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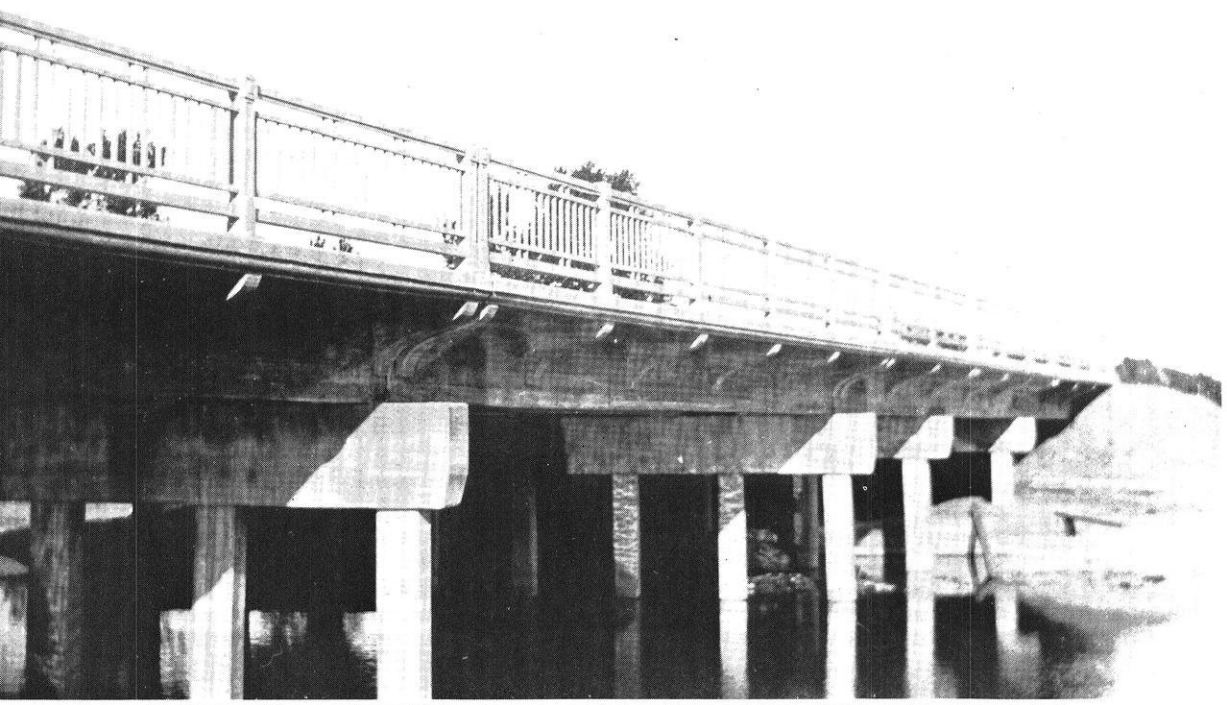
THE WISCONSIN ENGINEER

MEMBER E.C.M.A.



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The Wisconsin Engineer

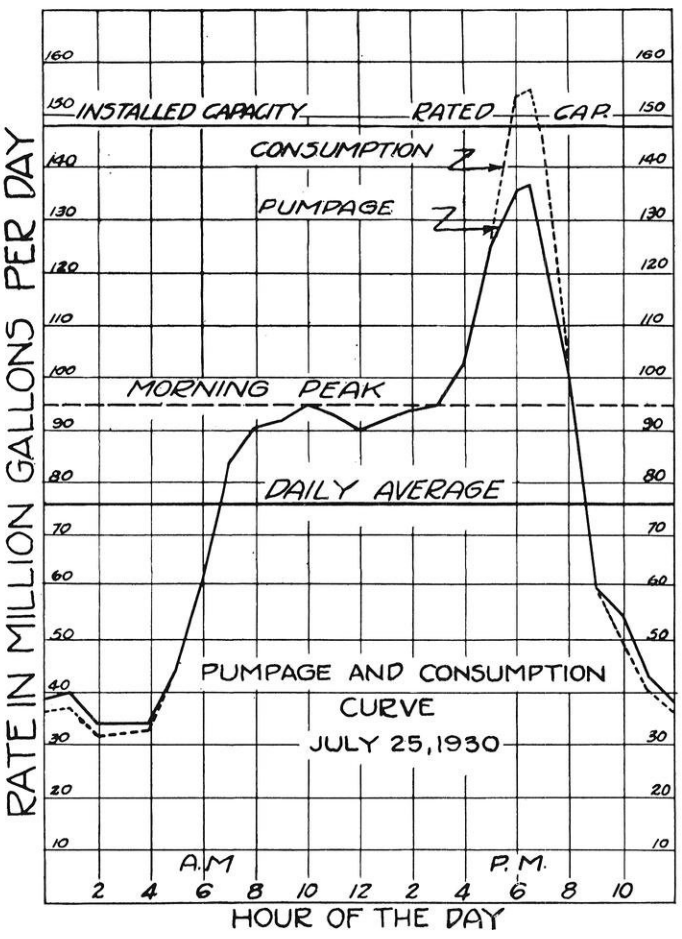
VOLUME 35, NO. 7 APRIL, 1931

Milwaukee Water Department

Finds Elevated Storage Economical*

By Edward F. Tanghe, Wis.'14
Engineer, Milwaukee Water Department

In the City of Milwaukee, a small area on the South Side, about 12 miles from the nearest pumping station, was experiencing poor pressure during the sprinkling peak. Studies were made under the direction of J. P. Schwada, city engineer, to determine how best to relieve this situation. The addition of another pump at one of the existing pumping stations would not solve the problem because of the pressure loss in the distribution system during the peak consumption demand. Enlarging the feeder main capacity to the poor pressure area would help, but the cost of a long line of pipe parallel to the existing feeder main would have been considerable. A new major pumping station will probably be needed eventually, but it was with the idea of postponing this large expenditure for tunnels, mains, and station, that elevated storage was considered. There is no elevation in or near the city suitable for a reservoir in the high service. This led to locating a site for an elevated tank near the existing feeder main. The tank was placed in a wooded park so that it would be partly hidden from view. It is fed directly by a 20-in. main, and in a somewhat round-about way by a 12-in. line. Recording pressure charts were obtained at the chosen site to help determine the height of tank to be built. A 1,500,000-gallon tank, 50 feet in depth, with overflow at elevation 255 feet above city datum, or about 175 feet above the ground, was chosen. The overflow was kept 22 feet below the static pressure elevation to insure the tank's filling over night. An automatic altitude valve prevents overflow by disconnecting the tank from the distribution system when proper level of water in tank is reached. This same valve, with the aid of a timing device, automatically places the tank on the line during the sprinkling peak.



The rate of consumption during the peak load is high and requires large pumping capacity if it is to be met by direct pumpage, but the actual amount of water used is relatively small and can be economically supplied by storage.

Storage Tank Solves the Problem

By operating the tank this way, the entire contents of the tank are used when needed most, namely, during the sprinkling peak. Recording pressure charts taken at the tank site are changed daily to obtain a record of the effects of storage, and also to make sure that the automatic devices were functioning properly at all times. On the peak-consumption day, the tank discharged water at a rate of about 18

*This paper was presented at the convention of the Engineering Society of Wisconsin on February 20, 1931, and will appear in the bulletin of that society.

m. g. d., the equivalent of a large pump. The pressures in the distribution system were boosted varying amounts depending upon the distances from the tank, and upon the rates of consumption for the entire city. In spite of the fact that the past summer was the driest in 36 years, no complaints were received because of poor water pressure.

The capacity of this tank is only about two per cent of the high service pumpage on a hot day. Studies were made to determine the feasibility of increasing this ratio of storage to pumpage. The highest point in the city is about 65 feet below the static head pumped against in the high service. This means that natural reservoir sites are not available. However, additional storage by means of tanks is being considered, and at the present time, the city is erecting a second elevated storage tank.

The graph represents the high-service pumping load curve for July 25, 1930, and is typical of the pumping curve on any hot day. From the low demand during the night, there is a rapid increase from 5 a. m to 7 a. m., culminating in a morning peak at about 10 a. m. After a slight recession around noon, there is another increase in demand reaching a peak at about 7 p. m. From this evening peak there is a decided and rapid falling off in the pumpage rate. To adjust the pumping to this irregular consumption demand requires the throttling, speeding up, putting on, and taking off of pumps, with a loss in efficiency due to the irregular operation of pumps.

An estimate was made to determine how and at what cost the evening peak in the high service could be eliminated. Using the records of the pumping rates since 1920, plotting these rates, and projecting the curves into the future, some idea was obtained of the probable consumption demands for the years up to 1950. The values obtained by this method are as follows:

Rates of Demand in Million Gallons per Day

	1940	1950
Peak Hour Consumption	250	360
Peak Morning Demand	152	208
Maximum Day's Pumpage	122	166
Yearly Average Daily Pumpage	73	100

Using the values obtained, and drawing curves similar to the 1930 consumption rate on the peak day, we obtain the approximate demand for water in the high service on the peak days in 1940 and 1950. These curves enable us to approximate the amount of active storage required to eliminate the evening peaks. These values in millions of gallons are about as follows:

1920—1, 1930—6, 1940—11, 1950—16

By adding a 60-m. g. d. pump at the pumping station and supplying 16 million gallons active storage, it would appear that the high service requirements could be met without the addition of another pumping station before 1950. Without elevated storage, it would probably be necessary to have another pumping station in operation in five or six years. The savings in interest, depreciation, and operating charges of storage over another station would in this case amount to about four and one-half million dollars.

In obtaining the probable future pumping requirements, the growth in rate of consumption for the last five or six years was used in extending the curves. This projection should give values, which, if anything, are larger than we may expect, since in this period the city has had a growth in area larger than that of the previous 70 years. It would not be necessary to install the entire storage capacity at one time, but rather as the requirements warrant.

