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Rose Technic

Volume LX, No. 8 March, 1949

In This Issue

FEATURES

COVER

The TECHNIC pays homage to Saint Patrick with a cover wearin' th' green.

FRONTISPIECE

A liquefied-petroleum gas flame being used to tip an oil-well drill bit with tungsten carbide. The extreme hardness of the carbide is necessary for rapid drilling and long bit life.
Photo by Robert Yarnall Richie.

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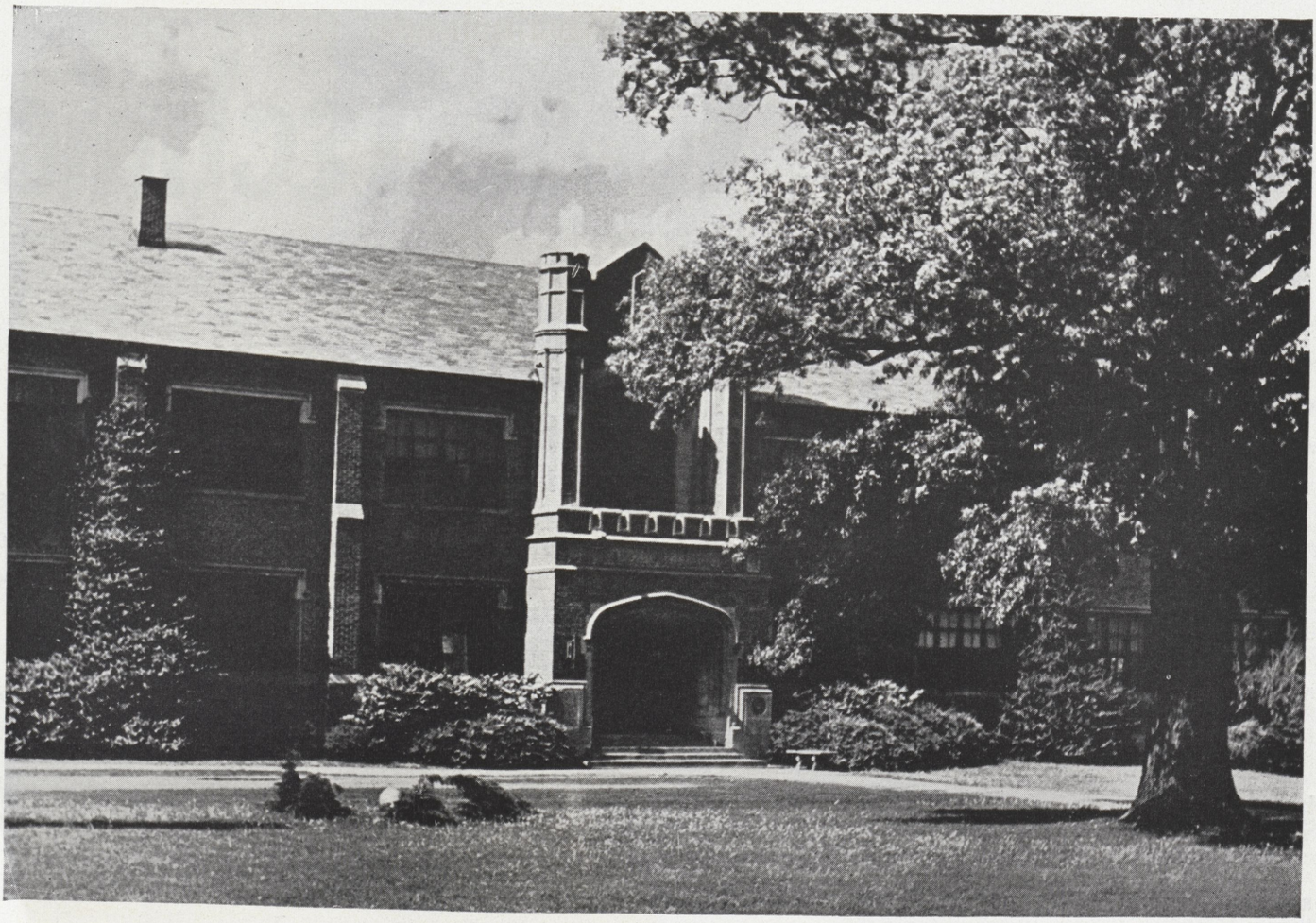

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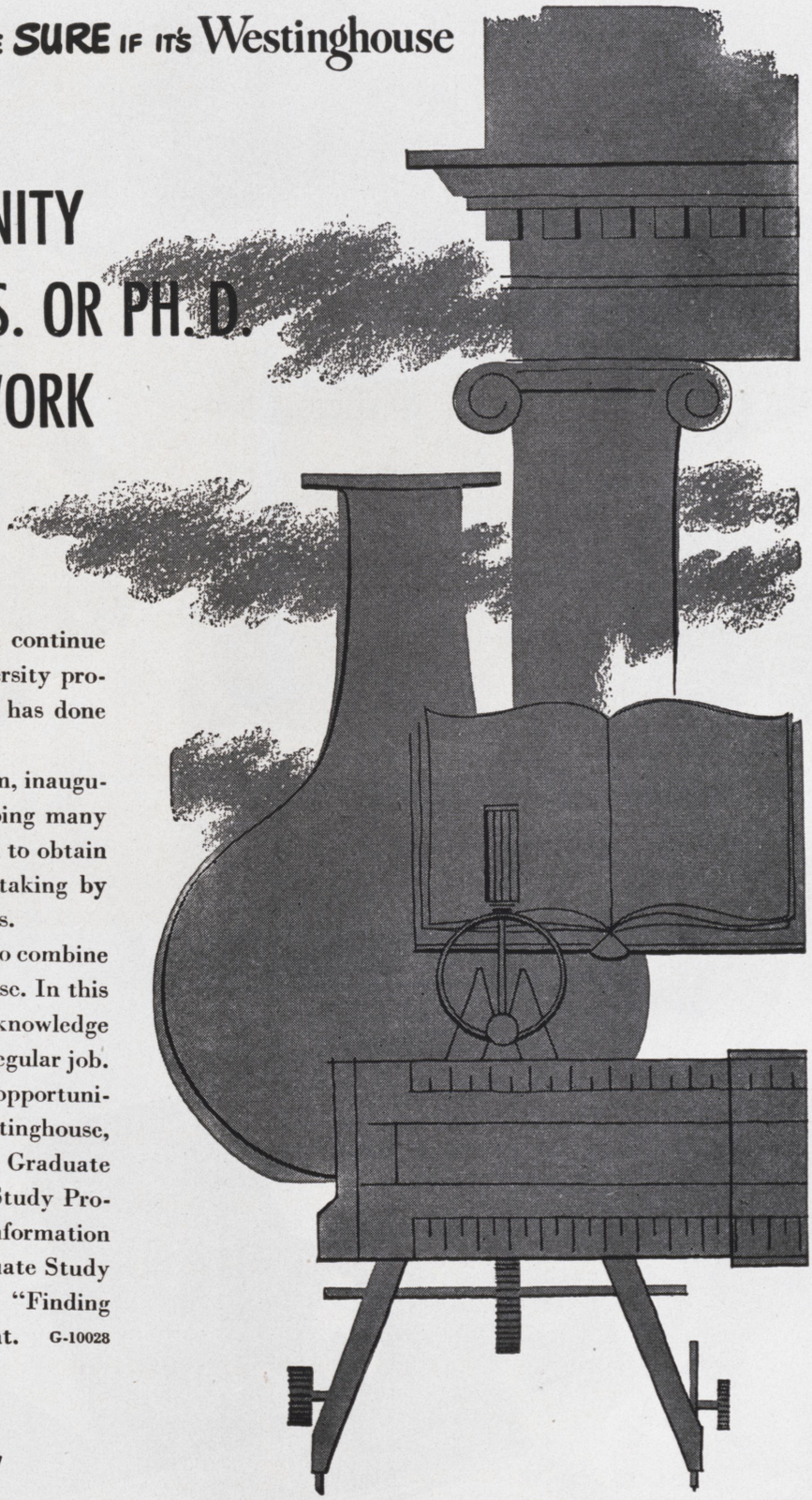

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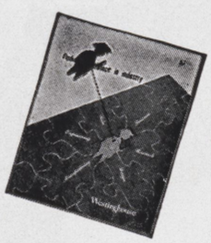

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Cut Courtesy Oilways

Welding with a liquefied-petroleum gas flame.

About St. Pat

For many years engineers have claimed St. Patrick as their patron saint and have been using his day as an excuse for some exceedingly gay times. But, ask an engineer, "Who is Saint Patrick?", and the usual answer is that classic of ignorance, "Dah-h-h-h." This may be partly justified because there seems to be no concrete facts with which we may grapple. In fact even the beginning of the story is vague. However, there is one thing of which we can be *sure*—St. Pat was born about 732 A.D. in Scotland, England, Wales, or France. Although originally of a good family he managed somehow to be carried off by pirates when he was sixteen and to be sold as a slave in Ireland, where he spent seven years as a swineherd in Country Autrim. It seems that the good St. Pat could not see a future for a bright young lad as a swineherd. After seven years as a swineherd he fled from Ireland and after many perilous adventures made his way to the continent.

Once on the continent St. Pat seems to have made amazing progress because he was ordained a deacon, a priest and a bishop in rapid succession. After he had been ordained a bishop St. Pat returned, in the best Christian fashion, to preach the gospel to the then heathen Irish. This proved to be no easy task because he was immediately opposed by the Druid priests who had been established for many centuries and naturally felt that St. Pat was encroaching on their land. The Druid priests were reputed to have been great magicians; being formidable opponents for a lesser personage than St. Pat. He, however, rose to the occasion and proved himself worthy of being the patron saint of all engineers by cursing the fertile lands of the Druids causing them to become dreary bogs; cursing the rivers of the Druids so that they yielded no fish, cursing their kettles so that no amount of patience could make them boil; and as a crowning touch cursing the Druids themselves so that the earth swallowed them. This ended the opposition to St. Pat and placed him on the best of terms with the local populace. From that time life favored our patron saint and he gradually built up to the high point of his career, the banishing of all venomous reptiles from the "Isle o' th' Green", thus making the Irish soil so obnoxious to serpents that they die instantaneously upon touching it. This miracle was accomplished, if legend is correct, by the beating of a drum. In fact, St. Pat beat the drum so hard he beat a hole in it and thereby came perilously close to failure, but an Angel appeared, patched the drum, and saved the day.

The story's ending is as vague as its beginning. St. Pat, as far as is known, is buried at Downpatrick, Ireland, along with St. Columb and St. Bridget. It is certainly reassuring for those of us who honor St. Pat as our patron saint to know that after spending so much time among the heathens he has spent these long years in such good company.

M. J. O.

Through discovery, invention, and engineering application, the engineer has made electricity of continually greater use to mankind. The invention of the dynamo made engine power many times more effective in relieving the toil, increasing the opportunities of industry and aiding the comforts of the home. Unfortunately the scope of the early dynamo was limited to relatively short distances from the power house because of low voltage distribution circuits and the use of direct current. Until the invention of the transformer, which made possible the use of high alternating voltages for distribution and the use of lower voltages in the household, electric power was available only in the immediate area of the power station.

Early power transmission definitely was limited to very short distances. The loss of energy in a conductor varies as the square of the current. For example if the transmission line had a resistance of one ohm and a current of one ampere passing through it, a loss of one watt of power in the line would result. If, however, the same line were used but two amperes passed through it, the loss of power increases to four watts. Of course, the resistance of the line may be reduced to prevent this waste of power. The resistance can best be reduced by increasing the diameter of the conductor that is carrying the current. Due to the cost of copper, there is a definite limiting economic value for the diameter of the conductor. Lord Kelvin made the statement that the annual cost of the energy loss for a given power transmission line should equal the interest on the financial investment on the power line. Also, when the power loss in the line increases, the voltage drop in the line increases. Since it is desired to get as much of the generated voltage across the load as possible, this is highly undesirable. In the early days when electricity was used primarily for electric lighting, much trouble was experienced from line voltage drop. The luminosity of ordinary electric light bulbs varies as the fourth power of the voltage. It is therefore apparent that a small change in voltage applied to an

Power Transmission

By Paul D. Ford, jr., e.e.

electric light bulb results in appreciable change in intensity of light given off.

Since it is the current flowing in the transmission line that produces the voltage drop and the power loss, it seems logical to increase the voltage at which the lines operate and decrease the current .Theoretically, this was the answer to all the problems of power transmission. Practically, it was not. The use of extremely high voltages has several disadvantages. There is more danger involved to life and property when high voltages are brought into the home and factory. Transmission lines must be constructed more carefully for the higher voltages to prevent any possible arc-overs or short circuits. The trouble with the early high voltage transmission systems was that the voltage could not be "stepped down," as it is today, for home and commercial consumption. Edison was able to achieve a degree of success along this line by his three wire system of transmission. In this system, it was possible to transmit the power to the consumer at 220 volts and then tap off 110 volts for the consumer's use. In other words he was ble for practical use of the general the consumer's usable voltage. This system was useful, but not adequate for long-distance transmission. Other early power-men even tried transmitting the power at a very high voltage and putting the loads in series. This system was entirely too inflexible for practical use of the general public. It was also too dangerous because extremely high voltages were present everywhere in the circuit. The only practical solution to this problem of efficient power transmission seemed to lie in some system of transmitting the power at high voltages to the consumer and then stepping down the voltage to some safe and useful value.

