, insures constant flow conditions for all low pressure work, and enables many refined experiments to be carried on. It is also accurately calibrated and may be used for measuring discharges from pumps volumetrically.

This year our facilities are being increased about 3000 sq. ft. of floor space which when equipped will give the University a splendid Sanitary Laboratory and a laboratory for the study of river control works. The funds for this equipment are not yet available. In the meantime the Sanitary Engineering Laboratory equipment is installed in the upper floor of the Hydraulic Laboratory.

The electric power supply is favorable to accurate work on Hydraulic machine testing. A new 175 k.w. synchronous motor generator set is now being installed to supply 220 volt direct current for the laboratory. Unusually exact speed regulations can be obtained with non-interference of other tests.

Splendid resources and an enthusiastic staff should well maintain the Laboratory at a high point of efficiency. The following experiments and investigations are being conducted this year by members of the department and students who are for the most part on Thesis work.

A comprehensive study of the flow of water through orifices on the end of a pipe is being made by G. B. Blackburn. Velocity of approach and partial suppression of the contraction affects the coefficients.

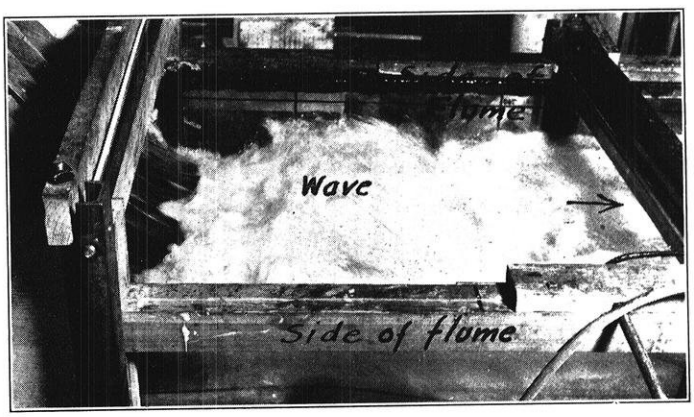
Perhaps the outstanding investigation is that by W. D. Merritt on the erosion below dams. He is dealing with a specific case where trouble might occur, and with the remedial works necessary to prevent scour.

Another investigation, by Junkerman, Johnson, and Henkel, is designed to find out the effect on the hydraulic jump of passing a portion of the water through the dam instead of over the dam.

One of the most necessary instruments required to advance the knowledge of experimental hydraulics, and which we do not now have, is some device for measuring small differences in velocities and small differences in pressures. Neil Lane is trying to design some such device.

Another of the major projects of the laboratory is a comprehensive analytical study of the flow of liquids over V-notch weirs. This work is being done by Miss Mary Soroka, Research Assistant, who is a graduate of Massachusetts Institute of Technology. The influence of viscosity is being especially considered.

Experiments are in progress by F. A. Fischer and E. Schlondrop on Air Life Pumps with outside air line and central air line. The water discharges from these pumps into a booster containing air under pressure. This energy enables the pumps to force the water horizontal distances. It is hoped such devices will increase the pump efficiency



View across apron of model dam showing standing wave. The glass flumes give a clear view of under currents and stream bed.

and widen its field of application since past experience limits the operation of the pump to lifting water vertical distances only. Considernig the size of pumps experimented with, the present rate of discharges are unusually satisfactory for pumping installations compared with other types of deep well pumping.

Mr. H. W. Mohr is enlarging the scope of the water hammer experiments on Locomotive Water Hydrants previously made by determining the discharge coefficients of cylindrical valves in these hydrants for different percentages of valve movements. His aim is to apply these coefficients in estimating the probable water hammer expectancy in field operation. If such can be obtained, it may be possible to develop a theory to determine the proper location of relief mechanisms and their respective sizes to eliminate destructive water hammer in the water supply lines.

Messrs. J. Oakey, J. Korfmacher, and O. Knechtges are completing an experimental study of the hydraulics involved in flow of water into deep wells at Monroe and Madison, Wisconsin. These wells are being pumped by working

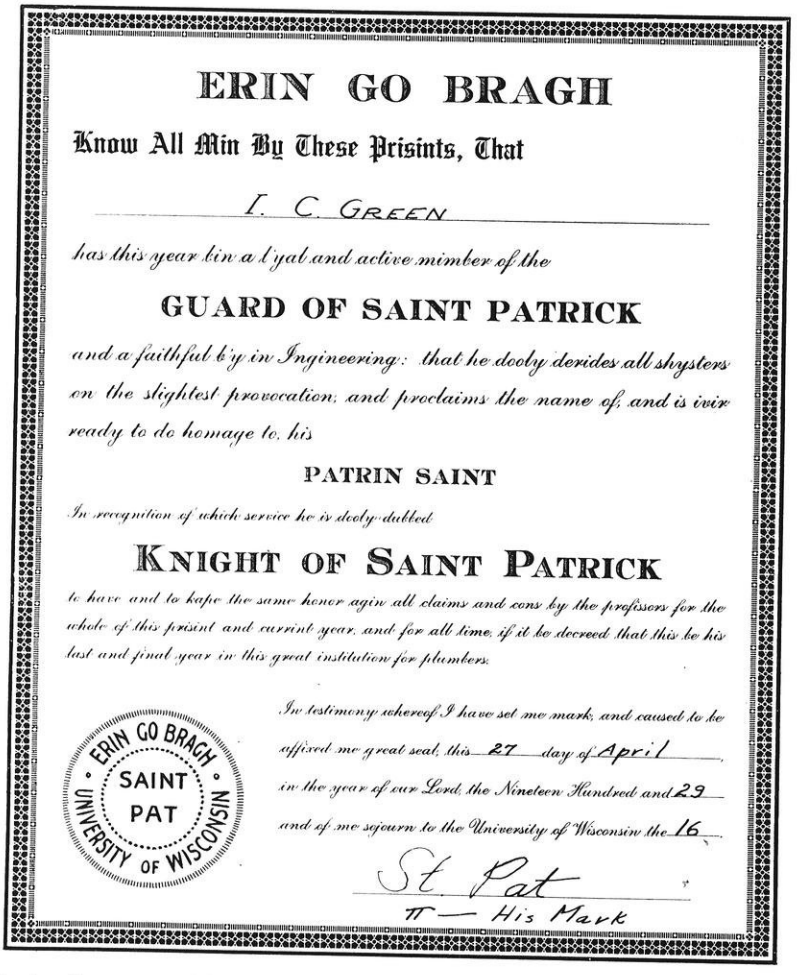
(Continued on page 302)

Campus Notes

WISCONSIN ENGINEERS PAY HOMAGE TO ST. PAT.

Led by a color guard bearing the banner of St. Pat, the Irish Free State, and the United States of America, the annual parade of the followers of St. Pat swept down State Street, around the Square and back Langdon Street to the Lower Campus, accompanied by the sprightly music of St. Pat's own band, the patter of raindrops, the acclaim of the assembled multitude, and the jeers of those few supporters of the ignoble art of shystering who dared brave the wrath of the engineers.

Guard composed of Wally Ziehlsdorf, Cliff Conry, Stan Binish and Ken Magee. The blarney stone, under heavy guard, rode in state with St. Pat.



ERIN GO BRAGH

Know All Min By These Prisints, That

I. C. GREEN

has this year bin a l'yal and active mimber of the

GUARD OF SAINT PATRICK

and a faithful b'y in Ingineering: that he dooly derides all shysters on the slightest provocation; and proclaims the name of; and is ivir ready to do homage to, his

PATRIN SAINT

In recognition of which service he is dooly dubbed

KNIGHT OF SAINT PATRICK

to have and to kape the same honor agin all claims and cons by the profissors for the whole of this prisint and currint year, and for all time, if it be decreed that this be his last and final year in this great institution for plumbers.

ERIN GO BRAGH SAINT PAT UNIVERSITY OF WISCONSIN

In testimony whereof I have set me mark, and caused to be affixed me great seal, this 27 day of April in the year of our Lord the Nineteen Hundred and 29 and of me sojourn to the University of Wisconsin the 16

St. Pat

π — His Mark

The floats, though few, showed unusual originality and wit. Kappa Eta Kappa depicted an engineer's 1:30 night. With cranks and ropes and pulleys, two strong men operated a huge slide rule under the direction of a brainy engineer. Simon Legree hung little Eva Shyster from the crane at the corner of Lake and Langdon Streets.

Triangle, with their floating university, announced that "All our sailors are men, but we can't swear that they are gentlemen." A. S. M. E. literally captured the lawyer's goat and took it with them on the parade. A. S. C. E. represented the proposed Barnard Hall Smoking Room as it might smoke. The float showing the two art students busy painting pictures of the beautiful models said to be Clara Bow and Laura LaPlante, was the offering of Delta Sigma Tau.

A lawyer in a cage in a manure spreader. What could be more fitting than the float entered by Sigma Phi Epsilon. Pulled by a caterpillar tractor, this float tore down the street with the "speed of a Memorial Union waiter" and advertised "Complete Campus Coverage".

Louis Berg throwing out Octy dirt and Bob Poss, a Phi Beta Kappa fifty years out of college, making a living by blowing music out of an automatic roll mouth organ, completed the procession in an adequate manner.

At the lower campus, after the parade, came the climax of the occasion. All worthy followers of St. Pat were knighted in the Royal Order of St. Pat after performing the sacred rite of kissing the Blarney Stone. And once again the engineers had ruled supreme. May St. Pat reign forever.

WHAT! NO MORE POISON IVY BURNS?

Has the day of the tough engineer passed? It used to be that the engineers at the civil's camp at Devils Lake used to walk into camp every evening with a rattlesnake hanging over one shoulder, and carrying a bouquet of poison ivy in one hand. We now hear that Prof. R. S. Owen is ordering a supply of an antidote for snakebite, and a cure for poison ivy burns.

TESTS BEING MADE ON MODEL OF FIELD HOUSE

Wisconsin's new field house will be comfortable for spectators. Determined to profit by the experience of other universities with their field houses, the designers of the Wisconsin edifice are conducting a series of experiments in heating the building on a model built to a scale of one in twenty. The tests are being made at the Capitol heating plant under the general supervision of

Prof. Gus L. Larson of the department of steam and gas engineering and under the immediate charge of Mr. Henry Zantow of the staff of the state power plant engineer.

