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The Wisconsin Engineer

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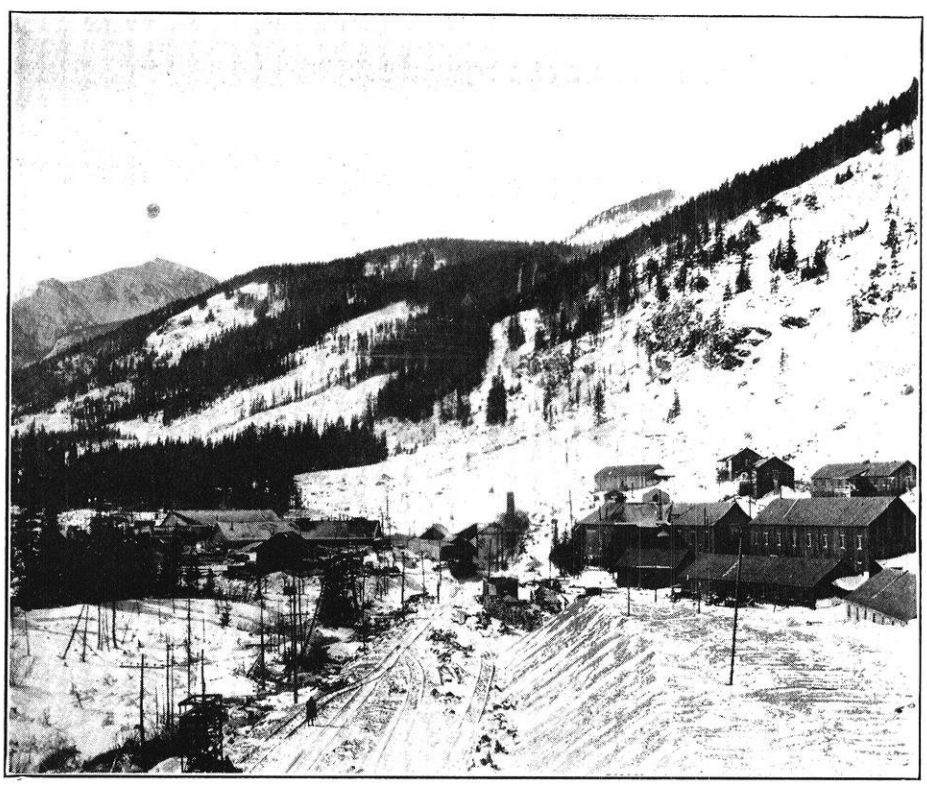
VOLUME XXXII NUMBER III



THE MOFFAT TUNNEL, EAST PORTAL

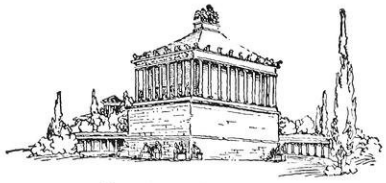
PUBLISHED BY THE ENGINEERING STUDENTS
of the UNIVERSITY OF WISCONSIN

December, 1927

The 7 Wonders of the World

THE Seven Wonders of the Ancient World were single monuments, glorifying one individual or at most a small group of people. Masterpieces of their kind, they yet had no influence on the life of the race which created them, and they benefited nobody.

There lies the difference between the old and the new civilization. The Seven Wonders of the Modern World are the inventions which have been of the greatest benefit to the greatest number of people. What are they? Although lists would differ radically, one item would be common to all. The Otis Elevator would surely be included as one of the Seven Wonders of the Modern World on all lists whether emanating from Greece, Egypt or Turkey; Lima in Peru, Shanghai in China or Hollywood, California. It is an international convenience, dedicated not to one person or even to one race, but to the comfort of any people whose buildings aspire towards the sky.



Mausoleum at Halicarnassus

Statue of Zeus by Phidias, at Olympia

Temple of Diana at Ephesus

Colossus of Rhodes

Hanging Gardens of Babylon

The Pharos or Lighthouse of Alexandria

Egyptian Pyramids

OTIS ELEVATOR COMPANY

Offices in all Principal Cities of the World

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The Wisconsin Engineer
UNIVERSITY OF WISCONSIN

VOL. XXXII, NO. 3 MADISON, WIS. DECEMBER, 1927

AMERICA'S LONGEST RAILROAD TUNNEL NEARLY COMPLETED

By C. A. BETTS, c'13
Office Engineer, Moffat Tunnel Commission
Reprinted through courtesy of The Yale Scientific Magazine

AS the construction of the Moffat Tunnel swings into the final stages following the holing through of the Water Tunnel on February 18, when President Coolidge fired the final round by telegraph, the work is attracting widespread attention throughout the nation and is focusing interest on Colorado and her resources.

The longest railroad tunnel in America, the sixth longest in the world, the Moffat Tunnel is being driven through the Continental Divide at elevation 9,100 feet above sea level, fifty miles west of Denver, by a District of the State of Colorado known as The Moffat Tunnel Improvement District which was authorized by the Legislature to carry out the project and to administer it when finished. Financing is accomplished by issuing bonds guaranteed by the property within the District, with the intention of ultimately retiring the investment out of revenue from rentals. The Denver & Salt Lake Railway Company has contracted for the railroad tunnel and will pay about one-half of the total costs. The remaining half can be paid by the District in return for the benefits received by water rentals or other uses.

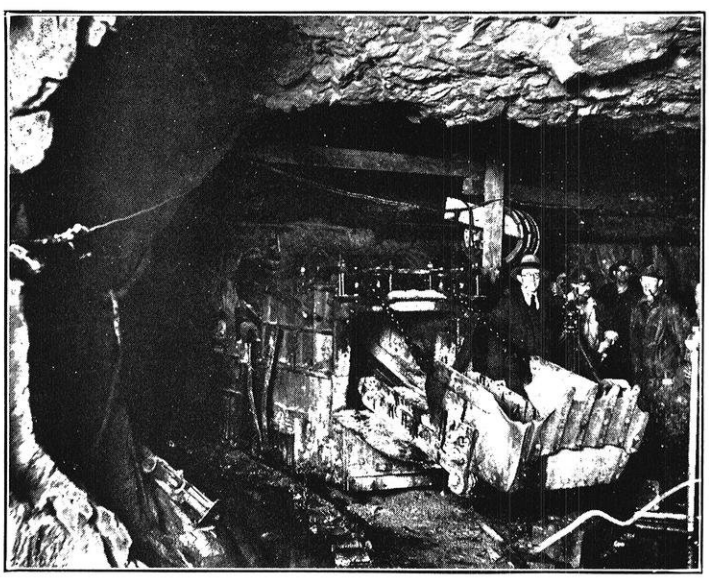


FIG. 1:
Survey Crew and Conway Electric Mucker at Crosscut Thirteen from which final round in water tunnel was shot. The author is on the left.

The purpose of this public enterprise is to provide adequate transportation for the rich Northwestern section of Colorado where vast resources consisting of coal, oil, oil-shale, minerals, live stock, agricultural products and timber await release. By the construction of the forty-mile Dotsero Cutoff connecting Orestod on the Denver & Salt Lake Railroad and Dotsero on the Denver & Rio Grande Western Railroad, the rail distance between Denver and Salt Lake City will be reduced 173 miles and Denver will be placed on a through Trans-Continental route. Eventually, if the line between Craig, Colo., and Salt Lake City is constructed, the wealth of the Uintah Basin in Utah, with its gilsonite, coal, and farm products, will be added to the volume of traffic.

In the twelve counties of Colorado that will be benefitted by the outlet afforded by the Moffat Tunnel, are over four and a half million acres of public lands, an area larger than the State of Connecticut. About 118,000 acres tributary to the Moffat Railroad are irrigated, 140,000 acres dry-farmed, and 700,000 acres used for grazing. Agricultural products from Middle and North Parks include head lettuce, peas and other special high altitude crops in addition to alfalfa, wheat, and potatoes. The lettuce is shipped as far as New York and demands top prices. There are large areas which have reached the limit of their development until railroad service is available to enable the producers to market their products.

It is estimated that by irrigation development about 130,000 acres more may be watered from the White, Yampa, and Colorado Rivers, and by re-use of water

brought from the Western Slope to Denver through the water tunnel, upwards of about 100,000 acres of productive land may be added to the wealth of the territory adjacent to Denver. The future value of 100,000 acre feet of additional water supply to Denver can scarcely be estimated at this time, as the Western Slope supply represents the last line of defense in obtaining new large supplies.

Approximately 2,000,000,000 feet of merchantable timber, including lodgepole pine, spruce, and fir, are estimated by the United State Forest Service to be

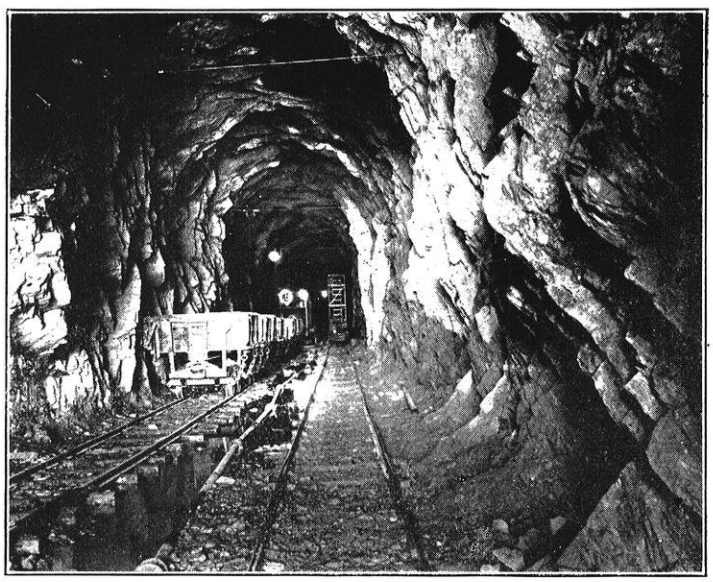


FIG. 2:
Single Track Railroad Tunnel Through Solid Rock

available beyond the tunnel and are being so administered that the future supplies will be preserved.

The mineral wealth of Northwestern Colorado consists of deposits of iron ore, zinc, lead, copper, molybdenum, uranium, vanadium, tungsten, and some gold and silver, largely undeveloped because the low grades which predominate require railroad transportation.

Of the oil-shale deposits in Colorado, which, it is estimated, contain as much as has been produced to date by all the wells in the United States combined, a large part are in northwestern Colorado, awaiting the time when their production will be demanded by an increased price in oil, or by more economical distillation.

The oil production from the Moffat field, two years after its discovery, exceeds 3,000 barrels per day. Prospecting for other structures is being actively carried on and points to important new discoveries.

It has been estimated by Prof. R. D. George, State Geologist, that there remains enough coal in Northwestern Colorado to supply the United States for 1,500 years, and that that much more is to be found over the Utah line in the Green River Uintah Basin. The Colorado fields include the Yampa, with an estimated tonnage of 39,000,000,000. The grades of coal range from bituminous to anthracite.

The Moffat Tunnel will be six miles long, rising on a grade of 3/10 of 1% from an elevation of 9,200 feet at East Portal to an apex near the center and thence descending on 8/10 and 9/10% grades to the West Portal, elevation, 9,085. This will eliminate the 30 miles of 4% grade over Rollins Pass at Corona, which has been the highest standard gauge railroad pass in the world, elevation 11,660 ft., and has been very difficult to maintain because of the snow hazards at that elevation. Ten thousand eight hundred degrees of curvature will be abandoned between East and West Portals, leaving the ruling grade of the Denver & Salt Lake Railway 2% compensated and the maximum elevation on the road 9,240 ft.

The tunnel consists of a 16′ x 24′ single track, standard gauge, railroad tunnel driven parallel with and 75 ft. to the north of an 8′ x 9′ water tunnel with which it is connected at 1,500 feet intervals by 8′ x 8′ crosscuts. The smaller bore has been of great assistance as a service tunnel in caring for transportation, wiring, piping and ventilation, leaving the enlargement operations of the railroad tunnel free of such interference.

Natural conditions imposed an unusual variety of problems on the builders of the Moffat Tunnel and have taxed their resources on many occasions. Soft ground, flows of water, and unusual length of piping and transportation have added to the ordinary difficulties of tunnel driving, while the severe weather conditions, due to high altitude, have added to the difficulties of surveying the line for the tunnel.

On one occasion an inflow of 1,800 gallons per minute from Crater Lake nearly drained that lake into the tunnel before the seams through which the water entered were clogged by silt. In March, 1926, an inflow of 3,000 gallons per minute from Ranch Creek drainage basin on the western slope flooded the east headings which had passed the apex and were advancing down grade toward West Portal. The 1,000 gallons per minute still flowing in from this source is being handled by pumps and gutters.

Speed has been one of the main objectives in driving the tunnel. To this end labor-saving devices have been developed on the job and many new tunnel schemes have been successfully adopted. An airlift switcher, which picks up a muck car, swings it clear of the track and again deposits it on the rails when needed, was developed at East Portal, as was also a drill carriage mounting four drills and running on a 24-inch gauge track from one heading to another as the crews alternated.

The use of the twin heading method of driving by alternating crews between the water tunnel and main heading was a new departure in methods of attack, and resulted in a month's progress of 1,583 ft., by three crews working 8 hours a shift, and has given as high as 33 ft. of progress in one day. By having the drilling crew shoot an 8 ft. round in the water tunnel, for instance, while the mucking crew cleaned up the railroad heading, and then reversing the crews, it was possible to complete a round in each heading in an

8-hour shift, with no interference between the crews. This was only practical in hard ground. Enlargement to full size by radial ring drilling followed the heading operation in the solid granite sections of the bore.

In the soft material, which was encountered for three miles in from West Portal, it was necessary to drive top headings instead of center headings and to employ every known timbering device to hold the ground as the pressure increased in some instances to over 6 tons per sq. ft. after exposure to the air.

The Lewis Traveling Girder (Fig. 3) was developed on the Moffat Tunnel to handle the enlargement of the railroad tunnel in this soft ground. A new departure in soft ground tunneling, this devise, which was designed to support the roof timbers and wall plates while the bench is being excavated and posts set to take the load, has successfully held the weight and speeded up progress. It is a contribution to tunnelling methods that will be of value in soft ground tunnels of large size and can be used for either heading and bench or pioneer tunnel operations.

Four Lewis girders have been put in use in the lined sections of the Moffat Tunnel, and their effectiveness has been tested through soft, running ground of slickensided gneiss as well as through blocky granite with water seams. On one occasion girder number one caught a cavein and probably saved the lives of many laborers working on the bench beneath.