The solution of this riddle of efficient power transmission over a distance did not come until the use of alternating current and the power transformer came into being. These steps produced revolutionary results in the electric industry. They made high voltage and long-distance transmission lines possible, thus placing power, through the medium of the alternating current generator, at the doorstep of practically everyone. The electric transformer in this country was developed by a Mr. William Stanley of the Westinghouse Electric Company. In the year 1886, the first alternating current system in America was put into operation at Great Barrington, Massachusetts. Mr. Stanley was in charge of the installation. Previously he had designed several transformers, to be used in parallel, with a 500 volt primary winding and a 100 volt secondary winding. The Siemens alternator, which Mr. Westinghouse had imported from London, was driven by a 25 horsepower steam engine located in an old deserted rubber mill in th enorth part of the village. The alternator had an output of 500 volts at a current of 12 amperes. The length of the line from the power station to downtown Great Barrington was about 4000 feet. With this small power station in Massachusetts originated the modern power transmission systems. Today practically all power systems use alternating current exclusively. Since Great Barrington, the power industry has grown until now it is capitalized at approximately 14 billion dollars and has an annual revenue of over two billion dollars.

The main sources of power for the generation of electricity are as follows: (1) Water; (2) Steam from (a) coal, (b) crude oil, (c) natural gas, and (3) Diesel power from crude oil. The great transmission systems of this country received their impetus as a result of hydro-electric developments early in this century. Waterpower was then very desirable because steam stations were relatively high in first cost and coal consumption per kilowatt hour was three times that of today, and finally be-

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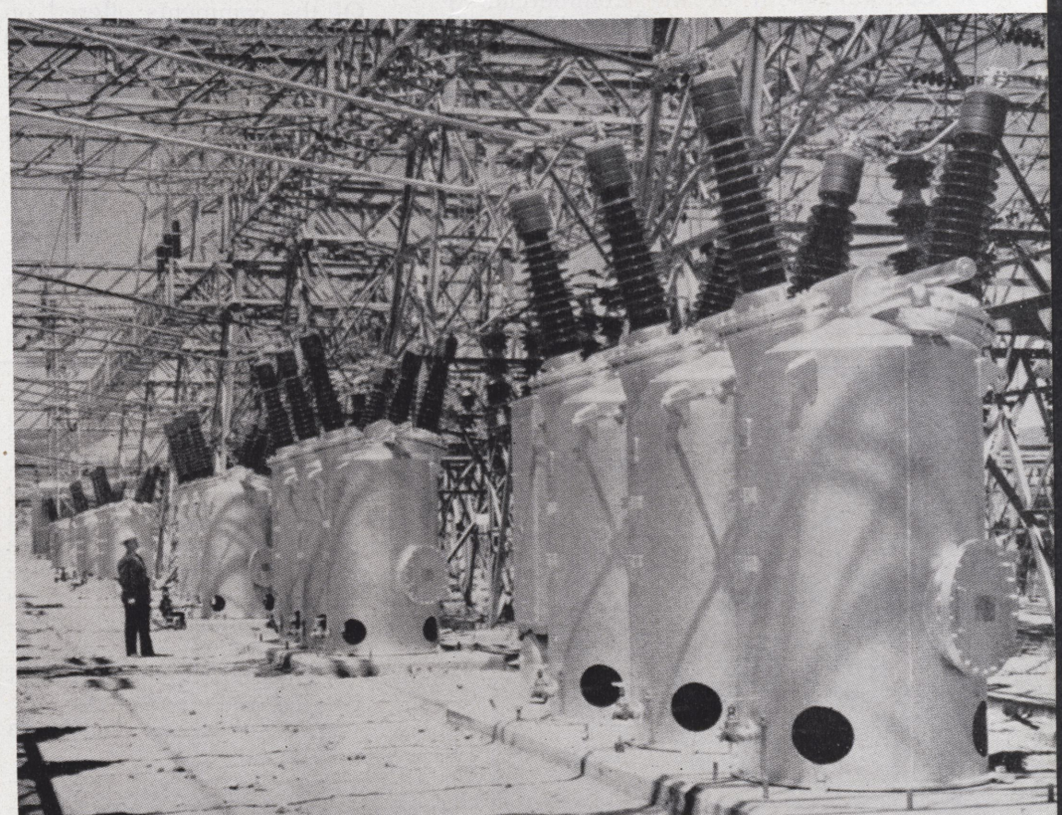


Cut Courtesy Allis-Chalmers

Switchyard construction now in progress at Coulee Dam in Washington will have seven 1,500 and 2,500-mva, 115-kv, 800-amp oil circuit breakers in operation. Principles of circuit interruption remain the same no matter how large the installation may be.

Campus

By Jayson Brentlinger, jr., m.e.

Chemical Department Forms Advisory Board

The formation of an industrial advisory board to the chemical engineering department has been announced by Dr. Charles E. Kircher, head of the department.

Designed to establish and maintain a close relationship between the chemical engineering department of the college and the chemical industry, and to provide the contact from which such a relationship migh operate, the board was formed and its purpose outlined at an organizational meeting, held at the college on January 23, 1949.

Constituting the board are six representatives of the chemical industry and five faculty members. They are Harry E. Bierbaum, Malinckrodt Chemical Works, St. Louis; Dr. Odon S. Knight and Thomas S. Carswell, both of the Commercial Solvents Corporation, Terre Haute; Bernard J. Juinn, representing Herman A. Poitras, Charles Pfizer & Company, Brooklyn, N. Y.; H. Edmund Wiedmann, consulting chemist, St. Louis, and Dr. F. B. Zienty, Monsanto Chemical Company, St. Louis; members of the Rose faculty are Dr. Charles E. Kircher, S. George Bankoff, and Walter S. Kaghan from the chemical engineering department, and Dr. Ralph K. Strong and Dr. Oran M. Knudsen from the chemistry department.

THE ROSE POLL

by Wayne Walter, sr., m.e. and Denzil Hammond

Last spring, both sides of the question of compulsory military training were presented in the nation's press. A bill was passed by Congress calling for the selection of young men of college age for training in the armed forces. Now that the system has been in operation for several months, it is interesting to see how it is regarded by the men it affects, particularly the men at Rose.

In reply to the question, "Should selective service be continued?", there were two very definite sets of opinions. From the results tabulated, it can be seen that the veterans favored continuance and the civilians definitely oppose it.

Of the comments offered on the question, the most common one, offered by those who oppose selective service, was that the selection should exclude college students. It was thought that many college men, particularly engineering students, would be of more value to their country by securing an education than by participating in military training.

These results were expected but the great difference between the civilian and veterans' opinions is still partially unexplained. One obvious reason, which cannot be disregarded, is that the veterans may, to some extent favor the draft because they will not be affected by it.

Some of the greatest opposition to the act arose from the viewpoint that the training would not materially prepare the country for defense and could affect the morals of those inducted. Perhaps the veterans favor the draft because they found, during their service, that military training was worth while and not degenerating.

Despite recent talk for repeal and the draft holiday during the past months, selective service is probably here to stay for a while. Let us hope it accomplishes its purpose.

Question: SHOULD SELECTIVE SERVICE BE CONTINUED?

	Yes	No
Veterans	72%	28%
Civilians	37%	63%

Canterbury scores two points against the Engineers.

At the organizational meeting, Dr. Kircher outlined what he felt the purpose of the board should be. Among the first points discussed by the group was the subject of revised curriculum. Several suggestions were considered. These included the suggested inclusion of courses such as logic, semantics, and applied differential equations in the required curriculum for chemicals, and asked that more stress be laid upon giving the chemical graduate greater facility in expression.

A discussion of present and proposed methods of encouraging a program of research and graduate study for chemical engineering students and faculty was led by Dr. Kircher, and in this connection he described the Detrex fellowship arrangement under which Professor Bankoff is working, and the Charles Pfizer & Co. project, in which chemical engineering students are assisting on a problem.

The placement of graduates was also the subject of a discussion, and general agreement between representatives of the college and industry was established concerning the best methods for maintaining live contacts with prospective employers.

First Assembly of the New Term

After a brief "bull session" with the seniors earlier on the morning of February 3, Mr. W. G. Cooper gave an interesting address to the student

Survey

and Jim Gaston, jr., m.e.

No this isn't the chow line, but registration day.

body on the topic of "Mining Today and Tomorrow."

In relating the history of the mining industry Mr. Cooper made one "slip." He was telling of the advent of the electric locomotives into the mine at the time. Yes, he did the one thing that most people do not care to do, he revealed his age by informing us tht the electric locomotive came to the mine in the same year of his birth 1887.

After outlining the interesting history of the "Oldest Industry of The World," Mr. Cooper made several predictions which he thought to be the fate of the mining industry of tomorrow. Some of these: that slope mining would take the place of shaft mining in most coal fields, continuous mining machinery would come to replace the old pick and shovel method, and that in some time not to far distant the mine would be illuminated as the modern factory is today.

He touched upon labor relations only slightly, but the two statements he made were very forceful. Mr. Cooper believes the greatest weakness of the union of today is the fact that the "tail wags the dog" instead of vice versa, i.e., a few control the majority. The second statement, which is more truth than fiction, is that, "Man has gone a long way in learning to control nature, but a very short way in learning to control himself."

In conclusion, Mr. Cooper declared, "While it is one of the oldest, mining is on its way to become one of the most progressive industries, and it is a promising field for a graduate engineer."

Army Commissions

From the Second Army Headquarters comes a news release that may be of interest to the vets who held commissions for one year or more during their tour of active duty. The Regular Army is offering commissions to former officers of any of the armed services.

Armed services are defined as any component of the Army. Navy, Marine Corps, Coast Guard, U. S. Public Health Service detailed for active duty with the Army or Navy, and Coast and Geodetic Survey Service serving with the Army or Navy.

Applicants must have a degree or receive their degree before June 1949; however, it is possible for men having 120 semester hours credit to obtain a waiver. To be eligible, applicants must be between 21 and 27 years old. The upper limit may be modified by adding total service as an officer between 7 December 1941 and 2 September 1945, or after 31 December 1947. Men who have passed their thirtieth birthday cannot be appointed.

Further information may be obtained from the Military Department. The deadline is 30 April 1949.

New Freshmen Learn the Ropes

The lake may be frozen, but the rough and ready Sophs have other methods of enforcing the law—don't they, Greencaps!

It looks as if we really have a highly spirited gang of neophytes, for the Sophs had their hands full from the start. Just after being given instructions about the "Freshman Commandments," a portion of the youngsters rose in revolt. Although they had a few critical minutes, the mighty Sophs thwarted the uprising and punished the leader by showing him how a "greased pig" feels when freshly lubricated.

Although the present methods are very effective as enforcement measures, the Sophs are looking forward to warm weather when they can make up for the baptismal services held last spring, so be prepared, young "Greencaps."

SOP at Rose for poor officiating.

Quality Control With

By Mark J.

In the dollars-and-cents manufacturing world only those processes which are economically sound survive. In just such a world quality control is becoming more important with each passing day. Quality control means not only a better product for the consumer, but also dollars saved for the manufacturer in the form of more accurate demensional control which means better interchangeability of parts, shortened assembly time, and fewer rejects.

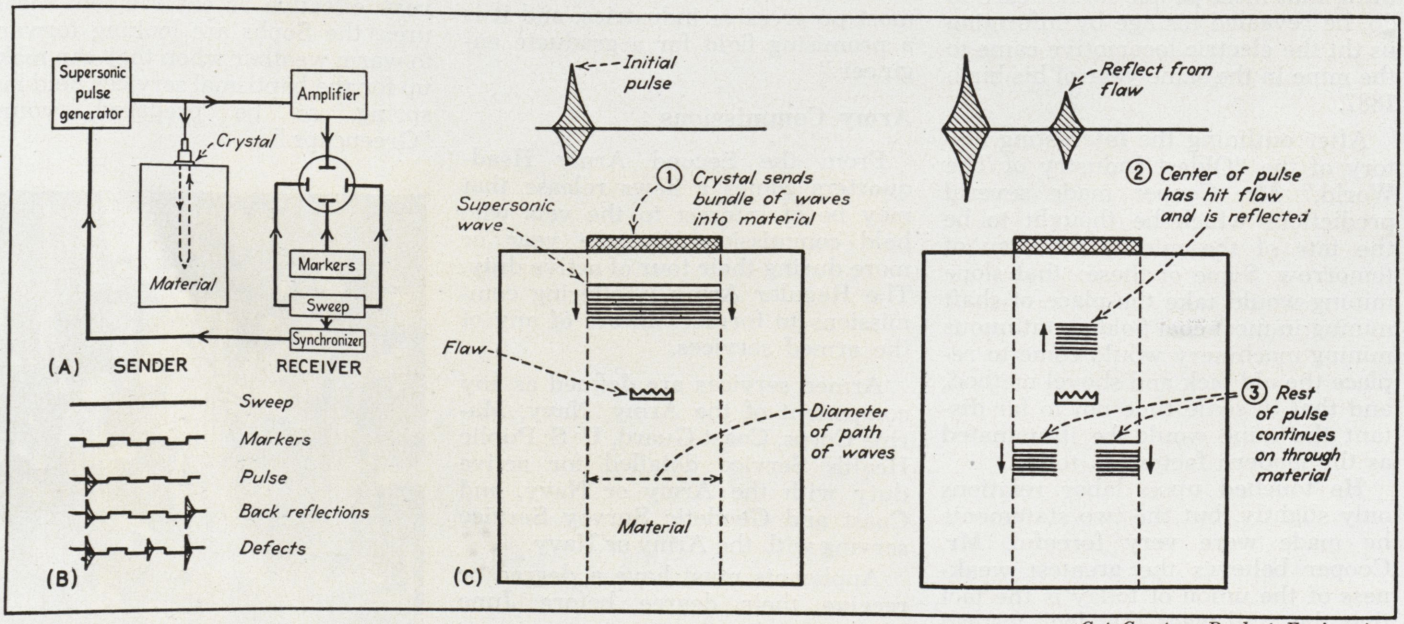
Quality control standards are dictated by the use to which the finished part is to be put, for instance, super finish would be an economic waste on a piece whose sliding velocity is very low as would be the holding of close dimensional tolerances on a can opener. Yet even the lowly can opener must meet certain standards, hardness if none other.

