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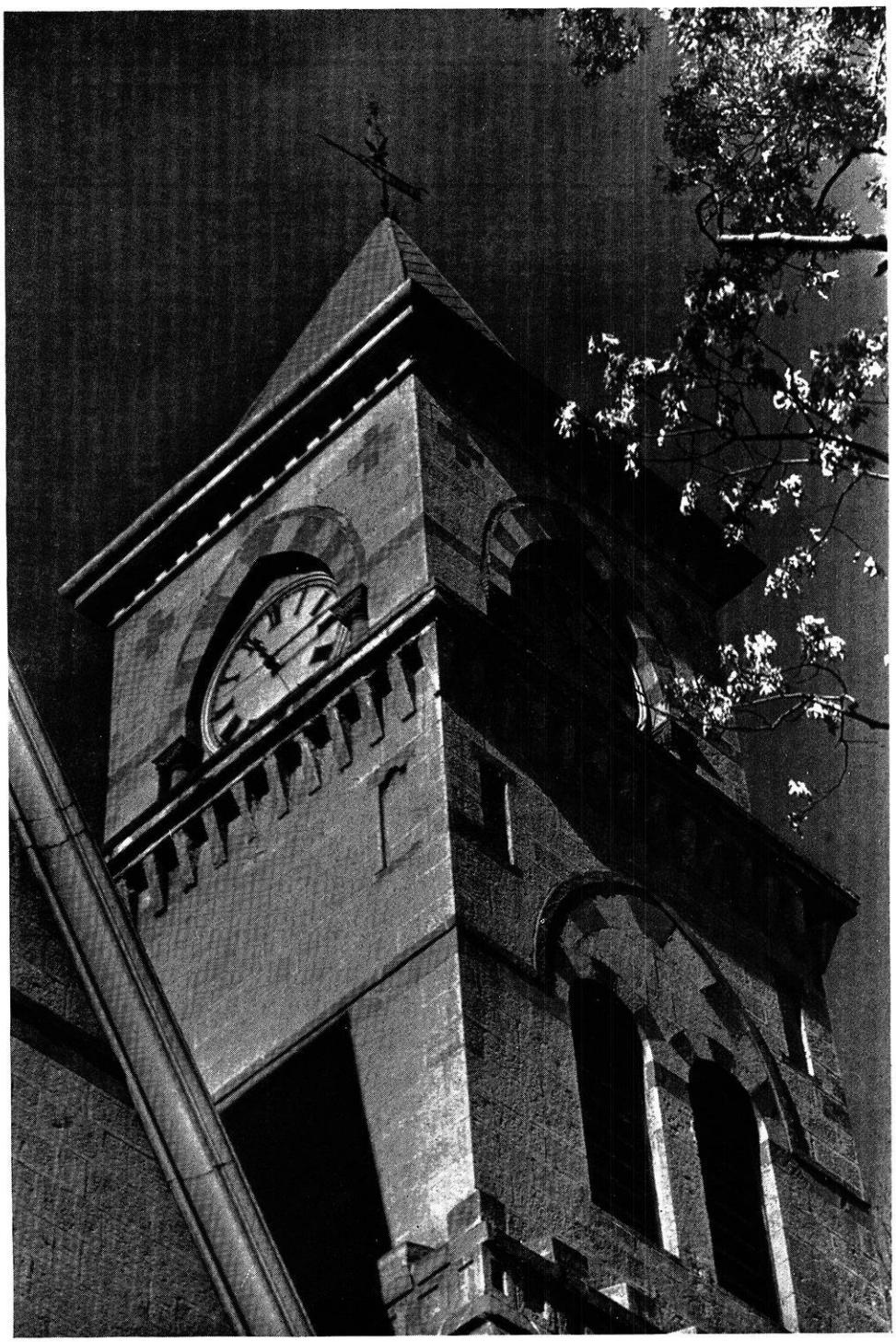
THE WISCONSIN ENGINEER



JANUARY 1938

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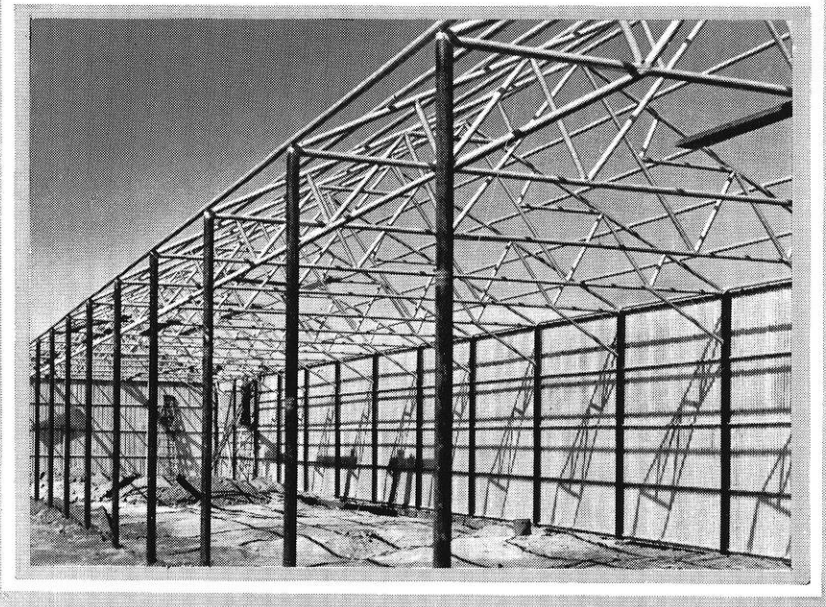
How WELDING *makes Frames Better*

This steel frame for a modern warehouse is better because all of its parts have been oxy-acetylene welded into a single jointless unit. It is light in weight, yet is strong, sturdy and rigid and can support heavier loads than could a frame of similar materials joined by any other method.

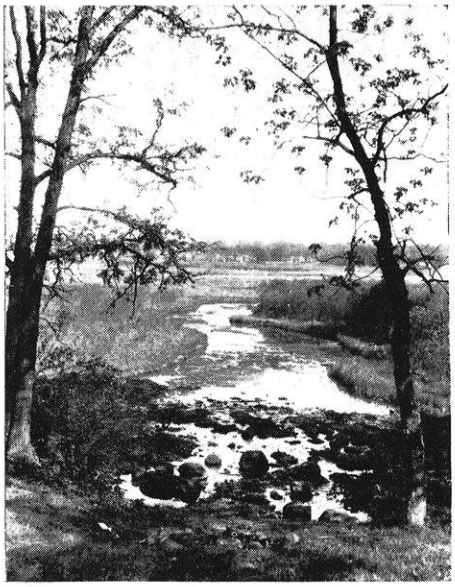
Frames for many things—from filing cabinets to railroad cars—can be joined by welding. When welded, their maintenance-free life is limited only by the design and materials used. These advantages of oxy-acetylene welding are obtainable at no additional cost or time for fabrication.

Several useful technical booklets describing the application of this modern metalworking process to a wide range of metals—steel and iron, aluminum, copper, brass and many other alloys and metals—are available, without obligation, from Linde offices in principal cities. Write to The Linde Air Products Company, Unit of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York, N. Y.



Everything for Oxy-Acetylene Welding and Cutting

LINDE OXYGEN • PREST-O-LITE ACETYLENE • OXWELD APPARATUS AND SUPPLIES FROM PRODUCTS OF UNITS OF UCC UNION CARBIDE AND CARBON CORPORATION LINDE UNION CARBIDE



Arboretum

With the Contributors . . .

- Those who remember November's article expressing the viewpoint of the "small company" personnel man will be especially interested in hearing the other side of the story as told by R. C. Muir, Wisconsin alumnus and G-E vice president. Page 63.
- The rejuvenated iron horse has attracted much newspaper comment lately. Mr. Yerges, staff member, relates on page 66 phases of this face-lifting process—the construction and installation of continuous rail track.
- Executive experience is an invaluable, if dearly bought, possession. When a man can condense all his effectively into a single typed page, as did the late John G. D. Mack, first Wisconsin state engineer, it compels our attention. See page 74.
- Those old standbys, Campus Notes on page 68 and Alumni Notes on page 72, are always worth a second glance.
- Several dormant campus organizations came suddenly to life this month for no apparent reason, held meetings, and in general earned themselves some space. Page 70.
- In spite of voluminous literature on the subject, one can find all the "dope" he would like when choosing his special field. A new and promising source in this field is reviewed on page 79.

