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The Wisconsin Engineer

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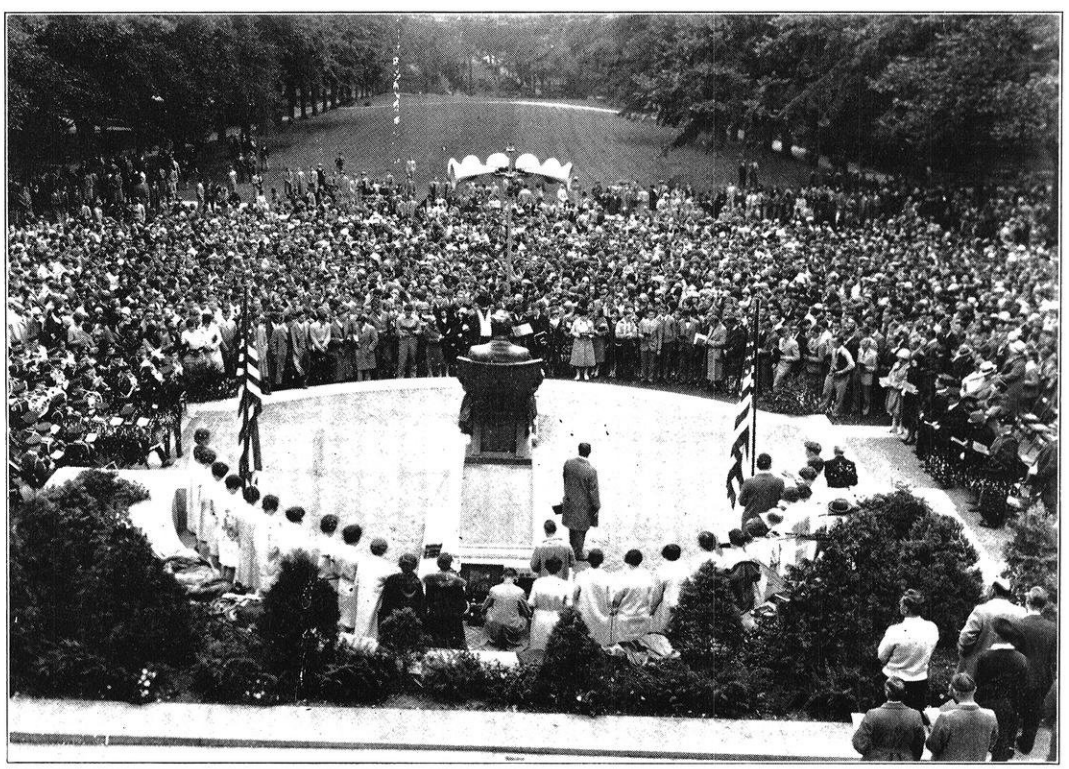
VOLUME XXXIII NUMBER I



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VOLUME 33 OCTOBER, 1928 NO. 1

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The Wisconsin Engineer

VOLUME XXXIII, NO. 1 OCTOBER, 1928

Comments on Foreign Industrial Methods and Conditions Made from Observations Taken During

An Industrial Survey of Europe

By J. R. Shea, e'09,

Superintendent of Manufacturing Development, Western Electric Company

A EUROPEAN industrial survey of seventy-four manufacturing plants in England, France, Belgium, Holland, Germany, Austria, Italy, and Switzerland was an opportunity which the writer had the good fortune to make. These countries, with a few exceptions, are making rapid progress industrially and feel that the future holds much in store for them. Our reception in every case was indeed a most cordial one, and at several factories the Managing Director called in his executives, engineers, metallurgists, and scientists to discuss their manufacturing practices, and the plans which they had laid out for the future, after our inspection trip had been made. In England and Germany I was met with a hearty handshake and a "Yes, I know you through the paper you presented at the Fifteenth Midwinter Convention of the American Institute of Electrical Engineers at New York".[1]

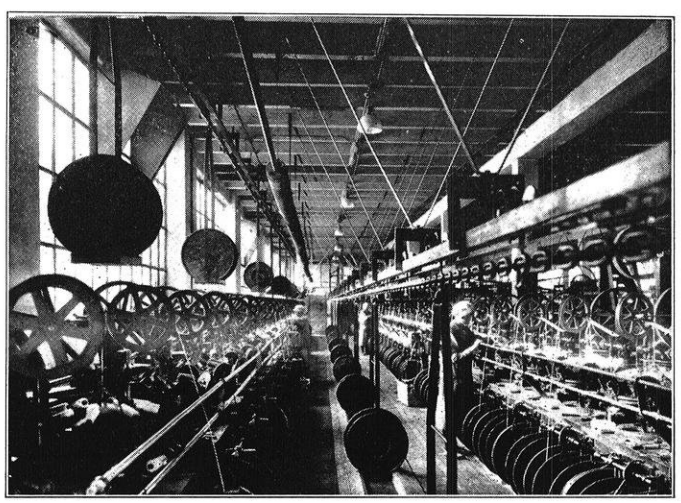

Fig. 1: Rubber covered wire plant in Holland showing conveyor system.

Such was my experience in Prescott, a suburb of Liverpool, England, where we visited a large cable manufacturing plant employing several thousand men and women. We were told that we were the first party outside of their Company to see their new copper rod mill which was equipped with many mechanical devices which we had planned to use. Yet this new mill was crowded into one of their existing buildings, such that they were restricted to the rolling of a 120 pound wire bar. We carefully observed the mill in full operation and were surprised to find that they passed only one rod through each pair of rolls at a time. Later when we told them that we were obtaining three times their output they could not understand how we did it until we pointed out in detail the effect of using a 220 pound bar and rolling two and three rods at a time through each pair of rolls instead of one. Many parts of their plant were efficiently engineered, such as the extrusion of the lead sheath on cable and the conversion of scrap copper, collected in process, into wire bars which were later roller and drawn into wire.

Have you ever heard of Froghall, England? It was at that town and in a small factory settled in the hills of Northern England that we saw two things done successfully which we had planned to try out. Scrap copper was refined and then cast in vertical instead of horizontal moulds, and the bar while still red hot was conveyed direct to the rolling mill and rolled into rod without being passed through a billet heating furnace.

Since we use a large amount of industrial diamonds in the drawing of telephone and cable wire, London among

[1] "Development in the Manufacture of Copper Wire" by J. R. Shea, published in the Journal of the American Institute of Electrical Engineers, Volume XLVI, PP. 346-355, April, 1927.

other things interested me because it is the diamond market center of the World. Hence, I was very pleased to meet one of the directors of the Diamond Syndicate, and was amazed at the large quantity of high quality diamonds which his Company carried in stock. Of particular interest were the processes of splitting and sawing diamonds done with great care and expertness, such that the natural cleavage planes could be oriented later with respect to the hole in the die, and thus give the die maximum strength. Through this gentleman I also obtained entrance to a plant in Amsterdam, Holland, where I followed each step in the preparation of diamonds for jewelry. London has many attractions, such as the House of Parliament and "The Cheshire Cheese". You may have read about the latter as the most famous haunt of Dr. Samuel Johnson and Charles Dickens. The basement of "The Cheshire Cheese" two floors below the main eating room was a Friar Monastary only a few centuries ago. To this secretive and haunted-like place a tall lean Scotchman directed us and from racks around the sides of the room he carefully withdrew a small cask of wine of the vintage of 1887, carressed it and spoke of it with more endearing terms than if it were his last shilling, and then put it back intact with a statement "Of courses, gentlemen, this one is reserved for a real special occasion".

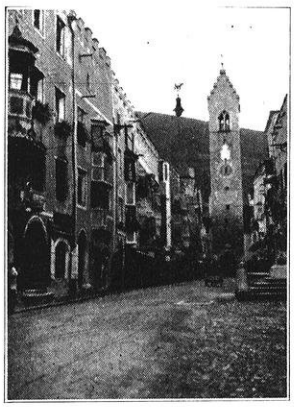

FIG. 2: Main Street, Vipiteno, Italy.

England industrially is in bad shape. The dole is still maintained and with a real wage urge removed from part of its people, production has slowed down, and taxes have increased. In some of the older industries the management in one breath prided itself on the processes, furnaces, and other equipment handed down from past generations and then blamed labor for its low production. In a few factories where the management took an active and progressive part in the development of processes and the use of automatic modern machines their business prospered and grew in a very satisfactory way.

The hospitality of the French is proverbial and such was our experience when we finished our first half day's inspection tour at La Havre, and at noon were invited to a light luncheon. It lasted from one until four-thirty with only a sufficient margin of time to catch our train to Paris. At Paris we visited some of the plants that were formally associated with our Company, and found that they were expanding their facilities to meet rapidly increasing demands.

Other industries visited were fairly active. Several very profitable ideas were found which have been applied directly to our processes of manufacture and as a whole it was our feeling that industrial conditions in France were slightly better than in England.

At the time we were in Belgium some of the industries which only a short time ago had been on a satisfactory basis, were meeting reverses due to an increase in tariffs by other European countries and due to a decrease in their own rate of exchange. These contracts were so striking that I could not fail to compare Belgium with some of our smaller states, and then realize how fortunate we were in having home markets with a large demand unhampered by tariffs and differences in money, weights, and measures. In spite of these conditions, some factories were flourishing under the leadership of an active progressive management. One such plant made aluminum foil with some of the best and most precise rolling mill equipment I have seen, and as a result controlled a good share of the European market. Such also was a telephone manufacturing plant in Antwerp, employing 10,000 people, which competed successfully in practically all parts of Europe.

While Holland is famous for its Dutch windmills, cheese, and diamond manufacturing, I was unexpectedly surprised to visit a plant manufacturing rubber covered wires, and find only modern machinery in use. That plant operated with an exceedingly low investment from the time raw material entered its mill until delivered to outgoing cars as a finished product. Conveyors were used wherever possible and the operating force displayed the best of team work in maintaining high production and keeping material on the move.

A very interesting and quaint point visited in Holland was Vollendam, and from the picture of the boatmen you might surmise that golf trousers originated there. While this place at present is in the Zuider Zee, within a few years its waterfront will disappear due to an extensive reclamation project which the Dutch government has under way which will reclaim thousands of square miles in this area.

FIG. 3: Vollendum, Holland, on the Zuider Zee.

Nordenham on the South shore of the North Sea was the first important town visited in Germany, and it was there that we went through a submarine cable manufacturing plant. We discussed various technical phases of cable

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[2]"Permalloy, An Alloy of Remarkable Magnetic Properties" by H. D. Arnold, and G. W. Elmen, published in the Journal of the Franklin Institute, Volume 195, 1923.

"Compressed Powdered Permalloy, Manufacture and Magnetic Properties", by W. J. Shackelton of the Bell Telephone Laboratories, and I. G. Barber of the Western Electric Company, Inc., published in the Journal of the American Institute of Electrical Engineers, June, 1928.

manufacture, and in particular that relating to permalloy[2], a material of unique magnetic properties which we manufactured for them as a part of the first high speed telegraph cable.

Berlin has to all outward appearances recovered from the War, and its industries with a few exceptions were operating at near full capacity. One of the most ingenious and practical men we met in Europe was a designer and builder of special machinery in Berlin. Some of the machines he was building were for Russia and were among some of the most clever and precise labor saving devices we saw in Europe. One machine which impressed me very much milled, turned, drilled, and slotted sewing machine parts at a very high rate of output. At another plant we saw machines being made which automatically gauged several dimensions of parts to within one thousandth of an inch variation at a very rapid rate. While some of these machines were for ammunition, a larger number were for electrical and other kinds of products using medium sized, interchangeable parts in large quantities. Part of such business was coming from Russia, brought about by a recent three year credit program set up between the Russian and German governments and the leading German banks. While I don't claim to be a financial expert, or a political economist, it was very evident to me that our country was indirectly financing Russia through credit extended to German banks. If so, we are taking part in a worthy cause of putting people to work with more efficient machinery, and Germany is in a much better position than our country to see that Russia pays her bills.

In a number of German plants progressive manufacture was carried out on large running standard products by grouping together machines which performed milling, drilling, and other similar operations. Conveyor installations were also used in assembly work, with the result that in one case the manufacturing interval was reduced from 5½ weeks to 30 hours, and the work performed with one-third less employees. Much of the old aristocatic spirit still reflects itself upon the relationship between management and labor, with the result that only a few suggestions for improvements are offered by the men to the management. Many of the German plants employ psychological tests with very effective results in the selection of men for training in highly skilled work, and boys for tool making apprentices. Such results were gauged by the larger percentage of men who successfully completed their training program and became skilled in their new line of work.