Observations have shown that at some of the big field houses the range of temperatures between the lower seats of a balcony and the higher ones is as much as twenty degrees. While the spectators on the lower seats are uncomfortably cold, those on the upper seats are uncomfortably warm. In the present tests heat is applied at various points on the model and the circulation is under careful control. The heating system finally adopted will represent the most advanced practice in this field.

TAU BETA PI

At a recent meeting of Tau Beta Pi, the following men were elected to membership: Ralph A. Kraut, m'30, Theodore Bolliger, e'30, Alvin H. Benesh, c'30, Everett A. Johnson, e'30, Robert W. Kubasta, m'30, Frederick Hornig, c'30, Alexander Schefe, m'30, Robert Fairweather, e'30, Edward Howes, e'30, and Adolph Hove, e'30.

THE NEW FOUNDRY COURSE

Wisconsin is one of the leading states in the production of gray iron, cast steel, electrical steel, and malleable iron. The increase in use of these materials, and the rapid growth of foundries for their production has created a demand for trained foundry technologists. The University has never been able to supply the men needed in this field, and as a result there is a shortage of trained men. Realizing the seriousness of the situation, and in an attempt to attract men who are already interested in the work, Prof. McCaffery is incorporating a course in foundry technology in the curriculum. This course will be taken as advanced work towards a master's degree. The subjects covered in the course will be, Iron and Steel Metallurgy, Metallography, Physical Chemistry of Metals, Laboratory work in Foundry Sand Testing, Pyrometry, Alloys of Iron and Steel, Foundry Practices, and Heat Treatment. By offering this course it is hoped that a number of students will enter the new field which has become so enlarged with the increased use of iron and steel products.

FACULTY ENTERTAINS MILWAUKEE ENGINEERS

On Friday, April 26, a delegation of 100 engineers from the Engineers Society of Milwaukee were guests of the faculty of the College of Engineering.

The Engineers society is made up of members of the various national societies of engineers. Last fall the society was visited by the faculty of the college. The purpose of the meetings is to establish a greater co-operation between the practicing engineers and the faculty.

The program arranged for the visitors was as follows:

Afternoon: Inspection of shops and laboratories with a discussion of the research work being carried on in each department.

Evening: Banquet at Great Hall, Memorial Union Building. Songs — led by Prof. L. H. Kessler. Some fun — Dr. J. C. Elsom of the Medical School.

Introduction of Guests — Mr. Hans Dahlstrand, President of the Engineers Society of Milwaukee.

Introduction of faculty members — Head of each department.

Greetings from the College of Engineering — Dean F. E. Turneaure.

Response from the Engineers Society of Milwaukee — Mr. Fred H. Dorner.

The new Mechanical Engineering Building — G. L. Larson.

Research activities of the College of Engineering — representatives of various departments.

Post collegiate training at Wisconsin — Prof. Edward Bennett.

Engineers Society of Milwaukee and the College of Engineering of the University of Wisconsin — Mr. Arthur Simon.

RESEARCH PROJECTS IN THE COLLEGE OF ENGINEERING

There are over 40 research projects being conducted by the faculty of the College of Engineering. Practically all departments have one or more projects under consideration. The results of these studies are published and made available to those who desire them.

The type of project varies with the department in which it is being studied. The mechanics department has by far the largest number of projects under consideration, numbering 16. The studies are along all branches of mechanics, covering the subjects of steel columns, concrete research, welded joints, fatigue of metals, and tank stresses.

Next in number of research projects is the department of mining and metallurgy with 7. The studies are on the various phases of iron and steel problems. The hydraulics and sanitary department has 5 projects, steam and gas department has 3, the electrical engineering faculty is studying 4 problems of interest to the electrical engineer and one in co-operation with the Geophysicists of the University. The chemical engineering is co-oprating with the Wisconsin paper makers on a paper research project along with 2 problems of general interest to chemical engineers.

CHI EPSILON

The five junior civils with the best scholastic average and who have taken an interest in the civil engineering activities are elected to the honorary civil engineering fraternity Chi Epsilon.

This year, James W. Arnold, Alvin H. Benesh, Franklin T. Matthias, Rezin S. Plotz, and George Washa were elected to membership.

WISCONSIN PROFESSOR HONORED

At the annual meeting of the American Foundrymen's Association held at the Stevens Hotel, Chicago, April 8-11, Prof. R. S. McCaffery was appointed to the committee on Cast Iron. Prof. McCaffery of the Mining Department is also a member of committees on Iron Blast Furnace Products, on Physical Chemistry of Steel Making, on co-operation with Canadian Institute of Mining and Metallurgical Engineers.

At the Chicago meeting, Prof. Scott Mackay, also of the Mining Department, was made chairman of the committee on Malleable Iron.

THE GROWTH OF ENGINEERING AT WISCONSIN

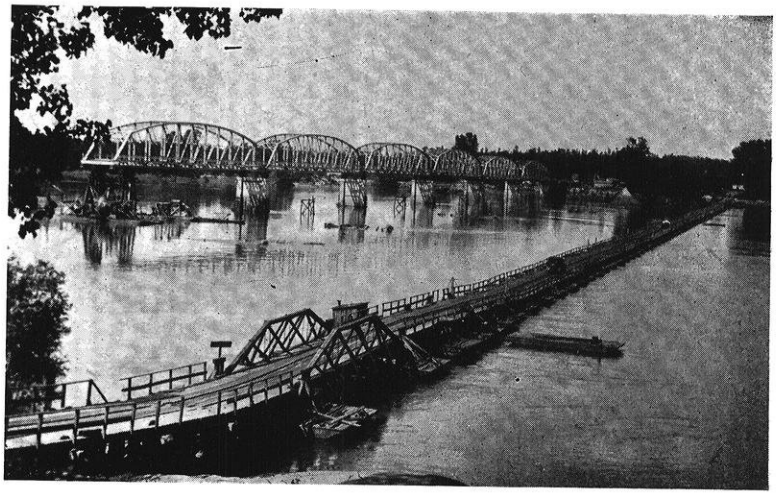
The first mention of an engineering course at Wisconsin was made in a letter of Edwin Coe to his parents written August 19, 1860, published in the Wisconsin Alumni Magazine of April, 1929. Mr. Coe writes:

"We are settled now and everything is in running order. I have not had to study very hard yet to keep up with my classes, and have

(Continued on page 298)

Alumni Notes

By R. S. PLOTZ, c'30



Pontoon Bridge and New Structure Across Arkansas River

World's Longest Pontoon Bridge Replaced

Under Direction of CLARK DUNN, c'23

DUNN, CLARK G., c'23, resident engineer for the Arkansas Highway Commission, sounded the death knell for the longest pontoon bridge in the world on January 17, 1929, when he opened to traffic a magnificent steel and concrete bridge across the Arkansas river. The bridge was finished on New Year's Day, 1929, seven months ahead of the contract date.

Seventy-two pontoons supported the old pontoon bridge which was 2,208 feet long and carried an 18 foot roadway. It was held in place by heavy wire cables anchored to seven towers placed at intervals across the river. In order to save the bridge from destruction in the time of high water it was built in 13 sections each of which could be towed by a specially constructed ferry and anchored on the bank.

First dirt for the new structure, which is one of the most important arteries of commerce for this entire section of Arkansas, was turned on November 30, 1927. Seven 214 foot six-inch steel trusses, one 362 foot steel draw span, and 160 feet of concrete girder approaches now span the river's channel. The seven fixed spans have a twenty foot concrete deck with a seven foot concrete walkway on the downstream side.

All piers were constructed by the pneumatic method and were sunk to bed rock which was found at approximately 32 feet below low water level. Much of the steel work was constructed on the bank and floated into position by means of two 40x90 foot barges with six foot gunnels. The spans were lowered into position on the piers by maneuvering the large barges into place and scuttling them. Approximately 23½ hours was consumed by a steel gang of six men in the erecting, bolting, and pinning of each span.

For 38 years the old pontoon toll bridge has acted as the main artery of the commerce of Dardanelle, Arkansas, but with the completion of this new structure under the contract of the Lakeside Bridge and Steel Company of North Milwaukee, Wisconsin, and the guidance of Dunn, a Wisconsin graduate, the city of Dardanelle hopes to expand beyond all expectations.

CIVILS

Bennett, William B., c'04, director of Research for the St. Louis Public Service Company, recently offered Wisconsin men a chance at two positions in his organization. Incidentally both Mr. and Mrs. Bennett will return to the University for the twenty-fifth reunion of the Jubilee Class to which they both belong.

Crump, Arthur W., c'15, who is production superintendent of the American Appraisal Company of Milwaukee and San Francisco, recently left the Milwaukee office to take charge of the San Francisco office located in the Russ Building, San Francisco, California. Since leaving school Mr. Crump has been married and has two sons, one five and one ten years old.

Ferguson, Phil M., C. E.'24, is associate professor of structural engineering at the University of Texas at Austin, Texas.

Fess, P. J., c'12, a Madison contractor, has been awarded the contract for $330,733 of concrete paving from Lakeview to Madison, and Middleton to Sauk City.

Geisse, Harlin J., c'17, who is an assistant chief engineer of the United States Navy, is now located at 217 North Princeton Avenue, Swarthmore, Pennsylvania.

Halseth, C. M., c'11, who while in school was a member of Haresfoot Club, track team, cross country team, and University Glee Club, is now Chief Engineer of the Civil Engineering Division of the Byllesby Engineering and Management Corporation of 231 South La Salle Street, Chicago, Illinois. His present work includes preliminary investigations of hydro-electric development, topographic surveys, and drilling investigations.

Jensen, Harold W., c'25, who is assistant general bridge inspector for the Chicago and Northwestern Railway Com-

pany, is now living at 411 Park Avenue, River Forest, Ill.

Maucini, Joseph J., c'16, who is a geologist for the Marland Products Company at Wichita Falls, Texas, is now living at 2001 Tyler Street, Amarillo, Texas.

Merz, H. Spencer, c'28, who lost his position with the Chicago Sanitary Commission when the latter had its big upheaval this winter, is now with Pearse, Greely, and Hansen working on plans for a two and one-half million dollar intercepting sewer system for the city of Rockford, Illinois. His address is 206 Lakin Terrace, Rockford, Ill.