MEMBER OF ENGINEERING COLLEGE MAGAZINES, ASSOCIATED

PROF. RICHARD W. BECKMAN, *National Chairman*
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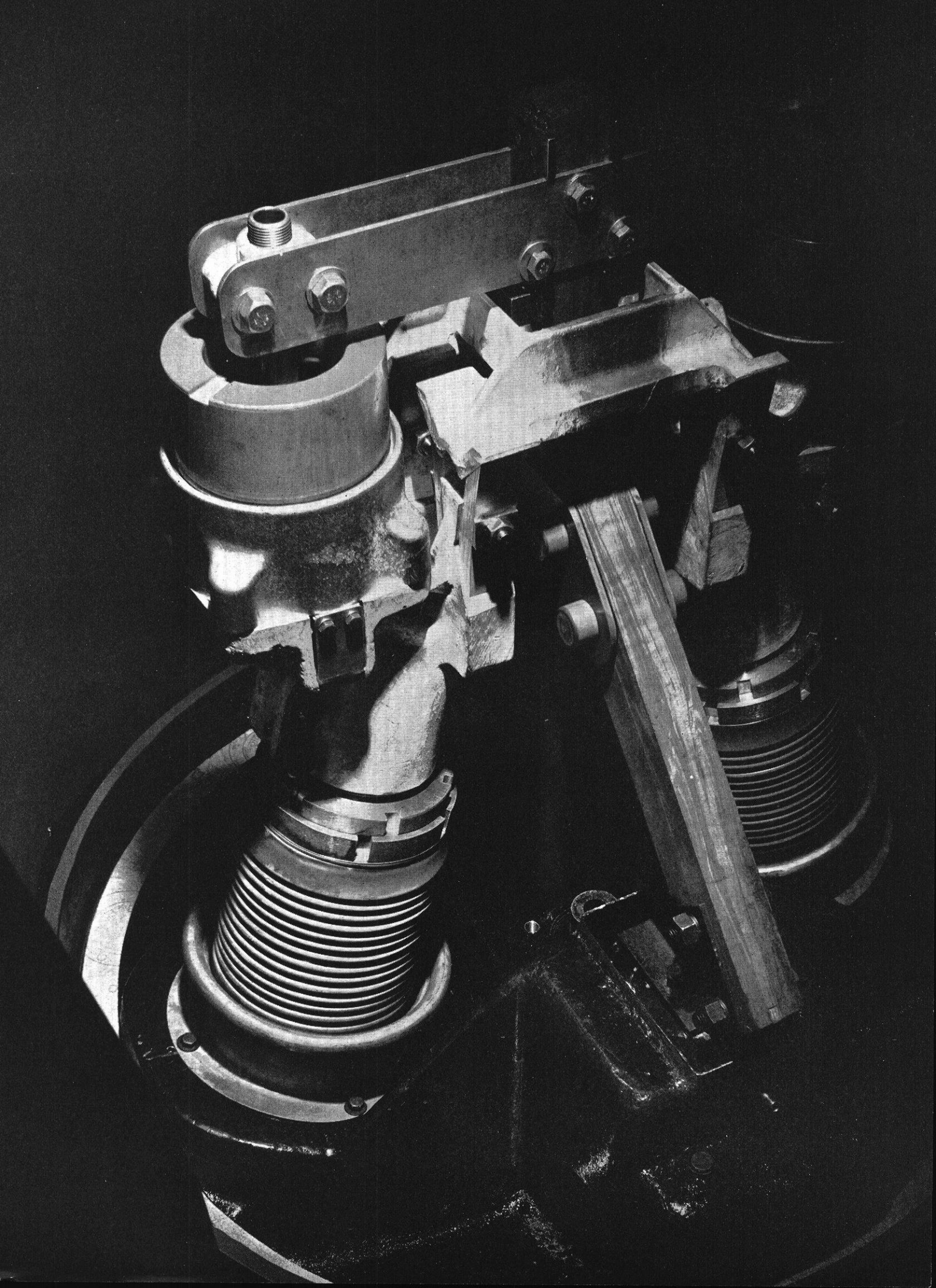


CONSIDER THE BIG COMPANY

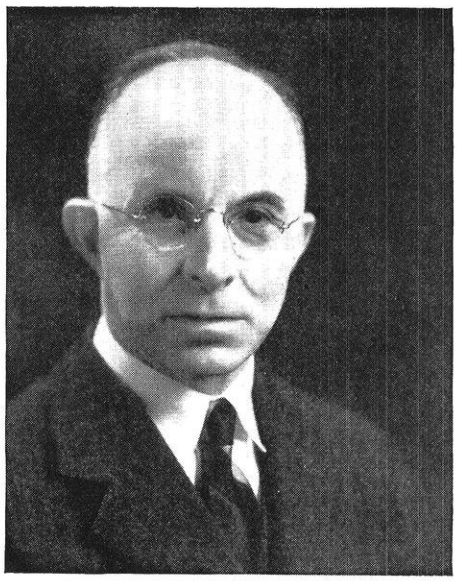
by **ROY C. MUIR, e'05**

Vice President in Charge of Engineering, General Electric Company

I HAVE been asked to present the case of the big company to the senior engineer. My credentials are: an alumnus of the University of Wisconsin who has spent his entire business life—32½ years to a day—with the General Electric Company. These have been happy and fascinating years—happy, because I have a host of friends and congenial associates and each year adds many more to this host—fascinating, because engineering has played the most important part in the rapid social and economic process over this period.

I have just reviewed a list of more than one hundred graduates of the University of Wisconsin who are a part of this big company, and among them I find one who has just been appointed Assistant to the President, a number of department heads, a nummer in responsible executive, administrative or managerial positions in engineering, research, sales, and manufacturing, and a number of promising young men who are starting out in the Test Course or getting under way in one of the many departments. I am proud of these fellow alumni and I feel they are proud of the company of which they are a part. I know not one of them who is smug or complacent, as each knows his advancement—in fact, his satisfaction and happiness—depends upon his continuing effort and contribution.

I wish to discuss the matter of finding and choosing a job most informally and without prejudice, and I hope the success and happy experiences of myself and associates in a big company will not unduly influence the graduating engineer in that direction. He soon must make what is probably the most important decision that he has yet been called upon to make, and he should take every opportunity to prepare himself to choose wisely.



Roy C. Muir

• *The graduating class of '05, College of Engineering, was much like any other class. On the day that the University of Wisconsin turned them out into the world, many people, including themselves, were wondering where each would be 30 years later. The records of some of them are lost, of others sketchy, of many dull. But the record of one among them, "Stuffy" Muir to his mates, tells as fine a success story as might be asked.*

• *Born at Arcadia, Wisconsin, in 1881, Roy C. Muir eventually entered the University of Wisconsin and graduated with his B.S. in E.E. in 1905. He began his career, as have so many others, on the G-E test floor, became interested in and soon graduated to turbine designing. Having proven himself, he joined the power and mining engineering department of the same organization, and from there stepped up to serve the International G-E Company as commercial engineer for three intensely interesting and busy years.*

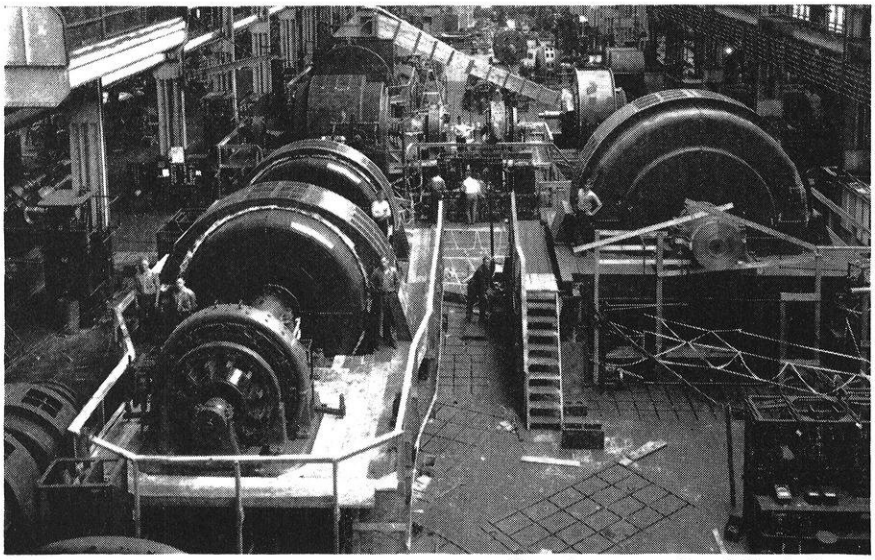
• *Promoted to Assistant Engineer of the G-E Industrial Engineering Department, he there spent eight years in application engineering work. Another step upward—in 1930, Mr. Muir was made General Assistant in charge of Administration for designing and engineering departments and the works laboratories. Then in 1934, General Electric made him Vice President in charge of Engineering.*

• *So we find him today in Schenectady, a gray-haired young man of 56, exceedingly earnest, outstandingly capable, popular, and considerate of his associates. Roy C. Muir is a living example of the human side of engineering. He is proud of Wisconsin, too, but not half as proud as we are of him.*

The classification "Big. vs. Little" is too broad to use as a basis for this decision. There are many types of big and little companies each offering different and varied opportunities. In the General Electric Company, which I assume throughout this article to be representative of large general manufacturing companies, there are many positions outside the strictly engineering field which are filled by technical graduates. Many of these men started out in engineering work and through their broad training and qualifications have continued to grow and have attained responsible positions in the management group. The title "Big vs. Little" implies a controversy which, in my opinion, does not exist. The outlet for the technical graduate must be expanded, and little companies and small business concerns, many outside the strictly engineering field, offer the technical graduate excellent opportunities which he is well qualified to accept.

It is more than likely that less than half the 1938 class will find places in the large organizations, and it is also probable that less than half would do their best in such organizations. The indications are that some men by their inherent and individual characteristics are suited for small companies and others for large companies, so that in either case, if the graduate tries to associate permanently in the wrong type of organization, he will not do his best or develop to the limit of his capabilities.

Many years ago, I recommended to Dean Turneaure that there be established in the University of Wisconsin a course which would enable the senior to learn more of industry so that he might better choose the kind of job that would match his abilities, aptitudes, and desires. The graduating engineer must satisfy himself: first, that he has the quali-



Illustrations courtesy General Electric Company

View of test floor showing 30,000 kv-a condenser (in rear) being tested by loading on 18,000 kv-a motor (at right) and 8,000 kv-a frequency converter set (at left).

fications demanded of the job he is considering, and second, that it offers him the opportunity for advancement commensurate with his ability, all to the end that he may live a wholesome, interesting, and useful life.