In the machine tool field Germany is making remarkable strides as evidenced by the fact that while in past years American machine tools were used almost exclusively in Europe, we saw recent German machines being used for quantity production work in many of the countries in Europe. Some of these manufacturers expressed regret about buying German machine tools, but spoke very highly of their quality and performance.

[3]"Modern Developments in the Hot Rolling of Brass and Copper in Germany" published in The Metal Industry of England, January 7, 1927.

One of the outstanding accomplishments which we saw in Europe was the hot rolling of brass and nickel silver on a large quantity production basis, and with the use of high speed labor saving machinery.[3] While without question the United States is in the lead in regard to steel making, it is very obvious that the European manufacturers have made a decided step in advance of the practice followed in our country in the manufacture of non-ferrous materials. In many cases large ingots of non-ferrous material were cast weighing as high as 2,000 pounds each instead of 600 pounds, the present American practice. These ingots were then heated to a dull red and reduced

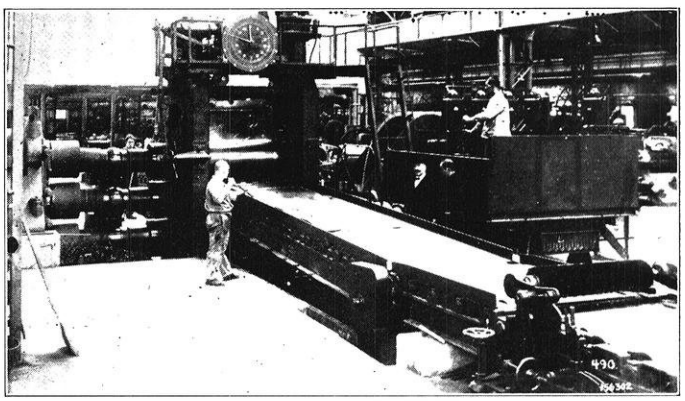


FIG. 4: Hot rolling of brass in Germany.

from approximately 2½" thick to 3/16" thick in a high speed three-high rolling mill. In that manner the cost of the initial rolling was not only reduced, but the material was handled through the remaining processes in long strips which reduced the total cost of manufacture. A number of manufacturers stated that they had reduced their cost of production approximately 30% by replacing their cold rolling process.

Several industrial museums were visited throughout Europe, and by far the most outstanding one was "The Deutsch Museum" at Munich, Germany. Such museums located in the vicinity of our University and industrial centers would be of real educational value, and I consider the move made in Chicago recently along this line a very worthy one to support.[4]

Industrial conditions in Austria were very unsatisfactory. While the wage scale in England is only about one-half of what the corresponding operators receive in this country, the German and Swiss about one-quarter, in Austria it is only one-eighth. In many lines of skilled work, men were receiving what is equivalent in our money to only $.11 per hour. As I viewed Austria it no longer even approaches an economic unit. The bulk of the raw material used in manufacture is imported and a large part of the finished product is again exported. Such conditions do not contribute to the economic or political stability of Europe. The southwestern portion of Austria, including the Dolomites, in the old Austrian Tyrol, covering approximately 6,000 square miles was ceded to Italy

[4]"Rosnewald Industrial Museum" as described in the Iron Age, May 24, 1928, Page 1465.

(Continued on page 36)

A Worthy Message to New and Old Students as Well as the Engineering Alumni is given in the

Dean's Welcome

By F. E. TURNEAURE,
Dean, College of Engineering

I am pleased to extend, hereby, my customary annual welcome to the many patrons of the *Wisconsin Engineer*. To alumni, I express my pleasure and satisfaction at their interest in the work of the engineering students as represented in this magazine; and to the old and new students a welcome to the college and the work of the coming school year.

The alumni of the Engineering College now numbers about 3700, widely distributed over the face of the earth. The alumni directory issued during the past year shows 30 in Asia, 19 in South America and the West Indies, and 14 in Australia and the Pacific Islands.

That these graduates of Wisconsin are loyal sons of the institution is well evidenced by letters received from time to time from far-off lands, and which furnish many of the notes appearing in this magazine. It seems to me that these alumni notes constitute one of the most attractive features of such a student publication, and can be made of even greater interest not only to alumni subscribers but to students and faculty members if our alumni in active practice will send in more items about themselves and their Wisconsin brothers. We know that they have had their full share of achievements in the profession and many hardships to overcome, and I am sure I bespeak the desire of the editors of this magazine when I urge upon these alumni to send in more information about their activities. Such accounts, short or long, of things which to them may seem humdrum are likely to be of greatest interest and value to the student with his limited outlook and experience.

DEAN F. E. TURNEAURE
(From portrait in Engineering Library)

The new student has already received a good deal of information and advice concerning his course of study and the university in general. Probably additional advice at this time will be of little value. The only way to learn is by working at the job yourself. Much has been written by enthusiasts regarding the great education value of the moving picture. Such illustrations of industrial operations are of some value although less than actual visits of inspection, but neither visits nor pictures will help one very much to master the principles of mathematics and science necessary in the work of the engineer. It would be a good deal like undertaking to learn how to perform military maneuvers by studying motion pictures of a battalion or to learn how to operate an airplane by a similar method. There is no easy road to such mastery. It takes hard work by the man himself, assisted, so far as practicable, by suggestions, corrections, and illustrations from the faculty. The first requisite for success is an interest in the field of work for which the student is preparing himself, and this must be accompanied by a willingness to work hard on the job and even on phases of the work that for the time being appear uninteresting and unrelated to the ultimate goal.

The school does not pretend to make of you a full-fledged engineer, but does offer the most convenient and economical method of learning the fundamental principles necessary in the profession, together with some of the elementary activities, so that on graduation the way is fairly open to satisfactory entrance upon the real work of the engineer. In the past generation, the engineering school has come to be recognized as the almost necessary training ground for the young man to acquire his knowledge of engineering principles, and nearly all who are now entering the engineering profession have spent a longer or shorter time in school. National engineering societies recognize this and are offering to engineering students certain affiliation therewith while yet students. This is a valuable privilege, and as membership in some such society should be the expectation of young engineers, the affiliation while yet in school is strongly recommended.

There are many other things that might be said in the hope of aiding the beginner to make the most of his college course. We could write much about the value of English; the relative importance of outside activities; careful budgeting of the student's time; etc, etc. Perhaps the relative importance of these things can be visualized somewhat by placing before yourself your ideal of the successful lawyer, doctor, preacher, engineer, or other professional man in a community of, say, 20,000 to 30,000 population. If he is the right kind in such a community, he would be right in the shop, in the camp, on the construction job, or in the city office. It is largely a matter of character.

The University's Water Supply

A Description of the University Pumping Station, giving Details of the Extensive System of Mains and Features of Its Operation

By M. J. O'LAUGHLIN, e'28

THERE are two separate water systems on the University of Wisconsin campus. One system is used only for drinking water which comes from mains of the city of Madison. It is delivered to the University at a pressure of approximately sixty pounds per square inch at a height of twenty feet above the level of Lake Mendota.

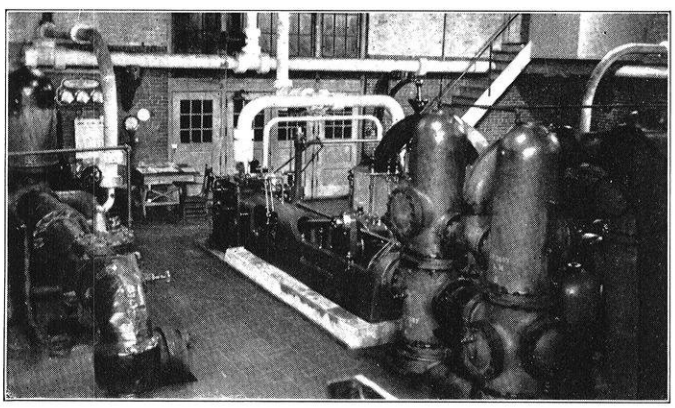


FIG. 1: A general view of the interior of the pumping station.

The other water system that supplies the University comes by way of the University Pumping Station from Lake Mendota, and it is used for all purposes except drinking. Thus, water for the steam at the heating plant, for the showers, the baths and kitchens at the dormitories, for the tanks at both gyms, and for the extinguishing of fires all comes from Lake Mendota.

The average amount of water taken from the lake by the University Pumping Station, except that used by the hydraulic department for research and extraordinary laboratory work, is about 850,000 gallons for twenty-four hours, excepting Sundays when the average is about 670,000 gallons per twenty-four hours. The average load during the daytime is between seven hundred to one thousand gallons per minute. This water enters the University mains at a pressure of approximately eighty-five pounds per square inch.

There are two mains leaving the University Pumping Station. One is an eight inch pipe which goes in the direction of the Men's gymnasium, around to Barnard and Chadbourne and then to the University Heating Station. This main conducts about 470,000 gallons per day. The second main is a twelve inch pipe going in the direction of Bascom Hall, the Agriculture Building, the Wisconsin General Hospital and back to the Heating Plant. This main averages about 380,000 gallons every 24 hours. The two mains connect at the University Heating Station.

The water that is pumped into the University mains comes from a cistern or reservoir located directly beneath the basement floor of the Pumping Station. The water is brought into this cistern by natural flow or siphon through a twenty-four inch pipe that extends about fifteen hundred feet out into the lake. The mouth of this pipe is protected by a heavy metal grating and is approximately eighteen feet below the surface of the lake. It can be seen very plainly from a boat on a bright day when the water is clear and has been calm for at least twenty-four hours.

There are five pumps that can be used in pumping the water into the mains. They are: one Platt centrifugal; one Snow, double expansion, duplex; one Fairbanks-Morse, double expansion, duplex; one Laidlow-Dunn-Gordon, double expansion, reciprocating; and one Allis Chalmers, single expansion, twin cylinder, corliss pump.

One of the problems in the water industry which must be most carefully considered, and against which all possible precautions must be taken into account, is fire. It is very rare that the University Pumping Station is called upon to supply water for the purpose of extinguishing fire, but it must, nevertheless, be thoroughly prepared for these emergencies when they do occur.

In the first place, water is pumped directly into the mains, and the water reserve is very small; in fact it is limited to two tanks each about sixty feet long and eight feet in diameter. In case a four inch hydrant should suddenly be opened, the pressure on the mains would almost immediately drop and the speed of the pumps

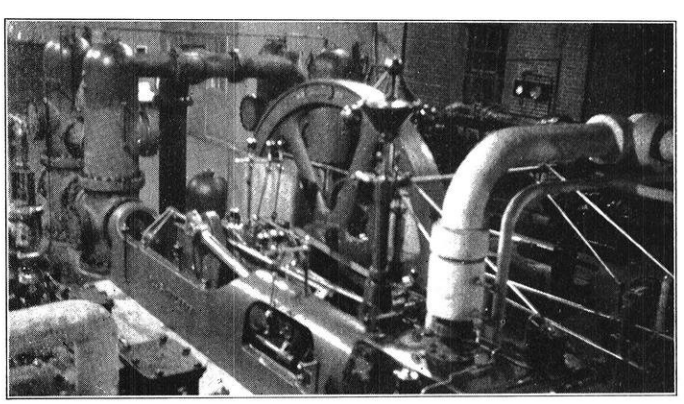


FIG. 2: The new Allis-Chalmers, single expansion, twin cylinder, Corliss pump.

would increase so fast that the pumps would be destroyed by their own velocity. To prevent this, the pumping station is provided with two steel tanks, exact duplicates of the two described above, which contain the reserve

(Continued on page 34)

The reign of Pluvius and Polaris
at Azimuth City on Devils Lake during

The 1928 Summer Survey Camp

By F. T. MATTHIAS, c'30

FRIDAY, JUNE 7, 1928. Again the Civil Engineers invaded the sacred precincts of Azimuth City, Summer Survey Camp at Devils Lake, Wisconsin. No more peace and quiet for the next six weeks in that neighborhood. One of the first things noticed in the commissary building was the daily schedule. And the first line of the schedule read amid the groans of those present: First Call — 5.30.

All day Friday the first car-load worked and worked and worked, stopping only long enough to welcome the new arrivals and to put them to work. The next day

Azimuth City Fire Department

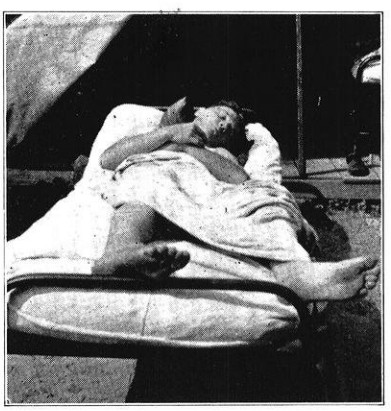
marked the arrival of most of the embroyo engineers. John Cullinane, running the Azimuth City-Madison transport line, claimed the credit for bringing the greatest number of men into camp. He made daily, or perhaps we should say, nightly, trips into Madison and always came back to camp with a car load. There was much speculation as to the reason for those numerous trips, but we found out later that Johnny did not need a reason to go to Madison; all he needed was an excuse. After knowing all the facts of the case, however, there were none in camp who censured him.