Pilz, Arthur, c'27, has left the extension division of the University at Madison and will work with the Eau Claire division of the Wisconsin Highway Commission.

Powell, Robert, c'23, died recently from injuries received in an automobile accident near Columbia, South Carolina. At the time of his death he was working on a power dam across the Saluda River. In memory of his notable work on the dam the power tower will be dedicated Powell Tower.

Rohlfing, Anthony F., c'22, who is superintendent of construction for the S. M. Siesel Company of Milwaukee, was a recent visitor at the College of Engineering.

Schwada, J. P., c'11, C. E.'26, who is a former instructor in structural engineering, was recently reappointed City Engineer of Milwaukee for the third time. At the present time Schwada's biggest job is the working out of the house renumbering, the street renaming, and the railroad grade separation in the city of Milwaukee.

Shore, Franklin K., c'29, one of our recent Chinese graduates, has done some of the structural designing upon what will be for a short time the tallest building in the world, the Bank of Manhattan building in New York. The structure will be sixty-four stories or 840 feet in height and will top the Woolworth building by 48 feet; but the Chicago Tower building, also called the Apparel Mart, upon which construction will start about May 1, will top the Bank of Manhattan building by 40 feet. The framing from the 19th to the 64th floor occupied less than one-hundred and twenty-four hours of actual work. The column loads for the tower, some of which were as much as fourteen million pounds, and the column loads for the entire building were also taken care of by Shore.

Sogard, Lawrence T., c'24, has recently entered the employ of the Johns-Manville organization, manufacturers and distributors of asbestos products. In a recent letter to Professor Van Hagan he writes: "My last job with the Sanitary District was a survey of the Chicago and Northwestern freight and coach yard under which the District proposed to drive an interceptor — some day. This yard was alive with switch engines. My Politico-rodmen and chainmen moved a bit more sprightly than was their usual wont, — much to my amusement." At present Sogard is living at 751 North Central Avenue, Chicago, Illinois.

Stephens, Clyde K., c'29, who completed his work in February and went to work with the army engineers in Milwaukee, is with a party that is starting a survey of the Muskegon River. "The river is about 210 miles long," he writes, "and there will be only one transit party, so you can guess how long it will take. We stay in one town and then pick up luggage and move to the new town."

Stivers, E. R., C. E.'15, is now connected with Beckley College, a private institution located at Harrisburg, Pennsylvania. His home address is 211 N. Front Street, Harrisburg, Pennsylvania.

Wiepking, Chris A., c'21, C. E.'26, who has charge of the research work for the Department of Public Works of Milwaukee, has recently been made an associate member of the American Society of Civil Engineers.

Youngberg, George E., c'14, who for the past four years has been located at Venice, Florida, as Chief Engineer of the Realty Corporation of the Brotherhood of Locomotive Engineers, has had charge of the surveys for farm and city development on about 60,000 acres. During the height of the boom he had about 100 surveyors and engineers working on the development of the paving, water supply, sewers, sidewalks, and electricity distribution.

Among the April visitors to the College of Engineering were: **C. M. Halseth,** c'11; **C. H. Luckey,** c'14; **A. W. Crump,** c'15; **H. A. Doeringsfeld,** c'16; **W. Z. Lidicker,** c'27; and **G. E. Youngberg,** c'14.

MINERS

Peterson, Orin P., E. M.'14, is now employed as a mining engineer for the William H. Taylor, Trustee, room 1205, 318 West 9th Street, Los Angeles, California. He is living at 215 Montana Avenue in Santa Monica, California.

MECHANICALS

Carson, W. H., m'23, is at present director of the school of Mechanical Engineering at the University of Oklahoma, Norman, Oklahoma.

Dabney, William L., mechanical, who was superintendent of the shops some six years ago is now living at 5902 Garfield Street, New Orleans, Louisiana. While in school Dabney was a member of Pi Tau Sigma, honorary mechanical engineering fraternity.

Hay, Donald Leith, m'17, M. S.'20, Ph. D.'22, is now consulting engineer for Naval Research Laboratory, "Bellevue", Anacostia, D. C. He is living at 3805 S. Street, N. W., Washington, D. C.

McArthur, Arthur R., m'00, who was president of the Gary Board of Education and Chief Engineer of the Gary Tin Mills suddenly passed away on March 12. For the last 12 years he had held the presidency of the board of education and had also served the tin mills for a great number of years.

Neess, Carl J., m'28, is now doing work in the Coke Plant of the Wisconsin Steel Company of 106 and Torrence Avenue, South Chicago, Illinois. At present he is in charge of the regulating devices in the coke plant and is also doing a little research work on the side. Neess home address is 3039 E. 91 Street, South Chicago, Illinois.

Robertson, L. B., m'06, is now superintendent of the Coke plant of the Wisconsin Steel plant at 106 and Torrence Avenue, South Chicago, Illinois.

Stewart, Fred C., m'23, is the author of two articles appearing in current issues of "The Southern Power Journal" under the subject "Some Factors of Furnace Design."

CHEMICALS

Downing, R. C., ch'10, is working on the installation of a high pressure gas compressor which will supply eight miles of the surburban territory surrounding Lowell, Mass. His home address is 81 Luce Street, Lowell, Mass.

Weimer, Bernard A., ch'24, was married on the sixth of April to Miss Annette Kay of Chicago.

ELECTRICALS

DeLay, Frederick Abraham, e'02, is now research engineer for the Middle West Utilities Company at 72 West Adams Street, Chicago, Illinois.

Haevers, William, e'09, is now an electrical engineer for the Public Servic Company at 82 W. Adams Street, Chicago, Illinois. He is living at 616 S. 18th Avenue, Maywood, Ill.

Johnson, C. E., e'26, located with the Consumers Power Company of Jackson, Michigan, has been married since February 18 to Miss Irene Schermerhorn of Orange City, Florida. Mr. and Mrs. Johnson are now at home at 812 South Mechanic Street, Jackson, Michigan.

(Continued on page 298)

Engineering Review

Dean F. E. Turneaure Reviews

MEMOIRS *and* ADDRESSES *of* TWO DECADES

By J. A. L. WADDELL, *Consulting Engineer*

THIS is a noteworthy collection of papers by one of our well-known and most successful engineers, whose active professional life has covered more than half a century. In this compendium of 1175 pages are included a total of 66 papers and addresses whose breadth of field is well illustrated by a list of the groups into which they are classified. These are as follows:

The Engineering Profession	9 papers
Ethics of Engineering	2 papers
Technical Education	7 papers
Engineering Literature	2 papers
Alloy Steels for Bridge Construction	5 papers
Economics	8 papers
Bridge Construction in General	11 papers
Contracts	2 papers
Railroad Subjects	3 papers
Matters Chinese	14 papers
Miscellaneous Topics	5 papers

A mere enumeration of the titles of these papers is sufficient to show that Dr. Waddell is no narrow technician. Of the sixty-six papers, more than half deal with subjects of broad professional and technical interest. Furthermore, in his treatment of the more technical subjects, he has in most cases dealt with important fundamental questions, and his conclusions, based on painstaking research and analysis, are presented in such a manner as to be readily understood and applied. To the engineering student it is of especial interest to know that many of these published papers are in the form of addresses to bodies of engineering on the commencement platform or before small groups of civil engineers. Among the papers of more general interest, are mentioned the following: "International Engineering Comity and Its Importance to American Industries"; "The American Academy of Engineers: Its Aims and Objects", — a proposal by Dr. Waddell for a congressional charter for an American Academy, to consist of distinguished engineers organized in such a way as to render the highest service to the public and the profession; "Engineering Research"; "Engineering Ideals"; "Important Questions in Engineering Education"; "Technical Book Writing"; "The Study of Economics in Engineering Schools"; "Bridge Economics for Foreign Lands"; "Esthetics in Bridge Design"; "Engineering Contracts"; and the fourteen papers under the group entitled "Matters Chinese", which relate to engineering and educational problems in China.

> ***Memoirs and Addresses of Two Decades***
>
> *was edited by Frank W. Skinner, Consulting Engineer, and published by Mack Printing Company, Easton, Pennsylvania.*
>
> *—The Editor.*

Dr. Waddell's interest in the Orient dates from 1882, when he was appointed professor of Civil Engineering at the Imperial University of Tokyo, and where he did much to assist in the development of Japanese engineering education. More recently, his engineering practice has carried him into many lands, and he is at present employed as engineering adviser to the Chinese Government. Incidentally, he is a thorough believer in foreign language study for engineers, and it is worth nothing that two of the papers published in this work were written in French, — one of them being an address delivered before the Franco-Chinese Institute of Shanghai in 1921; and the other a paper presented at a meeting of the National Society of Civil Engineers at Paris.

A valuable part of this book is the biographical sketch by the editor, which sets forth in an interesting way the career of this busy and successful engineer. It is difficult to understand how Dr. Waddell could have placed so much on record, — an accomplishment which has been possible only by reason of his great energy and enthusiasm, coupled with systematic habits of study and of recording results of his own professional work. The editor, Mr. Frank Skinner, a lifetime friend of the author, has done the profession a service in making available this collection of papers, and has greatly enhanced their value by the explanatory notes which preface each group. The book can be highly commended to the student of engineering, and it will well repay even a brief examination of its contents or a perusal of one or two of the papers. Dr. Waddell's writings have often been characterized by editors as illustrating most excellent diction and great clearness of expression, and have been used not infrequently by teachers of engineering students from that point of view. We take pleasure in bringing this work to the attention of the readers of the *Wisconsin Engineer*.

F. E. Turneaure, Dean,
College of Mechanics and Engineering
University of Wisconsin.

INTRODUCING A NEW ENGINEERING SCIENCE

Hotel Engineering is to be made a part of the summer curriculum at Cornell University, of Ithaca, New York. The course will treat the engineering fundamentals of hotel operation: heating, ventilating, machinery, electrical apparatus and appliances, communication systems, elevators, and the principles employed in

their maintainance and operation. A course in Hotel Administration, with engineering as an integral part, has been given since 1922; but this is the first time the subject has been open to summer course students since the institution of the four year course. course.