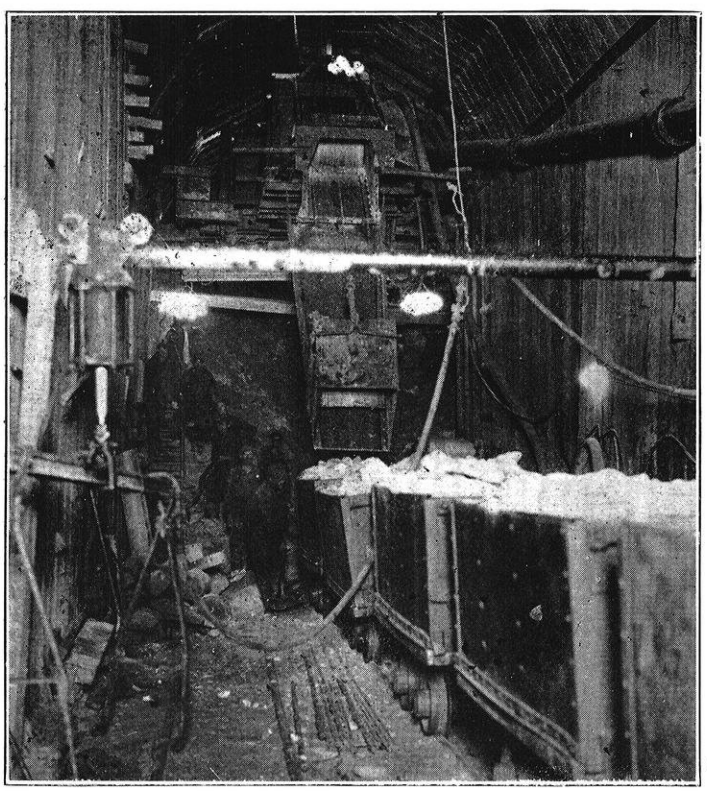


FIG. 3:

Lewis Traveling Cantilever Girder supporting Roof while bench is being excavated and posts set. Note conveyor for handling heading muck into two-yard cars and air hoist switcher in the foreground.

Two plate girders 42 inches deep by 65 feet long, spaced 6 feet apart, with rigid cross braces of structural angles, constitute the backbone of the machine. The cross arms extending at right angles to the center line of the girder and supported below it by steel stirrups, can be moved out under the wall plates and jacked tightly up against them, using 15-ton jacks. The girder is kept from being overbalanced by crossarms and jacks at the forward end, and the whole machine rides on two pair of steel dollies running on tracks along the bench, so that as soon as from 15 to 20 feet of bench has been excavated beneath the rear of the girder and the posts have been put in, the crossarms can be drawn in and the machine moved ahead to another set-up.

Alignment surveys for the tunnel were handicapped by severe climate conditions and by the refraction occurring between altitudes 12,000 and 9,100, which necessitated working at night with lights. A line was run over the Continental Divide between portals and sights established beyond East and West Portals, so that by setting up a transit on one of these sights and backsighting on a monument on the divide several miles away, the line could be plunged into the portal and thence carried under ground by repeated sights on six-inch Vernier bars rigidly suspended from the roof of the water tunnel. The length of the line was determined by triangulation, U. S. Government Invar tapes having a very low coefficient of expansion being used for the measurement of the base line. Grades were carried over the pass by precise levels along the center line clearing and checking by a line carried over the railroad tracks. The headings met within .11 feet when holed through, and were off only .3 of a foot on grade — a closure of 1/230000.

In the construction of the railroad and the water tunnels 750,000 cu. yds. of rock have been excavated and dumped in the valleys of South Boulder Creek at East Portal, and Fraser River at West Portal for the railroad approaches. Some of this rock has been so soft that it could be excavated by hand, showing that the center of the Rocky Mountains is not so rocky. Seven hundred miles of drill holes have been used with 2½ million pounds of dynamite and 28 million kilowatt hours of electric power. In the lining of the three miles of heavy ground, 11 million feet board measure of timber, largely Oregon fir, have been used, or an equivalent of 1″ x 12″ plank reaching from Denver to New York. Thru the worst section of 1,000 feet, 350 steel sets weighing over 5 tons each have been used to counteract the pressures. An average of 900 men have been working 8 hour shifts day and night for four years on this project.

Work was begun in September, 1923. The project is now virtually completed, the water tunnel having been holed thru on February 18, 1927, when President Coolidge pressed the telegraph key firing the last round, the railroad headings having been

(Continued on page 110)

THE MODERN DROP FORGE SHOP

By WALDEMAR NAUJOKS, m'26, ME'28

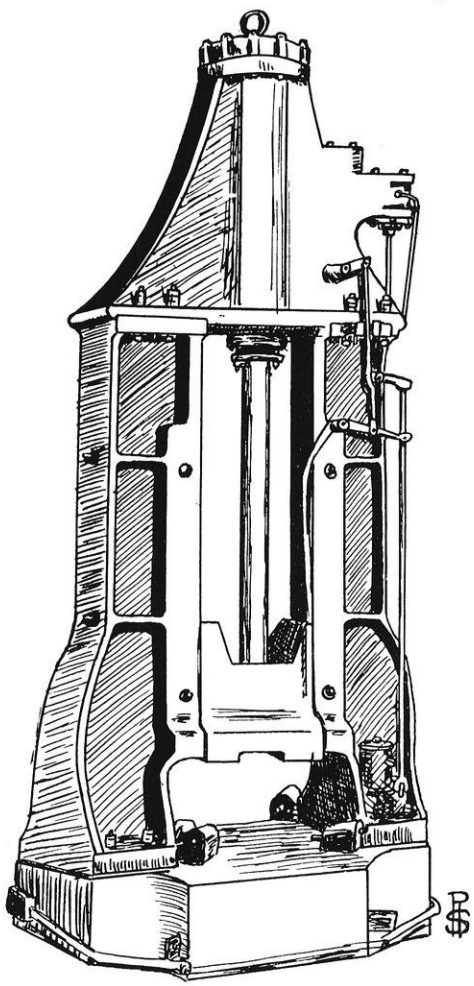
Foreword

THE purpose of this article is to give to the future Engineering Graduates an idea of modern shop practice, a sort of an aeroplane view of the operating conditions, and to show the Engineer's place in the industry. Technicalities have been avoided, the intention of this article being a short story of a Drop Forge Shop.

Introduction

Up to the 19th Century, the forging practice had changed but very little since the days of the Greek and Roman Gods. We can all tell tales of the Might of Vulcan at the forging game, and the Romance of the Enchanted Hammer of Thor. Forging equipment consisted of an anvil, a forge fire, bellows, and several sledge hammers. The blacksmith was a muscular chap as well as a skilled mechanic, and he could work wonders with wrought iron and steel. He made shoes for horses, edged tools for the building craft, shaped curiously wrought fences of iron, made nails, as well as countless other intricate and delicate articles. The skill was in his guiding hammer, and the necessary power was supplied by one or more helpers. But he was limited in his work to the extent of making only one article at a time, and if he desired to duplicate his work, the second piece would not have exactly the same dimensions the first piece did. They were very similar to the eye, but not alike to the scale.

During the first half of the 19th century a demand came for duplication in the gun industry, and in 1853 Colt, of revolver fame, invented the first drop hammer, the forerunner of the present drop hammer. This hammer consisted merely of a dead weight which slid between two guides. The weight was lifted to a certain height by a rope, and then allowed to drop on a large anvil. During the Civil war the first patent was issued on a drop hammer, and from this point the drop hammers were constantly improved, and they came into gradual use. Following the cry of the gun industry for duplicate forged shapes in quantity, the railroad industry began to use more and more forged parts, and at the beginning of the 20th century the automobile industry began to manufacture cars on a production basis, with the result that the forging shops required equipment which would make a quantity of forgings alike at a reasonable cost.



Direct Acting Steam Stamp

Today a forge shop may use either one or both of two types of drop hammers, a steam drop hammer or a board drop hammer. The steam drop hammer uses a steam cylinder to raise the weight and to add pressure to the falling weight, similar in action to a steam engine where the steam in the cylinder exerts pressure on a connecting rod. The board drop hammer uses the force of gravity alone to strike a blow. To raise the weight again, a set of rolls acting on a wooden connecting rod raise the weight, and when the weight is up to the top again, the rolls release, but an automatic grip holds the weight up until it is released again by the operator. The wooden rod is usually made of some hard wood, and hence the name, board hammer. The advantage of the board hammer over the steam drop hammer is that the board drop hammer does not require steam for motive power, but runs off of an electric motor or a line shaft. They are used to advantage in small sizes or where only a few are required. The steam drop hammer has a decided advantage of economy in the larger sizes, and the ability to regulate the power of the blow in all of the sizes. All drop hammers are rated in size by the size of the weight in pounds, and the board drop hammers range in size from 200 pound hammers to about 5000 pound hammers, while the steam drop hammers are built from 500 pound hammers to 20000 pound hammers.

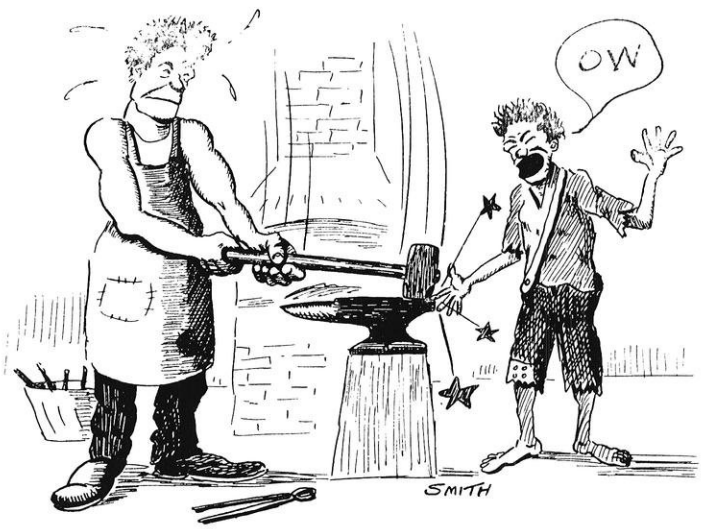
A modern forge shop contains not only the drop hammers to turn out quantity forgings, but is equipped with a complete heat treating department, a chemical and metallurgical laboratory, a large machine shop, and an inspection department. Quality is as important as quantity, and not only must every forging that leaves the plant conform to certain exact dimensions, but the forge company must also know that the forging has been treated to bring out the physical qualities demanded

in the contract, and that the material is in agreement with all specifications.

In the modern drop forge shop every bar of steel is analyzed before the shipment is accepted from the steel company, and a careful inspection of the steel is made for seams, cracks, and other defects. Samples are taken during the forging and heat treating process for inspection under the microscope after a polish and etch, since an axle or a steering arm forging must not fail in service.

Securing the Order

The Sales Department holds an important place for the Engineer in a Drop Forge Shop, for on the Engineers in this department rests the responsibility of estimating an attractive price from the blueprint, and a price can be given only after the method of manufacture of that particular piece has been determined. Let us suppose that an Automobile Manufacturing Company has sent in a blueprint of an axle forging and a steering arm forging on which they desire a quotation. The blueprints usually show the parts machined and it is up to the Sales Department to determine the most economical method of making the forging, both from a standpoint of economy in material and in machining.



The Original Way

The start is made by estimating the weight of the finished forging from the blueprint dimensions. Allowances are made for the weight of the material that will be machined off, as well as for the draft on the forging. The draft angle is usually 7°, and is put on the flat sides of a forging so as to prevent the forging from sticking in the dies. Some sections are easy to calculate while others are difficult, but an experienced estimator is usually quite accurate. And he must be. If the estimated weight is half a pound under the actual weight, the cost of 5000 pounds of steel is lost on a 10000 piece order. A 10000 piece order is by no means a top sized order. If the estimated weight is over the actual weight, the quotation price is raised, and the order is lost to some competitor. In conjunction with estimating the forged weight, the amount of extra material allowed for flash, burnoff, and a tonghold is also calculated. Flash is the excess material forced out between the dies, burnoff is the steel lost by the oxidation of the iron, and the tonghold is the piece of metal allowed the hammerman to fasten a pair of tongs to.

The estimator then visits the die room foreman who can give, with uncanny accuracy, the amount of time required to sink the dies, and the dimensions of the die blocks. The forge shop formeman is visited next. A discussion takes place, in which the estimator and the forgeshop foreman determine the size of hammer preferable on the forging under consideration, and the number of forgings a hammerman can make in an hour. The estimator tries to set the number of pieces an hour as large as he can, while the foreman wants the estimate to contain as few pieces an hour as possible, for this will give the hammerman a larger piece rate. Between the optomistic estimator and the pessimistic foreman, the estimate of the hammerman's ability is judged to a nicety.

The estimator now returns to his office and from the figures just obtained, estimates the cost of the dies, which are charged for separately, and the cost of the forging. The general overhead, heat treating, pickling, straightening, and other operations which may be put on the forging are taken from a cost sheet. They are either given in cost per pound or some simliar percentage. A sample estimate sheet is illustrated elsewhere in this article.

Upon the completion of the estimate, a check of it is made by the Sales Manager as to the accuracy of the estimate, and the correctness of the figures, so as to prevent any errors either in arithmetic or in the shop ability. A quotation is sent out to the inquiring company. Included in the quotation letter is the price of a forging in the quantity asked for, and a delivery promise if the order is received.

Executing the Order

The order for the forgings is received by the Sales Department. The Sales Manager immediately places a requisition with the Purchasing Agent to secure the raw material, and passes on the order to the Production Department. The Production Engineer gives an order to the Die Room Foreman for a set of dies, and also proceeds to schedule the forgings through the plant. The date of forging is determined by (1) the open capacity of the hammers, (2) the delivery promise of the steel, and (3) the time of finishing the forging dies. As soon as the shop schedule is finished, a copy is sent to all of the interested departments who follow this schedule to the best of their ability.

Let us look into the die room. There will be seen a number of planers, an assortment of shapers, special milling machines for the intricate die milling, and many portable grinding machines with the wheel mounted on the end of a flexible shaft, quite similar to a dentist's

flexible grinder, which most of us have had unfavorable contact with. The die blocks are first planed to get a flat surface on the face of the die, and two sides which are square to each other and to the flat surface, so that the die sinker can lay out his pattern on the surface of the die blocks. Following the layout, shapers, lathes

The Estimator Talks It Over With The Foreman

and milling machines are used to remove the excess material, and finally the die sinker uses an assortment of scrapers and grinders to finish the job. The dies must possess, generally speaking, an accuracy of $\pm$ 1/64" on all dimensions excepting the length, where from $\pm$ 1/32" to $\pm$ 1/16" may be allowed.

