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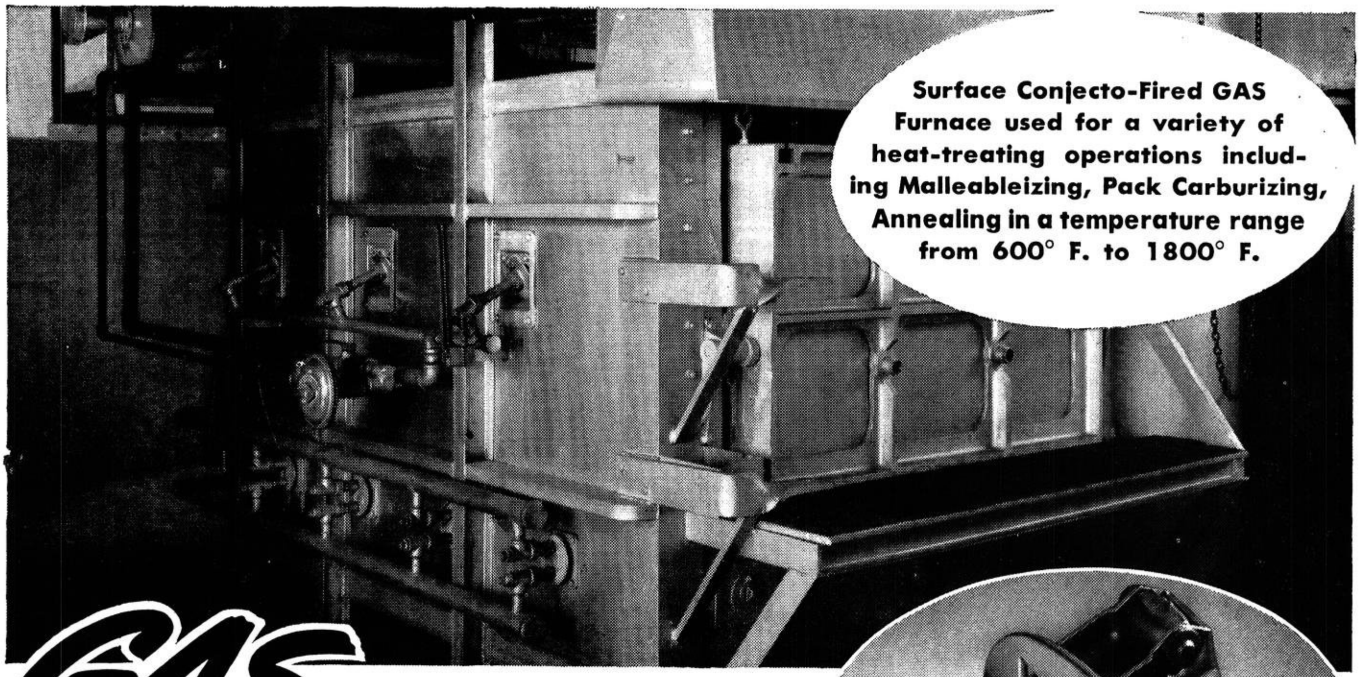
The Wisconsin

engineer

January, 1948

In This Issue:

15¢

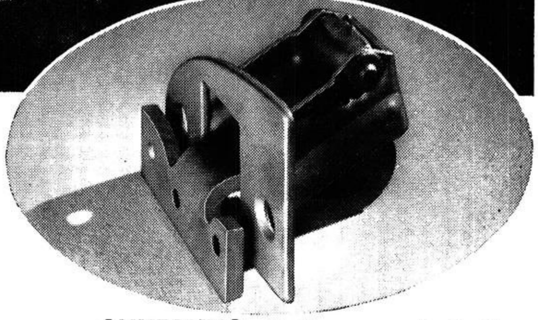


GAS FURNACE PERFORMS MULTIPLE HEAT-TREATING FUNCTIONS UNDER VARIED CONDITIONS

In modern heat-treating, adaptability of equipment and flexibility of fuel are primary influences in any cost-per-piece analysis. As a typical example of the flexibility of the productive flames of GAS, this Conjecto-Fired GAS Furnace is used for a variety of operations without any change other than regulation of the fuel-mix and temperature controls.

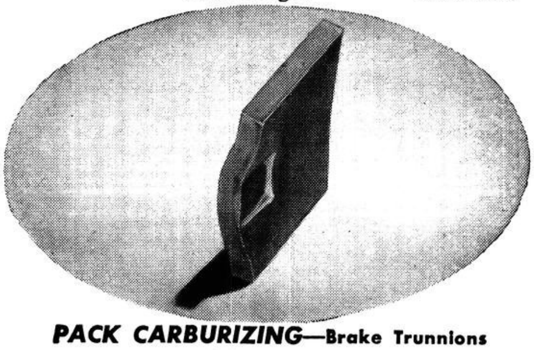
Atwood Vacuum Machine Company, Rockford, Illinois, is equipped to heat-treat pieces ranging from 1 ounce to 1000 pounds, in volume up to 15,000 pounds daily. Their modern Gas-fired Equipment is adapted for annealing, carburizing, drawing, hardening, normalizing, malleableizing, stress relieving, under rigid metallurgical specifications.

Experienced heat-treating specialists like Atwood Vacuum Machine Company use GAS because this flexible, controllable, rapid-heating fuel is so readily adaptable to all types of processing at any required temperature. The productive flames of GAS are so flexible that they can be used for any production-line heating operation, under the most exacting conditions.



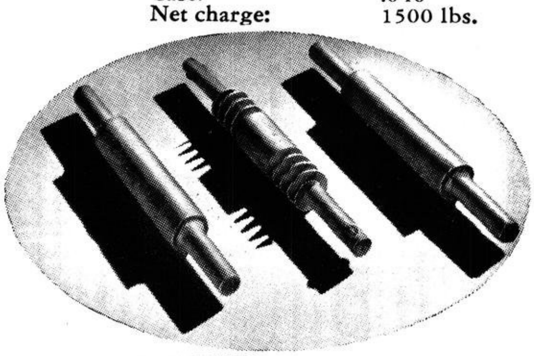
***ANNEALING*—Station wagon body hinge**

Material:	SAE 1020
Temperature:	1600° F.
Time Cycle:	36 hours
Net charge:	6400 lbs.



***PACK CARBURIZING*—Brake Trunnions**

Material:	Hot rolled SAE 1010
Temperature:	1650° F.
Time Cycle:	8 hours
Case:	.040
Net charge:	1500 lbs.



***MALLEABLEIZING*—Trailer Jack Screws**

Material:	Malleable Iron
Temperature:	1750° F.
Time Cycle:	72 hours
Net charge:	10,000 lbs.

AMERICAN GAS ASSOCIATION

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Data and Photos by SURFACE COMBUSTION CORPORATION, Toledo, Ohio, Manufacturers of Gas Heat-Treating equipment

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WISCONSIN ENGINEER

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MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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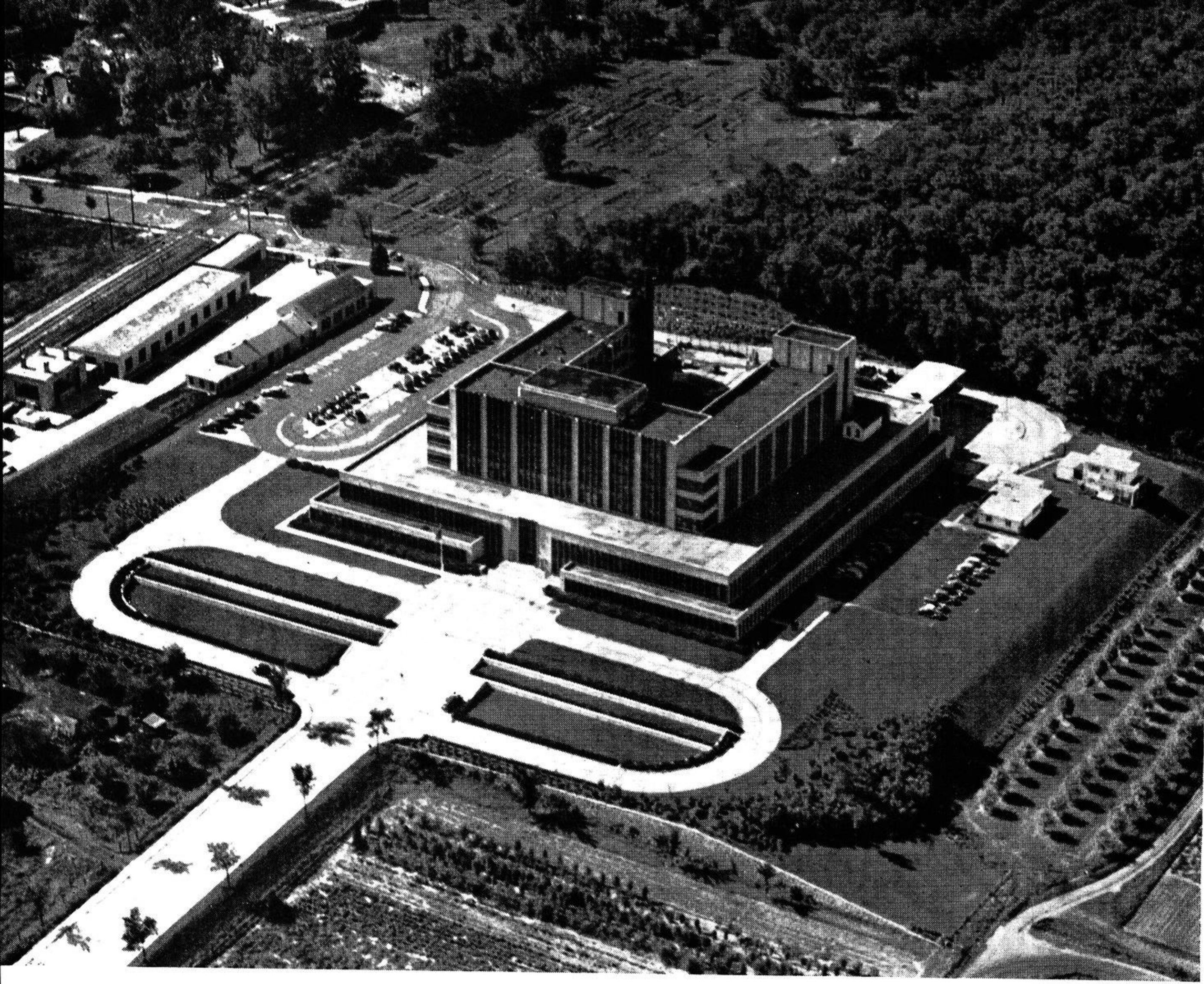
In This Issue . . .

COVER:

Anna Mae Eastlack, "Slip-Stick" Queen of 1947, receives her award from master of ceremonies, Charles Cheney, e'49.
—*Photograph by Art Rezin*



U. S. Forest Products Laboratory

The imposing Forest Products Laboratory is maintained at Madison by the U. S. Department of Agriculture in cooperation with the University of Wisconsin. Research is conducted at the "Lab" on subjects ranging from heat transfer through woods, to low-pressure molding plastics based on wood-waste products. Some of the most elaborate testing laboratories specifically devoted to wood studies are to be found within these walls. The basement of the building contains "cold rooms" for determining the behavior of materials under closely controlled temperature-and-humidity conditions. Forest products industries all over the world have benefited from research conducted here.

WOOD---

an engineering material

by Robert Hacker e'49

—Photographs courtesy Forest Products Laboratory

Edited from a paper prepared by L. J. Markwardt and presented as the Edgar Marburg Lecture at the annual meeting of the American Society for Testing Materials in 1943. Mr. Markwardt has been in engineering research at the U. S. Forest Products Laboratory at Madison for nearly thirty years. At the Laboratory he is in charge of the Division of Timber Mechanics. **—R. H.**

WOOD was among the first structural materials in the primitive world; yet significantly, it still maintains an indispensable place in the modern age. Although today most products are thought of as being made of steel, aluminum, and other metals, there is required to make these modern machines, buildings, and implements a larger quantity and greater variety of wood than ever before. In 1942 in the United States alone there was an annual lumber production of over 32 billion board feet. This is enough wood to lay a mat, 1 inch thick and 240 feet wide, completely around the world at the equator.

Wood users of the world have a wide choice of species, each of which exhibits, at least in some degree, properties or characteristics that are individual to itself. Around the particular properties of certain of these woods has developed a utility and demand for specific uses which has created a substantial world commerce.

The living tree contains great quantities of water that must be removed before the lumber, into which it is cut, is ready for building a home or for many of its other uses. Improved kilns for rapid seasoning of lumber have been developed, but in all the common seasoning methods, such as air drying and kiln drying, the wood dries from the outside in, and care must be taken to avoid serious checking, which is the principal cause of seasoning losses. Newest of the drying methods, known as chemical seasoning, reverses the process by causing the wood to dry from the interior to the exterior. The green wood may either be soaked in a chemical solution or dry chemical may be applied to its surface. In either instance, the wood is in contact with the chemical for a sufficient length of time to permit diffusion of the chemical into the outer zone of the wood surface. The chemical solution lowers the vapor pressure at the surface, while the normal vapor pressure of the moisture at the center of the piece is maintained. Thus moisture moves from the interior to the surface of the timber in response to this vapor pressure gradient, without the necessity of the normal moisture gradient.

Although this method is still comparatively new, it has already won wide acclaim. It has cut seasoning losses in some large timbers down to less than 5%. The losses formerly ran from 40 to 60%. Not only have these losses been cut, but the drying time has also been decreased. Douglas fir timbers, 6 by 16 inches in cross-section, that require a year or more to air season can be satisfactorily chemically seasoned with urea in 34 days.

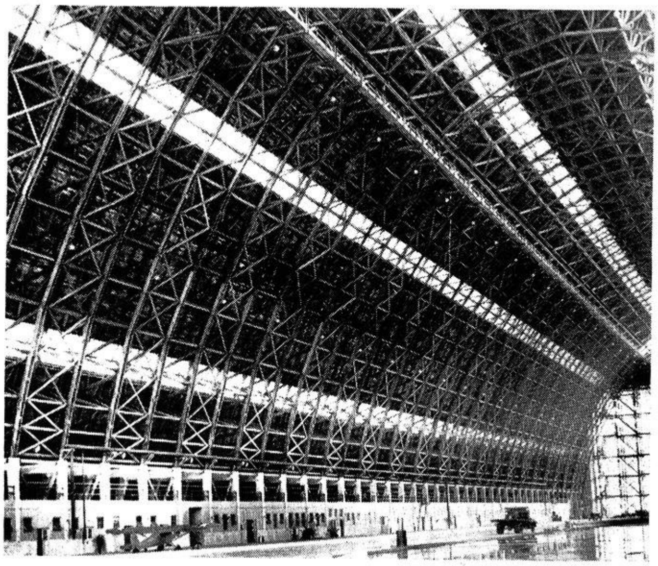
Laminated wood arch construction provides attractive buildings with large unobstructed floor areas.