A NEW USE FOR CHROMIUM PLATE

The use of chromium plate for automobile radiators, trimmings, and for plumbing fixtures is now almost universal; but the metal is finding application in a new field: that of reflecting surfaces for automobile headlights. The recent study by two Bureau of Standards scientists of the reflecting properties of several materials has revealed certain inherent characterists of these materials in the reflection of light of various frequencies of vibration. This research has furnished data on the reflection of light waves not only in the visible spectrum, but in the infra-red and ultra-violet ranges as well.

The observations regarding chromium show that it has a higher reflectivity than nickel in the ultra-violet range, a high maximum at 425 millimicrons (violet), and a wide flat minimum extending from 600 (orange) to 2000 (infra-red) millimicrons. Included in this study was a test of the resistance of the various reflecting surfaces to "dulling" when exposed to ultra violet radiation. The dulling effect of ultra-violet light upon chromium was found to be very slight. The marked superiority of chromium to nickel as a reflecting surface was well demonstrated by the work done on these metals.

—*Scientific American*

SPECIAL FUSES NEEDED TO EXPLODE DYNAMITE AT GREAT DEPTHS

Dynamite and T. N. T. were employed recently in the construction of the new highway bridge across the Mississippi from Cairo, Illinois, to Birds Point, Missouri. In sinking the caissons to the river bed, a hard, shale-like clay was encountered which clam-shell dredgers were unable to remove. The caissons were raised some five feet above the stratum of clay, holes bored into the river bed below them, and dynamite set off. As the depth increased, misfires began to occur due to the difficulty of detonating under the high pressures. Special fuses were obtained which contained T. N. T. and were capable of detonating under conditions under which ordinary fuses would fail. These fuses were of such a size and shape that they could be inserted into a hole drilled longitudinally into the dynamite cartridge. Five or six cartridges were strung together like beads on a string, the fuse in the topmost one. This final arrangement worked splendidly and the piers were lowered successfully with no further difficulty.

—*Explosive Engineer*

THE CURRENT NOW FLOWS FROM THE RIVER SHANNON

The River Shannon, long glorified in song and story, and considered as symbolic of Ireland as the Shamrock or St. Patrick himself, is being harnessed to furnish power for practically all of Ireland. A large hydro-electric plant is being built at Andacrusha, near Limerick, about 120 miles from Dublin. The area to be supplied is in excess of 25,000 square miles, and high tension lines up to 225 miles in length will be needed to distribute power over this territory.

The ultimate capacity of the plant, at the completion of the whole project, will be 180,000 kilowatts from six generators of 30,000 kilowatts each. The "partial development" now under construction will consist of only three of these generators with a combined output of 90,000 kilowatts, and will cost about 15,000,000 dollars, exclusive of the transmission equipment. The electrical and mechanical equipment will cost more than 2,500,000 dollars.

The temporary power requirements during construction are being met with a 4500 H. P. Diesel engine installation. An especially built railway, using both steam and electrically driven locomotives has been built from Longpavement to the various sites of construction; material is brought to Longpavement by motor truck from Limerick Harbor. Plant equipment was not available in Ireland to meet the enormous demand made by the magnitude of the undertaking; and so it was necessary to import from Germany over 125,000 tons of machinery, equipment, and fuel. The work is being done by the Siemens interests of Berlin, Germany.

—*Scientific American*

REJUVENATING TUNGSTEN BULBS

The blackening of high intensity tungsten electric lamps, caused by the depositing on cooler parts of the bulb of tungsten volatilized from the filament, can now be removed by a practical method, recently announced by the Lamp Development Laboratory of the General Electric Company, and now being incorporated in all high intensity lamps produced by that company. The new deposit remover consists of a small amount of powdered tungsten, a tablespoonful in most cases, which is placed inside the bulb before it is sealed. By removing the blackened lamp from its socket and shaking it, this coarse tungsten powder sweeps off the coating of tungsten on the glass, and restores the lamp to its original efficiency, as good as new. The deposit of tungsten-soot on the glass absorbs lights and radiates heat, and in time the temperature of the glass becomes so high that it undergoes devitrification and deformation. So this new method for removing this deposit will increase greatly the life and usefulness of tungsten lamps, both in length of service and in efficiency while in use.

—*Power*

OXY-ACETYLENE BLOWPIPE MAKES WAY FOR SKYSCRAPER

When steel construction began on a 53 story office building in the Grand Central zone of New York City recently, it became necessary to remove a fire escape projecting from the wall of an adjacent 20-story hotel, as the walls of the new structure were to be in contact with those of the older building at that point.

Before the development of the oxy-acetylene process this would have been a tedious and long drawn out task necessitating weeks of hard work. The oxy-acetylene cutting blowpipe reduced the operation to a matter of days. The manual labor involved was confined to the simple task of guiding the oxy-acetylene flame along the path of the cut. Railing, frames and supporting members were quickly severed. Where steel supports were anchored into the mortar and brick of the building, the cut was clean and close and accomplished with the utmost ease.

The oxy-acetylene cutting blowpipe is truly a remarkable tool. For structural or demolition work it has proven

(Continued on page 294)

Editorials

SHALL IT BE FORWARD?

THE Department of Mining and Metallurgy, has, in the past, pursued a policy of cooperative research with various manufacturing and mining companies throughout the country. Their research consisted of studies to discover the important fundamental knowledge of metallurgy as concerns refining and manufacturing processes. These studies were financed in part by the university and in part by the industry concerned.

Here we have a picture of the large manufacturing interests and a great state university, hand in hand, working to discover and develop the great mass of fundamental facts of metallurgy, without which there can be no progress in that field. The companies interested received their dividends in improved methods and a more complete knowledge of technical principles. However, the rest of the companies in that particular field, contributing nothing to cooperative research, found that all the work done at the university was available to them without any expenditure whatever. Why, then, should they bother to spend time and money on research? Why not pursue a "dog-in-the-manger" policy and "let George do it"?

This is exactly what happened. Industries are withdrawing their financial support from the University, prefering to do their own research in a secretive manner and reserving their findings for their own exclusive use.

What a shameful condition this is. Here is a university ready and eager to aid in the acceleration of industrial progress, and being stopped by the very interests that they are ready and willing to serve. Because of her own intellectual inertia and headstrong selfishness, industries are refusing the help of the university and are hibernating in their own laboratories for independent and ineffectual research.

What can be done about remedying this situation? That is for industry to say. Just as soon as she realizes that collective enterprise in research is essential; that selfishness ever stands in the way of intellectual advancement; that the universal dissemination of fundamental knowledge is the only way to real and lasting progress — just so soon will she turn again to technical educational institutions for the solution of her rapidly multiplying difficulties in scientific manufacture.

WE THANK YOU

With this, the last issue of the Wisconsin Engineer, the Staff wishes to take this opportunity to thank its readers and contributors for the generous support which you have given us throughout the past year. The success of such a publication as the WISCONSIN ENGINEER is due only to a hearty spirit of cooperation and good will among students, alumni, faculty and staff. May we continue to receive that cooperation that our college publication may rise to that position of eminence which is maintained by the institution that it represents.

We hope that our student readers will spend a profitable and enjoyable vacation and consider that vacation an opportunity to gain some practical experience in engineering work rather than merely three months to waste.

THE TRADE SCHOOL AND THE UNIVERSITY

ALIKE in many details, but fundamentally different are the trade school and the university which gives an engineering degree. The former is an institution of extreme specialization. It equips its students with a working knowledge and technique of one distinct trade. Its methods are intensely practical. Its graduates are ready to take up a job which offers a moderate salary with not much probability of promotion. There are many students in the university whose practical and methodical intellects would suit them to better advantage in the trade school, where theory is not stressed.

Although covering practically the same field as a trade school, the university tends toward a liberal education. Its students receive not a working knowledge of a trade, but a theoretical explanation of the fundamentals of an entire branch of engineering. Its graduates are of no great immediate value to an employer, but they must learn practical working methods which will eventually lead them to executive positions. The salary at first is low but increases rapidly until it exceeds the salary of the average trade school graduate. Many men in trade schools, who have the ability to plan and to assume responsibilities, would advantageously transfer to the university, where such ability might be more fully developed.

VACATION

SCARCELY more than a month away, looms the oasis which every one in college regards with intense interest — summer vacation. To some it means three months of steady loafing; some invade the soda fountain and bathing beaches for jobs; others have planned ahead and are ready to step into various fields of engineering where they are able to get some excellent experience.

The latter is the ideal way to spend the summer from an engineering standpoint. It provides the undergraduate with both financial returns and practical ideas. Many students get work with the same company for the four summers during which they are in college. In this way they are ready to step into a fairly good salary soon after graduation which the graduate who has spent his summers "life-guarding" or jerking sodas could never hope to receive.

ENGINEERING REVIEW

(Continued from page 291)

itself indispensable because of the speed and economy with which it accomplishes otherwise difficult tasks.

THE ENGINEER

He supplies the world with power and provides the machines by which the power is put to work.

He brings forth from the earth oil, coal, and ores of all kinds and converts them into useful products, guiding and controlling the complicated processes of manufacture.

He provides the various channels of transportation — highways, canals, railways, aqueducts, and pipelines — and he provides the vehicles that move over them — motor cars, boats, locomotives, and airplanes.

He makes possible rapid communication between all parts of the earth by means of the telegraph, telephone, and radio.

He furnishes the home with water, light, heat, fresh air and refrigeration and removes and disposes of the wastes.

He provides protection against floods, reclaims swamps and marshes by drainage works, and fertilizes arid regions by irrigation.

He builds bridges and tunnels the mountains. He erects tall steel and concrete buildings upon foundations which he carries down to great depths.

