The COLORADO ENGINEER

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COLLEGE MAGAZINES ASSOCIATED

UNIVERSITY OF
COLORADO
NOVEMBER
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In A Jointless-Minded World

Welding would prevail—and old methods of joining could not be restored to favor.

By **E. A. DOYLE***

If welding had become the standard method of manufacture before mechanical types of joints were introduced, it would be difficult, indeed, to convince manufacturers that they should redesign their metal products to use mechanical methods of joining.

NO RETREAT—pipe line constructors would never consent to a change from simple, portable welding equipment to the complicated devices essential to other methods.

Welding Gives Strength

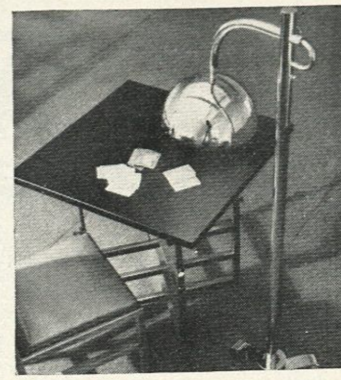
Strength would be a talking point for welding. The welded joint is strong as or stronger than the metal which it joins. The cutting of holes for screws or bolts would naturally weaken the structure. Appearance gives welding another vote. Joints made by welding are smooth in contour and have no depressions, bosses, projections or attachments as is often necessary in mechanical means of joining metals.

Costs Less to the User

Cost would be another argument for welded joints. The greater amount of material necessary with mechanical joints, the increased weight, and the decrease in pay load or performance-to-weight ratio, would make welding the preferred method. Nobody would consent to a joint in piping, which might, through a tiny leak cost much more than the permanently leakproof welded joint. Nor should it be necessary to buy expensive machinery to make mechanical joints which welding can equal in performance, economy and adaptability with a minimum investment in metal fabricating equipment.

Modernizes Automobile Design

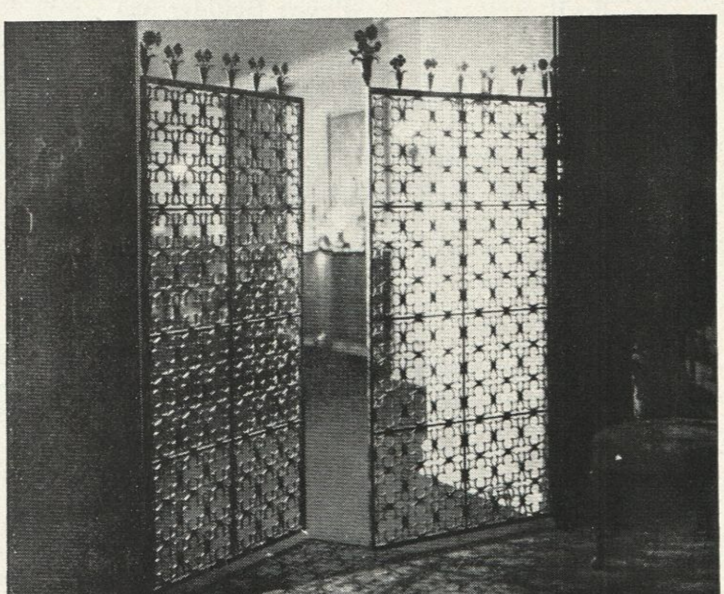
Automobile manufacturers would insist on welding rather than consent to a return to the design limitations imposed by mechanical joints. In face of a change from "teardrop" designs to the old boxlike bodies, with the attendant discomforts, with higher cost due to increased gas consumption and increased tire wear, with the fear of accidents increased by the lack of confidence in the joints, with appearance impaired and lacking the smooth surface for fine paint and lacquer finishes,—the automobile manufacturer would hesitate long before any but welded joints would even get a hearing.



METAL FURNITURE—The welded joints in metal beds, chairs and other similar furniture assure a sturdy and rigid assembly.

In the Future

Farsighted industrial executives can appreciate that a completely "welding-minded" industrial world is not far off. They should use in their own manufacturing operations as many of the advantages of welding as possible. The welding engineers of The Linde Air Products Company can advise how oxy-acetylene welding could best be used in your plant. This service is obtainable without cost or obligation by application to any of the sales offices of The Linde Air Products Company located at Atlanta, Baltimore, Birmingham, Boston, Buffalo, Butte, Chicago, Cleveland, Dallas, Denver, Detroit, El Paso, Houston, Indianapolis, Kansas City, Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Phoenix, Pittsburgh, Portland, Ore., St. Louis, Salt Lake City, San Francisco, Seattle, Spokane, and Tulsa. Everything for oxy-acetylene welding and cutting—including Linde Oxygen, Prest-O-Lite Acetylene, Union Carbide and Oxweld Apparatus and Supplies—is available from Linde through plants and warehouse stocks, everywhere.



BEAUTIFUL USEFULNESS—typified in this welded ornamental iron gateway. Every joint is strong, sound and was made inexpensively.

*Chief Engineer, Development Section, The Linde Air Products Company, New York. Unit of Union Carbide and Carbon Corporation.

THE COLORADO ENGINEER

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NOVEMBER, 1934

Engineering College Magazines Associated

Leonard H. Church, Chairman, 501 Guardian Building, Cleveland, Ohio.

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Washington State Engineeer
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UNIVERSITY OF COLORADO

Founded
1903

Do You Miss Something

IN PAST ISSUES, this space has been used to publish a pictorial reminder of Colorado. Now, forced by circumstances, we are obliged to utilize this space to send a vital message to every alumnus of the College of Engineering. Briefly, the message is this: The COLORADO ENGINEER must make a change in its policy toward our alumni or cease publication.

Since the founding, over thirty years ago, of the Journal of Engineering, the forerunner to this magazine, it has been our policy to send a copy of each issue of the magazine to every alumnus of the College, whether he had paid his subscription or not. The custom originated when all the graduates of our College numbered fewer than a hundred, and the cost of the program was negligible. For years this policy proved mutually advantageous to the magazine, the College, and the alumni. It made possible a large and interesting alumni section; it helped the administration of the College to keep in close contact with the graduates of other years; and, most important of all, this policy made possible the Alumni Directory, which, in the words of one alumnus, "Is a feature which places this magazine and this College in a class by themselves."

Now we are about to discontinue this policy because of the ever-increasing cost of sending the magazine to alumni who do not pay their subscriptions.

We are sending this issue to every alumnus, and we use this opportunity to ask each of you: Will you not help to maintain the COLORADO ENGINEER as a magazine " . . . published by the students, faculty, and alumni of the University of Colorado," by sending in your subscription and the information requested?

If many of you fail to subscribe, the comparatively few alumni who will then receive the magazine will fail to justify so large an Alumnews section, and the possibilities of reviving the Directory will be few indeed.

On the other hand, should you respond generously, we can continue to devote a large section to Alumnews, and we can promise to publish an up-to-date Directory within the next two years.

The policy of the **COLORADO ENGINEER** toward Colorado Alumni is in your hands.

Please fill out this blank and mail it to us *whether you send your subscription or not.*

Name____________________ Class of__________

Present Address______________________________

____

(Please send us your address whether it is temporary or permanent.

Present employment, and year obtained______________________________

____

REMARKS:

I enclose one dollar for a year's subscription to do my share in publishing our magazine.

I will contribute an article for the__________issue.

ALUMNEWS:______________________________

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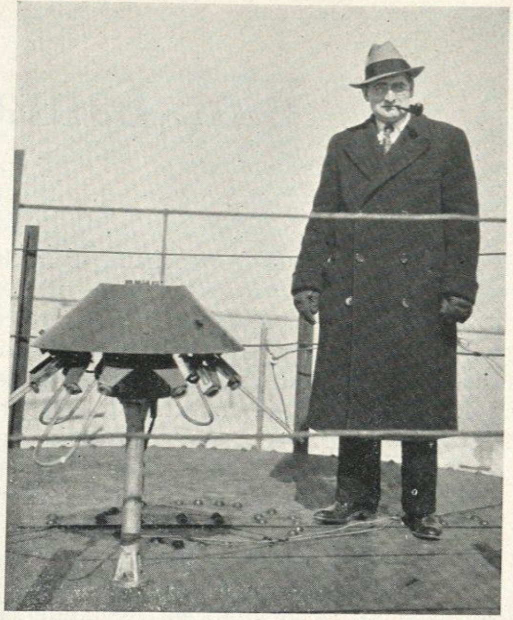
Remember that if we are to publish any Alumnews, you must supply it; so do not fail to send us the above information.

Duties and Pleasures of an Engineering Editor

By Harold W. Richardson, C., '23



The photograph shows the author on top of the pinnacle of the Empire State building, 1,250 feet above the streets of New York, the day the steel work was completed on the tower. Neon lights are temporary aircraft warning signs.

IT IS my fortunate lot to be associated in an editorial capacity with one of the great technical journals of the world. The younger editors of **Engineering News-Record,** of which I am one, cannot boast about the eminent position the journal occupies in engineering and construction circles today, for we are in no way responsible for the paper's development. But we keenly feel the responsibility of maintaining the high position of the paper, a responsibility that has been handed down by distinguished editors of the past whom engineering history will recognize as playing an important part in the advancement of engineering and construction in this country. Working side by side with the older members of the staff, one with 45 years of service, is a constant but inspiring reminder of the high ideals the paper endeavors to maintain.