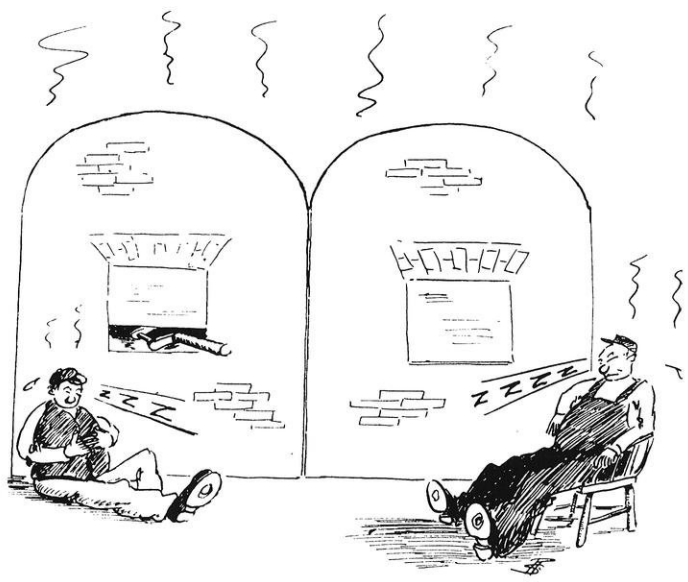
As soon as the dies are finished, they are put together and lead is poured between them to make a lead cast of the form. This lead cast is checked, and, if found correct, is sent to the customer. The customer either sends an O. K. or submits his criticisms. If corrections are necessary, another lead cast is sent after the changes have been made, and when the lead cast is approved of, the set of dies are ready for production. In former years the dies were made of tool steel and required hardening. The hardening process caused a loss at times by cracking a die, but at the present time alloy steels are used which makes hardening unnecessary. I do not know the exact composition of the die block steels, but my understanding is that the alloys are Chromium and Molybdenum.

In the meantime, while the dies are being sunk, the steel arrives at the plant, and the Metallurgist immediately gets a sample from each bar to analyze the steel. The bars are also inspected under a microscope to detect any seams, laps, or other defects that may cause a defective forging. The inspection and analysis completed, the steel is either accepted and stored away until needed, or it is shipped back for replacement.

The Forging Process

The day for the forging operation arrives. The dies are moved into the forge shop, and, at the same time, the steel is taken out of the store room to the shears for cutting into proper lengths. About three to four hours are used to set the dies in the drop hammer, and during this time, enough stock can be cut for about twelve to sixteen hours use. Oil furnaces are used to heat up the stock to a predetermined temperature, depending upon the type of steel. This temperature is regulated by means of an optical pyrometer in the hands of an experienced operator whose only duty is to check the temperature of the 36 furnaces in the shop. The set of dies in the hammer usually contain a roller, an edger, a roughing impression, and a finishing impression. The flash is trimmed off on a press standing next to the hammer.

During the forging operation, an inspector, called hot-inspector, moves from hammer to hammer to inspect the forgings as they come from the hammer. If he finds any defects such as cold-shuts, laps, or places on the forging not filled out, a written notice of the defects is given to the forge shop foreman at once, so that immediate steps can be taken to make a correction. Another inspector takes a sample of each forging to a layout table where the forgings are measured for dimensions. These precautions are taken to prevent the waste of material, time, and labor upon defective forgings, for the customer will not accept any forgings that do not conform to the blueprint. The forging continues until either the job is finished or the dies are worn out. A wornout die is one where the upper limit of tolerance



Holding The Heat For Two Hours

is reached, even though the impression may still retain a perfect shape.

The next step depends upon the type of forging, and the further treatment called for. In the case of an axle

(Continued on page 106)

THE ENGINEER AND HIS COMMUNITY

By LEONARD S. SMITH, c'90
Professor City Planning and Highway Engineer

BY engineer, I am speaking of the 200,000 trained and professional engineers now in the United States, to which number we are adding annually perhaps 10,000 more. This great army of scientifically trained men is chiefly located in our largest cities, cities which now contain more than half the population of our country. I wish briefly to discuss the question, first, as to whether these engineers generally understand the larger and more general problems of community development, and, second, if they have the larger understanding, knowledge and vision, — whether they are unselfishly giving their expert skill and vision in leadership for the development of their communities.

A rather broad observation of the facts leads me to the conclusion that, while there are many notable exceptions, as a rule technical engineers do not understand in a broad way the general community problems and as a result seem strangely uninterested in the civic affairs of the community. This apparent lack of interest is all the more regrettable because the education of the engineer and his practical training presumably should have fitted him better than any other class to pass wisely upon our many new civic problems of our fast growing cities. Does not this failure come partly at least, as a result of too much specialization in the courses of study,—a specialization which narrows instead of broadens the student's sympathies? This point has not escaped our Professor Mead, for in his paper on "Hydraulic Engineering Education" before the Society for the Promotion of Engineering Education in 1914, he says: "Specialization is in my opinion a serious mistake if carried far in a university course, if the desire is to educate engineers instead of trained workmen. The ideal university for the education of the engineer is not a trade school. The education should be largely general, etc. —" Again there is a vast difference between instruction and education, the latter resulting in changes of the heart, changes which profoundly modify the methods of thinking and acting; while instruction very often can be taken off like a coat, being not a part of the individual and frequently soon forgotten. It is the speaker's belief that engineering students should more largely succeed in cultivating liberal studies even if by so doing he attends the College of Engineering less. To make this possible more freedom of choice of electives should be given the upper classman so that he may broaden both his field of observation as well as broaden his human sympathies. A fuller knowledge of his own mind and his relations to his fellows is desired even if he miss some of the technical knowledge of sewage, cement, and iron. It is to be expected that he will learn some details after he leaves his college but he will never again have the same advantages of liberal studies of his university. A student who systematizes his work by a daily program can also find time to further broaden his views of life by reading the political and foreign news in the daily paper. But even a student broadly educated may find himself lacking in one other important requisite that will prevent him from taking part in the discussion and solution of his community problems. I refer to the common lack of a desire for social service, or service without pay. This failing may be expected because from his cradle, like all youth, he has been accustomed only to receiving services from parents, teacher, pastors and professors and only rarely to give service to others. During these 21 or more years he has always had someone to smooth and make easy his pathway. This is not calculated to create a spirit of generosity and desire to serve others. Of the many hundreds of students it has been the speaker's good fortune to assist in starting on professional careers, by far the greater number were fearful that the salary offered might be too small, although in most cases it exceeded the student's ability to earn. This attitude and the habit of "watching the clock" if persevered in precludes such engineers from taking interest in their community or in anything except their own selfish interest. Such men are not likely to make good husbands or good fathers and certainly not good citizens. Sooner or later the truly successful engineer must

Professor L. S. Smith

(Continued on page 105)

Campus Notes

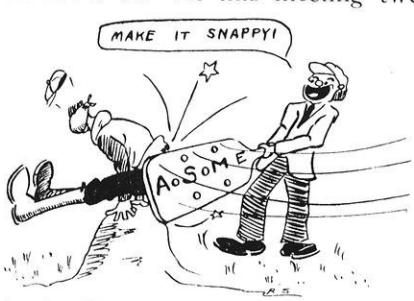
DEAN TURNEAURE SAILS FOR SOUTH AMERICA

Dean E. F. Turneaure sailed from New York, November 25, for Bolivia, South America, where he will visit his son Stewart, who is mining engineer for the Bolivian mining interests. Dean Turneaure was accompanied by his daughter-in-law.

The Dean's trip will last until February first. After seeing his son at the Patino mines, Llallagua, Bolivia, he will make an extended tour through Peru, Bolivia, and Argentina, ending up at Buenos Aires.

A. S. M. E. INITIATES TWENTY

A. S. M. E. held its regular fall initiation meeting on Nov. 16. At this meeting twenty mechanicals were initiated. The men initiated are: E. W. Azpell, '29; T. R. Coker, '20; C. J. Daniels, '30; L. A. Dodge, '29; W. V. Dewey, '30; H. A. Felten, '29; K. Hopkins, '30; H. G. Hyland, '29; W. E. Klatt, '29; R. E. Kratsch, '29; R. W. Kubasta, '30; R. E. Lhotak, '30; W. W. Lindeman, '30; K. C. Marting, '29; M. Matsen, '30; F. McGourty, '29; J. McLane, '29; M. H. Rutherford, '29; G. W. Schubert, '30; R. G. Walker, '29.



The new members were welcomed by E. T. Hansen, President.

H. E. Rex was elected Junior member to Polygon.

The meeting was closed by consuming a good deal of engineer's refreshments — cider and doughnuts.

A FLOATING FOUNDATION

"My upheaval," wrote the junior civil, "cast me upon bedrock, where I had to either swim or sink."

PUBLISH BULLETINS OF ENGINEERING EXPERIMENTAL STATION

A new bulletin, number 66, and two reprints, numbers 8 and 9, of the Engineering Experimental Station of the College of Engineering, will be issued shortly. The work of the Experimental Station is made available to the public in two ways. Some of the results are published in the form of bulletins as soon as they are ready, while the others are published as reprints after being presented before the various national technical society meetings.

Bulletin 66, by Prof. C. I. Corp and H. T. Hartwell, department of hydraulics, is entitled "Losses in various forms of pipe bends". Reprint number 8 is by Prof. G. L. Larson and is a copy of a paper presented before the American Society of Heating and Ventilating Engineers. Reprint number 9 is entitled "Composition of Iron Blast Furnace Slags" by Prof. R. S. McCaffery, J. F. Oesterle, and Leo Schapiro, department of mining engineering. It appeared in Technical publication No. 19 of the American Institute of Mining Engineers November 1927.

ENGINEER CHRISTMAS SING ADOPTED BY ALL-UNIVERSITY

The annual Christmas sing sponsored by the College of Engineering has been made an all-University event this year. The business management has been taken over by the University Y. W. C. A. and Y. M. C. A. The "sing" will probably be held in the gymnasium and a small admission charge is planned.

Engineers are glad to see this wholesome display of Christmas spirit adopted by the University as a whole and will be hearty supporters of it, remembering the good-will that prevailed at previous "sings."

ETA KAPPA NU ELECTS EIGHT MEN

Eta Kappa Nu, honorary electrical engineering fraternity, announces the election of the following eight men: seniors, B. A. Fairweather, R. C. Dubielzig, J. Bardeen, C. F. Andrews, G. H. Scheer, K. R. McDougal; juniors, R. G. Jewell, and R. G. Garlock.

Prof. L. F. Van Hagan, department of railway engineering, has been elected president of the University Club.

IT'S RIGHT NEXT TO THE PRECIPITATE

Chem. engineer: "Professor Kowalke, will you please help me out? It says here 'add silver nitrate and agitate', and I can't find the bottle of agitate."

CIVIL: "Who was that gentleman I saw you with last night?"

ELECTRICAL: "That was no gentleman — that was my lawyer."

LET'S GET THIS STRAIGHT

"Sand," writes a junior civil in a quiz in masonry, "is used in mortar to decrease shrinkage. The sand particles themselves shrink without a considerable change in size."

CHI EPSILON ELECTS FIVE MEN

Chi Epsilon, honorary civil engineering fraternity, announces the election of the following men: W. W. Behm, Marvin Hersh, and G. C. Ward, juniors; R. A. Burmeister and N. A. Christensen, seniors.

BOOK ON RADIO THEORY WRITTEN BY PETERS

A text book, "Theory of Thermionic Vacuum Tube Circuits," has been written by L. J. Peters, assistant professor of electrical engineering. It will take the place of the loose-leaved notes used in course E. E. 155, for the past six years.

The purpose of the book is to develop conventions and methods which may be used in the quantitative treatment of electrical network and systems containing trielectrode devices, according to Mr. Peters. The circuits and topics discussed are those which best illustrate the methods used in arriving at the performance of the triode circuits.

The sophomore civil who wrote in a recent quiz that a meander corner is a bend in a river must have been related to the sophomore mechanical who, in inspecting a steel tape, announced that it was five feet long on one side and sixty inches on the other.

FORMER INSTRUCTOR APPOINTED DEAN OF KANSAS ENGINEERING SCHOOL

George C. Schaad, who was recently appointed dean of the College of Engineering at the University of Kansas, was a member of the faculty of the department of electrical engineering for several years in the early part of the century.

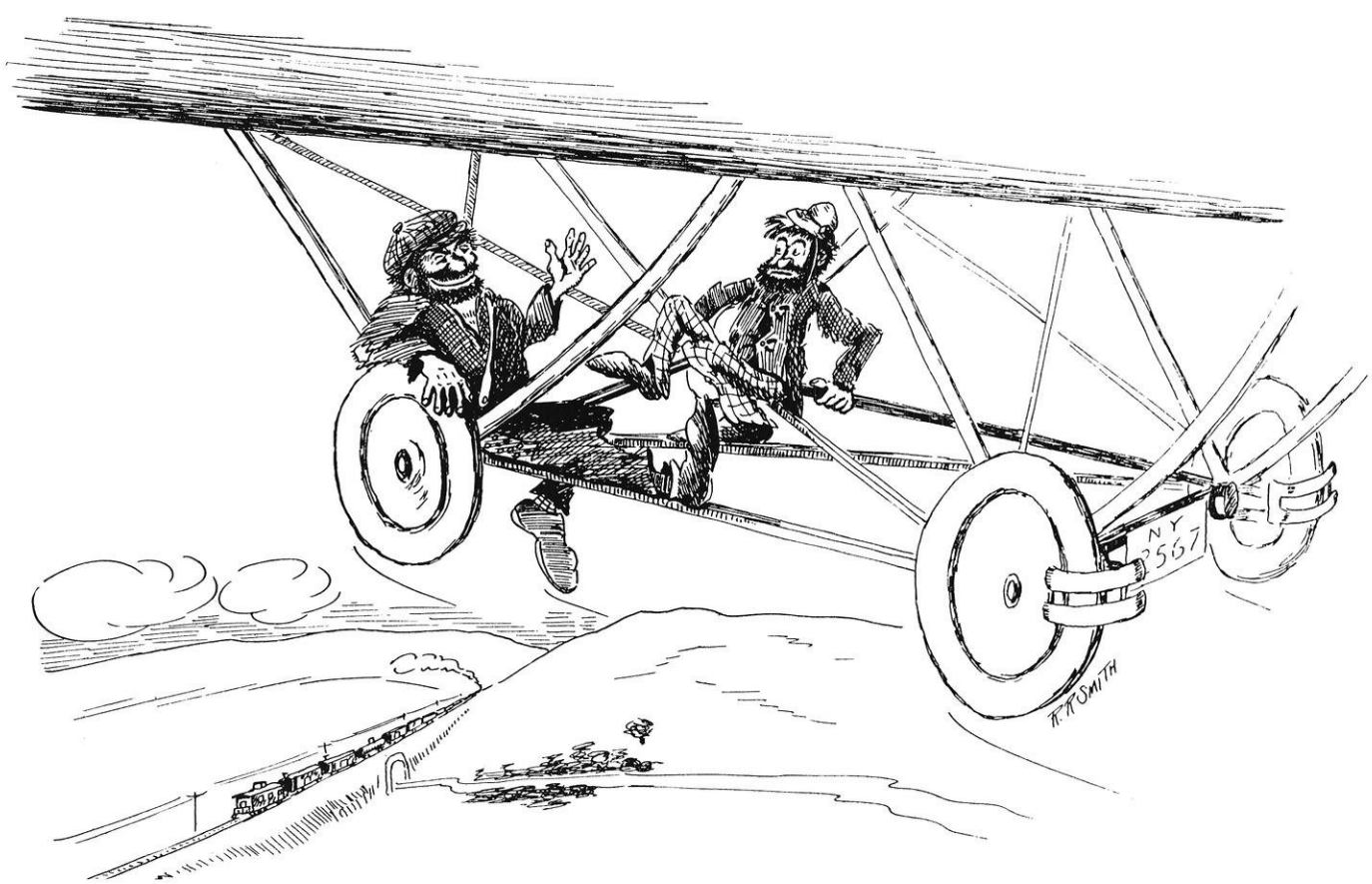
Prof. T. J. Rood and L. S. Baldwin have been appointed to the advisory committee of the university radio broadcasting station WHA. The committee is composed of thirty-two members of the faculty appointed by President Frank.