Advantages Obtained From Storage

A few of the gains we hope to make by means of elevated storage are as follows:

1. Secure the more continuous operation of the large-capacity pumps.
2. Save interest and depreciation on a large investment necessary to build new pumping station, mains, and tunnels.
3. Reduce the high velocities in feeder mains during peak consumption hours.
4. Delay the building of a new intake by cutting down the peak pumping rate by about 33-1/3%.
5. Reduce large fluctuations in pressure by reducing the large fluctuations in velocities.
6. Increase the use factor of pumps — present use factor about 35%.
7. Reduce the capacity of filtration plant or of the storage required at the plant.
8. Permit more flexible plant installation. Additions can be made in comparatively small units.
9. Increase pressures in the outlying areas by placing the storage in these areas.
10. Use smaller feeder mains because the system will be fed from several points during peak demands.

Method of Pre-determining Rate of Filling for Various Heights and Sizes of Tanks

Recording pressure charts taken during hot weather will record the elevation to which water will rise during the night, and if the feeder main is of ample size, and the tank not too large, the overflow may be placed at the elevation indicated by the pressure chart. But if the tank is large, the feeder mains comparatively small, and the distance from the pumping station considerable, the overflow will probably have to be placed somewhere below the pressure elevation indicated by the pressure chart. Without a tank to fill, the distribution system rapidly regains pressure lost during the sprinkling peak, and this pressure may approach its high point or static in a comparatively short period of time. With a large tank to fill, the distribution system does not build up its pressure so rapidly, the rate of regaining pressure depending upon the capacity, depth and height of tank to be filled, and upon the amount of water consumption during the night. The overflow of the tank should not be placed higher than the pressure elevation to which the pressure in the feeder main returns with the tank being filled. In attempting to pre-determine this elevation with its corresponding rate of filling, a continuous 24-hour record of pressure and flow in the feeder mains leading to the proposed tank site should be taken on a hot day. The pressure should be obtained at the tank site, and the flow at a point which feeds the area. Thus a definite relation between pressure and flow is obtained. A pressure-velocity curve, drawn with the pressures (plus elevation head) expressed in feet plotted at ordinates, and the corresponding flows expressed in m. g. d. plotted as abscissas, represents the piezometer read-

(Continued on page 208)

A Review of the

Short Course for Plumbers

A Class of 44 attends Course from February 9 to 20

The plumbing industry is apparently on the verge of a fundamental change. There is an obvious need for a better basis for the plumbing codes of the various states and cities. Manufacturers of plumbing equipment have no more troublesome problems than those that arise from the great variations in the codes now in effect. The Department of Commerce, acting through the Bureau of Standards and in co-operation with a sub-committee representing various phases of the plumbing industry, has been engaged for several years in studying codes and in ascertaining the scientific basis underlying plumbing design. The report of the sub-committee on plumbing of the Building Code Committee, entitled "Recommended Minimum Requirements for Plumbing," 1929, is being adopted widely by practical plumbers. The industry is changing rapidly from a practical to a scientific basis.

A ten-day short course for plumbing instructors, inspectors, and master and foreman plumbers was given by the Department of Hydraulic and Sanitary Engineering, under the direction of Prof. F. M. Dawson, from Feb. 9 to 20. Forty-four men took the full course. In addition, about 60 extra men came on Feb. 18, and a number of smaller groups attended for one-day periods. The 44 regulars took the full course with the exception of two men who left two days early. A fee of $10 was charged for the full course and $1.50 for one-day attendance. This was intended to cover certain incidental expenses such as printing, stationery, and laboratory help. Instructors and lecturers donated their services.

The course was the result of numerous conferences and meetings between representatives of the university, the state, and the master plumbers' association. Frank King, state plumbing inspector, George Hambrecht, state director of vocational work, and Henry Pommerenck, plumbing instructor for the vocational schools in Southern Wisconsin were active in making the course attractive and successful.

The purpose of the course was three-fold: First, to explain the physics of the plumbing system in such a way that the principles would be understood by the practical plumbers. Second, to explain the reasons underlying the requirements of the plumbing codes. Third, to correlate the everyday work of the plumber with certain fundamental features in other branches.

In general the daily schedule of the course included three periods of one hour each in the morning, a laboratory period of two and one-half hours in the afternoon, and an evening lecture. The schedule was adhered to; the topics and speakers proved to be interesting, and the members of the class took their work seriously. It was frequently difficult to close the building at night because they wanted to stay around and discuss matters.

The class was divided into six groups of seven to eight men each. Every afternoon each group performed certain experiments. These experiments were rotated for six days so that each party went through six different groups of experiments. The instructor remained with the various experiments and repeated his work six times in succession. This was a little tough on the instructor but worked well in every other way.

As an example of the work attempted in the laboratory, the experimental plumbing set-up may be cited. This was prepared by Mr. Pommerenck and consisted of essentially five floors of a building with a great variety of possible connections and conditions. All set-ups were for experimental purposes only and no complete installation was attempted, the idea being to show what happens when certain changes and alterations are made. The back siphonage of a clogged toilet bowl through flush valve into the supply line was demonstrated, and methods were shown for preventing it. The difference between copper, wrought iron, and wrought steel, as well as galvanized steel pipes and fittings, were strikingly illustrated in other experiments. Brazing, welding, the use of stream line fittings, the friction loss in various types of valves, composed another series of experiments. Water hammer, its causes and relief, with the actual measurement by a recording device of the increasing pressure due to sudden closure of ordinary faucets and certain quick-acting valves were shown, and each student was given the opportunity to make his own test. Another set of experiments embodied the method of measuring water through orifices, venturi meters, and over weirs. One party each day spent all the afternoon on certain pump tests, the intent being to show everyone an actual test, and every student in the course took at least enough measurements to make him familiar with the instruments used. Naturally the time available did not permit giving detailed tests of all the mechanical devices but sufficient was done with a small party to give all a concise idea of the principles involved.

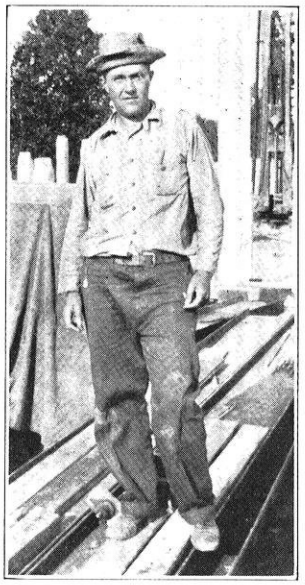
A group of about twenty specialists aside from the members of the department assisted by giving lectures. The members of the class appreciated these contacts and frequently expressed their pleasure in having the opportunity to hear the various lectures. Some of the lectures were of general nature not relating to the course and others were of direct interest to the plumbing industry. Whether they were of a technical nature or not appeared to make little difference. The men who attended received impressions and got ideas which will be of vital importance to them in their work.

A canvas of the members of the course showed that the opinion was unanimous that the course should be repeated next year. Opinions as to the proper length of course varied. It is probable that a six-day course, starting Monday morning and ending Saturday noon would attract a greater number of practical plumbers.

Several weeks have now elapsed since the completion of the course. The inquiries which have been received from manufacturers as well as from others engaged in plumbing, who were not at the course, are evidence that it was a success.

A Student Recounts His Experiences As

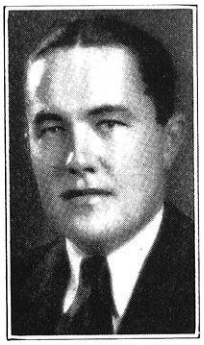
An Inspector on Bridge Construction



By LESLIE A. YOLTON, c'31

WHEN the construction engineer of the Wisconsin Highway Commission instructed the writer to act as inspector on the Interlake Bridge project over the Yahara River, in the summer of 1930, the boys in the office remarked, "Get out the ol' fish pole, Les." Of course, they knew well enough that if the inspection work was to be done thoroughly, there would be no time to waste; their kidding simply reflected the conventional idea that an inspector has little to do other than wear a white collar and look wise.

At the beginning of the work the contractor's pile foreman, who was about six feet two inches tall and weighed approximately 250 pounds, tried to smoke-out the inspector. One day he took occasion to describe how he dealt with inspectors with whom he had differences of opinion. The story was accepted without comment. When the concrete work began, it was obvious that the foreman was none too sure of himself. The contractor decided to sublet the driving of the concrete piles and the foreman was demoted to common laborer and quit the job. The contractor had also engaged a carpenter-foreman and a general superintendent. Each seemed to have about an equal amount of authority and they quarreled constantly. The inspector soon came to realize that he must be a diplomat in order to get work done properly.



LESLIE A. YOLTON

La Crosse, Wisconsin

This story of a student engineer's experiences as an inspector on construction is offered in the belief that it will interest our readers, many of whom are certain to find themselves, before long, in similar positions, where their inexperience in practical construction and in dealing with men will cause them many anxious moments. A foreknowledge of some of the inspector's problems should increase their confidence.

It is generally the consensus among young graduate engineers that common laborers are an ignorant class, but in contact with laborers, one will find that they are well-informed about some things. For example, through continued experiences some know construction details; by travelling about, others gain knowledge regarding different sections of the country; a few read good books; and many are up-to-date on politics. Of course, it is to be noted that these laborers are not the class known as road "skinners," who are lazy and content with their lot. Many of the better class of common laborers are intelligent and ambitious, though they lack special training and have not ordered their lives successfully. Of course they understand practically nothing of design and know little about strength of materials or the laws of mechanics, but they do have a knowledge of such things as the amount of support required by the false-work in concrete construction and how much camber should be given long beams in order that the beams will not sag after the load is placed.

College boys who go out to their jobs with the idea that they can tell contractor, foremen, or laborers a thing or two are not long in finding out that the foremen and some of the laborers who have worked at construction a greater part of their lives are familiar with more phases of construction than is the beginning engineer.