What are the qualifications demanded by the large company? Several years ago I answered this question to the **Wisconsin Engineer** as follows:

> "We look for those qualifications in an applicant which lead us to believe that he can 'accomplish things,' 'do a job,' and 'get results.' High scholastic standing and commendable campus activities are favorable evidence. We also depend upon the personal interview and the opinions of the professors to judge the applicant's more general qualifications such as character, power of self-expression, poise, personality, alertness of mind, industry, originality, and common sense.
>
> "We do not look for a high degree of specialization, we prefer a high degree of understanding of the fundamentals in engineering, supplemented by some economic, cultural and social education. The opportunities in our Company are so many and varied that we prefer the engineering graduate who is adaptable; we feel the high degree of specialization which is often necessary can be best acquired after he comes with us."

Above all, the young man entering a large corporation must be able to work effectively with others. He must do so with the expectation that he shall play an important part in a big undertaking, but that he will not acquire sudden fame or riches. He will make progress as the result of study and experience through which he will acquire the common sense, judgment, and intuition which most successful men must have. In the words of Mr. F. S. Terry, a former official of the General Electric Company, "We are making a journey—not running a race," and I am reminded of a statement made by my former Professor, Mr. Dougal C. Jackson, to the effect that he looked up his students twenty or more years after graduation to determine whether or not they had been successful. If the graduating engineer enters the large company with this philosophy, he shall find the opportunity he is looking for.

The change from academic to business life is abrupt at the best, but the big company has its training courses which are designed to continue the education and self-improvement of the young engineer and to allow him to develop more naturally and broadly. The training courses are planned so that the young man earns his way as he goes. He learns to develop confidence in himself and how to assume responsibility. He acquires friends who will carry through his entire business life and later will prove not only a great pleasure to him but will be a factor in his continuing success.

Two things are always necessary for success,—one is his qualifications, in other words, ability, personality, and character, and the other is the opportunity. A large company is made up of a large number of comparatively small organizations or divisions, each of which is essentially a business in itself and, therefore, offers opportunities, for example, in manufacturing, engineering or sales, any of which the engineering graduate is well qualified to fill. These various divisions are tied together through management and one of the principal responsibilities of management is to maintain close observations of the men composing each division. There must be a continual and close study of the individuals in order to approach the ideal of having, in all cases, the right man on the right job. There is always a dirth of really good, outstanding men, so that, if there is an outstanding man in any division where the opportunity for advancement does not exist, he is given an opportunity in some other division. His broad early training makes him adaptable, so that he is qualified for any of a number of positions. There seems to be an impression that the man entering a big company is lost sight of, the work is not arduous, in other words, it is a soft job, and the man will not develop as he would under more rigorous circumstances or treatment. My feeling is that we might as well say that our engineering schools do not help a man to become an engineer, as to say that the supplementary or business training in the large company does not help him to develop into a bigger man. As a matter of fact, competition in the large company is keen, the work is arduous, the individual is carefully watched and rated and is not lost sight of, but the philosophy is that through training and assistance and placing responsibility upon the man as rapidly as he can accept it he develops more rapidly and into the kind of man a large company must have if it is to be successful.

The training courses in the large company extend the period of germination, if you will, so that the engineer may come into full bloom more naturally. It provides a period where he may learn more about industry and its opportunities on the one hand, and his own abilities and aptitudes on the other hand. His foundation must be sub-

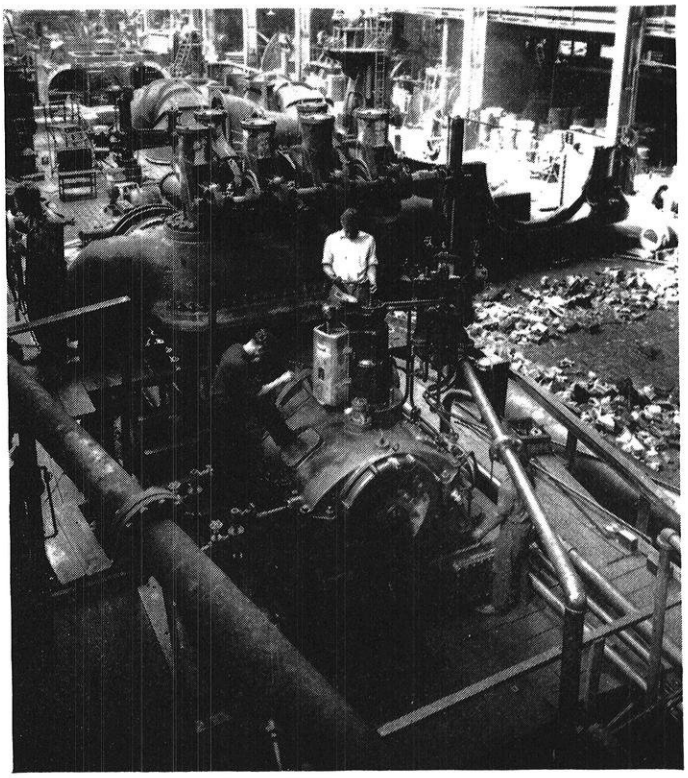
stantial and sound if he wishes to build a substantial career.

The company of which I am a part operates a test course which was initiated more than forty years ago as a matter of necessity to train experts to install electrical machinery. Since that time more than 15,000 technical graduates have passed through this course, and the engineering and sales organizations and the supervisors in the manufacturing organizations as it exists today are largely composed of graduates of this course. More than half of this 15,000 have found their way into the electric light and power industry, industrial concerns, large and small, and numerous other fields of activity. It is evident then, that the graduating engineer starting out in a big company must not necessarily stay with the big company, but he does obtain a training and experience which enables him to assume responsible positions in other large or small organizations.

There is quite a common feeling among seniors that they would prefer to be a big cog in a small wheel rather than a small cog in a big wheel, and many who join the big company do so to see how a large corporation does it, with the expectation of becoming affiliated with a smaller organization later.

A young man, and a very bright one who graduated from one of our well known technical schools three years ago, called upon me today and his story was something like this:

"I have a good position and can probably hold it for life, but several situations have developed which indicate to me that my older associates are not familiar with engineering developments of recent years. My younger associates, several of whom have been employed within the past three years, know of many of these new developments but not enough about them to have them introduced. I have the approval of my superior to a year's leave of absence provided I can spend that year with your company to acquire a broader experience in up-to-date equipment and engineering practices. I would like, therefore, to spend a year on your test course with this in view, and then I feel I can go back to my job and do very much better than I could do otherwise. I feel that, unless I do this, my progress will be very slow and my future will be quite limited."

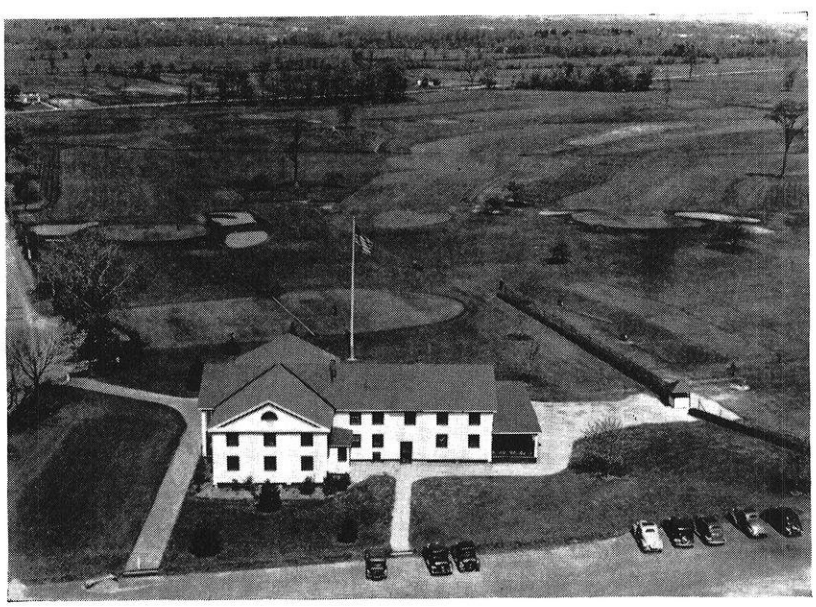


Student engineers testing large steam turbine.

We shall try to make arrangements whereby he can obtain this experience. I cite this incident—and we have many similar cases coming up throughout the year—as evidence that the engineering graduate who has outstanding qualifications and wishes to make the most of them requires a broader base than his college education upon which to build, and the large company can provide this broader base of experience through its training course.

The underlying philosophy of the test course when started was to place responsibility upon the young technical graduate for the testing of all of the product manufactured. This basic principle of training has not been changed although the variety and type of the product have greatly expanded and the facilities for testing are quite different and improved over those originally employed. The young man entering this course starts out by working with others under another graduate, probably of the same graduating class or the one preceding it. Within a short time he is given charge of the test of a certain machine and then others are working under him. He

(continued on page 78)



Locker house and part of golf course of Edison club.

Illustrations courtesy Sperry Products, Inc.

General view of the work on the Delaware & Hudson RR.

CONTINUOUS WELDED RAILS

by **LYLE F. YERGES, c'38**

IF YOU have ever traveled by rail, you are familiar with the steady click caused by the car-wheels passing over rail-joints. While this noise may be a boon to traveling insomniacs who count rail joints instead of sheep, it is a source of constant annoyance to maintenance engineers. However, another problem, more serious than noise, is the added wear and tear due to shock and vibration upon rolling stock.