EXTRA NEWS ITEMS FROM CHICAGO

The honorable mayor of the Windy City is at present waging a vigorous campaign against the use of thermodynamic text books because they deal with British Thermal Units.

FOUR ENGINEERS RECEIVE LEGISLATIVE SCHOLARSHIPS

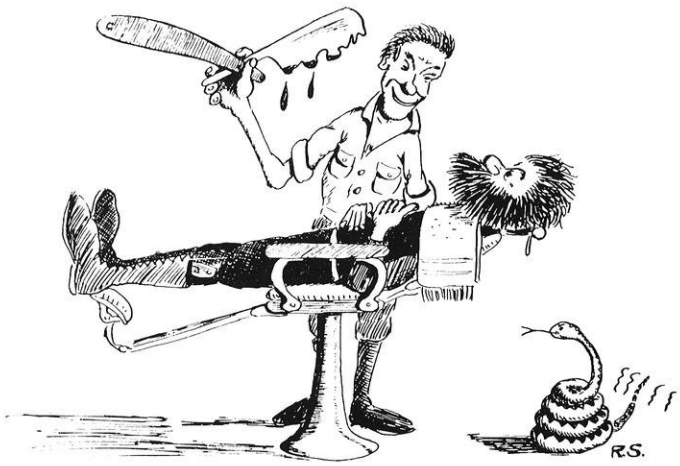
In the recent granting of Legislative Scholarships to out-of-state students, four engineers were included. They are: John F. Kittson, m'30; James B. Owen, '27; Dimitry P. Tiedeman, e'27; and Roland E. Toole, c'27.



FIRST HOBO: *"Talk about progressin' times; why my old man used ter ride on a slow, dirty, old freight train"*

BARBER CHAIR INSTALLED AT DEVILS LAKE CAMP

Among the additions and changes in equipment for the civil camp at Devils Lake next summer is a barber chair which was purchased by the Topographic Engineering department to take the place of the rickety old chair pressed into service every other Sunday by the



doughty civils who did not care to take any chances with the renowned Baraboo barbers. Now, the only things lacking are plate glass mirror and a striped barbers' pole to make the camp barn look like State Street.

A TRIP TO THE GREAT CAVE OF DANE COUNTY

Five sophomore engineers representing each course in the College of Engineering emerged at dusk from the Great Cave of Dane county, so muddy as to be scarcely recognizable, after exploring over 2500 feet of its tortuous caverns and tunnels. Clarke Silcott, Irv Bessert, Hal Porter, Jack Lacher, and the writer were the lucky men to spend four of the most interesting hours of their lives in this old limestone cave, whose end has yet been undiscovered.

At times the going is very good, at others the only way to progress is by fairly worming oneself between the sharp roof and muddy floor. Often one comes upon a great room hung with stalactites, and whose walls are carved into artistic shapes by the rushing waters that sweep through it in the spring. The stalactites are of considerable girth, but few are perfect due to the ravages of previous explorers.

A great mud "slide" furnished a good deal of fun both going up and coming down, for it was a task to make the ascent in one start, or to make the descent in better than on all fours. An "inland sea" of considerable length furnished thrills, as the depth was indefinite and the low hanging ceiling was too obvious; one was lucky if he escaped a bath or a good bump on the head from some stubborn stalactite. Candles were used, as flash lights proved inefficient. Irv Bessert, pulling up the rear, found floating on the surface of the muddy waters what he though to be fish scales. Only the pity of the rest of the party saved him from a ducking when they turned out to be drippings from the candles. A discovery of scientific interest was that of a large bone which proved to be the tibia of the Bovinius Domesticus.

It was indeed a thrill, never to be forgotten when it was realized that the party was in over 2000 feet, and that if the arrows in the mud were incorrectly marked or obliterated many hours would be spent in seeking the main passage out. No claims are made that the cave rivals the great caves of the west or of Kentucky, but it has proved a source of adventure for many years, and it was found to be every bit as good as many historians claim it to be.

As regards the geology of the cave, it lies on the edge of the driftless area, to the north west of Verona in a limestone outcrop. It strikes off south west, following the limestone until, it is claimed, the underlying sandstone beds are reached where it is thought rooms of colossal size will appear. No one has ever reached the end, and it is very probable that it extends to the lead regions of southwestern Wisconsin.

—Carl Schmedeman, min' 30

ONLY HOT AIR IS DELIVERED THAT WAY

Mrs. Baldwin: "Just think, Mrs. Doke, my husband got Hamburg and Java on the radio yesterday."

Mrs. Doke: "Do tell, my dear. Are they really delivering groceries by radio now?"

A. S. C. E. LEARNS OF BUSINESS FINANCING

"Where industry obtains its money" was the subject of a lecture given by Prof. C. L. Jamison, department of business administration of the school of commerce, before the American Society of Civil Engineers on November 24, 1927. Professor Jamison explained and answered the question "How can I obtain money to start a business of my own?"

The series of lectures given by professors of different departments of the university in order that the civil engineers may become acquainted with what is being done in other fields than engineering will be continued. Prof. W. J. Mead, department of geology, gave the first of the talks, speaking on the location of dam sites.

The following men, surveying the ordeal of a written examination and five and a half do-nuts in a red bag, have been initiated into the society: W. J. Burmeister, A. H. Frazier, S. D. Baillies, O. H. Winne, J. Wahlgemuth, F. J. Summeril, O. Wehrle, L. Janicki, M. Swinney, C. A. Knoll, W. A. Milbrandt, H. Smith, R. Kviathofsky, R. Matsen, J. C. Blancher, H. A. Brown, H. S. Merz, A. Benesh, F. V. Burcalow, H. J. Lenschow, J. Lehman, W. C. Milton, H. Olsen, R. J. Poss, H. C. Sauer, R. Standorf, W. F. Steuber.

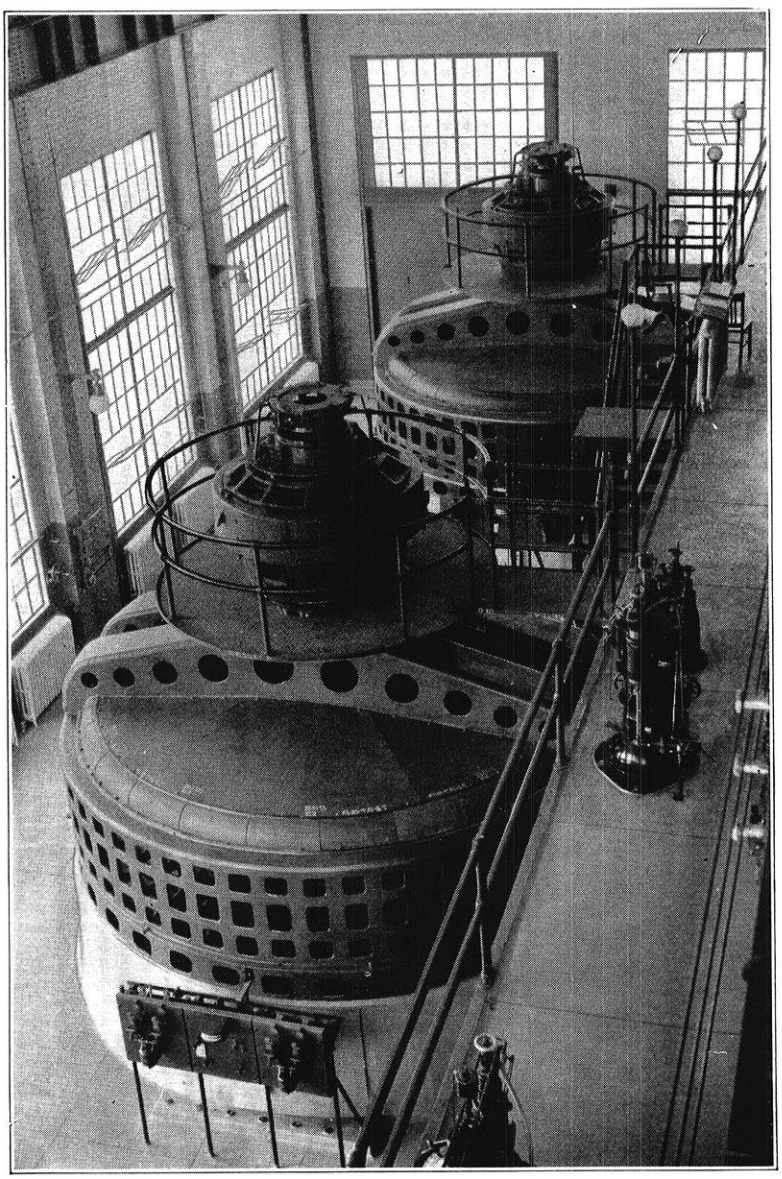
SIX ENGINEERS ELECTED TO PHI KAPPA PHI

Phi Kappa Phi, national honorary campus fraternity, announces the election of six engineers among the thirty seven seniors chosen to membership. The engineers are H. S. Merz, civil; W. B. Murphy and R. K. Neller, chemicals; W. H. Fuldner, electrical; and F. A. Mattka and R. W. Leach, mechanicals.

SOME SUPERPOWER POSSIBILITIES

By JAMES THERON ROOD
Professor of Electrical Engineering

SUPERPOWER is a recently coined engineering term intended to designate the interconnecting of local electrical generating and distributing systems by transmission network of high capacity and low loss to the end that each such local system may be in position to help any of all of such other systems with which it thus intertied. While the interconnection of neighboring generating plants through relatively short transmission lines is not new, the electrically tying together of large parts of the country is of recent origin. Already very considerable sections of the United States and Canada are so connected and as yet only a start has been made.



Modern Generator Equipment

Over fifteen primary advantages are supposed to arise through superpower, but fundamentally the advantages are four in number. First, the reduction in the number of generating stations on a system. Through interconnection a few large plants may take the place of a number of small ones. Per kilowatt capacity the larger plants are cheaper to build than smaller ones and should produce energy at lower cost. Second, stations with low production efficiency can be scrapped. This allows older, less efficient generating plants to be either shut down or held for peak load or emergency operation. Third, the load on the more economic stations can be held approximately constant, while the less economic plants carry the variable part of the load. The base load is thus thrown on the stations having the lowest cost per kilowatt hour and their production cost is still further reduced through this improvement in their operation factor. High operation factor is especially necessary for economic operation of hydro-electric generating stations on account of their high overhead charges; also that all available water may be utilized. If the proposed St. Lawrence waterway with its accompanying stupendous electric power development is to become an accomplished fact, it will be largely because of the possibility of making it a base load plant and of distributing the enormous resulting electric energy over considerable portions of the two countries through superpower systems. Fourth, reducing in amount the excess generator capacity which is necessary in every station to take care of emergency loads, as well as to insure, as far as possible, the continuity of power supply to the local system. With two stations interconnected this standby apparatus will be less than that which would be required if the two plants were not tied together. Again, were one station on a superpower system to be seriously crippled through accident, the other stations on the system probably could still supply large amounts of electrical energy to the local territory of the injured plant. Thus continuity of supply could be had, a matter of very great importance where electric energy is sold for the operation of manufacturing plants, particularly steel works and cement plants.

Superpower development carries along with it other

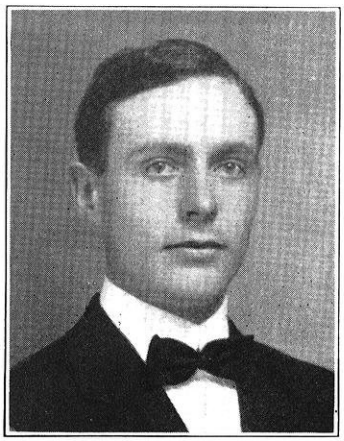
(Continued on page 100)

Alumni Notes

DEATH OF H. W. VROMAN

Harry W. Vroman, engineer in charge of division No. 2 of the Wisconsin Highway Commission, with headquarters at Milwaukee, died Monday, November 7, at the age of 40.

Mr. Vroman was a graduate of the University of Wisconsin and had been connected with the Wisconsin Highway Commission since June, 1913, when he was employed as a draftsman by Division No. 1 at Madison. In September, 1915, he was transferred to Division No. 6 at Eau Claire; in 1918 he was promoted to acting division engineer, and in January, 1920 he became division engineer. On December 1, 1925, Mr. Vroman took charge of the division office at Milwaukee. Prior to his connection with the state highway department, Mr. Vroman was employed by Milwaukee county as a concrete inspector and taught for a year at the University of Wisconsin.



H. W. Vroman

Mr. Vroman was taken ill with a cold on October 21 and was confined to his bed a few days later when his illness was diagnosed as a sort of intestinal flu which on November 4 developed into pneumonia, resulting in his death.

Funeral services which were attended by many of his former friends and associates, were held Wednesday, November 9, with burial in Forest Home cemetery. The pall bearers were: J. A. Stransky, Milwaukee; O. C. Rollman, Green Bay; A. L. Hambrecht, Madison; C. R. Weymouth, Madison; F. M. Balsley, Milwaukee, and J. R. McLean, Superior.

Mr. Vroman is survived by his wife, Helen; a son, George Miles; a daughter, Mary Jane; his parents, Mr. and Mrs. Hiram Vroman, living at Fitchburg, Wis., and two brothers, Arthur and Albert. He was a member of Eau Claire Lodge No. 112, F. & A. M.

Two of the main projects which were undertaken during Mr. Vroman's office at Milwaukee were the Atwater bridge (now Capitol Drive bridge), and the beginning of super-highway development in Wisconsin.

The sudden and unexpected death of Harry Vroman is a distinct shock to his many friends and associates, for, as State Highway Engineer H. J. Kuelling declared, "Harry was probably the best-loved and most popular engineer in the employ of the commission, being known as a square shooter."

—Reprint from The Western Builder

MINERS

Corner, Douglas C., min'13, invented the Conway Electric Mucker which was used in the digging of the Moffat tunnel a project supervised by Clifford A. Betts c'13.

Jones, Everett W., min'23, reports the arrival of a daughter, Carol Ann, on Nov. 1.