The Interlake bridge, which was designed by the Wisconsin Highway bridge department, is of reinforced concrete supported on pre-cast concrete piles. It was the first bridge with pre-cast concrete piles to be constructed by the Highway Commission in this locality, although two others were under construction in other parts of the State. The piles were constructed on the job.

The piles were 16 by 16 inches and were required to have at least ten feet of penetration in solid material and a bearing capacity of forty tons. In order to determine the proper length to make the piles, eight wooden test piles were driven. They were driven near where the concrete piles would be driven, so that the data would be reasonably representative, yet in such a position that they would not interfere with the future work. From the data obtained, it was determined that concrete piles were to be cast in lengths of 35 and 50 feet. The contractor, on his own initiative, constructed two extra piles to prevent delays in case any were broken in handling or driving.

The piles were of 1:2:2½ concrete, with four 1⅛-inch, square, deformed steel bars, wound with ¼-inch wire embedded in the concrete to strengthen the piles for handling. The concrete was kept as dry as possible without becoming unworkable. This required a continual check-up

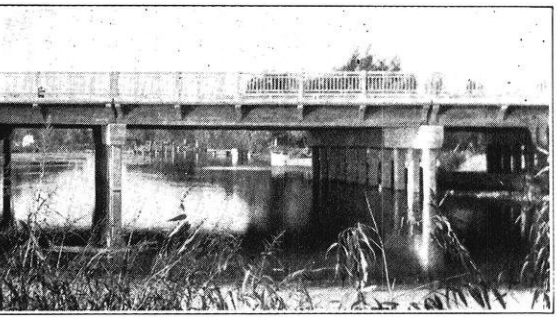
on the part of the inspector, inasmuch as the contractor was trying to get along with as few men as possible. The mixer operator had to be reminded frequently regarding changes in the moisture content of the sand and aggregate. Changes in moisture content are especially noticeable on a job of this size where the stock pile is small and fresh supplies of material are constantly arriving. The men who did the puddling and worked the concrete into the forms had to be continually awakened to the fact that they had forgotten some corner here or there.

It was discovered, in staking out the bents, that one was located diagonally across an old concrete lock in the river. It was impossible to drive the piles through the concrete. The matter was referred to the construction engineer, who informed the inspector that it was just one of those details which he would have to work out in the field. It was decided that the locks should be removed by the contractor for cost plus a reasonable profit and that both the inspector and the contractor would keep tab on the costs. This was done by keeping account of the time and wages of the men engaged in this special work.

The driving of the seven-ton, pre-cast concrete piles was sublet to a firm that made a specialty of pile driving, but it was their first experience with pre-cast concrete piles. Throughout the job, the foreman and the inspector experimented and bluffed along, both admitting at the finish that they had learned a good deal on the job.

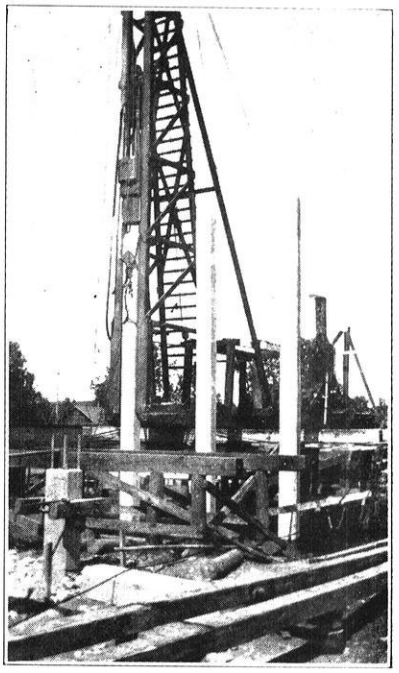
Black bands were painted on the piles at the fifth-points from the ends to indicate where they should be picked up or supported while being moved. The placing of the pick-up points at these positions gave approximately equal positive and negative movements, and therefore an equal distribution of stress during the handling. In one instance a pile was being jacked up at only one pick-up point leaving the other end bearing into the ground. The inspector noted that there were cracks in the concrete on the lower side, which was in tension. This was called to the attention of the foreman who blamed the two helpless laborers for attempting to raise the pile alone when four men were required, over-looking the fact that he had instructed but two men to do the task. The pile was discarded.

After a pile had been lifted into the leads and lowered to the ground, it would settle under its own weight two or three feet. The pile was checked for centering by means of horizontal cords placed in two directions and off-set ten inches in each of the two directions from the center. This placed the strings two inches from the edge of the pile. These cords acted as reference lines, and with a ruler it was an easy matter to check the centering. The pile had to be picked up and lowered several times to get it started in the correct position, the tolerance being two inches. It was necessary also to check for plumb, which was done with a three-foot carpenter's level. The tolerance was one-quarter inch per foot out of plumb.



Interlake Bridge over the Yahara River on Highway 12.

The piles were driven with a single-acting steam hammer working at fifty-five blows per minute, with a stroke of 3.5 feet. Between the concrete pile and the hammer, there was a follower cap containing a four-inch soft-wood block, a twelve-inch coil of rope, and a four-inch hard-wood block. Besides the steam hammer, a 1⅛-inch water jet was used under a pressure of 150 pounds per square inch. The soil in the Yahara River was clay for the first few feet, and as the depth increased there were layers of sand, gravel, and sandrock. Large boulders were encountered throughout.



The 7-ton piles were spotted within a 2-inch tolerance.

After the pile had been driven to a depth of about six feet below the surface of the ground, the jet was applied. The water was supplied by a separate steam engine attached to a double-acting reciprocating pump. The jet pipe consisted of a 2½-inch pipe, thirty-six feet long, with a 1⅛-inch nozzle. Because of its weight, it was operated by a rope and a pulley over the top of the leads and down to the nigger-head of the hoist. The jet was used to loosen the earth around the pile and to help guide it. If too much jetting was done on one side of a pile, there was danger of the pile shifting in that direction. In some spots it was impossible to get the jet deeper than fifteen feet below the surface because boulders or other hard materials were encountered. The ideal soil for jetting is sand. Whenever the jet broke through a layer of gravel, care was taken not to lift and drop the jet pipe in a pounding manner more than a few inches, because, if it were raised too high, gravel and boulders would drop down into its path and clog the way. When the jet encountered a layer of hard material, such as a layer of gravel, twisting the pipe was more effective than any other method in forcing the jet down. The jet was effective in

(Continued on page 206)

Some Uses of The Diesel Engine in the Power Station

By W. H. TEARE, e'31

THOUGH internal combustion engines were among the first prime movers to be used for driving dynamos, and though they have had their share of technical improvement since that time, the extent to which they are now used in power stations is trifling. It amounts to only some one per cent of the total. The small use of Diesel engines in particular is conspicuous because of the remarkable progress of this type of engine in the marine engineering field. Whatever part internal combustion engines may be destined ultimately to play in the extension of electric power, and however far they are from having been shown to be the primary equipment of great power stations, they have possible applications which seem to deserve more attention than they have received.

WILLIAM H. TEARE
Menominee,
Wisconsin

This paper was prepared for the course in the preparation and presentation of technical papers that is conducted by Prof. C. M. Jansky. It offers some suggestions upon the ever-interesting subject of power that seem well worth presenting to the readers of this magazine.

Probably the most important use of the Diesel is that of an auxiliary to both steam and hydroelectric central stations. Due to its limitations in size the Diesel will never be a competitor of the largest steam turbines, but it can be advantageously used in an auxiliary capacity as follows:

1. By carrying normal peaks, permitting steam equipment to be operated at the most favorable constant loads with highest efficiency.
2. For emergency peaks.
3. As standby and reserve to high-lines.
4. Hydroelectric auxiliary.

Self-contained, with a minimum of piping and auxiliary equipment, and using easily handled and stored fuel, the large Diesel generating unit forms a very desirable 10 or 20 per cent of the capacity of steam turbine generating stations. Peak loads, bugbear of the central station efficiency operator, are easily handled by the Diesel. However loads may be levelled, there will always be peaks. They may be of short duration, but they must be provided for either by firing additional boilers and warming up additional turbine capacity, or by operating the remainder of the day at less than the maximum efficiency of both. The Diesel, however, is simple to start and is capable of delivering full output within a few minutes time. It is reported that the three unit, 10,000 hp. plant installed in connection with the Panama Canal, carried full load 32 seconds after the engines were started.

Aside from the normal daily peak loads, there are occasional unexpected fluctuations in the load curve, especially in large cities, such as might be caused by a bright day becoming suddenly cloudy. Upon such an occasion, large lighting demand, seldom felt during daylight hours, comes on quickly. For such loads, and for breakdown emergencies, the separate, self-contained Diesel serves excellently.

The third use of Diesel equipment is as a standby and reserve for high-tension power lines. The Eastern superpower systems are closely tied in with comparatively short distances between large generating stations. This is not the case in the West. The high-tension lines here are longer and supply smaller and more widely separated communities. Furthermore, the western part of the country is more subject to wind and sleet storms, which cause damage to high-tension distribution lines often requiring days to repair. Service must be continued, inasmuch as the support of these small municipalities as customers is almost a necessity for the proper electrical development of the western part of our country. Industrial power demands are less in the East, and their growth is at a lesser rate. Eastern holding companies which have extended their operation to the Middle West have found that it is extremely difficult to appease the complaints of disgruntled small-town citizens about interruptions of high-line service. The answer to this problem is to install part of the capacity of the system in Diesel generating units placed at important feeder points and used for constant operation, where the cost of Diesel fuel favors, the surplus capacity being held in readiness in the distant steam-turbine station for emergencies. If, however, the cost of steam generation is lower, the Diesel could be used to supply service during interruptions and to carry peak loads.