In talking about **Engineering News-Record** we are not talking about something that belongs to us alone. The paper is an institution tightly bound to the great art of civil engineering and construction. It is a part of the daily life of those in the profession, and belongs to them. For only with the full cooperation of its readers can any technical journal be a success.

The duties of a member of the **EN-R** editorial staff are intensely interesting. If the reader will pardon the writer for talking about himself I shall endeavor to illustrate our work as editors by recounting some personal experiences. Thereby I shall try at least to indicate the process of creating week after week a series of printed pages which record the advancements, the hopes, failures and successes of a great profession, and the flesh and blood activities of those who have chosen the field of improving the physical benefits of mankind for their life work.

Coming from the construction field into an editorial office, as I did in 1928, was like entering another world. Replacing the terrific rush, feverish activity and worry of carrying through a construction job was the quiet, dignified procedure of editing a magazine. Later I was to find that the seemingly effortlessness of this procedure merely cloaked a mental rush that equalled the physical rush of former days. Very early I was taught the ideals and purpose of the paper—to record the advancement of the art, to provide means for exchange of ideas and experiences, without which no profession can advance, to keep ahead of the field in thinking so as to provide a form of leadership and a guiding hand and to praise where possible but to criticize and condemn where the welfare of the industry was believed to be endangered.

The editorial staff is set up on a functional basis. At present nine editors including the chief, make up the staff, and each one is a specialist in some line, all having had practical experience in the field. As I was nothing more than a construction "stiff" with an engineering education I was naturally assigned to the field of heavy construction. Others specialize in waterworks and sewerage, in highways, in municipal engineering, in structural design, etc. Each editor is responsible for the coverage of his field.

More deliberate planning goes into the paper than is generally realized; little is left to chance. Each editor must keep in touch with, know and analyze his field so that it may be properly and adequately covered. Some articles can be planned in advance; others bear on current happenings and must be prepared in a hurry. Recognition of the needs of his own particular field and meeting of those needs is the individual editor's greatest responsibility. Yet all this work has to be properly coordinated and balanced; otherwise a hodge podge would result. Consequently, every Saturday morning we hold an editorial conference, where each editor outlines the situation and happenings in his own field. Current news is discussed, problems of the industry are considered and editorial policies are determined. Special issues are planned in these conferences, and long-range plans are made, though the laying out of normal issues is left to the managing editor.

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The Santa Monica Breakwater

By Irvin Frazier, C., '28

BE WARNED beforehand that this article is about a concrete structure that **failed.** Does it seem unorthodox to give an account of this sort in a technical journal which so properly eulogizes the successful engineering projects of the day? Perhaps so, for it is but natural that our prime interest lies in the successes. For us as engineers, however, the failures should hold object lessons fully as important as any to be derived elsewhere. Too often the failures and their causes are known only to those in close touch with the project.

With this viewpoint the writer has agreed to give an account, as an innocent bystander, of the failure of the caisson-type concrete breakwater originally planned for the Santa Monica yacht harbor. The concrete plan had to be abandoned, but the harbor project was carried to successful completion with a rock-fill breakwater, the completion of which was attended by a gala celebration in August, 1934. Chief interest in the original plan lies in the fact that it defines one more limitation in the use of reinforced concrete.

After thirty years of striving to obtain harbor facilities, the City of Santa Monica, California, situated in the middle of a 25-mile stretch of beach exposed to ocean currents, neared its goal in 1931. In June of that year the late Governor Rolph gave final approval to a bill which had been passed by the State Legislature providing the necessary machinery for creation of a harbor at Santa Monica. In September, 1931, the citizens of Santa Monica voted overwhelming approval to a $690,000 bond issue to cover the cost of constructing a municipal yacht harbor and breakwater. The City Council approved plans submitted by City Engineer Howard B. Carter, for a concrete caisson- or crib-type breakwater extending 2,000 feet parallel to the shore line and situated 2,000 feet offshore. A bridge to be constructed from the

Fairchild Aerial Surveys, Inc., L. A.

Airplane view of the city of Santa Monica and its municipal pier. Since this picture was taken the stone breakwater has been constructed. It is located 400 feet from the end of the pier, with the greater part of it projecting to the left of the pier.

existing 1,600-foot pier to the breakwater would complete the L-shaped structure providing the required protection for a yacht harbor.

Construction plans were unique for a structure of this sort, and had been patented by City Engineer Carter. He waived his patent rights in this instance in order to have the city adopt the plans. There were to be 18 units or "cribs," each approximately 111 feet long and each consisting of three huge concrete cylinders 35 feet in diameter and 36 feet high, poured as a unit so that the three were joined together. Each unit was provided with interlocking tongues at the ends for holding it in place in the completed breakwater. These cribs were to be built up of welded-steel reinforcement with 5 inches of concrete on either side, giving a 10-inch concrete wall for the cylinder. After completion in the dry-dock each unit was to be floated into position, lowered into the water, and then pumped full of sand, first having been anchored by concrete piling driven into the ocean floor. The completed effect would be similar in appearance to a sea-wall composed of 54 concrete piles or caissons each 35 feet in diameter and high enough to stand above the highest waves.

In August, 1932, the $690,000 bond issue was sold, and bids were received for the contract. The City Engineer's estimate of cost was $584,760, leaving enough balance from the bond issue to provide a complete superstructure consisting of promenade, ramps to the mooring wharves, etc. The only bid received for constructing the breakwater was for $539,535, submitted by Puget Sound Bridge & Dredging Company, of Seattle, in conjunction with W. F. Way of Los Angeles. The contract was officially let to these joint contractors, and actual construction was begun late in September, 1932.

The dry-dock in which the caissons were built was located at San Pedro harbor, for a number of reasons. First, the aggregate used in the concrete could be brought conveniently by barge from Catalina Island to that point. Also, the contractors already had some facilities located at San Pedro, and the completed caissons could be towed from there to final position off Santa Monica.

In March, 1933, the first unit was completed and an engineering precedent was set when the 2,000-ton concrete structure was floated and taken for a 30-mile sea voyage by tugboats to Santa Monica. The caisson had been anchored inside the entrance to San Pedro harbor for three weeks after actual completion, before making the trip, in order to allow the concrete to "cure" properly. This trip was made under the most auspicious circumstances and the caisson, properly placed in temporary position, was filled with water. Final placing of the caissons was to await completion of all, two more of which had been poured by this time.

Within a week or ten days after the first unit had thus been towed into place, both the contractors and the city officials were thrown into a state of consternation by the development of a small crack in the outer wall of the caisson. The crack ran downward from the top of the central part of the structure. Because of the seriousness of the situation, all work on additional caissons was suspended pending examination of the crack by a diver. After numerous conferences between the contractors and city officials, Major D. E. Hughes, in charge of the San Pedro (rock-fill) breakwater construction and for 40 years connected with the U. S. Army Engineering Corps, was called in for consultation.

Major Hughes had the 2,000-ton caisson floated again, and after full investigation recommended that the concrete-crib plan for a breakwater be abandoned as impractical. He urged construction of a random stone breakwater with top width of 10 feet. The cracking of the concrete, he reported, was due to the

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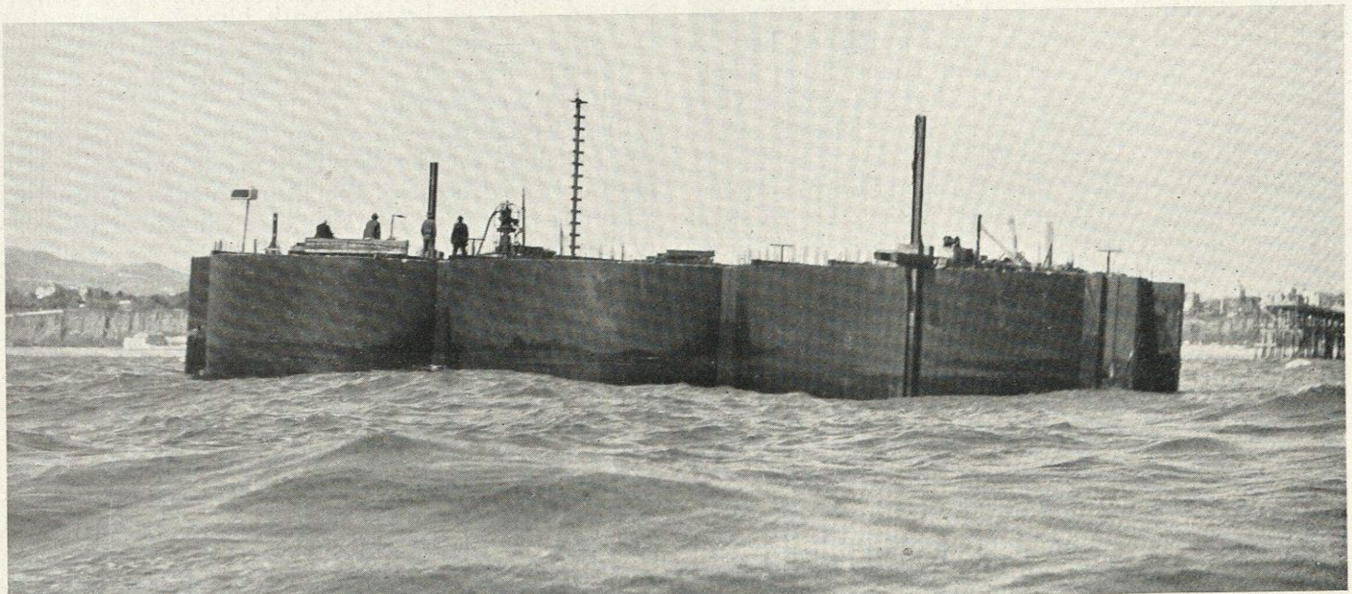

The first concrete caisson being lowered into position near the end of the Santa Monica pier. Shortly after being placed in temporary position, the top of the center cylinder cracked, and eventually the central part collapsed entirely.