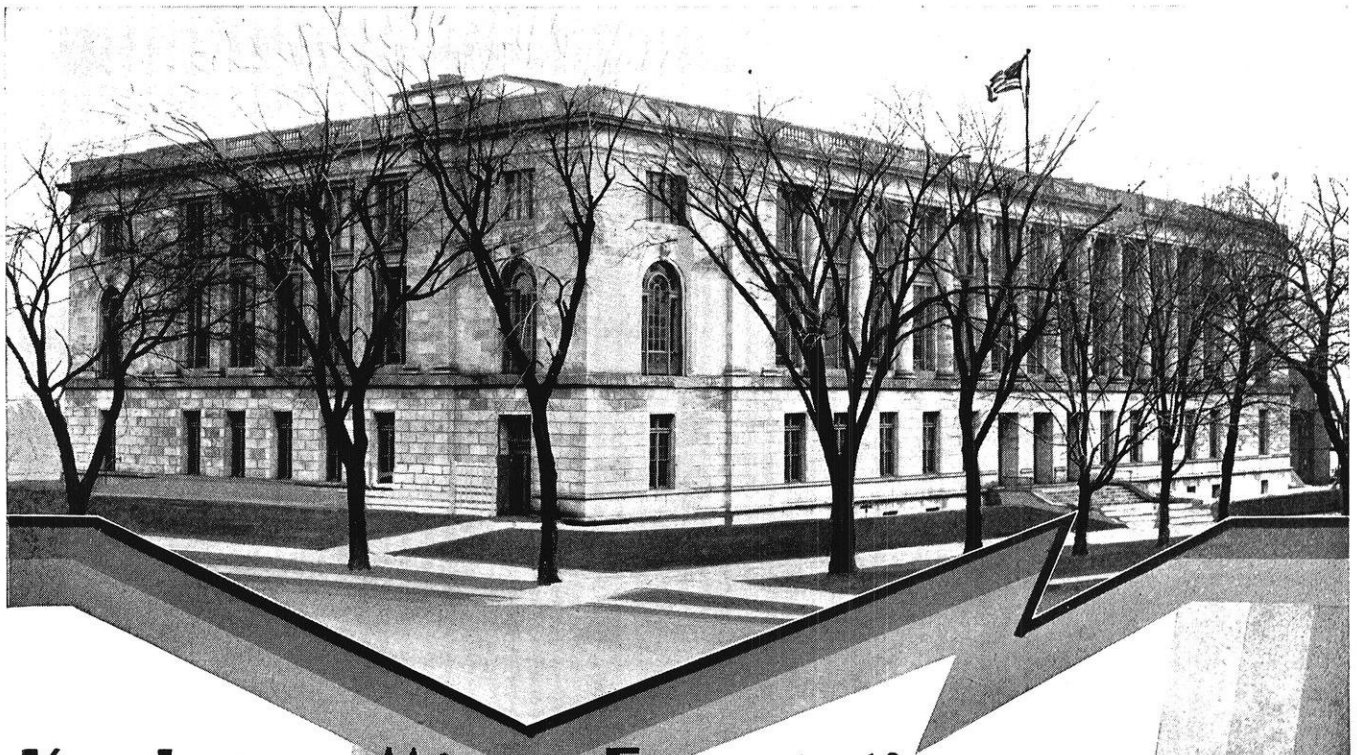
He measures and maps the earth; he has led the way in exploration.

PROGRESS IN THE COAL-GAS INDUSTRY

A plant is being erected near Glasgow, Scotland, using a new process of coal distillation perfected by the Bussey Coal Distillation Company. The distinguishing feature of the process lies in the retort used; it is of the vertical, internally-heated type, and of new design. It is a simple steel shell, lined with fire-brick and of the form of a truncated cone of oval or rectangular cross-section. The retort is supported upon its larger end, permitting of gravity discharge, the coke being severed from the mass above at regular intervals by a cutter-bar, and falling into a hopper below where it is steam-quenched and removed.

The process has several distinct features. In the common methods of coal gas production in the United States, the process is discontinuous and the retorts are externally heated. The use of the Bussey retort, however, permits of a continuous process; and the charge is heated by the admission of the proper amounts of air, gas, and steam into the retort.

Ordinary coal gas, as produced, has a high calorific value, and must be diluted for domestic usage; the output is about 13,000 cubic feet of gas per ton of coal used, with the formation of about 70% of the weight of the charge of coke. The Bussey process produces 20,000 to 30,000 cubic feet of gas per ton of coal, having a lower calorific value, but admirably adapted to industrial heating and the generation of power. The yield of coke from the Bussey retort is almost as high as that from the ordinary coal gas retort; but the Bussey coke has a higher density and combustibility, and is particularly suited for use as a metallurgical coke and as a fuel for water gas manufacture. The yield of crude oil, or "coal tar", from the Bussey process is from two to four times that of the closed-retort gas process; in this respect, however, a comparison means little; for in the



Koehring-Mixed Foundation
for Federal Building

Probably one of the most interesting and attractive of the federal buildings erected during the last year is the United States Post Office and Court House at Madison, Wisconsin. In addition it is one of the first in the building program resumed since the World War.

Situated in the shadow of the state capitol and only a few hundred feet from Lake Monona, one of the four lakes which surround Madison, the three-story building of Bedford stone has an ideal setting.

Employing the latest methods in the interior transfer of mails the Post Office department arranged the rooms, conveying machinery and platforms to bring about greater ease and speed in the handling of all classes of mail.

In the main lobby, marble slabs cover the walls from the floor to a height of eight feet. Quarter-sawed oak is the interior finish throughout the building.

Despite other unique features found in the Madison Post Office, its foundation of dominant strength concrete is similar to that of other well-known building projects throughout the world — concrete mixed by a Koehring.

The ingredients of concrete are the same in all cases but the Koehring re-mixing action — a fundamental principle of Koehring concrete mixers and pavers — coats every particle of sand and gravel with cement to produce dominant strength concrete.

"Concrete—Its Manufacture and Use," a complete treatise and handbook on present methods of preparing and handling portland cement concrete, will be gladly sent on request to engineering students, faculty members and others interested.

KOEHRING COMPANY
MILWAUKEE, WISCONSIN
Manufacturers of
Pavers, Mixers—Gasoline Shovels, Pull Shovels, Cranes and Draglines
Division of National Equipment Corporation

KOEHRING HEAVY DUTY KE

KOEHRING

Bussey process, the coal tar is more than a "by-product" — the process is designed for its efficient production. In the coal-gas industry the "tar" is purely a "by-product". —*Engineering*

THE ELECTRIC FURNACE COMES INTO ITS OWN

A new installation of electric heat-treating equipment has met with outstanding success in the heat-treatment of tools at a large eastern plant. Before the adoption of this new equipment the work was done entirely by gas-fired furnaces, which, though they were capable of producing a product of high quality, were expensive in operation and required a large working force. With the electric furnace, the freedom from danger of explosion, the accuracy with which the temperature may be controlled, and the regulation of the furnace atmosphere are all advantages not to be found in the gas-fired furnace. The quality of work turned out is far superior to that produced by experienced operators using a gas-fired installation, and the percentage of rejections is much smaller.

The furnaces installed are all of the lead-bath type, and are heated by nickel-chromium alloy resistance units so mounted as to produce uniform heating in the furnace. The temperatures are controlled and recorded by controlling pyrometer. Thermocouple elements are installed in both the lead-baths and in the furnace chamber, thus enabling the operator to check the temperatures of both in order that the element temperature may be held within safe limits and the bath temperature checked frequently. An automatic switching device connects the pyrometer to each couple alternately at thirty second intervals.

The operation of the furnace is a batch process which is practically continuous. A large saving in number of employees, in lead loss, and in pot life is effected; and the percentage of rejections, over 15% with gas-fired furnaces, has dropped to practically nothing with the electric furnace installation. Electric heat-treating is making great progress both in this country and in Canada, and manufacturers are rapidly becoming aware of the great economies effected by its use. —*Engineering Journal*

CAMPUS NOTES

(Continued from page 287)

had time to get ready to enter the Practical Surveying Class, which begins very soon. The Institution owns a fine set of instruments and I mean to learn all I can about surveying as it may come in very handy to me some time. Mr. Cargell has charge of this and we go out into the field two or three times a week and practice."

At that time the surveying was given by the department of mathematics. In 1865, a course in Military Tactics and Engineering was incorporated into the curriculum. The course covered military tactics very thoroughly with less attention to the civil engineering.

In 1875, according to President-Emeritus Birge, a course in engineering was made a part of the general science course. The freshmen and sophomore years were devoted to regular "Hill" subjects, while the last two years covered briefly the field engineering. Prof. Nicodemus and one assistant taught all the subjects.

The College of Engineering was organized by Dean Johnson in 1890. Today it has five four-year courses with the possibility of a student specializing in work under a particular department.

RACING CAR TO BE SHOT AT TARGET

In a short time Major O. D. Seagrave, British former speed champion, will attempt to regain his lost record. He is now superintending the building of a car in which he hopes to travel at the speed of 240 miles per hour, or four miles per minute.

The new car, the Golden Bullet, will have a Napier 900 hp. engine, rotating at 3400 revolution per minute. The frame is braced with steel tubes of the utmost strength. The steering gear controls the front wheels through a separate mechanism for each. The car stands three feet nine inches high, twenty-six feet long, and six feet four inches wide at its widest part. It has a seven-inch ground clearance. The probable speed of the wheels will be about 2500 r.p.m. and the tires are to be 37x7.

The Napier engine is twelve cylindered, the cylinders spreading fanwise in three rows of four cylinders each. The motor is valve-in-head and there are six overhead camshafts. The bore is five and one-half and the stroke five and one-eighth.

The car has been equipped with rifle sights which will be aimed at a target at the end of the course. The target is an enormous bull's-eye which will be suspended from a wire strung between two towers thirty feet high. At the front of the hood is set the front sight—the bead of the rifle. The back telescopic sight is immediately in front of the driver. A black band painted on the hood connects the two sights.

—*Popular Science*

NEW DESIGN IN TELEVISION SETS

The old type of television receiver, with the large scanning disc and large neon tube that required so much current, has been superceded by a more practical piece of apparatus. This new set is the result of four years of television research and experiments made by C. Francis Jenkins, the owner of Station W3XK, Washington, D. C. The usual television set has a picture screen of 1½" x 1½" whereas the new set produces an image about a foot square. This is done by reflecting the picture through a magnifying glass. In Jenkins' new set, he employs a special lamp with four plates, each plate serving to illuminate one-fourth of the screen. The plates are flashed on the screen in rotation, similar to the way auto spark plugs fire. Enormous illumination may be obtained with only the ordinary radio's two units of audio frequency amplification. The operation spells simplicity in itself; a switch starts the motor that drives the scanning drum. The radio set is tuned to the broadcast wave lengths, or short-wave lengths if convenient, that carry the television signals. A second switch turns on the neon lamp, and a series of parallel lines and flickering shadows appear on the screen. A third switch brings the picture into perfect synchronization with the transmitter. The picture is framed by means of a level placed on the screen.