Dimensional tolerances are first brought to mind with quality control but since micrometers, verniers, and dial gauges are familiar they will not be treated in this article, but rather the less familiar aspects of surface smoothness, hardness, and supersonic examination will be discussed.

As we have turned more and more to turbines for power and as engine speeds have increased, lubrication problems have become more and more difficult. Intensive studies of this problem have brought to life the important part played by the bearing surface. Even ground and lapped surfaces have minute imperfections. If these imperfections are to be eliminated it is first necessary that they be measurable. To accomplish this mechanically approaches the impossible so an electro-mechanical system called the Profilometer has been developed by the Physicists Research Company to measure surface imperfections.

For convenient classification surface irregularities are grouped into three groups; surface flaws which are scratches, cracks, holes, or ridges which occur at random intervals on the surface, waviness which is a recurrent pattern of flaws in the form of waves, roughness which is caused by random and irregularily spaced flaws which are more closely spaced than waves.

The Profilometer is made up of three components. The tracer which is moved over the surface and which translates surface irregularities into corresponding electrical voltages. The amplifier which amplifies the tracer output in both amplitude and impedance. The meter which is actually a voltmeter calibrated in micro-inches (rms). Figure one shows the tracer in cross section. As the tracer moves over the surface being tested the diamond pointed tracer gives its verticle motion to the coil which moves in the field of a permanent magnet mounted in the tracer thus producing a voltage of the order of two microvolts for a one micro-inch flaw. This voltage is fed to the amplifier and then to the integrating circuits. Since the voltage is produced by the movement of a coil in a magnetic field its magnitude is dependant upon the rate at which the magnetic lines of flux are cut. From this we would expect that the generated voltage would be proportional to the rate at which the tracer moves over the surface. Special integrating circuits completely compensate for this effect, thus the tracer can be moved by hand or mechanically at varying speeds without affecting the accuracy of the profilometer. The frequency response of the amplifier is from 20 to 10,000 cps so the basic requirement of the tracer is that the frequency of the generated voltage be greater than 20 cps. This means that the minimum tracer speed would be .25 fps if the flaws are .013 inches apart. The speed required to generate a voltage of



Cut Courtesy Product Engineering

How supersonic testing works. (a) Block Diagram of elements (b) Diagrammatic traces that appear on oscilloscope. (c) Successive stages in detection of flaw tracing the sequence of wave travel.

Non Destructive Testing

Orelup, sr., e.e.

10,000 cps is greatly in excess of usuable tracer speeds.

The pressure with which the diamond point is held against the surface may be controlled by the micrometer screw at the top of the tracer. Even with careless adjustment and use of the diamond tracer it is difficult to damage the surface, however a change in the appearance of the surface may occur because the skids alter minor irregularities which are superimposed on the irregularities which constitute the roughness and change the light reflecting properties of the surface. This change in appearance does not damage the surface. Even in cases when the tracer does scratch the surface through careless use of the diamond on copper or aluminum the roughness readings are correct within a few percent.

The tracer is calibrated by comparing the motion of the diamond with a known length by means of a microscope.

Today there are many methods of measuring hardness which are reliable and easy to use. The Brinell and Vickers machines are examples of hardness testers which use the ratio of the impressed load to the area of the resulting indentation to obtain a hardness number. When using either machine a load which is predetermined by the operator is applied to the sample through a steel ball in the case of the Brinell and a square based diamond pyramid in the case of the Vickers. The diameter of the Brinell indentation or the diagonal distance of the Vickers indentation is measured with an ocular micrometer and the resulting measurement is converted into a hardness number by substituting this measurement into especially developed equations or tables. The Rockwell hardness tester also uses a predetermined load but instead of measuring the area of the indentation it measures the difference between the depths of penetration at two loads. The first load, called the minor load, is applied to drive the diamond or steel ball indenter through surface imperfectations, the second load, called the major load, is applied to make the major penetration. The machine measures the difference between the two penetrations. Rockwell hardness numbers are read directly from the indicator scale. The Scleroscope is an instrument which uses the novel principle of measuring the drop and rebound of a diamond tipped hammer to measure hardness. The hammer is dropped from a fixed height and the rebound from the specimen is read against a graduated scale which reads directly in Scleroscope hardness numbers.

All of the methods mentioned above are used in conventional practice, but none are satisfactory for measuring the hardness of fine wires, superficially hardened surfaces, plastics, or enameled surfaces. To meet this need the Wilson Company has developed an instrument called the Tukon Tester which may be used for micro- as well as micro-hardness testing. This instrument is similar to both the Brinell and Vickers in that

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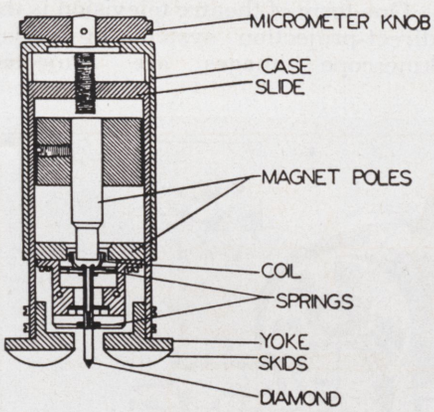
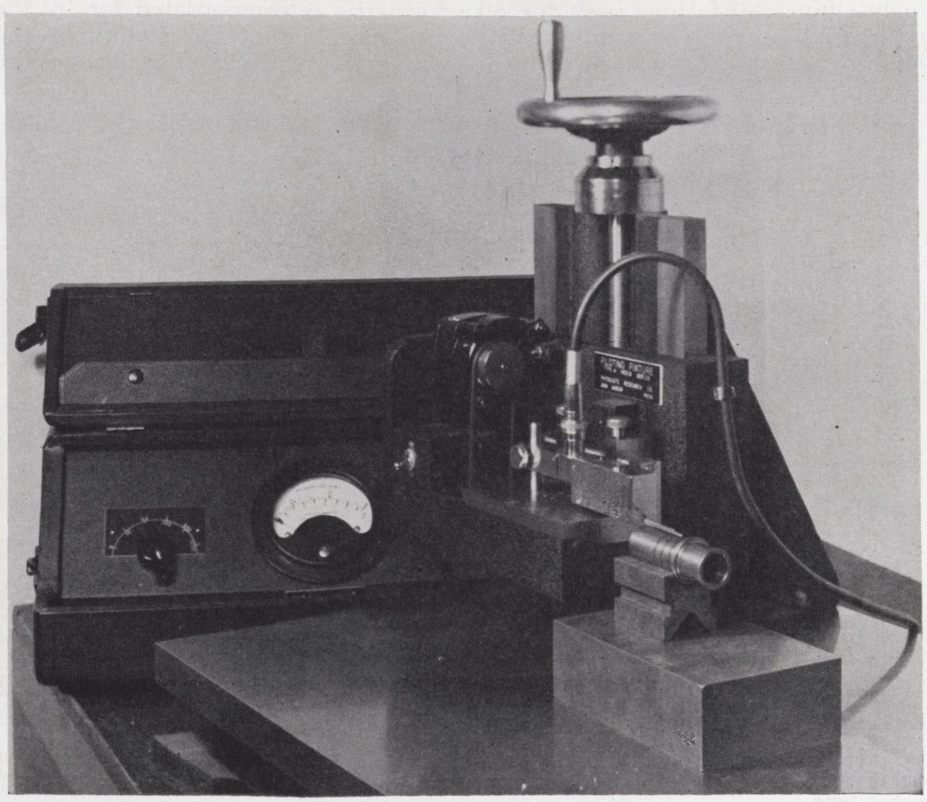


Above: Cross section of a Profilometer Tracer.



Right: A Profilometer complete with piloting fixture.

Research and

By George Eddy, jr., m.e.

Torque Converter

The new General Motors Torque Converter is now being manufactured for use with the Detroit Diesel Series 71 engines as a complete, self-contained engine-converter unit.

The converter is of the "rotating housing" type and consists of the following: the pump, the turbine, and two stators. These parts are heat-treated plaster-mold aluminum castings with blading specially developed for each model.

Since the torque converter transmits power through the medium of oil, provision must be made for filling the converter with oil under pressure and for absorbing the heat which accumulates in the oil during the operation of the converter.

Circulation of the oil through the converter and the cooler is obtained by means of a small charging pump located on the flywheel of the engine. A charging pressure of 60-90 psi is maintained in order to circulate sufficient oil for adequate cooling and to eliminate any possibility of cavitation.

A unique and effective method of maintaining satisfactory seals for oil under high pressure on rotating parts in the converter in the form of two-stage seals has been developed. The high pressure seal consists of piston rings in grooves, one pair of which is located inside and one pair outside the "ground sleeve" near the outer end. A small amount of oil (about a pint per minute) escapes these rings from the high pressure side and is collected in an annular space in the converter housing from whence it is drained back to the oil reservoir. Leakage from this annular space or collector to the inside of the convertor housing or to the outside around the power take-off shaft is easily prevented by the use of common lip-type seals. The outer lip-type seal is protected from dust by a synthetic-rubber disc.

Operation of the torque converter is fully automatic and requires no attention from the operator. Because the angles of the blades are generally fixed, optimum performance of a fluid coupling or converter can be obtained under only one set of conditions of input speed vs. output speed. At speeds above or below this optimum point, there is a drop in efficiency. This normal drop in performance is compensated for by the free-wheeling of the stators in the convertor, which in effect changes the angularity of the blades and gives three separate blade combinations or blade angles.

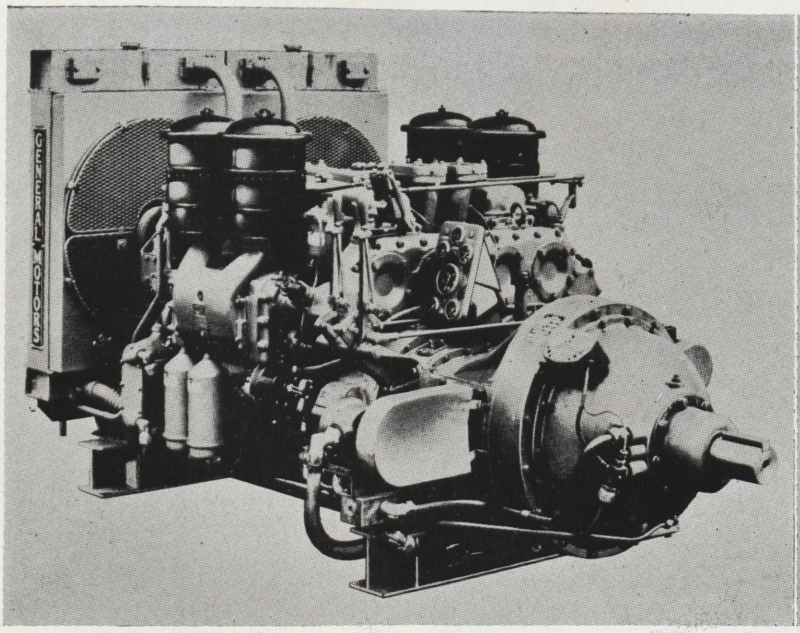
In addition to the ability of making maximum horsepower available at the output shaft, the converter furthermore makes it impossible to operate the engine at full load except in the upper 25% of its speed range. This protects the engine from lugging at low speeds and avoids excess fuel consumption that occurs when an engine is pulled down below its most efficient range of operation. The engine speed and torque characteristics show that they are nearly constant through the entire speed range of the unit.

Another outstanding feature of the converter is that its performance characteristics do not change with use, as there is no wear of the moving parts.

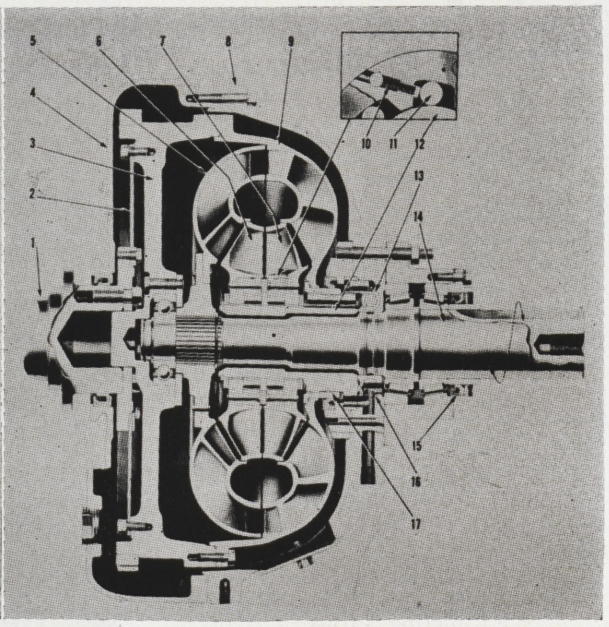
Theatre Television Is Near

With two basically different systems of large-screen television undergoing practical tests, the dream of "theatre" television comes closer to realization.

One form of theatre television is the direct-projection system by which kinescope images are projected



General Motors Series 71 Twin 6 Diesel engine-torque converter unit rated at 300 BHP. The complete unit is 106-5/32 inches long.



Cutaway view of new torgue converter, showing similarity to the Hydra-matic drive.

Development

and Dale Carey, jr., e.e.

through a reflective optical system; the other is an intermediate film system using standard motion picture projection technique, after the kinescope images have been photographed on motion picture film.

In the direct projection television system there are three major elements: the special projection kinescope which is the source of the light image; the optical system which projects the image; and the viewing screen.

Although similar in many ways to the direct viewing tube used in the conventional television receiver, the kinescope produces an image of much greater brilliancy because of the higher voltage applied to it.