Linden, John F., min'24, writes that he is employed by Arthur Iron Mining Co. (Great Northern Subsidiary) as mining engineer at Hibbing, Minn.

Millman, Deane A., min'26, is engineer in charge of operations at the Bruce Mines, Hibbing, Minn.

Thomas, Ray E., min, ex'16, has just left a job as Superintendent of Construction on an Electrolitic Zinc plant and copper ore crushing plant at Anaconda, Mont. He stopped here for Homecoming on his way to Poland, via Paris, where he is to be Assistant Chief Engineer at Giesche Spolka Akeyjna properties of the Anaconda Copper Co. at Katowice, Poland. He will assist in the erection of a $5,000,000 plant for the electric recovery of zinc. He says he needs a German speaking instrument man.

MECHANICALS

Benfer, Maurice F., m'27, reports a change of address. He is now at 5039 Griscom St., Philadelphia, Pa.

Brightly, Fred C. Jr., is now with the Standard Galvanizing Co., 2619 W. Van Buren St., Chicago, Ill.

Brunke, S. T., m'25, has moved from Watertown, Wisconsin, and is living at 383 63rd Street, Wauwatosa, Wis.

Cox, Edward L., m'22, visited his home in Madison this summer. He is chemist for the Monarch Company of St. Louis, Missouri.

Davis, K. C., m'27, who has been working with the General Electric Co., has been promoted into the commercial organization under one of the district managers. Mr. Davis has been working along the line of ventilation, designing ventilating systems for ovens, paint and spray booths, treating vats, and similar equipment.

Dean, Horace K., m'21, is associated with the Fuller Lehigh Company, a subsidiary of the Babcock and Wilcox Company, at Fullerton, Pennsylvania.

Edwards, Arthur W., m'25, has changed his address to 307 Building Industries Building, Cincinnati, Ohio.

Johnson, Carl A., m'91, and Mrs. Lucy McGlachlin Berry were married in Madison on October 28. Mr. Johnson is president of the Gisholt Machine Company of Madison and is a past present of the Wisconsin Manufacturers Association.

Moeller, Roland, m'09, has been forced by ill health to give up his business in New York and he now lives in More Haven, Florida. Up to the time of his retirement, Mr. Moeller operated the Polytechnic and Commercial Bureau in New York City, a specialized employment agency for technical men.

Mueller, Emmet J., m'19, was one of the visitors at Madison for the Michigan game. Mr. Mueller is district manager of the Vilter Manufacturing Company, at 2457 Woodward Avenue, Detroit, Michigan.

Shoemaker, William P., m'26, writes that he is to be married to Irene M. Lampert, H. E.'27, of Boscobel, Wis., on Thanksgiving day. His address after December 1st, will be 115 S. 42nd Street, Philadelphia, Pa.

Stewart, Frederick C., m'25, Professor in the experimental engineering department of the Georgia School of

Technology, writes, "I enjoyed receiving the October number very much. It surely is good to hear of 'Old Wisconsin' and know that everything is going as it should."

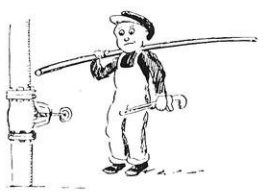
Suhs, Guy H., m'10, has been made plant engineer for the Rhinelander Paper Co. at Rhinelander, Wisconsin.

Trane, Rueben M., m'10, of the Trane Co. of La Crosse, has invented a new type of heater, which is being manufactured by his company. He was assisted in his work by **Edwards, Arthur W.,** m'25, and **Miller, Merl W.,** m'25.

Mr. Trane recently presented a paper describing his invention before the Society of Heating and Ventilating Engineers.

Williams, Edward B., m'19, has become a member of the financial advertising department of the New York Evening Post.

Milbrook, Alfred T., m'25, who will be remembered better perhaps as Alfred Muehlenbruch, before the change to the present simplified spelling, has written to Prof. Larson, concerning his work in connection with the construction of the new power plant for Whiting, Indiana; "We are still hard at work on our power house but are getting to the point where the results of our labor are taking form quite rapidly. Work is progressing on all eight of the boilers which are in all stages of construction. Now long ago we let the contract for the high pressure steam piping (400 lb.) which I had the pleasure of designing and which drew some very favorable comments from Mr. Hershfeld as well as the Babcock and Wilcox Co. **Smith, Harold,** m'26, has been doing a great deal of piping layout work and has proven to be quite a valuable man, to say nothing of having a good reserve of stories and snappy comebacks. The entire building which is of concrete construction, is now completed, three 5000 kw. high pressure turbines are installed, and the electrical switch gear is beginning to arrive. The way things look now we will have steam up some time next spring but there is still plenty to do."



Mr. Milbrook gives his present address as 7508 Essex Avenue, Chicago, Ill.

CIVILS

Bartlelt, Harvey E., c'26, who is with Barzhof and Watson of Milwaukee, surveyed and mapped the stone quarry at Sturgeon Bay, Wis., formerly owned by Leathem D. Smith Stone Co. This company was recently purchased by the Dolomite Products Co. of Cleveland, Ohio.

Becker, J. Walter, c'09, C. E.'10, is president of two companies engaged in the manufacture of electrical specialties, the Commutator Company, and the Artcraft Company. Mr. Becker makes his home in Sycamore, Illinois.

Blau, Herman A., c'20, is assistant engineer with the Port of New York Authority and is engaged in the construction of the 3500 foot span Hudson River Bridge. He gives his residence address as 230 Naples Terrace, New York, N. Y.

Brown, Herbert H., c'17, is engineer for the city of Milwaukee in charge of design and construction of pumping stations.

Chase, Herman, c'27, is working for the resident engineer of the New England Power Co. on their new hydro-electric development at Bellows Falls, Vermont.

Christianson, C. B., c'22, and **Oettmeier, A. G.,** c'27, are with Engstrom and Wynn, general contractors of Wheeling, W. Va. Christianson's address is 1117 Chapline St., and Oettmeier lives at 62 Virginia St.

Cooper, Fennimore F., c'14, has joined the staff of the research division of the department of water works of Milwaukee, Wisconsin.

Cowie, H. I., c'03, is connected with the Carborundum Company of America, at Niagara Falls, New York. Mr. Cowie played host to the party of Electricals who made the eastern inspection trip this fall.

Crew, Louis C., c'25, is design engineer with the Southern International Paper Co. at Camden, Ark.

Donahue, Jerry, c'07, president of the Jerry Donahue Engineering Company, Sheboygan, is the author of an article entitled "Separate Sludge Digestion in Wisconsin." It describes the sludge digestion plant at Hartford, the first built in Wisconsin, and a recent plant built at Antigo. One of the features of the Antigo plant is the utilization of the gases from the digesting sludge as fuel for heating the sludge during cold weather. **Frank K. Quimby,** c'20, had charge of the construction of the plant and, as city engineer of Antigo, is now in charge of its operation.

Eriksen, E. T., c'89, C. E.'90, is engaged in the construction of the Stony Gage dam, an Ambursen type construction across Stony Creek. It is being built for the Orland Irrigation Project to form a storage reservoir. The work is under the supervision of the U. S. Bureau of Reclamation located at Glennco, Calif.

Mr. Eriksen gives his address as Elk Creek, Calif.

Grant, Eugene L., c'17, is in New York City for the year 1927-28, on leave of absence from his duties as Assistant Professor of Civil Engineering at Montana State College. Mr. Grant is taking graduate work in economics at Columbia University and is collecting material for a book on the principles of engineering economy. His present address is 3977 Bliss St., Long Island City, New York.

Kuelling, H. J., c'08, C. E.'11, state highway engineer, has been granted a leave of absence of three or four weeks, to make a survey of economic conditions relative to the building and maintenance of roads and streets in Cook County (Chicago) Illinois. Mr. Kuelling was engaged by the Chicago Chamber of Commerce at the request of the Cook County Board.

Kurtz, Henry W., c'19, who for the past three years has been conducting a contracting business at Sheboygan, Wisconsin, is now with the Concrete Steel Co., Chicago.

Lembke, Louis W., c'27, reports his address as 190—32nd Street, Milwaukee, Wis.

Luckey, Carroll H., c'14, has established himself as consulting engineer with an office in Moorehead, Minnesota.

ALL ROADS LEAD TO DEVILS LAKE

The First Annual Homecoming for Civil Engineers is to take place at the summer survey camp at Devils Lake, the week end preceding the Fourth of July next summer. These camp reunions will be exclusively for civil engineering alumni and their families. Prof. R. S. Owen (mayor of Azimuth City, Devils Lake, Wis.) states that the affair is going to be a humdinger and that the town will be wide open.

Complete plans will be announced in a coming issue. Watch for it.

Mr. Luckey is also at the present time city engineer for the city of Moorhead.

Lulberg, A. P., c'11, has left the University of Idaho, where he was Professor of Civil Engineering and gives his new address as 256 Ellsworth St., Gary, Indiana.

Mackie, J. E., c'23, who has been secretary and treasurer of the "Pacific Coast Building Officials Conference" during the past year, has just been made managing secretary-treasurer, a full-time position. His headquarters are at 132 Pine Ave., Long Beach, California. Mr. Mackie has taken a very prominent part in the great work of drawing up a "Uniform Building Code for Pacific Coast Cities." The code was approved by the conference at a recent meeting and has already been adopted formally by some of the coast cities. When he rose to speak, at the meeting at which the code was approved, Mackie was given a rising salute of appreciation for his work in connection with the code.

Preston, Burt K., c'25, is with Consoer, Older, & Quinlan, consulting engineers of Chicago. He is located at Palatine, Ill.

Rockett, L. C., c'15, sends us his subscription from way down in New Mexico, together with a change of street address. His new address is Casitas del Rio No. 5, Santa Fe, New Mexico.

Smith, Leathem D., c'09, has sold his interest in the L. D. Smith Stone Co. to the Dolomite Products Co. of Cleveland, Ohio. The L. D. Smith Co. is located in Sturgeon Bay, Wis. The Leathem D. Smith Dock Co. of Sturgeon Bay is operated by Mr. Smith.

West, Kenneth A., c'25, reports his address 317 Penn Ave., Wilkinsburg, Pa.

CHEMICALS

Gilman, Edgar Dow, ch'13, C. E.'14, is Director of Public Utilities at Cincinnatti, Ohio.

Hall, John L., ch'25, of Whitewater, Wisconsin, and Miss Myrtle May Porter, of Port Atkinson, Wisconsin, were married at Whitewater on August 20. Mr. and Mrs. Hall will make their home in Milwaukee where Mr. Hall is a chemist with the Pittsburgh Plate Glass Company.

Silver, Charles A., ch'24, died in a Madison hospital on September 9, after an illness of several months. Mr. Silver has been employed as a research chemical engineer at the Burgess Battery Laboratories in Madison, since the time of his graduation in 1924. He is survived by his widow; his parents, Mr. and Mrs. A. J. Silver, of Tampa, Florida; a brother, Harry S. Silver, of Madison; and a sister, Mrs. M. N. Boutrelle, of Orlando, Florida. Interment took place September 11, in Forest Hill Cemetery in Madison.

Tesch, W. I., ch'23, joined the staff of the C. F. Burgess Laboratories in August. He is associated with the Patent Department.

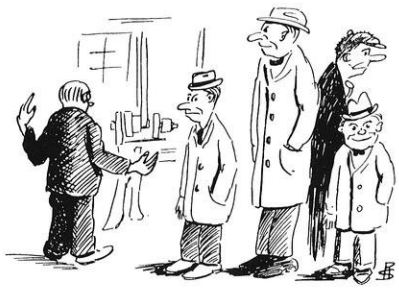
Vobach, Arnold C., ch'21, has left Whiting, Indiana, and gives his new address as 70 Hanover Street, Wellsville, New York.

ELECTRICALS

Carlson, M. S., e'25, is proposal engineer in the switchboard sales department of the General Electric Co. of Schenectady, N. Y. He expects to be transferred to the Philadelphia office on December 1st.

Anderson, F. W., e'12, has recently been made chief of apparatus inspection and repair planning at the Kearny factory of the Western Electric, at Kearny, New Jersey.

Bassett, W. B., e'09, is in charge of the Marine Development Department of the Westinghouse Company, at East Pittsburg, Pennsylvania. Mr. Bassett helped to make the Electrical Eastern Trip a success by personally conducting the party through the Westinghouse shops at East Pittsburgh.



Conley, B. L., e'18, M. S.'20, has changed his address from 4215 Lindell Blvd., St. Louis, Missouri, to 616 Locksley Place, Webster Groves, Missouri.

Holmes, H. G., e'25, is with the Consumer's Power Co. of Jackson, Michigan. He writes that he is working with several other Wisconsin engineers; **"Bob" Dohr,** e'23, **"Bud" Lindner,** c'25, **Walter Schmidt,** e'24, all of the same office. He goes on to say, "With so many of us in one office we are one outfit that does not have to take any 'sass' from the Michigan guys. We are all looking forward to seeing Minnesota trample all over them and expect to get a lot of pleasure out of it, while we wait for Wisconsin to take a crack at them." (More power to them—may they not have long to wait).

Any of these men can be reached through the Consumer's Power Co. of Jackson, Michigan. Holmes' address is 535 Wildwood Ave., Jackson, Michigan.

Johnson, Lloyd, e'24, is design Engineer of the Circuit Breaker Division of the Westinghouse Electric Mfg. Co. His address is 415 Lamar St., Wilkinsburg, Pa.

Jones, A. C., e'14, is now in charge of apparatus drafting for the manufacturing planning division of the Western Electric at its Hawthorne plant, near Chicago.

Lilja, Edgar D., e'24, gives his address as 915-10th Street, Rockford, Illinois.

McCoy, Robert C., e'27, while in Madison for Homecoming, dropped into the office for a chat. He is at present located at Joliet, Ill., with the Central Station Institute of Chicago, but expects to be transferred again about December first.

Miller, Harry I., e'21, has been made president of the U. W. Alumni Club, at Marinette, Wisconsin.

Outzen, Andrew N., e'10, at a recent meeting of the Michigan Board of Examiners for registration, was granted a certificate with the title of Registered Mechanical Engineer.

Rufsvold, Arnold S., e'25, is General Engineer with Westinghouse Electric and Mfg. Co., Pittsburgh. He went to France with the American Legion to the Paris Convention. His address is 793 Susquehanna St., Pittsburgh.

Golder, Lloyd W., e'96, who has served for the past 21 years as secretary of the Metal Specialties Manufacturing Company of Chicago, has recently been elected treasurer and general manager of this same company.

Hayden, Charles B., e'96, has been elected alderman of the first ward in Madison to fill the vacancy left by Mr. Spencer A. Lucas. Mr. Hayden is at present assistant engineer of the state railroad commission.