This system of installing Diesels at outlying points on high-lines has other advantages. Overloaded high-lines need not be replaced with distribution systems of greater capacity. Diesel generating plants can be installed where new properties are being developed far from any existing transmission

line, and where the loads do not justify the immediate extension of a high-line. The rates of the parent station may in all probability be maintained for the customers of the Diesel plant. Even where steam fuel can be obtained at a more favorable cost, the Diesel generating station will produce power at costs comparable with large turbine installation.

Replacement of antiquated steam equipment may be deferred by the installation of more generating units utilizing Diesel engines as prime movers, the obsolete equipment being held as reserve capacity.

Another field for the Diesel engine is its use as a hydroelectric auxiliary plant. When the water flow is a minimum the Diesel may be operated with minimum attendance. A single attendant can start even quite a large engine to carry occasional loads, and for more sustained seasonal operating, additional personnel can be supplied as required. Depreciation of equipment is practically nil when the plant is not operating, in contrast to the heavy depreciation of idle steam equipment. The Diesel uses fuel which may be safely stored for long periods without danger of spontaneous combustion or depreciation from weathering. The fuel may be delivered to the hydroelectric power house by means of a gravity pipe line. The life of a Diesel operating as a standby auxiliary is almost indefinite; the working parts are bathed in oil and are not subject to rusting or deterioration.

Where water storage capacity is sufficient, and where peak loads exceed the capacity of a hydroelectric plant, the Diesel auxiliary may be operated as a hydraulic accumulator. That is, during the light load periods of the day it could be used to pump water back over the dam.

Extensive studies have been made many times, during the past ten years, of the advantages of large Diesel-hydroelectric auxiliary plants. Each time the lack of actual installations of large Diesels has introduced an experimental hazard which, for so large an investment, has prevented consummation of such plans. This hazard has now been eliminated, to an extent, by the extensive building of large marine plants. Engineers in charge of super-power development will, no doubt, profit by the experiences of these builders.

The main advantage of the Diesel engine as compared to the steam plant, is its high thermal efficiency. It is obvious, however, that a steam plant of half the terminal efficiency of the Diesel can produce power at lower fuel costs provided that the cost of coal is low enough. As a general statement, the United States is a country of cheap coal. Because the greatest industrial developments centered around the coal mines of the East, the great power-plant engineering problems have been worked out without any consideration of the Diesel whatsoever. Diesel power cannot compete with steam generation under these circumstances. The cost of the liquid fuel delivered may be many times the cost of the fuel at the oil field because of the transportation charges.

But this is a country of vast area, and there are large sections remote from coal mines and within easy reach of oil fields. This is especially true of the Middle West and the seaboard states inasmuch as oil may be brought to the latter at low costs in ocean-going tank ships. These are decidedly examples of Diesel territory.

Also, industry is moving westward with the center of population, and the demand for power throughout the West is growing with the increase of population. This favors the more general adoption of the large Diesel.

It has been estimated that at least half of the fuel oil now burned under the boilers of public utility power plants could be saved were it to be burned in Diesel engines. Average fuel consumption per kilowatt hour in large modern steam plants is generally about 1.2 lbs. of fuel oil as compared with about 0.6 lb. burned in large Diesel engines. Varying load conditions, and different types of equipment will change these figures, but they are approximately correct.

The next question to consider is whether this saving of fuel oil would be dissipated by fixed charges on higher Diesel plant costs or higher Diesel operating costs. Though steam plant costs are generally known, such information is not available on large Diesel plants due to lack of actual installations. Because the market has not been established, the prices quoted on large Diesels in advance of installation are very unstable.

However, basing costs on the actual selling price of the few large Diesels which have been sold, it is found that the cost of a large Diesel generating station is about that of a modern steam plant. In some cases the Diesel installation may cost less, depending on the availability of condensing water for the steam plant. The total cost of a large Diesel generating station will probably amount to about $135 per kilowatt of installed capacity. For average conditions, this may be made up as follows:

Estimate of Cost of a Four-Unit, 15,000 B. Hp., 10,000 Kilowatt Diesel Installation *

Real Estate	$ 10,000
Building, including 21-ton crane	75,000
Foundations	40,000
Four 3750 b. hp. Diesel engines, f. o. b. point of manufacture	900,000
Freight on engines at $1 per cwt.	40,000
Generators and exciters, direct-driven	100,000
Freight on generators and exciters	5,000
Unloading and placing foundations	15,000
Erection	15,000
Station piping	15,000
Cooling-water system (if required)	25,000
Fuel storage	10,000
Switchboard and wiring	20,000
Miscellaneous, contingencies and engineering	80,000
Total	$1,350,000

Diesel station cost per kilowatt of installed capacity $135

The installation of the Diesel equipment is extremely simple; about half the floor space necessary for turbine installations is required, the building may be somewhat lower, and smokestacks or coal and ash handling equipment are unnecessary.

(Continued on page 212)

*Figures given by Edward B. Pollister of Busch-Sulzer Bros. Diesel Engine Co., in Vol. 50, No. 21 of the Oil and Gas Power Transactions of the A. S. M. E.

Editorials

ASSUMING THAT YOU ARE INTERESTED

Our five women engineering students made the front page on March 1. M. Jeanne Glab, Margaret Donnelly, and Margaret Bardelson are freshmen in chemical engineering, Louise Bebb, whose dad was the first editor of this magazine, is a sophomore in civil engineering, and Rosalind Moore is a junior in electrical engineering. As one of the girls succinctly remarked: "At first the boys thought it a joke, but we are still here and some of the boys are not."

* * * *

Two independent elevator cages are being operated in a single shaft in a new building at Pittsburgh. They are operated under a block system much as a single track railway might use. The big idea is to reduce non-revenue-producing floorspace.

* * * *

The demoralized coal industry of the world may have something to look forward to. Its problems, according to President Baker of Carnegie Institute, can be solved through research that leads to the extraction of all the products that come out of crude coal, so that there will be no further use for the raw product. This will demand a control of production and a high degree of co-ordination in the industry.

* * * *

It is estimated by the Associated General Contractors that there are 200,000 convicts employed in public construction work at present. Feeling that convict labor is beating down wage rates and depriving free labor of employment, the AGC suggests that convicts be kept busy in such work as reforestation.

* * * *

Canberra, Australia's hand-made capital city, may once more return to its original condition of sheep pasture if the urgings of many leading public men are heeded. This out-standing example of city planning is proving to be costly and inconvenient because of its isolated location and the scattering of its present buildings over a large area. One literally walks a mile for whatever he wants.

* * * *

The Watsongraph, a device whereby radiograms are received in typewritten form, was demonstrated in Detroit before federal representatives late in February.

REGISTRATION AND EDUCATION

Legislation designed to raise the educational requirements for registration in New York State received indorsement at the February meeting of the New York Society of Professional Engineers. It is a natural step in the evolution of the profession. Once the profession becomes organized so that it can control qualifications for membership, it may be expected that those qualifications will be raised from time to time as the conditions warrant. Not only will qualifications for registration be raised until a technical education becomes a standard requirement, but the technical schools themselves will feel the effect of a strengthening of the professional status. Many educators and engineers now feel that four years is too short a time in which to acquire the essentials of an engineering education, but their efforts to increase the length of the standard course have failed. Their hope of success lies in the integration of engineers into a professional group. Registration seems to offer the most effective method of securing that integration.

"From the time the universities undertook the training of engineers, they became vastly more useful institutions."
—Sir Arthur Currie, McGill University.

THEY NEED A WEEK STRETCHER

According to a statement by the Dean those departments which have been shown by the recent survey to be excessive in their demands on student time will immediately modify their requirements. However, the modification has not yet been manifested to the junior mechanicals. Their life is a series of lab courses, cuts, and reports, with little spare time for breathing.

A man finds himself behind in E E and in order that he avoid being embarrassed at the next meeting of the class, he cuts a three-hour lab in machine design and does E E. This leaves him a day behind in machine design, so, in order to catch the class in machine design, he hits on the idea of cutting a steam and gas class. Being now even in machine design, he finds that he is a class behind in steam and gas with another class in E E approaching. The student gets reckless, and cuts a whole day of classes, burning the well-known oil far into the night. Dawn finds him weak, but somewhat caught up in his work. At least he has caught up to where he left off, but in the day that he has cut, doles have proceeded at prodigious rate, and the next attendance at the cut classes shows that it will require several nights, and the best parts of a class day or two to make things even again. This proceeds at great rate throughout the semester, and by the time the balmy days of May with their inherent distractions come along, our searcher of knowledge has become hopelessly mired in a slough of cut classes and back work, so that he will still be cutting classes next fall to catch up in the work he missed during the spring semester.

The lumbermen tell the tale of Paul Bunyan and his device for solving such difficulties. When Paul got pushed

for time he would dig out his week stretcher and stretch the seven days into fourteen. The junior mechanicals might do well to institute a search for this famous device, since it offers their only means of salvation.

"Woe to him who teaches men faster than they can learn!"—Socrates.

EMPLOYMENT STABILIZATION

The Prosperity Reserve bill which has been supported by the engineering profession for many years was made public law on February 10 under the official name of the Employment Stabilization Act of 1931. The new law creates the Federal Employment Stabilization Board whose duty it is to advise the President of the trend of employment and business activity, and to warn him of the existence or approach of periods of depression or unemployment in the country. Whenever the President finds that a depression or unemployment exists or is apt to exist within the following six months, he is to transmit to Congress estimates for appropriations to be spent on government construction in the affected area. By this plan it is expected that the government can avail itself of economical construction and at the same time assist in warding off depression. The appropriations will be spent for such works as river and harbor maintenance, flood control, or any other project authorized by Congress. Each head of a department having jurisdiction over one or more of the government construction agencies is to prepare a six year advance plan with estimates showing the projects allotted to each year, and he shall be ready to commence and carry out an expanded program at any time. The six year plan is to be kept up to date by anual revision.