By Saturday night most of the tents were up, and the camp was beginning to look more attractive. Wires were strung to furnish lights to the tents, the commissary was cleaned up and stocked with supplies, walks were staked out along the heavily routes around camp, and each tired engineer went to bed that night in a condition of mind well expressed by the pessimistic statement, 'It looks as though we are in for a long summer."

Perhaps somewhere in the world, there is one who wrote in his diary for Sunday, June 9, something like this, —"Today being Sunday, we rested from our labors." But it would not be found in one belonging to a citizen of Azimuth City during the summer of 1928. The only difference between Saturday afternoon and Sunday morning was one eight-hour night. By Sunday noon everything was coming along all right, thanks to the energy and perseverance showed by Professor Ray Owen and Mr. Wesle in their executive positions. During the Sunday afternoon rest we began to discover that Azimuth City wasn't just one job after another. The old tin lake "buggies" were taken out and rowed around the lake by indominitable souls, who did not get enough punishment the day before to hold over on Sunday; some the more ambitious lads climbed bluffs or adjusted their instruments, but the chief amusement was the diverting task of doing nothing.

About that time the fellows began to realize that there was a very extraordinary individual in camp who was functioning in a highly satisfactory manner. Mrs. Huntington, presiding over the kitchen, was turning out meals that were a source of joy to the most particular gastronomical expert in the camp. There was no way to beat her. Even Bill Denzler, notorious in a town of famous eaters, for his ability to stow away food in huge amounts, always found plenty to eat when he came to the table and said, "Pass everything this way, please."

Monday morning 'Gabriel's trumpet", mounted in a tree near the rows of tents, aroused the camp at an unseemly hour, and in no time at all, everyone was out of bed and "rarin' to go." The forenoon was spent in a universal housecleaning that made our summer home much more pleasant and comfortable. Bob Poss finished up the wiring in good shape, but he had a most unfortunate accident. While pounding an insulator into a tree he missed the nail and landed a lusty "right to face," — his own face, however. While he was standing on the ladder holding a handkerchief to his bleeding wound, a sympathetic on-looker inquired as to what he was trying to do. With marvelous self-control and with strict adherence to those principles of honesty for which our Bob is famous, he calmly answered, "Believe it or not, I was waiting for a street car."



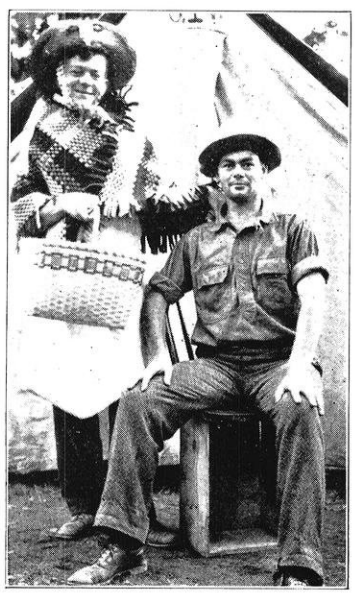
After a Waa-joe Party

Speaking of clever tricks reminds me of the one pulled by a certain engineer at camp. He so hated to make the poor electric current run through all those small wires

leading into the tents that he helped it out by hooking a direct short across the circuit to make it easier going. It worked fine until someone wanted lights.

At noon the A, B, and C divisions of the Key Line Railroad started their spurs to Bularena mine. The topog men began their transit-stadia survey, and for some time Azimuth Station was a highly desirable position. From then on, it was dangerous to walk through the woods. One might stumble on one of those traverse hubs driven "flush with the ground." And from then on, everyone had lots of work to do, and seemingly, a lot of time to do it in. But how that "lots of time" did shrink. By the end of the camp, — but then, I am anticipating my story. I must leave something for the end.

That night base ball was played, and for many nights thereafter. It degenerated toward the end of camp to an intense pitcher's rivalry between Assistant Chief Paschen of the Azimuth City Fire Department, and Vernon Hamel, his tentmate. Perhaps the most famous game was the one in which the Fire Department played the rest of the camp, and lost. That game proved conclusively that specialization is the thing. They were a first class Fire Department, but they had concentrated on being a good department, and had not had time to become proficient in base ball.



Heap Big Injuns

During the evenings of this first week some of the fellows decided to investigate the reported attractions of the North End. Tom Peppard and Leo Peleske, especially, were determined that the acquaintances made during their stadia traverse should not be wasted. They had an area which included a cottage in which there was a house party.

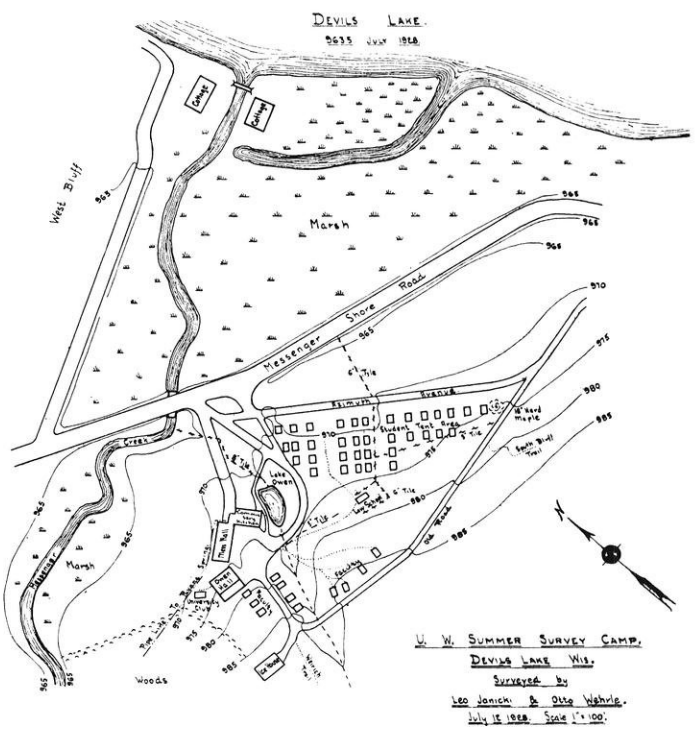
About midnight on the first Saturday the inhabitants of Azimuth City were awakened by sounds of sweet music. The Azimuth City quartet, quintet, or whatever it happened to be at the time, was swinging into action. Their efforts were much appreciated by all the rest of the camp and their prsence was requested at all celebrations.

All this time Azimuth City had been worrying along without any form of government except that furnished by the cook, Mrs. Huntington, and Gabriel's trumpet; and the lawless element were getting the upper hand. As a partial remedy to the general disorganization and inefficiency, the Azimuth City Board of Fire and Police Commissioners was organized, and Azimuth City became a city in reality. Mayor Ray Owen surprised the citizens at dinner one evening by his announcement of the personnel of the Board. Larry Beck was chosen City Clerk; Wesle, Treasurer; Van Hagan, Comptroller; Merz, Sanitary Engineer; Baillies, City Engineer; and Landwehr, Street Commissioner.

Bob Greiling, an engineer with social ambitions, had been elected Prom Chairman and plans were well under way for the biggest and best Prom, when he remembered that he had forgotten to acquire a Prom queen. If he had not forgotten, he was apparently afraid to announce it. All Azimuth City was excited over the prospect of a queen-less Prom. But Bob came through and chose Helen Davenport of Baraboo and the University of Wisconsin as his "Queen of Night". Prom was saved. Amidst the decorations of leaves, range poles and stadia rods, and firemen's hats and firemen's buckets, the dance went on. Girls from Madison, Baraboo, Chicago and other places were our guests for the evening. Were they welcome? Now I ask you, were they?

The Battle of the Century

For some time we had been hearing about the Whoopees, a society which had its beginnings in a little joy ride to Sauk City, where various potent beverages are available.



Plane Table Map of Azimuth City

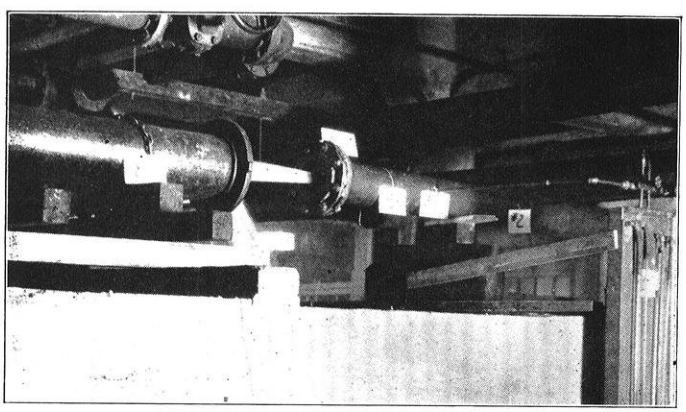
By applying the weight of their abilities to serve their purposes, the charter members, Eddie Landwehr, "Dunc" Baillies and Bob Matson, managed to enlarge the or-

(Continued on page 32)

An Investigation *of the* Coefficients *of* Discharge *of* Circular Orifices *on the* End *of* A Pipe

By R. H. BRIGHAM, c'28

ENGINEERS and men connected with industry often desire to measure accurately the flow of water discharging freely into the atmosphere, and it is desirable to do this by placing an orifice on the end of a pipe. The usual coefficients of discharge for standard orifices do not apply accurately to cases of this kind. In determining the coefficient of discharge on standard orifices the orifice is placed in a tank wall or in the head of a drum. The walls of the tank or drum are far enough from the orifice edge so that the contraction of the discharging stream is



Jet from 2 inch orifice under a 50 foot head.

not effected, and because of the size of the tank or drum the velocity of approach is considered to be negligible. With the orifice on the end of a pipe the contraction of the discharging stream is less because of the proximity of the walls of the pipe to the edge of the orifice, and the velocity of approach becomes quite appreciable because of the small size of the approach channel. Men connected with hydraulic work have felt the need of information that would show the relation of the discharge of an orifice so located and its coefficient as related to standard conditions of head, size of pipe and size of orifice. This investigation was carried out with these things in view.

PURPOSE OF THE INVESTIGATION

The purpose was to investigate and determine the coefficients of discharge of standard sharp edged orifices on the end of a six inch wrought iron pipe under heads of from one to sixty feet of water and discharging freely into the atmosphere. From these coefficients for various sized orifices the relation between the ratio of the area of the pipe to the area of the orifice and the coefficient of discharge for several heads on the orifices was obtained.

As a correlated study the author included, first a study of the variation in head measured at points in the supply line two feet and four feet from the orifice, and second a study showing the effect which a very small amount of pitting caused by rust or rounding of the orifice edge had on the coefficient of discharge.

GENERAL THEORY

The coefficient of discharge of an orifice without velocity of approach or suppression of contraction has long been established as being very near the value .61, but the practical men have found that this value increases to as high as .68 and .70 for larger orifices on the end of a pipe at high heads. However, no general rule has been established which will apply to various sized orifices on end flanges of pipe. There is practically but one sound method by which a rule might be established. It is to make a series of experimental runs with various sized orifices over a range of heads. By measuring the actual discharge for a given period of time at a constant measured head, the coefficient of discharge can be computed. This method was carried out in the work embraced by this report.

METHOD OF OPERATION

A Run Defined

The procedure of operation consisted of making runs over a range of heads for each size of orifice. A run consisted of letting the water discharging from the orifice under a constant head empty into the measuring basin for a given length of time. During each run three to five readings of the mercury gage were taken depending on the length of run. The initial and final readings of the measuring basin gage were taken and the time of starting and stopping of each run was recorded accurately.

Time

The length of run for the small orifices was arbitrarily set by the author at fifteen minutes. For the larger orifices the length of the run had to be reduced because of the capacity of the measuring basin. Very few runs were taken of less than five minutes duration.

Procedure to Obtain Desired Head

At the beginning of each experimental period, the water was turned on and the gage flushed out by means of the pet cock at the top. All air was released from the pipe. The water was turned on until the head desired was obtained. Then it was allowed to flow for a short time or until the discharge from the catch basin was relatively constant.