(Continued on page 100)

SENIOR CIVILS VISIT MILWAUKEE

By R. A. BURMEISTER, c'28

The Senior Civils on October 26, 27, and 28, enjoyed a most excellent inspection trip to Milwaukee where they visited such places as the Riverside pumping station, the refuse incinerator, the Jones Island sewage-testing station, Wisconsin Bridge and Iron Works, Allis-Chalmers Manufacturing Company, and looked over various bridges and pavements. In contrast to previous years, the weather was quite balmy and agreeable.

The greater portion of the first morning was spent in examining bridges and construction work. Street cars, motorists, and pedestrians had to wait, perhaps impatiently, while the bridges were opened for inspection and their mechanisms were explained by the city's engineers.

The Wisconsin Bridge and Iron Works played host in the afternoon. This visit was especially interesting because the plant was fabricating trusses similar to those now being designed by the seniors. The return to Hotel Antlers, which was the headquarters for the trip, was made via bus and street car. Professor Kinne attempted to get by the conductor of the street car, but, at the gleeful howl of several observing students, he returned and surrendered his transfer.

The refuse incinerator and the Jones Island sewage treatment plant were points of interest in the second morning. The good ship "Edna", which had performed for previous classes, transported the boys out to the island. No one fell into any of the large tanks, so the morning was without incident.

An arduous afternoon was spent at the Allis-Chalmers plant. This particular inspection entailed considerable walking for the plant covers a large area.

The Riverside pumping station was visited on the third morning. The weather was not so balmy on this day, and the sheltering walls of the station were

The Senior Civils

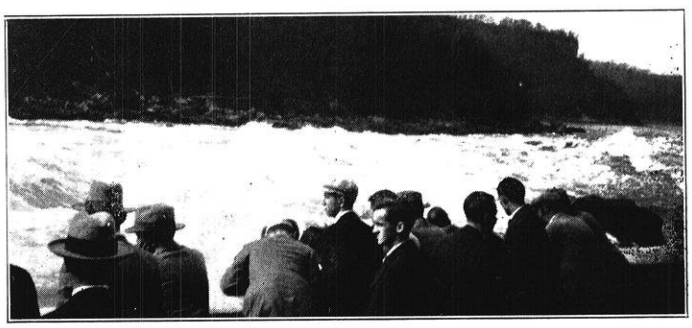
appreciated. At 12 o'clock the party met at the city hall, and were led by Professor Smith to the Blatz Hotel for luncheon, — minus the Blatz. Following the luncheon came talks by Professor Smith and city paving officials and then an inspection of the various pavements, the city kindly furnishing the necessary automobiles, among them a Packard, a Ford, Sr., and a Cadillac.

THE EASTERN INSPECTION TRIP

By W. H. FULDNER, e'28

The thirty senior electrical engineers who went on the annual Eastern Inspection Trip were not dismayed by the omen connected with the magic number 13. All hands were on deck when the *Shirvan,* our Pullman, started on its journey on November 13th. Professor Rood was in command of the party.

During the first part of the journey E. Felch baffled the railroad conductors with his Government pass, while Clyde Nooker, our Haresfoot lady entertained some female acquaintances who were enroute to



After A Barrel Of Canadian Beer

Detroit. Professor Meyer's berth caught on fire and it is rumored that he was attempting to retire in his berth while enjoying one of the complimentary cigars presented by the Madison station master.

The Inspection Party spent Monday and Tuesday visiting the numerous hydro-electric power plants in the vicinity of Niagara Falls. The power plants which seemed to impress the men most were the American Niagara Power Plant, which is located in the heart of the city, and the Queenstown Plant of the Ontario Hydro-electric Commission, which is located down-stream from the Falls and is a masterpiece of the technical art of engineering. The scenic beauty of the Falls was appreciated by some members of the party, while others enjoyed the proximity of Canada.

Pittsburg greeted us on Wednesday morning with its proverbial smoke and soot increased in density by a drizzling rain; nevertheless the reception tendered to us by the alumni in Pittsburg was warm and pleasant. We received a royal welcome at the Westinghouse Co. All of the U. of W. grads in the organization had dinner with us at the Westinghouse Club. W. B. Bassett '09 acted as host and led the group in the singing of *Varsity.*

Half of the party made a short special trip to the area in Pittsburg devastated by the gas explosion. The extent of the damages and the gruesomeness of the scenes appeared to be greater than that indicated in newspaper accounts of the disaster.

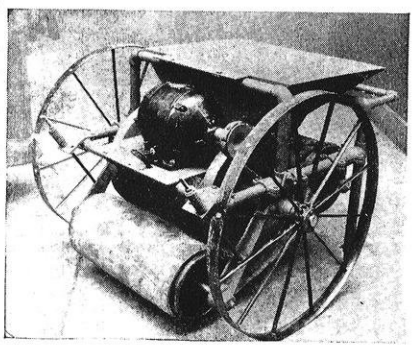
After inspecting two steam power plants and the coal mine operated in conjunction with the Springdale Power Plant, the party was entertained at a smoker given by the Pittsburg Alumni Club. A very humerous professional entertainer impersonated a head waiter

(Continued on page 100)

Engineering Review

NEW BOX CAR LOADER USES NOVEL PRINCIPLE

Instead of conveying the material to be loaded into the box car, a new box car loader which has been recently developed, utilizes centrifugal force to throw the material to the desired position. By the use of the new machine, which can be easily manipulated by one man, a box car can be loaded to capacity in 15 to 30 minutes, according to the nature of the material to be loaded. The new Sinden Loader consists of a short, high speed, motor driven belt, fed by a hopper and mounted on running gears to facilitate moving the machine from one place to another. The carrying run of the three foot belt is depressed into a circular curve, and the hopper is so placed that the material to be loaded drops through the bottom of the hopper and meets the belt traveling in the same direction, that is, downward. By this means all of the initial speed of the falling material is retained. As the material falls on the concave side of the curve, it is forced against the fast moving belt and attains the same velocity as the belt when it is thrown off tangentially. By virtue of the clinging effect caused by the centrifugal force there is secured a tractive force of several times the normal force of gravity. Thus the material accelerates very rapidly and a very short belt is all that is required to give it sufficient velocity to project it to any part of the car. The material is projected in a steady stream or jet which forms a pile beginning at the far end of the car and working backward toward the car door.



—Westinghouse Press Bulletin

MAMMOTH SUSPENSION BRIDGE

There is being constructed at present between Fort Washington and Fort Lee a gigantic extension bridge which will have an estimated cost of fifty million dollars. Construction is undertaken by the Port of New York Authority acting under the mandate of the states of New York and New Jersey. The bridge is to be built in two stages. When the first stage is completed, it will provide for four traffic lanes and two sidewalks; but later to meet the growth of population and travel, the upper roadway will be widened to accommodate eight vehicular lanes and two sidewalks, as well as making the addition of a lower deck which will accommodate four lines of rapid transit tracks. The entire cost of the structure when finally completed will be about seventy-five million dollars.

The central span will be one of thirty-five hundred feet which is exactly twice as long as the largest span in the world today, that of the Camden Bridge across the Delaware. The length from anchorage to anchorage will be forty-eight hundred feet. To resist the pull of the cables on the New York side there will be built an enormous concrete anchorage weighing three hundred and seventy thousand tons. If wire cables are used, there will be four cables, each a yard in diameter and each consisting of twenty-eight thousand five hundred number six galvanized steel wires laid parallel, bunched snugly by hydraulic pressure and wrapped with a steel wire protecting covering.

So great will be the weight of the structure, itself, that the truss usually provided to prevent sagging under a load will be displaced by a comparatively shallow truss. In the design a maximum lateral swing of three to five feet has been provided for, though the highly improbable force of a strong wind will move it less than two feet.

The proposed fifty-ninth street bridge will be even larger and more costly than this project.

—Scientific American

WORLD'S LARGEST ARTIFICIAL LAKE

Alabama is building for power purposes what is claimed to be the largest artificial lake in the world. The lake will cover sixty thousand acres of farm and forest land located in three counties. There will be about five hundred thirty billion gallons at the Cherokees Bluffs where the dam is built. The magnitude of this quantity becomes more apparent when it is compared with that of Muscle Shoals' one hundred seventy million gallons; the supply for New York City, two hundred billion gallons; the supply for San Francisco, sixty-seven billion gallons; and that of the Pathfinder Dam of the United States Reclamation Service, three hundred thirty billion gallons. Prior to the start of actual clearing, permits to change the location of twelve cemeteries were secured and nine hundred graves were moved to locations outside the flooded area where land was purchased by the company and donated to the local community churches. It was also necessary to relocate several miles of railroad and one hundred miles of highway. A plate girder bridge and a reinforced concrete bridge twenty-five hundred feet long were constructed. So far as changing the map is concerned, this is one of the most elaborate projects ever undertaken in the southern states.

IMPORTANCE OF THE TRIPOD IN SURVEYING

The importance of the part played by the tripod in eliminating errors of surveying done with either the transit or the level, is to often not considered by engineers. The tripod, being a bulky and sometimes heavy accessory of the instrument, receives the most wear and tear, even to the point of abuse, whereas scant attention is paid to giving it occasional examination, and much less to regular care. Looseness in shoe and in head causes most of the errors, which can be easily prevented by a careful examination of the tripod before using. A stiff breeze will cause unusual vibration in a loose tripod, no matter how heavy it is. Another source of error is that due to residual torque or twist remaining in the tripod head after the instrument has been tightly screwed on. The error appears as a variable back sight reading when a number of readings are taken from one set-up.

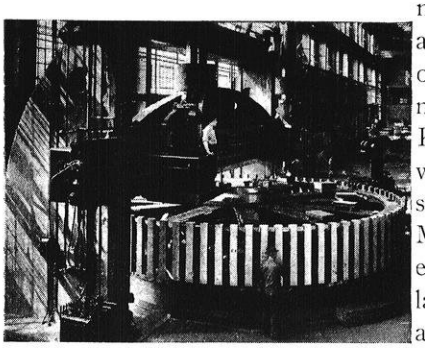
CORROSION PROOF PIPE

A compressed wood fiber pipe has been recently developed which is not affected by acids, alkalies, or electrolysis, and can be used with liquids at a reasonably elevated temperature. The pipe is impregnated under high pressure with boiling pitch and can be shaped into any size or form. Rust and scaling are eliminated with the result that tests have shown that the pipe remains free flowing over protracted periods.

—*Chemical and Metallurgical Engineering*

LARGE SPIDER TO BE USED IN CONOWINGO GENERATOR

A new spider is being machined at the South Philadelphia Works of the Westinghouse Electric and Manufacturing Company, weighing 175,000 pounds and measuring 29 feet across. It will be part of the rotating element of the 40,000 KVA generator which will be installed at Conowingo, Maryland. This generator will have the largest diameter of any ever built, being 37 feet over all. It will run at the speed of 81.1 revolutions per minute.



—*Westinghouse Press Bulletin*

MICROBES PRODUCE COPPER

Copper is ordinarily thought of as one of our most valuable metals which is found in the earth in deposits caused by some geological action of the rocks; but according to a recent report of the Department of the Interior, it now appears that metallic copper may be deposited—in relatively small quantities—through the action of bacteria. During a survey of the region near Cooke, Montana, by the Geological Survey, spongy masses of native copper were found in the black muck of a bog. About half a mile above this bog is an outcrop of pyritic copper ore; this weathers rapidly, and the copper is removed from it in solution as cupric sulphate. Redeposition of the copper as native metal only in the black muck and in none of the gravels and sands in the vicinity was ample proof that something in the muck had caused the precipitation of metallic copper from the sulphate solution, but the identity for the precipitating agent remained to be determined. After considerable experimentation, certain bacilli were found by means of which it was proved beyond question that the copper was deposited by the action of microbes.

BOILER FEED-WATER PROBLEM DEMANDS ATTENTION

An ideal water for steam making should contain no scale forming solids, should not cause priming or foaming, and should not corrode. The problem to be faced is, *How much treatment is pratical from an economic standpoint, and how much is too expensive when the ultimate return is considered?*

Plain subsidence is the oldest and cheapest method applied to remove suspended solids. It is still used to good advantage in connection with other systems. Chemicals are frequently used to convert the scale forming salts into insoluble compounds, so that these solids can be removed by filtration. In many places zeolite softening is used. Cold water is passed through a bed of zeolite minerals that contracts the scale forming solids and replaces them with sodium salts.

The oxygen and carbon dioxide gases have a much better chance to corrode when the scale forming substances are not present. For this reason the gases must be removed. There are various ways of doing this. The most common is to use the heat of the blow down to heat the feed water.

Many boiler compounds are available to prevent scale forming corrosions. However, only in rare cases is it advisable to use these. External treatment of feed water is claimed to be better.

Very little definite knowledge is available about the causes of priming and foaming. Unfortunately many of the treatments for feed water increase this tendency, but, of course, some do not.

—*Power Plant Engineering*

CONCRETE FLOORS PROTECTED AND CURED BY NEW MATERIAL

For protecting concrete floors, especially of decorative concrete, during the curing period, a new material known as "Stainproof" has been recently developed.

Stainproof is a jelly-like material which is applied to the surface in a thin film about 36 hours after the final troweling. When dry, it forms a non-porous, viscous film which is said to be so tough that the heavy traffic which new floors have to bear cannot

(Continued on page 96)

FLAMING YOUTH AS IS The senior civils were on their annual inspection trip to Milwaukee. Prof. Kinne stood in the hotel lobby, with a cigar in the north-east corner of his face, waiting until time to lead the gathering host of students forth for the day's work. The young fellows were standing or sitting and chatting quietly. There was no boisterousness, no rough-house, nothing in fact to indicate that they were *collitch*. They might have been so many young business men. A stranger turned to Professor Kinne and said, "What a fine lot of alert, clean-cut young men there are about the lobby of this hotel." It was with considerable pride that Professor Kinne explained that they were a party of the much-maligned class known as college students, and that they came from the University of Wisconsin. Whatever faults the college student may have acquired in recent years, at least one of his old faults is passing into the discard: He is no longer obsessed with the idea of playing the village cut-up in and out of season.

WHY OUR COUNTRY IS PROSPEROUS There are several dark spots on the "Business Conditions" map of the United States. The vast flooded areas will be a long time in recovery, and the mid-west farmers are still far below a satisfactory condition. But general business and industrial conditions continue to disappoint the prophets of evil by persisting in being very good.

The American people had in 1926 an aggregate income of nearly 90 billion dollars, a record total, and an increase of approximately 27 billions, or 43%, in the five years since 1921. This income, which averages over $2,000 for every person gainfully employed, indicates the highest standard of living for the population as a whole ever attained in this or any other country.

CAN YOU RECOGNIZE AN ENGINEER? In the good old days, it was a common supposition among campus folk that if a man wore a flannel shirt and a week's growth of whiskers and had a slip stick protruding out of his hip pocket it was a safe bet that he had never been farther up the Hill than the Engineering Building. It was reasonable to believe that if the Law School were mentioned to such an individual he would curl up and begin to exude a stream of profanity that would liken itself unto the fire and brimstone that covered Sodom.