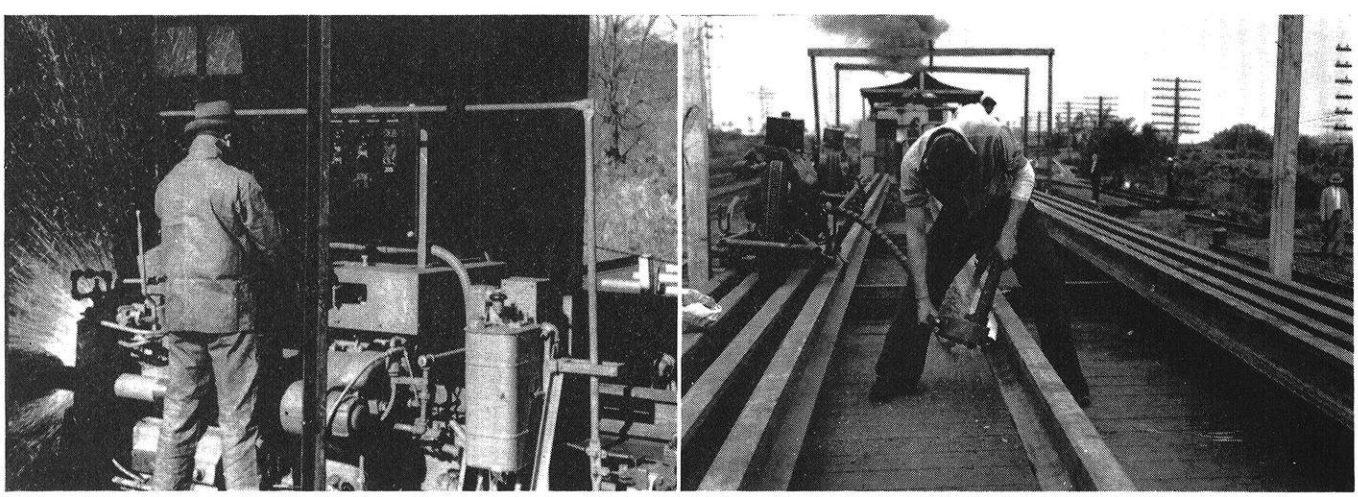
Welding rails together, although not entirely satisfactory at present, is probably the most successful way of eliminating this trouble. As early as 1933 the Delaware and Hudson Railroad laid a few miles of welded rail and found it quite satisfactory. There have been experiments for years in Europe with welded rail, Poland having used gas-welding of rails for a long time. The Berlin Rapid Transit Lines in Germany conducted a test from 1926 to 1929 on five miles of Thermit-welded track and found the track unsatisfactory because of "cupping" and breaks at welds due to wear and excessive tension resulting from extreme cold.

The Delaware and Hudson Railroad in 1937 laid 316,-800 linear feet of track in lengths of one mile or more. The method used in this work is representative of the method generally employed in the United States. A large amount of machinery and equipment is needed in this process, and most of the work is done by private companies such as Sperry.

The equipment for welding consists of a welding car with machinery, a generator car, a locomotive to supply steam for a generator turbine, a rail-rack car for lining up and preparing rails, five flat cars for stress-relieving equipment and joint grinders, and several cars to carry the finished rail.

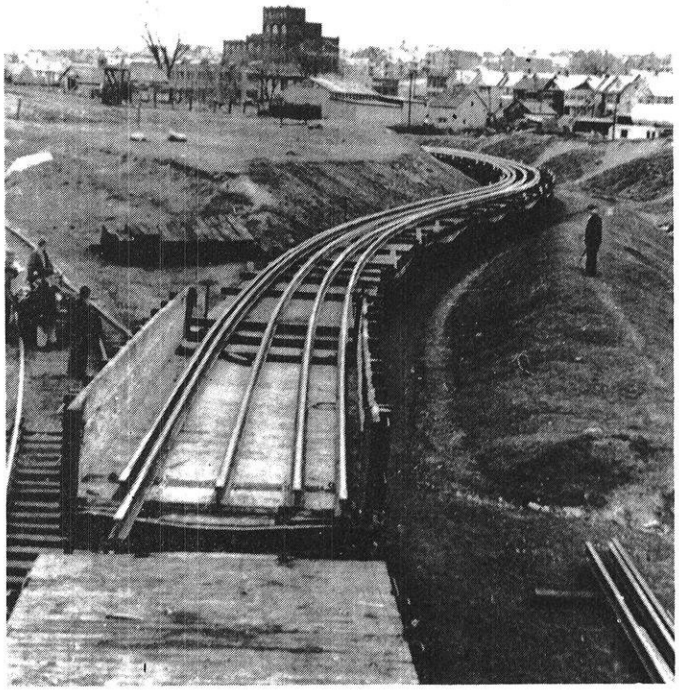
Heavy sections, usually 39 feet long, are loaded on the flat cars and clamped into the welding machine. Two sections are held with their ends close together, and the ends are pre-heated by intermittent short-circuiting of a heavy current through the rail ends. Oxides and impurities are burned off in this process.

In the next processes, called "flashing and pushing," the rails are put in contact until the ends become almost molten. Then they are squeezed together and allowed to cool.



Left: Inside the welder car. The flash that gives part of its name to the electric flash butt welding process. Right: Fillet grinder. (On third flat car). Upset metal at "fillet," immediately below rail head, and upset metal immediately above base is removed. This is done to eliminate possibility of a fatigue fracture developing at these points of compression and tension when rail is carrying load in track.

Result in Noiseless Track



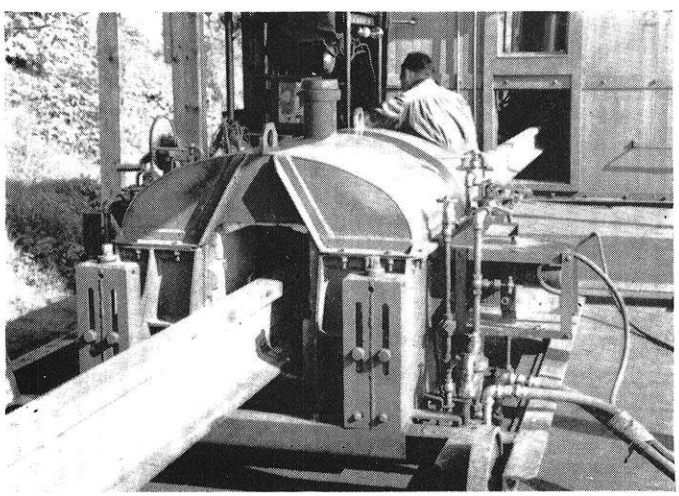
Rounding a 15-degree curve. Without being fastened down to the cars in any way, long rails conform exactly to track curvature during transportation and offer no difficulty in transport.

The welded section is then pulled back to the stress-relieving and joint-grinding cars where welds are heat treated and joints are ground smooth. A section of about 780 feet long is joined in this way, aligned, and pulled on the flat cars which carry the section to the place of use. A section of this length is flexible and readily conforms to the shape of the train which carries the rail, even when rounding sharp curves.

The section is unloaded by holding one end on the roadbed and running the train out from under the rail. After placement on the roadbed, the rails are fastened down and joined by Thermit welds into sections of more than 6,000 feet long between insulated joints. Such a Thermit weld requires the usual Thermit equipment and about three hours' time to complete as contrasted with the few minutes required for the electric welds. Consequently the Thermit welds must be made during hours of light traffic.

The result is a smooth, continuous ribbon of steel which gives a quiet, and unbelievably smooth ride.

The reader may wonder how expansion and contraction are taken care of in such a section. There is, of course, a tremendous expansion and contraction effect in such long sections, but steel can withstand this stress with ease. (A temperature change of 100 degrees F. from time of placement of rail would stress the rail to about 18,000 lbs. over the entire cross-section.). Since the distance between ties is small, there can be little buckling of rails due to column action, and the spikes can withstand the lateral stresses. Thus the problem of expansion and contraction is not serious.



Stress-relieving furnace. Weld is fed directly from welder to this furnace in which it is normalized by controlled cooling.

Although not a panacea, welding rails appears to be a practice that will be generally adopted by many roads in the future. Germany's experience with "cupping" and breaking has not been prevalent in the United States. Fatigue tests on the sections have failed to show any serious effects. At present the chief drawback to welded rails is the troublesome repair necessary if a rail should break. The ends at the break must be punched and splice bars bolted on until a permanent weld can be made. In spite of the expense of the process, it is said to be more economical than punching the rails, using splice bar connections, and welding on cables to carry current for signals. The reduction in wear and tear on rolling stock is believed to effect a saving which will more than pay for the actual process of welding.

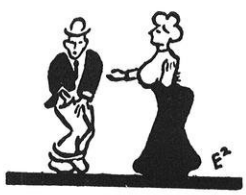
In the future we may expect to glide along a smooth rail without any annoying rumble or bumps. We will experience a ride so quiet that the traveling insomniac will have to go back to counting sheep while other passengers sleep in an atmosphere more quiet than their own homes.

ON THE CAMPUS

EXTRA!! RED WAGNER IN CAPTIVITY

On Tuesday, the seventh of December, 1937, Eldon C. Wagner, better known as "Red," was initiated into the ranks of married men. He is instructor in the T. E. department. The lucky lady was Rose Rundesill of Madison. She is a home ec grad, and has been teaching at Wisconsin Dells. She took her field work at the civils' camp last summer, where she was a dining room girl; so "Red" should have no trouble with "bride's biscuits."

After the wedding, "Red" was surprised no end to have his car blow up. The cause was one of those little starter bombs.