The law with its aim to avoid periods of depression is of particular interest at present due to the fact that the whole country is either in the midst of a depression or is just starting a convalescence from a national depression of a serious nature. The feature of advance planning which has been incorporated into the new law bears a more rational aspect than did the recent frenzied outburst of proposed construction in this state, and should find more support in the profession. There are those economists who argue that the business cycle is unavoidable, and that plans such as this are useless. It will be interesting to watch the functioning of the Board in the future.

"More and more has science become the basis of intellectual advancement, and culture may come out of the proper teaching of drawing, descriptive geometry, mechanics, and thermodynamics, and in fact all subjects in the engineering curriculum."—R. I. Rees, A. T. & T. Co.

WE MAY BITE ONCE

Recently in econ 1-a the fair lecturer announced to the class that they would be expected to prepare problem 15 page 24 by the next class period. The engineers, who have been taught by bitter experience in the engineering college that such assignments are to be given proper treatment, devoted a portion of their precious 52 hours a week to the solution of the problem. Imagine, then, the chagrin which they experienced the following class period when the instructor gave no notice to the problem aside from the remark that if it had been worked it was time well spent in practice. Engineers may be only engineers, but as the old saying goes, "No foolem injun twice," and when the next problem is announced — well, write your own ticket.

"The outstanding problem and the ideal of our economic system is to secure freedom of initiative and to preserve stability in the economic structure in order that the door of opportunity be open to all citizens; that every business man shall go about his affairs with confidence in the future; that it shall give assurance to our people of a job for everyone who wishes to work; that it shall, by steady improvement through research and invention, advance standards of living to the whole of our people."

—Herbert Hoover.

TEACHER'S UNION LOCAL NO. 211

A news item recently announced that the faculty members of the university, largely from the economics department, had formed a Madison local of the Teacher's Union affiliated with the A. F. of L., the purpose of which is to prevent the exploitation of graduate students by the university, to protect the academic rights of free speech among the faculty members, and to promote legislation in the interests of the working classes.

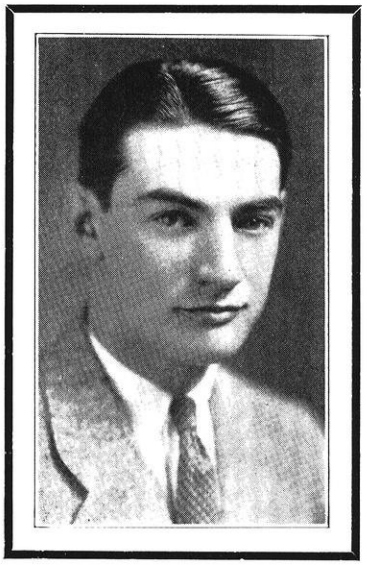
The chief object of unionism is that of collective bargaining with capital, and unions have been ready to adopt extra-legal means of gaining their ends, a tendency which has put them under gang domination in Chicago. As a rule unions are opposed to governmental agencies such as courts and law-enforcement agencies.

The faculty members are employees of the government, and as such are not subject to exploitation by capital. The exploitation of graduate students claimed by members of the union is an evil which is due to economic pressure, and it rests upon the legislature which fixes the funds available for university use. The question is one of more money or fewer students, and a union would be rather powerless in combatting the situation. The academic right of free speech desired by the union does not exist anywhere. A wise man realizes that no public speaker can go beyond the limits of tolerance of his public without running into trouble.

The action offers interest, but its appeal to possible members is doubtful.

The power of a man increases steadily by continuance in one direction. He becomes acquainted with the restances and with his own tools; increases his skill and strength and learns the favorable moments and favorable accidents. He is his own apprentice, and more time gives a great addition of power, just as a falling body acquires momentum with every foot of fall.—Emerson.

Alumni Notes



Tablet Commemorates Robert Powell

The pride of a state is in its men and the pride of an engineer is in his work. Robert Powell went out from Wisconsin and in the sister state of South Carolina devoted himself to bearing a part in the design and construction of a great dam. Before the work was completed he lost his life, but, in spite of his youth and the immensity of the project, he had impressed himself so strongly upon the work that he won an unusual tribute: his associates chose a great granite boulder, that stands at the site of the dam, and placed upon it a tablet inscribed to him and his work. It is a tribute that touches deeply his friends of the college and of the state.

The Inscription

IN MEMORY OF
ROBERT BRUETTE POWELL
WHOSE PROMISING CAREER CAME TO AN END BEFORE THE COMPLETION OF THE DEVELOPMENT. AS A MEMBER OF THE STAFF OF MURRAY AND FLOOD, ENGINEERS FOR THE PROJECT, HIS OUTSTANDING WORK WAS THE SUPERVISION OF THE CONSTRUCTION OF THE PENSTOCK BENEATH THE DAM AND THE INTAKE TOWERS RISING FROM THE LAKE. THIS TABLET IS PLACED AS A TOKEN OF THE AFFECTION AND ESTEEM IN WHICH HE WAS HELD BY HIS ASSOCIATES.
BORN MAY 23, 1900
DIED MARCH 11, 1929

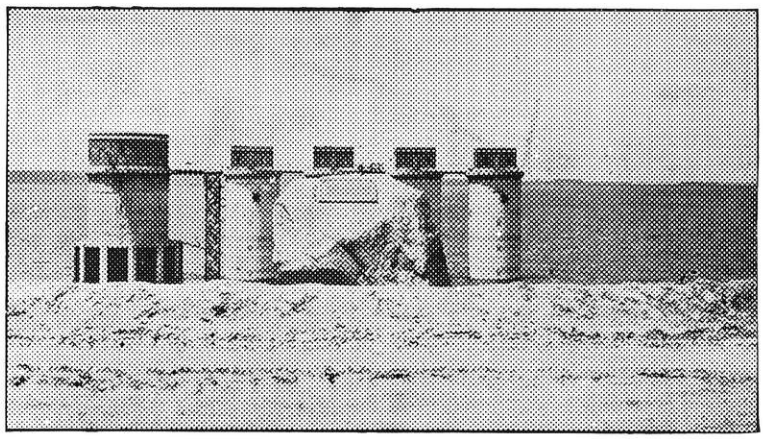
Robert Bruette Powell, son of Frank J. Powell, dentist, was born in Fort Atkinson, Wis. The family moved to Wausau, from which place Robert entered the university. He was graduated from the course in civil engineering in February, 1923. During his college years he spent the summer vacations on various engineering projects. From June to September, 1920, he was instrumentman on dam construction for the Wisconsin Valley Electric Co. of Wausau. During the summers of 1921 and 1922 he made surveys on the Spirit River for the Wisconsin Valley Improvement Co.

Following his graduation, Powell was engaged on surveys for a dam on the Chippewa River until May when he joined the staff of the Dixie Construction Company of the Alabama Power Company. For nine months he served as chief of party on the location of transmission lines and on basin surveys.

In April, 1924, Powell became designer in the hydraulic division of the Electric Bond and Share Company of New York. During his three years with this company he gained experience in a great variety of work. He left this position to join the staff of Murray and Flood, engineers, of New York City, and was sent to Columbia, S. C., to take part in the preliminary studies for the Saluda River hydroelectric development.

The Saluda dam, which lies ten miles west of Columbia, is said to be the largest high earth dam in the world. It is 7838 feet long, 208 feet high, and contains eleven million yards of fill. It creates Lake Murray, which is 40 miles long by 14 miles wide and has a shore line of 520 miles. The dam was completed July 1, 1930.

When construction began, Powell was promoted to the position of supervising structural engineer, his main assignment being the supervision of the erection of the penstocks and the intakes. These structures were practically completed before his sudden death in an automobile accident on March 11, 1929.



Memorial Tablet to Robert Bruette Powell.

The men who worked with him describe for us the Robert Powell they knew on the job. One states, "I never worked with one more sincere, more exacting, and more

faithful to any trust." T. C. Williams, vice president of the Lexington Water Power Company, owners of the Saluda development, says, "He had such a pleasing personality and was so well liked by every one. I was especially impressed by his cheerful willingness to work just as many hours as necessary, and when there was a peak load he was always ready to go the limit."

A. R. Wellwood, resident engineer for Murray and Flood and Powell's immediate superior, says, "I feel that I have lost a friend as well as a valued co-worker. He had a very bright engineering mind, and I considered him an A-1 engineer. He was due to go a long way in his chosen field. He had been entrusted with very important features of the construction of the Saluda Dam and had done efficiently each task assigned."

BERT PECK GETS NEW UTILITY JOB

Washington dispatches dated Feb. 26 carried the following item about **Bert H. Peck,** e'06, EE'16:

"Bert H. Peck, Madison engineer who came here last August to revalue Washington public utilities properties for the public utilities commission, has resigned his $5,600 job as chief engineer of the commission to take a $7,500 job with the Washington Gas and Light Company.

"Recent reorganization of the gas company here, accompanied by a supposed reduction of rates, resulted in higher gas bills and the consumers complained mightily. Peck made a report showing that the abnormally high pressure put into effect caused the higher gas bills.

"His new job is to be that of assistant to the president of the gas company, a post he will assume Monday."

CHEMICALS

Houghland, Glen S., ch'17, is chemical engineer with the M. W. Kellogg Co., New York City. Address: 399 Lincoln Ave., Orange, N. J.

Suhm, Clarence F., ch'21, who is with the Cream City Chemical Works at Milwaukee writes that he has a daughter, Evangeline Rae, a year old. Address: 1946 S. Kinnickinnic Ave.

MECHANICALS

Johnson, Lloyd M., m'23, mechanical engineer with the Sanitary District of Chicago, has invented an automatic screen cleaner.

Kratsch, A. E., m'29, is on the engineering staff of the Kimberly-Clark Corp. Address: 895 S. Commercial St., Neenah, Wis.