The Colorado Engineer

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VOLUME XXXI, No. 1 — Founded 1903 — NOVEMBER, 1934

A Tribute to Dean Ketchum

ON September 1, 1934, Dean Milo S. Ketchum, Dean of the College of Engineering and Director of the Experimental Station of the University of Illinois, was retired as Dean and Director Emeritus. The COLORADO ENGINEER joins with his many friends in paying tribute to one of the most significant and colorful personalities in the history of the University of Colorado and of the entire profession of engineering.

It is very appropriate that we do so, for the COLORADO ENGINEER owes its very existence to Dean Ketchum. It was at his instigation that the first Journal of Engineering was published here in 1904, and by means of his faithful support that magazine, which was to become the COLORADO ENGINEER, was published for many years when it otherwise could not have survived.

Milo S. Ketchum was born at Burns, Henry County, Illinois, on January 26, 1872. He received his elementary education in the Elmwood, Illinois, High School; his bachelor's degree in Civil Engineering in 1895, and his degree of Civil Engineer in 1900, both from the University of Illinois. He was made an honorary member of Tau Beta Pi shortly after the chapter was founded there in 1897.

In 1904 he came to the University of Colorado as Head of the Department of Civil Engineering. He was instrumental in the establishment of the Colorado Beta chapter of Tau Beta Pi here in June, 1905, and in recognition of his services was made a special honorary member of the chapter. In the fall of 1905 he became Dean of the College of Engineering, where he served until 1909, when he obtained a year's leave of absence from this office to organize, with H. S. Crocker, a consulting engineering firm in Denver. In one year this firm designed the Twentieth Street Viaduct, the Alameda Subway, an extension on the Sixteenth Street Viaduct, the Ayres Grain Elevator, and several minor projects, all in Denver. He then returned to the University again until 1917, when he obtained leave of absence in order to design and supervise the construction of a huge explosives plant at Nitro, West Virginia. Under his guidance the $70,000,000 project took form with astonishing speed. When he returned to the University in December, 1918, he brought with him the report that the project—on which work was started in March, 1918—had been 90 per cent completed before the armistice was signed.

He served as Dean of our College for one more year; then, in the fall of 1919, he resigned to accept a position as Director of the Department of Civil Engineering at the University of Pennsylvania.

During his thirteen years of active service here, he had worked ceaselessly to build up the character and reputation of the College. He was a man of tremendous energy, and much of the prestige which our College enjoys today can be attributed to his thirteen energetic years here.

In 1922 he resigned from his position at the University of Pennsylvania to return to his Alma Mater as Dean and Director of the Experimental Station at the University of Illinois, where he served until his retirement in September.

During his thirty-nine years of professional life, he published many books and engineering treatises, among the most important of which are the following: **Surveying Manual** (Pence and Ketchum);

Steel Mill Buildings; Highway Bridges; Mine Structures; Structural Engineers' Handbook; and **Walls, Bins and Grain Elevators.** He was given an honorary degree of Doctor of Science at the fiftieth anniversary of the University of Colorado. He is a Member of the American Society of Civil Engineers, the Society for the Promotion of Engineering Education, the American Society for Testing Materials, the American Association for the Advancement of Science, Tau Beta Pi, Chi Epsilon, and Sigma Xi.

Now that he has retired, Dean Ketchum has started a program of research upon several problems to which he is now able to devote his time. His retirement, therefore, consists merely of a shift from an active professional life to an active private life—one which is still dedicated to the service of his fellow man.

Dean Ketchum, the COLORADO ENGINEER salutes you. May you have many years ahead of you in which you may find a well-earned enjoyment and rest in your new life!

Duties and Pleasures of an Engineering Editor

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The publishing policy of **Engineering News-Record** decrees that editors cannot perform their functions sitting at a desk. Consequently we travel extensively, with one or more of us on the road all the time, coming in actual contact with our several fields and observing first hand the activities of the industry. In covering heavy construction work for the past six years I have traveled over 60,000 miles, visiting every state east of the Rocky Mountains (a Pacific Coast editor takes care of western territory). Trips have varied from a day in Brooklyn on subway construction to an 8,500-mile jaunt that lasted three months.

Articles are obtained from three sources—voluntary contributions, requested contributions, and staff preparations. When an unsolicited contribution is received, it is assigned to the editor into whose field it falls. This editor, except in rare cases, has the responsibility of accepting or rejecting the material. Articles written by request are usually handled by the editor making the request. Staff-written articles are prepared by the various editors from material gathered in the field and from various other sources. With few exceptions the editors receive splendid cooperation from those in the field, gratifying indeed to those of us on the staff. To guard our reputation for accuracy, staff articles are submitted to the engineers and contractors involved for checking and criticism.

Many amusing and often embarrassing situations arise in the editing of contributed articles. Engineers are notoriously poor writers, with exceptions of course, and most of them admit it and are willing for their contributions to be edited as we see fit. The intense competition for space, as well as consideration for the reader, demands that every article be kept as short as possible. Therefore almost every contributed article must be cut down, and often a re-arrangement is necessary for logical presentation of the facts. This procedure usually results in wrecking the author's original material, though his style and manner of presentation are retained as much as possible. Occasionally an author seriously resents such manhandling of his brain child. Usually these differences of opinion can be ironed out, though at times situations arise that would stump a European diplomat.

There is far more to the preparation of an article for publication than the mere editing of copy. Photographs and drawings must be selected for illustration purposes, and editing of drawings is sometimes a greater task than editing of text. Incidentally, the preparation of drawings for reproduction is interesting. The editor selects the drawings to be used, and marks up the various items and lettering to be shown, giving the size of the cut as it is to appear in the paper. The drawing then goes to the illustration department drafting room, where it is photostated to three times the width of cut desired. From this photostat the drawing is traced, including only the material the editor has indicated. A standard form of tracing has been developed, which eliminates the flat, drab appearance of ordinary reduced drawings and makes the lettering legible regardless of reduction. When the tracing has been approved by the editor, it is sent to the engraver, who makes a zinc line-cut one-third the size of the tracing. Photographs are cropped and marked for size, usually going direct to the engraver for the making of a halftone (fine-screen copper cut).

Headlines, subheads and illustration captions are all written by the editor preparing the story. When the text is finally complete, it is turned over to the managing editor along with the drawings and photographs. He is the first distinterested party to read the story, and is in a position to offer valuable criticism and suggestions. When the article finally meets with his approval, the managing editor puts it through the "mill" and schedules it for a definite issue, keeping in mind the necessity of holding a balance of subject matter and type of articles in each issue. Before going to the composing room the text is read by an expert copy reader, who marks it for style and size of type, and sees that it corresponds to our standard punctuation, spelling, capitalization, etc.

Of course I am prejudiced, but I regard the heavy construction field as the most interesting and fascinating of all. Though I have visited hundreds of large jobs, I have never lost my enthusiasm or admiration for this type of work. In my extensive travels I naturally encounter many interesting and amusing experiences, some of them actually thrilling.

The greatest kick comes in visiting compressed air work. The first time under compressed air is an experience never to be forgotten. My first experience of this kind was in the Fulton Street subway tunnels under East River. The contractor's superintendent gave me instructions for keeping the ears from blocking. A company doctor assured me my innards would stand compressing a little. Yet it was with a mingled feeling of mild terror and curiosity that I entered the formidable looking cylinder serving as the air lock. Once the outer door is closed you feel that you are shut off in another world. A grizzled but kindly old lock tender, realizing that I was a novice, told me to give him the high sign if I became distressed. Then the inlet valve was opened. A terrifying roar of inrushing air was accompanied by a terrific pressure on the ear drums. For a few seconds I was helpless, but I finally remembered my instructions to hold the nose and blow, thereby equalizing the pressure on the ears. What a relief. The roaring soon died down, and the door on the tunnel side swung open. We entered the tunnel in a strange atmosphere. One's own voice sounded strange; that of others sounded almost uncanny; no sound seemed natural. To my astonishment I found I could not whistle. Puckering up my lips and blowing produced nothing but silence. Later I found that whistling is impossible in pressure above 16 lb. to the sq. in.

But the strangeness of the surroundings was soon lost in the fascination of seeing a tunnel shield at work for the first time. I was permitted to crawl up under the hood during a shove. With an uncanny silence the huge structure moved irresistibly forward with a speed that was so slow as to be almost tantalizing. An occasional shout broke the stillness as the engineers stationed at several points reported the forward progress at their positions. An eighth of an inch variation in progress on one side or the other was enough to call for corrective measures—putting more pressure on the jacks on the short side.

On this first trip under air I got my worst scare. The greatest danger in compressed air tunnels is the possibility of the top of the heading blowing out. In a 22-ft. tunnel there is a difference of some 10 or 11 lb. to the sq. in. in hydrostatic pressure between the top and bottom. The air pressure is balanced at the mid-point, causing a leakage of air out of the tunnel at the top of the face and a seepage of water into the tunnel at the bottom. Naturally one has this in mind at all times. In this particular tunnel, grouting operations were under way some distance back from the face, about the shore line where buildings were overhead. Grouting under high pressure in a situation such as this consolidates the ground and aids in preventing settlement. But just as I got into the shield that day a charge of grout under high pressure traveled along the outside of the roof of the tunnel and broke into the tunnel at the face with an explosive roar. I certainly was scared, but I wasn't alone, for later I was told the noise was similar to that of a blow-out. My grout-impregnated suit was of little use thereafter, but otherwise no damage was done. Locking out of the tunnel was a slow and uneventful procedure, though I was surprised at the rapid chilling of the air within the lock and the dense fog created. But the "sand hogs" can see well enough in the fog to utilize locking out time for poker playing.