The Run

When the flow had been adjusted to begin the run, the galvanized iron deflecting spout at the end of the catch basin which had been so directed as to waste the water, was turned so as to direct the flow of water into

(Continued on page 26)

What The Class *of* 1928 Is Doing

By R. S. PLOTZ, c'30

THREE MONTHS of hardship, strife, and anxiety have passed, and the graduates of the class of 1928 remain at labor in the terrific turmoil of the swift moving business world, while the oncoming hordes in Madison enjoy a comparatively easy life in the luxury of the class room. Information concerning the men of '28 has been collected by the *Wisconsin Engineer* and is here presented for the benefit of their former classmates and friends. Doubtless many of the readers have more recent information than that given here, and if so the *Engineer* will be pleased to receive it or to learn of any errors which may appear in the following columns. To all of the graduates the *Wisconsin Engineer* wishes continued success. May we hear often from all of you!

MECHANICALS

Boldenweck, Leo, who is acting corresponding secretary for the mechanical engineering class of 1928 has located with the United Autographic Register Company of Chicago. His address is 5623 Winthrop Avenue, Chicago.

Christensen, Raymon L., is taking the training course of the American Appraisal Company of Milwaukee. His address is 4711 Roger Street, West Allis, Wisconsin.

Carrier, Earl, is taking a test course with the General Electric Company of Schenectady. His address is 107 Union Street, Schenectady, New York.

Cahoon, Roger C., is employed by the American Blower Corporation of Detroit, Michigan. He may be reached in care of that company.

Dempsey, Paul D., is at his home at 38 Arbor Avenue, West Chicago, Illinois.

Farwell, Porter, is a master mechanic's understudy in a paper mill at East Ryegat, Vermont. Mail addressed to him at East Ryegat, Vermont, will reach him.

Hahn, F. C., is employed by the General Electric Company of Schenectady. Mail addressed to 601—1st Avenue, Cedar Rapids, Iowa, will reach him.

Hansen, Einar T., is now an assistant in the steam and gas department of the University. His address is 614 Langdon St., Madison, Wisconsin.

Hanson, Karl P., is doing heating and ventilating work with C. A. Hooper of Madison. His address is 911 W. Dayton St. Mr. Hanson is in the planning and estimating department and is also doing some architectural work.

Jacobsen, E. A., is a mechanical engineer with the Jacobsen Manufacturing Company of Racine. His home address is 1520 Phillips Avenue, Racine, Wisconsin.

Johnson, William Norton, is on the engineering staff of the C. H. Wheeler Manufacturing Company. His address is 6430 Germantown Avenue, Germantown, Philadelphia, Pa.

Koebke, Edwin J., has been employed as student sales engineer with the Worthington Pump and Machinery Corporation of Newark. His address is 107 Halsey Street, Newark, New Jersey.

Lawton, C. A., is vice president in charge of the engineering and estimating department of the C. A. Lawton Company of De Pere, Wisconsin. His home address is 721 N. Broadway, De Pere, Wis.

Mattka, Frederick A., has located in the radio test department of the General Electric Company. His address is given as 301 Riverside Avenue, Scotia, New York.

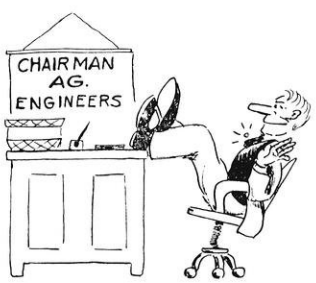
Nees, Carl J., is employed in the coke oven department of the Wisconsin Steel Company of Chicago. His mailing address is 3039 East 91st Street, South Chicago, Ill.

Runke, George R., is doing cadet work and further study with the Westinghouse Company at Pittsburgh. His address is 501 Penwood Avenue, care of the Westinghouse club, Pittsburgh, Pennsylvania.

Schilstra, George, is temporarily located with the Gas Meter department of the Wisconsin Power and Light Company. His address is 411 Noyes Street, Berlin, Wisconsin.

Thompson, D. W., is employed by the tractor works of the International Harvester Company of Chicago. His address is 4712 Drexel Boulevard, Hyde Park Station, Chicago, Illinois.

Smith, Ronald R., is enrolled in the student course of the International Harvester Company of Chicago. His address is 3210 Arthington Street, Chicago, Illinois.



Stowers, James C., is a student engineer with the Public Service Company of Colorado. He writes, "We are within sight of world famous mountain peaks and my 'hill climbing' training at Wisconsin has stood me in good stead as I have climbed Mount Elbert, Gray's Peak, and Torrey's Peak." His mailing address is 1755 Grant Street, Apt. 11, Denver, Colorado.

CHEMICALS

Bloxdorf, Walter R., has located with the Macwhyte Company of Kenosha. His address is 2002—52nd Street, Kenosha, Wisconsin.

Brabender, G. J., has been employed as a research engineer with the Northwest Paper Company of Cloquet, Minnesota. Mail addressed to 1005 Carlton Avenue, Cloquet, Minnesota, will reach him.

Brown, Orlo E., is employed on the technical staff of the Simmons Company of Kenosha. He is living with his parents at 6838—5th Avenue, Kenosha, Wisconsin.

Erickson, Newell L., has located in the process development department of the Du Pont Rayon Company of Buffalo, New York. His address is 92 Ashland Avenue, Buffalo, New York.

Flugge, S. L., is working in the research department of the Continental Can Company of Chicago. His address is 4633 West Grand Avenue, Chicago, Illinois.

Forrester, Jay H., is working in the food products department of the A. R. Jones Company of Chicago. The latest address obtainable is 5212 University Avenue, Chicago, Illinois.

Herro, Alex C., is at home with his parents at 404 West Wisconsin Avenue, Oconomowoc, Wisconsin.

Johannes, Karl F., is with the process development department of the Du Pont Rayon Company. He is living at 199 Chadduck Avenue, Buffalo, New York.

Kieweg, Homer E., is living at 438 N. Frances St., Madison, Wisconsin.

Long, Clarence H., is at home with his parents at 2437 So. Chicago Avenue, South Milwaukee, Wisconsin.

Menestrena, Lloyd C., has been employed as junior chemist with the Roxana Petroleum Corporation at Wood River, Ill. His address is 736 Madison Avenue, Wood River, Illinois.

Murphy, W. P., is employed as an engineer with the A. C. Nielsen Company of Chicago. His address is 4450 Ravenswood Avenue, Chicago, Illinois.

Neller, Richard Karl, is employed in the Kimberly-Clark Sulphite Mill at Neenah, Wisconsin. His Neenah address is unknown, but mail addressed to 410 E. Washington Street, Appleton, Wisconsin, will reach him.

Riplinger, Ellis C., is employed as Cadet Chemical Engineer by the Seaboard By-Products Coke Company of Jersey City, New Jersey. He is sharing an apartment at 432 Beach Street, Arlington, New Jersey, with **Karl Kuhnke,** ch'27 and **J. M. Spees,** ch'27, who are also employed at Seaboard By-Products Company.

Rheineck, Alfred E., is employed by the City of Milwaukee in the Street Construction and Materials Testing laboratory. His address is 913 Second Street, Milwaukee, Wisconsin.

Schaefer, Norman C., is employed as efficiency engineer by the Chicago By-Product Coke Company. His Chicago address is 501 N. Central Avenue.

Schulein, Joseph, is employed in the engineerig department of the Barber-Colman Company of Rockford. His address is 1033 Rockton Avenue, Rockford, Illinois.

Zoerb, Frederick C., is employed by the Flintkote Company, makers of asphalt roofing. His address is Y. M. C. A., Passiac, New Jersey.

CIVILS

Alperovitz, Julius, has not yet been employed. His address is 1242 State St., Racine, Wis.

Bamberry, James E., is employed by the U. S. Engineering department at Milwaukee, doing construction work and surveying. His address is Federal Building, Milwaukee, in care of War Dept., U. S. Engr. Office.

Brigham, R. H., is now working for the State Highway Commission at Madison and is living at 915 Chandler St.

Brown, Herbert, is superintendent of construction with Alfred Brown and Co., Road and Bridge Contractors, at Holcombe, Wisconsin.

Burmeister, Robert A., is employed by the city of Milwaukee in their materials testing laboratory. His address is 594 American Ave., Milwaukee.

Bundok, Mariano G., is with H. C. Webster, Consulting Engineer, with offices in the M. and M. Bank Building, Milwaukee, Wisconsin.

Copeland, Ronald E., is now an inspector on Sewer Construction with Consoer, Older and Quinlan, Inc., Consulting Engineers. He is living at 1614 South 4th St., Maywood, Ill.

Fell, Paul D., is with the Prairie Pipe Line Company of Kansas. His address is Box 75, Independence, Kansas.

Frazier, Arthur H., is making stream flow measurements for the Railroad Commission. He is living at 213 N. Park St., Madison, Wis.

Harker, Dave L., is running instrument for the Wisconsin Highway Commission in Division 4. His address is 340 Third St., South.

Hayden, Leland H., is at his home at 420 W. 7th St., Ladysmith, Wisconsin.

Held, Wilmer O., is now Junior Engineer in the Milwaukee County Regional Planning Department. His address is 1136—12th St., Milwaukee, Wisconsin.

Isabella, Joe J., is with the Wisconsin Highway Commission, Superior Division. His address is Spooner, Wis., of tht Division office in the Telegram Building, Superior, Wis.

Lenz, Arno, is instructing in the hydraulics department of the University. He is living at 213 N. Park St., Madison, Wisconsin.

Merz, H. Spencer, is Junior Sanitary Engineer with the Sanitary District of Chicago. His work is to design experimental sewage treatment plants.

Reinke, Richard E., is now a sanitary engineer with the U. S. Bureau of Health. His address is U. S. Bureau of Health, 4141 Clarendon Ave., Chicago, Ill.

Ruf, Harold, is with the Wisconsin State Sanitary Department. His address is De Forest, Wisconsin.

Sanborn, Wilfred A., is at his home in Waupun, Wis.

Smallshaw, John, is at his home at 1415—11th Avenue South, Birmingham, Alabama.

Summeril, F. J., is at his home in Monroe, Wis.

Toole, R. E., is with Mead, Seastone, and Mead, Consulting Engineers, located in the State Journal Building at Madison, Wis. His address is 915 University Avenue, Madison.

Yonkers, Carl, is chief of survey for the Dane County Highway Commission. He is living at his home at 401½ E. Johnson St., Madison, Wis.

White, Don, is with the White Paving Company of Chicago, Ill. His home address is 5219 Magnolia Ave., Chicago.

ELECTRICALS

Anderson, Carl G., has been employed by the Michigan Power Company of Appleton, Wisconsin. His address is 500 N. Division Street, Appleton, Wisconsin.

Andrews, C. F., has been employed as a foreman with the Illinois Northern Utilities Company of Dixon, Ill. He is engaged for the greater part on electrical construction. His address is 315 E. McKinney Street, Dixon, Illinois.

Baker, J. G., is taking the graduate student course of the Westinghouse Electric and Manufacturing Company. He may be reached in care of Westinghouse Electric Company at East Pittsburgh, Pennsylvania.

Bardeen, John, has been employed as a research assistant at the University. His present residence is 23 Mendota Court, Madison, Wisconsin.

Bartels, Arnold L., is with the Milwaukee Electric Railway and Light Co. He is in their student training course.

Mr. Bartels is living at the Y. M. C. A., Fourth St., Milwaukee, Wis.

Beach, Gordon L., is enrolled in the Western Union School at Valparaiso, Indiana. He is learning about Simplex Work and will finish the course about Thanksgiving after which he will probably be sent to Chicago. He may be reached in care of the Western Union School, Valparaiso, Ind.

Beeman, Kenneth C., who is now tract manager for the Beeman Realty Company of Los Angeles, has announced his engagement to Florence Petersen, a 1928 graduate of the Letters and Science course of the University of Wisconsin. His address is 603 S. Vermont Ave., Los Angeles, Calif.

Bishofberger, C. I., is taking the year's training course offered by the Electric Machinery Manufacturing Company of Minneapolis, Minn. As yet no permanent Minneapolis address has been obtained, but mail sent to him at Medford, Wisconsin, will reach him.

Boerner, T. J., has located with the Radio Corporation of America as Student Engineer. His address is care of the Radio Corporation of America, Rocky Point, L. I., New York.

Broecker, Arthur F., is employed in the power department of the Kimberly-Clark Corporation. He is living at the Y. M. C. A. at Appleton, Wisconsin.

Chen, D. S., has been employed as an inspector by the Globe Electrical Manufacturing Company of Milwaukee. He is rooming at the Y. M. C. A. in Milwaukee, Wis.