Kraut, Ralph J., m'30, after a tour around the world following his graduation, is with the research department of the A. O. Smith Corp. of Milwaukee.

Mantonya, William G., m'19, writes: "Am keeping myself busy these days doing my bit to build a subway for Chicago. We have completed all of the preliminary work necessary for the court proceedings, and expect to start construction in the spring."

Porth, Walter H., m'23, is sales engineer for the Bucyrus-Erie Co. with headquarters in Argentina and Brazil.

Pulaski, Steve, m'26, is assistant superintendent of the Forsythe Leather Co. at Wauwatosa. Address: 202 Avon Court.

Risteen, Horace W., m'24, is engineer with the Comet Engine Corp. of Madison.

Slezak, John, m'23, writes that he has just resigned his job with the Western Electric Company to become works manager of the Turner Brass Works, Sycamore, Ill.

Stewart, Frederick C., m'23, professor of mechanical engineering and in charge of the mechanical laboratories at Penn State College, has recently published the results of research into the heat transfer in vertical surfaces in connection with refrigerating engineering.

Vilter, E. F., m'27, is acting as secretary of the Haren Manufacturing Co. of Milwaukee. Address: 2618 N. Summit Ave., Milwaukee, Wisconsin.

MINERS

Knoll, W. A., min'14, M. S.'22, has been appointed general superintendent of the Gobegic and Marquette iron ranges in Michigan for the Pickards, Mather & Co., Ironwood, Michigan.

Roden, P. S., min'30, and **R. S. Bemis,** min'29, are both junior mining engineers of the Braden Copper Co., Rancagua, Chile. They write that they are enjoying the work.

ELECTRICALS

Barland, George C., e'22, M. S.'26, announces his change of address to 2717 Greenwich St., San Francisco, California. He is interested in the construction of the East Bay Bridge from San Francisco to Oakland. This bridge will be built by the state of California at the cost of seventy-two millions of dollars.

Johnson, J. Frank, e'16, is vice president and general manager of the Oildraulic Lift Co. of Memphis, Tenn. Address: 904 N. Belvedere Blvd.

Lee, Harold R., e'22, is with the Mound City Electrical Engineering Co. of St. Louis. Address: 1436 Park Ave., Pekin, Ill.

Magdsick, H. H., e'10, executive engineer, Nela Park Engineering Dept., General Electric Co., Cleveland, spoke on "Building Prosperity Avenue" before the Engineers' Society of Milwaukee on March 18.

Seielstad, Harold D., e'30, is with the Cadillac Motor Car Company, at Detroit, as draftsman. His residence is 1336 Lakepointe Avenue. After having had some experience with Michigan registration of engineers he states: "After some thought I realized that the registration of engineers is a good thing and I hope that Wisconsin soon has a similar system."

Wolfe, Harry C., e'26, former editor of the "Wisconsin Engineer," announces the arrival of a third daughter, Alice Ann, on October 29. He is general manager for the United States Chromium Corporation.

CIVILS

Allen, Andrews, c'91, member of the firm of Allen and Garcia, consulting engineers of Chicago, died suddenly on March 21 at Jaspar, Ala., while on a business trip. He was an authority on coal mining and his company has agents in Russia assisting with the Soviet five-year plan. He is survived by his wife and four children.

Ballam, Horace V., c'25, is superintendent and engineer for the Rapids Construction Company, Wisconsin Rapids, Wisconsin. They specialize in grading and paving contracts.

Christensen, A. E., c'13, president of Christensen, Jacob and Gardner, engineers and contractors of Salt Lake City has been elected president of the Inter-mountain branch of the Associated General Contractors.

Connelly, Robert M., c'16, conducts a consulting practice and is principal of the vocational school at Appleton. Address: 102 E. College Ave.

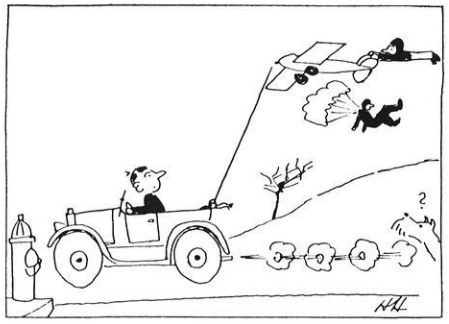
Davis, Louis S., c'10, is working on the Boulder Dam project laying out the new construction city. He says that the water has to be pumped 2000 feet from a river up to the city. He also states that it is so hot on the job that

(Continued on page 210)

Campus Notes

GLIDER CLUB REORGANIZES

Richard E. Goodrich, freshman mechanical of Madison, will act as temporary chairman of the university Glider Club, and G. Willard Gibson, senior mechanical of Janesville, is to be the treasurer as a result of the elections held at the recent meeting of students interested in the sport. The meeting was held on March 18, and was attended by fifteen enthusiasts, most of them engineers.



The glider to be used by the club has practically been completed, according to Mr. R. S. Hartenberg, instructor in mechanics, and will be used as soon as the members of the organization have completed a ground course and are able to fly it. Membership in the club will be limited to twenty-five, but in case more are interested, another ship will be constructed. The machine will be put into the air either by towing it with a car, or by throwing it into the air by means of elastic shock cord.

THEY EVEN RASSLE

Coach Hitchcock's wrestling squad looked fine at the beginning of the season; so good, in fact, that a championship was predicted. Fate stepped in the battles, however, and injuries varying from wrenched joints to the famous attack of mumps experienced by the coach and some of the wrestlers caused the Badgers to go through a rather unsuccessful season. Two senior mechanicals are members of the squad; both of them from Milwaukee. Ferdinand Hammer was the 155 pound conference champion in 1928, and came very close to winning the championship in 1929. Hammer was forced to drop the sport temporarily to bring the grades back to par. Walt Karsten promised to show up well this season, but unfortunately slipped on the library steps and wrenched his shoulder. A better season is predicted for next year by Coach Hitchcock, and no doubt engineer names will appear on his roster.

ELECTRICALS TREAT TO MOVIES

Hydro-electric Power Production in the New South," "Building New York's Newest Subway," and "Driving the Longest Railroad Tunnel in the Western Hemisphere" were the titles of motion pictures presented by the student branch of the American Institute of Electrical Engineers on Wednesday, March 25. Inasmuch as the pictures were of interest to civils as well as electricals, numerous of the former sons of St. Pat were present. The first film depicted a great hydro-electric power project in the Great Smoky Mountains of North Carolina. The new subway in New York City was described pictorially by the second film. This subway is expected to be completed in 1931. The third picture was concerned with the driving of the Cascade Tunnel and the solution of the numerous water problems which were met in this project.

ERICHSEN SPEAKS TO A. S. C. E.

Frank P. Erichsen, senior civil, described the building of breakwaters on the great lakes, before the student chapter of A. S. C. E. on March 11. He spoke from personal experience, having spent last summer working with the Great Lakes Dredge and Dock Co.

WATSON HEADS ATHENA

Charles C. Watson, junior chemical, on March 5, was elected president of Athena, oldest of men's literary societies at this university. The new president is a debater of recognized ability.

DIGGING UP AN OLD ONE

Professor "Jimmy" Watson was an honorary member of the Storks, organized at Wisconsin in 1905. Nix. It had nothing to do with babies. Membership indicated that one's hat perched high above the ground.

ENGINEERS TAKE TO THE RING

Many of the flying fists displayed in the all-university boxing tournaments belonged to engineer arms. Five of the fighters who survived the semi-finals were again seen in the ring a week later to bid for the championship of their class. David Horwitz, freshman mechanical of Sheboygan, overcame odds to score a technical knockout on George Broming in the bantamweight division. George Peck, freshman electrical of Berlin (Wisconsin), lost a hard fight by decision in the featherweight class. The civil's representative, Larry Fuhr, found it necessary to fight an additional round to win a decision over John J. O'Connor and thereby win the junior lightweight, or 130 pound, championship. Fuhr is a senior civil coming from Milwaukee.

Vaness Hall, freshman electrical, pounded his way through to victory in the 135 pound lightweight division. Hall is from Madison. John Phillipi lost the 140 pound junior welterweight championship to George Heidt by the judges' unpopular verdict. Phillippi is from Madison, and is a freshman in the mechanical engineering course. Lewis Dequine, freshman chemical, fought Bradley Goodyear for four tough rounds, and finally took the bout on the flip of a coin. Dequine is a welterweight, and hails from Long Beach, N. J.

John Schneller's football prowess was of little use in warding off Rosenbaum, and the sophomore electrical lost the fight by a K. O. in the first round. Tough bunch, these engineers.

SOME BRIDGE

Albert Wolfe, in his report of the inspection trip which the senior civils took last fall, records that the State Street bridge in Milwaukee has a roadway 418 feet wide. Not only is this structure amazingly wide, it is also powered with motors that will raise it against a wind pressure of 103 pounds per sq. inch, if we take his word for it.

HAGESTAD HEADS A. S. C. E.

The meeting of the student section of the American Society of Civil Engineers on February 11 resulted in the election of the following men as officers: Herman T. Hagestad, River Falls, president; Ray Jackson, of Parrish, vice-president; Frank Erichsen, Milwaukee, secretary-treasurer; Homer T. Sowls, Darlington, publicity manager.

FLYING HIGH

Three freshmen engineers made a straight A average for the first semester: Kinne, Neill, and Randolph. Four men are in the high-honor group, and twenty-four are in the honor group as follows:

High Honor Rate:

Kinne, Wm. S. _____51 pts. 17 crs.
Neill, Wayne K. ____51 pts. 17 crs.
Randolph, Burr H. __51 pts. 17 crs.

DeNoyer, Donald B. _47 pts. 17 crs.

Honor Rate:

Brennan, John E. ___46 pts. 17 crs.
Mohn, H. Leroy ____46 pts. 17 crs.