Probably the high spot of my experience in the field was in the Alabama flood of 1929. I was in New Orleans at the time. Meager newspaper reports told of whole towns washed away, of highways and bridges wrecked, and the destruction of 75 miles of main line on the L. & N. R. R. Fortunately I met the chief engineer of the railroad just as he was leaving on a special train for Mobile to enter the flood torn area. He kindly invited me to go along, and I was thus able to get into the heart of the area in a short time. At Flomaton, Ala., the special stopped, for north of there, there was little left of what had once been a fine roadbed. So I took to National Guard trucks, to horseback and to foot. For four days I covered the south half of the state, visiting scenes of desolation that seldom have been equalled in peace times. One whole day was spent with a National Guard officer going from one small village to another, helping bewildered citizens to establish a safe water supply. The next day I hired a car, and by keeping to the ridges was able to get around without getting mired down more than once. From a small town, in distress itself, I took a carload of bread to the next town, where I found the only food supply was canned goods dug out of the mud at the site of wrecked stores. Upon reaching the city of Dothan, on the fringe of the flood belt, my story was despatched to New York with a series of photographs I had taken, developed by a sympathetic local photographer who worked until far in the night with me.

Other experiences could be recited at length, but they would only become tiresome. Then too, they would sound tame to those engaged in active construction, where sensational events become commonplace. Naturally I have had narrow escapes on several occasions, but after all, crossing Fifth Avenue on foot has its dangers also.

Incidents in connection with visiting large construction projects are always submerged by the thrill of being close to work that is making engineering and construction history. I have been fortunate in seeing every large project in the East and Midwest. Watching the progress of the George Washington bridge, the Kill van Kull arch, the Empire State building, New York water tunnel No. 2, Fifteen Miles Falls dam and other large jobs is certainly a pleasure, even though it means work in the end.

Coupled with this pleasure of seeing great structures grow to ultimate completion is the great pleasure of meeting and knowing the men who conceive and build them—men who are upholding the traditions of a noble profession. Daily contact with these men is a constant inspiration.

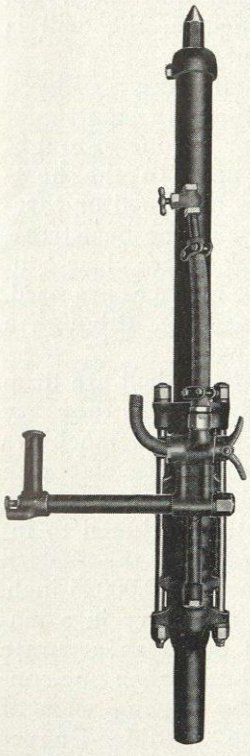
Though he never designs or builds a structure, the engineering editor feels that he has a small part in the creation of the engineering works that serve mankind. For through him is dispensed the information and exchange of experiences that make continued engineering progress possible.

The Rock-Drill---a Prerequisite to Progress in Excavation

By Walter Lucking, M., '35

THE world of today owes much to a tool of which we hear very little, namely, the rock-drill. Without its use we would never have had the great tunnels, harbors, cheap roads, and canals in our system of transportation. With the aid of the rock-drill, the stone and metals used in the construction of the large buildings, which make up our cities, have been obtained. These are only a few of the achievements which can be credited to this tool. Yet, when we read articles on the construction of these huge undertakings, seldom do we read anything of the rock-drill and the important part it is playing. We might well call it the silent, but one of the most important cogs in our industrial world.

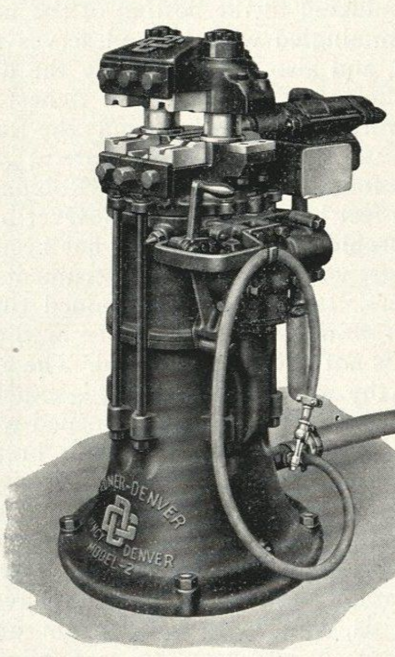
If we examine first the history of the rock-drill, we find that the first machine that has any semblance of the modern machine was a rotary, steam-driven drill invented in 1813. However, the first machine that anticipated the present type of rock-drill was invented about 1853. At this time the use of compressed air as the means of motivating the rock-drill was started. Today all of the successful ones are driven by compressed air.



Hand Rotated Wet Stoping Drill

The history of the rock-drill, however, covers not only a series of dates and improvements in mechanical features, but also the history of modern mining and of modern engineering and development. It is said that without this machine the world would have exhausted its supply of precious and industrial metals long ago. The mining of the past was done only with the expenditure of a great amount of time and effort. In this modern age of rapid production, this slow type of mining cannot be tolerated. The miner with the aid of a rock-drill can now extract low grade ore at a relatively low cost; he can work in hard rock, something which he was seldom able to do before; and, the most important factor of all, he can mine large quantities at a low cost and with tremendous speed.

The rock-drill was first used for tunneling. The best example of how it aided in the digging of a tunnel is the Mt. Cenis tunnel, completed in 1871, which connected France and Italy through the Alps. The primitive methods of drilling by hand and blasting with black powder netted a progress of only nine inches a day in each of the two small tunnels which were started from opposite sides. At this rate of progress, about forty years would have been required to connect the small tunnels and years more to enlarge them to full size. What a contrast with the advent of the rock-drill and dynamite! The small tunnels were enlarged to full size, and sixteen chattering drills punctured each of the huge holes six feet farther into the mountain every day. It is interesting to note that two hundred complete machine drills had to be on hand to keep these sixteen in operation.



Drill Steel Sharpener

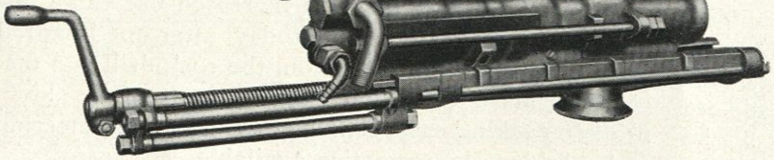
After this successful application of the machine drill to tunnel driving, its future was assured, even though miners offered considerable opposition to it at first; and, after a few years of hesitation, mining companies the world over adopted the rock-drill as an indispensable tool. With increased use came improvements in quality, until today, after one hundred and twenty years of evolution, the rock-drill is a mechanical masterpiece. Its manufacture, from blueprint to packing case, represents the best engineering and machine shop practice available.

In the design of the modern drill, consideration must be given to the comfort and safety of the miner who is to use the machine. All recent drills have helped to reduce physical labor and discomfort, by means of making a lighter and a more efficient drill, by cushioning the hammer to reduce vibration, and by increasing the rotative power of the drill.

In certain mines the dust formed during the drilling operation is harmful to the miner. The minute dust particles which are held suspended in the air are inhaled, and if a miner has sensitive bronchial tubes or lungs, these dust particles quickly induce a dreaded disease known by the various names of Miners' Phthisis, Silicosis, or Miners' Consumption. This dust menace is most prevalent where drills are used without water. The great majority of them, however, use hollow drill steel through which water is conducted to the bottom of the hole. This water is commingled with air and serves to eject the cuttings, and also to partly allay the dust.

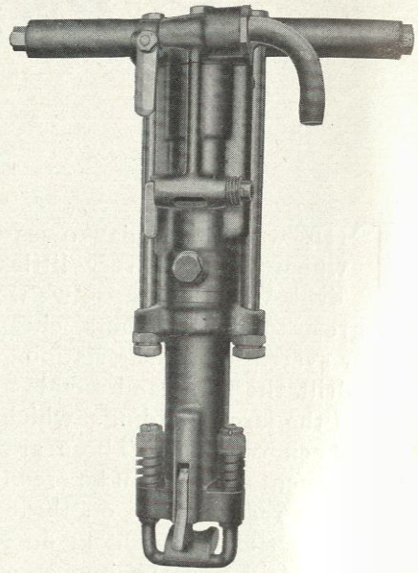
The most extensive and richest mining area in the world is what is known as the Rand in the Union of South Africa. The mines are at great depth. The deepest one, known as the Robinson, is operating 8,300 feet below the surface. Over a period of years, the problem of dust control has been given the most exhaustive research by government and mining engineers. It has been determined that when air and water flow through the hole in the drill steel, the dust is not effectively allayed. The air is commingled with the water, and when it is expelled at the collar of the hole, air bubbles are loaded with silicious dust particles. These small bubbles break and the dust particles, which under a microscope look like a fish hook, are so light that they are for a time suspended in the air. The mining interests in South Africa have been taxed in the past very heavily to provide a compensation fund for men who have succumbed to Phthisis, and quite apart from any humanitarian thought, it has been an economical move to take definite steps to allay the dust. At present, no drill can be sold in the Rand District where any air under pressure is allowed to enter the hollow steel. In other words, water is the only cleaning medium. This regulation has been in effect on the Rand for the past six or seven years, and the mortality due to Phthisis has been almost eliminated.