Elements of the optical system, based on the Schmidt astronomical camera, consist of a spherical mirror and a correcting lens. The principal feature involved in the Schmidt system is the method employed to correct the spherical eberration of the system for finite focus.

The alternate system of large screen television projection is the intermediate film method which consists of three major units. The first is the television recording unit with a high-quality kinescope tube and a special 35mm motion-picture camera, the second consists of a high-speed film processing machine, and the third, a conventional 35 mm theatre film projector. Such a system can be so integrated that the time elapsing between the appearance of the image on the kinescope and its projection on the viewing screen is less than one minute.

A special camera was devised which would compensate for the difference between the 30 complete images per second as used in television and the standardized rate of travel of motion picture film at 24 frames per second. This camera also provides for sound-on-film recording.

In performance, large-screen projectors are now limited by the quality of signals available for projection. The technical possibilities of the projection system are equal to the best studio television equipment. Inferior pictures on the screen are caused usually by deterioration of the signal between camera and projector.

The direct-projection method has the merits of immediate reproduction, simplicity of operation and low operating expense. Its disadvantages are the necessity for a special screen and the fact that the optical system is limited in its "throw" or projection distance.

Advantages of the intermediate film system are that programs can be scheduled as desired; the screen has a brightness equal to that of standard film projection equipment; film may be edited and can be retained for successive showings. The disadvantages of this method are its cost of installation and operation, plus the fact that the sound must be separately recorded.

Snow-Melting Highway

The dream of every motorist and every highway engineer — a snow-melting highway — is about to be opened for use in the town of Klamath Falls, Oregon.

In the first application of radiant heating principles to a public road, the highway will be heated in bad weather by hot water from an underground spring circulated through a network of welded wrought-iron pipe laid in the concrete. Four lanes wide, 450 feet long with an eight per cent grade, this dangerous road area is designed to remain clear and skid-free in all weather by automatically melting up to one inch of snow or one-tenth inch of ice per hour.

The stretch of all-weather heated pavement is on the Dallas-California Highway leading into Klamath Falls from the north. It passes under the Southern Pacific Railway viaduct and a few hundred feet farther crosses an irrigation ditch, thus necessitating a grade two or three per cent steeper than would normally be used.

Work was started on the road late last spring, after a ten-inch well had

Continued On Page 28

An operator at the control console of the large screen television projector. This unit produces high quality pictures six by eight feet. Programs fed into the unit from any standard television source can be enlarged by the projector making possible large viewing audiences of several hundred persons.

Good English and The Engineer

A Tau Beta Pi Essay

By Sidney Zeid, sr., c.e.

A universal fallacy among a vast majority of engineering students is that professional lecturers and writers and politicians are the chosen few who need to speak and write effectively. Actually, however, these constitute but a relatively small group of people, who must command the English language for their professional benefit. Business men, doctors, lawyers—as well as engineers—indeed, men and women in all vocations—are called upon every day to communicate ideas and information to other minds. The success which they attain depends largely upon their ability to express their thoughts in correct and forceful English. To convey messages adequately, they must be able to speak and write in a manner that is immediately clear. Without this ability, they are seriously handicapped in all their contacts, professional as well as social. For everyday expression, therefore, proficiency in the use of English is essential.

Many in numbers are the engineering students who do not fully realize the importance of good English to the graduate engineer. Indeed, good English is one of the most important tools which the engineer has at his command. In a vast number of industries the only immediate method by which the engineer may convey his ideas is by means of written inter-office correspondence. By far the greater majority of engineering jobs require periodic and final reports by the engineer in charge, and very often an engineer is hired for the sole purpose of surveying a certain set of conditions and then transmitting his ideas and proposals to others in the form of a written report. The writing of effective papers and reports, therefore, often constitutes the only means by which the ability of the engineer may be judged.

The head of a large engineering firm once made this statement, "I have over fifty excellent engineers working for me, and not one of them can write an adequate report. I would gladly pay any one of them double his salary if he could only write as well as he uses his handbooks." This indeed tends to cast a reflection upon our engineering schools of today, but actually it is the student himself who is to blame. Far too many of us do not fully realize the importance of good English, and often wonder why it is even taught in an engineering school. With this thought in mind, the student passes lightly through the course without giving it much attention. As a result, while good engineering principles are attained, good English is lacking, and the graduate is at once handicapped. It must be remembered that information and ideas which cannot be adequately transmitted to others is as useless as a ship that has not been launched.

Since good English is a basic requirement in all engineering work, students should master the language before they leave college. After graduation, skill in expression will not appear magically when it is needed. It can be acquired only by forming the habit of using correct English both in and out of classroom at every possible opportunity. It should be remembered that it is also of prime importance for effective work in all other branches of the curriculum, and above all, as has been pointed out, in later engineering work.

In this economic system of ours, as it exists today, it is well for the engineering student to remember that his ultimate success lies in his ability to sell his ideas and opinions, and information—based on sound engineering principles—to those who might employ his services. And to be able to adequately accomplish this end, good English is one of the basic factors.

Alumni News

Mort Hief, soph., Bill Bannister, soph.,

and Richard J. Kuehl, soph.

Abe Silverstein

Last December 17, the anniversary of the first flight by the Wright brothers, the Institute of Aeronautical Sciences brought honor to itself and to Mr. Abe Silverstein, Rose '29, in having Silverstein as the Wright Brothers Lecturer before that group. His paper, "Research on Aircraft Propulsion Systems," summarized the recent great achievements and the expected goals of the United States aircraft propulsion field. Mr. Silverstein has made important contributions to this field.

Mr. Silverstein graduated from Rose in 1929 with a B.S. degree in Mechanical Engineering, and in 1934 he received an M.S. degree from Rose. After his graduation he began work with the National Advisory Committee for Aeronautics (NACA), and he has been with this organization since. He has been Wind Tunnel and Flight Chief since 1945, and directs research in the altitude, icing research, in supersonic wind tunnels and flights at the Lewis Flight Propulsion Laboratory of the NACA in Cleveland, Ohio. His work has included cooling, operational, and performance characteristics of jet-propeller aircraft, turbojet, ram-jet, and reciprocating engines, as well as the problem of propellers under high altitude and high power conditions.

Mr. Silverstein is 37 years old. His mother lives in Terre Haute where Abe was born. His father died some years ago. Before entering Rose, he attended Wiley High School. At Rose his major activity was debating, but at the present he is much too busy for outside activity.

We are deeply indebted to *Wingtips,* a newspaper published by the personnel of Lewis Laboratory, and to Mrs. Silverstein, Abe's mother, for information they gave us concerning Mr. Silverstein.

George Kelsall

Recently an article in the New York Times announcing the death of George Avery Kelsall came to the attention of officials at Rose Polytechnic Institute.

Born in Louisville, Kentucky, Mr. Kelsall was graduated from Rose in 1906. Up to the time of his death on January 4, 1949, he resided at 70 Preston Street, Belleville, New Jersey. A retired electrical engineer formerly with the Bell Telephone Laboratories, he was also a member of the faculty of Upsala College of East Orange, New Jersey.

Mr. Kelsall, who specialized in mathematics and magnetics, was with the Western Electric Company in New York before transferring to Bell Laboratories, where he remained for thirty-three years .

In 1934 he conducted experiments on electro-magnets using cores of an iron-cobalt alloy. These magnets lifted their own weight of pure iron. The next year he was credited with the discovery that by heat-treating certain magnetic metals enormous increases in permeability resulted.

Mr. Kelsall held a number of patents on inventions in his field and was credited with nearly 100 inventions improving electrical instruments.

Since retiring three years ago, he had lectured on mathematics at Upsala College and at the Newark College of Engineering. He was a member of the American Institute of Electrical Engineers and the American Physical Society.

Surviving are his widow, Mrs. Hannah Diggles Kelsall; two daughters, Mrs. Helen K. Nickerson, a member of the faculty at Wheaton College, Norton, Massachusetts, and Miss Ann L. Kelsall; a son, Avery C. Kelsall of Louisville, who graduated from Rose Polytechnic Institute in 1940; a brother, Dr. O. N. Kelsall of Louisville, and a grandson.

The next meeting of the Chicago Rose Tech Club will be held in one of the rooms of the Chicago Bar Association, 29 South LaSalle St., Chicago, Illinois, March 17, starting about six o'clock in the evening.

'15 James E. Sheldon of Anderson has been named Dictrict Engineer of the Crawfordsville district of the state highway system, in which Terre Haute is located. The announcement was made by Samuel Hadden, chairman of the State Highway Commission.

Sheldon holds a B.S. degree in civil engineering from Rose and was employed by the Pennsylvania Railroad prior to World War I. He served in the Army during that war and since has been employed by the Indiana State Highway Commission and the Michigan Highway Department. He previously served in the Crawfordsville district as assistant district engineer. Recently he has been assistant engineer of construction for the Greenfield district.

'18 J. G. White Engineering Corporation has just notified The Technic that Fred W. Springer died September 7 of last year.

'25 C. Derby McDaigh died January 12, 1949. He was associated with J. W. Beretta Engineers, Inc.

'30 Carl E. Ehienhardt, formerly with General Electric Co. at Bloomfield, New Jersey, has returned to Terre Haute as secretary of the Winslow Government Standard Scale Works, Inc.

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Fraternity Notes

Theta XI

Kappa of Theta Xi wishes to forward their congratulations to the new chapter at Indiana University. Alpha Tau Chapter's installation was held at I. U. on February 19, with members attending from Purdue and Rose. A formal installation ceremony in the afternoon followed by a banquet and dance was the schedule which proved to be a big success.

Congratulations also to ur graduating members: Bill Berling, Robert Somers, Otto Andres, Kenneth Arney, Gerry Miller, Lenny Silverman, and Albert Silverman. We wish all of you good luck in your new jobs.

More congratulations, this time to the men who lost jewelry. Bob Royer's pin went to Miss Carol Pierce; John Smith is now engaged to Miss Helen Hattix; and Tim Kelley is slated to wed Miss Barbara Allen sometime this spring.

Our main social event after the wild Christmas holidays was a stag party held at the house on February 11. It was very well attended and it was suggested that such a class in "fluids" be held more regularly. Dr. Sousley and Mr. McDonald held the title of *Chaperon.*

Theta Xi again extends its hand to our new pledges, Dave Kennedy, John Anderson, and Roger Hart.

Sigma Nu

Mr. and Mrs. Robert Briggs of South Bend are the proud parents of a baby boy born last January 22. He has been named Robert Fordyce and weighed seven pounds and twelve ounces at birth. Another potential man for Beta Upsilon.

Brother Robert Bohrman, who recently moved into the fraternity house, passed out cigars a few weeks ago. Bob "pinned" Miss Harriet Reifel of Indianapolis.

Beta Upsilon is in the process of looking for a new house, as yet nothing definite has been planned. We are just looking toward the future. Several Terre Haute houses have been inspected by our "house committee" but none were satisfactory.

Beta Upsilon now has its own bowling team which competes weekly with other teams from Rose. The members of our team are William Miller, Robert Atherton, Jack Marshall, Harold Skelly, and William Slagley.

Brother Andy Hallden evidently likes the wide open spaces. He recently moved to a farm just east of Rose Poly. Perry Ray, one of our more active members while in school, returned to the house for a short visit a few weeks ago. We forgot to ask him if he is still putting out his pin.

That National Broadcasting Company honored the Sigma Nu fraternity last month by dedicating a program of dance music to Sigma Nu. The program originated at Frank Daley's Meadowbrook in New Jersey and featured the orchestra of Ray Anthony.

Brother Jim Schwier recently sold his old jalopy and purchased a new-used Chevrolet. Missouri isn't very far away with a good car we hear.

The chapter is still sending packages to Luppo in Holland. Luppo, a war orphan, has been adopted by the chapter. Many letters are received from the boy but somehow the men at the house seem to have trouble answering all of them.

Lambda Chi Alpha

A new slate of officers was elected at the January 3 business meeting. The following men were elected to head the fraternity for the next two terms: Dave Smith, President; Dick Fairbrother, Vice-President; Bill Tilton, Secretary; Ronald Lange, Treasurer; Aaron Hogg, Ritualist; Jim Boyd, Social Chairman; and Bill Atto, Rush Chairman. Installation ceremonies were held at the following meeting.

Theta Kappa extends its congratulation to the members who graduated January 22, 1949. LeRoy Peterson, one of these graduates and former president, has been given a fellowship which will enable him to continue his studies at the Speed Institute in Louisville, Kentucky. The other men who graduated with this class were Ed Bollinger, Al Kiefer, Bob Devlin, and Wayne McCoy.

During the vacation between terms brothers Ray Sumerlot, Don Inman, Carl Wokasien, and Aaron Hogg journeyed southward via St. Louis, stopping off at Georgetown University, the University of Tennessee, and last of all at Georgia Tech. They have reported back that the study hours at Georgia Tech rival those at Rose, but of greater interest was their disclosure that the women outnumber the men at Georgetown.

Members are reminded of the State Conclave to be held in Indianapolis under the sponsoriship of the Indianapolis Lambda Chi Alpha Alumni Association on March 19, 1949. Leroy Wilson will speak at the luncheon and in the evening a dance will be held at the Murat Temple.

Alpha Tau Omega

On the weekend prior to Valentine's day, the fraternity paid homage to the patron saint of all pin-givers, ball and chain men, and other miscellaneous female admirers. A pilgrimage was made to Edgewood Cabin, and the evening whiled away in terpsichorean endeavor, gab-fests, and general hilarity—this last term includes activities too numerous to mention.

By way of maintaining the seasonal atmosphere, the hall was well garnished with hearts, arrows, and gaily colored streamers. Comic valentines were attached to the programs, and, in some cases, the character depicted stared knowingly into the eye of his flesh and blood counterpart.

Keynoting the entertainment for the evening, Maestro Jim Morris led the Friday-Night-Kazoo-Club in several ear-splitting renditions of Rimsy-Ripshiscorsetoff's "Ode to an Alley-cat."