Schiller, Robt. A. ___46 pts. 17 crs.
West, Paul H. ______45 pts. 17 crs.
Wilde, Erwin H. ____45 pts. 17 crs.
Shower, Albert J. ___42 pts. 16 crs.
Bardelson, Margaret _44 pts. 17 crs.
Clark, Charles O. ___44 pts. 17 crs.
Lemke, Arthur A. ___44 pts. 17 crs

Engelhardt, Robt. L. _43 pts. 17 crs.
Lund, A. O. ________43 pts. 17 crs.
Seifert, Frederick F. _43 pts. 17 crs.
Zack, Joseph W. ____43 pts. 17 crs.

Berg, Eutelle W. ____42 pts. 17 crs.
Fritschel, Herman G._42 pts. 17 crs.
Horton, Wm. H. ____44 pts 18 crs.

Howes, Robt. I. ____41 pts. 17 crs.
Doerfler, Joseph H. __42 pts. 18 crs.

Dequine, Louis E. ___39 pts. 17 crs.
Frank, Orville C. ___39 pts. 17 crs.
Gates, Wallace G. ___39 pts. 17 crs.
Killam, Leslie V. ____39 pts. 17 crs.
Lefevre, W. C. _____39 pts. 17 crs.
Max, Abraham M. __39 pts. 17 crs.

The following freshmen, although not in the honor group, are in the highest 15 per cent of the class:

Braun, Frank J. _____38 pts. 17 crs.
Canright, John ______38 pts. 17 crs.
Dysland, Lloyd S. ___38 pts. 17 crs.
Lyke, James C. _____38 pts. 17 crs.
Wheeler, Ed. N. ___38 pts. 17 crs.

Rosenthal, P. C. ____40 pts. 18 crs.
Topp, Albert L. ____40 pts. 18 crs.

Newlin, Benjamin ___37 pts. 17 crs.

Biggs, John A. ______36 pts. 17 crs.
Mollica, S. A. ______36 pts. 17 crs.
Smith, Rex. M. _____36 pts. 17 crs.
Tock, Wilfred H. ___36 pts. 17 crs.
Wood, Russell A. ___36 pts. 17 crs.
Wustrack, Otto H. __36 pts. 17 crs.

Danielson, Wm. N. _35 pts. 17 crs.
Donaldson, James R. 35 pts. 17 crs.

Holm, Howard G. ___37 pts. 18 crs.
Ellis, Charles F. ____34 pts. 17 crs.

SIC TRANSIT GLORIA

What was said to be the quietest St. Pat's Day in many years marked, or failed to mark, the celebration of the first engineer's birthday on the seventeenth of March. Last year green feathers marked the event. A few green ties were observed about the campus, but even they may have been worn unintentionally. The *Daily Cardinal* lamented the passing of the old engineer spirit in a write-up. Perhaps it isn't too late and the old boy will bob up some weeks late. How about some ideas on the commemoration of St. Patrick?

PHI ETA SIGMA INITIATES

As a result of their industry during what has passed of their freshman year, the following men are to be awarded Phi Eta Sigma keys. Phi Eta Sigma is the freshman honorary scholastic fraternity.

Kinne, Wm. S., C. E., Madison.
Neill, Wayne K., Ch. E., Madison.
Randolph, Burr H., C. E., Milwaukee.
DeNoyer, Donald B., M. E., Madison.
Brennan, John E., M. E., Tomah.
Mohn, H. Leroy, M. E., Akron, Pa.
Schiller, Robt. A., C. E., Milwaukee.
West, Paul H., C. E., Madison.
Wilde, Erwin H., C. E., Milwaukee.
Shower, Chas. Otis, C. E., Lodi.
Lemke, Arthur A., C. E., Watertown.
Engelhardt, Robt., C. E., Milwaukee.
Lund, Alvin O., E. E., Madison.
Seifert, Frederick, E. E., Milwaukee.
Zack, Joseph W., C. E., Milwaukee.

HIGH BUILDINGS LEAD TO NEW ELEVATOR DESIGNS

Recent announcement that two elevator cages would be operated in one shaft in a new sky scraper is followed by the announcement that a schedule that calls for a total day's run of 171 miles at a top speed of 1,000 ft. a minute has been adopted for a New York building now under construction.

THE GRAF ZEPPELIN PAYS EXPENSES

The astonishing total of 144,275 miles was flown by the great German airship, Graf Zeppelin, during 1930. During 155 flights, the ship carried a total of 6,278 passengers, 2,200,000 pieces of mail, and 12,166 pounds of freight Passenger fares are reported to have covered the cost of operating the ship.

NEW RADIO TUBE HAS NO FILAMENT

A radio tube that has no filament has recently been patented by Adolph A. Thomas, who claims that the tube will not heat and that there will be no noise or hum due to filament circuits. The tube will not burn out and no A battery will be required. The new tube if found practicable, will be something of a sensation in the radio field.

HUGE CASTING BELIEVED RECORD BREAKER

A single-piece steel casting weighing 460,000 lbs., believed to be the largest ever made, was completed by the Bethlehem Steel Co. on February 16. It will be used as a cylinder jacket for a forging press in the company's plant. The total job required about ten weeks. The pouring time was 38 minutes.

Landlord: "This room was formerly occupied by a chemist. He invented a new explosive."

Prospective Boarder: "I suppose the spots on the wall are the results of his experiments."

Landlord: "Well, indirectly, yes. You see that's the chemist."

"I'd like some rat poison."
"Will you take it with you?"
"No, I'll send the rats over after it."

AN INSPECTOR ON BRIDGE CONSTRUCTION

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bringing the piles into their correct position if they started out of alignment. This was accomplished as follows: The jet was moved to the side in the direction in which the pile was to be moved and was worked down until it was near the point of the pile. It was considered desirable to keep the hammer going continuously after the driving started, but if a pile was continuing to go out of line, the driving was stopped until the jet reached the point on the pile. After the hammer was started, the pile usually shifted back into line; that is, toward the side on which the jet was working.

In some instances the pile would be driven out of line by a large boulder, and even after considerable jetting it would be impossible to get the jet past a boulder. It was then necessary to raise the jet and start in a new position about 2½ feet from the pile in hope that the jet would pass the rock on the farther side. Jetting around the rock on the farther side would loosen the earth around it so that it could be moved out of the path of the pile.

After two bents of piles had been driven and several piles had been accepted, which were just within specification, it was the inspector's belief that the best results were not being obtained. He suggested, therefore, that timber guides be used to help guide the piles and to obtain better alignment. The foreman disagreed and the idea was dropped. Later it was necessary for the contractor to remove one of the piles that was too far out of position. This particular pile struck a large boulder which could not be jetted out of the path and was forced out of alignment. On being ordered to remove the pile, the foreman objected and tried to force it into its proper place by means of block and tackle. It was now up to the inspector to make a decision: Should the pile be accepted if it were forced back into its proper position and if no cracks were visible? He decided that the pile should not be accepted. After it had been removed, it was observed that the lower portion had been badly cracked by the pulling and twisting.

Again it was suggested that timber guides be used to guide the piles. The foreman protested that experience had taught him it would be unsuccessful. The inspector insisted that he too wanted this experience, and so heavy 12x12-inch timber guides twenty feet long were used. The results obtained were a great satisfaction to both the foreman and the inspector. The guides made it possible to drive more piles per day and secure better alignment.

The piles were designed for a load of 40 tons per pile. It was computed from the *Engineering-News* pile equation that the penetration under the last twenty blows of the hammer should not exceed 6.6 inch. Measurements were made on every pile, although the piles were actually driven to refusal so that they carried their loads by column action instead of by skin friction as assumed by the pile equation. Penetrations were taken by making a mark on the pile corresponding to a mark on the leads, counting twenty blows, and making another mark on the pile corresponding

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to the mark on the leads. A carpenter's rule then quickly gave the required information.

When the pile reached refusal, the jet was removed but the driving continued for at least thirty more blows. One pile required 901 blows for twenty feet of penetration. All piles received approximately the same number of blows.

The final problem arose when the steel railing for the bridge arrived on the job and scales of rust were found beneath the shop coat of red lead. The inspector would not permit the railing to be erected until the rust had been removed. It was finally cleaned by the contractor and given another coat of red lead.

THE INSPECTOR

By Elldee

All day he tramps about the job puff-puffing on his old corn cob, inspecting this — inspecting that, his tattered, weather-kissed felt hat pulled down to shield his eagle eye from Old Sol's hot shafts from on high — which otherwise might pull his cork and dry him up like old New York. He sees all — knows all — keeps things straight. He is a tried and trusty skate, who measures to a tinker's yam the "mix" that goes into the dam; who keeps retaining walls to line — not crooked as a pumpkin vine; who sees that cuts and fills are made at right degree of centigrade. From dawn till dark, day out, day in, from concrete shack to gravel bin, from dizzy slope to deepest ditch, with nerves attuned to keenest pitch, he "carries on," and when night falls and off he peels his overalls and flops back in the fragrant hay to saw wood till another day, he sleeps the slumber of the blest, for he has done his level best to make the "big dream" come to pass — and earn his little bag of brass! A good inspector on the job with pep and something in his knob, who sails right in and does his work and has no time to loaf or shirk, will "get there" in due course of time and he won't have to scribble rhyme; for many "big chiefs" of today at one time drew inspectors' pay!

—*Engineering News-Record.*

ELEVATED STORAGE

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ings (referred to datum) for various velocities in the mains. This curve will give us the average rate of flow between any two elevations chosen as the top and bottom of the proposed tank. Subtracting the night consumption rate from this average flow rate will give us the net rate available for filling the tank. This will determine the size of tank which can be filled over night for a given elevation, or if the capacity of tank is fixed, it will give us the height to be used. The night consumption rate obtained on the day of the test should be adjusted to the night consumption rate on the peak day. This may be done by multiplying by the ratio of the night consumption rate for the entire city on the peak day to the night consumption rate for the entire city on the day of the test. The field test should preferably be made on a very hot day.