In this country to date, the use of water and air combined has been considered an effective method of allaying dust, but in the last two or three years, many mining districts have come to the conclusion that the system followed in South Africa will have to be adopted in this country. Already some of the largest mining companies in the United States are confronted with serious law-suits brought by miners or their families for permanent injury to health or, in many cases, death, due entirely to inhaling dust created in drilling operations.



Drifting and Tunneling Drill

In order to see more clearly how the manufacturer complies with safety regulations and makes the drill to suit every need, it may be suitable to go into the manufacture of the machine. It would be well to call attention to the fact that the rock-drill receives the roughest treatment of any tool manufactured. Notwithstanding this fact, every part of a good rock-drill is one hundred per cent interchangeable.



Sinking Drill

The new drill is usually conceived in the engineering department. After it is designed, a number of experimental drills are made and put into the field for testing. During this testing, the drill is watched very carefully for any defects that may show up. After every defect has been remedied, the drill is ready to be placed into production.

All the steel going into its manufacture is ordered under the direction of the metallurgical department where it is sampled and tested for hardness, toughness, strength, and grain structure. In the heat-treating laboratory the material is hardened or case-carburized. Gas furnaces are used in the heat-treating except for very particular work where close control is necessary, for which electric furnaces are used. Generally oil is the quenching medium, although a salt brine bath is used for some work.

In the forge shop, the parts of the drill are drop forged to their approximate shapes, and they are sent to the machine shop, where special machines finish them to very close tolerances. An elaborate system of master gage blocks and ring gages is used to insure accurate test-gages for the workmen to inspect the completed parts. Some parts on the modern drill are held to tolerances of 0.00025 inch. The extreme accuracy necessary in a machine in order to turn out such accurate products can be appreciated when one considers their cost. In the machine shop of one manufacturer, the Gardner-Denver Company, for example, the tools alone are valued at about $1,500,000.

After every part manufactured has been carefully checked, it then passes to the fin-

Continued on Page 15

CAMPUS NEWS

THE THIRTY-SECOND ANNUAL ENGINEERS APPLEFEST

Traditional entertainment was provided for a capacity crowd of engineers on Tuesday, October 30, 1934, in the Men's Gymnasium. The evening was featured by speakers, boxing bouts, a wrestling bout, corn-cob pipes, doughnuts, and apple cider. The speakers were Dean H. S. Evans and Dean H. G. Carlson.

Calza-Tinsley, Davidson-Gerringer, and Tompkins-Vance put on nine lively rounds of boxing, while Carlson-Burky furnished one of the best events of the evening in a spectacular wrestling match. F. R. "Pop" Dungan acted as referee.

A NEW OPPORTUNITY FOR ENGINEERING STUDENTS

The old bugaboo that an engineering student's education is entirely too narrow has been dealt a severe blow with the opening of the 1934-35 school year. Much has been said concerning the one-sidedness of an engineer's education, but heretofore, little has been done about it. Now, however, students in the College of Engineering are able to acquire an education in engineering, plus training in business that will give them a more rounded education, as well as providing them with effective training for obtaining and holding better positions in their chosen line of work. Courses have been arranged by the administration of the colleges of business and engineering, so that one may obtain his engineering degree in four years of scholastic work, and a business degree in one additional year. Starting with the junior year, all electives and some less essential engineering courses are replaced by courses in the business school. The regular engineering degree is granted on the completion of four years' work, the additional year's work being entirely optional. Work during the fifth year consists of business courses. This combination offers an opportunity for students to obtain a well-rounded education with a minimum of time and expense.

CONTRIBUTORS' BOX

HAROLD W. RICHARDSON (C., '23), who in this issue describes the making of a great technical journal, has been Assistant Editor of Engineering News-Record since 1928. Before that time, from 1923 to 1928, he was actively engaged in construction work as Engineer and Superintendent of Bates and Rogers Construction Co., of Chicago.

IRVIN FRAZIER (C., '28), is Office Manager for the Geological Division of The Texas Company in Los Angeles. After making topographic maps in Kentucky for the U. S. Geological Survey during his first year out of college, he accepted a position there with The Texas Company, in whose employ he has been ever since. His various assignments have included aerial photography, field work as magnetometer operator, drafting, secretarial work, and refraction and reflection seismograph work.

WALTER LUCKING (M., '35), has contributed to this issue a very interesting article which deals with the rock-drill. Much of the authentic and up-to-date data used in this article were furnished by the Gardner-Denver Company, of which Mr. Lucking's brother is an employee.

The Midwest Steel and Iron Works has recently completed a model illustrating modern practice in structural steel work which, through the courtesy of Mr. Ira C. Bower, is to be presented to the Department of Civil Engineering. The fabrication, which consists of two columns supporting a beam, shows standard beam-to-beam, beam-to-column, and column-to-footing connections. A feature of additional interest is a welded column-to-footing connection illustrating the comparatively new practice of welding joints instead of riveting them. This well-designed specimen of steel construction practice should prove of value to those studying Mechanics, Building Construction, and Structural Drafting. Arrangements have been made for accommodation of the model in the Materials Testing Laboratory.

Mr. Waino S. Nyland, instructor in the Department of English, was in Butte, Montana, this summer, gathering material and atmosphere for a book dealing with the Finns and Scandinavians living in the mining communities.

F. E. R. A. WORK ON THE CAMPUS

Again this year, work has been provided under the F. E. R. A. for many needy students. As far as possible, engineering students have been assigned to jobs in the several departments of the engineering school. Some, however, are doing yard work and repair work about the campus, and others are employed in the departments of physics and chemistry, assisting with research work.

In the electrical and mechanical departments, several students are doing general clean-up and repair work. An interesting project is being conducted by the civil department: a basement room is being constructed in the southwest corner of the materials testing laboratory. When the project is completed, it will provide a suitable place for curing and preparing concrete for tests.

Professors W. O. Birk, C. L. Eckel, and W. F. Brubaker attended the convention of the Society for the Promotion of Engineering Education held at Cornell University, Ithaca, New York, June 19-23, 1934. An attendance of over eleven hundred made this the best attended convention in the history of the organization.

A large portion of time was devoted to the application of models and photo-elastic studies in solving difficult engineering structures. These devices are aids to mathematical analyses and do not supplant the use of mathematics.

C. C. Williams, one-time Assistant Professor of Civil Engineering at Colorado and now Dean of the College of Engineering at the University of Iowa, was elected president of the Society. (Dean Evans is a past president.) Professor Eckel was elected to the Council for a three-year term. Professor Birk was named on the Committee on English for the thirteenth consecutive year.

Professor Charles A. Hutchinson, Head of the Department of Engineering Mathematics, has just published a new book entitled **Differential Equations for Students of Engineering and Physics.** The first portion was published in a preliminary edition last January. The complete volume is to be used the winter and spring quarters.

Mr. Paul V. Thompson has returned to the staff of the Department of Engineering English to take the place of Mr. Frank A. Grismer, who has resigned to become the commanding officer of a CCC Camp in Arizona. Mr. Thompson, an assistant in the same department from 1930 to 1932, has recently returned from England, where he spent the summer gathering material for his doctoral dissertation. He has his Bachelor's degree from Dartmouth, his Master's degree from the University of Colorado, and has completed all requirements except his dissertation for the Ph.D. degree from Northwestern University.

AMERICAN SOCIETY OF CIVIL ENGINEERS

The student chapter of the American Society of Civil Engineers selected the following list of officers for the year 1934-35: George Phillips, president; Byron Hewlitt, vice-president; Dana Malchow, secretary; and Robert Matthews, treasurer. The first meeting was held Wednesday evening, October 3, 1934. In accordance with a past custom, various members who had engaged in engineering work during the summer described the projects on which they were employed.

THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS

held its last meeting on April 25, 1934, at which time officers for the coming year were elected. They are as follows: Robert Davidge, president; Newell Parker, vice-president; Glen Frantz, secretary; Vincent Hackett, treasurer; and Professor DuVall, counselor. A regular meeting was held October 10, 1934, at which time Professor DuVall spoke on "The Purposes of A. I. E. E."

Six out of a total of seventy-seven delegates who attended the convention of the Eighth District of the Institute held in September at Los Angeles were graduates of the University of Colorado.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The student branch of the American Society of Mechanical Engineers had its first meeting October 3, under the direction of Walter Lucking, chairman; Bryson Reinhardt, vice-chairman; Wallace Swan, secretary; and Clifford Wrigley, treasurer. During the business meeting, plans were made for the reception of Mr. Earnest Hartford, a national officer of the Society, who will visit the University late in October. William Werner and Robert Burt entertained the group with short talks about their experiences during the summer.

The main attraction of the second meeting was a talk by a widely known graduate of the class of 1933, Gardner Turman, who gave an interesting account of his experiences since graduation.

AMERICAN INSTITUTE OF CHEMICAL ENGINEERS

Officers of the Institute for the coming year are Franklin W. Church, president; Wayne Chatfield, vice-president; John Taney, secretary; and Daniel Yocum, treasurer.

Among the list of speakers for the year are Dr. Gustafson of Denver University, and Mr. Carstanfen, well known consulting engineer of Denver.