The couple spent the vacation at Knoxville, visiting grads who are working on TVA, including the groom's brother, who is also "Red" Wagner.

A humorous note was added at the wedding. Just when the organist had started playing "Lohengrin," and all the people were craning their necks to see the happy couple, in walked . . . "Whitey" Mortensen and Elizabeth Ebbott.

As an afterthought, and at the risk of being mistaken for Engin Ears, we wonder if "Red" proposed of his own accord, or if it was just that "The Bride Wore Red" out.

•

SHOP 7 CLASSES MAKE INSPECTION TRIP

On Wednesday, January 12, the Shop 7 classes made inspection trips through Gisholts and the Madison-Kipp Company. The purpose of the trip was to illustrate methods used in the field which the boys had previously studied in class.

PROFESSOR SHOREY ACTS AS CHAIRMAN

At the annual meeting of the Advisory Committee on Mine Safety, Prof. E. R. Shorey acted as chairman of the industrial committee, a post which he has held since the organization was started 15 years ago. Representatives are made up of members of the Federal Bureau of Mines, mine operators, and organized labor, who meet to revise the mine safety requirements in Wisconsin.

Mr. Shorey was also a member of the program committee of the American Mining Congress which met in Salt Lake City in September. At the present time he is working on the Advisory Committee of Mining Exhibits Incorporated of San Francisco. It is a non-profit organization for the planning and staging of the mineral industrial exhibits at the Golden Gate International Exhibit in 1939.

•

ARCHITECTURAL SHORT COURSE

Some very interesting lectures and discussions on the design and application of architectural concrete were held in the auditorium of the Engineering Building on the evenings of January 4, 5, and 6. They were jointly sponsored by the University and the Portland Cement Association. The subjects under discussion included such timely topics as: the design of forms; the use of reinforcing; curing and protection; and specifications. The classes were attended by both students and business men from in and around Madison.

•

ALUMNUS WRITES ARTICLE

John A. Oakey, c'29, M.S.'34, has recently had an article published in the Engineering News-Record. It is entitled "A New Stadia Technique," and appeared in the December 23 issue.

HERE AND THERE

Bob McNiesh, m'39, handed in a problem in steam and gas the other day that even had Prof. L. A. Wilson stumped. The best part of it was that he actually came out with the right answer, although the process leading up to the answer was a deep dark mystery until "Wottaman" Bill Bates started to show how it was done. As he explained it, he worked a calculation which caused Professor Wilson to exclaim, "You can't do that." There was dead silence for a split second, followed by a deep voice from the back of the room saying, "The Hell you can't!"

•

BEST CRACK OF THE MONTH

To Ed Davey (He's a lawyer, boys, go get him) goes the honor for the best crack of the month. During a recent cold snap the garage attendant told him the reason his car wouldn't start was because the water in the battery was frozen. Ed first looked dismayed and then indignant as he replied, "But they checked the radiator the other day and told me the water was good for 35 below." And so to a lawyer we gladly award this month's prize, five gallons of Prof. Ben Elliott's new fire-proof gasoline.

Incidentally, Ed also admitted that he didn't exactly know what the fan was for, either.

•

Incidentally, the junior class of engineers seem to be in for a bit of good stiff competition as far as grades are concerned. There are entirely too many intellectuals among the extension division transfers to suit them. We're beginning to wonder if anybody from the extension division ever gets less than a straight A average in anything.

T.E. DEPARTMENTAL NOTICE

If the poor misguided fellow who jimmied open one of the lockers and removed the telescope and vertical circle from a transit will come back and get the tripod and bubble tubes, he will find the whole much more useful, and the department will not be bothered with an unattached tripod on its hands.

This month's celluloid lamp chimney for the best crack goes to Professor Owen. He was explaining a boundary dispute in which the eaves of a house overhung the property line. The house belonged to Professor Page, of the law school. Professor Owen felt the need of a figure. So, in drawing the house, he drew it in the crescent-adorned form so well known to the boys who hail from the country.

•

An engraved l e m o n also this month to Professor Van Hagan. In rails class, he made the following statement, funny but all too true: "The principles of engineering," quoth he, "never change. Two times two is always four . . . except when you guys do it on a slide rule."

•

OWEN ATTENDS CONVENTION

For the past few days, Professor Owen has been attending a convention in Washington, D. C. He left the morning of January 3; and on Thursday, as secretary of the Engineering Society of Wisconsin, he was president at the conference of the Engineering Societies of America. On Friday and Saturday, he attended the meetings of the American Engineering Council.

•

MINERS TRAVEL

Athletes are m a d e, not born, seems to be the sentiment of the metallurgy inspection-trippers. The eleven boys and Prof. George Barker during their one day trip, on J a n u a r y 5, to the International Smelting and Refining Company (East Chicago, Indiana) had to take a "waistline-trimming" to make all their train connections of the day.

At 5:45 a. m., several of them staggered breathlessly onto the platform of the Chicago-bound train. In Chicago, during their race from the Union Depot to the Illinois Central station, Professor Barker showed his "eleven" how to make yardage without knocking d o w n poor old ladies. In East Chicago, unable to make it to the train stop, they blocked the track and flagged the train to a halt.

The International Smelting and Refining Company, infected with the "Recession-bug," offered interesting sights, but also a shivering atmosphere to the spectators, for many of the furnaces were shut down. The plant uses the Parks process for the desilverization of lead. It also has an electrolytic white lead process in operation.

About mid-afternoon, after the boys appeased their starvation with a fine five-course Italian dinner, they were revived in spirit and rollicked childishly through the Hyde Park district on their way to the Museum of Science and Industry.

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PHI KAPPA PHI

The engineering school was again well represented when twelve of the fifty-seven initiates to Phi Kappa Phi were engineers. The initiation was held in the Memorial Union on January 19, with Prof. Farrington Daniels of the chemistry department as the guest speaker.

Election to Phi Kappa Phi is based upon high scholarship combined with participation in worthwhile campus activities and is open to seniors of all departments of the university.

The twelve outstanding engineers whose names are well known to most of us are:

Mechanicals — Willard G. Hanson, Karl E. Sager, Robert A. Sharp, Roger U. Stanley, and Henry K. Voigt; Electricals—Robert Berg, and Paul M. Ketchum; Civils—Lewis E. Sheerar, Lyle F. Yerges, and Robert F. Zwettler; Chemicals—Francis E. Fontaine, and Leo Herning.

CAN'T TAKE IT

Pat Hyland has repeated his feelings regarding foul smelling pipes so often to his classes that they are beginning to get just a wee bit weary of it all. Particularly when they are wondering just how he manages to escape asphyxiation every morning from the blue haze created by his not-too-sweet-smelling cigar. Maybe he does it in self-defense, because he knows that only a very few of the more hardy engineers will venture into his office when it is in a state very similar to a London fog.

When Pi Tau Sigma had its picture taken for the Badger, Dale Greenwald, that diminutive junior mechanical from Chippewa Falls, didn't exactly fit. It seems he was too short, or something, but the photographer fixed that in a hurry. He simply gave Dale a two inch block to stand on. Sounds as if Dale wasn't the only short boy in school after all.

And then there was the dorm boy who came home pretty well inebriated (engineers get inebriated, but lawyers get drunk) one night and was having quite a time getting his key in the lock. When John, the night watchman, showed up and asked him if he was having trouble holding the key steady, the inebriate replied, "H—— no. I can hold the key all right, you just hold the building still."

John Huppler is n u r s i n g a healthy grudge against Nathan Itzkowitz. At the last A. S. C. E. meeting, refreshments consisted of cider and doughnuts. When the boys had finished guzzling, there remained one bottle half full of cider. Quite naturally, a lively verbal battle ensued, in which Nate finally subdued Hupp, and took home the highly prized beverage. John is not only mad, but dry as well.

WITH THE SOCIETIES

A. S. C. E.

The American Society of Civil Engineers was confronted at the start of the year with the necessity of an election. Kwasniewski, who was chosen last spring to be this year's president, suffered a stroke at the Devil's Lake summer camp, and did not enter school this year. The members chose John Huppler to succeed him as president. The first meeting was enlivened with an interesting talk by Professor Koehler of the Forest Products Lab on the work he did in the Lindbergh kidnapping case.

At the second meeting, the guest speaker was Professor Gillin of the Sociology department and the State Pardon Board. His talk was on the methods of dealing with criminals.

The society's activities for the first semester closed with a meeting shortly before Christmas when Prof. Ray Owen presented a series of movies. The movies included pictures of the T.E. skating party and the Civils' summer camp at Devil's Lake.

A. I. Ch. E. MEETING

Prof. Max Otto of the philosophy department was the main speaker at the January 5th meeting of the A. I. Ch. E. in the Old Madison room of Memorial Union.

Professor Otto presented an entertaining, yet instructive, speech in which he cautioned engineers not to let themselves become too rigid in their thinking, but be open to new ideas and thoughts. Three main approaches of philosophy were presented.

POLYGON

At the meeting of Polygon, January 11, the following new officers and committee chairmen were elcted:

President, Edward E. Bauer; program chairman, John E. Heuser; secretary, William F. Hafstrum; treasurer, Arnold W. Voss; publicity, Charles W. Schmidt.

The first type was the type in which the characteristics of a man could be determined by his features. This, in turn, gave way to the so-called behavior type of philosophy in which the brain and nerve processes were the only things which controlled behavior. The last and newest type is that man is regarded in respect to his surroundings and the effect of environment on human behavior. Human nature is made what it is through the outside factors, not through some inherent force, Professor Otto stated.