—*Special*

THE ROCKET-AUTOMOBILE

This German novelty is the subject of a brief article in "The Explosives Engineer" by Rudolf Feuchtinger. The development of the rocket-car is due to a German engineer, Fritz von Open, chief of the firm of Adam Opel, proprietors of the automobile plant at Russelsheim, with the assistance of Messrs. Sander and Valier, his aids, as a preliminary stage to the rocket-airplane and the rocket-airship. We read:

"The first official trial was made April, 1928, with an Opel rocket-car on the so-called 'Avusbahn' race-track near Berlin. The rocket-car, steered by Engineer Fritz von Opel, reached a speed maximum of 122 miles an hour. The total explosive charge of the rockets which were placed in the rear of the car and provided with electric ignition, amounted to about 1,200 pounds.

"Since the world's speed record for automobiles, which is at present about 207 miles an hour, was not reached on the race-track, further experiments and trial drives were continued with an especially constructed railroad rocket-car on an unused railroad line near Burgwedel (Hanover) in June, 1928. The car was started without a driver and reached a maximum speed of 149 miles an hour on this track.

"On a further increase of the rocket charge (about four times as much), the car was hurled from the rails and destroyed almost completely.

"In spite of the failures at the beginning, in a short time the unexpected difficulties will be overcome. This would mean a considerable approach to the practical realization of the idea of flying into space."

—*Literary Digest*

WIRELESS LIGHT

The ideal of illumination engineers is to produce light that rivals the sun. We are soon going to give up the use of hot-filament electric light bulbs, made of the fine wire that burns up and causes a deposit of metallic vapor to form on the glass, thus reducing lighting efficiency. The proposed lamp will be a crystal globe, free from wires bith inside and out. These will be filled with some rare gas. This lamp will receive its energy from a coil concealed in the walls of our houses. Their action is very similar to the neon glow signs that are so prevalent in the modern sign. It has been found certain gases issue a highly illuminate glow when subjected to the fluxuating intensity of a field produced by a high frequency current. In a high frequency coil the current changes direction from maximum in one direction to maximum in the opposite direction many times a second, hence, the field set up by this current varies, likewise many times a second. The electrons in the gas-filled globe are sensitive to the varying force upon them, traveling first in one direction then in another. The intensity of their travel makes them luminescent. The feature of this lamp is, that it is practically wear resistant and cheap to operate as well as being an asset to the aesthetic beauty of the most luxurious home. The source of this high frequency power may in time be transmitted by wireless. —*Popular Mechanics*

ALUMNI NOTES

(Continued from page 289)

Tjoflat, Gerald B., e'24, is now employed in the patent office department of the Westinghouse Electric and Manufacturing Company at East Pittsburgh. His residence address is Georgian Apartments, Ellsworth Avenue, Pittsburgh, Pennsylvania.

CONFESSIONS OF A CHEMICAL WEED KILLER

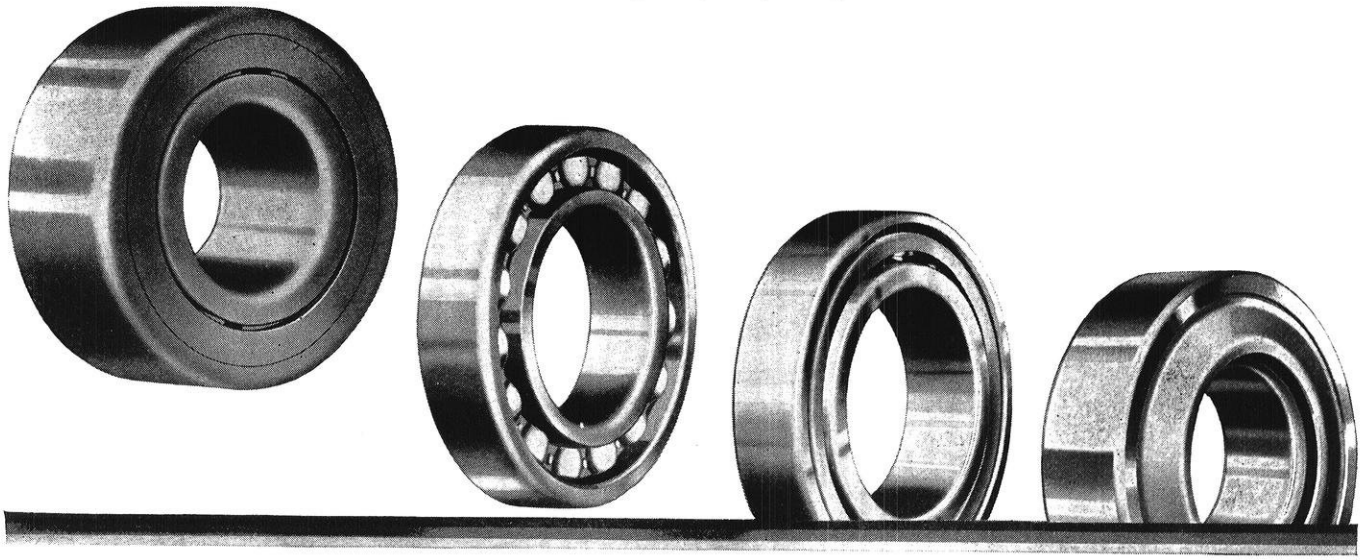
(Continued from page 284)

work train. That overtime, by the way, was a source of dismay to us; the different roadmasters and train crews could stand a few days of 16 hours without any trouble because as soon as we were off their division they were through; but when we went from one division to another and had another string of long days, we began to know it about the middle of the afternoon. It will be a long time before I'll forget Slim. He was a good brakeman, but he talked all day long. He seldom repeated himself and he was a good story teller. His best stories were about his many clashes with his superiors and how he got the best of them. I might add that when we saw him with his trainmaster, he was a very well behaved little lamb. Then there was Chuck, another brakeman and famed talker. His imagination was so vivid that you didn't have to doubt it.

Taking water was always quite an exciting event. We would have to stand on top of the tank car dome with only the standpipe valve handle to hang onto. If there was a poor fit between the dome opening and the spout we would have to stand perched on top of the standpipe to keep from getting a shower. It was much more dangerous to have to stand on the spout from a water tank. We had to stand on them to hold them down in the dome, and when the sheet iron pipe was old and battered it was not very firm, and usually leaked considerably. Some of the spouts were braced, slightly, laterally by a couple of ropes, others weren't braced at all; so when all you had to hang onto was the valve rope you can see why we thought we possessed the so called "airman's poise". Most of the time we didn't waste much water, but on one occasion the spout made a terrible fit, and as there was no other water supply near, we drained half a water tank in taking on 6000 gallons. There was another rather thrilling event which occurred several times during the summer; that was, to be standing next to the dome of a swaying tank car when we went over a sixty-foot trestle.

The list of incidents which happened during the summer has not been exhausted, but there is neither time nor space to add any more. You may have wondered if we got through the season without being poisoned. Some of the fellows did, I had a poisoned foot for a while, and at another time we got our faces burned by the caustic soda in the weed killer. This happened when we pushed a box car ahead of us for about seven miles in a hard wind.

The weed killer is very deadly to live stock. The poison first cures the weeds before they turn brown, and in that state they give off an aroma almost identical with that of new mown hay; so besides being deadly it is also quite



THE "watch jewels" of industry are New Departure Ball Bearings . . . the most largely used anti-friction bearings for all purposes. 165,000 a day are produced in sizes and types for every service requirement.

Double Row, having two rows of balls and ball raceways with angular contact lines to withstand both radial and thrust loads, singly or in any combination.

Single Row, a radial load bearing having, under certain conditions, a definite amount of thrust capacity. Furnished in two styles: Deep groove non-loading groove type and deep groove maximum capacity type.

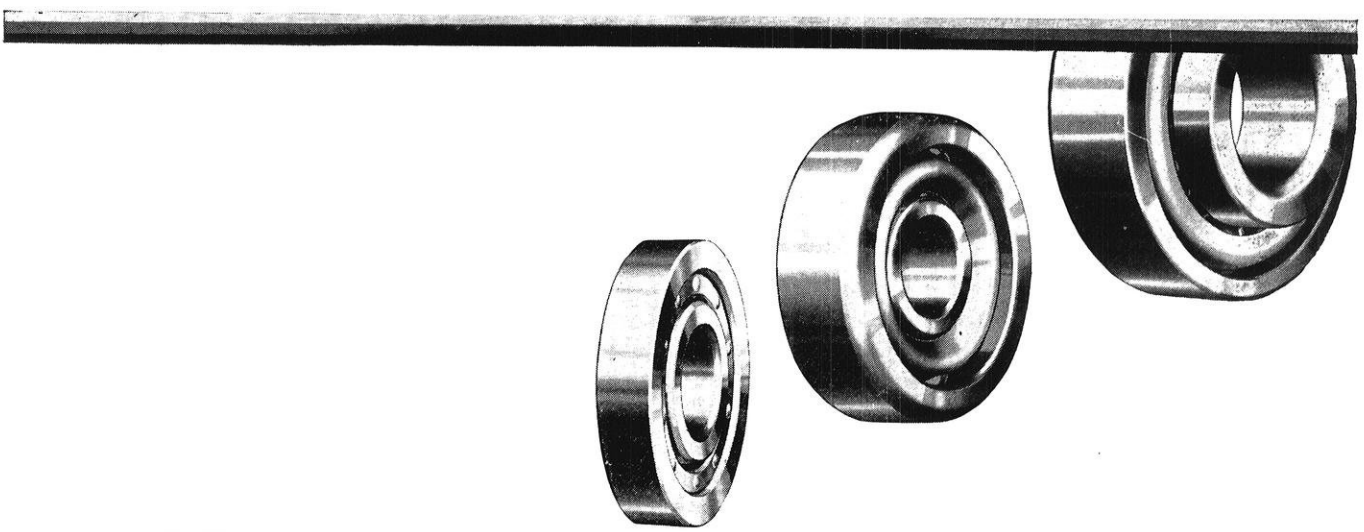
Radax, a bearing capable of taking radial and one-direction thrust loads in combination. Made in three separate styles, according to the amount of thrust capacity desired.