TAU BETA PI

On May 16, 1934, Tau Beta Pi selected the following officers for this year: Clifford Wrigley, president; Peter Nagel, vice-president; Robert Davidge, corresponding secretary; Cavis Ham, recording secretary; Professor E. O. Bergman, treasurer; and Dr. O. S. Knight, cataloguer. Members of the faculty advisory board are Dean H. S. Evans, and Professors C. L. Eckel, M. S. Coover, and W. S. Beattie.

At a convention of Tau Beta Pi held at Columbia University, October 11-13, 1934, two new chapters—one at Stanford University and another at Rutgers were approved.

The three honor juniors who are selected annually to be the first three members of their class to become members of Tau Beta Pi were announced at the Engineers Applefest. They are Charles Craig, Frank Laucomer, and William Wolf.

SIGMA TAU

Having already held two meetings this year, and, with eighteen members in school, Sigma Tau is headed for a most successful season. Under the leadership of John Burky, president; Norman Hill, vice-president; Peter Nagel, secretary; Abbott Hastings, treasurer; and Bob Shay, historian, Sigma Tau expects to engage in a well rounded group of activities.

Tuesday night, October 30, at the Applefest, Sigma Tau pledged the following men: Dick Armstrong, Lester Barry, Marcus Bogue, Robert Burt, John Gebaur, Vincent Hackett, Don Nicholson, George Phillips, John Strickland, John Taney, Robert Rathburn, and William Wolf.

During the first week of school, John Burky attended the thirtieth annual conclave of Sigma Tau, held at Lincoln, Nebraska, and brought back a report of a most successful convention.

PI TAU SIGMA

Pi Tau Sigma, honorary mechanical engineering fraternity, began its fifth year on the campus under the leadership of the following officers: Wallace Swan, president; Walter Lucking, vice-president; Edward Lootens, recording secretary; John O'Brien, corresponding secretary; and Harry Hoffmann, treasurer. The first meeting of the quarter was devoted to the selection of new members. Five juniors—Fred H. Ballou, Robert A. Burt, Charles T. Grace, William F. Hull, and John Strickland—were pledged to the honorary fraternity.

CHI EPSILON

Chi Epsilon, the honorary civil engineering fraternity, selected the following officers for the year 1934-35: president, Dana Malchow; vice-president, Herbert Cox; treasurer, Frank Ciochetto; and secretary, Cavis Ham. A dinner was held on October 7, at which Lionel Ketchum, Smith Ketchum, and Frank Cook, all of Denver, were guests. After the dinner, Mr. Cook entertained the group with a short talk.

Last May Arthur McNair, then president, installed the Texas chapter at the University of Texas in Austin.

ETA KAPPA NU

Eta Kappa Nu, honorary electrical engineering fraternity, elected the following officers at the meeting on May 15, 1934: Bill Lootens, president; Harold Kruitbosch, editor of Bridge; Robert Osborn, recording secretary; Jim Rose, corresponding secretary; and Casper Kistler, treasurer. At an open meeting held on November 14, 1934, Dean Peterson, of the business school, gave a very interesting and educational talk, illustrated with colored slides, on his tour of the world with the floating university in 1927 and 1928.

ALPHA CHI SIGMA

The honorary chemical fraternity, Alpha Chi Sigma, will have for this year the following officers: Woodrow Knott, president; John Taney, vice-president; Wayne Chatfield, secretary; Franklin Church, treasurer; and Dr. O. S. Knight, faculty advisor.

A weir box has been installed on special columns on the north side of the steam laboratory for use in taking measurements on the flow of water through a variable sized weir. The box is large enough to measure a flow of 400 gallons of water per minute.

A water box is placed directly below the weir box, which will hold 600 gallons of water. This tank is used in calibrating the weir and also a plate orifice, which is placed in the pipe line leading from the water pump to this water box.

After a test has been made and the water caught in the water box, the water may be weighed at leisure by allowing it to run out of this box into the small water barrels placed on platform scales.

One of the most interesting of all the projects completed under the F. E. R. A. in the engineering departments is a large cross-sectional model of a steam turbine, built by two senior mechanical engineers under the supervision of Professor S. L. Simmering.

The model is to be used for illustrative purposes in the classes in the Mechanical Department dealing with thermodynamic relations and their applications. It will be a big help to the instructors in their all-too-difficult task of teaching thermodynamic applications, as well as in demonstrating just where the various parts go in a turbine, and why. The major details have been emphasized, and the minor ones, such as pipes, governor, and auxiliary apparatus have been omitted in order to clarify operation of the principal mechanism.

It cannot, perhaps, be called a model in the usual sense of the word, for it is really a full-size cross-section of a Westinghouse turbine. Furthermore, it is supplied with a complete set of blades for one cross-section taken from an actual turbine.

The Rock Drill

Continued from Page 12

ished parts room where every part is classified and held awaiting assembly of a unit of the shipment of spare parts to the field. When it is desired to assemble a drill, an order is given the finished parts room for the required parts, and these are in turn delivered to the assembly department, where the drill or unit is assembled and tested prior to shipment into the field. A record is maintained of every part going into the assembly of a unit, so that in the event any part fails or undue wear occurs, the history of that part may be traced through the shop. It is interesting to note that streamlining has also entered this field. All drills are streamlined as much as possible, and have no external parts protruding whenever it is practical to make them that way.

The completed rock-drill is a work of mechanical artistry. Very close limits have been kept on all the parts, and every effort has been made to keep it as simple as possible to suit the needs of the workmen. In the completed machine, we find one of man's most useful tools. Without it, who can say what the future would bring in mining and construction?

** ALUMNEWS **

'34

Dolph Campbell, e, is with S. R. De Boer, Landscape Architect, Santa Fe, New Mexico. Campbell has charge of the recreational study, for a state plan of New Mexico.

William Hull, m, can be found at College Station, Texas, where he is a graduate assistant in the mechanical engineering department of the Agricultural and Mechanical College of Texas.

Eugene Eipper, a, who was Alumnews Editor last year, is employed as a draftsman by the General Motors Truck Corporation, at Pontiac, Michigan.

Garwood Andresen, m, was awarded an assistantship at Yale in order that he may prepare for his doctorate degree in mechanical engineering. Last August, Garwood was married to Harriet Menzel, who is also a graduate of the University.

Frank Manley, ch, worked all summer in Denver designing a paint factory. He is now in Los Angeles supervising the erection of the plant.

'33

Oliver McNeel, c, is employed on the Sutherland Project under the National Reemployment office in North Platte, Nebraska.

Alfred J. Ryan, c, is working in the shop for the Midwest Steel Company, Denver, Colorado.

Norman J. Castellan, c, former editor of the COLORADO ENGINEER is working on an oil project over Tennessee Pass, Colorado.

Joseph E. Maudru, ch, was married to Dorothy Van Valkenburgh, also a graduate of the University of Colorado, on June 7, 1934. The couple are now living at Pahala, Hawaii, where the bridegroom is employed by a sugar company.

John Evans, e, son of Dean Evans, is employed in Washington, D. C., at the office of the General Electric Company. He is also studying law at George Washington University.

Sidney D. Larson, e, was married on June 8, 1934, to Reva Hickox. Sidney is employed in the United States Reclamation service. The Larsons are in Denver at this time.

Robert Nicholas, e, an honor graduate of the University engineering college, has been appointed junior engineer and photographer on the Parker Dam project in Arizona. The appointment was obtained through the reclamation bureau in Denver.

John W. Stanley, c, has been employed by the state highway department at Trinidad, Colorado.

Edward Gemmill, e, has a job with the Owl Creek Coal Company in Gebo, Wyoming.

'32

Everly W. Austin, e, was married to Miss Onita Lucile King of Wauneta, Nebraska, last June. The couple are now living in Boulder.

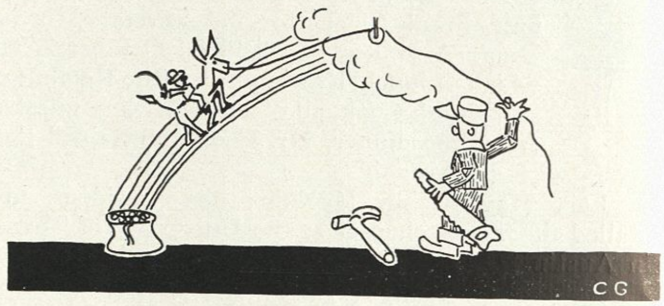
Sheldon A. Brown, c, is on a construction job in Yellowstone National Park.

Jess Smith, c, is at Randolph Field, Texas, learning how to fly the device known as the airplane.

Robert E. Lee, e, is with the LaCrosse Dredging Company at La Crosse, Wisconsin.

Rhoden W. Chase, e, has a position with the Frigidaire Corporation at Fort Worth, Texas. He makes his home at 1630 South Jennings, Fort Worth, Texas.

Fred C. Knoth, c, is making a name for himself in Hollywood. He isn't in pictures, but is making miniatures for the Warner Brothers Studio. He recently completed the scene for "Wonder Bar" which shows Al Jolson going to heaven on a mule via a rainbow, and he made much of the scenery for "Dames."



'31

David Beach, c, is director of management in the United States Bureau of Public Roads at Washington, D. C.

Frank M. Russel, a, who is now employed by the United States Bureau of Reclamation in Boulder, was married to Miss Grace Allen on May 26, 1934.