While coffee and sandwiches were served, Mr. Otto was besieged by those anxious to argue or ask further questions about the speech. One of the largest crowds to attend an A. I. Ch. E. meeting in recent years was present, denoting a revival of interest in the affairs of the student chapter.

MINING CLUB

"Steel-making is an art . . . not a science," stated Dr. Shapiro, head of the Process Control department of the Carnegie Illinois Steel Corporation, in his address to the Mining Club at its last monthly meeting.

A great many of the steel industry's stickler problems are not licked by the direct application of scientific principles, he explained. The best methods of solving production problems are based on the application of experience or on the extended use of statistical data, which when plotted, gives empirical curves that suggest solutions to such problems.

"Statistical analysis is becoming so important in industry that all engineering schools should teach statistics as applied to engineering problems," he asserted.

Dr. Shapiro in conclusion stated that advancement is not forthcoming to those young graduate engineers who are angling for "that easy 'white-collar' job" in the metallurgical laboratory or any other soft job, but to those who are one hundred per cent interested in their work and do not mind the heat, grime, irregular hours, and hard work in production.

After the address the dish-washing party was organized to "sluice out" the dishes left from the supper, which was served before the meeting.

A. I. E. E.

The last A. I. E. E. meeting was held December 7. Reports of the A. I. E. E. convention in Milwaukee last June were given by Chairman August Ferber. Professor Tracy spoke briefly on why junior A. I. E. E. members should join the enrolled student branch. Mr. Theron Brown, superintendent of Distribution of the Madison Gas and Electric Company, gave an illustrated lecture on the development of power distribution in Madison. The meeting was ended with refreshments of cider and doughnuts.

STUDENT BRANCH OF THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS

The aim of the student branch of the American Society of Mechanical Engineers is to develop among students in the department of Mechanical Engineering a knowledge of some of the outstanding industries and utilities.

"We realize," stated William A. Mitchell, president, "that it is impossible to give every man an insight into the particular field in which he will be engaged after graduation. We do, however, bring to our group a source of knowledge not to be found in the regular curriculum, provide them with the opportunity to meet and talk to outstanding men in representative industries and utilities, and thus engender an understanding of business and manufacture which would otherwise be gained only after the student has finished his schooling.

"Our last meeting, for example, was typical of the thing we are trying to do. This particular meeting was addressed by Mr. A. T. Lillegren, sales manager of the Madison-Kipp Corporation, the world's largest producers of die-castings and die-casting machinery. Mr. Lillegren brought with him five other men who were the heads of their respective departments to assist in the discussion following his talk. These five men represented the shop itself, production, development and research. With the aid of a display of some 200 castings, they presented the problems, the past, and the future of the die-casting industry.

"Our program for this year is not a pretentious one, but is exceedingly interesting. One of the programs being planned at the present time by Allen Jorgensen, our program director, will consist of a talk followed by a round table discussion with several members of the personnel of the United Air Lines. While all the details are not yet available, the meeting will be educational and enjoyable to all who attend."

The meetings of the A. S. M. E. are held at the Memorial Union on the second Thursday of each month —the time, 7:30.

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CHI EPSILON

At its regular monthly meeting, January 13, Chi Epsilon elected the following new officers for the next semester:

Joe Maldari, president; Arnold Voss, vice president; John Huppler, secretary; Glen Krejcik, associate Editor of Transit; Glen Thompson, treasurer.

These men, selected from the ranks of the new initiates, will replace the retiring officers, Lyle Yerges, president; Robert Zwettler, vice president; and Herbert Johnson, treasurer.

During the coming semester, Chi Epsilon expects to have several meetings. Election of members will be held soon after the beginning of the second semester.

ALUMNI NOTES

Mechanicals

ZIMMERMAN, O. B., '96, M.S.'00, the past year has acted as a special representative of the Society of Automotive Engineers, with the objective of developing production engineering activity. This resulted in an exceptional interest at the national meeting at Flint, Michigan, in December.

COWIE, ALEX, '31, resigned from his position as test engineer with the Honeywell Company of Minneapolis to teach mechanism at the Armour Institute of Technology in Chicago beginning February 1.

WAGGERHAUSER, HERMAN H., '33, who is assistant manager of production in the German factory branch of the Eastman Kodak Company, visited the mechanical engineering department during the holidays.

THOMAS, JOHN P., '36, left the Elmendorf Corporation, Chicago, to train for the position of sales engineer with the Shell Oil Company.

ANDERSON, EDWARD, '37, is in the Shell Chemical Research Laboratory at Wood River, Illinois.

LEY, RALPH M., '34, recently returned from the East Texas oil field of the Shell Oil Company, and is now located in the lubricating department of the North Central Division office in Des Moines, Iowa.

PAULSEN, MILTON, '34, left the Shell Oil Company to teach mechanical engineering at Rensselaer Polytechnic Institute, Troy, New York.

BUXTON, BREWSTER, '36, as meteorologist for Pan-American Airways at Auckland, New Zealand, did the weather forecasting for Captain E. C. Musick during the latter's recent flight from New Zealand to Samoa.

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Chemicals

BENNETT, MARTIN T., '25, on January 3 accepted the position of principal valuation engineer of the public service commission of New York with offices in the State Office Building, Albany, New York. For the past 11 years Mr. Bennett has been employed by the Wisconsin Public Service Commission.

DAMAN, GLEN, '26, teaches general chemistry at Michigan College of Mining and Technology, Houghton, Michigan. He is also continuing his research in physical chemistry and chemical engineering problems.

VOIGTMAN, EDWARD, '30, is in charge of research work in the Neenah plant of the Kimberly-Clark Company.

KOCH, PHILIP, '35, was married to Gertrude Gant '43 on October 9. Philip works at Nine Springs Sewage Treatment Plant as chemist and bacteriologist.

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Electricals

LILJA, EDGAR D., '24, who is employed by the Barber-Coleman Company of Rockford, Illinois, has taken out a patent on an automatic garage door opener.

LEHRKIND, AGUSTUS, '36, is in the acoustic division of the Burgess Battery Company in Chicago in charge of designing and drafting "multivent" ventilating ceilings for railway cars, etc.

Philip D. Reed

REED, PHILIP D., '21, was made assistant to the president of the General Electric Company on December 16. After graduating from Wisconsin, Mr. Reed received a bachelor of laws degree from Fordham University in 1924, and was employed as a patent attorney by several well known firms. In 1926 he entered the employ of the General Electric Company and has served in the law department, and as counsel in the lamp department.

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Civils

ADAMS, WALTER K., '03, is senior foreman, National Park Service at McGregor, Texas. For three years he was chief engineer of a banana plantation on the Pacific coast, north of Manzanillo. Previous to that he was engaged in road construction north of San Antonio.

TRESTER, A. M., '06, is field engineer, Madison Metropolitan Sewerage district.

MIELENZ, HAROLD F., '17, is engineer with the Koehring Company at Milwaukee.

LIVINGSTON, PENN P., '22 is with the U. S. Geological Survey at Big Springs, Texas.

WALDEN, DONALD O., '23, is chief engineer for the Hidalgo County Water Improvement District No. 2, San Juan, Texas. During the past two years he designed and constructed one and three-quarter million dollars of concrete canal lining and pipe line.

FIDDLE, GEORGE F., '27, is city manager of Muskegon Heights, Michigan, and also has a municipal consulting practice. He is contractor engineer on bridge and sewage plant construction.

PEPPARD, THOMAS D., '29, was married on September 25 to Miss Grace E. Phelan of Chicago. At present, Thomas is associate highway engineer.

HOVEY, WILLIAM, '32, is visiting in Madison after returning from Venezuela, where he was employed as a civil engineer by the Gulf Oil Company. He will return to Venezuela soon, but with the Standard Oil Company.

METZ, ROMAN, '33, has accepted the position of sales engineer for the Kohler Company.

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Miners and Metallurgists

SCHMEDEMAN, CARL, '30, has returned to South America as geologist for Cerro de Pasco Copper Corporation at Marococha, Peru.

TIEMANN, THEODORE, '30, Ph.D. '34, is assistant petrographer for Universal Cement Company, 208 S. LaSalle Street, Chicago.

KLOPF, ARTHUR, '34, has resigned as instructor in the Marquette University School of Engineering to become assistant to the president of Ross-Meehan Foundries at Chattanooga, Tennessee.

GALLISTEL, A. T., '35, M.S.'36, whose engagement and approaching marriage has been announced recently in the Madison newspapers, is employed in the technical division of Leeds, Northrup Company at Philadelphia.

OKERHAUSER, THOMAS E., '36, who has been with the Shell Petroleum Corporation at McPherson, Kansas, has been transferred to the Tulsa office of the same corporation.

"Can it be done?"

...here is the *Western Electric* answer!

Several years ago the question was raised: "Has the limit been reached in the speed of drawing copper wire?"

Western Electric engineers, assigned to find the answer, developed new methods and machines that did it three times faster. With further study, they surpassed even this record—twelve times the original speed! And the product is *lower in cost, higher in quality!*

Aiming always for this goal—better and more economical equipment for the Bell System—Western Electric engineers continue to develop the art of manufacture.

Manufacturing Plants at Chicago, Ill., Kearny, N. J., and Baltimore, Md.

Fundamental Rules For An Executive

by One . . .