Magneto Type, a small angular contact bearing developed especially for noiseless operation at high speeds in small electrical devices.

Oil Shield Type, a single row bearing with special pressed steel shield for the retention of lubricant in such inaccessible locations as clutch pilots, etc.

Application data and engineering consultation service upon request.

New Departure Manufacturing Company, General Offices and Main Works, Bristol, Connecticut. Engineering and Sales Offices at Detroit, Chicago and San Francisco.



NEW DEPARTURE

BALL BEARINGS

Please mention The Wisconsin Engineer when you write

tempting. To prevent the cattle loss which occurred with arsenical weed killer, a non-poisonous weed killer was developed. This was not only harmless to live stock but was even more effective in eradicating horse tail, Johnson grass, and a few others which were not much effected by the arsenical killer. The application end has also been developed so that now it is possible to us a "Duo Application" method in which the spray can be instantly changed from poisonous to non-poisonous at the discretion of the operator.

The future of chemical weed killing lies with the railroads, because the present price cutting war which is seriously affecting the weed killing poison manufacturers is not a stable condition. Only by the choice of the company which gives the most thoroughly dependable service, regardless of rates, can the industry be expected to continue and flourish. The only other answer and probably the most practical one is given by the now common by-word of "Consolidation".

CURRENT RESEARCH IN THE HYDRAULICS LABORATORY

(Continued from page 285)

barrel, air lift, and deep well centrifugal. Drawdown and recovery curves are being studied to determine the capacity of respective wells. All wells are properly cased, and metered water is also poured into these wells so that the relation to the amount of water the wells absorb and capacity when pumped can be determined. If some relationship can be observed, this method of testing deep wells is very simple and practical with only short shut-downs of well drilling rigs and crews. Special emphasis is being given to geological studies concerning ground water supply in Southern Wisconsin below a line drawn east and west through Madison. At present some of the partially accepted theories of ground water supply do not seem to be checking practical experience.

Messrs. C. Paschen, L. W. Peleske, and R. W. Stevens have completed survey studies at Williams Bay, Wisconsin, and are designing a complete water supply and sewerage system for this village. Because of the large area to be covered, its rugged topography and the unusual seasonal demands on water and sewerage due to the summer resorts, the problem is quite different and unusually interesting. The problems involve an application of many of the professional courses in the civil engineering curriculum.

Prof. L. H. Kessler is completing final analyses of Wrought Iron Pipe Friction Losses, to be published soon as a bulletin by the Engineering Experiment Station. Special attention is now being given to the effect of temperature on the friction factors so that the data from the 1120 tests completed can be extended to larger sizes of pipe.

In the field of Sanitary Engineering, Hillis and Beran are working on chemical treatment of creamery wastes, and Binish and Fleischer are studying surface aeration of the same type of waste. This work is a continuation of the cooperation with the State Board of Health started some years ago by Professor Corp.

Burmeister and Van Akren chose as their thesis the design of a sewerage system and sewage disposal plant for Middleton, Wisconsin.

S. R. Buglass, working alone, has been compiling data on processes and theories of trade waste treatment and disposal in Wisconsin.

HIGH PRESSURE GAS DISTRIBUTION

(Continued from page 282)

at the production center, along the transmission line or at the distributing points.

In compressing manufactured gas, reciprocating or piston type compressors are generally used. These units may be single- or multi-stage and the driving mechanism may be steam, electricity, gas or oil, depending entirely on local conditions. From an operating standpoint it is desirable to have duplicate or standby units driven by a source of power other than that regularly employed.

The standard design of air compressor equipment is satisfactory for gas, with minor changes to unloaders, relief valves, etc., to prevent escape of gas in the compressor station.

Pressure carried in actual practice range between 30 and 60 pounds. Many gas engineers feel that 100 pounds is the economical limit for compression and this is one of the problems which will not be solved without further study and experimenting.

As high pressure pipe lines become loaded to capacity, it is found practical to install repumping stations in the system, thereby increasing the original capacity of the lines. These repumping stations can be made entirely automatic in operation.

Cooling the gas after compression to remove moisture and light oils is a matter which is receiving particular attention in colder climates. Upon compression the gas may attain temperatures of 250 to 550 degrees Fahrenheit, depending on the pressure carried, and after cooling may be employed to reduce this to a normal value of 60 to 80 degrees Fahrenheit. Water or air cooled apparatus can be used to remove much of the moisture and drip oils, instead of permitting these liquids to be carried into the pipe line system, where they must be removed in drips so as to prevent interruptions of gas flow. Drips or blow off connections are of course provided in the first mile or two of a transmission system, and it is found that all condensate is usually removed within such distance from the compressor station.

Computations for a typical system show that compression at 50 lbs. with subsequent aftercooling to 75° F. may produce about one gallon of moisture per 10,000 cubic feet of gas. A city of 40,000 population, uses about 1,000,000 cubic feet of gas daily, and aftercooling of this quantity of gas would give us 100 gals. per day. In warm weather, such moisture would flow to the drips without affecting the system, but it is apparent that line stoppages or freezing might occur in cold weather.

In constructing the pipe line itself, the chief problems are to provide sufficient strength and flexibility to withstand pressures and expansion strains; to secure freedom

from leakage and to afford protection against corrosion. The use of ordinary steel pipe has become a general rule. Special alloy steels have not been placed on the market at a price to enable widespread use. Some types of alloy steel pipe have been tried out, but it will be several years before their relative value can be ascertained. Steel pipe may be obtained in 40-foot lengths and this reduces the number of joints. Usual sizes in transmission practice are from 3″ to 10″ although some 2″ pipe is used in distribution service.

It is found that the best protection against corrosion at this time is afforded by the use of the various pipe coatings or wrappers obtainable on the market. The coatings employ asphalts or processed greases for base materials, while the wrappers may be felt, paper or cloth. Protective coatings may be applied by hand or machine methods. Present practice does not call for protection of the entire line, but protection is afforded under poor soil conditions and other places depending on the judgment of the engineer.

Due to the possibility of heavy losses from a break or leak in a high pressure line it is customary to install sectionalizing valves at intervals of one mile or more, throughout the system. Defective sections can be repaired without draining the entire system. Gauge connections may also be welded into the line at valve locations to assist in locating stoppages by measurement of pressure drop. Since valves are put in the line with dresser couplings, some expansion is taken care of at valve locations.

If gas is being transmitted to a locality having a low pressure holder and distribution system, it is possible to introduce the pressure gas directly into the holder. In communities where gas is distributed at high pressures, the line pressure is reduced by an automatic governor so as to maintain the branch distribution mains at 5 to 15 points. In this type of system, the distribution pressure is carried into the consumers premises and then reduced to the usual 4″ to 6″ pressure with a house governor.

Some localities still engage in the practice of connecting the consumer's service to the distribution main, by using a service clamp or saddle with screwed joint. Here again it is felt that the elimination of the joint is desirable and at present many engineers weld the service pipe direct to the steel main. Of course where cast iron piping has been used for constructing the distribution system, it is impossible to use the welded joint.

Several methods of storage are provided on a high pressure system. Pressure tanks may be located at the compressor station or holders may be installed at other points in the system depending on load or demand factors. High pressure holders may be connected so as to "float on the line", or by the use of governors such holders may be permitted to fill up only at times when the line pressure is high, and discharge back into the line when pressure is low.

Pressure holders now coming into use, and familiarly seen in various parts of the country, are the spherical or the bullet shaped type designed to store gas at 30 to 75 lbs. pressure.

The engineer who plans the construction and operating procedure for a high pressure gas system is not hampered by any worn out traditions of the gas business. On the other hand, he is called upon to bring this knowledge and training into play on problems which have not caused any great concern heretofore. Present technique in high pressure work should suggest many problems to the engineer who asks, "Can it be done better, and how can it be improved?"

THE SHARP EYES OF ELECTRICITY

(Continued from page 281)

as commonplace a field as possible — the breakfast table. Nothing could be more prosaic than corn flakes. They must be nicely browned, but they must not be burned. The manufacturers of this breakfast food have to provide a trained force of workers to make observations and determine the quality of the product. There are limits in the ability of the human eye to accurately determine the color of the flakes. The photo-electric tube may be used to indicate this fact as the flakes emerge from the oven and automatically regulate the oven temperature accordingly.

It is a small step from corn flakes to coffee. At present coffee grading is done by hand. The unroasted beans are spread out on a slow moving cloth conveyor where the discolored ones are picked out by hand. On the average, a woman can sort from three to five 132-pound bags per day. A device has been developed by means of which, without human agency, the discolored beans are perceived, as it were, by the photo-electric tube and are automatically rejected.

In the photo-electric grading device shown in Figure 2, the beans are automatically placed on a rotating disc and spaced a short distance apart. At one point each bean passes beneath a beam of light and is observed by a photo-electric tube. A plunger is operated by the photo-electric tube when it perceives a change in the reflected light. The good beans have no effect on the tube since the surface of the disc is the same color.

We have seen how the patient efforts of physicists and research workers, have developed the photo-electric tube from a scientific novelty to a standarized, cheap and reliable commercial product. They have thus placed in the hands of industry a new tool of unsurpassing, almost miraculous, possibilities — a veritable electric eye.

MANUFACTURE OF PAPER FROM CORNSTALKS

(Continued from page 279)

pulp was used in the run which was made on a new 164 inch Beloit fourdrinier. About 58,000 lb. sheets along with some specialties and coatings were made in nine hours. Although the company considered the run to be an entire success and the paper satisfactory in every way, members of the printing industry seemed to think the paper slightly inferior in quality.

Cornstalk pulp as a material for the manufacture of paper has some valuable properties, but also has certain limitations. It is probable that a certain small percentage

can be used in the manufacture of the highest grade printing papers, and more in lower grade papers. Experts do not agree on just how large the percentage of substitution can be made without sacrificing quality. Technicians of the Cornstalk Products Co. think that as high as 75% can be used, while others who have had no special experience with the Dorner process seem assured that more than 20% cornstalk pulp will cause the paper to be quite unsatisfactory. In the manufacture of transparent paper this new pulp should be of considerable value. It also has a limited use in the manufacture of stiff cardboard.