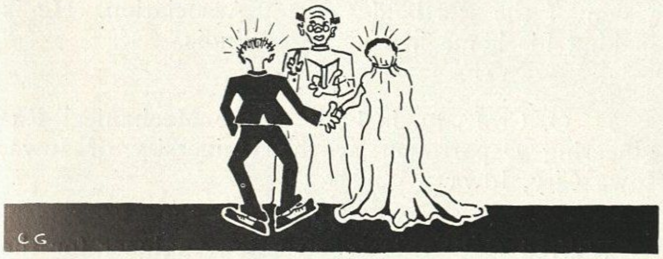
Donald Estes, m, was married to Miss Virginia Sullivan on September 12, 1934. Don is now associated with his father, Edwin J. Estes, in business. They are located at Longmont, Colorado.

Douglas B. Halford, c, is manager of the Johnson Service Co., located in Salt Lake City, Utah. He was on the campus this fall renewing old acquaintances.

Gilbert Kullgren, e, and Tyler A. Shinn, e, visited the campus during their vacations from the General

Electric Company at Schenectady, New York. Mr. Kullgren is a former staff member of the COLORADO ENGINEER.

Grosvenor Kennedy, m, was married to Miss Margaret Allshouse of St. Louis, Missouri, April 11, 1934. The Kennedys make their home in Denver, Colorado.



'30

Keith and Kenneth Shields, a, who are known as the twins that were graduated with honors, visited in Boulder this summer. They can be found in Cambridge, Pennsylvania, holding positions with the American Bridge Company.

'29

C. H. Durning, m, is employed in the refrigeration department of the United Fruit Company. He was sent by his employers to attend the sessions on refrigeration at the convention of the Society for the Promotion of Engineering Education.

Sartwell Edgerton, c, is with the Truscon Company, Newark, New Jersey.

G. Leland White, c, has a position as assistant architect in the Division of Architecture of the department of Public Works of New York State.

Hudson Rathburn, e, graduated from George Washington University with an LL.B. degree. Mr. and Mrs. Rathburn are living in Schenectady, New York, where Mr. Rathburn is employed by the General Electric Company.

Maurice Terrill, c, is with the Ingersoll-Rand Company in Denver, Colorado.

'28

Dr. Odgen S. Knight, ch, was married to Miss Jean McColgin of Indianapolis, Indiana, on September 16, 1934. Dr. Knight is an instructor in the mechanical engineering department of the University.

Robert Braggins, e, is working in the stock room of the sound department of the Fox studios in Hollywood, California.

Chris Bartlett, e, is the athletic coach and an instructor in mathematics at the Junior College at Grand Junction, Colorado.

'27

Glen Thompson, e, was married to Miss Margaret Sandry of Stillwater, Minnesota. They plan to make their home at Gary, Indiana, where Mr. Thompson has a position with the Northern Indiana Public Sewer Company.

Carl Borgman, ch, has returned to the United States after three years' absence in Europe. He obtained the degree of Doctor of Philosophy at Cambridge University in England, and now has a position in the chemical engineering department at the University of North Carolina, Chapel Hill, North Carolina.

Stanley C. Shubart, m, and Rita Sanders Shubart, B.A. '27, M.A. '29, announce the birth of a daughter. Sally Daisy Shubart, born June 27, 1934, at their home in Detroit, Michigan. "Sally," he writes, "applies for matriculation in the U. of C. class of 1955."

'26

Wade L. Menoher, c, has a position teaching in the Shannon City schools, at Shannon City, Iowa.

Dallas J. Frandsen, e, visited the campus this summer, accompanied by Mrs. Frandsen. Mr. Frandsen is employed by the Public Service Company at Tulsa, Oklahoma.

Edwin A. Heath, e, has a leave of absence from the Kansas Gas and Electric Company at Wichita, and is taking advanced work at the University of Colorado.

Orville V. Miller, e, was married to Nancy Jane Smalley of Detroit on September 21, 1934. G. Elbert Messer, e '26, was the best man. The couple are living in Detroit.

'25

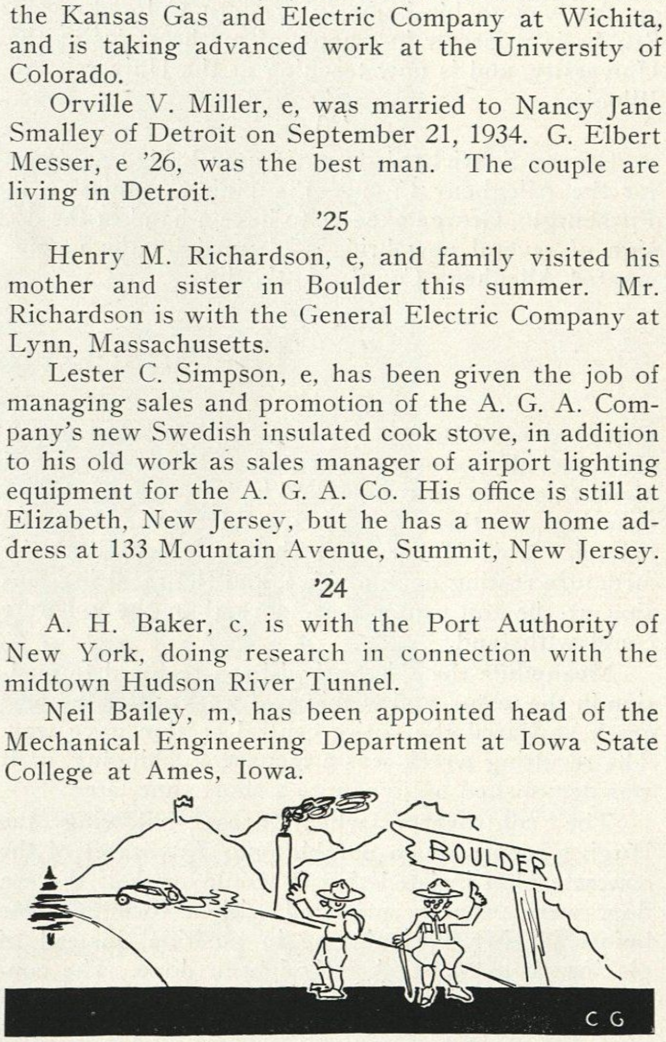
Henry M. Richardson, e, and family visited his mother and sister in Boulder this summer. Mr. Richardson is with the General Electric Company at Lynn, Massachusetts.

Lester C. Simpson, e, has been given the job of managing sales and promotion of the A. G. A. Company's new Swedish insulated cook stove, in addition to his old work as sales manager of airport lighting equipment for the A. G. A. Co. His office is still at Elizabeth, New Jersey, but he has a new home address at 133 Mountain Avenue, Summit, New Jersey.

'24

A. H. Baker, c, is with the Port Authority of New York, doing research in connection with the midtown Hudson River Tunnel.

Neil Bailey, m, has been appointed head of the Mechanical Engineering Department at Iowa State College at Ames, Iowa.



'23

William Linsenmaier, c, and Fred Pneuman, c, '22, visited Boulder on their vacations. Both of them are living in Gary, Indiana.

George M. Beveridge, one of the last of the bachelor holdouts of the civil class of '23, succumbed to the charms of Miss Betty Welker of Pittsburgh and was married in September, 1934. In the time he can spare from his newly-acquired domestic duties Bevo, as the new district sales manager of the Truscon Steel Co. in Pittsburgh, is using his old football tactics on his competitors.

'22

Don Sylvester, e, and his wife are in Denver, Colorado, having come to benefit Mr. Sylvester's health. He is a former instructor in the physics department. He has a year's leave-of-absence from his job as an engineer on the New York subway system.

'21

Clarence H. Caughey, m, and Mrs. Caughey announce the birth of a daughter on October 7, 1934. They are living in Aurora, Illinois, where Mr. Caughey is employed with the Barber-Greene Manufacturing Company.

Frank W. Stubbs, c, was in Boulder this summer on the way to his home in western Colorado. Mr. Stubbs is a former instructor of mathematics at the University, and is now teaching at the University of Illinois.

'20

George S. Richardson, c, is now bridge engineer for the Allegheny County Planning Commission in Pittsburgh. George expects to have a hand in the design of several new bridges planned by the newly-created Allegheny County Authority.

'19

Harold C. Guggan, m, can be found at 2037 Blvd. in West Hartford, Conneticut. He is employed by the Oakite Products, Incorporated.

'18

Arthur Boase, c, is manager of the structural division of the Portland Cement Association. He is making his home in Chicago, Illinois.

'17

H. O. Croft, m, is head of the Mechanical Engineering Department at the University of Iowa, Iowa City, Iowa.

'16

Wilfred Hall, c, is construction engineer for the General Joe Wheeler Dam of T. V. A. at Towncreek, Alabama.

'10

Floyd H. Millard, c, is comptroller of the Cotton Belt Railroad, which has its offices in St. Louis, Missouri. Mr. Millard visited Boulder this summer.

Kenneth White, ch, and family were in Boulder this summer for a visit with his parents. Mr. White is a patent attorney for the Doherty Research Company.

The Santa Monica Breakwater

Continued from Page 7

changing sea floor, and not to defective workmanship. Unexpectedly strong ocean currents had developed along this open shore-line, and had proved capable of scouring out the sea floor around each end of the caisson. This in turn left the central part of the structure resting upon a ridge, and the resulting tension at the top center was more than the concrete could withstand.

Meanwhile the caisson had been restored to position in the water, and within two weeks after the first crack appeared the entire central section gave way. The resulting wreck was a menace to shipping, so it was demolished by dynamite a short time later.