One of the most important recent innovations in the lumber field was the use of timber connectors. These were introduced into the United States in 1930, and their possibilities were quickly recognized. Connectors are devices used in conjunction with bolts to increase the efficiency of joints in wood members. The split-ring type fits into pre-cut grooves; the alligator type is passed into the wood between the members to be joined; other types fit into bored recesses. Whatever the type, they all serve to reinforce the joint by providing effective shear resistance between the members. Modern metal connectors have been used in a great variety of structures and structural members. These include timber trusses of 200 foot span, such as were used in buildings of the Golden Gate International Exposition; timber bridges of various kinds; and radio and forest lookout towers.

During the recent war the Navy found itself short of long oak timbers. It was necessary to provide a substitute. An adequate one was found in laminated construction.

This refers to two or more layers of wood glued together with the grain of all layers approximately parallel. The laminations may vary as to species, number, size, shape, and thickness. The properties of laminated members are essentially the same as those of solid wood, but laminated members, if well constructed, are usually more uniform in strength properties and less apt to change shape with variations in moisture content.

A recent development in timber structures is the use of laminated members made in straight or curved form by bonding seasoned and properly surfaced boards with a water-resistant glue. A principal application is the construction of wood roof arches which have greater strength and efficiency and better appearance than were previously possible.



The timber trusses used for blimp hangars are a striking example of connector construction.

A composite construction, in which a creosoted timber base is overlaid with a lightly reinforced concrete mat, has been successfully employed in bridge decks and for other heavy duty floors for some years. Special triangular shear keys are employed to secure adequate bond of the two materials. Advantages are that joist and stringer systems are not required, and that the timber base, which can be simply laid, provides the required tensile strength, and during construction serves effectively in facilitating the remainder of the work.

A form of structural unit gaining favor is the so-called "rigid frame." This consists essentially of a wood frame covered with a sheet material, usually plywood. The sheet material may be nailed to the frame or may be bonded with casein water-resistant glue. Casein glue has the advantage that it can be applied cold and that it does not need to be applied immediately after mixing. After the application of the glue, the cover is nailed to the frame. The principal function of the nails in this case is to apply suitable pressure while the glue sets. Obviously, the stress analysis of rigid frames is complicated. So far, but little research has been done to demonstrate their strength and rigidity and to develop design methods.

Important Glues

Perhaps no single factor has been more responsible for the significance advance in the field of modern wood construction than the development in glues and gluing technique. Most of the glues fall into one of three general classes. They are the casein glues, blood-albumin glues, and synthetic-resin glues. The basic constituent of the casein class of glues is the dried casein of milk. It is combined with alkalies or alkali-producing chemicals which, when mixed with water, dissolve the casein. The addition of lime or other materials causes the glue to set and later retain a part of its strength, even when saturated with water.

Previous to the development of the synthetic-resin glues, the blood-albumins were the most water-resistant and durable of the woodworking glues. Blood-albumin glues are formulated by the user, usually from dried animal blood. The most water-resistant glues of this type are a combination of blood and formaldehyde. Hot pressing is necessary, however, to develop their full strength.

The synthetic-resin glues may be classified as thermosetting or thermoplastic. The resins of the thermoplastic class are those that soften whenever the temperature is raised above the softening range that is characteristic of each particular type of resin. A thermoplastic resin must be first heated and then cooled under pressure in using it as an adhesive. In the resins that belong to the thermosetting class once the condensation reaction which is hastened by heating is completed no subsequent softening occurs even though the temperature is increased.

Multi-ply Wood

An important product of the wood industry is plywood. In plywood, the orthotropic structure of wood is further diversified by a reorientation of the material. Plywood consists of a combination of three or more sheets of veneer, with the grain of alternate plies usually at right angles. As compared with solid wood, the chief advantages of plywood are an equalization of strength properties along the length and width of the panel, greater resistance to checking and splitting, and less change in dimensions with changes in moisture content.

Aside from the use of wood and plywood in a more or less natural form, five other types of products should be considered as engineering materials: (1) resin-impregnated wood (compressed or not); (2) wood plastic; (3) laminated paper plastic; (4) heat-stabilized compressed wood; and (5) insulation and building board.

When wood is impregnated with synthetic resin and subjected to heat, new properties are imparted to the material. This is due to the fact that the resin-forming materials enter the cell-wall structure and become chemically combined throughout the cell wall. By this treatment the product is made highly resistant to swelling and shrinking. Also, this treatment gives a marked improve-

(continued on page 24)

LOGIC is wonderful.

World War II wreaked widespread destruction in all those nations who played the role of battlefield or bomb target. Homes, railroads, plants, power installations, communication lines, mines, all went up in smoke and millions of the trained minds and muscles, which might have gone into their reconstruction, were destroyed with them. Thousands of students are now crowded into the overtaxed facilities of American engineering colleges. Every four months, a large number of them complete their four-year grind and seek some place to apply that absorbed "know how," as well as to achieve practical experience in their respective fields.

One plus one equals two.

The above facts add up to an inescapable conclusion. Why not take a job in some foreign country, gain experience, and have a hand in the reconstruction of a war-torn world?

In the past four months, the **Wisconsin Engineer** has sought the answer to that seemingly simple question by surveying the representatives of fifty-eight countries.

In order that the reader understand the answers received from a cross-section of the responses of the foreign representatives, the questionnaire sent out by the **Wisconsin Engineer** is reproduced below.

Gentlemen:

The Wisconsin Engineer, undergraduate engineering college magazine at the University of Wisconsin, is endeavoring to compile a series of articles on opportunities for American engineers abroad.

We would, therefore, appreciate response to the following questions at your earliest convenience.

1. Is there available employment in your country for the following classes of engineers?
   a) Electric Power
   b) Communications and Electronics
   c) Mechanical
   d) Civil
   e) Chemical
   f) Mining and Metallurgy
2. Is there available employment for people interested in research in any of the above fields?
3. If such employment is available,
   a) What are the minimum experience requirements?
   b) Are engineers, who have just completed their schooling, eligible?
   c) What is the relative salary range for engineers in the above groupings? (American dollars.)
   d) How does the cost of living compare with that in the United States?
   e) What arrangements are made for the families of the above engineers?
   f) Are there any difficulties involved in obtaining work visas?
   g) Are the travel costs covered by your government or other prospective employers?

We would also appreciate any published material or pictures and cuts, depicting the technical reconstruction now being carried on in your country and the life of the people.

Very truly yours,
Gerald Estrin

In general, the results of the survey fell into the following categories:

A—Fourteen countries were definite in their response that there is no available employment for foreign engineers.

B—Eight countries indicated some possibility of employment.

C—Thirty-six countries showed by either not answering or by indicating their inability to answer the questions that there is no great need for foreign technical personnel in those places.

D—Our State Department also indicated a deplorable lack of information along these lines.

In toto, the **Engineer** received 37 responses to the survey.

It is of some interest, in attempting to understand the reasons for this state of affairs to quote a sampling of the letters in the above categories.

A sample of the letters received in answer to the Engineer's questionnaire.

GROUP A . . . NO JOBS

Brazil . . . . . "Foreign lawyers, engineers, doctors, and dentists cannot practice in Brazil, unless they become Brazilian citizens and revalidate their diplomas. A permanence of 10 years in the country is required for citizenship."

Mexico . . . . . "Present Mexican labor regulations prohibit the employment of foreigners in Mexico, in any field, except where a Mexican citizen . . . . . cannot fill a specialized or technical job that may be urgently needed."

Italy . . . . . " . . . , I regret to inform you that the present situation does not even permit the employment of Italian technicians and engineers."

Norway . . . . . " . . . there is no available employment, for the time being, for foreign engineers in Norway."

Iceland . . . . . " . . . there is a sufficient number of Icelandic engineers available . . . "

China . . . . . " . . . contrary to the general impression, the Chinese Government is not making an organized attempt to recruit engineers . . .
" . . . for various complicated reasons, we have not been able to carry out the reconstruction program as planned."

Switzerland . . . . . "For our own purposes, we already have too many, so that we have to send our own engineers to foreign countries."

Siam . . . . . " . . . it is the policy of the Siamese government to employ Siamese nationals as far as it is practicable."

Luxembourg . . . . . " . . . there are no openings for foreigners in Luxembourg. Tourists are welcome . . . but the economic situation of the country following devastation of the northern agricultural regions during the Battle of the Bulge, does not encourage foreign workers."

Hence, there are a few points that make our logic illogical. Italy, Norway, and Luxembourg truly require reconstruction, but these same countries have not the strength to really tackle the job. China is still in the throes of civil war, and guided by an apparently inefficient government. Brazil and Mexico retain in their statutes the deep-seated resentment of the "Yankee Dollar," that seems to be widespread "south of the border."

GROUP B . . . JOBS

Of the eight countries who indicated some possibility of employment, many showed some "catch" that made their offer leave the class of the golden opportunity of the century.

Sweden . . . . . "Engineers and engineering students desiring trainee employment in Sweden are advised to write, **in duplicate** (their emphasis . . . Ed.) to the American-Scandinavian Foundation, giving full particulars about themselves and particulars as to what kind of position they wish. In the field of Electric Power, there might be opportunities at the 'ASEA' in Vasteras, the equivalent of the 'General Electric Company' of the United States."

"For Americans, who have no knowledge of the Swedish language, it would be almost necessary to start working as a laborer or workman. For trainees, about $70-$85 (wages . . . Ed.) per month. In purchasing power this would correspond to some $100-$110 in the U. S. Trainees must pay their own travel expenses."

Syria . . . . . "Available employment exists on a very small scale for engineers as specified in your classifications 'a' to 'd.' Salaries vary from $700 to $1,000 monthly When the government engages a foreign engineer, it usually takes care of providing all facilities for his family."

(continued on page 28)

Meet Your Department Head

Prof. H. A. Peterson

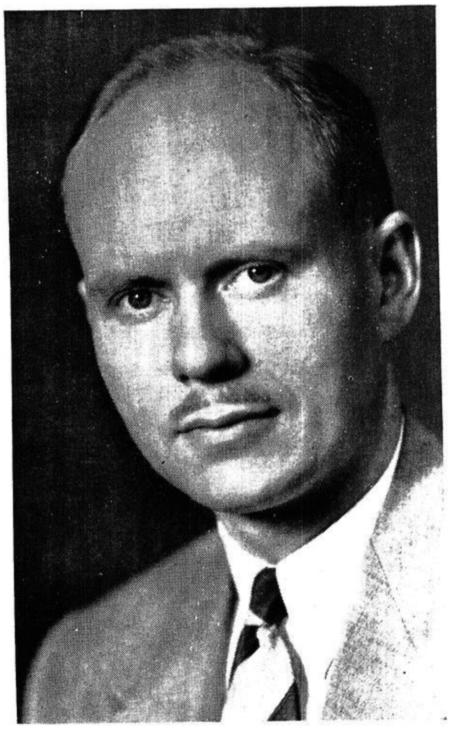
by William M. Haas c'49

"Curiosity is a potent motivator," remarked Professor H. A. Peterson, as he explained his early interest in electricity. The Chairman of the Department of Electrical Engineering was referring to his interest in crystal radios when he was in high school. To satisfy this curiosity, he enrolled in the electrical engineering course at the University of Iowa. Basic subjects were essentially the same then as now, but the advanced studies were undergoing a change at that time. Operational circuit analysis, now extended to a great variety of engineering problems, was just being introduced. Television had become of some general interest, and Iowans were learning about it by using mechanical disk type apparatus.

That was in the lush year of 1928 when students were sure of placement upon graduation. Then came '29, and the picture was changed. It was almost impossible for engineering graduates to get jobs (as it was for anyone). Many engineers eventually found employment in other lines, "just to get by until . . ." But these men became so established in other fields that when the demand for engineers again developed, they found that it was too late to go back to the profession they had studied for in school. Under these circumstances, Professor Peterson felt very fortunate when he was granted a research assistantship upon graduation in 1932. Therefore, he stayed at Iowa to investigate the output time lag of the photo-electric cell. He received his Master of Science degree in 1933, and began work toward a doctorate, but left school in 1934 to accept a position with General Electric.

His first assignment was testing oil burning furnaces. Then he was transferred to the electrical research section of the Pittsfield Works laboratory, where he did testing and developmental work for two and a half years. His objective was the more efficient use of insulation. In May of 1937 he went to the Analytical Division of the Central Station Engineering Divisions at Schenectady, where he was engaged in electrical engineering application and consulting work for large utilities. The work of this division was to apply analytical tools to engineering problems. It was here that Professor Peterson helped design, build, and use analytical machines.

In September of 1946 he came to the University of Wisconsin, and a year later was appointed Chairman of the Electrical Engineering Department. He strongly feels that the tie between industry and education should be strengthened, and advocates that more time and encouragement be given to departmental research as a means of attaining that objective. Another aid to attainment of that objective is to further strengthen the course offerings and opportunities at the Graduate level. His philosophy, built around these ideas, plus the prospects of a new building, should permit continued advancement. The department is adding new courses and hopes to add to the staff so as to be in a better position to meet the student load requirements and to promote progress towards achieving these goals.

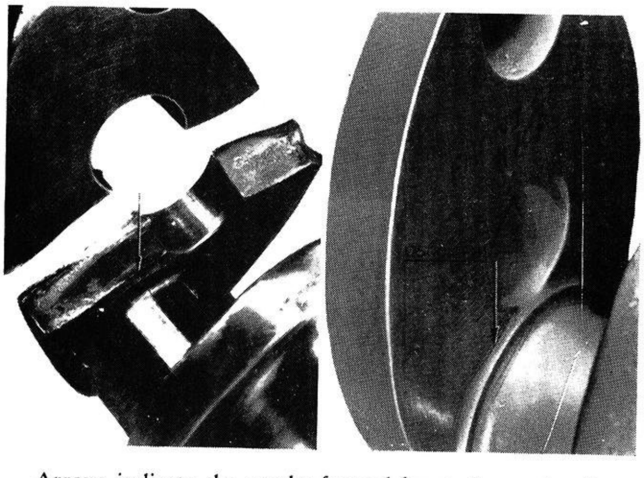


Referring again to the changes that fifteen years have brought about, Professor Peterson believes that the present opportunities for the engineer are now much greater in scope, not merely because of improved economic conditions, but mostly as a result of the great expansion of the engineering field itself. Today society recognizes the importance of the engineering profession more than at any time in the past. As a result, engineers currently command a high prestige that implies a responsibility to society greater than ever before. The engineer has a great opportunity in helping to meet this challenge successfully. It is well for him to bear this in mind as he proceeds methodically with his solutions of technical problems.