Another development of the utilization of cornstalk is being tried out at Ames, Iowa. Experiments in making board from a disintegrated cornstalk pulp indicate that there are some possibilities in this line. Such a board would be thick and similar to some of the wall boards now on the market. The work so far has not been carried on sufficiently long to pass judgment on the possibilities of the cornstalk board paper.

Much publicity has been given to the development of cornstalk pulp. The estimates available indicate that the farmer will receive $3 to $5 per acre for his cornstalks. Obviously it is necessary in a new development of this kind to go into the problem slowly. The market for cornstalk pulp is as yet limited and undeveloped. Naturally it is not feasible that cornstalk pulp mills be established all over the country immediately. Such a development will be slow and only sufficient to meet the demands of the product.

UNDERPINNING THE MUTUAL LIFE INSURANCE BUILDING

(Continued from page 278)

this way economy of time as well as uninterrupted operation were assured when there was a heavy demand, such as the combination of a Pretest and the jacking of two or three cylinders in various pits under the footing. When a pier had been completely underpinned the cylinders were tested further in a group test. Three or four cylinders at a time were connected so that each received 80 tons when they were tested as a group. Under this test there was absolutely no further penetration of any of the 90 cylinders.

In completing the underpinning, a concrete mat was poured from a depth of 6 in. below the top of the lowest pile in a pit to 6 in. above the top of the highest. The cylinders under each pier were in this way tied together as a unit. About 24 hours later, 2 ft. by 3 ft. forms were built around the wedging beams, and each was then concreted. In the event of future investigation of the underpinning it will be a simple matter to identify the individual cylinders by this method. In between the concreted I-beams we backfilled with sand from the subway cut, compacting it with a jet of water.

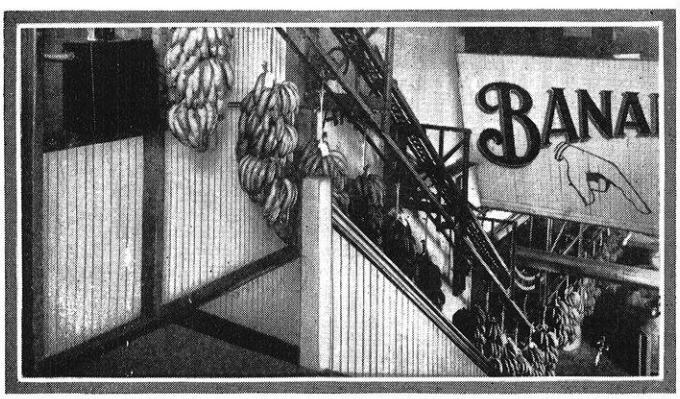
The maximum settlement in any pier was 7/16 in. The average settlement was ¼ in. Work was begun by Spencer, White and Prentis, Inc., on June 30 and completed November 17, 1929.

Food for Thought

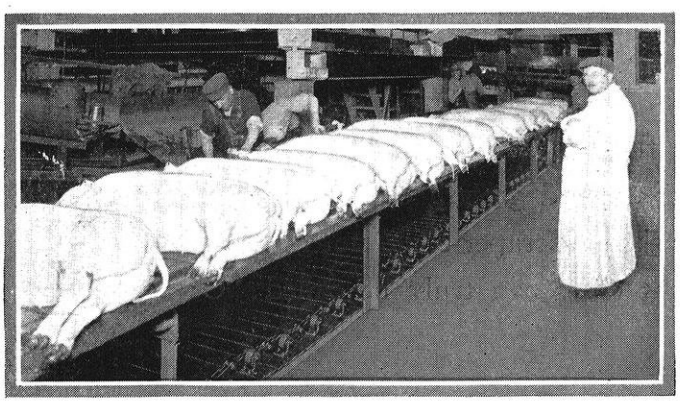
. . . . . and Food for the Multitudes

THE days when every good housewife baked her own bread, and grew her vegetables, and the family produced its own meat passed with the growth of our overwhelmingly urban population.

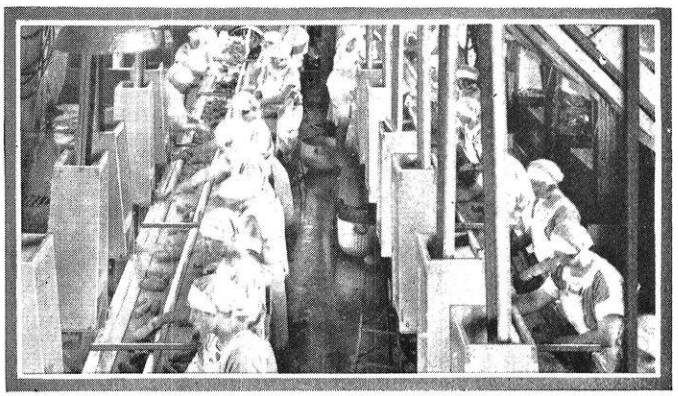
Today's teeming cities are largely dependent upon "manufactured" foodstuffs.



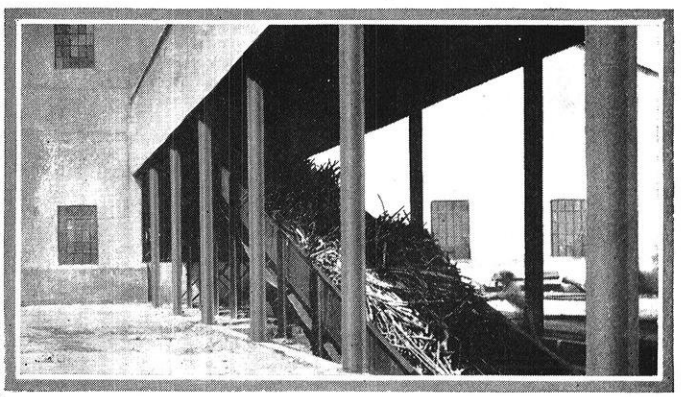
In a Banana Warehouse



In a Modern Packing Plant



In a Corn Canning Plant



In a Cuban Sugar Mill

This economical, large scale production of foodstuffs has been made possible largely by those engineers who have developed the Mechanical Handling Equipment needed.

In many branches of the food industry, Rex Conveyors, designed and built by the Chain Belt Company, are moving foodstuffs along in a continuous stream today. They save floor space; save time; eliminate much manual labor, and contribute generally to increased production and savings in plant operating costs, all of which bring food to the ultimate consumer at lower cost.

We will gladly furnish information on Rex Mechanical Handling Equipment as may be applied to the industry that interests you.

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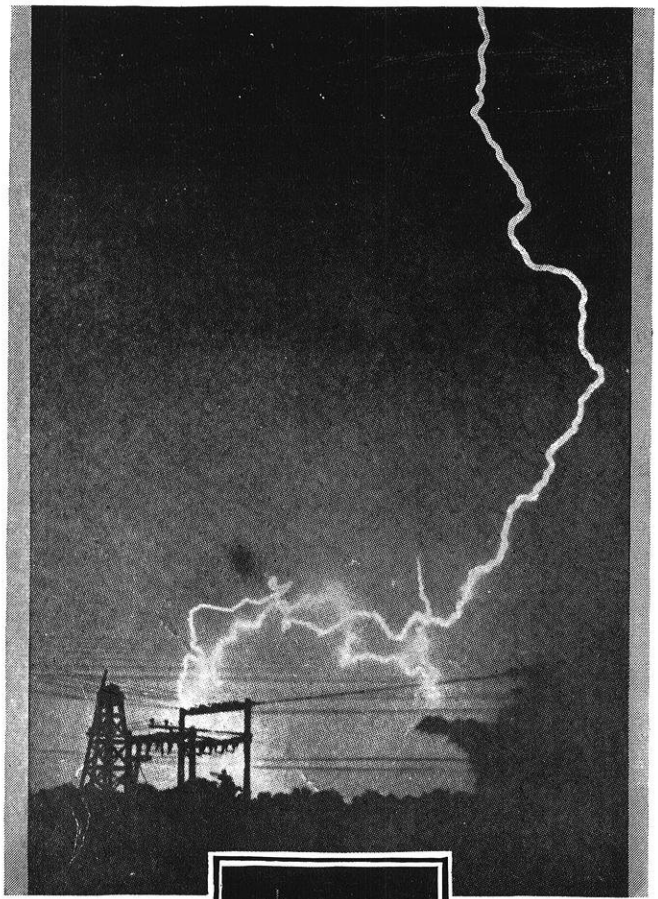
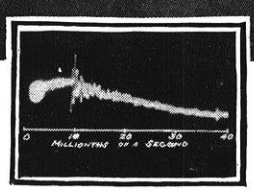
Man's hand upon the lightning



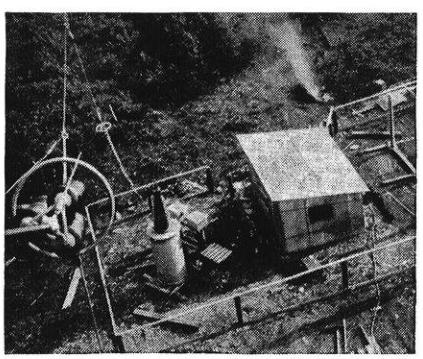


The cathode-ray oscillogram of the induced lightning surge

NOT yet is the lightning tamed. But the hand of science reaches forth. Already a way has been found to make the lightning write its own record of this destructive force measured in millions of horsepower, which is still the greatest enemy of high-voltage transmission lines.

One such record is reproduced on this page. It was taken on the lines of the Pennsylvania Power and Light System by a cathode-ray oscillograph—a high-speed camera developed in the General Electric laboratories. The surge that was recorded measured 2,500,000 volts; the record showed that the lightning lasted 40 millionths of a second. From such data and measurements ultimately comes control of natural forces.

There are unlimited opportunities such as this for fundamental research in the application of electricity. Literally beyond price is its ultimate value to the electrical industry and to the public. Here is a challenge to stir the imagination of any engineer.



The special field laboratory which was used for the epoch-making experiment

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