The controversy which arose following the Hughes report was a notable one. Advocates of the concrete plan insisted that it would work if the sea floor were properly prepared with a rock mattress before placing the caissons in position, instead of placing them on sand as had been done. The contractors were willing to proceed with construction of a rock-fill breakwater, provided allowance be made for the approximately $250,000 which they claimed to have invested in the concrete project to date. Their barges could bring the rock from Catalina Island, as was done for the San Pedro harbor breakwater. The City Attorney of Santa Monica ruled that the change to rock-fill breakwater under the existing contract could be made only if the extra cost did not exceed 15% of the original contract.

After many investigations by various committees and after some legal action aimed at forcing the contractors to complete construction under the existing contract, the City Council issued a change-order to the contractors, authorizing a change to rock-fill type of breakwater. In June, 1933, the contractors filed a "friendly suit" in Los Angeles Superior Court to establish the legality of this order, which was approved. The change-order under the original contract was allowed to stand in force, and the contractors proceeded with construction of the rock-fill breakwater.

In August, 1934, the rock-fill breakwater was completed, having a bottom width of 102½ feet, a top width of 10 feet, and a height of 10 feet above mean low water. The top structure was finished with boulders each weighing 8 tons or more, lifted by derricks and keyed and chinked in place. Thus 4 million square feet of yacht harbor has been provided for Santa Monica. Plans are already being made for a $1,450,000 extension to the breakwater, with hoped-for assistance from the Public Works Administration. This extension will provide sheltered mooring space for 700 more pleasure craft and be entirely self-liquidating through revenue to be derived from mooring charges.

The applicability of concrete construction to ocean breakwaters is not necessarily disproved in this case. The fact remains, however, that the rock-fill structure has been completed satisfactorily and already has been put to a remarkable test. Heavy seas which have caused high waves off the coast of southern California this summer have not harmed it. The moral would appear to be that the random rock structure at least is a safe one for this purpose.

THE HONORARY SOCIETY OF LUBRICATING ENGINEERING

OIL CAN

ILLUMINATING CHAPTER

LUBRICITY SHALL LACK NO CHAMPION

FRICTION SHALL NOT THRIVE UNOPPOSED

ANOTHER University year has begun; another year of cerebral exertion—for the student—is in the offing; a new era of Brobdingnagian wonders of engineering achievement is proclaimed by the society of the oil can. Such a prediction is, indeed, not unfounded but rather supported by the veritable avalanche of new inventions which have found their way to the oily archives of that venerable society during the short space of five weeks. Of course, we are pleased to note such enthusiastic response to the cause of lubricity, but we must, of necessity, remind you, dear readers and aspirants to greasy fame, that only from the ranks of the upperclassmen are our members selected. Experience has shown that the brain child of the freshman is but an embryo awaiting incubation; and until you have achieved a higher stage of mental development, you are privileged only to witness in awe the expoundings and vociferous manifestations of the lubricated minds of the upperclassmen. Thus with the graceful gesture of superlubricated motion, we are compelled, by tradition, to file the unique discoveries of the plebes in the perforated waste-can.

It is with a great deal of pride that we reveal our selection of new associates, and announce their respective awards. The coveted grand prix, a gill of transmission line oil, is entrusted to the care of Lester Barry, senior electrical, that he may better continue his quest for a separately excited D-C motor.

Gilbert Brown, junior civil, reveals one of the most startling developments in the field of metallurgical research. While reposing in one of Mr. Thoman's Engineering Materials classes, Gil was asked to give the common form of pig-iron. He replied after pondering the question for a moment, "I believe it usually comes in powdered form." For his contribution, this eminent scholar is awarded one-half pint of dehydrated grain oil and an upholstered hobby horse.

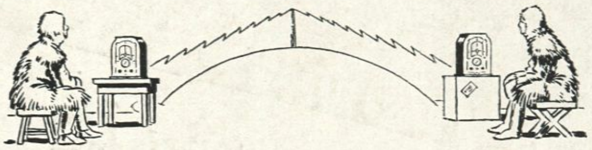
None other than our worthy editor is the recipient of this, our third prize. Bryson Reinhardt, senior mechanical, having become acquainted with the phenomena of half wave rectification of alternating current, decried the entire electrical engineering profession for permitting what he chooses to call, "the waste of half the power of an alternating current." Bryson has announced his intention of embarking on a program of thorough investigation of the situation. The hammered aluminum ohm sifter is presented him with the sincere wishes of the entire organization for his success.

Rarely, indeed, is a single individual twice granted recognition for his meritorious work in this organization. However, of such universal interest is this second discovery by Mr. Roy Misenheimer that our duty to science prevails upon us to reveal the facts. In a recent Communications Engineering class, a sub-station telephone circuit was sketched on the board. Roy has shown, to his own satisfaction, that since a direct current flows in the primary winding of the transformer in the circuit, and since one terminal of the primary is connected to one terminal of the secondary, a direct current will flow in the secondary circuit of the unit. The committee on awards will make the presentation of one pint of transmitter oil to be used before and after calling a "date."

The inventive genius of Dan Jacovetta, senior mechanical, has won for him the admiration of his colleagues and the respect of every housewife. Dan, when asked, in a refrigeration class, the proper location of the condenser coils of a refrigeration system, shyly confessed that in his new design the coils would be contained within the cooling room. The ENGINEER is endeavoring to enlist the cooperation of the Federal Government in creating a new alphabetical project to assist this eminent scientist in his research. In the meantime, Dan may be found any evening in the cooling room of the Women's dormitory. For his contribution, one gallon of freeze-proof condenser oil will be delivered to him in the cooling room.

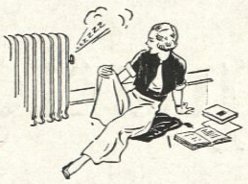
Our faith was not misplaced when in the spring quarter of last year, during the Engineer's Day exercises, the OIL CAN presentation was made from the stage of Macky auditorium before an august assembly of prominent engineers, faculty members, and students—to John Burky. The wisdom of our choice is evidenced by this most recent discovery by our learned brother oiler, wherein he shows a method of compensating for the impact of a dead load in steel structures. Though the final tests were performed in collaboration with Herbert Cox, senior architectural, by whom the details were divulged, John modestly admits that the original idea was his. Both of these worthy brothers in oildom will be furnished with a corrugated rubber oil dispenser with which to further their investigation if they will call at the office of the COLORADO ENGINEER.

G-E *Campus* News



TWO POLES IN ONE

Radio entertainment and "airmail" have been sent to the Antarctic through General Electric's short-wave station W2XAF, ever since Rear Admiral Byrd arrived there last year. Recently, in conjunction with a Byrd program, another was sent out to Rockwell Kent and his son in the Arctic region—thus linking simultaneously Americans who are, in the matter of latitude, farthest apart. Governor McNutt of Indiana and other prominent Hoosiers spoke to the Byrd Expedition from Indianapolis in a program sponsored by the *Indianapolis Star.* Immediately afterward, the Coffee House Club, an organization of artists and writers to which Rockwell Kent belongs, sent music and greetings from New York to him on the island of Ubekjent, just off the coast of Greenland, 600 miles within the Arctic circle. Features of this program were special greetings from Mrs. Kent and her daughter, and a talk in the Eskimo language by Vilhjalmar Steffanssen, Arctic explorer, for the benefit of the natives. Both programs were broadcast over a coast-to-coast NBC network as well as by short waves.



GOOD-BYE, SMOKESTACK

For many years, the old central heating plant at Mt. Holyoke College in Massachusetts, with its tall, unsightly smokestack, barred the way to certain necessary improvements and landscape developments on the campus. This summer the old boilers and the smokestack were torn down. In one of the buildings of the old plant stand 120 General Electric oil furnaces arranged in circular groups of five. Fifty-two more G-E oil furnaces are installed in the smaller or more isolated buildings of the campus, operating singly, in pairs, and, in one instance, in a battery of 10. In the central plant, only as many groups of furnaces will operate as are necessary to maintain the required steam pressure. The remainder will be shut down, avoiding stand-by losses. The individual furnaces and small groups in distant buildings permit the abandonment of some of the longer runs in the underground steam-distribution network. The high efficiency of the system is expected to produce savings which will pay for the installation in five to seven years. In addition, as a result of the more careful regulation of temperature, it is expected that health conditions at the college will be considerably improved.

The main plans for the system were drawn up by C. W. Colby, consulting engineer. D. W. McLenegan, Wisconsin, '21, assistant engineer of the Air Conditioning Department; W. O. Lum, and H. R. Crago, Penn State, '18, both of the same department, handled engineering details for General Electric.

FLYING POWER PLANT

Gold was discovered in 1925 along the Bulola River in New Guinea, an island just north of Australia. Prospectors worked the richer veins by hand methods, and packed their "take" on the backs of natives through 40 miles of cannibal-infested and nearly impassable jungles to Lae on the coast. After the best veins had been worked out, it became apparent that placer operations on a large scale would pay if the necessary dredges and other machinery could be brought to the location. Land transportation was impossible, so a plane was sent in. The pilot found a spot to land, and a flying field was cleared off.

Four 875-kv-a. General Electric waterwheel generators were among the equipment ordered. When they arrived at Lae, they were transferred to huge all-metal Junkers freight planes and flown to the location piece by piece. The largest single pieces had a net weight of 6545 pounds. As the load limit of the planes is 7000 pounds, it was a tight squeeze. D. B. Gearhart, Iowa State, '27, of International General Electric, Inc., handled the order for the Company.

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