The fraternity's guests for the evening included Dr. and Mrs. C. E. Kircher, Mr. and Mrs. Gordon K. Haist, and Mr. and Mrs. William Hollis.

The chapter wishes to extend its hand in warm welcome to Dick Mace, who was recently pledged.

For the fourth straight year, Terre Haute was selected as the site of the Annual Province Conclave. Five hundred ATO's from the chapters of Province 17 were in town for the occasion. The Rose chapter again has had the opportunity of meeting with their brothers from DePauw, Indiana, Illinois, Northwestern, Purdue and Monmouth.

Events for the day included the afternoon banquet and the formal dance in the evening. In addition to the normal events than usually transpire at a banquet of this type; trophies were awarded for the three best choral groups, the chapter with the most number of men present, the chapter with the most number of man-miles traveled, and the chapter having the best news-letter. The province Thomas Arkle Clark award winner was named.

BURIED ALIVE

Aerial cable gets protective wrapping before going underground.

A highway near Ann Arbor, Michigan, was being widened. This meant that a telephone pole line had to come down. But the cables it carried were too busy and too important to be cut. They had to remain in constant use.

Telephone engineers got busy.

Within two months, cables along the five mile stretch were "buried alive"—with every circuit in service all the time. Every inch of cable was given a protective wrapping to make it suitable for underground use. Streets, highways and railroad tracks were crossed. Work was done at night to avoid busy-hour traffic. Yet not a single telephone call was interrupted.

The skill and initiative of the telephone engineer are important reasons why America has the finest telephone service in the world—at the lowest possible cost.

BELL TELEPHONE SYSTEM

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cause fuel oil for diesel operation was not readily available. As undeveloped water-power sites became economically less desirable, steam staions less costly and their efficiency higher, and as fuel oil and natural gas became more generally available through pipe lines, steam stations rapidly outgrew hydro-electric stations in number and capacity. Today very few water-power sites in the United States can be developed at such low cost as to be competive with steam stations in economic energy production. For this reason, hydro-electric developments of recent years have almost all been undertaken by government agencies, which are in a position to include in the projects other considerations, such as navigation, flood control, irrigation, conservtaion of resources, thus giving them great social value.

As the water-power developments within easy reach of the load centers were utilized and it became necessary to reach greater distances for water power, only large developments could be considered, and stations of less than 100,000 kilowatts became the exception rather than the rule. As station capacity increased, there was a trend toward larger generators.

The modern steam-electric station using turbines can be dated from the installation of the Hartford Electric Light Company in 1900 of a 2000 kilowatt unit which then was a large machine. From that time until now, progress in design and efficiency has been both continuous and rapid. For instance, the 1920 average coal consumption per kilowatt hour generated for all public utility plants was three pounds. Today that figure has dropped to one and four-tenths pounds for the industry as a whole. The best base-load stations can operate using less than one pound of coal per kilowatt hour. The credit for these remarkable savings is attributed to the manufacturers of boilers and turbines, who, through continuous refinement of design and materials, have been able to raise steam pressures and temperatures from about 200 pounds at 600 degrees to 1250 pounds at 925 degrees. In the meantime, engineers have reduced generator losses by 30%. These losses, however, were negligible in comparison with the turbine and boiler losses before improvement.

Because of seasonal variations in water flow there are very few locations today where an important market can be supplied entirely from water power. In most cases a saving will be realized by combining water and steam power. The saving results from the combination of low operating cost of water-power plants with the low investment cost of steam stations. Moreover, hydro-electric units in themselves have certain valuable advantages when used in combination with steam units. They start more quickly than steam-driven uits, providing a high degree of stand-by readiness in case of emergency. They are also well adapted to maintenance of frequency. Water turbines can conveniently be drawn upon to relieve

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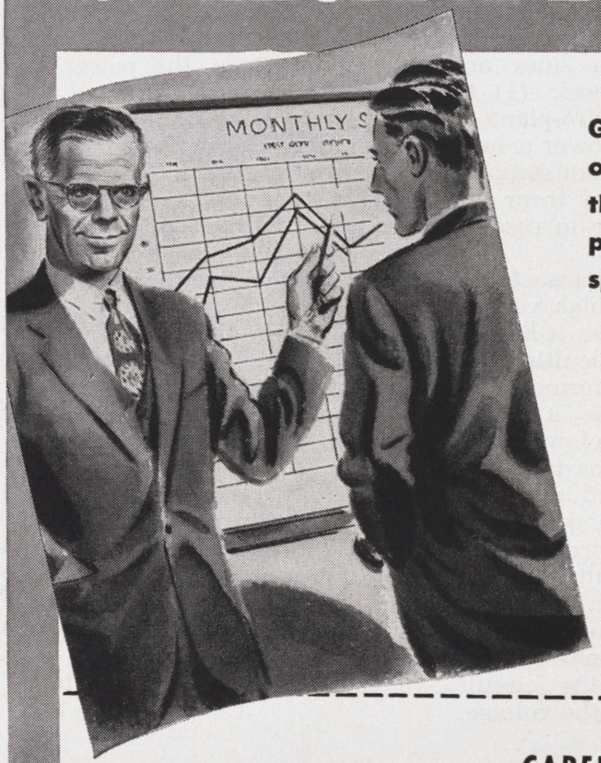
CAREERS AT GENERAL ELECTRIC



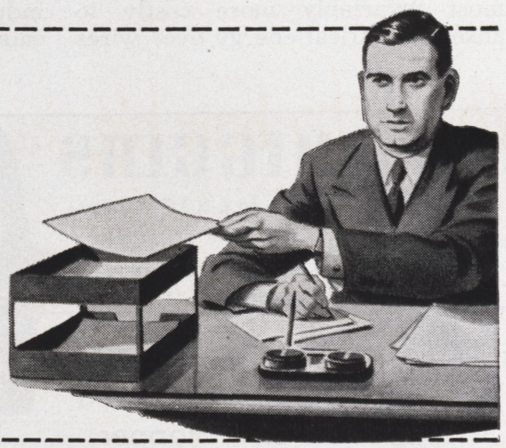
General Electric is not one business, but an organization of many businesses, offering opportunities in virtually all the professions. Here three G-E men brief the career-possibilities which the company offers to the marketing specialist, the accountant, and the manufacturing trainee.

FUTURES IN MARKETING

C. H. Lang (Michigan), Vice President responsible for all sales activities of Apparatus Dept.: "I believe that the need for increased sales efforts to maintain the current high level of business activity provides new and greater opportunities in the marketing of industrial products. Extensive training is offered in all phases of our marketing program—selling, application and service engineering, market analysis, and advertising and sales promotion."

CAREER IN FINANCE

H. A. MacKinnon, Assistant Comptroller and member of Company Education Committee: "New products coupled with the company's growth are providing excellent openings in business management. Since 1919, our Business Training Course and travelling auditors staff have provided direct channels through which young men have progressed into all types of accounting and financial management positions with General Electric."



MANUFACTURING TRAINEE

Dick Saunders (Rochester): "As a member of the G-E Manufacturing Leadership Program, I'm getting the know-how of manufacturing through 'personal apprenticeships' to seasoned managers. These varied assignments have included sitting in on labor relations meetings, handling grievances, taking time studies, establishing production schedules, and operating machine tools. It's the best way I know to learn the working of a complex business."

For further information about a BUSINESS CAREER with General Electric, write Business Training Course, Schenectady, N. Y.—a career in TECHNICAL FIELDS, write Technical Personnel Division, Schenectady, N. Y.

GENERAL ELECTRIC

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steam plants for short time peaks to save banking extra boilers.

To what extent a water-power site can be developed economically involves a thorough investigation of individual cases. An economic balance must be struck between the steam and water power to give maximum economy. A unit could be installed to absorb the maximum flow of a river during a short period. The cost per kilowatt hour installed would be low but the use made of the equipment would also be low. On the other hand, a unit might be installed with only enough generating capacity to take care of the minimum flow of the river. Obviously this is not the answer. Somewhere between the two extremes there is an optimum value.

In a hydro-electric plant, transmission of the power to the consumer generally becomes a large factor of expense. As an example, power transmission from Boulder Dam to Los Angeles costs over $90 per kilowatt. In fact, under present conditions it is almost invariably more costly to transmit electrical energy over wires than to transport the equivalent fuel to a steam station near the market, that is assuming the full cost of the development is charged to power.

Electrical transmission lines are essential for three purposes: (1) to transmit power from hydro-plant to market, (2) to transmit power to load centers from outlying steam stations, and (3) to transfer power from one power system to another in case of emergency.

As the use of the power transformer has made the use of high voltage transmission lines possible, it has also introduced several difficulties into power work. The transformer was highly practical because it could change a high voltage to a lower voltage without any moving parts. When transformers were installed in the circuits, the early power engineers found that the inductance of the transformer itself caused some difficulties. In an alternating current circuit, maximum power will be realized when the voltage and current are in phase. Any inductance present in the circuit causes the current to lag the voltage. In other words, they would not reach their peaks at the same time. Electrical engineers call the cosine of the angular difference between the current and voltage, the power factor. When this angle is zero and the cosine equals one, maximum power may be realized. Power men try to keep the power factor of their circuits as near one as is possible. Large capaciators are often used to cancel the effects of the inductance in the circuit.

The question of the frequency to use in power transmission is no longer a problem. In the United States 60 cycles has been accepted as the standard while 50 cycles is standard in most foreign countries. Some railway systems transmit their power at 25 cycles.

The only condition under which any frequency other than 50 or 60 cycles might be considered for a new project would be the case of a long transmission of 300 to 600 miles. For such long transmissions a frequency of less than 60 cycles might be advantageous because the reactance of

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DU PONT Digest
For Students of Science and Engineering

PRODUCING METALLIC TITANIUM FOR INDUSTRIAL EVALUATION

Du Pont group research developed a pilot plant with daily capacity of 100 pounds

Du Pont research has just made available to industry what may become one of America's key structural materials, titanium metal. Midway in density between aluminum and iron and with an especially high melting point, silvery-white titanium offers an extraordinary combination of strength, lightness, corrosion resistance and hardness.

Titanium is the ninth most common element. But it has been slow in coming into its own as a metal because of the difficulty of separating it in pure form from its ores.

Men pictured *on this page were members of titanium research team. E. L. Anderson, A.B.Ch., Brigham Young '40; J. B. Sutton, Ph.D.Phys.Ch., West Virginia '35; A. R. Conklin, M.S.Phys.Ch., Georgia '40, are shown inspecting 300 lbs. of Du Pont titanium metal sponge.*

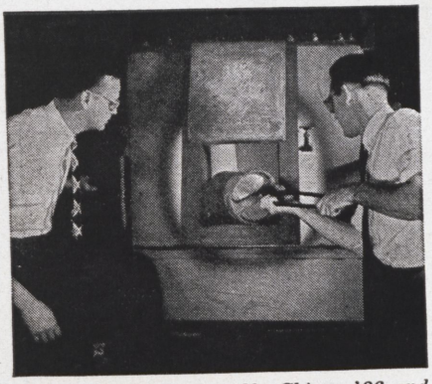
Du Pont scientists first began to probe the possibilities of metallic titanium in the course of their long experience with the titanium oxide pigments. Their research was interrupted by World War II. Meanwhile, the U.S. Bureau of Mines laboratories succeeded in producing the metal for research purposes.

After the war, Du Pont scientists developed a process for the production of ductile titanium metal that can be scaled up to meet commercial demands. The research team that mastered the complex problem consisted of chemical engineers specializing in design and production, as well as chemists and a metallurgist. In September 1948, a pilot plant was opened with a daily capacity of 100 pounds. Titanium metal is now being produced in sponge and ingot form. Samples are available to industrial and college laboratories with research projects in related fields. Studies of methods for forming, machining and alloying are under way.

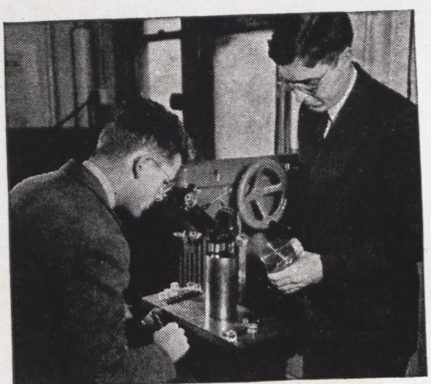
Exhaustive studies will be necessary before the many possibilities of titanium metal can be known. Because of its high ratio of strength to weight, early uses may be in airplane power plants and structural parts. Its hardness and rust-resistance recommend it for railroad transportation equipment, marine power plants and propellers, and food packaging equipment. Its high melting point suggests use in pistons, and its resistance to electric currents points to electronics. Titanium wire may be used for springs and titanium sheet for such highly stressed parts as microphone diaphragms.

Your Opportunity in Research

The commercial development of titanium metal is a typical example of Du Pont research in action. However, the Pigments Department, which worked out the process, is but one of the ten Du Pont manufacturing departments. Each conducts continuous research. Each is operated much like a separate company. Within these "companies"—whose interests range from heavy chemicals to plastics and textile fibers—college trained men and women work in congenial groups where they have every opportunity to display individual talent and capabilities. Who knows what their contributions will mean in the future to science and the world!



C. M. Olson, *Ph.D.Phys.Ch., Chicago '36, and C. H. Winter, Jr., B.S.Ch.E., Virginia Polytechnic Institute '40, removing 100-lb. titanium ingot from furnace in heat-treating study.*



R. C. Reidinger, *B.S.Ch.E., Princeton '47, and T. D. McKinley, B.S.Ch., Worcester Polytechnic Institute '35, making a test of the hardness of ingots of Du Pont titanium metal.*

Power Transmission

Concluded From Page 20

the line decreases directly with the frequency, resulting in higher load limits, transmission efficiency, and better regulation.