ALUMNI NOTES

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it is necessary to install an extensive refrigeration plant in order to cool the concrete. Sounds odd but he verifies the statement with the remark that in the middle of the day the rocks are too hot to touch.

Geiss, J. H., c'17, is building a six-in-line, prestone-cooled motor for the Navy Department at the shops of the Comet Motor Company, Madison.

Gillette, Paul C., c'18, is the New York representative of the Empire Securities Co. of Bridgeport, Conn. He writes: "Am finding business quite good and prospects of the future look bright."

Goss, William A., c'15, is on the engineering staff of the C. & N. W. Ry. in Chicago.

Graham, G. A., c'05, is vice-president and secretary of Parker, Graham and Sexton, which recently completed a six and one-half mile tunnel through the Smoky Mountains of North Carolina for use in hydroelectric development.

Jardine, Zac, ex-c'25, is with Alfred Brown & Co., contractors of Chippewa Falls, Wisconsin.

McMullen, Ralph E., c'27, gives his address as Army and Navy Y. M. C. A., Seattle, Wash. He has recently been engaged on monumentation work along forest roads and highways under a temporary appointment with the U. S. Bureau of Public Roads. He writes: "I would advise the members of the graduating class to take the Junior Engineer, or similar exam upon graduation so that their names will appear upon the Civil Service Register should they seek an appointment with the government in later years."

Markwardt, L. J., c'12, CE'22, assistant in charge of the timber mechanics section of the Forest Products Labora-

tory at Madison, is the author of a new bulletin, "The Distribution and Mechanical Properties of Alaska Woods," which has just been issued by the Department of Agriculture. The bulletin is based on a personal survey in the national forests of Alaska by Mr. Markwardt and on extensive tests carried on under his supervision.

Peppard, Thomas D., c'29, has transferred to the Chicago office of the United States Bureau of Public Roads, with offices in the South Chicago Post Office Building. He is assistant office manager and in addition to general office work he has charge of all computations, design, and construction coming under the supervision of the office.

Thiel, Walter C., c'22, announces the birth of a daughter, Marlys Marie, on November 23, 1930.

Traxler, Henry, c'13, was one of the principal speakers at the festival week activities of the Wisconsin Dramatic Guild. Mr. Traxler spoke, March 5, on "The Little Theater, A Community Asset." He appeared again in the evening as one of the cast in the play, "No sabe." Traxler is city manager at Janesville, and is given credit for much of the progress of Janesville's Little Theater during its existence of a little more than a year.

WHEN DID THEY GET THERE?

Railroad Engineers certainly must have had a superabundance of good judgment in the early days of railroading, and collisions must have been unknown in Kansas. That State at one time passed a bill which ordered that "when two trains approach each other at a crossing, they shall both come to a full stop, and neither shall start up again until the other has gone."

DIESEL ENGINES IN THE POWER STATION

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Maintenance cost of the Diesel decreases as the size increases. The replacing of a working part on a 2000 hp. engine does not cost as much as a similar part on a 200 hp. engine. Similarly, the operator who takes care of a small engine may just as well look after one several times as large. There is no more work to do while the engine is in operation; upkeep would be somewhat greater, but not in proportion to the increased size of the larger engine.

Thus, in all probability, the saving of fuel oil through the use of Diesels could be added to the net income of the utilities, or else reflected in lower rates.

Although the Diesel industry and the public utility companies have much in common, they also have conflicting interests, which may in part account for the relatively small use of Diesels by the utilities. Both the Diesel industry and the electric utilities are competitors for industrial and municipal load projects, and such competition may be easily accompanied by ill feeling. There is also a tendency of utility companies to hesitate to invest in any equipment which is relatively new and untried; steam power has been accepted as a matter of course for so long that the average engineer is inclined to think only in terms of steam and very large central stations. But the problem of decreasing costs is of such vast importance that the industries will be forced to work together for their mutual benefit.

WHEN IS A BEAM LIKE A COW?

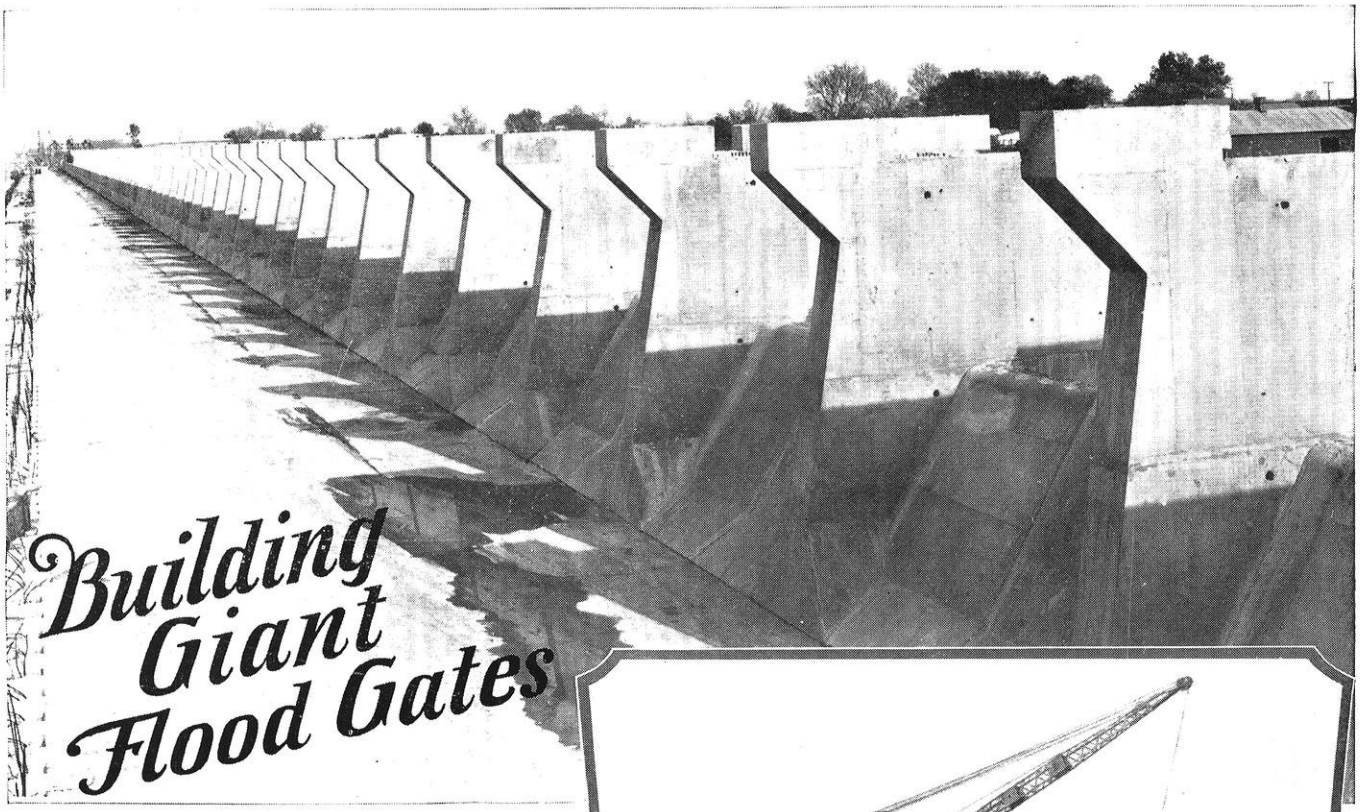
According to a student in Mechanics 3, there are points of resemblance between a beam and a cow. As he explains it, "The capacity of a beam is not the load it happens to be supporting at any given moment, but is the greatest load it can support, just as the capacity of a cow is not the quantity of milk it happens to be giving, but the greatest quantity it could be made to yield." Not so bad, not so bad.

EVERY MAN TO HIS JOB

NOTE: An attempt by an engineering society to get its members to write an engineering short story or novel by offering substantial prizes has met with disappointing results.

The engineers, they have no fears,
They wear thick leather panties.
They spend their time in tropic clime
And live in wooden shanties.
Meanwhile just look, on screen, in book
Is told their tale romantic
By scribblers gay so dumb that they
Drive engineers near frantic.
But why in hell cannot they tell
These tales like any other?
The fact remains, they lack the brains
Or find it too much bother.

—*Bob in Engineering News-Record.*



Building Giant Flood Gates

TWENTY-EIGHT miles upstream from New Orleans a great flood gate known as the Bonnet Carre spillway is being completed. In times of high water this concrete dam on the east bank of the Mississippi will tap the flood before it reaches the city, diverting the dangerous excess into Lake Pontchartrain.

The Bonnet Carre spillway consists of a concrete dam and a pier-and-weir section about 7700 feet long. The weir sections, which are twenty feet wide between the piers, have timber needles on the crests at two levels — elevations 16 and 18 A traveling crane, on a bridge spanning the piers, removes the timber needles for discharge.

N. E. C. equipment played an important part in the construction set-up. Two Koehring Cranes handled aggregate at the material bins and a third Koehring placed the concrete with an Insley bucket. Two large Smith mixers mixed the 127,000 cu. yds. of concrete used on the project.

Wherever you find construction work in progress, you find N. E. C. equipment!

NEC

"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
Pavers, Mixers; Power Shovels, Pull Shovels, Cranes, Draglines; Dumptors.

INSLEY
Excavators; Concrete Placing Equipment; Cars, Buckets, Derricks.

T. L. SMITH
Tilting and Non-tilting Mixers, Pavers, Weigh-Mix.

PARSONS
Trenchers, Backfillers.

C. H. & E.
Portable Saw Rigs, Pumps, Hoists, Material Elevators, Ditchers.

KWIK-MIX
Mixers — Concrete, Plaster and Mortar.

National Equipment Corporation

30th St. & Concordia Ave.
Milwaukee, Wisconsin