JOHN G. D. MACK

1. *Never do anything which it is possible for a subordinate to do unless the element of personal danger enters. Your chief business is supervision, readiness to serve, to make policies, and to meet ever rising emergencies.*

2. *In everything which does not seriously interfere with you or your trust, give others their own way as far as possible. Wrangling over petty details of no consequence as to how they are solved blocks progress and may wreck the enterprise.*

3. *Give all credit to subordinates for if you like credit, more than sufficient for your needs will reflect on you. It is a far more commendable task to select or train an efficient employee than to do the work yourself.*

4. *Do not fear a subordinate who is a better man than you are but endeavor to equip your department with such men and take a just pride in the fact.*

5. *All essays on loyalty deal with loyalty of subordinate to superior. Be loyal to your subordinates and they will be loyal to you.*

6. *Encourage criticisms or suggestions for betterment from all sources and receive them kindly although you may be able to apply but few of them.*

7. *Be considerate of others' opinions even though you may know them to be wrong.*

8. *Give undivided attention to the matter in hand and never show evidence of being in a "hurry," for that trait is like a slipping clutch. A tiresome interview can be happily terminated at any time.*

9. *Express appreciation for service well performed, even though the employee be paid for that service.*

10. *If a verbal order which you give goes wrong, absorb the blame and forget it.*

11. *Be brief, but tell all the leading facts or none.*

12. *Never use "to speak frankly" or similar phrases, for the other person will immediately and possibly with justice jump to the conclusion that your statements lacking this qualification are full of dissimilation.*

13. *Always be polite in word and action. Politeness is an impenetrable armor.*

14. *Never scold nor show anger. If you scold you are a joke as your back is turned and if you show anger it is a break in your armor which places you at the mercy of a skilled antagonist.*

15. *Never make a show of authority until all else has failed, but in this almost impossible emergency use your authority to the limit.*

16. *Have endless patience.*

The rules for an executive, presented herewith, were prepared by John G. D. Mack, state engineer of Wisconsin, shortly before his death in 1924. They have recently come to our attention and seem so valuable that we are laying them before our readers. These are the rules that guided a man who was recognized as an unusually successful executive. He was the first state engineer in Wisconsin and took the position in the critical formative period. His success was hard-won but complete. These rules may be accepted as the opinions of a man who knew what he was talking about, who practiced what he preached, and who was successful in his practice.

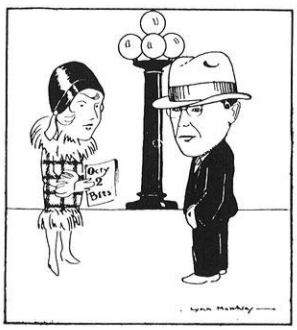
To old-timers, Professor Mack needs no introduction, but for the benefit of the present generation, we would state that he was part and parcel of this college. He was a member of the faculty from 1893 to 1915, when he was appointed state engineer. He was made professor of machine design in 1903 and headed that department for a dozen years. He was not a man to confine himself to a department, however; he made his presence and influence felt throughout the college in many ways. **The Wisconsin Engineer** was one of those ways; he encouraged the students who established the magazine and supported it by his courage and his personal assistance during the difficult period of getting started. **The Engineer**, therefore, takes pleasure in recalling his memory and takes satisfaction in being able once more to print a story by "Johnny Mack."

"STATIC"

by **ENGIN EARS**

Sarcasm?

We have an idea we're being heckled. We have a basket in the Engineer office—so far as we know, very few people know of the existence of this basket — whose sole purpose in this complex world is to receive contributions for this page. A few days ago we found therein a copy of Octy, placed there by some guy who either has a sense of humor or hasn't.



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Overheard in physics lab: "And the barometer . . . how much is it, Abie?"

"Oi, it's a bargain . . . only 29.98."

•

Contribution

Heard in Econ 101: Instructor—"From now on we will have no more problems assigned. The course will consist entirely of bull from me and answers, of a slightly different nature, from you."

•

"The sultan's son is apt to be a bit wild."

"Harum scarum, eh?"

"No, he's used to them."

•

Speaking of pin-hangings, which we weren't and won't, Wayne Mitchell, in true engineer fashion, hung a monkey-wrench on his girl.

The Engineer staff got all excited the other day when, in answer to one of a batch of circulation letters, the mailman brought a big impressive-looking 9 by 12 envelope with 9 cents postage from an important firm of Chicago corporation lawyers. Inside was a neatly-folded sheet of **Wisconsin Engineer** stationery, all clean and blank, with the accompanying letter: "This is what I found in the mail today. I wonder if I missed something of importance."

Philosophy, or Why Boys Take Engineering

"A piano becomes a great pianist when it finds Paderewski and teaches him how to play."—**Max Otto**

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"Yessir," philosophizes Rucks, "you certainly meet a lot of people on these no-cut days."

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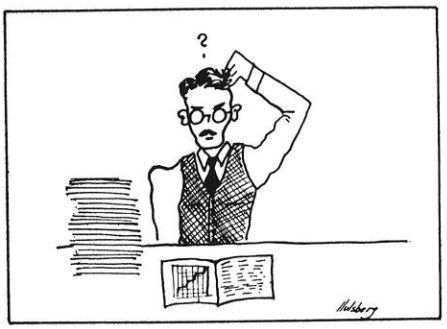
Definitions:

Research: A blind man in a dark room looking for a black cat that isn't there.

Calculus: That branch of mathematics that makes Ag students out of many budding engineers.

Electron: A dot of electricity that speeds very fast backwards from the direction that electricity really goes, and loses its sense of direction and gets turned around where the magnetic field is fluxing.

Those who know, say that EE 116 is a bum course because it deals with transients.



And the mention of EE 116 brings up the suggestion that Professor Koehler figure out a way to adapt oscillograph technique to the measurement of the duration of New Year's resolutions.

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"A skunk sat on a stump. The skunk thunk the stump stunk and the stump thunk the skunk stunk."

—**Montana Engineer.**

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Business Manager Yerges says that 4 out of 5 girls are beautiful and the fifth one comes to Wisconsin.

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In the library catalogue are just fourteen references under the title "Motors," and, of these, all but one are in a foreign language.

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All right, did you ever try to fill up 72 square inches of humor in small type?

Consider The Big Company . .

(*continued from page 65*)

is transferred from the test of one type of apparatus to the test of another type of apparatus where he goes through the same procedure, and during the year he will go through several of these testing departments. Throughout the year he is developing a confidence in himself to do things and the ability to work with others and to assume responsibility, aside from a knowledge of the product and its manufacture and of how a manufacturing organization is run. This is supplemented by classroom work where he obtains a knowledge of the complete organization and its operations, as well as something of the engineering and business problems confronting the organization.

The elaborate detail of this program has been developed to take care of our future. All positions now filled by successful and mature technical graduates will some day be filled by the younger generation who have recently entered the engineering, sales or other fields, who are now in the test, or who are still in college.

We feel that a man to know men must learn to play with others, as well as to work with others, in fact, that this is also an important part of his development; therefore, recreational facilities are provided for this purpose. At its main plant the General Electric Company maintains the Edison Club which includes among its many activities golf, tennis, and other country club facilities. For the young college graduate employees, those on training courses are admitted to the Edison Club at greatly reduced dues, so that these recreational activities are available to the student at a cost well within his means. Similar club facilities are available at the other works of the company. Membership is not compulsory but it is encouraged. This feature of the training program may lead one to believe that the work in a large corporation it not too arduous, but our philosophy is that it is a necessary part of the normal broad development of the individual. One can do his most effective work in congenial surroundings and when he is happy.

In concluding these comments, I wish to emphasize that the big company offers to the senior an excellent opportunity to continue his development and to broaden his experience. The training period extends the time when he must make a decision as to the specific line of endeavor which he will undertake and places him in a position so that he can better choose the work for which his abilities and aptitudes are best fitted whether it be inside or outside the big company in which he obtains this training.

If the senior is desirous of entering a large corporation, he should start there, as most large corporations have found it advantageous to develop their own personnel. Starting with the large company does not preclude the possibility of joining the small company later, but the probability is that the graduating engineer starting with a small company will not find his way into the large corporation.

The opportunities in the big company are many and varied, and the training is broad enough so that he may be placed where the opportunities at the moment exist. Competition within the company is keen and a man advances upon his record of accomplishment. The problem of "pull" or "family" is not encountered. The big company is looking for men well grounded in the fundamentals of engineering and with other desirable personal qualifications which lead to success, above all, he must be able to work effectively with others.

The senior who has the qualifications and is desirous of making a journey—not running a race—will find that the big company offers him opportunities for advancement commensurate with his abilities.

The Power Of The Sun

Bridgemen working on the new San Francisco Bay bridge were faced with an unexpected situation when the rising sun drew the tops of the bridge towers almost two inches east each morning. As the sun moved in its course, the towers reeled with it. Only two inches, but if you were trying to hammer the head of a four-inch rivet flush and there were two inches between your beam and your tower, you would have to do something. On the Bay bridge they had to wait until nightfall, after the sun had quit having fun with the bridge, to fit some of the crossbeams.

—Frank J. Taylor in *Collier's*

Technological Trends

IF YOU plan to become an expert in air conditioning, a research chemist, an engineer in an agricultural machinery concern, or to enter any of the other fields that an engineering education prepares one for, the publication, "Technological Trends and National Policy" will be of interest to you. It presents a survey of many fields of technology and applied science covering the social aspects of inventions, the relation of science to technology, and a detailed discussion of many industries.

Inventions are discussed in the beginning of the book. The prediction of new inventions, the huge fatality rate, their social aspects, and the resistance encountered in the adoption of something new are all elaborated on. Since the book is a compiling of the works of many experts, each in his own field, its presents very accurate information of inventions and industries.