Full advantage of low frequency can be realized, however, only when the utilization is at low frequency. If the low transmission frequency must be converted to 60 cycles for consumption, most of the advantage is lost because of limitations of terminal conversion equipment.

Long distance direct-current transmission has also been considered. It offers advantages that look atractive, but present limitations in conversion and inversion equipment make the prospect of any application in the near future unlikely.

In selecting the transmission line voltage, consideration should be given to the present and probably future voltage of other lines in the vicinity. The advantages of being able to tie together adjoining power districts at a common voltage will frequently outweigh a choice of voltage based on lowest immediate cost. If the contemplated transmission line is remote from any existing system, the choice of voltage will follow a complete study of all factors involved.

When choosing a conductor for transmission in the lower voltage ranges the conductor cross section varies inversely as the square of the voltage. Thus if the voltage is doubled, the cross section of the conductor for a given energy loss in the conductor will be quartered. This saving in conductive material for a given energy loss becomes less as the higher voltages are reached. This is due to leakage across the insulators and leakage through the air, commonly known as corona discharge. Corona discharge may be identified by a hissing sound and by its glow which is visible in the dark. Diameter of the conductor will be quartered. This between the conductors, and atmospheric conditions determine the amount of corona discharge in a given situation. The power losses due to this discharge varies as the square of the line voltage above the voltage necessary to start the discharge. In addition to corona discharge, the charging current for a given transmission line increases as the voltage is increased.

Electrical transmission lines are constructed of stranded copper, hollow copper, and aluminum cable with steel reinforcement. Resistance, skin effect, inductive reactance, and capacitive reactance all have to be considered in line design. Electrically, a transmission line may be considered as a series of inductances with a capacitor to ground at each terminal connection. Due to these electrical qualities a given transmission line has a certain time constant. That is, if a pulse of electricity is fed into the input end of the line, a definite time interval will be required for the pulse to reach the other end of the line.

Near strokes of lightning are often dangerous to power lines. Often a cloud may charge a line merely by induction. This charging causes the line voltage to decrease. As the charge is released the line voltage increases, often causing damage to electrical equipment. Often insulators will arc-over due to this increased voltage and then continue to arc when the surge has died. Also, these pulses often cause damage to the first few turns of a transformer. For that reason the first few turns are especially insulated.

After the electrical power has reached its destination, it is distributed at a low voltage. The power companies have developed many automatic circuits for use in case of failure of one distribution system. The control circuits of the power companies are many and varied. Completely automatic switching is provided for in most cases to protect the equipment instantly in case of a short circuit. Electrical power system networks are very intricate and fascinating. For instance a load dispatcher is constantly on duty to switch circuits, correct power factor, etc. This dispatcher communicates with various strategic points by means of carrier current telephony. Since 1886 and the first alternating current system employing transformers at Great Barrington, great strides have been made in electrical power transmission. Today we have three phase transmission systems which further improve service. The price of electrical power has steadily decreased although the actual service has increased. Inexpensive electrical power is dynamic proof of the wonderful age in which we live.

Temperature Ranges Required for Pressure Vessels at BLACK, SIVALLS & BRYSON, Inc. Demonstrate Controllability of *GAS*

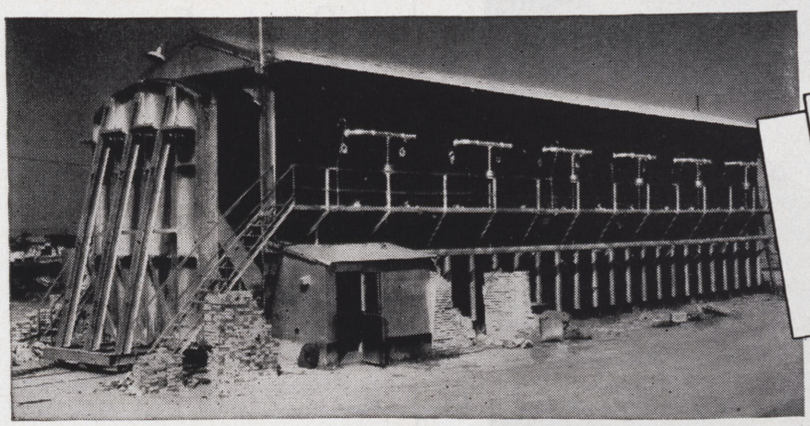
Safety codes govern many of the manufacturing and testing methods for pressure vessels. One of the most important processes, stress relieving, requires precise control of temperatures throughout the cycle—just the type of temperature control to be found in thousands of industrial applications of GAS for heat treating.

Specialists in the manufacture of pressure vessels depend on GAS for heat processing of all types. The pioneering firm of Black, Sivalls and Bryson, Inc., Kansas City, uses GAS in the manufacture of tanks, valves, pressure vessels and safety heads. President A. J. Smith says,

"Throughout the past 25 years we have depended on GAS to provide the exacting temperatures for our work. In many of our plants we have developed special GAS equipment; our large stress-relieving furnace at Oklahoma City is a typical example."

In this large furnace the GAS control system is arranged to provide temperatures up to 1200° F. for any time-cycle required. Automatic regulators and recording pyrometers assure maximum fuel efficiency while the flexibility of GAS is an important factor in maintaining production schedules on vital equipment.

Stress-relieving is just one of the applications of GAS for heat processing. You'll find hundreds of other uses for the productive flames of GAS—they're worth investigating.



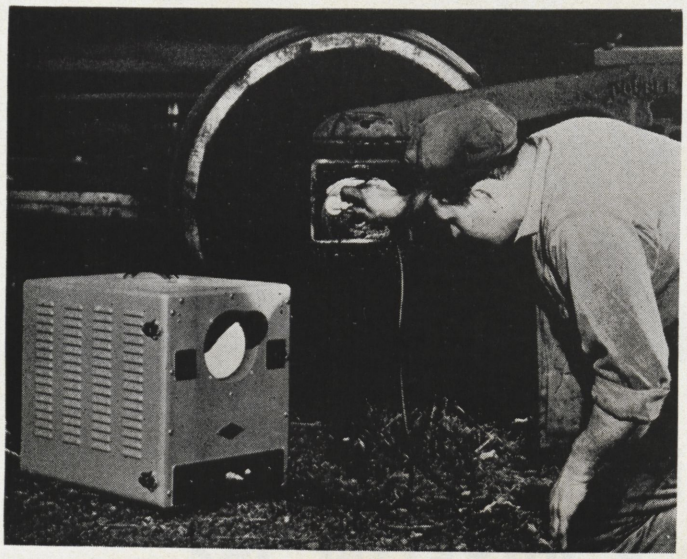
MORE AND MORE...
THE TREND IS TO GAS
FOR ALL INDUSTRIAL HEATING

One of the largest stress-relieving ovens in the United States, this installation at Oklahoma City is 77' long, 12' wide, 18' high—Gas-fired and equipped with recording pyrometers.

AMERICAN GAS ASSOCIATION

420 LEXINGTON AVENUE NEW YORK 17, N. Y.

Continued From Page 11



The Reflectscope, using supersonic energy, being used to check freight car wheels and bearings.

it uses the area of an indentation caused by a predetermined load to measure hardness. A Knoop Indenter which is a diamond so ground that it permits hardness determination of exceptionally hard and brittle materials without cracking or spalling the surface is used. For micro-hardness testing a load of 25 to 3600 grams is employed and the resulting indentation varies from about 2 to 600 microns in depth. A microscope is used to locate an area of a few square millimeters where the indentation is to be made and the load is applied electrically to eliminate the human factor. The hardness is determined by measuring the length of the indentation and using that value in an empirically developed equation. In research work this instrument is invaluable because of the ease and preciseness with which an extremely minute area may be located for hardness determination.

Internal flaws such as voids, segregations, or laminations have long been a source of trouble to manufacturers who machined their parts from castings or rolled shapes. To date X-ray examination has been the only method of detecting these flaws, but X-ray equipment is expensive, bulky, and not to be classed as portable. Another approach to this problem has been made by the Sperry people with an instrument designed to utilize supersonic energy. The Reflectscope uses the same principle that is used in Radar, that is, a pulse

Continued On Page 26

"—The real essence of work is concentrated energy"—WALTER BAGEHOT

Why construction gets better all the time

WHERE ROADS were once built a shovelful at a time . . . today mammoth earth-movers handle a ton of earth at a time. Mobile cranes swing 20 tons at the flick of a switch. Giant crushers grind 150 tons of rock an hour. Traveling concrete mixers place entire batches as they go.

These are just a few of our improved powered tools of today that do a better job of construction *faster* and *easier*. They help provide us with critically needed new housing and business buildings . . . with super-highways and airfields for safer, smoother travel. And these tools are ours today because of *better materials* . . . and continuing research.

Alloy steels, for example, give them greater strength to resist shock and abrasive action . . . stamina to overcome the strain of day-by-day speed-up demands. And modern oxy-acetylene processes for welding and flame-cutting speed production of these better products of better steel.

Carbon is in the picture, too. In the form of electrodes, it's essential both to the production of alloy steels and the making of calcium carbide . . . from which comes acetylene gas for welding. Also, a chemical known as an *amine* provides a wetting agent for asphalt . . . speeding construction by making the asphalt stick more easily and firmly to its crushed rock base.

The people of Union Carbide produce these and many other materials essential to today's better building and construction. They also produce hundreds of other materials for the use of science and industry, to help meet the needs of mankind.

FREE: *You are invited to send for the new illustrated booklet, "Products and Processes," which describes the ways in which industry uses UCC's Alloys, Chemicals, Carbons, Gases, and Plastics.*

UNION CARBIDE
AND CARBON CORPORATION
30 EAST 42ND STREET UCC NEW YORK 17, N. Y.

Trade-marked Products of Divisions and Units include

ELECTROMET Alloys and Metals • HAYNES STELLITE Alloys • PREST-O-LITE Acetylene • LINDE Oxygen
BAKELITE, KRENE, VINYON, and VINYLITE Plastics • SYNTHETIC ORGANIC CHEMICALS • PYROFAX Gas
ACHESON Electrodes • NATIONAL Carbons • PRESTONE and TREK Anti-Freezes • EVEREADY Flashlights and Batteries

Quality Control . . . .

Concluded From Page 24

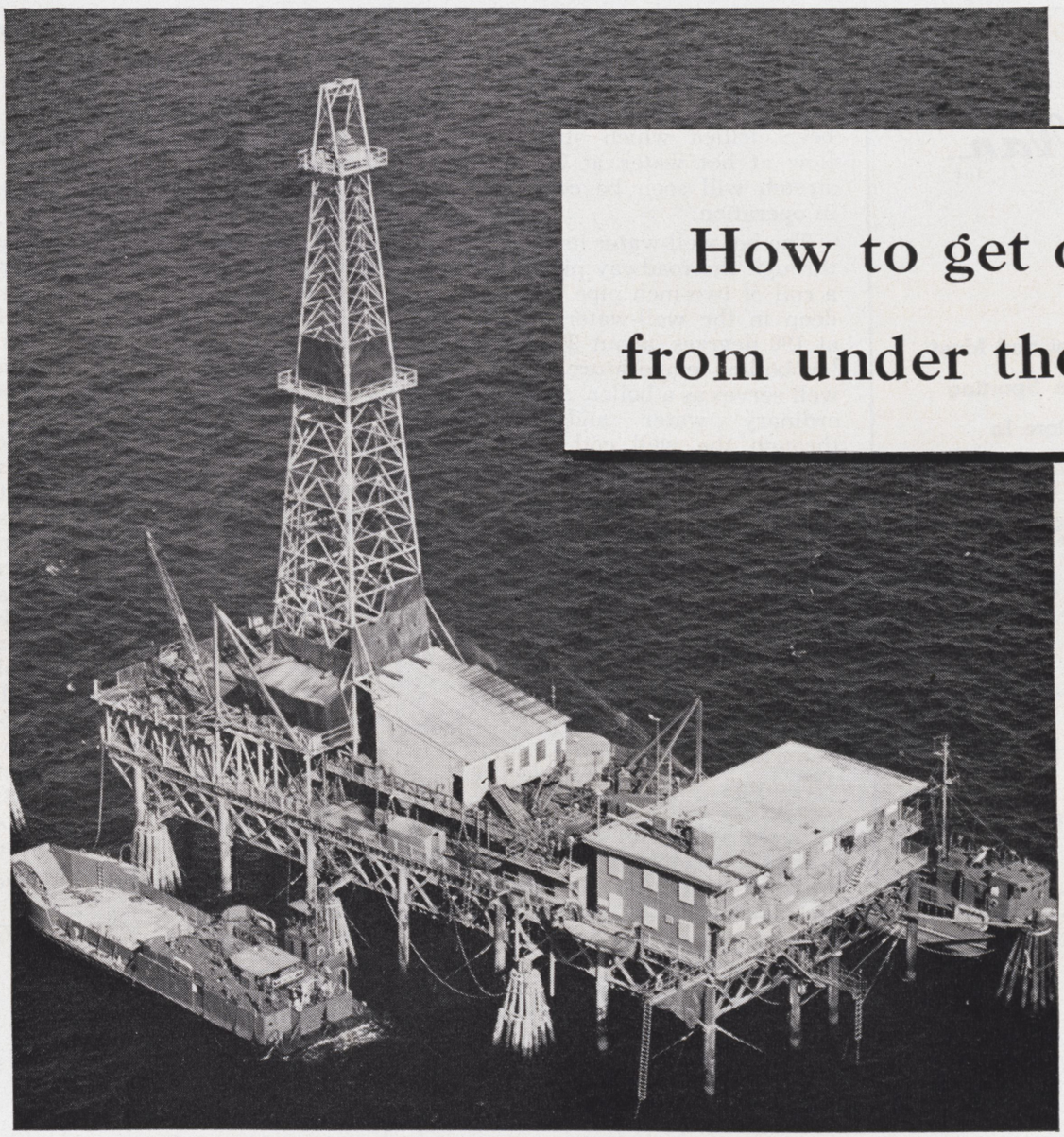
of highly directional supersonic energy is sent into the material and the time required for the pulse to return is measured. A flaw such as a lap, void, or segregation changes the acoustic impedance of the material and causes a portion of the pulse to be reflected at that point. This reflected portion returns to the transducer before the rest of the beam and causes a pip on the screen of the cathod ray osciliscope.