Dubielzig, Richard C., is in the testing department of the Commonwealth Edison Company at Wilmette, Ill. His address is 251 Laurel Avenue, Wilmette, Ill.

Eckstein, E. J., who, as a reaction to the long period of schooling, hitch-hiked to Wyoming during the summer, is at present located with the engineering department of the Briggs & Stratton Corporation of Milwaukee. His address is 26—36th Street, Milwaukee, Wis.

Edwards, William H., attended the United States Army Signal school at Fort Monmouth, New Jersey, during the summer months, but is now employed as Student Engineer in the Engineering department of the Wisconsin Telephone Company of Milwaukee. His present Milwaukee address is 3303 Wells Street, but mail sent to Bannon, Wisconsin, will reach him.

Evinger, H. H., is taking the student course at the Westinghouse Electric and Manufacturing Company's Wilkinsburg plant. His address is 313 Rebecca Avenue, Wilkinsburg, Pennsylvania.

Fairweather, Burton A., is working on repeaters at the Bell Telephone Laboratories in Brooklyn. He, with **Merlin L. Martin, Irvin Gerks,** and **H. J. Romnes,** is staying at 60 Prospect Place, Brooklyn, New York.

Felber, Henry J., has been employed in the repeater and transmission department of the Wisconsin Telephone Company. His address is 126—18th Street, Milwaukee, Wis.

Frackelton, W. B., is taking the General Electric test course at Schenectady. He and **"Red" Carrier** are rooming at 107 Union Street, Schenectady, New York.

Fuldner, W. H., who was expecting to return to the University as a fellow in Electrical Engineering has resigned his fellowship and gone to South Carolina to recuperate from a nervous breakdown due to over-work.

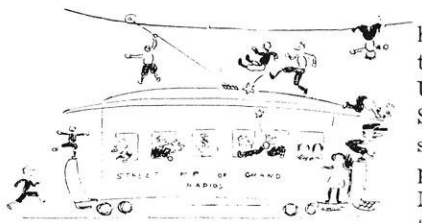
Galbraith, John F., has located in the student test department of the Westinghouse Electric and Manufacturing Company. The address is 815 Franklin Avenue, Wilkinsburg, Pennsylvania.

Goshaw, Percy L., is employed by the system of engineering division of the T. M. E. R. & L. Company of Milwaukee. His Milwaukee address is 3303 Wells Street.

Grubb, Arthur W., is installing electrical equipment in substations for the Detroit Edison Company. His address is given as 227 King Avenue, Detroit, Michigan.

Heath, Oliver K., is employed as valuation engineer for the Wisconsin Power and Light Company and is located at 900 Gay Building, Madison, Wis.

Hilliard, Gordon E., is living with his parents at 421 West Wilson Street, Madison, Wisconsin.



Krueger, Robert G., has been appointed as the Wisconsin Public Utilities Railway Scholar at the University of Wisconsin. He plans to work for his Masters degree and his thesis will be on the same phase of Electric Railways. His address is 1814 Chadbourne Avenue, Madison, Wisconsin.

Leach, Richard W., is employed in the substation department of the T. M. E. R. & L. Company where he has been working on supervisory control. His address is 821 Lake Avenue, Racine, Wisconsin.

Lueck, Irving B., is employed as an engineer with the Illinois Bell Telephone Company. His address is 208 West Washington Street, Chicago, Ill.

McArthur, R. M., has been employed as Manager and Trouble Shooter with the Merchants Power and Light Company of Baraboo, Wisconsin.

McDougal, Kenneth R., is taking the test course of the General Electric Company at Fort Wayne, Indiana. With him are **Cameron Thomson, Royce Robarge,** and **Ben Weichers.** McDougal's address is 2628 Broadway, Fort Wayne, Indiana.

Martin, Merlin L., is doing research work in the laboratories of the Bell Telephone Company at New York City. His address is 60 Prospect Place, Brooklyn, New York.

Maxham, Kenneth, is a student engineer with the Westinghouse Electric and Manufacturing Company and is at present at 206 Roseville Avenue, Newark, New Jersey. Since Maxham is in Newark only temporarily he may be reached at the Westinghouse Club in Wilkinsburg, Pa.

Metcalf, Ralph H., is junior sales engineer for the Century Electric Company of Webster Groves, Missouri. He may be reached at 110 W. Jackson Rd., Webster Groves, Missouri.

Montgomery, Wardwell B., has been employed as a results engineer with the Madison Gas and Electric Company of Madison. His home address is 602 S. Dickinson Street, Madison, Wisconsin.

Morack, Marvin M., is working in the radio testing laboratories of the General Electric Company at Schenectady. He is living at 900 Union Street in Schenectady, New York.

Loeber, Walter, is in the position of Junior Engineer with the Milwaukee County Highway Commission, Regional Planning Department. Walter says, "Graduated as EE but judging from the fact that the pay check comes in regularly, EE's must make good Civils. EE's always did maintain that Civil Engineering was a 'pipe'." His address is 509—58th Street, Milwaukee, Wisconsin.

Moore, John B., has been employed as an engineer with the Northern Indiana Public Service Company at Hammond, Ind. He is rooming at 48 Waltham Street in Hammond.

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Campus Notes

FINAL PLANS MADE FOR NEW M. E. BUILDING

The new building to house the Mechanical Engineering department is now an assured reality. All financial appropriations for the construction of the building, heating tunnels, and furnishings have been made and it is expected that ground will be broken for the foundation before the year is out. The state architect and his assistants are now working on the final detailed plans.

The new building to be erected on the ground near Randall Shops and the Stadium will provide room for the Steam and Gas department, the Machine Design department, the Machine Shops, and the Engineering college mechanician, Mr. Romare. There will be a clubroom available for A.S.M.E. and honorary fraternity meetings. A library and reading room will occupy part of the space and it is hoped that permission will be granted to install a smoking and lounging room.

MEAD AND ROOD GO ON LEAVE OF ABSENCE

Prof. Daniel W. Mead of the Hydraulics department will be absent for the first half of this semester to act on a committee connected with the new Boulder Dam.

Prof. J. T. Rood of the Electrical department has been granted a year's leave of absence to head the department of Electrical Engineering at the University of Iowa.

FELLOWSHIPS ARE GRANTED TO SEVEN

Seven appointments wree made at a recent meeting of the committee on the granting of Engineering Fellowships.

A. P. Colburn was granted a fellowship in chemical engineering and H. F. Woo one in structural engineering. Oscar Fritsche has been appointed to a research fellowship in mining engineering and B. R. Teare to one in electrical engineering.

R. G. Krueger has been awarded the fellowship offered by Electric Railways. George McGregor has been awarded the fellowship given by the Northwest Paper Co. and Norman Ceagalske the one in chemical engineering offered by the Gas Section of Wisconsin Utilities.

FACULTY CHANGES

During the period between the closing of school in June and the recent opening, several changes have been made in the faculty both in the promotion of present members and in the addition of new ones.

J. W. Watson and J. R. Price of the Electrical Engineering department have been promoted from associate professors to full professors. G. F. Tracy of the same department has been advanced from instructor to assistant professor. John Bardeen has been appointed research assistant.

F. M. Dawson has been appointed with the rank of professor to fill the vacancy made by the death of Prof. C. I. Corp.

In the department of Highway Engineering, Prof. H. F. Janda has been appointed to fill the vacancy made by the retirement of Prof. L. S. Smith.

Paul Norton of the Mechanics department has been promoted from the rank of instructor to that of assistant professor and E. T. Hansen, a graduate of last year, has been appointed instructor in Steam and Gas.

941 STUDENTS ENROLL IN ENGINEERING COLLEGE

Course	Freshmen	Sophs.	Jrs.	Srs.	Grads.	Total
C. E.	87	82	57	50	5	281
M. E.	57	60	44	30	3	194
E. E.	84	98	79	51	9	321
Ch. E.	37	29	24	18	9	117
Min. E.	7	7	6	7	1	28
Grand Total						941

There is no marked difference in the distribution of the students as compared with previous years. The electrical course still seems the most popular with the civil course a fair second.

Freshmen registration is not record-breaking although it compares favorably with the records of previous years.

The hum of the engines being tested in the steam and gas laboratory coupled with the tramp of almost a thousand students down the corridors and stairs has lent an industrious atmosphere to the building the engineers call home, a hum that is gratifying to the ears of seniors and quite alarming to the timid freshman.

Yes, school has started in earnest.

WELL, IT'S A GOOD GUESS

"The phrase, 'Out of wind' ", explained the junior civil in a quiz in Masonry, "refers to that portion of a structure not struck by the wind."

AUTOMATIC RECORDING MICRO-BAROGRAPH IN TOPOG DEPARTMENT

A recording microbarograph has been given to the Topographic Engineering department by Dean Turneaure. It records air pressures on a cylinder which has provisions for a week's run without changing the graph paper on it. It measures the pressure in inches of mercury. The device was made in England.

SUMMER CONFERENCE FOR ENGINEERING TEACHERS

Two sessions sponsored by the Society for the Promotion of Engineering Education and similar in nature to the school for teachers of mechanics conducted last summer at Madison were held this summer, one at Cam-

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Editorials

DO YOU GUESS? Most people guess most of the time — some even guess that their guess is right. The world is entering an era of fine tooth competition where guesses will no longer make a consistent living for a man.

There is plenty of exact information in the form of facts upon which to base intelligent judgment; most of us are too lazy to dig it up. Today is a good time to begin that mental housecleaning that we have so often promised ourselves, starting with the resolution: "I'll get the facts first, then act accordingly."

We wager that if all actions were delayed pending the ascertaining of facts, we would get ahead faster, make fewer mistakes, and have a lot of time left over.

Anyone desiring the index to Volume 32, Sept. 1927 to May, 1928, may get one by calling at the Engineering Library or writing to the office of the *Wisconsin Engineer*.

A THIRD OF A CENTURY! In the year of 1896 there appeared in our halls a small 7x10 booklet entitled "*The Wisconsin Engineer,* Published Quarterly by the Students of the College of Engineering". A third of a century later you hold in your hand the October, 1928, issue of that publication which, by virtue of your support and the support of those who have gone before you, has become one of the foremost engineering college publications in the country!

The first printed words in our first volume state clearly the policies and principles for which we stand. We repeat them:

> "With this number *The Wisconsin Engineer* comes out for its trial trip in the field of technical journalism.
>
> "It has for some time been the desire of many students and alumni of the College of Mechanics and Engineering that they might have a representative among the periodicals issued by technical schools of the country; and that, if possible, they might take, as an institution, some more active part in the dissemination of engineering knowledge and experience.
>
> "It is the aim of this journal to fill that want in so far as it may be able. It is desired more especially to make known the results of original investigations by students and others connected with the University and to publish communications from graduates who are engaged in the practice of their profession. . . . Articles of merit will be gladly received from any who may see fit to contribute."

The form in which the magazine first appeared has been changed and brought up to date many times, but the spirit with which the institution was founded has continued throughout the years unwavering and true — *a third of a century of service!*

The *Engineer* has represented Wisconsin in the ranks of technical school periodicals, and our worthy predecessors have raised us from a position of comparative obscurity to the front rank. We have taken an active part in the "dissemination of engineering knowledge and experience" — a glance through our files will interest you. Any original investigation which has taken place in our University has been given space in preference to any other matter. Finally, our contributors have roamed the seven seas and have reached the far corners of the earth, and to them, in no small measure, is due the credit for the interest our pages have held in the past.

We maintain, again, that we have fulfilled the purpose for which we were founded. We pledge ourselves, with your support to bring to you this year the best magazine that we have published in *a third of a century!*

STAFF POSITIONS While the staff of the *Wisconsin Engineer* is reasonably well rounded out, there are still some fine positions left open for men who wish to gain the very valuable experience which this type of work offers. We wish to take this opportunity to especially urge the freshmen and sophomores to make themselves known to the staff members and indicate what branch of our work interests them.

There seems to be a mistaken idea going the rounds that to work on the staff of the *Engineer* requires some uncanny superhuman ability or a God-gvien aptitude at putting one's thoughts and mental processes down on paper. Nothing could be farther from being correct. One must, of course, be able to write coherently and simply, but beyond that point no special ability is required.

Our year is getting nicely under way. The first and most difficult issue is off the press. From now on the going will be smooth and anyone who has a desire to become a staff member will find that this is the time to begin. Engineering journalism is a broad field, rapidly increasing in importance, and employers are eager to secure the services of men who have shown ability in that direction. Here is the place to start and now is the time — come around and get acquainted with the staff.