But many years have come and gone and the picturesque engineer of yore has become extinct. With plus eights and ear-splitting socks, rent-a-cars and co-eds, Gillettes and straight edges corrupting us, and with the medics, the ags, the inhabitants of the red stone building across the terrace, and what-have-you all approving our styles in haberdashery and facial decoration, it is becoming impossible to identify the engineer who sallies forth without a slip stick for a badge.

Feeling the need of some emblem to identify ourselves, we have gotten the engineer's recognition pin. The pin is a slide-rule on a cardinal W as a background, and is symbolic of all branches of engineering. It is a distinct honor for a man to wear this pin as it puts the mark of Wisconsin upon him. As seniors and graduates only can wear it, it is equivalent to being stamped with a trade mark of sterling quality, for a man must be good in order to survive to be a senior in the College of Engineering. Wisconsin engineers have always been known for their *esprit de corps* and for their traditions. Seniors and graduates, wear the engineers' pin — it's yours! Make it a tradition and keep up the old spirit!

WESTWARD THE COURSE OF INDUSTRY TAKES ITS WAY In January, 1908, the center of industry in the United States was on the northern boundary of Indiana, about 110 miles east of Chicago. In January, 1918, it was still on the northern boundary of Indiana but had moved about 50 miles nearer Chicago. In January, 1926, it had moved 25 miles to the southwest of its position in 1918, and was about 50 miles southeast of Chicago. The total movement in the 18 years from 1908 to 1926 was about 75 miles in a west by south direction. This slow movement of the center of industry during a period when the capacity of prime movers in central stations and manufacturing plants increased about 140 per cent, indicates that industrial development in the United States is proceeding at about the same rate in all sections, but a trifle more rapidly in the western and southern parts of the country.

These determinations of the center of industry, which have been made by the Geological Survey, Department of the Interior, are based on the capacity of steam engines, steam turbines, water wheels, and internal-combustion engines installed in manufacturing plants and in public-utility power plants. Twice the weight is given to the power equipment in public-utility power plants, as it is used twice as much as is power equipment in manufacturing plants. Previous determinations of the center of industry have been based on the installed capacity of prime movers in manufacturing plants only. It is believed that more representative results are ob-

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ENGINEERING REVIEW

(Continued from page 93)

grind through it. The coating of Stainproof is then removed when the construction is completed and the building is ready for occupancy. It is also claimed that the Stainproof coating has aided proper curing by sealing the original moisture in the topping, thus preventing too quick drying. Although developed principally for protecting and curing concrete, it can also be used on new terazzo floors, marble and stone floors, and on tile floors. —*Engineering News-Record*

IDENTIFICATION SYSTEMS FOR PIPING SHOULD BE UNIFORM

The American Engineering Standards Committee has proposed tentative plans for the indentification of piping systems. Many color schemes for the identification of piping systems have been used in the past, but there has been little uniformity. Especially in the case of pipes and materials safe and unsafe to handle, there are no universal designations. In order to correct these faults the plans have been proposed.

The principle requirements for a standard scheme of identification of piping systems are: distinguishability, flexibility, inclusiveness, simplicity, practicabiltiy, and nationality. It is believed that the proposal meets these needs.

The system briefly is as follows: there shall be five general classifications, A, safe products; B, dangerous materials; C, defective materials; D, extra valuable materials; E, fire protection equipment. The identification marks may be bands of color, a stencil legend, or coloring of the entire pipe line. The colors suggested for the various classifications are as follows: A, green, or the achromatic colors, white, black, gray, or aluminum; B, yellow and orange; C, blue; D, purple; E, red. These plans are now up for discussion. Something definite will be done as soon as widespread enough discussion warrants it. —*Power Plant Engineering*

FRANCE SOON TO DEVELOP RHINE POWER

Work is about to be started on the construction of a canal between Strasbourg and Kembs, in Germany, which will make possible the realization of good power between Basle and Strasbourg.

The concession for the construction of the Kembs Power Station has been granted by both Switzerland and France. Acting under the treaty of Versailles, France is to build the dam and control it and have exclusive right to the power upon the payment to Germany of the value of one half of the power produced.

The canal will be about 7 Km. long and about seven M. deep. At the Kembs power house there are to be two locks: one 185 meters and the other 100 meters long, and each is to be 25 meters wide.

There will be a drop of about 11 meters at the Kembs station. Its average power will be 120,000 Hp. The average monthly output will be about 54,000 Kw. It will take about five years to complete the Kembs station at a cost of about $12,000,000. —*Power*

MANUFACTURING BY ELECTRIC HEAT

For many years there was little advance being made in the use of electric heat in manufacturing. This was due chiefly to lack of data which would convince a manufacturer of the advisability of using electric heat. Now that data is being found, the use of electric heat in manufacturing is becoming more and more common.

In past years when a metallurgist or a chemist would make his tests to determine the proper rate of heating, he would have an ideal condition, an electric furnace. When a shop used his specifications a skilled heat treater would try to duplicate the laboratory results with his new equipment. In some places at present most any workman can control the electrical equipment and produce a fine and better article at less cost. In the future, we may well guess, many more factories will make use of electric heat.

—*The Electrician*

MANUFACTURE OF WHITING IN ENGLAND

As chalk comes from the quarry, it is dirty and stained; so that it must be washed. For this purpose there are large pits, filled with water, in which the chalk is placed. The slush thus formed is continually stirred until all of the soft lumps are broken. From these washing pits the slush is passed through several screens of various sizes. The lumps of chalk that are caught in these screens are taken to a sand pit, while the liquid is passed on to a settling pit. These pits are usually about ten by eight by six feet. After the chalk has settled the water is run off and the chalk, which by this time is in a thick sludge, is sent on to be dried.

There are large drying floors about thirty by twenty feet; these floors are covered, but they have no sides. Beneath the iron floors are coal-fired furnaces. The white sludge is spread over this floor to the thickness of about ten inches. Then the heat is applied for about thirty-six hours. At the end of this time, when the sludge will have dried and formed large cakes of chalk, the chalk is shoveled up and then broken up. Now the process is complete and the chalk is barreled and bagged and sent to the London docks.

—*Rock Products*

SUCTION CLEANER FOR RAILROAD TRACKS

An interesting suction apparatus has been developed recently by the Pennsylvania Railroad for cleaning its tracks. The device consists of a flat car pushed ahead of the locomotive, which also supplies steam for the suction operation.

From a raised framework on the car, extend backward and downward at an angle of about 45 degrees, are seven flexible connected 8-inch suction pipes, having their open ends as close to the track as possible. Five of these tubes are on the inside of the tracks and two on the outside. The suction pipes are connected to other horizontal pipes which are placed overhead

and extend forward, emptying into a coal car or other receptacle. The steam pipe, with an 11/16-inch nozzle, discharges steam at a pressure of 150 to 175 pounds into each of the pipes—producing an effective vacuum and driving forward and out, all the refuse collected. The flexible connections permit the pipes to be raised or lowered, as circumstances may require. This is done by pneumatic devices that draw on the air-brake system for power.

PRACTICAL APPLICATION OF PHOTO-ELECTRIC EFFECTS

A fire alarm device that literally "sees" and responds to the faintest trace of smoke, has been recently developed and is to put on the market in the near future. The agency that operates the alarm is a combination of a photo-electric cell and what is practically a standard radio tube — an achievement of Dr. V. K. Zworykin, physicist on the research staff of the Westinghouse Electric Co. The tube is so responsive to light changes that smoke, as faint as a whiff from a cigarette, will be of sufficient magnitude to turn on a red light which is connected in the circuit. This Zworykin tube is the first invention to make possible the practical application of photo-electric effects. In addition to acting as a fire detector, the device has a number of other practical applications. One of these is the automatic control of light houses in untended stretches of the sea. With the Zworykin device, such lights may be turned on and off by the agencies of light and shadow.

DRY ICE

Solid carbon dioxide is being advantageously used as a refrigerant. Natural and manufactured ice distributors received a jolt when the iceless refrigerators for the home came into use, though their consolation was that shipping still required packing ice. Now we have the advent of dry CO_2 which is colder than ordinary ice and does not change state as quickly. This better refrigerant has made possible five day railroad shipments without repacking, whereas formerly ice packing needed repacking at least once in such a long journey. Also it is possible to ship large quantities of ice cream to Cuba, something heretofore not accomplished without refrigerating machinery aboard ship. In fact such large quantities of ice cream have been shipped that an embargo is likely to be declared upon it.

—Scientific American.

NEW PERMANENT MAGNET HAS GREATER STRENGTH THAN ANY OTHER IN EXISTANCE

A new magnetic alloy has been recently developed which is so highly magnetized that it will lift a bar thirty times its own weight, thus representing a strength five times that of the ordinary magnet. The material used is cobalt steel alloyed with tungsten, and was developed by Dr. P. H. Brace, research engineer, after months of experimentation in the laboratory. One of the features which makes it so desirable, is that it clings tenaciously to its magnetic power and will not lose it. The cobalt steel such as used is relatively expensive so that the alloy will only be used where performance is worth more than the price, as in delicate meters, fine phonographs and other precise machines.

FIRST ARC-WELDED BRIDGE TO BE BUILT

An arc-welded, rivetless steel railroad bridge, the first of its kind to be built, is to be erected on the line of the Boston and Maine Railroad at Chicopee Falls, Massachusetts. The bridge, when finished, will be practically a one-piece structure since every joint will be welded solid and immovable. Weaknesses due to movable joints and rivet holes are thereby eliminated. As a result, the welded bridge is lighter than the corresponding riveted bridge to carry the same size load and costs less. The bridge to be constructed is to be 175 feet long, and will cross a water power canal. Only eighty tons of steel are needed for the welded job, while over one hundred and twenty tons would be used if the job were riveted. A longer life is also expected, particularly in the case of the floor construction.

HOLLAND TUBE OPENED

At midnight, Saturday, November 12, the Holland Vehicular tunnel under the Hudson River was opened for traffic. It is a 9,250 ft., forty-eight million dollar tunnel which has been under construction for seven years and which connects New York City and Jersey City.

The safety and success of the tunnel depend principally upon its ventilation and lighting. To insure a continued power supply, there are three circuits on each side of the river at about 13,800 volts, three phase, 60 cycles.

There are 42 blowing fans run by motors totaling more than 6,000 Hp. About 250 Kw. is required to light the tunnel itself and 150 Kw. more to light the approaches.

—Electrical World

EDITORIALS

(Continued from page 94)

tained by using the capacity of power equipment in both manufacturing and public-utility plants.

The geographic center of the United States is near the center of the northern boundary of Kansas, and the center of population is in Owen County, south-western Indiana. The center of industry of the United States in 1926 was therefore 640 miles east by north of the geographic center and about 170 miles due north of the center of population.

Ideas, not gold, govern the world. The lack of ideas makes the average man.

—Selected

EASTERN INSPECTION TRIP

(Continued from page 91)

and gave D. Tiedeman the title of Feenamint.

While in Cleveland on Friday we inspected The White Motor Factory, The Williard Battery Establishment, and the Nela Park Laboratories. The presence of a number of very attractive girls in Nela Park served to make our visit more interesting. The staff at Nela Park spared no efforts in making us see the value of good light.

After a sorrowful farewell ceremony — the porter being in a receptive mood — had been completed, we left the *Shirvan* Saturday morning in Chicago. The members of our party joined the Western Trip men in inspecting the State-Central automatic telephone exchange of the Illinois Bell Company. The details and principles of the latest telephonic development, telephotography, were also explained.

The final meeting of the Inspection Trip Parties was held at Stagg Field. Although the results of the Chicago-Wisconsin game left much to be desired, Terrace Gardens and the College Inn were very effective in minimizing the sorrow.

The men who went on the Eastern Trip feel that the success of the trip was due to the excellent arrangements made by Professor Rood.

ALUMNI

(Continued from page 90)

Schildhauer, Edward, e'97, E. E.'11, is vice president of the Solvay Process Co., Syracuse, New York.

Shea, J. R., e'09, has been appointed superintendent of manufacturing development for the Western Electric Company. He is located at the company's main factory at Hawthorne on the southern edge of Chicago.

Since his graduation his experiences have been very interesting and varied. He has held a number of important positions with the Western Electric, including a period in Tokyo, Japan, as supervisor of building for the Nippon Electric Company, then a subsidiary of the Western Electric. Since then he has been connected with development work.

SUPERPOWER POSSIBILITIES

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possibilities that may become of great importance, even to the revolutionizing of some of our present conditions. For instance, why should not our steam railway rights-of-way become electric transmission line rights-of-way to transfer large blocks of electric power? The railroads would transport the necessary fuel to large stations located at big centers of population where power requirements are large and where the water required for boilers and condensers is usually avoidable. The railroads could be electrified and their rights-of-way would serve for transportation, transmission, telegraph and telephone communication, signaling and control.

On some railway systems nearly one-half the total traffic is in coal, with resulting constriction in traffic

and added trackage demand. With some lines practically one-half of the coal carried is for the operation of the lines themselves. Since coal will average around ten per cent ash, there is a large amount of uneconomic transportation resulting which could be largely saved through electrification. This could be still further reduced by generation of the electric power directly at the mine mouth, or nearby with minimum fuel transportation should there not be sufficient condenser water supply at the mine. Even such amounts of condensing water may not be necessary should the gas turbine be developed. The tremendous deposits of lignite would then become available for power development and distribution through superpower and electrification.

Every engineer passing along our waterways is continuously struck with the number of points where hydroelectric generating plants might be located, and the thought of this constant loss of possible power is irritating. But from their location such plants can now rarely be made to pay if constructed, since their cost be kilowatt capacity is high and the demand for power in their immediate neighborhood is commonly small, and this demand is commonly so irregular that the resulting station operation factor is distressingly poor. It is no wonder that at present bankers look askance at any hydroelectric projects save those of considerable magnitude. Suppose, however, that it was possible to tie small hydroelectric plants into superpower systems; also to operate them through either automatic or remote control, thus saving labor operation charges. Then the future may see enormous numbers of small hydro plants spring up over the country on little waterways now economically undevelopable. These will serve their local communities with their small, variable power demand but will turn their base power into the superpower system to which they are connected. The saving in fuel transportation as well as consumption will be tremendous. If in the future with these small, local hydroelectric plants can be linked the manufacture of fertilizers through electric nitrogen fixation, every drop of available water can be utilized; the operation factor of the station be made to approach unity, with resulting decrease cost of power production; the local farming community can be supplied with low cost fertilizers so that the traditional two blades of grass will flourish where but one grew before.

These are but a few of the potential possibilities accompanying superpower development. With these will come new and strange economic and political questions, some of which will doubtless be difficult to settle. Tremendously powerful, possibly selfish power trusts may arise. Transportation and transmission will become largely merged into a single function. The powers of the Interstate Commerce Commission, or its successor, will be enormously widened and increased. State rights will have to give way to common good. Boundaries between countries may become even more illusory than at present. But from it all, life will be more interesting than ever, more comfortable, more effective. It will

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be a wonderful field for the engineer in the next fifty years in the development of superpower alone, disregarding the tremendous changes which will come to pass because of it.