The transducer transforms electrical energy into acoustical energy and using frequencies from 0.5 to 5.0 megacycles sends a pulse of acoustical energy of one to ten micro-seconds duration into the sold. After each pulse the generator stops and the system waits for the returning energy. The returning pulse mechanically stresses the crystal in the transducer and so by an inverse Piezo effect generates a small voltage which is received by the amplifier and fed to the osciliscope.

The sweep of the cathode ray indicator is adjustable to suit the size of the piece being tested. Superimposed on the sweep is a timing pulse that may be adjusted to any convenient scale to measure the distance to the flaw indicated. This timing pulse is calibrated by placing the transducer on a piece of known dimensions and adjusting the pulse until a easily used scale is found.

Energy dissapation within the piece is so small that detection of flaws in a ten foot piece is as easy as detection in a piece a few inches long. If, however, the transducer is placed on a dry surface only a small amount of energy will be transmitted through the junction because of the great difference in the acoustic impedances at that junction. Any liquid that will wet the surface will act as an impedance matching device and will reduce the loss at the junction to a negligible amount. A thin transformer oil, benzene, glycerine, or even soap suds has served satisfactorily.

This method of inspection for subsurface flaws has certain definite advantages; machining a piece from a blank that contains a flaw can be prevented, inspection of parts already assembled can be performed, and defects at a depth of 25 feet can be easily found.



How to get oil from under the sea

OUT of sight of land, miles offshore in the Gulf of Mexico, oil is now being brought from under the bottom of the sea.

Through its subsidiary, the Stanolind Oil and Gas Company, Standard Oil undertook to develop this new source of oil to help fill the growing need of Americans for petroleum products of all kinds. Offshore drilling presented our technical men with brand-new problems. These were solved so successfully that oil hitherto unavailable is beginning to flow to refineries, and products made from that oil are helping meet the public's huge demand.

This is important news to an oil-hungry nation, now and for the future. It is also a tribute to the ingenuity and skill of the Stanolind Oil and Gas Company men who engineered the project. There are places in Standard Oil for other men who, in the research and operating departments, can help find new ways to provide more and better petroleum products.

Standard Oil Company

(INDIANA)

STANDARD

STANDARD SERVICE

 Continued From Page 13

been drilled which struck a good flow at hot water at 390 feet. The stretch will soon be completed and in operation.

The hot well-water itself is not run through the roadway piping. Instead, a coil of two-inch pipe is submerged deep in the well-water, which tests at 190 degrees, about 20 degrees below boiling temperature. In effect, the well serves as a boiler. A pump sends ordinary water and anti-freeze through the well coil, where it is heated or reheated to not less than 160 degrees.

A two-inch pipe runs from the well to the pavement, and then parallel to the road for a distance of about 400 feet. In the pavement slab are embedded 15,000 feet of three-fourth-inch wrought iron pipe, made up into one grid for each of a series of 30-foot road panels. Each of these 15 panels is connected with the two-inch water main by valves.

The pipe carried a coating of asphalt before being laid in the concrete. Wrought iron was used in the installation because of its resistance to corrosion and because its coefficient of expansion is virtually the same as that of concrete, thus keeping the bond and minimizing the danger of cracking the concrete.

The two-inch main and the series of grids comprise a closed circuit through which heated water is pumped, the valves insuring an even flow of water through each grid. Thus the whole eight-inch slab of road concrete is warmed to snow melting temperature.

The pump, thermostatically controlled, automatically begins to circulate the water when air temperature drops to freezing and continues to operate until the temperature rises above freezing. Another pump draws water from the well since it loses its heat value as the cool water flows from the road through the heat transfer coils. Hot water then bubbles from the earth back into the well.

This type of heating, with a boiler used to heat the water, has been increasingly popular in residential, industrial and business construction. During the past few years it has been brought outdoors in many installa-

Continued On Page 30

Mercury, "messenger of the gods," was slow compared with Ultrafax—which moves at the speed of light.

This messenger
delivers a million words a minute

Recently, at the Library of Congress, a distinguished audience saw documents flashed across Washington by a new means of communication . . . and reproduced before them in *facsimile*.

This was Ultrafax in action—a super-fast television communications system developed at RCA Laboratories. Reproductions of *any* mail—personal, business, or military . . . including police descriptions, fingerprints, bank drafts, government records—can travel at 186,000 miles a second!

Material to be sent is placed before an RCA "flying spot" scanner, and transmitted by ultra-high frequency radio signals. Miles away the pictures appear on a picture tube and are photographed. Negatives are ready for printing or projection in 40 seconds.

Eventually, when Ultrafax comes into commercial use, a complete Sunday paper—every word, and every single picture—may cross America in 60 seconds . . . a letter in the twinkling of an eye.

Science at work . . .

Ultrafax is but *one* of scores of major achievements pioneered at RCA Laboratories. This leadership in the fields of science and engineering adds *value beyond price* to any product or service of RCA and RCA Victor.

• • •

Examples of the newest developments in radio, television, and electronics may be seen in action at RCA Exhibition Hall, 36 W. 49th St., N. Y. Admission is free. Radio Corporation of America, Radio City, N. Y. 20.

Continue your education with pay—at RCA

Graduate Electrical Engineers: RCA Victor—one of the world's foremost manufacturers of radio and electronic products—offers you opportunity to gain valuable, well-rounded training and experience at a good salary with opportunities for advancement. Here are only five of the many projects which offer unusual promise:

- Development and design of radio receivers (including broadcast, short wave and FM circuits, television, and phonograph combinations).
- Advanced development and design of AM and FM broadcast transmitters, R-F induction heating, mobile communications equipment, relay systems.
- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.

Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RADIO CORPORATION of AMERICA

World Leader in Radio—First in Television

RESEARCH AND DEVELOPMENT Continued From Page 28

tions to winter-proof sidewalks, airports private driveways and filling station areas. A private road opened last winter near Boston has a 600-foot-long two-lane driveway protected by embedded wrought iron pipe coils.

The natural hot water at Klamath Falls in Southern Oregon is widely used by residents. It has been tapped to heat 400 homes, a swimming pool, two hospitals, a high school, a new office building, several apartment houses, business buildings, and a newly-constructed $3,000,000 veterans hospital. It is used for sterilizing dairy and soft drink bottles. Ranchers outside the town use it to heat their poultry sheds and green houses and to warm drinking water for their stock.

New Atomic Clock Developed

An atomic clock — invariant with age and for the first time independent of astronomical observations — has been developed. The clock is based on a constant, natural vibration frequency of atoms in the ammonia molecule.

This first atomic clock has run with a constancy of better than one part in 20 million and is already being improved. By use of the proper atomic system a potential accuracy of one part in ten billion is theoretically indicated.

Because it is a standard of frequency as well as of time, the new method may be applied to the precise control of radio frequencies, eliminating the "drift" allowances in present bandwith allocations, and thus providing additional room in the ultra-high-frequency bands. The maximum utilization of available space in the radio spectrum depends on the accuracy with which the frequency of an individual station can be controlled. Such control would also make possible the permanent establishment of radio channels on such an exact basis that tuning could be made as automatic as the dialing of a telephone.

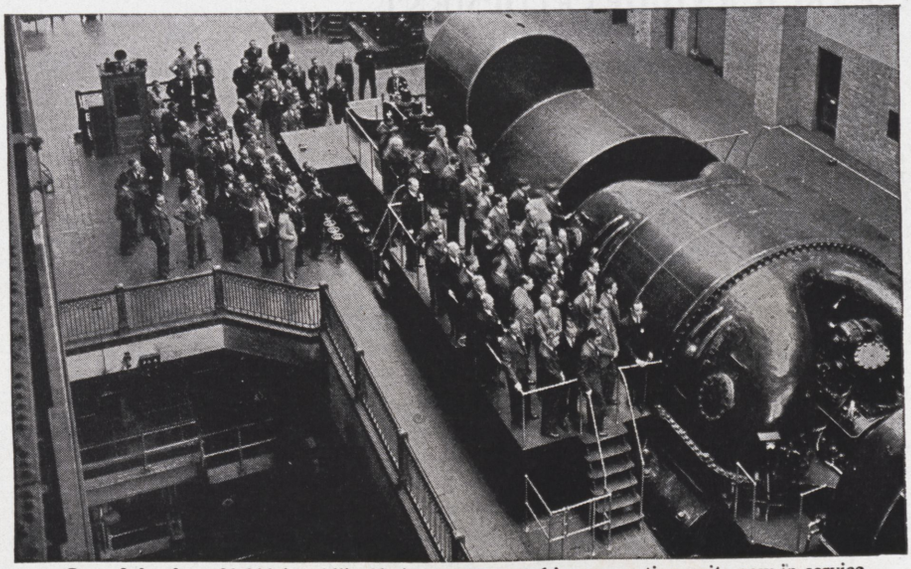
Improvement of the accuracy of the atomic clock will make it useful in several fields of pure and applied

Concluded On Page 32

Change Your Mind...

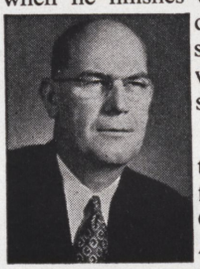
Most of us have, at one time or another

by J. L. SINGLETON
Vice-Pres. and Director of Sales, General Machinery Division
ALLIS-CHALMERS MANUFACTURING CO.
(*Graduate Training Course 1928*)



One of the three 80,000 kw Allis-Chalmers steam turbine generating units now in service in a big mid-western power plant. A fourth unit is being built, and a fifth is on order.

You may be one of those men who knows exactly the sort of work he wants to do when he finishes engineering school. I did. I was going into straight engineering work. But I became a salesman.



J. L. SINGLETON

I've noticed since that it's not unusual for Graduate Training Course students at Allis-Chalmers to change their minds. Here, opportunities have a way of seeking out a man according to his ability. Sometimes these opportunities are in fields that he had not fully understood or considered before. There are so many kinds of work to do here that a man is almost sure to end up in work that will bring him the most in personal satisfaction and advancement.

Opportunities in Selling

For example—sales. Not every engineer is a salesman, but at Allis-Chalmers every salesman is an engineer. Engineering plays a vital part in the sale of a big steam turbine, a cement plant—or even a multiple V-belt drive.

There's a thrill in landing orders—really big ones, such as two 115,000 HP generators for Hoover Dam—all of the rolls and purifiers for the world's newest and most modern flour mill—the world's largest axial compressor for use in a supersonic wind tunnel, or volume sales of small motors, pumps and drives. Orders like these come through teamwork of engineering, manufacturing skill, high-level salesmanship and merchandising. It's good to be a member of such a team.

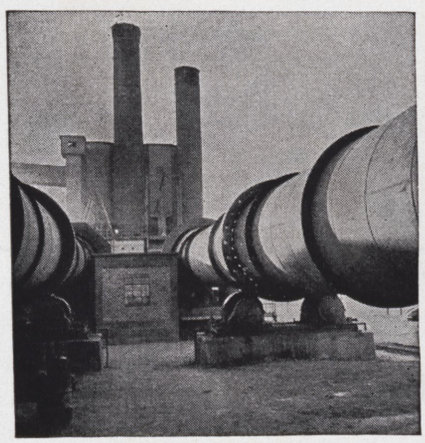
If you have ability and a leaning toward sales work, you'll have plenty of chance to test and develop it at Allis-Chalmers during your Graduate Training Course. Then you take your place in a Coast-to-Coast sales organization—perhaps even in a foreign office.

Many Fields Are Open

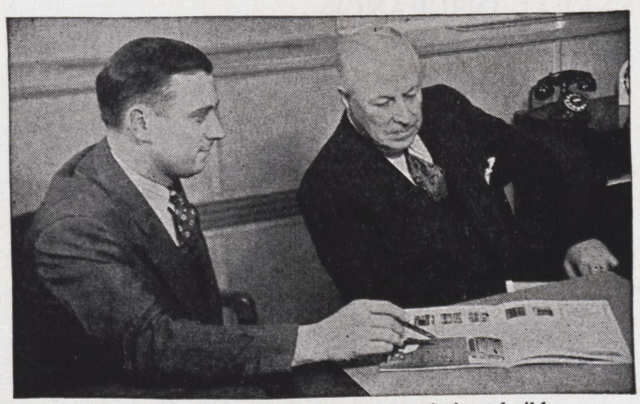
Or, maybe you'll change your mind. Research and development—or manufacturing—or design engineering may prove your field. The point I want to make is, all of these things are open to you at Allis-Chalmers. This company is in intimate touch with every basic industry: mining and ore processing, electric power, pulp and wood products, flour milling, steel, agriculture, public works.

The Graduate Training Course here doesn't hold you down. You help plan it yourself, and are free to change as you go along. You work with engineers of national reputation—divide your time between shops and offices—can earn advanced degrees in engineering at the same time.

Those are some of the things that appealed to me 23 years ago. They're still good.



Rotary Kilns are the most gigantic of all machines. Allis-Chalmers has designed and built kilns up to 475 feet in length, 12 feet in diameter—supplies all basic machinery for complete cement mills and processing plants.



Front-line man on the A-C team that designs, builds and sells basic machinery to all industry.

Write for details of the Allis-Chalmers Graduate Training Course — requirements, salary, advantages. Representatives may visit your school. Watch for date.