This report is of particular value to the student who is undecided as to which field of industry he wishes to enter, or to the senior who has already made up his mind, but wishes more information of his chosen field. It contains an analysis of practically every large industry both with respect to its past and to the future. For example, the future trends in automobiles, the possibility of a demand for more automobiles than we are using, and the effects the invention of the automobile have produced on society as a whole are discussed thoroughly. In a similar manner, the past, present, and future of the steel industries and others are described.

In the pages of "Technological Trends and National Policy" you may find much that will change or modify the opinions you have of some line of endeavor. That is, such questions as: is this industry a growing one, is it one that supplies a genuine demand, or is it one that will pass out of existence soon, are answered by men who have worked for years in these industries and know the answers to these questions as well as anyone reasonably can.

Copies of the report may be had by writing to your congressman or sending one dollar to the Superintendent of Documents, Washington, D. C.

EDITORIALS

"For God so loved the world that He gave His only begotten Son that whosoever believeth in Him should not perish but have everlasting life." —JOHN 3:16

A CORNERSTONE LAID

The President's recent message to Congress caused, as usual, considerable journalistic stir. The professional "interpreters," always eager to guide the apparently slow-witted man-on-the-street, turned the spotlight upon the government's attitude toward "big business." But we were impressed most by one simple statement which, though sharply defined in the radio broadcast, was utterly lost in the long columns of newsprint.

The point made was that the time is now past when any man has the right to use or misuse land or resources, under whatever ownership claims, without regard for the effect of his actions upon his neighbors, present or future. It is these farm lands, forest, fisheries, oil, and ore that constitute the nation's wealth—today's wealth and tomorrow's wealth. To squander such wealth, even under the guise of traditional American individualism, is criminal. With the lesson of the "dust bowls," of ever increasing floods, played-out land, and gutted mines before us, the nation is at last becoming officially aware that the use of the country's natural resources, by whomever owned, is of national, not private, concern.

Whether the present administration's policy of farm production subsidies and governmental supervision of forests and oil is the answer to this is not our present concern. But open public recognition of the long range cooperative conservation principle will start us toward the ultimate solution of the problem. Once again the economics of the engineer is being brought to bear for the benefit of the nation.

MAKE TIME

The story is told of the man whose house was burning down: In his anxiety to get water on the fire, he rushed to the well, pumped a few quarts of water into his pail, dashed around the house to the portion that was afire, and handed the practically empty pail to his neighbor to throw on the flames. The neighbor took one look at the pail and told him to go back to the pump and fill it up. The man, overcome by the fear of losing his home and generally demoralized by the blaze, retorted: "I haven't got time."

Isn't this true of college students in general. We are all trying to do so many things at the same time that we have little time for that most important part of our college course, the school work itself. Or we are inclined to dash from one subject to the other in the course of an evening spent with our books, just getting a smattering of each assignment and not actually learning any one lesson well. That is, we fail to apply our time in the right manner, we fail to put it in the places where it will produce the greatest returns.

Since this is the season of the year for making resolutions, and it is also the season of the year for those much dreaded finals, wouldn't it be an excellent chance to make a resolution never to say "I haven't got time" when it applies to our school work. Wouldn't it be better to say: "I'll make the time to do this assignment."

A LITTLE HONEST PRIDE

With the start of each new year it seems the custom—and not a bad one—to reflect upon the events and experiences of the past year and to make resolutions or predictions accordingly for the year in store. Predictions, however, we will leave to those better qualified to make them; resolutions we leave to those of sterner moral fiber than ourselves. We can take time, however, to reflect upon the days just past. No place is it more true than in our own line that future courses of action are decided upon through careful analysis of that which has gone before.

In the world at large this has been a year of war and confusion, in politics bickering and distrust, economically one of aimless bewilderment. In spite of which examination will show that technical progress moves on in its unhurried stride. Greater dams and bridges go up each year, new synthetic materials make their appearance in an uninterrupted stream, more ingenuous, more efficient appliances and machines are constantly produced, economy of raw materials and quality of finished goods goes ever upward.

Though we hear the old cry that the engineer is prone to turn his back on modern social problems and bury his head in his machinery, the protesters must admit that we apparently run our business better than the financiers, politicians, and economists run theirs. The explanation to us is that ours is a field in which cooperation rules. There may be never-ending work ahead, there are problems to test the limits of human patience, but the engineer, at least, doesn't work at cross purposes with his fellows; his business competition is a cooperative competition. On the other hand, to the best of our knowledge there are only one or two schools in the country offering correlated preparation for a diplomatic or any other public service career. Few economists speak the same language. Financiers have their own code of ethics. That is why, in the confusion, the engineer seeks to keep on ground with which he is familiar, where he can both give and get cooperation. Nor can we blame him.

BECAUSE A KAFIR COULDN'T STAND THE GAFF...

● Man's quest for gold has led him into strange places . . . the frozen lands of the north, the deserts of the south, the bowels of the earth. But from the land of Cecil Rhodes comes an amazing tale of muck and sweat and terrific heat . . . and man's victory over the elements!

The Robinson Deep Mine, Johannesburg, South Africa, is the world's deepest hole—8,500 feet *down!* In those depths is gold, but with temperatures exceeding 100° Fahrenheit and humidities approaching 100%, production reached what seemed to be an impassable barrier Even the natives couldn't stand the intolerable heat!

What could be done to improve conditions, to increase the efficiency of miners, to permit deeper excavations for gold? The answer was Carrier Air Conditioning!

Into those black depths went Carrier engineers and for 365 days tackled the problems of rock temperature and adiabatic compression of air, both of which go higher as shafts go lower. They studied the excessive humidity; heat from oxidation; heat from human bodies; frictional heat from machinery; and heat from explosives. And from their analysis came the installation of a Carrier Air Conditioning system with a cooling effect equal to 4,000,000 pounds of ice every 24 hours.

Thus again had engineering triumphed in a victory affecting not only production, efficiency and comfort, but one which left its impress on world economics.

There is no limit to the scope of Carrier Air Conditioning—nor to Carrier's further expansion and future accomplishments—except as measured by the number and ability of the young engineers Carrier can bring under the training of the pioneers who have been through the 35 years of the development of the art.

In the Carrier organization, *young* men hold responsible positions—their capacity gauged not by age, but by ability. And whether that ability is fostered best by laboratory research or field work in the far corners of the world, Carrier enables engineers to progress. Today in 99 different countries, you will find evidence of Carrier engineers' contribution to the world's progress!

Carrier
Air Conditioning

During 1937, Carrier trained 300 recent graduates from leading engineering schools in every section of the country. Carrier needs more men. If you had a good school record, and are interested in the world's most fascinating and fastest-growing industry, write us.

CARRIER CORPORATION, SYRACUSE, N. Y.

AN ORGANIZATION OF ENGINEERS

G-E *Campus News*

NETWORK ANALYZER

WITH the aim of aiding public utilities in laying out power systems, R. N. Slinger, Oregon State '26, R. G. Lorraine, U. of Colorado '27, and H. P. Kuehni, Eidgen Technische Hochschule '20, Zurich, Switzerland, Union '29, spent more than a year in designing and constructing an alternating-current network analyzer. The apparatus is so arranged that any distribution circuit in the country may be simulated merely by plugging various impedance units and power sources from the plugging cabinets

and reading the results on the master instrument panel.

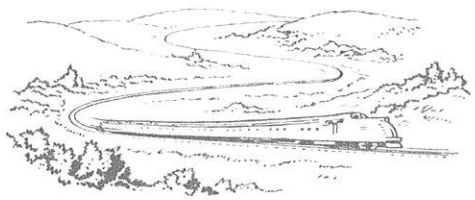
The a-c analyzer, a miniature power system, provides General Electric engineers with an advanced tool for system analysis and is made available to utility operating companies for their individual problems. Speed and accuracy of calculations are the two main advantages of the analyzer, and any experienced operator can, in two or three days, solve network problems which would take months to work out using other methods.

LOOKING THROUGH A BRICK WALL

LOOKING through a brick wall would not be a practical use for the G-E industrial x-ray machine, but it would be less difficult than the tasks to which it is put every day. Developed for use in factories where expensive castings and machined parts must be inspected, the x-ray permits inspection for flaws in castings and welds without damage to the article under observation.

The industrial x-ray machine is, in reality, an enlargement of the familiar machine used by doctors and dentists. Mounted on a dolly, or suspended from a hand crane, the machine is easily transported from one job to another and can be quickly set up for the inspection, saving time and money and assuring the customer of a perfect casting or welded seam.

Developments such as this are being made by college graduates who were at one time "on Test." Many of them have been off the college campus but a few years and are entering a career in one of the many engineering and business fields in the General Electric Company.



RUBBER RAILROAD RAILS

NO, the railroad companies have not started to use rubber rails, but the new welded steel rails that are a mile in length have many of the characteristics which rubber rails probably would have. Developed after research and experimental work by the Delaware and Hudson Railroad, Sperry Products Company, and General Electric Company, the welding which makes possible these mile-long rails introduces flash butt welding of the preheated ends of regular-length rails to form one long continuous rail.

When these rails are loaded on flatcars, they bend easily around the sharpest curves as they are carried to the spot where they are to be laid. In addition to their flexibility, the rails are remarkably quiet. No longer will there be the continual bump and clatter of wheels over worn and gaping rail joints to disturb sleeping passengers. To reduce the noise even more, the rails are laid so that there will be no two parallel joints.

The flexibility and smoothness of the new rails reduce the wear and tear on the rolling stock, so that the initial expenditure for the rails will be compensated by the saving on maintenance.