DESIGN EN

MECHANICAL design is the field of engineering in which ideas are translated into physical form. All branches of engineering, whether mechanical, electrical, or chemical, and all the various phases, such as research, development, or production depend upon design for the execution of engineering projects. In most cases the relative success of a project hinges upon the ingenuity and judgment of the engineer who is responsible for the mechanical design. Thus design ability is a valuable asset to an engineer in any field, and this ability may represent the difference between a successful engineer and a mediocre engineer.

A discussion of design in general covers a tremendously broad subject. Relatively few engineers are engaged specifically in design, but on the other hand practically all men who enter engineering work are continually associated with design problems, either directly or indirectly. For instance, test engineers in most cases obtain data regarding the performance or strength of a machine or machine part primarily for transmission to the design department. Engineers who specialize in theoretical or mathematical analysis are usually assigned design problems and calculations. Electrical or chemical engineers are often faced with the problem of constructing special laboratory equipment for research projects. One of the main functions of metallurgical engineers in industry is that of supplying the design department with information regarding the properties of materials with which it is working. Even in the executive field the chief engineer must appraise new designs and design policies and must direct the entire research or development program towards obtaining the solution to important design problems.



Arrows indicate the cracks formed by strains under the brittle "stress-coat" and the ultimate failure at that point. Information derived from "stress-coat" tests is used in compensating design.

In order to consider mechanical design as a career in engineering it is necessary to analyze the function of the design engineer in modern industry. While there is great variation between the practices of the various branches of industry, the entire pattern is gradually changing. Design is slowly receiving the recognition to which it is entitled. Industrial corporations cannot afford to tool up and manufacture a model which will fail in service and alienate the customer. Neither can they afford to spend the time and money which is consumed in blind make-and-break procedure. The design must be right, and it must be evolved as scientifically as possible. A perspective of the entire machine design picture can be obtained by briefly reviewing the history of design from the early days of the steam engine to the present.

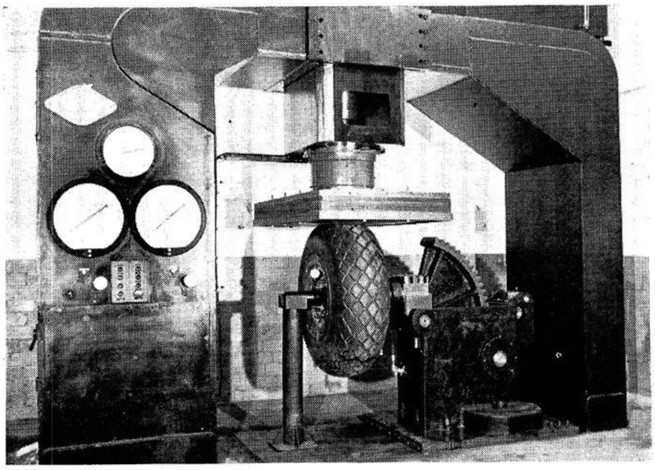
Machine design years ago was the science of designing machines on the basis of a few fundamental theoretical and empirical equations. In practice this science was tempered with considerable intuition, experience, and with a generous factor of safety. Often much of the actual designing was done by draftsmen with little or no knowledge of stress analysis. Machines in general were heavy and slow. The problem of fatigue failure was in its infancy. Safety, although important, did not assume the proportions that it does today when the cost of a mechanical failure on an automobile, airplane, or high speed train may be measured in many human lives. A further factor was the comparatively limited production which did not justify great refinement in the design stage. Design materials were primarily cast iron and steel, and manufacturing processes usually involved only routine machining operations. Testing of the finished machine was often left to the customer.

Unfortunately design practice in some industries conforms rather closely to the foregoing description, and progressive design practice is either not needed or not desired. In other industries, however, the responsibility of the design engineer has increased tremendously in recent years. It is becoming more and more apparent that an economical and dependable design involves rational analysis and the intelligent interpretation of quantitative test results. This is especially true in designs where the reduction of the size and weight of parts to a minimum is a prime con-

GINEERING

by R. J. Harker, Ass't Professor, ME Dept.

—Photographs courtesy of SAE



This special hydraulic ram is used to subject aircraft wheels to their static requirements. The radial load is measured by an Emery-Tate cell.

sideration. Design problems are further complicated by the hundreds of alloys, both ferrous and non-ferrous, the plastics, and the variety of manufacturing processes now available to industry. In addition, design is no longer restricted to machines in the strict sense of the term. Practically any part which is now mechanically produced on a production basis requires the services of a competent designer or design department.

Along with the increasing complexity of the design problem comes the development program for a particular design. Tentative designs must in many cases be paralleled with preliminary testing or new processes of manufacture, and modified thereby. Information obtained from all sources—from tests, calculations, considerations of cost, machining, and service factors must be intelligently integrated into a finished design. This broad field of integration now replaces the former limited field of machine design. It might better be called design engineering.

Of all the changes which have taken place, there are several which seem to be most important from an engineering point of view:

(a) The application of theoretical stress analysis to an increasing number of problems that arise on the drafting board.

(b) The development and use of experimental stress and strain measuring techniques which permit a quantitative approach to the general stress picture.

(c) The increasing appreciation of the fatigue problem, embracing the entire field of vibratory and dynamic analysis and of experimental fatigue testing.

From the foregoing it can be seen that design is no longer purely a drafting proposition. The horror of being kept on the "board" was once justified to some extent, but

R. J. Harker, m'38, MS'41, returned to the University of Wisconsin in March, 1946 after six years with the Hamilton Propeller Corporation of Hartford, Connecticut. During his employment with the firm he conducted extensive experiments on the vibrations of variable-pitch propellers while in flight. He is now an Assistant Professor in the Mechanical Engineering department, teaching machine design.

the incorporation in design work of analytical and experimental projects has created many opportunities for engineering talent in the prosecution of a design project. In fact, the design field perhaps offers more opportunities to the engineer for the application of his technical training and ability than most others.

The activities of an engineer in design depend of course on his initiative, experience, personality, and the responsibility of his position. In general, though, his work will involve the following:

(a) Analysis of a problem. He must think through the various aspects of a design and decide which points are critical, what calculations of loads, stresses, deflections, or natural frequencies are necessary. He

(continued on page 36)

Our Useful Temporary Buildings

by Robert Hacker e'49

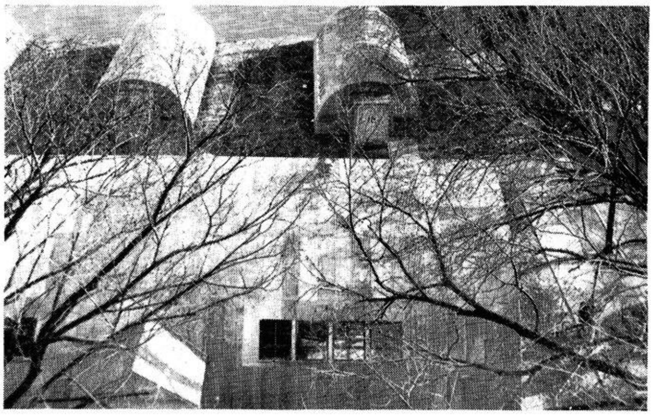
MUCH has been said about the value and usefulness of the temporary buildings that have been erected on the campus. Although they don't improve its looks, there has been shown a definite need for them.

Among the buildings that have been put up, there are several that have been placed under the jurisdiction of the Engineering College. Through the use of these buildings the College has been able to extend and improve the existing laboratory and classroom facilities.

Two of these buildings are being used by the Electrical Engineering department. One of them, T-7, was erected behind the already existing dynamo lab., and it is being used as an electric circuits lab. Through the use of this Transite type building the congestion in the dynamo lab. was greatly reduced. The other building used by the E.E.'s is T-23. It is located west and to the rear of the M.E. Building. Mr. Koehler and the Communication section are using this building both as a lab. and for classrooms. The labs. are being rapidly developed for the various phases of electronics. This is a 6,500 square foot structure with two classrooms, three laboratories, three research rooms, a workshop, and five offices.

The Chemical Engineering department also has two temporary buildings for its use. They are both of the Quonset type. The first one, Q-14, is north of the Chemical Engineering Building near the lake. It is being used for unit operations and shop work. The second one, Q-15, is located north of the Education and Engineering Building and work is done in chemical kinetics. Recently a new distillation tower was installed in this building that allows the fractional distillation of samples as small as 2-5 c.c.

Coffee hours in the Breese Terrace cafeteria.
—*Photograph by J. Kroot e'48*



Upper campus Quonset huts as seen from atop the Historical Library.

In building T-25 advanced laboratory work in combustion is being done. Eventually it will house a small wind tunnel and a test cell for testing automobile engines. This is the building that is located between the M.E. and the Mining and Metallurgy Buildings.

An addition to the old saw mill at the rear of the Mining and Metallurgy Building is T-26. Here 8,000 square feet has been provided for the new home of the foundry. When the building has been completed, the foundry will be moved out of the M.E. Building. This will allow more classrooms to be built in the M.E. Building itself. The foundry is now in a two story room, and present plans call for a floor to be laid at the second floor level. This extra space can then be converted into classrooms.

Recently a research grant was made to the University by the Four-Wheel Drive Co. for truck research. Much of this work will be done under Mr. Easton in T-27. This building is directly to the east of the Mining and Metallurgy Building.

A building that is under the jurisdiction of the Engineering College and is used by both "hill" and engineering

(continued on page 22)

Positive Displacement Compressor

by R. H. Pipkorn m'49

—Photos courtesy Pesco Division of Borg Warner Corp.

AIR under pressure is required by many industries in various applications. Many have looked to the Roots type compressor because it is a positive displacement compressor, that is, it delivers a given quantity of air for each revolution regardless of the operating speed. This type of compressor has been associated most closely with the Diesel engine, but numerous other industries also depend on it for their requirements.

All of the numerous designs of Roots type compressors have the same basic parts, but design characteristics make them unique. The basic parts are illustrated in Figure 1. The housing has two parallel bores running the entire length. Inside these bores, the rotors, carried by the bearings in the end plates, revolve "in mesh." Actually there is no contact between the rotors, but they are kept revolving in their relative positions by a set of gears which have very little backlash. Port openings in the housing allow the air to enter and leave.

The air is not actually compressed inside this compressor. It enters the inlet port because of atmospheric pressure and is helped by a partial vacuum produced. A volume of air is trapped between the rotor and the housing and carried around the outside to the outlet port (Figure 1). Here the air is "piled up," giving the required pressure. The efficiency of the compressor depends on small clearances between rotors, between rotors and housing, and small end clearances between rotors and end plates. The unit is rated by the cubic feet it delivers per minute and the pressure developed.

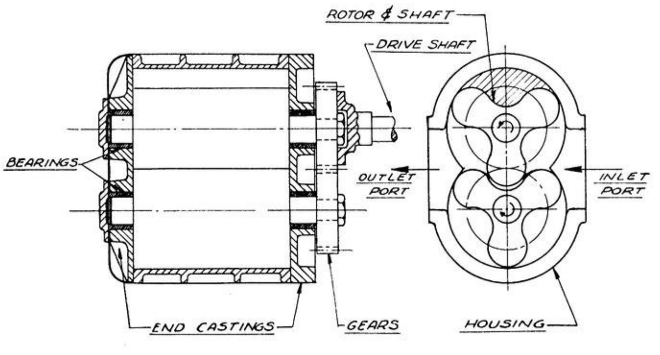


Figure 1 — Main parts of the Roots type supercharger using the three lobed rotor. Shaded area shows trapped air being "compressed."

Varieties of design are so numerous that only a few of the better known designs can be investigated. Figure 2 shows another common shape used in rotors, the two-lobed rotor. It gives the maximum volume of air per revolution. Other variations of meshing shapes are employed (Elliot-Lysholm compressor). The sudden opening of the air chamber to the outlet port as the rotor revolves causes noisy operation. To overcome this, helical rotors are employed, which open the chamber gradually to the outlet port (General Motors and Roots-Connersville compressors). This helical rotor also eliminates any pulsation in the air stream. However, a disadvantage of this rotor is the cost of production. The ports need not be located on the sides of the housing but may be located in the end plates, both on one end, or one on each end. Various kinds of bearings are employed, plain, ball, and roller. Various kinds of drives are supplied for specific uses, including sheave for V-belt drive, gear and chain drives, and in some instances, direct drive.

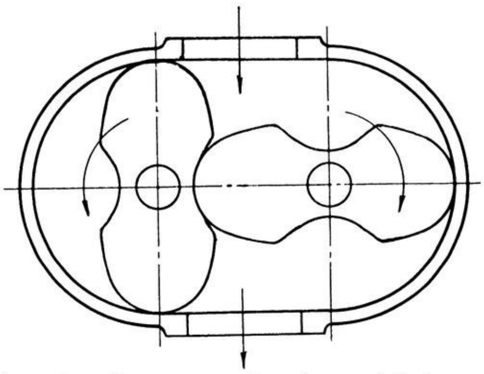


Figure 2 — Compresser using the two lobed rotor.

The Pesco Products Division of the Borg Warner Corporation in Cleveland, Ohio, manufactures a line of Roots type compressors which incorporate many unique ideas to gain efficiency and ease of manufacture. To reduce end clearances after the end plates are completely machined, rubber grids are molded directly to them. The ends of the rotors are serrated. When the rotors expand because of increased temperatures, they develop their own clearance by wearing away the rubber. A fiber strip is rolled tightly in place in a groove on the peripheral edge

(continued on page 39)

Truck Research

by H. R. Wahlin m'49

—Photographs by H. R. Wahlin m'49

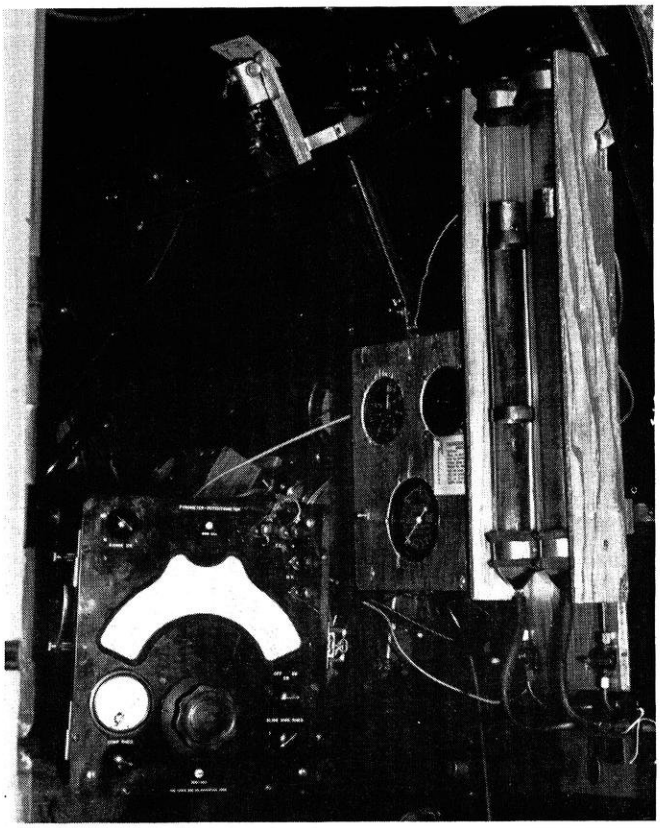
INQUISITIVE engineers who wish to see the University of Wisconsin Truck Research Project will find it located just east of the M. & M. Building in T-27. There they will find Archie H. Easton, Harry H. Miller, and Lorell B. Gillette preparing trucks and equipment for test.