THE ENGINEER AND HIS COMMUNITY

(Continued from page 83)

learn that services rendered to the community without a fee, or even a thought of fees, very often pay the largest dividends in the long run. This is because of the esteem and resulting recognition certain to be given him by the public. Services so given amount to "casting your bread upon the water," — after many days it will return to you. If an example is needed to explain the working of this suggestion, suppose the community is considering a new or an enlarged water supply and public meetings are being held to discuss the situation. There would usually be engineers, citizens of the city, who would be in possession of valuable facts germane to the subject, and if so, such engineers should speak up in the meeting instead of allowing the doctors and lawyers to express opinions based perhaps upon prejudice or hearsay. The frequent failure of the engineer to give his views in public meetings has often resulted in far reaching community losses.

But it is not always that the engineer is competent to speak on community problems of a general social and economic nature. For example, suppose the subject of public discussion be city zoning. While it was due to the skill of the civil engineer that the great steel skyscrapers have been built, only within two or three years have such engineers given even casual attention to the grave community problems of sanitation and traffic control which have resulted from building the city vertically instead of horizontally. Even now only a few engineers can give an intelligent explanation of the reasons for or the methods of city zoning. This is due to the fact that because of our overspecialization we have produced 57 varieties of engineers, each intent and expert in his own narrow field, but only casually informed as to the others, and very often quite without either horizon or vision of the future city or even of the city of today. Such a man frequently lacks the vision of the lawyer, the doctor, or even of the successful business man, and must remain in life as he began — an expert *clerk*.

How can we expect our profession to receive public recognition when we do not recognize the public by taking and holding a much needed leadership in civic development. Are we not conceiving our duties to the public in a selfish and too narrow a way, and are we not as a profession paying dearly for the lack of leadership? Why should we complain of the low and often pitifully inadequate salaries allotted us by the public? Are they not a just measure of the public service given? Certain it is that the university expects and has a right to expect the best of leadership from its sons and daughters. Were this not so the university could not exist, nor could it be justified. The city can

grow to be a work of art, but how different from a picture or a poem. For some one has said: "The picture once painted or the poem sung, it stands henceforth by itself alone; the artist can do no more for it. It must live or die without further help from him. But the city is never thus separated from us, its builders. It remains tied to us by the invisible cord of nourishing passions. It grows with us or it dies with us. It is in a more real and personal sense a part of us as we are a part of it. It becomes then the reflex of the lives and aspirations of the people who dwell in it. So that a city, its streets, its highways, its buildings, its parks and public places, as well as its business and social life is an embodiment of ourselves. It is this living spirit that may hearten and inspire us; that may delight and enchant us, and that may also break and destroy us."

I am mindful of the fact that these sentiments may seem to some too idealistic and non-practical to serve as a guide to professional action. In answer let me say, do not be ashamed of having high ideals of life and service. Such ideals guarantee contentment and professional advancement as nothing else can, and the sooner they are comprehended the better both for the individual and for the community.

In closing, may I express my belief that this chapter of men specially selected because of the exceptional attainments of its members may some day say and feel that it is a splendid thing to be a part of a wide-awake city; a splendid thing to feel that your own strength is infinitely multiplied by the strength and wisdom of other men who love their city as do you, and that by unselfish co-operation the wholesome blood of the entire community can be united in a common purpose, so that selfish prejudices will fall away, a universal spirit of service be engendered, and as a result a greatly enhanced sense of individual power and pleasure of achievement come to all.

Emerson has made it clear in his essays that with great gifts and great opportunities such as ours always go great responsibilities for their wise and generous use. May we not all also realize the truth of what was written over 2000 years ago, "Where there is no vision the people perish."

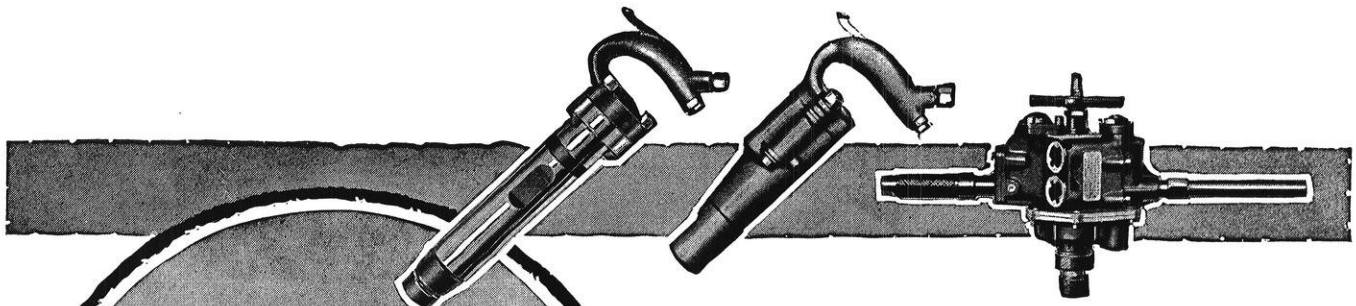
THE MODERN DROP FORGE SHOP

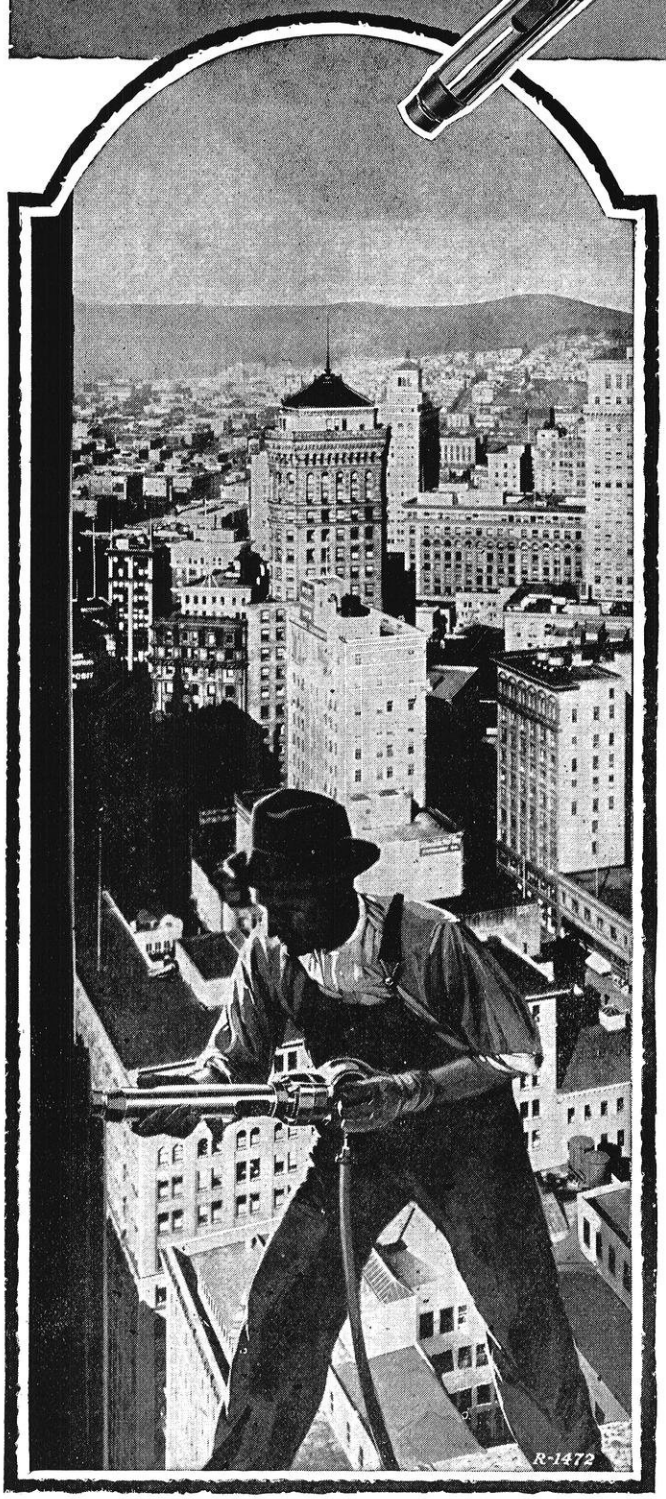
(Continued from page 82)

forging, a bulldozing operation is necessary, so as to get the correct length on the axle forging. The axles are forged a trifle short, for they can be lengthened much easier than they can be shortened, though both operations are used. The Bulldozer is a machine which is used to lengthen, and a Sizing Machine is used to shorten axles. All forgings, upon cooling, are placed upon portable racks which can be moved from place to place by an electric truck.

Heat Treatment

The axles are now ready for the heat treatment. The furnaces in this department are also heated by oil,





A riveting scene that is typical of structural steel work. The operator is more than 200 feet in the air.

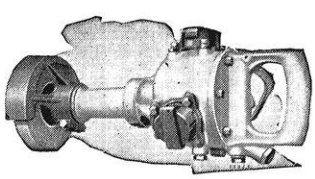
Pneumatic Tools

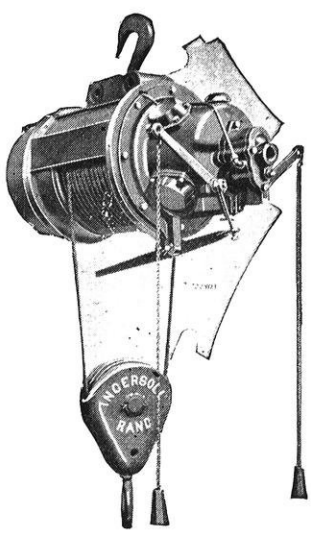
Without the riveting hammer, or "gun," as it is sometimes called, there would be no towering skyscrapers—none of the massive structures that characterize our modern industrial life.

Few, however, understand the important work that falls to the lot of other pneumatic tools. Grinders, hoists, chippers, drills—they replace hand labor in every trade and speed the output of all our present-day commodities. There is scarcely an object of every-day use whose production at some point is not hastened or bettered through the skillful use of compressed-air equipment.

Ingersoll-Rand Company manufactures all sizes and types of air compressors, as well as a complete line of air-operated, labor-saving tools. Among these are included sand rammers, clay and trench diggers, backfill tampers, concrete surfacers, tie tampers, scaling hammers, riveters, and "safety-first" pneumatic saws. All of these tools are fast and positive in action, each performing the duties that formerly required from 3 to 10 men working by hand.

INGERSOLL-RAND COMPANY
11 Broadway New York City
Offices in principal cities the world over





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but in this department, the temperature of the furnaces is checked by a thermo-couple and a potentiometer. The

SAMPLE ESTIMATE SHEET

No. of Forging = 10,000
Est. Wt. of Forging = 42.6#
Est. Wt. of Stock = 56½#
Steel SAE 1040

Cut Stock 56½# @ 1/10c a lb.	.0565
Cost of Material 56½# @ 3.50	1.9775
Overhead 4000 lb. Hammer	.3750
Overhead 4000 lb. Hammer	.3750
Overhead Bulldozer	.1560
4000 Hammer 20 Hr.	.0600
4000 Hammer 20 Hr.	.0600
Bulldozer 30 Hr.	.0400
4 Hammer Helpers	.0720
2 Bulldozer Helpers	.0640
Straightening	.1500
Pickling	.0639
Heat treat and draw	.3195
Inspection	.1200
Grinding	.1000
TOTAL	3.9894
GENERAL OVERHEAD 20%	.7979
NET COST OF FORGING	4.7873
PROFIT 10%	.4787
DIE CHARGE	.2000
Est. Selling Price	4.9660
ALLOWED FOR CASH 2%	.0993
	5.0653

PRICE QUOTED $5.10
PRICE ON DIES $1029.00
Forging to be Straightened.
Heat treated and Pickled.
COST OF DIES

2 Finishing Blocks, 30 x 20 x 20	120.00
2 Roughing Blocks, 30 x 20 x 20	101.87
Trimmer Mat.	25.10
Labor 450 Hrs. @ 1.00	450.00
Overhead 150% of labor	675.00
	$1371.97
25% absorbed in die charge	342.99
Cost to Customer	$1028.98

axles are heated up to the required temperature, held at this temperature for about two hours, and then quenched in hot water, the water temperature being around 170°F. The hot water reduces the chances of obtaining a cracked axle during the quenching operation. The quench is followed by a drawing heat, commonly called tempering, in a lead bath.

The forgings are now moved over to the Brinnell machine to test the hardness, and if the hardness comes within the specified limits, the forgings are taken to

the pickling room, where they are immersed in an acid bath for some time to remove all forging scale. Sometimes small forgings are sandblasted instead of pickled, but the advantage of pickling over sandblasting is that any defects such as hairline cracks, fine cold-shuts, and similar cracks that have, up to this time, escaped the eagle eyes of the inspector, are enlarged by the action of the acid, and such forgings can be thrown out before shipment, while in sandblasting such minute cracks are even more thoroughly covered up.

Forgings, such as axles, are now ready for the final straightening operation. The "I" beam section is straightened under a hydraulic press, while the bosses on an axle are lined up in special jigs or fixtures by hand. Connecting rod forgings are straightened by hand with a lead hammer, and cam forgings are straightened by reheating them a little and restriking them lightly in the forgings dies.

A final inspection of the forgings is made and if the forgings pass this inspection, they are moved to the shipping department where they are placed in cars to be forwarded to the customer.

The final, and important step, is taken in the accounting department, where an invoice is made out and sent to the customer.

Conclusion

A final word on the place of the Engineer in the Drop Forge Industry would not be inappropriate. The first step is taken by the Sales Engineer in deciding upon the method of operation. The Production Engineer is necessary to schedule the order to the best of advantage, improve or simplify operations, increase production, and hold down the overhead expense. The Maintenance Engineer must keep the tools in working order, and prevent any unnecessary shutdowns or delays. The Chemical Engineer, or Metallurgist must watch the quality of the work and of the material.

From the time the inquiry enters the Sales Department until the finished forgings are placed on the cars for shipment, the course of the forging is followed through the plant under the watchful eye of the Engineer.

AMERICA'S LONGEST TUNNEL NEARLY COMPLETED

(Continued from page 79)

finished July 13, and the railroad enlargement operations lacking but 1,800 feet of 10 x 16 foot bench. As this excavation is being cleaned up, ballast and 110# rails on creosoted oak ties are being placed preparatory for the first train.

When the first Denver & Salt Lake train christens the massive concrete portals this year, it will mean the unlocking of the latent resources of Northwestern Colorado and overcoming of a great natural barrier that has heretofore stood in the way of transcontinental transportation thru Colorado.

Every man in his time must either wear out or rust out. I prefer to wear out. —*Selected.*