ARTERIES OF THE NATION Exactly one hundred years ago, the first American railroad system was inaugerated. Staid citizens of the time used to gasp at the "comic strip" engine followed by a few cars traveling slowly over its brief length of track. Today, the new monster three cylinder locomotives hauling many comfortable cars, with finest appointments and sleeping accommodations, speed over 420,000 miles of track in every section of the United States.

In this hundred year period practically all American

(Continued on page 24)

Engineering Review

HOW STABILITY WILL BE RESTORED TO PISA'S LEANING TOWER

The engineers of the Francois Cementation Company, which is to undertake the work of strengthening the foundation of the Leaning Tower of Pisa, will first prepare the ground and subsoil some 50 yards away from the present foundations of the tower to test the resistance of the soil, which is partly mixed with moving sand, gravel and running water. The process to be used consists of certain chemical applications, followed by injections of specially prepared cement.

It is said that, in the course of the last 50 or 100 years, the famous tower has rather accentuated its inclination, and it is now supposed to be moving slightly at the rate of one millimeter (0.039 inches) per year. According to this estimate, it would take at least 200 years for the center of gravity of the tower to fall outside of the perpindicular. One precaution which has been suggested is to drain thoroughly a large area within hundreds of yards of the tower and the cathedral of all water, and to prevent any further possible infiltrations of moisture, which makes the foundation soft and causes them to slowly yield.

CAST STONE

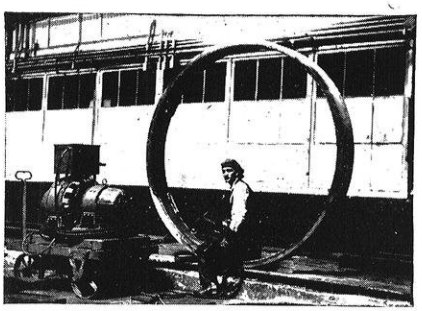
A process for casting stone in much the same manner as that in which iron is cast is now in use. A flexible mixture is obtained by using one part of cement to three and one-half parts of marble or granite aggregate, with eight gallons of water to one bag of cement. Three sizes of aggregates are used, the largest screening through a one-half inch mesh. It is possible to make statuary castings which resemble the finest carved work. Necessarily the batch must be agitated while it is being poured to secure uniform distribution of the aggregate. An advantage of cast stone work is that large pieces may be made hollow.

—*Scientific American.*

RECLAIMING A BRAKE RIM BY ARC-WELDING

A new use for arc welding has been found in the reclamation of large steel pieces which are not perfect as they come to the shop. Many pieces that would otherwise be scrapped are now reclaimed by the use of the electric arc.

In reclaiming the brake rim shown



in the adjoining illustration, a low carbon steel filler rod was used. The piece was built up ¼ inch around the inner rim, and the filling was carried back from the edge for about two inches. The rim was then machined in the usual manner, and since the difference in the carbon contents of the steel and the filler was so slight, no difficulty was met with in this operation. Neither was any line of demarcation found in the finished piece. —*Westinghouse News.*

WASTE OIL AIDS GARBAGE INCINERATION

The use of waste motor oils from the garages of Utica, New York, as an aid to combustion in garage disposal has resulted in greater efficiency. By raising the combustion temperature, the oil gives more thorough combustion, resulting in a cost saving of about 60 per cent. Waste oil was formerly dumped in the sewer system, necessitating costly cleaning operations.

CHEMICAL "ICE" RINK

A chemical composition, which apparently includes a soda ash and resembles crude rock salt, is being used in Germany for summer "ice" skating. In preparing the "ice" rink a smooth wood floor is laid and the material, first heated to reduce it to liquid form, is sprayed upon the surface. The compound becomes solid quickly and any unevenness can be removed with an ordinary steel scraper.

—*The Auroco News.*

RADIUM RAYS TEST FLAWS IN CASTINGS

Using radium rays so penetrating that they can go through pieces of 15 inch metal to test for hidden flaws in large castings, is one of the latest accomplishments of the Russian State Radium Institute, Leningrad.

These "gamma rays" as they are called, are similar to X rays, but are of much shorter wavelength. They are more penetrating and can pass through pieces of metal too thick to be examined with the X rays. Examination by radium is said also to be cheaper than with X rays, because the same radium can be used over and over for an indefinite period of time.

Large and expensive photographic plates are not required since, the rays, after passing through the object, act upon a special, sensitive electroscope. The test record is preserved for future reference in the form of a simple diagram automatically traced. Another advantage is that gamma rays speed up the inspection—it may cut down to a couple of minutes for a large casting—while X rays require a very long exposure, often of several hours, when metal is more than two or three inches thick.

The apparatus, as developed by the Russian scientists, is very simply constructed. A tiny glass capsule with a radium preparation is inserted into a

(Continued on page 30)

Alumni Notes

ELECTRICALS

Biegler, Phillip S., e'05, professor of electrical engineering at the University of Southern California has been made acting dean of the newly created college of engineering at that institution. Prior to going to that university five years ago, Prof. Biegler taught for thirteen years at the University of Iowa, Illinois, and Purdue, and at Washington State College. From 1918 to 1921 he was associate editor of the Electrical World. He also spent a number of years with the Commonwealth Edison Company in Chicago and with the Washington Water Power Company in Spokane.

Hudson, Alfred, e'25, visited Madison during August. On Sept. 3rd, he was married to Miss Margherita Libby, a University graduate of the class of '26. Mr. and Mrs. Hudson left immediately after the wedding for Havana, Cuba, where they will make their home.

Jordan, R. DeWitt, e'27, who has been employed by the General Electric Company as a Student Engineer since October 31, 1927, has been transferred to the Publicity Department, General Office of the General Electric Company at 1 River Road, Schenectady, New York.

Peterson, Holmer A., e'21, who has been employed by the General Electric Company as Student Engineer since October 24, 1927, has been transferred to the Central Station Department of the same Company, at Chicago, Ill.

Sogard, Ralph H., e'26, married Mary Field of Racine, August 16. Mr. and Mrs. Sogard are now living at 339—44th St., Milwaukee, Wis.

Summers, Erwin R., e'26, one time editor of the Wisconsin Engineer, and now instructor at the University of Minnesota, was married to Miss Bernice Rom, a graduate of the Home Economics course with the class of '27, on September 22.

Thayer, Neal, e'27, is with the Public Service Co. of Colorado, and can be reached care of that company at their Denver Office. **Tweeb, Noel**, e'27, is also with the Public Service Co.

Wolfe, Harry C., e'26, has left Westinghouse, where he has been since graduation, and is now superintending the installation and operations at the Cleveland plant of the Chromium Corporation of America. His address is 1598 Nela Crest, Cleveland, Ohio. Mr. Wolfe was editor of the Wisconsin Engineer while at school.

MECHANICALS

Anderson, Edward, m'18, who has been instructor in the Steam and Gas Engineering department of the University of Wisconsin, leaves for Lincoln, Neb., some time in August. He has been made Assistant Professor of Mechanical Engineering at the University of Nebraska, and will give courses in metallography and the heat treatment of metals as well as some work in steam and gas engineering.

Elmendorf, Armin, m'19, was in Madison on business the last week-end in September and visited old friends on the Campus. He is in charge of the engineering research department of the Celotex Co. with headquarters at 645 N. Michigan Ave., Chicago, Ill., and his work is chiefly in the development of new uses for the material manufactured by this company. Celotex is a building board made from bagasse, the sugar cane fibre which are the refuse of the cane sugar mills. Mr. Elmendorf recently returned from a sojourn in Europe and Egypt where he has been engaged in development work for his firm.

Kurtz, Henry W., m'19, is with the National Welding Products Corporation of Chicago. His address is 6427 N. Rockwell Ave., Chicago, Ill.

Phillips, Rufus S., m'23, and **Caldwell, Earl L.**, m'24, are with the Portland Cement Association of Chicago.

Soulen, R. J., m'27, is in Chicago working in the Sales and Service department of the White Motors Co.

Williams, M. J., m'27, is in Detroit with the Northington Pump and Machine Co., with offices at the Book Building, Detroit. Mr. Williams had been located in Boston and later in East Orange, N. J., before his transfer to the Detroit office. He was a former business Manager of the Wisconsin Engineer.

CHEMICALS

Cretnez, R. W., ch'21, of Monroe, La., announces the birth of a daughter, Beatrice Ann, on August 11.

Dexheimer, E. C., ch'16, of the National Enameling and Stamping Co., St. Louis, visited friends in Madison during registration week.

Hansen, Russell E., ch'26, is now employed by the Leeds & Northrop Company, 307 N. Michigan Ave., Chicago, Ill. as a sales engineer. He is living at 7151 Bennett Ave.

Millington, F. M., ch'23, has been appointed industrial gas engineer for the entire territory served by the Wisconsin Public Service Corporation.

Moon, H. J., ch'16, is on the research staff of the National Enameling and Stamping Co. and at present is detailed to the Milwaukee plant.

Murphy, W. B., ch'28, is a member of the engineering staff of the A. C. Neilsen Company, 4450 Rosewood Ave., Chicago, Ill.

Roberts, J. W., ch'23, is employed by C. E. Badeaux, Industrial Engineer, Chicago.

Ruhnke, Karl, ch'27, is with the Seaboard By-Products Coke Co., Jersey City, New Jersey. His address is 432 Beech Street, Arlington, New Jersey.

Spees, J. M., ch'27, is now working with the Seaboard By-Products Coke Co. at Jersey City, N. J. He is living at 432 Beech St., Arlington, N. J.

Zinn, Robert E., ch'27, employed by the Victor Chemical Works of Chicago Heights, was married to Miss Helene Carless of Neillsville, Wisconsin, on August 22. Their home address is 1317 Vincennes Avenue, Chicago Heights, Illinois.

CIVILS

Abendroth, George, c'25, who has been Engineer of construction at the Wilmington Boat Yard of the Dravo Contracting Company, left on a belated honeymoon on September 1. He will be assigned to the Pittsburgh Office, and will work in the estimating department.

Chase, L. E., c'22, is engineer with Consoler, Older & Quinlan Co. of Chicago. Mr. Chase is working in the Niles Center office and is living at 1319 Maple Avenue, Evanston, Ill. He has recently been admitted as associate member in the American Society of Civil Engineers. In December of 1927, he passed the examination for registration as an engineer in Michigan.

Levin, Jacob D., c'27, is an engineer for Wells Brothers Construction Co., of Chicago, on the building of an eleven story produce warehouse at 15th Place and Blue Island Avenue. He can be reached in care of that company at 1551 South Loomis St. Mr. Levin is in charge of the horizontal and grade lines, and was required to give centers for eighty-four caissons on the open type. His job, besides locating the positions of the cassions, is to check up on the steel reinforcing, to keep records of soil condition and to supervise the digging. The north property line is directly below a retaining wall which, due to the undermining done by the workmen, is constantly shifting in toward the work. He writes that it is somewhat more difficult to survey work such as that when one has been brought up on work under such ideal conditions as surveying around the campus.

EDITORIALS

(Continued from page 18)

progress has been made. There could have been no satisfactory settling of our great stretches of isolated country without a means of communication better than the ox-cart or ships that came around South America to our west coast. The railroad provided the means and brought the supplies for the extension of our country on a large scale. In short, it brought expansion and prosperity. The growth of our country is synonomous with the development of the railroad.

WHAT THE CLASS OF 1928 IS DOING

(Continued from page 15)

Roberts, Hubert H., is doing carrier circuit testing for the Wisconsin Telephone Company of Milwaukee. He may be reached by writing 418 Broadway, Milwaukee, Wis.

Romnes, H. I., is one of the circuit designing engineers for the Bell Telephone Laboratories. His work includes circuit designing for trans-Atlantic telephony, chain broadcasting and picture transmission. His address is 60 Prospect Place, Brooklyn, New York.

Saari, Leonard V., is a cable tester for the Wisconsin Telephone Company of Milwaukee, and may be reached in care of that Company at Milwaukee, Wisconsin. According to latest reports he is planning on marrying a former University of Wisconsin co-ed.

Mueller, George J., after working during the summer months in the engineering department of the T. M. E. R. & L. Company is now attending graduate school at Cornell University in Ithaca, New York. Mail addressed to 589 Summit Avenue, Milwaukee, Wisconsin, will reach him.

Nooker, Clyde W., is employed by the Mississippi Valley Public Service Company. His address is 705 West 7th Street, Winona, Minnesota.

Nowack, David C., is with the test and Inspection department of the Westinghouse Electric and Manufacturing Company at Sharon, Pennsylvania. Mail addressed to him in Watertown will reach him.

Paula, M. W., is employed as valuation engineer by Victor A. Dorsey and Company of Chicago. His address is 4042 W. Cullerton Street, Chicago, Illinois.