Operating under a grant to the university from the Four-Wheel Drive Auto Company, of Clintonville, Wisconsin, the project is expected to require many more months, perhaps years, for its completion.

Studies up to this point have largely been of fuel consumption, and the accompanying photographs illustrate this phase of the work. Tests thus far completed have been conducted on a level stretch of concrete (0.0 per cent grade) two miles west of Spring Green, Wis. The truck under test is loaded with concrete weights in 50 per cent increments of payload up to 150 per cent payload and driven over a one mile course at speeds from 15 to 45 mph in 5 mph increments. Fuel consumed is fed to the engine from two burrettes in the truck cab which are connected to the carburetor via a three-way valve about 100 yards before entering the course. Readings of the fuel level at the beginning and end of the course are synchronized with an automatically actuated stop watch. Thus it is possible to measure fuel consumption to 1 per cent.

Personnel of the truck research project inspecting a new multi-channel oscillograph which will be used in future investigations. (Left to right) Harry H. Miller, A. H. Easton, director, and Lorell B. Gillette.

Nominal speeds are determined by a fifth wheel speedometer attached to the truck. Other readings recorded are air speed, intake manifold vacuum, and the following temperatures: Ambient (air), fuel in carburetor, air to carburetor, coolant to and from engine, oil in crankcase and in front and rear differentials, and spark plug No. 1. The temperatures are measured by means of thermocouples located at the various points throughout the truck and an instrument called a pyrometer-potentiometer carried in the cab.



Instrument arrangement in the cab of test truck. To the right are the two fuel burettes; at bottom left is the dial of the pyrometer - potentiometer used for determining operating temperatures.

As to the results of the studies thus far compiled (work has been in progress all summer), Mr. Easton stated that the data has not yet been approved for publication. He

(continued on page 30)

AWARDS GRANTED

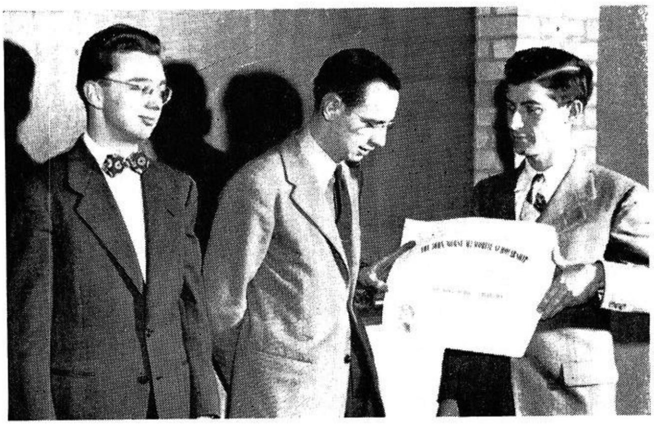
by R. Mitchell m'48
E. Kasum e'48

EACH year, three engineering students of the University of Wisconsin receive a very generous $500 award from the John Morse Memorial Foundation. The foundation was originally established by Col. Robert H. Morse in memory of his deceased son. The Wisconsin men who received this scholarship for the year of '47-'48 are:

Gayle Adams, of Cherry Valley, Illinois. Gayle graduated from East Rockford High School, Rockford, Illinois. At present he is a junior in the School of Electrical Engineering. As to what his plans are after graduation, he says, "I'll probably go into communications work—but that isn't definite." Though not out for athletics in high school, Gayle was a trackman while in Rockford.

Robert Doyle, of Fond du Lac, Wisconsin. Bob is a mechanical engineering junior, and another high school trackman. Having realized his first ambition (i. e., graduating from high school) he now has his sights set on design engineering in the future.

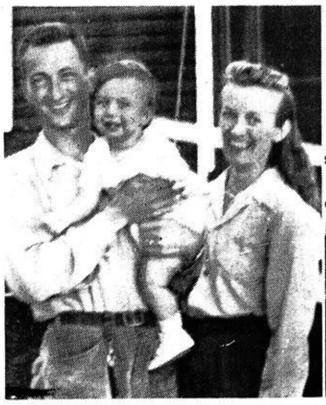
Hugh Wahlin, who "lives at home and likes it." His home is in Madison, where he graduated from West High. Hugh is the old man of the bunch, having served from 1943 to 1946 in the infantry in Germany and the Philippines. The camera bug has taken a big bite out of his time—Hugh's pictures are to be found in the Badger, Wisconsin Engineer, and the files of the Union News Service. At present he is the Program Chairman of the Camera Club, is on the Union Darkroom Committee at the Union, and takes private photographs in his spare time. The future looks interesting to Hugh, as he has an interest in a growing field—rocket research.



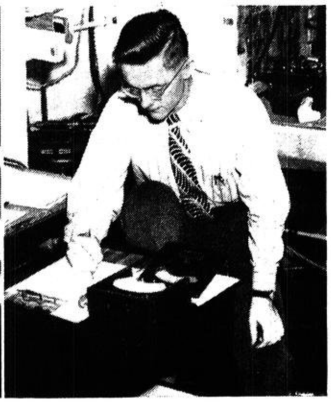
Left to right, Gayle Adams, Hugh Wahlin, and Robert Doyle examine the Morse Award Certificate. The photograph was taken by Wahlin, center.

Hugh Wahlin also received the Pi Tau Sigma award for his high grade average during his freshman year. The award consisted of a Mechanical Engineer's Handbook.

Here is a pat on the back for three fellows who have proved themselves outstanding enough to receive the Morse Scholarship. These awards are made to men showing evidence of "outstanding ability, intellectual attainment, superior character, potential leadership, and promise of future usefulness to the engineering profession and to society generally."



Edwin S. Baugh and family



Robert Johnson at work in the Standards Lab.

A Navy veteran with twenty-two months' service, Edwin S. Baugh, M&M '50, received the Tau Beta Pi award for high scholastic standing during his freshman year. Baugh is a graduate of West Allis Central High School (1937), where he received the American Legion Award for all-around attainment during his high school days. The latter award required participation in sports, membership in the student governing body, and a high grade average.

With pre-war experience in metallurgical research as an assistant metallurgist with the Chain Belt Company of Milwaukee, he is aiming towards a position where he can conduct research in ferrous metals. His earlier work consisted of fatigue problems of metals, corrosion resistance, and problems concerned with pearlitic malleable iron.

His two greatest rooters and admirers are his wife and two-year-old son. The family lives in the Madison "sub-

(continued on page 22)

CAMPUS HIGHLIGHTS

by John Ashenbrucker e'49

Russ Pavlat e'48

SAE

A steam driven automobile was the object of much curiosity and lively discussion Wednesday evening, Nov. 19th, as the members of the SAE society gathered in the back of the ME building to see Charles F. Keen demonstrate the novel vehicle. Student engineers were amazed at the noiseless operation of the two cylinder compound-condensing engine which develops horsepower equivalent to that of an eight-cylinder gasoline motor, or about 100 horsepower. An average of 16 to 18 miles per gallon of fuel is claimed by Keen, the inventor of the auto. Kerosene is used for fuel because it is cheaper than gasoline.

According to Keen, the "Steamliner" can attain a speed of 70 mph from a dead stop in a matter of seconds. A hand operated throttle controls the power output directly and eliminates the need of a gearshift. The lightning-fast getaway is possible because the high torque of the engine is applied to the wheels immediately after the throttle is opened. When the car is parked or idled, a small pilot light automatically keeps the head of steam up to at least 650 pounds per square inch in the boiler. The boiler is a vertical fire-tube type and outwardly resembles the top half of a steel barrel; it is placed under the hood. The engine, which is in the rear of the car, is geared directly to the rear axle.

The steam automobile was built in Madison at the Keen Manufacturing Company under the direction of Mr. Charles F. Keen, president, at a cost of about $5,000.

Mr. Wayne B. Grieve, Technical Director of the LeRoi Co., lectured to the SAE on Wednesday evening, December 10th. His subject was, "Engine Characteristics Explored by Electronic Methods."

Mr. Keen, surrounded by SAE members, exhibiting his "Steamliner."

Engineer Ball

No good engineer was studying on Friday evening, December 12th, for he and his escort were dancing to the strains of Lou Rene and his orchestra in Turner Hall. Sponsoring the Christmas Engineer Ball was Polygon Board, governing body for the student branches of the engineering societies on campus.

PI TAU SIGMA

Pi Tau Sigma held its winter formal initiation banquet at the Capital Hotel the evening of December 4th. Present at the banquet were numerous Pi Tau Madison engineers, faculty members, and undergraduate actives. Completing the roster were the twenty newly initiated Pi Taus:

Donald H. Bennett, William O. Clark, George R. Creedle, Robert E. Doyle, Richard H. France, David H. Goodman, John W. Mann, Lester W. Maresh, George H. Montemayor, Allen B. Pagel, Russell H. Pipkorn, Ernest R. Reichmann, Alvin C. Roeker, Stephen P. Sanders, Thomas V. Severson, Reno Testolin, Morris H. Thorson, Hugh R. Wahlin, Carl F. Zickert, Lawrence A. Zuchowski.

Guest speaker for the evening was Mr. Leonard Howell, City Manager of Madison, a registered engineer. Mr. Howell, speaking on "The Engineer and City Government," praised the analytical mind developed by an engineering education, and encouraged more widespread interest in community activities.

Dave Retzinger reported on the National Convention held at Purdue this year, while John Mann fol-

(continued on page 34)

The Way We See It . . .

In Closing

GRADUATION time brings an end to college activities, and as in my case there are going to be void spaces left which they once kept full. The largest of my personal voids will be that which was occupied by the Wisconsin Engineer. True, it has caused the losing of a few more hairs on my head and burning of a few more quarts of oil, but on the whole it has been a wonderful experience.

Though not as eloquently as desirable, I have expressed some of my sincere beliefs in past issues of the Engineer. These ran the gauntlet from the need for increased awareness by engineers of occurrences beyond their books and slide rules, to making the magazine a more representative publication of the whole college.

In attempting to bring into realization the latter item, I have had the privilege of working with top-notch men and women. Some who have left before me and others who will take up the reins and progress farther with the Engineer. To those who have worked with me I would like to take this opportunity to extend my thanks for their excellent cooperation and assistance.

As a final editorial thought I would like to put forth an idea which could go a long way towards making the Engineer a more representative publication. In working out articles and their method of presentation, the staff strives for a goal of maximum readability and interest. Whether success is attained in this direction is not definitely known, as there is no method to positively measure student reaction. Therefore, why not let the Engineer hear from you, the student body, on what you think of the Wisconsin Engineer, what articles you would like to see published, and what queries and complaints you may have about the magazine or school policies. There is no reason why the Engineer should not have a Forum Page in which this type of discussion could be carried on. Let's start those letters coming. —E. K.

The "Five-Year" Plan

MORE and more we hear about the advisability of a five-year course for engineers. Some say "Yea," and some are emphatically against it. The majority of those who are in favor of a longer course for engineers are those who are no longer in school, and, conversely, those who are against it are the gruelling engineering students who wonder if **four** years will ever end.

Some bitter comments overheard on the subject indicate that students think the old "dyed in the wool" engineers advocate a longer course to make their own degrees more significant. The advocates, however, point out that recent advances make a longer training period necessary. The students immediately man their sliderules and announce that an addition of one year to the course each time a series of significant advances is made would now have the course well over one hundred years long.

As is usually the case in controversy, both sides attempt to establish their points through exaggeration. There are valid points both for and against the lengthened program. Finances will play an important part when the idealism clears away. Some of us just cannot afford another year. Others, such as myself, have reached the saturation point. Even the students who dread the longer grind admit, however, that there are many things that they "have not had time to learn."

In answer to both groups, I would like to point out the fact that there are such things as night schools. Unless the subject is interested only in the name or degree involved, the night school is ideal. It is a release from the everyday chores of making a living, and what one learns has more significance under such conditions. More, and more elaborate, arguments are possible on either side, but I cannot help thinking that the evening colleges, though not "cure-alls," are the best answer to both. —R.J.M.

Alumni Notes

by J. J. Kunes e'48
L. Hunholz e'47

E. E.

Benjamin S. Adams (EE'03) started as Superintendent in distribution for the Madison Gas and Electric Company and is now president, general manager and director of the Gas Service Company.

Benjamin S. Adams

Starting with Cities Service immediately after graduation, Mr. Adams in 1906 became general superintendent of the Lincoln (Nebr.) Gas and Electric Company, and three years later its general manager and vice president. In 1913 he assumed the same offices with the Spokane (Wash.) Gas & Fuel Co. The following year he went abroad to do company appraisal work in Brazilian properties for Ellis & Company in London. He became vice president and general manager of the Montgomery (Ala.) Light & Water Power Company in 1915, and in successive years held the same posts in the Empire District Electric Company, the St. Joseph Light, Heat, & Power Company and the Toledo Edison Company, assuming his present position in 1940. He also holds office as vice president and director of the Kansas City Gas Company and the Wyandotte County Gas Company.

Mr. Adams' career is one of leadership on many municipal and advisory committees and in many technical and social organizations.

Stephen B. Severson (EE'07) began his career as a Cadet Engineer with the Denver Gas & Electric Company and is now president, director, and general manager of both Republic Light, Heat, & Power Co. and the Dominion Natural Gas Co., Ltd.

Stephen B. Severson

Following his Cadet Engineer period, Mr. Severson was for two years Engineer of the Empire Electric Company. In 1911 he joined the Urban Water Supply Company as engineer and the following year became engineer and manager of the Mt. Vernon Gas & Electric Co. In 1914 he became vice president and manager of the Manhattan & Queens Traction Company and three years later assistant chief engineer and superintendent of oil production for the Empire Gas & Fuel Company, a position which he held for seven years. He held office as vice president and general manager of the Dominion and Republic properties from 1924 to 1946, when he moved up to his present position. In addition, he is general manager of the Penn-York Natural Gas Co.

Bert E. Miller (EE'11), Madison, Wis., secretary of the Wisconsin Power & Light Co., and manager of the rate and valuation department, has retired after over thirty years' service with the company. He will continue working on a contract basis until he completes a special project with which he is now engaged.