ALLIS-CHALMERS MFG. CO.
Milwaukee 1, Wisconsin

ALLIS-CHALMERS

One of the Big 3 in Electric Power Equipment—Biggest of All in Range of Industrial Products

Concluded From Page 30

science. The lengths of the mean solar day, used in astronomical measurements, fluctuate as much as one part in 20 to 30 million, because of variations in the rate of rotation of the earth on its axis. The variation in present time standards, due to those fluctuations, causes errors in the location of heavenly bodies and in studies of their orbits and motions. The atomic clock offers the possibility of an invariant master clock against which the variation in the earth's time-keeping could be measured. An absorption cell on an atomic clock could, for some purposes, take the place of an astronomical observatory.

The principle used in the atomic clock should also greatly improve long-range navigation and communication systems, precise surveying, military map-making, and systems where atoms can serve as electronic components, such as in radio filters, telephone relays, and radar.

The atomic clock consists essentially of a quartz crystal oscillator, a frequency multiplier, a frequency discriminator, and a frequency divider, all housed in two small cabinets on the top of which are mounted a special 50-cycle clock and a waveguide absorption cell.

Ship-Steering Recorder

A new instrument, which automatically and continuously records a ship's course, has been developed recently by engineers.

The "ship steering recorder" marks the ship's rudder position and compass direction, and calculates any deviation from the set course on a moving roll of paper. Nine of the instruments have been delivered to the U. S. Navy for experimental installation in several destroyer and submarine chart rooms. The device can detect an error in course as slight as two-tenths of a degree.

liquid death!

THAT'S WHAT ESTERON 245 IS to tough, stubborn weeds and woody growth.

Weed and brush control along highways, power lines and other utility right of ways is important. Esteron 245, a close cousin of 2,4-D, was developed for weeds found resistant to that well-known compound. It is particularly effective against woody growth, osage orange, gum, brambles, hickory and oak.

An unusual feature of this plant hormone-type weed killer is that it kills by chemical action which accelerates the normal growth processes, resulting in death of the plant.

The development of Esteron 245, following Esteron 44 and 2,4-D, is indicative of the unceasing effort to better things that is characteristic of Dow research.

Dow produces more than five hundred essential chemicals from plants located in Michigan, Texas, California and Ontario, Canada. These include agricultural chemicals, the Dowicides (including PENTAchlorophenol—the chemical that increases the life of wood many years) plastics, which is becoming a by-word in everyday living, as well as major industrial and pharmaceutical chemicals.

They Die!

Esteron 245 destroys or inhibits herbaceous and woody growth, spares grass and allows the establishment of good sod.

THE DOW CHEMICAL COMPANY • MIDLAND, MICHIGAN

New York • Boston • Philadelphia • Washington • Cleveland • Detroit • Chicago
St. Louis • Houston • San Francisco • Los Angeles • Seattle
Dow Chemical of Canada, Limited, Toronto, Canada

DOW

CHEMICALS INDISPENSABLE TO INDUSTRY AND AGRICULTURE

Concluded From Page 15

'37 Mr. and Mrs. Clyde Cromwell have announced the birth of a son, Douglas Henry. He was born on October 12, 1948 and weighed 6 lbs. and 13 oz.

Gaylord Barrick died in Louisville on November 19, 1948. This notification came from his brother, Edwin Barrick, '41, who is now residing in Brazil, Indiana.

'39 John W. Yaw of Sullivan was appointed to be district engineer of the Sullivan district for the Indiana State Highway Commission. He received his B.S. degree in civil engineering. He has held various posts with the department and has been a senior project enginer. During World War II he was an aircraft designer.

'43 Mr. and Mrs. James March have announced the birth of a daughter, Susan May Carolyn, on September 14, 1948. Jim is now in business for himself as the March Equipment Sales Company of Chicago.

'46 Frank Jones is now with the Link-Belt Company in Indianapolis.

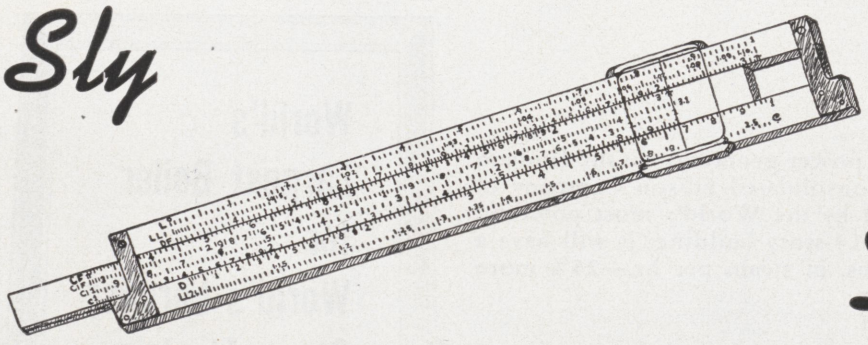
'47 Willis Rose has taken a position with the Roots-Connersville Pump Company in Connersville, Indiana.

Paul Benning has joined the new Terre Haute plant of the Pfizer Chemical Company.

Mr. and Mrs. William Plenge of Monaca, Pennsylvania are the proud parents of a new daughter, Roberta Ann, who arrived November 6 of last year.

'48 Edward Kott and Miss Delores June Carey were married October 23 in St. Stephen's Episcopal Church in Terre Haute. They will live in Chicago. Best wishes from the TECHNIC.

Sly Droolings



By Robert Campbell, sr., c.e.

Here's to the civil lying on the floor, he tried to slam a swinging door!

* * * * *

The new textbook for A.C. Machinery dealing with hot circuits will be 'Forever Ampere.'

* * * * *

A boy attending Sunday School for the first time was being questioned by his teacher. "Now where does God live?" asked the teacher.

"I think that he stays in our bathroom," chirped the youngster.

"Why do you think that?" asked the teacher.

"Well, every morning Daddy goes to the bathroom door and yells, 'God! are you still in there?"

* * * * *

First Husband: "Where did you get that derby?"

Second Husband: "It was a surprise from my wife."

First Husband: "A surprise?"

Second Husband: "Yeah, I came home the other night, and found it on the table."

* * * * *

A pilot had just crashed into a telephone pole after overshooting the field. Wires, pole came down around his ears. He was found unconscious in the wreckage, but as they were untangling him he reached out, fingered the wires and murmured:

"Thank heaven, I lived a clean life—they've given me a harp."

* * * * *

Boy: "Can you read my mind?"
Girl: "Yes."
Boy: "Go ahead."
Girl: "No, you go ahead."

* * * * *

A Texan entered a saloon with his wife and three year old child. "Two straight whiskeys," he said. "Hey Pa," the kid asked, "ain't Ma drinkin'."

First Coed: "An engineer got pretty fresh with me last night."

Second Coed: "Did you get the upper hand?"

First Coed: "Yes, but I couldn't do a thing with the one on my knee."

* * * * *

Gene Hart to State Siren: "I'd like to ask you for the next dance but all of the cars are taken."

* * * * *

Her (at Prom): "Wait here for me, Bill, while I go powder my nose."

Her (three dances later): "Have you been waiting long?"

Him: "No, but I've been looking for you to give you your compact."

* * * * *

A woman's face is her fortune if it runs into a nice little figure.

* * * * *

Al: "What's eating you?"

Jim: "Oh, nothing much, but when your girl friend said she'd dig up a date for me—she wasn't kidding!"

"Miss Helen," said the parson impressively, as he led her into the brook for baptism, "I'se gwine lead you out inter dis heah stream an' wash out every spot o' sin you'se got."

"Lawsy, Pahson," giggled the erstwhile frolicsome damsel, "in that li'l ole hole."

* * * * *

A traveling salesman, slightly inebriated, sent the B. W. the following message: "Having a wonderful wish. Time you were here."

* * * * *

Rose Freshman: "I'm knee deep in love with you."

St. Mary's Coed: "You're third on my wading list."

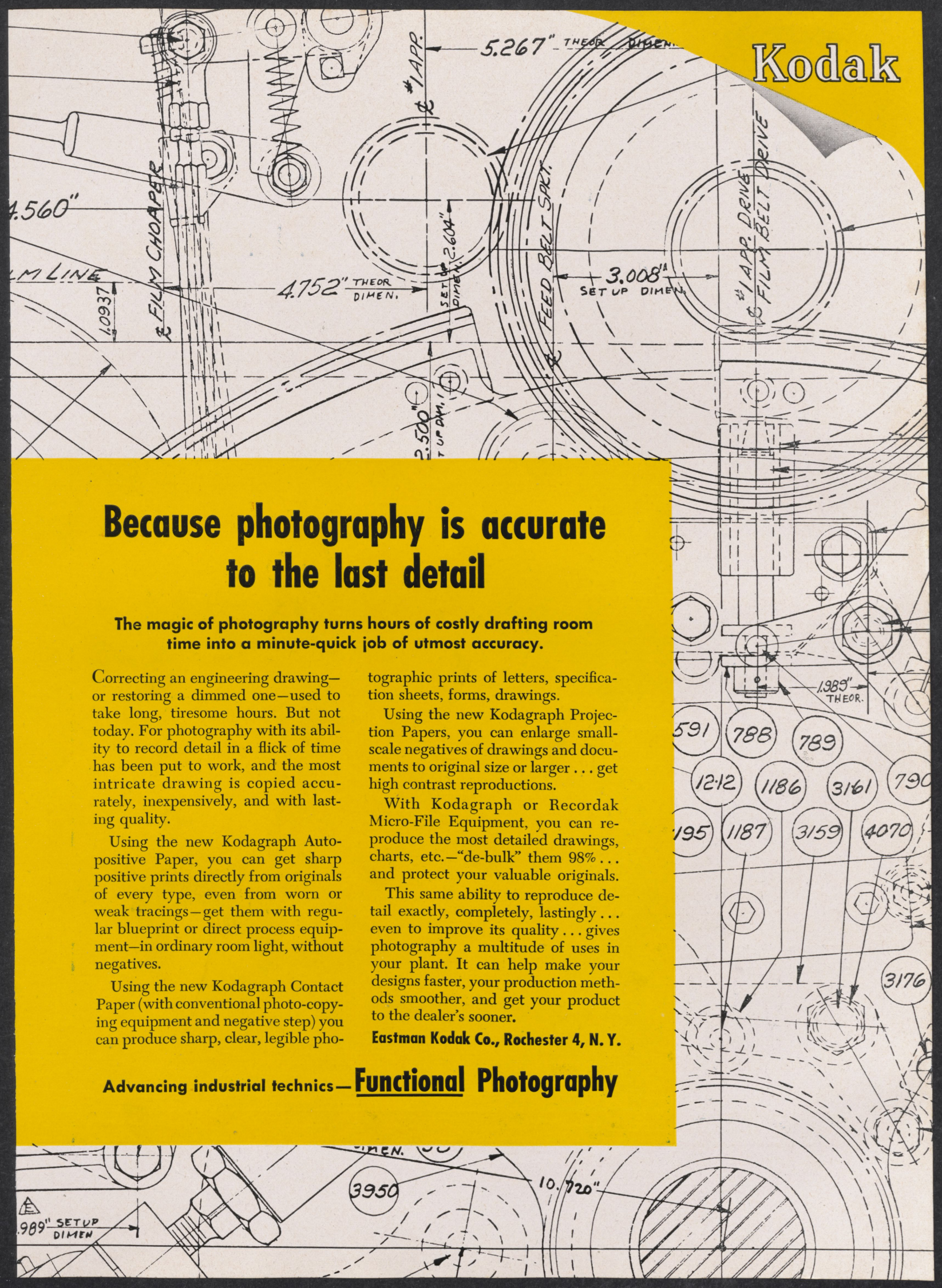
* * * * *

Doc Sousley: "What is all this on your Analyt paper?"

Bright Student: "Those are my Mae West problems."

Doc: "Mae West?"

B. Student: "Yes, I done 'em wrong."



Because photography is accurate to the last detail

The magic of photography turns hours of costly drafting room time into a minute-quick job of utmost accuracy.

Correcting an engineering drawing—or restoring a dimmed one—used to take long, tiresome hours. But not today. For photography with its ability to record detail in a flick of time has been put to work, and the most intricate drawing is copied accurately, inexpensively, and with lasting quality.

Using the new Kodagraph Autopositive Paper, you can get sharp positive prints directly from originals of every type, even from worn or weak tracings—get them with regular blueprint or direct process equipment—in ordinary room light, without negatives.

Using the new Kodagraph Contact Paper (with conventional photo-copying equipment and negative step) you can produce sharp, clear, legible photographic prints of letters, specification sheets, forms, drawings.

Using the new Kodagraph Projection Papers, you can enlarge small-scale negatives of drawings and documents to original size or larger . . . get high contrast reproductions.

With Kodagraph or Recordak Micro-File Equipment, you can reproduce the most detailed drawings, charts, etc.—"de-bulk" them 98% . . . and protect your valuable originals.

This same ability to reproduce detail exactly, completely, lastingly . . . even to improve its quality . . . gives photography a multitude of uses in your plant. It can help make your designs faster, your production methods smoother, and get your product to the dealer's sooner.

Eastman Kodak Co., Rochester 4, N. Y.

Advancing industrial technics—Functional Photography

Always Buy CHESTERFIELD

"Everybody likes Chesterfield because it's MILDER it's MY cigarette."

Linda Darnell

Starring in

"A LETTER TO THREE WIVES"

A 20th Century-Fox Production

"I've been smoking Chesterfields ever since I've been smoking. They buy the best cigarette tobacco grown . . . it's MILD, sweet tobacco."

M. H. Griffin

TOBACCO FARMER
BAILEY, N.C.

(FROM A SERIES OF STATEMENTS BY PROMINENT TOBACCO FARMERS)

MAKE YOURS THE **MILDER** CIGARETTE