Sargent, John, is working as clerk in the distribution department of the Wisconsin Public Service Corporation of Green Bay. He is living at 1481 Eliza St., Green Bay, Wis.

Scheer, George Henry, is in the training course of the educational department of the Westinghouse Electric and Manufacturing Company. His address is 815 Franklin Avenue, Wilkinsburg, Pennsylvania.

Silver, Harold S., has been employed as a patent examiner for the United States Government. Along with his duties, Silver is studying law at the evening classes of the George Washington University in Washington, D. C. His address is given as 13 Cecil Avenue, Hyattsville, Maryland.

Straub, Richard F., is at present drafting for the Wisconsin Public Utilities Corporation. He can be reached in care of the Y. M. C. A. at Green Bay, Wisconsin.

Thomson, Cameron A., is checking all types of distributors for the General Electric Company of Fort Wayne, Ind. His address is 2628 Broadway, Fort Wayne, Indiana.

Tyler, Ransom, is employed in the general shop and service work, leading to sales. His address is 432 Eastwood Place, Milwaukee, Wisconsin.

Weichers, Frederick J., who has recently returned from a trip to Mexico where he installed small hydro-electric plants for privately owned "haciendas" (small towns), worked on a variable speed induction motor for a rotary press of Mexico's new newspaper "La Prensa", and helped design substations in Mexico City, is now enrolled in the University of Michigan where he is a candidate for the degree of Master of Science in Aeronautical Engineering. His Ann Arbor, Michigan, address is 1706 Cambridge Road.

Whitmore, Harland W., is with the Wisconsin Power and Light Company of Beloit. His address is 1235 Dewey Avenue, Beloit, Wisconsin.

Wunsch, Benjamin A., is in the transmission testing department of the Wisconsin Telephone Company. His only permanent address is Reedsville, Wis., R. 2.

Zillmann, Don H., is at present with his parents in Colby, Wisconsin. He expects to start work in November.

COEFFICIENTS OF DISCHARGE OF CIRCULAR ORIFICES

(Continued from page 12)

the measuring basin. This started the run at the end of which the water was again turned into the waste channel. During the time of the run the left and right leg readings of the head gage were taken and recorded at regular intervals. After the measuring basin gage was read and recorded the basin was emptied by means of the waste valve shown in the end view of Figure No. 2.

Water Measurement

The discharged water was measured volumetrically in the accurately calibrated Basin No. 4 located beneath the floor as shown in Figure No. 2. This basin has a capacity of 1,300 cubic feet and has a water gage as shown in Figure No. 2. The actual discharge of a run is computed from the difference of the initial and final readings, and

the initial and final readings of the gage in conjuction with the calibration curve of the basin.

It was first thought best to weigh the discharged water for the small orifices, but after making a test run with the one and a half inch orifice the author decided that in view of the good results obtained and the better facilities for volumetric measurements to use this method throughout.

Water Supply

The source of water supply was either from the University Water Works Pressure Tanks located in the adjoining building or the Hydraulic Laboratory Reservoir. The reservoir is situated on a bluff above the Hydraulic Laboratory and at an elevation that gives a pressure head of fifty-eight feet at the level of the main floor. Its capacity is 220,000 gallons. It is filled with water from the university water system or from the pumps in the laboratory.

Observations

The flow from the larger orifices and that from the small orifices under high heads was not smooth, but was agitated and sputtery. The author believed this condition to be a disturbance caused by the high velocity of the passing stream and not avoidable in this experiment. For the low heads the flow was uniform and smooth for all orifices.

This disturbed condition of the discharging stream would seriously hinder any attempt to make an exact study of the area of the stream at the point of maximum contraction. The author believes that this is the type of disturbance which Messrs Judd and King of Ohio State University mentioned as being the cause of their not publishing the data on their largest orifice. They determined coefficients of an orifice on the end of a drum and made a close study of the stream at maximum contraction.

The author drew the following conclusions from the results of his study:

1. The relation of the coefficient of discharge to the area ration is a parabolic function. The coefficients increase as the area ration decreases for all heads, but they seem to increase faster for the high heads.
2. For all orifices tested the relation of the practical coefficient of discharge to the area ratio is constant for heads above fifteen feet.
3. Very slight irregularities in the orifice edge has a considerable effect on the coefficient of discharge, noticeably increasing it.
4. The head on orifices located on ends of pressure pipes can be measured from two to four feet from the orifice without any material difference in pressure being noted.

Universities can give a man much. They can give him the rudiments of knowledge, they can teach him to study, but they cannot make him anything. That is a responsibility he must assume and a result which he can only accomplish himself. —*E. W. Beaty.*

ENGINEERING REVIEW

(Continued from page 20)

deep hole bored in a large lead ingot. This ingot stops all rays, except a narrow strong beam that goes along the bore. This beam pierces the casting and encounters two filaments charged with electricity and enclosed within a copper cage. There is an air space between the filaments and the cage which acts normally as a perfect insulator, allowing no electric current to pass through it. But as soon as gamma rays have a chance to get in the cage they ionize the air and turn it into a conductor.

Electricity from a battery flows from the filaments to the copper cage and from it passes through a galvanometer and back to the battery.

As the intensity of the rays changes with the thickness of metal pierced by them, the rate of ionization varies accordingly. Therefore the flow of electric current exactly mirrors the shape of the object under test. Any deviation at once shows that some imperfection is present.

—*Scientific American.*

CAMPUS NOTES

(Continued from page 16)

bridge, Mass., for teachers of physics, and the other at Pittsburgh for teachers of electrical engineering.

The Pittsburgh session lasted three weeks, from July 5 to July 25. Most of the meetings were held in Thaw Hall, the engineering building of the University of Pittsburgh. The average day's program consisted of two addresses in the morning and one in the afternoon, each address being followed by lively discussion. Five days were spent at the plant of the Westinghouse Company at East Pittsburgh; and on these days the addresses were given by members of the company's staff.

Prof. C. F. Harding of Purdue University and Prof. E. Bennett of Wisconsin gave the principal addresses on the teaching of the fundamentals of electrical engineering. Prof W. R. Work of Carnegie Institute of Technology led the study of the teaching of electrical machinery. Other topics taken up were laboratory practice, communications, and public utilities. Prof. A. E. Kennelly of Harvard gave talks on the teaching of engineering mathematics and the standardization of electrical units, which were not only authoritative but were given in the delightfully pleasant manner which is unique with Prof. Kennelly.

The need of more scholarship was urged by Prof. V. Karapetoff of Cornell in his talk on transient phenomena; and Prof. G. H. Alderman and Prof. W. W. D. Sones, both of the University of Pittsburgh, outlined the processes of teaching from the educationalist's point of view. Among the men of the Westinghouse Company's staff who addressed the conference were Mr. R. E. Hellmund, Mr. A. M. Dudley, Mr. E. D. Newbury, and Mr. S. M. Kintner.

—*By G. F. Tracy,*
Asst. Prof. of Elec. Eng.

WHY MENTION IT?

"This is a pretty bad record," said Dean Millar in fatherly tones to the frosh engineer. "You have failed in every subject. What have you to say about this situation, anyway?"

"Well, Dean," answered the frosh, "you know that nobody is perfect."

THAT'S TRUE

The visiting alumnus had expressed his opinion that college professors should receive more pay.

"I'm glad to hear you say that," replied his old adviser. "I'm certainly pleased to hear an old student of mine say that he thinks teachers should receive bigger salaries."

"I am very much for it, professor," explained the alumnus earnestly. "I think in that way we could attract a much better class of teachers."

Before going out into the battle of life last June, the senior civils unloaded the following gems of thought from their chests in a final examination in substructures:

"It is *assumed* that the foundation supports the structure."

"The relative cost of the two methods is an economic one."

"Caisson disease is a disease common to those who work under *atmospheric pressure above normal.*"

"Puddle is a mixture of gravel and clay. The *gravel* tends to fill any seepage holes in the clay and *acts as a binder* for the mass."

"Puddle is sometimes used as a core in *masonry* dams."

"The theory of the *floating* foundation is that the structure will settle evenly provided the *piles* are long enough."

THE 1928 SUMMER SURVEY CAMP

(Continued from page 11)

ganization of the Whoopee club until it was a mighty power. Soon after its entrance into camp it included among its members such men as Ray Owen, Chief Engineer Otto Wehrle, and Judge Halstead, our friend and neighbor. A rival club, the Waa-joes, was then organized to counteract the pernicious influence of the Whoopees, and gained control of the Fire Department. From then on, it was war, and you all know what war is. The search for bigger and better Whoopees and stronger and wiser Waa-joes began. Even Mr. Nelson, our instructor in plane technique came to breakfast one morning with a tired look and a Whoopee pledge pin.

The second Sunday of camp the University truck came up with a fire engine to enable us to help ourselves efficiently in case of fire. With the aid of red paint, Prof. Van Hagen's lettering ability, some rain hats, and a special meeting of the newly organized Board of Fire and Police Commissioners, the Fire Department was organized. Led by Chief Mohr, Ass't Chief Paschen, Captain Schlondrop, 1st Lt. Matthias, and 2nd Lt. Frank Fischer, the seven horsemen of Azimuth City, Airis, Stevens, Kutzke, Peterson, Henkel, Max Fischer, and Otto Wehrle, ably protected Azimuth City and suburbs during the rest of the encampment. The Fire Department met its great test on the Fourth of July, when it bravely battled and subdued a huge conflagration which was threatening the marshes at the mouth of Messenger Creek.

Amidst all this merriment, foolishness, or what have you, — WORK was being done. In fact, everyone was clamoring for more work to do. The days were too short; everyone extended them far into the night, laboring mightily. Then, one fine sleepy morning, Bill Kutzke, our valiant bugler, decided to improve the camp schedule a bit and blew first call at 4:30 instead of 5:30. It didn't work very well, as only a few people got up to enjoy the extra hour. These few, however, were loud and emphatic in their condemnation of Bill's revised schedule.

Towards the end of the fourth week the base ball games were abandoned in favor of contour lines, water power maps, stream gauging reports, hydrography maps, and the many other little tasks too numerous to mention, which the faculty thought ought to be done. The four weeks men were finishing up and the six weeks men beginning to realize that they had better look forward to finishing up something too.

After several days work Mr. Wesle finally got permission from the Park Superintendent to hold the annual snipe hunt in the Park. We had to promise not to bag all the snipe, before the Park Superintendent could get the permit through the Conservation Commissioner's office. On the afternoon of July 3, the permit came through and the hunt was scheduled for that night. Led by Mr. Wesle, the brave hunters went out, armed with clubs, bags, lanterns, and a never-say-die spirit. Far back in the wilds of the park where the snipe were reported to be the thickest, the bag-holders, Benesh, Poss, and Borrud were stationed, to bag the wary game, while the other drove

towards them. It was an exceptionally poor night for snipe as there were none caught, although one flock ran very close to Benesh.

On the Fourth of July, the alumni picnic to the Pee-wit's Nest was held. After an exciting base ball game, a very good lunch was eaten. After lunch, while sitting in two groups around the fire, — the Whoopees and the Waa-joes do not mix — the Whoopees burst violently into song. Not to be outdone, the Waa-joes sang. Then both groups sang, and for a long time nothing could be heard but the strains of sweet (?) music in the Pee-wit's Nest. The singing closed by a hearty rendition of *On Wisconsin* and *Varsity* with Ray Owen as conductor extraordinary.

From then on, all was excitement around the camp. The work had to be finished. Some of us wanted to leave early, and — of course — all of us wanted to leave sometime. The annual banquet was held on Wednesday, July 18. The talk by Judge Halstead was especially enjoyed, giving us a glimpse back at former camps like ours, and of days when Devils Lake was not as it now is.