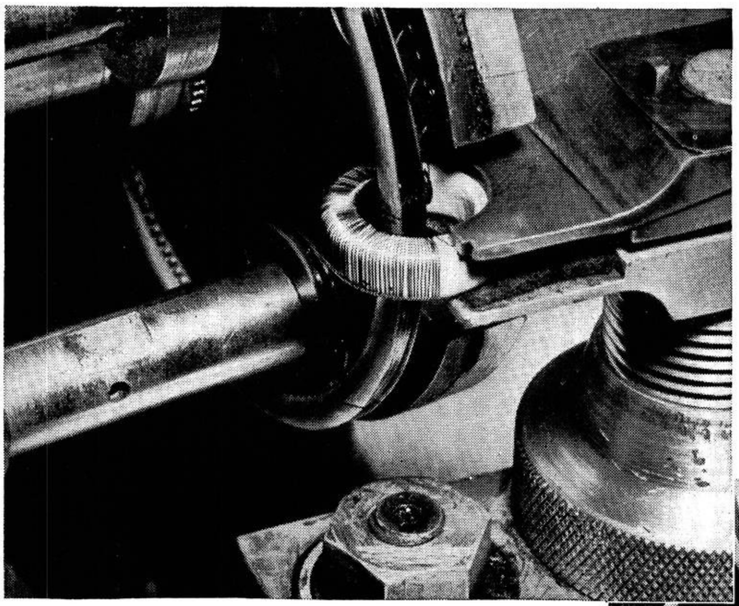
Theodore N. Racheff (EE'32) is a field engineer for the Commonwealth Edison Company of Chicago.

Otis C. Ingebritsen (EE'47) was employed by Underwriters' Laboratories, Inc., in Chicago, Ill., doing testing in their electrical department. He is now employed by the National Advisory Committee on Aeronautics at Langley Field, Virginia, and is assigned to the Instrument Research and Development Department.

(continued on page 26)

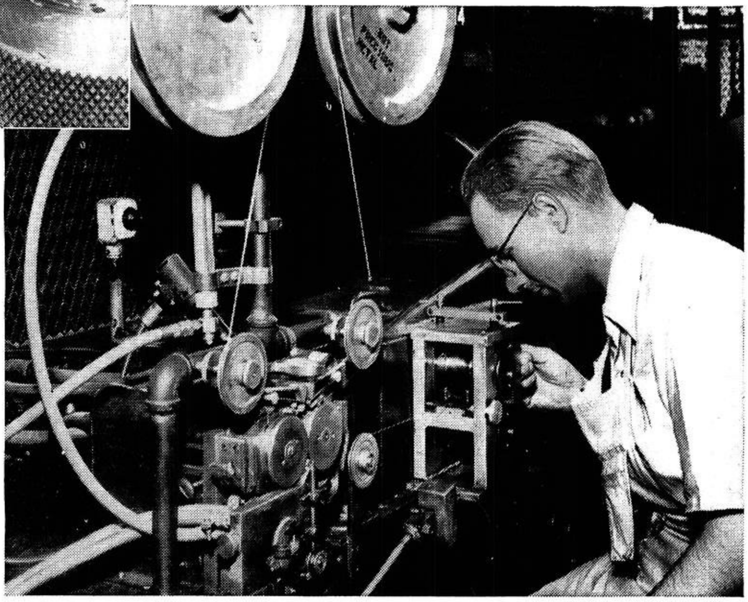
NUMBER 9 OF A SERIES

Newsworthy Notes for Engineers



Winding wire on a "wedding ring"

This is the "Sea Breeze," a machine developed by Western Electric engineers. It solves the problem of winding wire half the thickness of a human hair on a toroidal core the size of a wedding ring. Compressed air drives the flyer which maintains the wire under positive tension at all times, winding as many as 40,000 turns of #46 wire on the core. It winds finer wire than any previous machine, lays turns more uniformly, winds a wider range of wire sizes, increases efficiency in utilization of winding space and permits the manufacture of coils half the size of those previously possible.



Metal welding that saves millions

Here, palladium and nickel tape are welded together at the rate of 400 feet an hour. Tiny bars are later snipped from this bi-metal tape and used to replace the precious pinhead-size platinum rivets once used as contacts in Bell System relays. These contacts, which minimize noise in telephone conversation, are used by the billions in relays that perform switching operations. The use of this bi-metal tape . . . devised by Bell Telephone Laboratories scientists and produced on machines developed by Western Electric engineers . . . saves millions of dollars a year in the cost of producing telephone equipment.

Engineering problems *are many and varied at Western Electric, where manufacturing telephone and radio apparatus for the Bell System is the primary job. Engineers of many kinds—electrical, mechanical, industrial, chemical, metallurgical—are constantly working to devise and improve machines and processes for mass production of highest quality communications equipment.*

Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882

AWARDS GRANTED (continued from page 17)

urb" of Badger Village. (Ed. Note: Badger Village is a University Veterans' Housing Project located thirty-five miles from the University.) Photography, cabinet-making, and intramural basketball comprise his outside interests.

—*Photograph by J. Kroot e'48*

Hugh Wahlin receives Handbook Award from Carl Goldbeck.

Recipient of the annual Eta Kappa Nu (Honorary Electrical Engineering Society) Freshman Award, an Electrical Engineer's Handbook, was Robert R. Johnson. Bob was chosen for having attained an "A" average during his freshman year.

He was graduated from West High School of Rockford, Illinois, in 1946 and scholastically was sixth in a class of five hundred. While in high school he was elected to The National Honor Society, and was President of the School Orchestra. His paper on "Theoretical Aspects of Adhesion" won him honorable mention in the "Westinghouse Science Talent Search" conducted amongst high school students.

His summers were spent working in the chemical laboratories of Servisoft and the engineering department of Barber-Coleman. At the latter place he worked under Mr. Royce Johnson, his father and former professor in the Electrical Engineering Department here at Wisconsin.

Besides working on his grade point, Bob plays the French horn in the marching band, and works in the Electrical Standards Laboratory. He is also a member of Phi Eta Sigma, Freshman Honorary Society. His hobbies and outside interests vary from geology and music to tennis and swimming.

Temporary Buildings (continued from page 14)

students is T-24. This is a Transite type building of 13,000 square feet and includes a large drawing room, four offices, and fourteen classrooms.

A really welcome addition to the western end of the campus is T-21. This is the Cafeteria that is located at the corner of Breese Terrace and University Ave. At the present time they are serving about 2,200 persons per day. Now it is no longer necessary for students to spend valuable time commuting to and from the Union.

While the Engineering College has its share of temporary buildings, it isn't the only college of the university to benefit from these structures. All told, there are fifteen Quonset huts and twenty-seven other temporary buildings. They range from the huge Quonset hut on the lower campus that is used for the library reading room to the smaller buildings used for classrooms. Most of the buildings are used as classrooms, by the Physics, Pharmacy, and Chemistry departments lave labs. in them. Also, T-16 is a large lecture hall.

Although no definite date has been set for the removal of these temporary buildings from the campus, it is hoped that removal can begin in 5-7 years. The only way that they can be gotten along without, is if the enrollment drops off or if new buildings are erected. If the new Engineering building is built as scheduled, it will allow all engineering activities to be carried on south of University Ave. except that of hydraulics. If the other building programs are carried out, eventually the campus will be restored to its former beauty.

Year after year, the Square D Company emphasizes to industrial executives, the importance of their electrical men. Advertisements such as this one appear regularly in leading business magazines. We believe they perform a three-way job. They enhance the standing of today's and tomorrow's electrical men. They build acceptance for Square D Field Engineers, practically all of whom come to us from leading engineering schools such as yours.

A good place to get Cost-Reducing Ideas

Your head electrical man is a good source of workable, cost-reducing suggestions. And right now is a particularly good time to let him prove it.

During the tremendously increased production of recent years, there has been a sharp increase in the amount of power used per employee. Most electrical systems have been operating under abnormal stress. Many are overloaded, unreliable and poorly located or inflexible with respect to present machine locations. Excessive "down time" and higher production costs are certainties.

Check with your head electrical man for possible cost-reducing opportunities in your plant. A Square D Field Engineer will be glad to work with him in analyzing any electrical problem and selecting corrective power distribution and electric motor control equipment.

Field Engineering Counsel is available, without obligation, through Square D offices located in 50 principal U. S., Canadian and Mexican cities.

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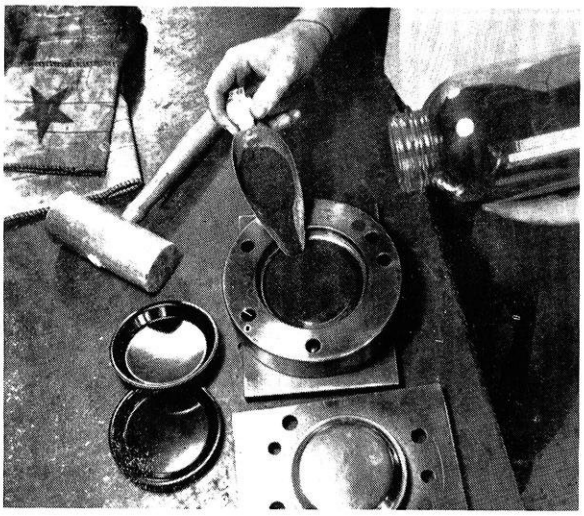
Wood . . .

(continued from page 8)

ment in some mechanical properties, particularly hardness and compression perpendicular to the grain.

Plastic Compound

The Forest Products Laboratory has developed from sawdust or other wood waste a plastic molding compound, useful in nonstressed or moderately stressed articles. In the method used, hardwood sawdust is treated by a dilute acid under steam pressure. The residue, after removal of the sugar solution formed by this process, is ground to a powder and, when mixed with a plasticizer, can be molded into various shapes under proper temperature and pressure. The result is a cheap molding compound that forms into a black lustrous plastic.



A variety of molded shapes can be made from the Forest Products Laboratories' waste-lignin molding powder.

An improved laminated paper-base plastic of high tensile strength has recently been developed and is already being experimentally used in the form of aircraft parts, including wing ribs, wing tip skins, and control surfaces. Experimental data thus far indicate the product has very high tensile strength, that it can be molded to desired shapes at temperatures and pressures and on equipment now used for making plywood; that it is resistant to moisture and remains extremely stable at both high and low temperatures, and that it is resistant to scratching and denting. Lowest of the mechanical properties is impact resistance. Laminated paper has a smooth surface requiring no special finish.

Compressed Wood

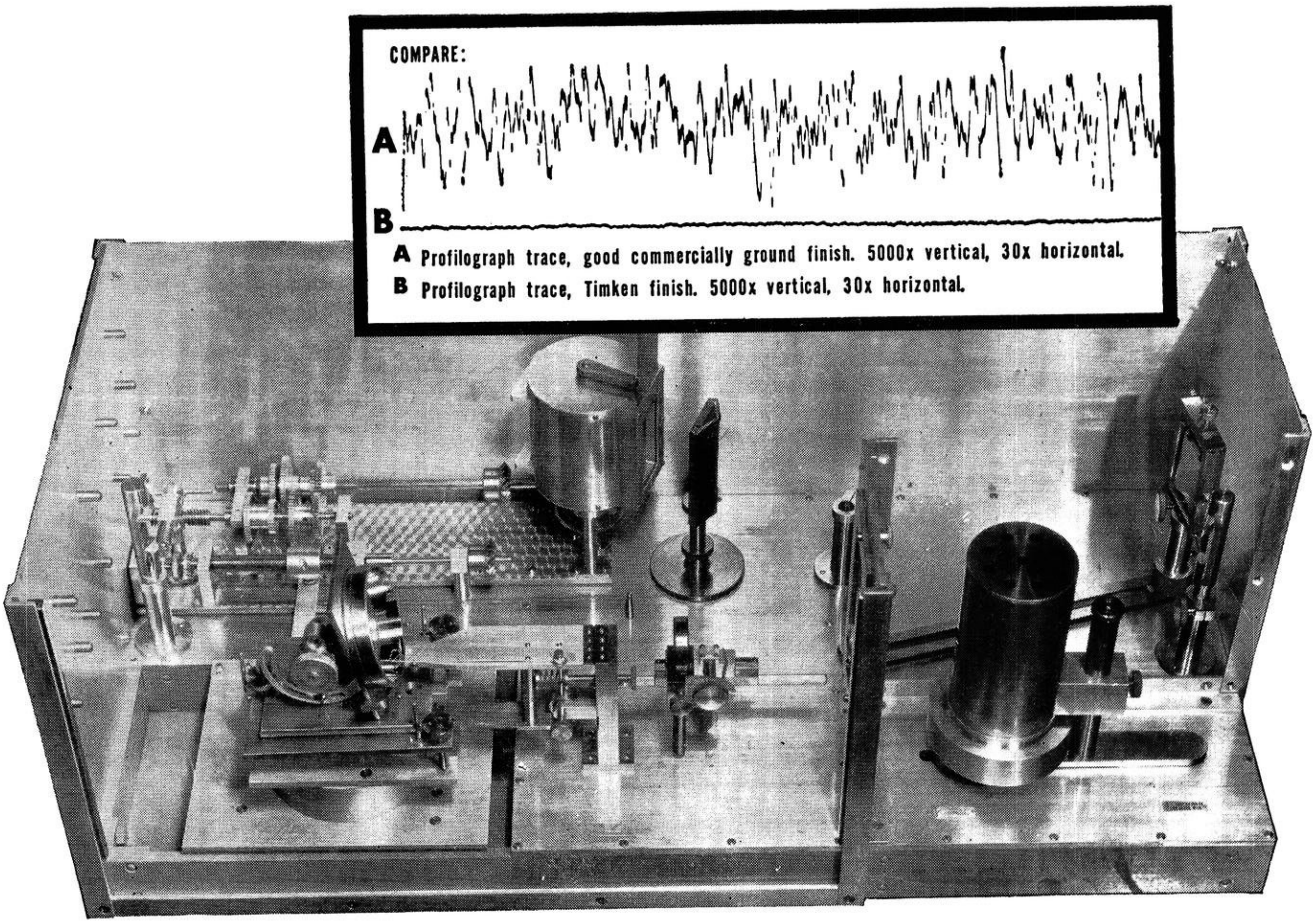
Another development is heat-stabilized, compressed wood. Wood is exceedingly compressible in the across-the-grain direction, and it is possible to increase the density of some woods more than twofold and to increase certain properties by such compression. Many commercial adaptations are based on this principle. The main limitation to the process has been the lack of stabilization of dimension in that when subjected to adverse moisture conditions the compressed wood expands greatly and tends to regain its original size. Recent developments have shown that if pressure is applied under certain conditions of optimum temperature and moisture content, compressed wood results which is relatively moisture stable. This process results in the retention of the high shock properties of the wood, and appears very promising for many uses.

Waste Materials Used

A great number of insulation and building boards are in common use. This class of boards includes a wide variety of fibrous products ranging from bulky materials weighing from 1½ to 2 pounds per cubic foot to dense hard boards of more than 60 pounds per cubic foot. The use of this material has expanded very rapidly during the past 15 years. These boards are made from both plant and wood fibers. In a great many instances these are waste materials of logging, lumbering, or other woodworking industries. The dense panel boards or hard boards are relatively poor thermal insulators. The grades with greater insulating value are more porous and range from ¼ inch to several inches in thickness. Generally, the boards consist of two types of fibers: a coarse fiber to provide structural framework and finer fiber for bonding purposes. The important physical characteristics of wallboard should include a fair degree of rigidity and water resistance, good flexural and compressive strengths, but low thermal conductivity. Surface texture, hardness, and ability to take paint are also important properties.

Though wood and wood products have a long tradition as important structural and engineering materials, during the past decade an awakened interest in their use and application has been stimulated by significant research developments and more recently by the exigencies of war.

What of future forest supplies? Says Lyle F. Watts, Chief, Forest Service, United States Department of Agriculture: "Wood, in contrast to so many other engineering materials, is a crop and the supply can be renewed indefinitely. But like other crops produced from the soil, the growing of the needed quantity and quality of product requires the application of sound management practices. The only acceptable philosophy for balancing the drain with the growth is to grow more timber—not to grow less. If reasonably good forest practice is applied throughout the country we may expect to build up forest growing stock in the next century to a point that is substantially in excess of the current rate of utilization and should be ample for all foreseeable needs."



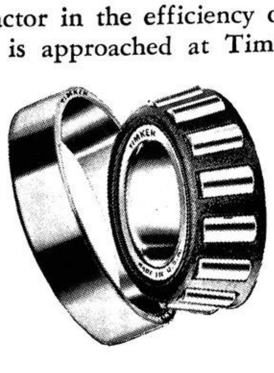
Answers the question— "How rough is smooth?"

ONE of the reasons Timken Tapered Roller Bearings perform with such frictionless, wear-free ease is the amazingly smooth surface finish on the rolls and races—the finest known to modern bearing science.

Now, when you talk about finishes like this, you're talking about surface irregularities of only a few millionths of an inch — irregularities which are impossible to detect by any ordinary means. So, when Timken first began to develop this finish, one of the biggest obstacles was the absence of an accurate method of measuring the roughness of an apparently smooth surface.

The profilograph pictured above was the answer. Developed by Timken in 1928 and steadily improved since then, the profilograph determines surface irregularities to within one-millionth of an inch. Equipped with this measuring stick, Timken engineers were able to develop new finishing methods and machines, which have resulted in the microscopic surface accuracy of the Timken Bearings you use today.

Every factor in the efficiency of a bearing is approached at Timken in this same scientific manner. For example, Timken makes its own steel to assure constant quality. And Timken is the acknowledged leader in: 1. advanced design; 2. precision manufacture; 3. rigid quality control; 4. special analysis steels. No wonder you can always be sure of uniformly top quality and performance in the Timken Bearings you use. The Timken Roller Bearing Company, Canton 6, Ohio.



TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

Alumni

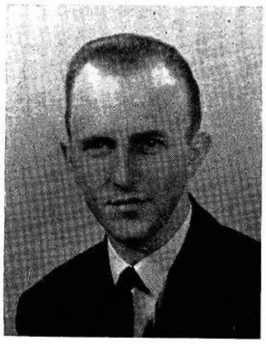
(continued from page 20)

Paul Patterson (EE'32) is back at the University, with the distinction of having TWO offices. He has been with the University Extension Division since 1944 and is now also teaching EE lab courses.

After graduation he had his own Radio Sales and Service in Monroe, Wisconsin, until 1942 (the war). Then he sold his business and taught radio at Truax Field (Madison) for two years, also teaching some night classes at the University Extension Division. In his spare time he did quite a bit of work for USAFI and designed and built a Physics lab for the Racine Extension school.

R. W. Moore (EE'39) entered the D. C. design section of the motor division of Westinghouse upon completing the graduate student course in 1940. During the war he assisted in the design of motors for naval vessels, the electric torpedo, and for mines. He moved from the design to application in the steel mill section and lately has been helping to plan the electrification of steel mills to be built in France and South Africa.

Daniel R. Miller (EE'41) is living in Schenectady, N. Y., where he is an engineer with General Electric.



D. R. Miller

He has just completed his fourth year on GE's advanced engineering program. There is a young Millerette, 3, and a young Miller, 9 mos. a radio engineer in the Naval Re-

Notes

search Laboratory, Washington, D. C.

Harold Peterson (EE'46) is an application engineer for Commonwealth Edison in Chicago.

H. Peterson

Theodore H. Faber (EE'46) is a production engineer working for the Electrovoice Microphone Company, in Chicago.

Donald E. Strom (EE'47), classed with the ME's last month by error (excuse please), is in training in the electrical engineering, specification writing, drafting, and test department of the Carnegie Illinois Steel Corporation.

Clarence W. Puent (EE'47) is an assistant and trainee in the engineering and sales departments of Line Material Company, Milwaukee. He will be at the South Milwaukee plant for three months; plans to walk up the aisle with a local gal and will probably be situated at the Stroudsburg, Penn., plant at the end of the training program.

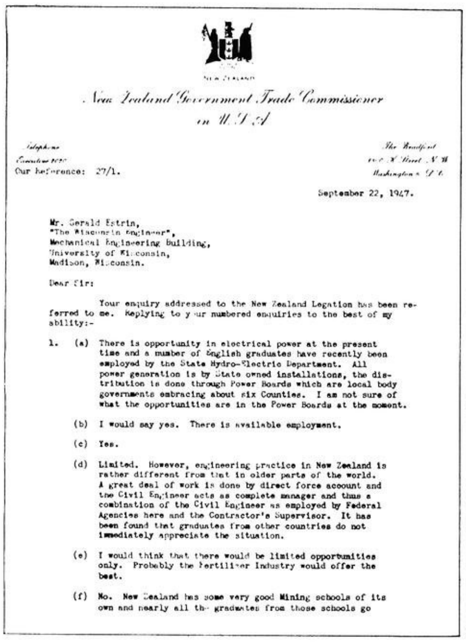
M.E.

Maurice E. Fitze (ME'24) died Nov. 19, after a valiant effort to overcome the asthma attacks that plagued him the past two years. Residence in Albuquerque had helped him, but only temporarily. He had been Senior Test Engineer with the W. E. P. Co., Milwaukee.

Karl P. Hanson (ME'28) is now head of the Mechanical Engineering Dept. at North Carolina State College, Raleigh.

"We regret . . ."

(continued from page 10)



New Zealand Government Trade Commissioner in U.S.A.

Telephone Executive 1020
Our Reference: 27/1.

The Bradford 1000 H Street N.W. Washington, D.C.

September 22, 1947.

Mr. Gerald Estrin,
"The Wisconsin Engineer",
Mechanical Engineering Building,
University of Wisconsin,
Madison, Wisconsin.

Dear Sir:

Your enquiry addressed to the New Zealand Legation has been referred to me. Replying to your numbered enquiries to the best of my ability:-

1. (a) There is opportunity in electrical power at the present time and a number of English graduates have recently been employed by the State Hydro-Electric Department. All power generation is by State owned installations, the distribution is done through Power Boards which are local body governments embracing about six Counties. I am not sure of what the opportunities are in the Power Boards at the moment.

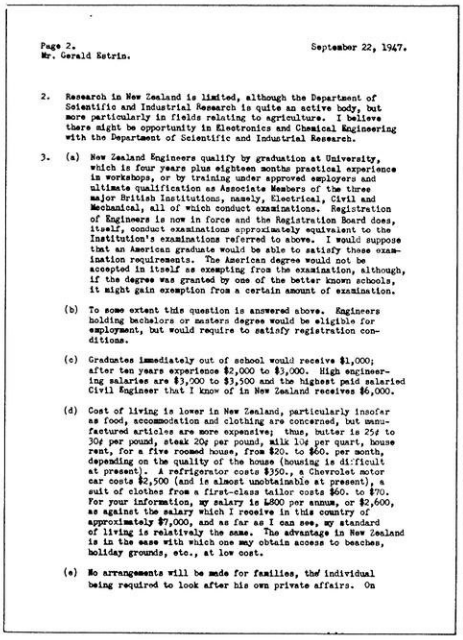
(b) I would say yes. There is available employment.

(c) Yes.

(d) Limited. However, engineering practice in New Zealand is rather different from that in older parts of the world. A great deal of work is done by direct force account and the Civil Engineer acts as complete manager and thus a combination of the Civil Engineer as employed by Federal Agencies here and the Contractor's Supervisor. It has been found that graduates from other countries do not immediately appreciate the situation.

(e) I would think that there would be limited opportunities only. Probably the Fertilizer Industry would offer the best.

(f) No. New Zealand has some very good Mining schools of its own and nearly all the graduates from those schools go



Page 2.
Mr. Gerald Estrin.

September 22, 1947.

2. Research in New Zealand is limited, although the Department of Scientific and Industrial Research is quite an active body, but more particularly in fields relating to agriculture. I believe there might be opportunity in Electronics and Chemical Engineering with the Department of Scientific and Industrial Research.

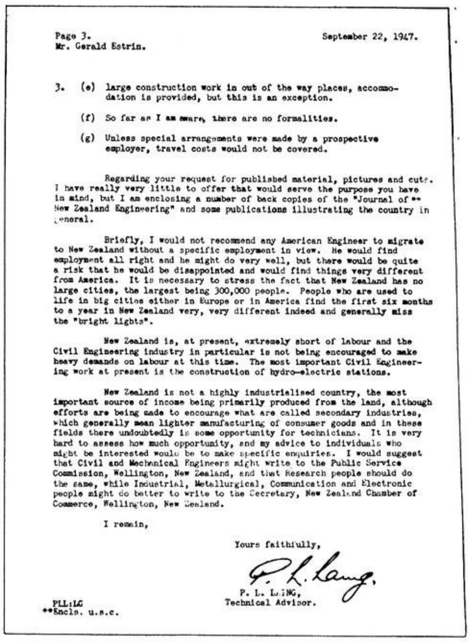
3. (a) New Zealand Engineers qualify by graduation at University, which is four years plus eighteen months practical experience in workshops, or by training under approved employers and ultimate qualification as Associate Members of the three major British Institutions, namely, Electrical, Civil and Mechanical, all of which conduct examinations. Registration of Engineers is now in force and the Registration Board does, itself, conduct examinations approximately equivalent to the Institution's examinations referred to above. I would suppose that an American graduate would be able to satisfy these examination requirements. The American degree would not be accepted in itself as exempting from the examination, although, if the degree was granted by one of the better known schools, it might gain exemption from a certain amount of examination.

(b) To some extent this question is answered above. Engineers holding bachelors or masters degree would be eligible for employment, but would require to satisfy registration conditions.

(c) Graduates immediately out of school would receive $1,000; after ten years experience $2,000 to $3,000. High engineering salaries are $3,000 to $3,500 and the highest paid salaried Civil Engineer that I know of in New Zealand receives $6,000.

(d) Cost of living is lower in New Zealand, particularly insofar as food, accommodation and clothing are concerned, but manufactured articles are more expensive; thus, butter is 25¢ to 30¢ per pound, steak 20¢ per pound, milk 10¢ per quart, house rent, for a five roomed house, from $20. to $60. per month, depending on the quality of the house (housing is difficult at present). A refrigerator costs $350., a Chevrolet motor car costs $2,500 (and is almost unobtainable at present), a suit of clothes from a first-class tailor costs $60. to $70. For your information, my salary is £800 per annum, or $2,600, as against the salary which I receive in this country of approximately $7,000, and as far as I can see, my standard of living is relatively the same. The advantage in New Zealand is in the ease with which one may obtain access to beaches, holiday grounds, etc., at low cost.

(e) No arrangements will be made for families, the individual being required to look after his own private affairs. On



Page 3.
Mr. Gerald Estrin.

September 22, 1947.

3. (e) large construction work in out of the way places, accommodation is provided, but this is an exception.

(f) So far as I am aware, there are no formalities.

(g) Unless special arrangements were made by a prospective employer, travel costs would not be covered.

Regarding your request for published material, pictures and cuts. I have really very little to offer that would serve the purpose you have in mind, but I am enclosing a number of back copies of the "Journal of ** New Zealand Engineering" and some publications illustrating the country in general.

Briefly, I would not recommend any American Engineer to migrate to New Zealand without a specific employment in view. He would find employment all right and he might do very well, but there would be quite a risk that he would be disappointed and would find things very different from America. It is necessary to stress the fact that New Zealand has no large cities, the largest being 300,000 people. People who are used to life in big cities either in Europe or in America find the first six months to a year in New Zealand very, very different indeed and generally miss the "bright lights".

New Zealand is, at present, extremely short of labour and the Civil Engineering industry in particular is not being encouraged to make heavy demands on labour at this time. The most important Civil Engineering work at present is the construction of hydro-electric stations.

New Zealand is not a highly industrialised country, the most important source of income being primarily produced from the land, although efforts are being made to encourage what are called secondary industries, which generally mean lighter manufacturing of consumer goods and in these fields there undoubtedly is some opportunity for technicians. It is very hard to assess how much opportunity, and my advice to individuals who might be interested would be to make specific enquiries. I would suggest that Civil and Mechanical Engineers might write to the Public Service Commission, Wellington, New Zealand, and that Research people should do the same, while Industrial, Metallurgical, Communication and Electronic people might do better to write to the Secretary, New Zealand Chamber of Commerce, Wellington, New Zealand.

I remain,

Yours faithfully,

P. L. Laing.

P. L. LAING,
Technical Advisor.

PLL:LC
**Encls. u.s.c.

The most detailed and complete answer received by the Engineer, wherein thirty cent butter, twenty cent steaks, clash with $2500 Chevrolets (which are hard to get).

"The Syrian Government only engages engineers with a good background and experience of at least 10 YEARS' DURATION (our emphasis . . . Ed.)."

Australia . . . . . "As a gesture of good-will to Americans, the Australian government has decided to subsidize trans-Pacific steamer fares of U. S. veterans and their dependents who wish to settle permanently in Australia. The Commonwealth Department of Labor and National Service is . . . making a comprehensive survey of industries throughout Australia. This will show the number and types of jobs waiting to be filled."

" . . . the scheme applies only to ex-Service personnel and their dependents of PURE European descent."

Union of South Africa . . . . . "There are openings in South Africa for all classes of men with technical skill . . . there is tremendous expansion in South African industrial development generally.

" . . . the cost of living compares favorably with that in the United States.

"In regard to visas, no difficulty should be encountered if the applicant has a job in the Union. In this connection, you should write to the South African Legation, 3101 Massachusetts Ave., Washington, D. C.

"Travel costs are not borne by the Union government . . . "

In this category, there was one letter which answered our survey in a manner which would have provided us with much more extensive information had all the other representatives been able to follow suit. This letter was from New Zealand and will be quoted in full.

What conclusions can be drawn from all this information?

If you (like the author) had ideas of grabbing his diploma and running off to a constructive, interesting, well-paying job in some foreign land—stop dreaming!!! Your choice is very restricted. Many of us developed bloated concepts of the American Engineer. Our technical accomplishments are great, but there are good engineers all over this globe.