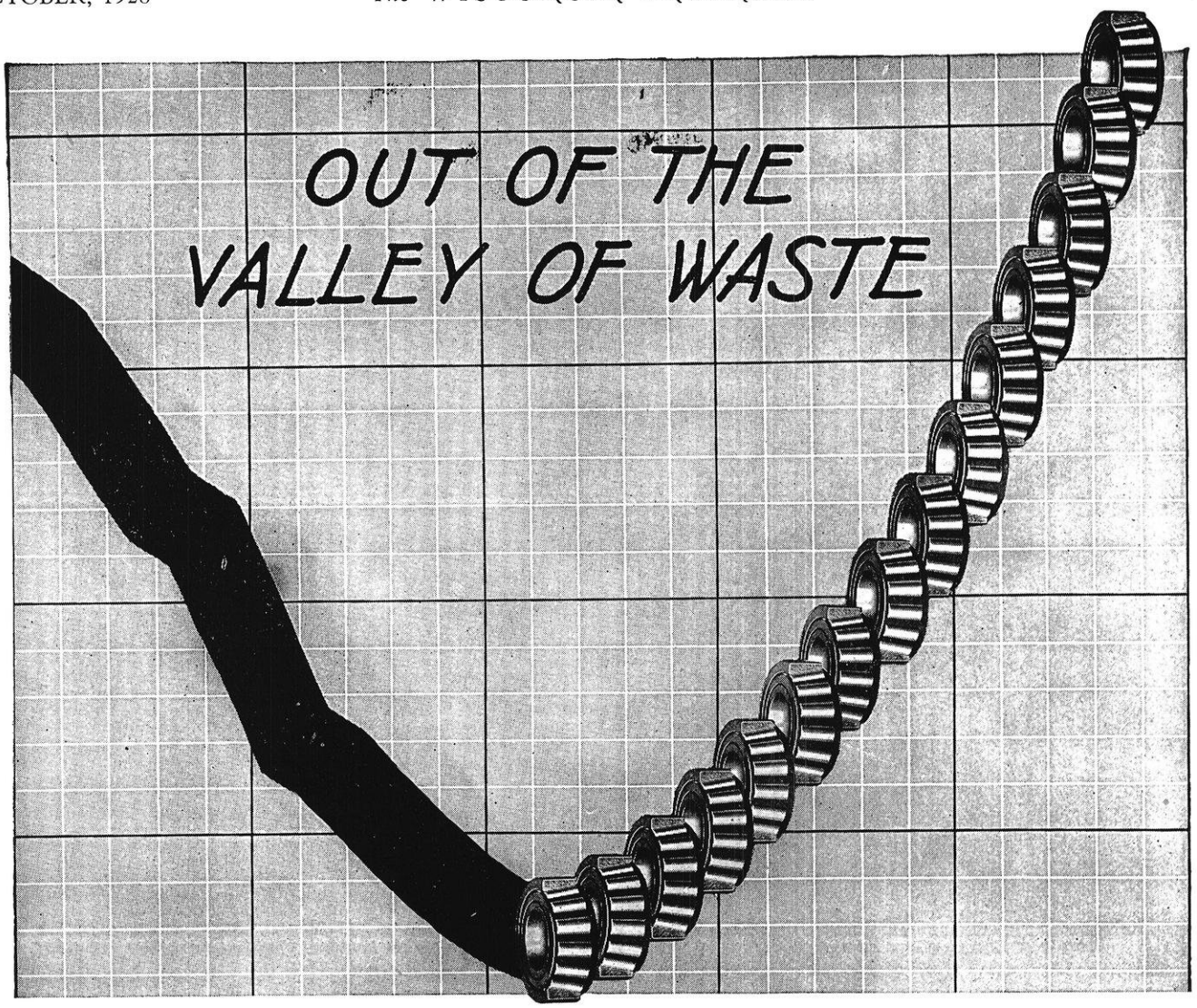
The improvements made around the camp this year were numerous and effective. The commissary, Ray Owen Hall, and other small buildings about the camp were covered with green shingles. Lake Owen dam was built up and enlarged, increasing the size of the lake. A new driveway was built into the camp. Some tile lines were put in to better drain the area, and many other minor repairs and changes were made. The Mess Hall was somewhat improved by the addition of walls, which made it more comfortable in case of rain and wind. The buildings were put on the electric light line from Baraboo, so the camp generator could rest occasionally.

Wednesday, July 25 was the last day of camp. Many had left before that, but they all left feeling that their time had been well spent. We enjoyed the camp at Devils Lake in spite of all the hard work we had to do. The friendships that we made there and the memories of the pleasant things we did there will always be treasured. May the Civil Engineer's camp go on and may future residents of Azimuth City enjoy their summer there as much as did the engineers in the summer of 1928.

THE UNIVERSITY'S WATER SUPPLY

(Continued from page 9)

water. These two duplicate tanks are filled with compressed air under a pressure of from one hundred thirty-five to one hundred forty pounds per square inch. The valve mechanism which connects the two air tanks with the two water tanks is so arranged that when the pressure in the water mains drops below 75 pounds, the air from the air tanks is let down into the water tanks. It can hold the water pressure at 75 pounds for, from a half an hour, to an hour. Another feature of the above mentioned mechanism is its alarm signal. When the water pressure drops to 75 pounds, a mercury contact closes an electric circuit which contains a large railroad signal bell, which can be heard for at least a hundred yards from the building. This gives the operator at least a half an hour after the



THE moment you put theoretical knowledge into practice you will find that the factor of friction is something all Industry has to fight.

You will also find the foremost factor in fighting friction to be Timken Bearings with their full thrust-radial capacity and anti-friction properties, their Timken-made electric steel, Timken tapered construction and Timken *POSITIVELY ALIGNED ROLLS.*

Installed at the hard service points in motor vehicles and any type of industrial machinery, it becomes graphically apparent that Timken Bearings are bringing Industry out of the valley of waste and up into the higher plane of profit.

THE TIMKEN ROLLER BEARING CO., CANTON, OHIO

TIMKEN *Tapered Roller* **BEARINGS**

Please mention The Wisconsin Engineer when you write

warning to put all idle pumps into operation in order to meet the emergency.

Another precaution taken against fire that the designers of the pumping station have taken is a valve that can be opened to let Madison city water into the University Mains. This valve is kept closed at all times; it cannot be open except in cases of extreme emergencies, for the city water pressure is only 60 pounds per square inch while that on the University mains is 85 pounds. Thus, if this valve were opened the lake water from the University mains would flow into the city system and make the city water unfit for drinking purposes.

By summing up the capacity of the pumps mentioned there is a possible capacity of 4,300 gallons per minute which should be sufficient for any fire emergency.

"In what does the commander's superiority consist? In his mental qualities: insight, calculation, decision, eloquence, knowledge of men." —*Napoleon.*

AN INDUSTRIAL SURVEY OF EUROPE

(Continued from page 7)

by the terms of the peace-treaty. The entire area is under very intensive military supervision and from our talks with the Austrian natives it is without doubt one of the places from which future disturbances in Europe may radiate. In my opinion, it would have been much better if that area had remained with Austria both from the standpoint of the people involved and the avoidance of excessive clashes which may bring on future trouble.

A very quaint town now named Vipiteno (formerly Sterzing) was a stopping point in our trip. The photograph which shows the high tower in the background is the main part of the village. During the evening a musical concert was held around this tower, and the scene was one which many of our movie directors would have difficulty in exceeding.

While the Italian government was spending a large amount of money in insuring peace in this area it was also carrying on water power developments which without doubt will aid Italy industrially in the future. A number of manufacturing industries were visited in Italy, and while the majority were working below capacity they were experiencing an increase in business. Both the working people and business men felt that the Mussolini administration had accomplished a stupendous task in reviving Italy industrially. While the method used was directly opposite to our ideal of governmental administration, no doubt Italy is fortunate in having such an administration during the present critical period.

While in Como, Italy, we visited the Volta exposition. Practically every manufacturer of electrical equipment in Europe had an exhibit at this exposition, and it was a very instructive one to attend. We saw at least fifteen different companies exhibiting practically the same kind of equipment with but only slight modifications in design, and each Company was competing for and obtaining a

portion of Europe's business. It was apparent to us that this situation resulted in great inefficiency in the use of engineering talent and manufacturing facilities as compared with conditions in the United States.

In Switzerland, the manufacturers of small machine tools have perfected a number of devices which we consider of value in our line of manufacture, and some of this equipment has been ordered for trial purposes. Contrary to the usual impression, we found that the Swiss Watch Manufacturing Industries were conducted on a quantity production interchangeable basis, and that the control of the raw material and the accuracy of workmanship was equal to that in this country on similar grades of products. Electrical energy is distributed from numerous hydroelectric plants to many small industries located in the smaller towns and villages of only a few hundred population. In this respect living conditions for the worker were much improved as compared with our large conjested industrial centers, a contrast which is worthy of study on the part of many of our industries which are of such a nature that the operations can be decentralized without a decrease in productive results.

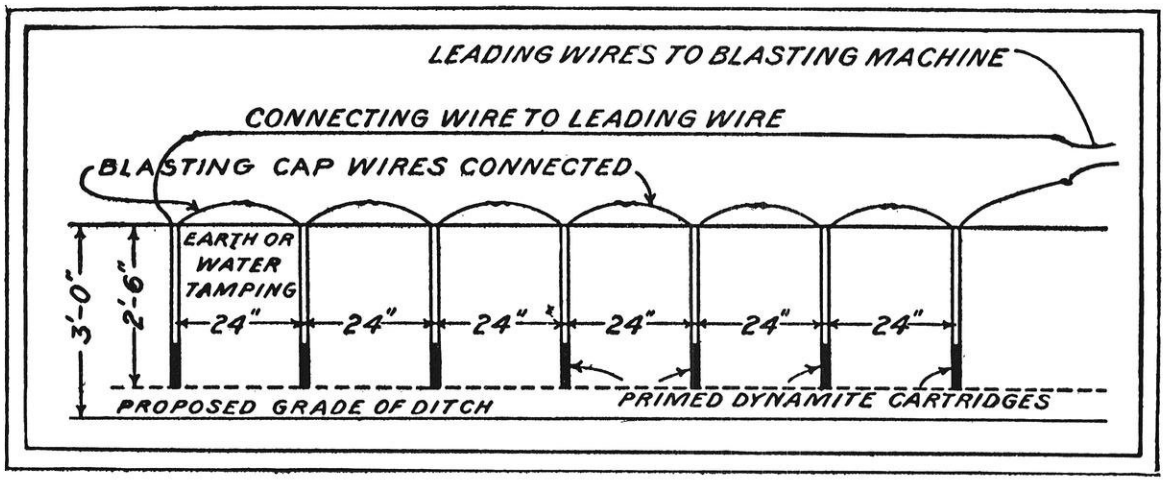
Of course, in this survey we did not shy away from recreation, and by the time we had reached Switzerland, the end of our journey in Europe, we felt that we had earned a few days' vacation. The larger part of such time was spent exploring the higher altitudes, such as the Rhone Glacier, the origin of the Rhone River; the Matterhorn and the Jungfrau, two of the most famous mountain peaks in Europe.

In the lines of manufacture in which we were particularly interested, it appeared to us that European industrial efficiency suffers from too great a number of small companies competing in the same field. In some lines there are four to five times as many plants in Europe as in America. As a result some are so small that they cannot justify the expenditures required for modern high production equipment. Apparently, it is quite common for European manufacturers to keep their plants busy by unloading part of their production in other countries at about actual cost. As the practice appears to be quite generally followed, its consequences are rather demoralizing. This difficulty has been accentuated in the metal industries by increases in plant capacity made during the War.

These conditions cannot continue to exist indefinitely, and we came in contact with evidence that economic influences are at work. In England a large steel and machine tool combine is forming with a Small Arms Company in control. A great chemical combine has recently been formed which includes in it one of the most modern and interesting plants visited by us in England.

In Germany a brass combine is under way, and several of the antiquated plants have been purchased and will no doubt be dismantled. The big steel combination of Germany now includes 60% of the steel capacity of that country leaving Krupp with the other 40%. This new combination has closed down some of the excess capacity and are reorganizing to eliminate duplicate manufacture in different plants.

Ditching and Drainage



LESSON NUMBER 11 OF THE

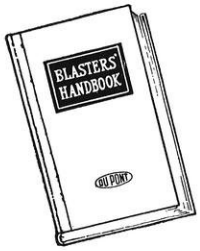
BLASTERS' HANDBOOK

THE economic advantages of blasting ditches with dynamite warrant obtaining a practical understanding of the methods commonly used. Blasting ditches cost less; the soil is evenly distributed on either side of the ditch; no spoil banks are created because the explosive distributes the earth and makes the ditch where required; no expensive machinery to locate and operate; there are no overhead expenses for equipment; ditches can be dug with dynamite where the conditions are too difficult for other methods, and, finally, the process is so simple.

Do you understand the propagation method of ditch blasting? Do you know the proper way to load, the amount of charges, the kind of explosives to use for each kind of ditch?

All these questions are completely and practically answered in the Blasters' Handbook. There are tables of charges, plans for loading, cross-section views, and concise instructions for every step. Here is information seldom given in the average text-book—the "boiled-down" experience of field men skilled in the use of explosives for every purpose.

The Blasters' Handbook is yours, without cost, by merely mailing this coupon



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Please send me a copy of your "Blasters' Handbook."

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