SURVEY REPORT

Some of you remember the mimeographed form that was circulated in the ME 105 classes early in December, and perhaps wonder what some of the results of this survey are. Much of the material is of a confidential nature, but some is of general interest and we are free to print that:

Average wage expected upon graduation—$255.77.

Major dislike of some companies: "Too big. A man could get lost and never be heard from again."

Wage expectations ran from $190 to $500 per month. (A recent survey of graduates from the University of California school of engineering showed actual salaries were between $250 and $260 per month to start.)

At RCA Exhibition Hall, radio, television, and electronics are on parade in fascinating new exhibits

"World's Fair" of radio-electronic wonders... RCA Exhibition Hall

100,000 visitors every month—that's how people have responded to the exciting new RCA Exhibition Hall in Radio City.

Like a "World's Fair," this is a place where you can watch, and even operate, many recent developments of RCA Laboratories. Television, radio, loran, the electron microscope, and other scientific achievements . . . you'll find them "on show," fully explained, and thrilling to see.

For instance: step on a platform and televise yourself, see yourself in action on a real television screen. Watch radio waves heat steel red-hot in a jiffy. Hear the newest RCA Victor recordings. Take home a souvenir message from globe-encircling RCA Communications—see Radiomarine's radar and learn exactly how the NBC Network operates to bring its "Parade of Stars" to your home.

Conveniently located in the heart of Radio City—at 40 West 49th Street—RCA Exhibition Hall is open 11 a.m. to 9 p.m. daily; everyone is welcome, there is no admission charge. *Radio Corporation of America, RCA Building, Radio City, New York 20, N. Y.*

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 reproducing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

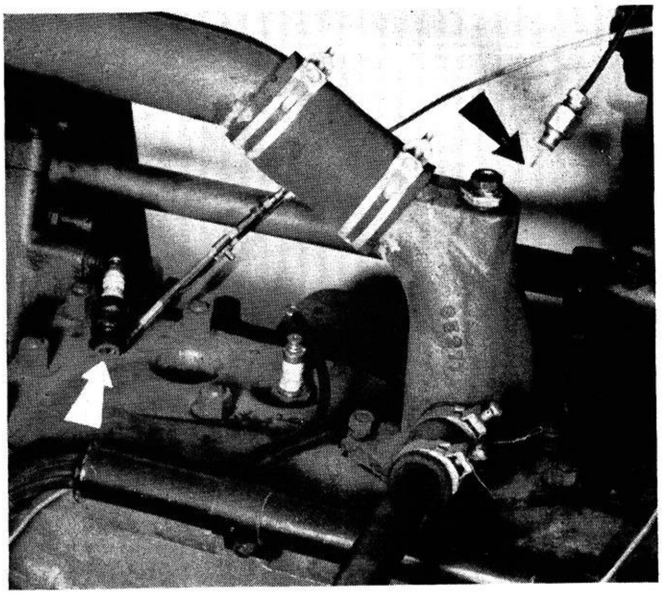
Write today to National Recruiting Division, RCA Victor, Camden, New Jersey.

Also many opportunities for Mechanical and Chemical Engineers and Physicists.

RADIO CORPORATION of AMERICA

Truck Research

(continued from page 16)



Two of the many thermocouples used in measuring engine temperatures (arrows). One is in the form of a plug which screws into cooling system; other is imbedded in a special gasket for spark plug number one.

did, however, say that the purpose of the research is "to promote more safe, economical, and efficient truck transportation."

In line with this, plans are being laid for the following future studies: Investigation of fuel consumption of competitive two-wheel drive trucks at various speeds and loads, measurement of full throttle acceleration and drawbar pull, block tests of the various truck components, studies with torquemeters installed in the driving wheels, and studies of the slip angles at the front and rear as a means of determining the effect of type of drive, loading surface, anti-skid devices, and weather on stability of a vehicle.

Regarding difficulties encountered thus far, Mr. Easton had the following comments: "Our initial fuel consumption tests were conducted on state route 30 about 10 miles east of the city limits of Madison. Because the differences we were measuring were so small, they were obscured by the irregularities caused by variations in grade from 0.1 to 0.7 per cent. Thus the decision to conduct these tests at Spring Green where the grade is 0.0 per cent." This should be of interest to civil engineers.

The pet of the project at the present time is a multi-channel oscillograph and amplifier which will be used as the indicating and recording instrument in many of the studies. Cradling this concentrated bit of gadgetry in his arms, Mr. Miller, the electrical engineer said, "It's hard to realize that I have the price of two new Studebaker Champions right here in my hands."

Science Highlights

by E. Robinson m'49

E. Zimmerman e'49

BACTERIA INCREASE OIL WELL YIELDS

Doctor Claude ZoBell, marine bacteriologist at the Scripps Institute of Oceanography, LaJolla, California, has been granted U. S. Patent Number 2,413,278 on putting bacteria to work to increase oil well yields. The patent is assigned to the American Petroleum Institute, which in turn has dedicated it "to the public throughout the world."

Since the micro-organism used is a comparative newcomer to bacterial science, it has not yet received a scientific name. It belongs to the genus Desulfovibrio. Conditions prevailing in deep oil wells are particularly suited to this organism, for it thrives best in salt-water brine, likes high temperatures, and cannot live in the presence of either light or air. It has been named by Dr. ZoBell Desulfovibrio Halohydrocarbonoclasticus because of the foregoing conditions and because it feeds on sulfur compounds found in oil, and apparently on the larger molecules of the oil itself. Its multiple actions release oil from the grip of rock pores and sand crevices. These actions are: Generating acid, which dissolves limestone, which thereby enlarges the flow channels. Lowering surface tension, which makes the oil more free to flow. Producing CO_2, thus increasing the oil pushing gas-pressure, and its action in cracking large molecules aids in making the oil more fluid.

Through the use of this bacteria the old oil fields which have ceased to flow can again be put into use, and vastly increase our potential supply of oil at a comparatively small cost. This method is also useful in lowering the undesirable sulfur content in oil. The unique properties of this micro-organism lend itself to decreasing the cost of refining.

MAGNETIC ALLOYS

During the year a new magnetic alloy was announced which affords a maximum permeability of 1,000,000 as compared to about 100,000 for the best previously available material. The alloy, which contains 79% nickel, has already been used in considerable quantity in apparatus supplied to the U. S. Navy. Its use in communications transformers has been found to permit a threefold increase in the range of frequencies transmitted. Interest in magnetic amplifiers and frequency multipliers using saturating nickel-iron cores is growing rapidly.

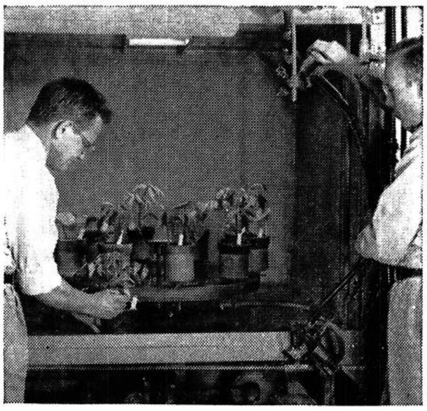
EARTH'S MAGNETISM
(Sept. '47 Science Digest)

A new law of nature that the earth may be a magnet solely because it is so large and is spinning around its axis at high speed has been put forward by the British cosmic-ray expert, Prof. P. M. S. Blackett. If this law becomes accepted, then magnetism may be considered just another fundamental property of all matter. All the elements, not just iron, steel, and cobalt, could be capable of producing magnetic fields if this is true.

(continued on page 35)

DU PONT Digest

For Students of Science and Engineering



B. L. Richards, Jr. Ph.D., Cornell '44, and A. H. Goddin, M.S., University of West Virginia '32, test efficiency of "Parzate" fungicide in control of tomato late blight and bean rust. Equipment is specially designed laboratory spray chamber.

Rubber accelerators lead the way to new agricultural fungicides

Vulcanization accelerators for rubber and agricultural fungicides would seem to have little in common. But the wide variety of interests of men in the Du Pont organization sometimes result in outstanding developments from such apparently unrelated products.

A rubber chemist suggested to a plant pathologist that derivatives of dithiocarbamic acid, NH_2-C(S)SH, parent substance of a well-known group of rubber accelerators, be tested as insecticides. His suggestion was based on the possibility that sulfur combined in this form might be more effective than free sulfur, a recognized insecticide.

Entomologists and plant pathologists investigated the fungicidal as well as the insecticidal properties of this group. One of the first compounds tested, sodium dimethyldithiocarbamate, $(CH_3)_2$N-C(S)SNa, even in dilutions of 1:30,000, was found to be a powerful fungicide, but somewhat injurious to plant life.

This led to a systematic program of research including other metallic salts, the ethyl, propyl, butyl, phenyl, and other aryl derivatives of the dithiocarbamates and thiuram mono- and disulfides, and the related compounds made from ethylenediamine and morpholine. In this phase of the work, organic chemists played an important role by suggesting various derivatives and preparing them for tests. Later, in cases where proper dispersion and adherence of the compounds to plants were important, the skill of physical chemists was called upon.

In general, the compounds of greater chemical stability were found to be less effective. Fungicidal efficiency diminished with increase in size of alkyl radical, and as aryl radicals were substituted for alkyl. Thus the unusual situation developed that with the exception of the bisethylene (dithiocarbamates), the first and simplest products tested, the methyl derivatives, proved to be the best fungicides.

Iron and zinc dimethyldithiocarbamates, $(CH_3)_2$NC(S)-S-M-S-(S)CN$(CH_3)_2$, are now sold as "Fermate" fungicide and "Zerlate" fungicide respectively, for control of fungous diseases of many fruit and vegetable crops, tobacco, flowers and other ornamentals. Zinc ethylenebis(dithiocarbamate), Zn(-SC(S)NHCH_2CH_2NH(S)CS-), marketed as "Parzate" fungicide, has specific action in the control of late blight on potatoes and tomatoes. Tetramethylthiuram disulfide, $(CH_3)_2$NC(S)-S-S-C(S)N$(CH_3)_2$, is used in two compositions, as "Arasan" disinfectant for seeds and "Tersan" fungicide for turf diseases.

Overall, the derivatives of these groups of compounds proved to be outstanding as fungicides, rather than as insecticides. Although a marked degree of specificity for different pests was characteristic of the members of this series, it is interesting to note that all three were highly effective. This work offers still another example of how the breadth of interest in a company like Du Pont can lead to worthwhile developments.

Field testing of promising fungicides, including "Parzate" formulations, for control of tomato late blight.

Questions College Men ask about working with Du Pont

What are the opportunities for research men?

Men qualified for fundamental or applied research are offered unusual opportunities in facilities and funds. Investigations in the fields of organic, inorganic and physical chemistry, biology, parasitology, plant pathology and engineering suggest the wide range of activities. Write for booklet, "The Du Pont Company and the College Graduate," 2521-A Nemours Building, Wilmington 98, Delaware.

DU PONT

REG. U. S. PAT. OFF.

BETTER THINGS FOR BETTER LIVING
...THROUGH CHEMISTRY

More facts about Du Pont — Listen to "Cavalcade of America," Mondays, 8 P.M., EST on NBC

Campus Highlights

(continued from page 18)

lowed with a short response on behalf of the newly initiated class.

Serving ably as toastmaster, Prof. Ralph J. Harker's guiding hand warmly welcomed the new initiates to the Brotherhood of Pi Tau Sigma.

LOW BLOWS

BEWARE. It doesn't pay to sleep during those class movies any more. Jerry Kroot, EE 3, the local photo-fiend, is sneaking around and taking candid shots with a flash gun. The complaints so far registered by napping students are largely over loss of sleep rather than the necessity of explaining their pose to the instructor.

ETA KAPPA NU

Dick Lathrop seemed a little worried as he delivered his prize winning essay entitled, "L and S, Here I Come" to the Theta Chapter of Eta Kappa Nu, national Electrical Engineering Honorary fraternity, at their initiation ceremony on Wednesday evening, December 3rd. Neophytes in the organization include: Gayle Adams, Richard Ausborne, Theodore Bernstein, John Conley, Arthur Cooke, Thomas DePauw, David Fell, Sidney Gunderson, Roy Hyink, Richard Jacobson, William Kissinger, Richard Lathrop, Frank Noll, Gordon Osterhaus, David Rice, Robert Sagen, George Scholes, and Harvey Wyckoff.

After the ceremony the fraternity treated the new initiates to a banquet at the Wooden Bowl. Prof. Clagett of the Biochemistry department addressed the group, speaking on the International Aspects of Science. Professor Benedict from the EE department served as toastmaster.

TAU BETA PI INITIATION

Tau Beta Pi, honorary engineering fraternity, held its formal initiation at the Capital Hotel on Tuesday, Dec. 9. The program included a welcome to the initiates by Pres. V. V. Holmes, a response by initiate N. J. Stickney and a talk by Roundy Coughlin of the State Journal. Toastmaster for the occasion was Mr. Pat Norris of the Johns-Manville Corporation.

Initiates included: W. K. Dehaven, F. F. Hansen, A. J. Hausladen, W. A. Ullman, C. Warren, G. J. Anderson, G. H. Buelow, R. E. Cech, A. J. Cooke, W. R. Corzilius, G. R. Creedle, T. E. De Pauw, F. S. Dreher, A. R. Ebi, H. D. Goodman, M. L. Grien, H. Holtzman, C. A. Halla, K. P. Johannes, W. H. Kissinger, C. W. Korndoefer, G. H. Montemayor, J. E. Scott, N. J. Stickney, H. L. Wyckoff, R. G. Young, C. F. Dickert, D. V. Dodge, D. D. Fell, R. K. Ausbourne, R. S. Donaldson, D. Golden, S. R. Lange, A. B. Pagel, E. P. Young, R. L. Foss, D. A. Plautz, L. A. Zuchowski, F. R. Noll.

Thelma Estrin

Latest Tau Beta Pi badge winner (women are not admitted to full membership) is Mrs. Thelma A. Estrin, e'48. Having acquired experience as an engineering assistant for Radio Receptor Corporation, and as a civilian radio mechanic for the Army Air Forces, she hopes to work in the field of electronic applications to medicine after she receives her master's degree in electrical engineering. While maintaining her 2.76 grade point, she has taught in the Physics department and is now a laboratory instructor in the Electrical Engineering department. She is also a member of AIEE and IRE.

(continued on page 38)

Science Highlights . . . (continued from page 32)

It has been known that the earth's magnetic field could not result from the great masses of iron inside the earth, because—even though there is a great deal of iron in the earth's core—the iron at the core is at temperatures which do not permit magnetic properties.

As reported to the British Royal Society, Prof. Blackett bases his theory on two important observations:

1. Measurement of the sun's magnetic field shows that it is like that of the earth **when allowances are made for the sun's greater mass and slower rate of rotation.**

2. Measurement of the star 78 Virginis indicates that it, too, is closely proportional to that of the earth and sun, when allowances are made for its mass and speed of rotation.

In 1928, two scientists rotated a copper sphere (about six inches in diameter) at 200 rpm in an attempt to verify a similar theory. When they obtained no measurable results, they abandoned the experiment. The experiment was bound to fail, for by Blackett's formula, any body which could be spun in a laboratory would have to rotate so fast to produce a measurable field that it would fly to pieces. Ultra sensitive magnetic field indicators would aid scientists in verifying this theory.

NICKEL-SILVER ALLOYS

Nickel-silver alloys, particularly those with 18% nickel, are being used for springs in telephone and electrical equipment.

TRANSFORMER CORE COMPOSITION

What might well be called a modified glycerine-litharge cement is used by H. J. Benner and A. M. Hadley in the cores of tuned, intermediate transformers for radio equipment. As described in U. S. Patent 2,413,-098, iron is powdered to the fineness of flour. Two parts of this iron are mixed with one part of litharge and sufficient glycerine to render the composition pasty when first mixed and non-brittle when hardened. The paste is poured or injected into the transformer housing, and the coils and condensers are placed in the correct position to obtain the desired characteristics. The iron-litharge-glycerine composition hardens in a few hours without change of volume, so that the space relationship of the coils is maintained.

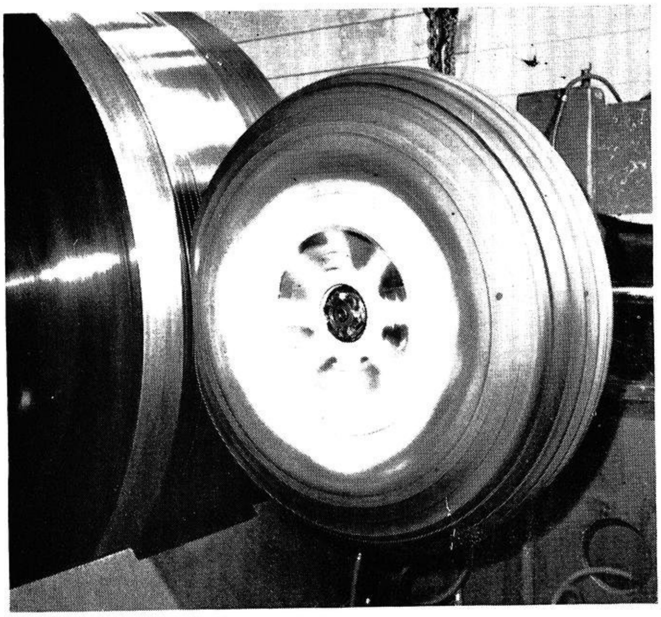
Design Engineering

(continued from page 13)

may have to indicate the test data which must be obtained to supplement the design computations.

(b) Supervision of design calculations. Except in the very small company, the design engineer will do little routine calculation. Usually such work will be turned over to people hired especially for this purpose; however, he must understand and supervise all computations.

(c) Experimental testing. It is often possible for a man to work on the design, test, and experimental manufacture of a particular project. This arrangement



Dynamic testing being performed on a flywheel dynamometer. This simulates conditions encountered by landing gear.

obviously has many advantages, both to the engineer and to the company, when it can be successfully applied.

(d) Investigation of new methods. Often the designer is faced with unique problems for which he must find a solution. This may involve development of original equations, and a continual survey of the technical publications in his particular field. New processes of manufacture, new engineering materials, and new products of all kinds which may be utilized in his work, are all factors which must be considered if design procedure is to keep pace with industrial progress.

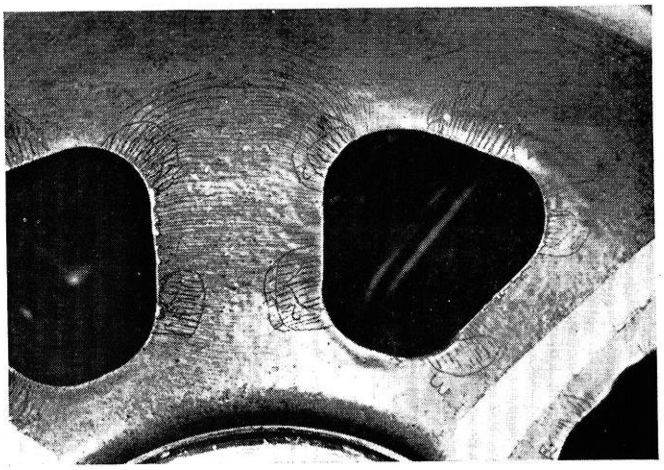
(e) Contact with vendors. Part of the designer's time is spent in dealing with vendors or sub-contracting manufacturers. This meeting of people outside of his own company broadens the designer's viewpoint and increases his understanding of the entire design picture.

(f) Contact with other departments. Within his own company, the designer is in constant touch with production, experimental, and service problems, and with the men in these various departments.

(g) Contact with specialists. A designer must often depend upon experts in such fields as metallurgy, hydraulics, mathematics, or stress analysis. These consultations, whether with men in or outside of his company, increase his engineering knowledge and background.

(h) Routine duties. As in any other branch of engineering, the design engineer must spend a portion of his time doing such things as making out reports, signing drawings, authorizing changes, and handling paper work in general. This can be kept to a minimum, but seems to be a necessary evil.

Regarding the qualities which a successful designer must possess, a good technical and practical background is essential; but more than this, he must possess sound judgment so necessary in making design decisions. He must be able to simplify. He must incorporate, by compromise, as many desirable features and as few undesirable features as possible. Further, he should be able to sift the practical ideas from the impractical, and to integrate all considerations into the optimum result.



These wheel spokes show the growth of contoured tension patterns as the load is increased.

Finally, but perhaps most important of all, a designer must possess originality of thought. The thinking through of new designs and the application of original ideas can be a source of personal satisfaction, and of perpetual interest, so apt to be lacking in many engineering jobs.

S-T-A-T-I-C

by C. Strasse e'49

"I fell over fifty feet!"
"And you mean to tell me you weren't hurt?"
"No, I was getting off a Madison bus."

* * *

A man's eyes are like a bird . . . They flit from limb to limb.

* * *

"I'm always ill the day before a journey."
"Then why don't you go a day earlier?"

* * *

Breathes there a man with soul so dead,
Who never turned around and said: "Not bad."

* * *

A new and complete lunch wagon has been made of aluminum alloys and weighs only 425 pounds. Of course it is only a light lunch wagon.

* * *

Seventeen . . . the age when a girl puts away her doll —and becomes one.

* * *

Three slightly deaf old men were riding on an old noisy train in England. As they neared a city one asked:
"Is this Wembly?"
"No," replied the second, "this is Thursday."
"So am I," put in the third, "let's stop and have one."

* * *

"For two pins," said the wolf, "I'd stop this car and kiss you."
"Here take these," said the girl, "my hair will come undone anyway."

* * *

Customer: "Waiter, what's wrong with these eggs?"
Waiter: "Don't ask me, I only laid the table."

* * *

Question: "Do you know why the little bee buzzes?"
Answer: "You'd buzz, too, if some one stole your honey and nectar."

* * *

She: "I'm having a book published by Simon and Sh."
He: "Who's Sh?"
She: "He's the silent partner."

* * *

"I was shot in the leg in Africa," said the vet.
"Have a scar?"
"No, thanks, I don't smoke."

Grandma says: "Holding a boy's hand used to be an offense—now it's a defense."

* * *

An economical wife is one whose husband wears one darned thing after another.

* * *

"Were you ever in the state 'pen'?"
"Why no, what makes you ask?"
"Well why is that number 394862 on your back?"
"Oh that's where my wife hit me with the car while I was holding the garage door open."

* * *

A typical co-ed was being shown through the railroad shops.
"And here," said her guide, "we have the locomotive boiler."
"But why do they boil locomotives?" she asked.
"To keep the engine tender," he replied.

* * *

Love starts when she sinks in your arms and ends with your arms in the sink.

* * *

When Bobby came back from his first dancing lesson he was asked how he liked it.
"Aw it's easy," he replied. "All you have to do is turn around and keep wiping your feet."

* * *

Wife: "I see that in some parts of India a good wife can be bought for two dollars. Isn't that awful?"
Husband: "Oh I don't know, a good wife would be worth it."

* * *

He: "Do you smoke?"
She: "No, I don't smoke."
He: "Do you drink?"
She: "No, I don't drink."
He: "Do you neck?"
She: "No, I don't neck."
He: "Well, what do you do?"
She: "I tell lies."

* * *

Diner: "I'll have a dollar dinner please."
Waitress: "On wheat or rye?"

CAMPUS HIGHLIGHTS

(continued from page 34)

Kappa Eta Kappa

Meeting as a body for the first time since 1942, members of Kappa Eta Kappa, Electrical Engineering fraternity, assembled at Lawrence, Kansas, over Thanksgiving weekend to hold their National Convention. Those attending from the Wisconsin Delta chapter included: Mervine Oleson, Chapter President; Mike Larson, Vice-Pres. of National Organization in charge of expansion; Richard Kraunt; John Gemlo; and LaVerne Stelter.

KHK is bowling them over in the Wisconsin Union of late. The fraternity team has not only been winning their bowling matches with other campus groups, but has been taking them by all three games of the evening. Twice the team has also walked off with individual high scores and team high score.

Prof. M. O. Withey, dean of the College of Engineering, spoke to the local ASME chapter on the Professional Status of the Engineer at the meeting of the local student chapter on Tuesday evening. December 9th. Refreshments were served after the talk.

Engineering Lectures

Engineers are "all over the place" said Mr. A. vonWening, of the A. O. Smith Corporation in Milwaukee, as he addressed the Engineering students on the "Place of the Engineer in Industry" in the Union Theater on Friday morning, December 5th. During his talk Mr. von-Wening outlined the functions of business and said that Engineers are present in all of the departments including: Sales, Manufacturing, Engineering, and even Finance and Auditing. He impressed the group with the idea that education is an endless process and that a young man must continually learn if he strives for a high place in industry.

After graduating from Cornell University in 1918, Mr. vonWening spent 21 years with the Continental Illinois National Bank and Trust Company of Chicago, Illinois. He left that organization to join the A. O. Smith Corporation in 1940 as assistant to the president. At the present time he is a Vice-President and Controller of that Corporation, and is also a Director and member of the Executive Committee. He is also a director of several other companies.

Throughout the more than 70 years of its existence, the A. O. Smith Corporation has placed a great emphasis upon engineering in the development and improvement of its products. This fact places Mr. vonWening in an advantageous position to discuss the place of the engineer in industry.

The program was planned by the Engineering Lectures Committee.

FREE, FREE

Need an airplane? Rumor has it that the University would part with the P51 in the Steam and Gas Laboratory. The only catch is that the fighter plane doesn't go through the twelve foot exit which is the only gateway to the outdoors. So if you feel like tearing things apart, put in your bid.

AIEE FIELD TRIP

Fifty-six electrical engineering students, accompanied by Professor J. C. Weber and Assistant Professor J. R. Hafstrom, inspected three prominent Milwaukee plants on December 5, 1947. Despite bad traveling conditions, the group arrived at Cutler-Hammer by 9:30 A.M., where Mr. R. A. Hoffman and five assistants conducted them throughout the plant. Especially interesting were the moulding operations, the endurance testing room, and a demonstration lecture on their gas calorimeters. At Allen Bradley, the entire group lunched as guests of the company. Mr. J. J. Mellon, chief engineer of Allen Bradley, gave a talk on the products made by the company, and mentioned objects of interest to be observed on the tour. The tour was exceptionally well conducted, the most interesting part being the inspection of the department making carbon resistors under the trade name of "Ohmite."

Arriving at A. O. Smith about half an hour late, the group was unable to make the tour of the plant but was conducted through the display auditorium. Here they received a very informative talk on the company's production methods by Mr. G. R. Allen. All expenses of the trip were paid by AIEE with arrangements made by AIEE Chairman Arthur Falk.

Triangle-Kappa Eta Kappa

Santa, presents, Christmas tree, and approximately seventy-five couples from the two fraternities were all gayly mixed into a grand party on Friday evening, December 19th, as KHK and Triangle fraternities entertained in their traditional Christmas Dance. Will Harold's orchestra furnished the music and Professors Ben G. Elliott and Kurt F. Wendt were chaperons.

Big Wally Griskavich from Triangle, complete with pillows, beard, and red suit, fooled the youngsters present and distributed the gift favors. In charge of the affair were Rex Roe from Kappa Eta Kappa, and Art Bukovich and Dick Wilson from Triangle.

Triangle

Triangle fraternity entertained a group of engineering students at a rushee smoker at the Chapter House on Wednesday evening, December 3rd. Movies were shown and refreshments served. Stan Jeselun was in charge of arrangements.

Compressor . . . (continued from page 15)

of each lobe. As the rotor expands radially the fiber is worn away, developing the required clearance. These two improvements give minimum clearances, consequently maximum efficiency without damage to parts or too difficult a manufacturing problem. Noisy operation because of straight rotors, mentioned in the foregoing paragraph, has been overcome by using a relief bore in the main bores on the outlet port, so that actually the chamber opens gradually to the port. The clearance between the meshing lobes of the rotors must be consistent. This depends, first of all, on accurate machining of rotors, and, secondly, on accurate machining and timing of gears. The gears are timed on the shafts and held in position by keys. To take care of manufacturing discrepancies, one of the helical gears is made in two parts, a shell and a hub. The two parts are doweled and bolted together with a shim between. This shim can be varied in thickness. This moves the shell and consequently the axial position of the gear. On a helical gear this axial movement changes the radial position and consequently the timing of the gears. The gears, being keyed to the shafts, remain in this adjusted position (Figure 3). Anti-friction bearings are employed in the unit, a double row ball bearing on the gear end and a roller bearing on the closed end. The roller bearing is used to allow for temperature expansion of the rotor assembly.

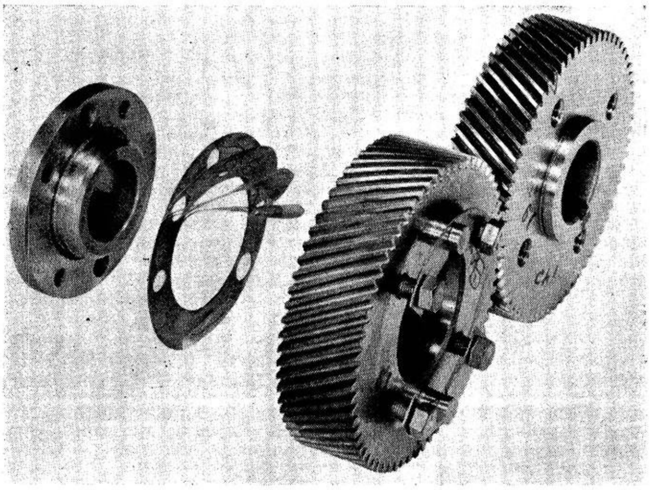
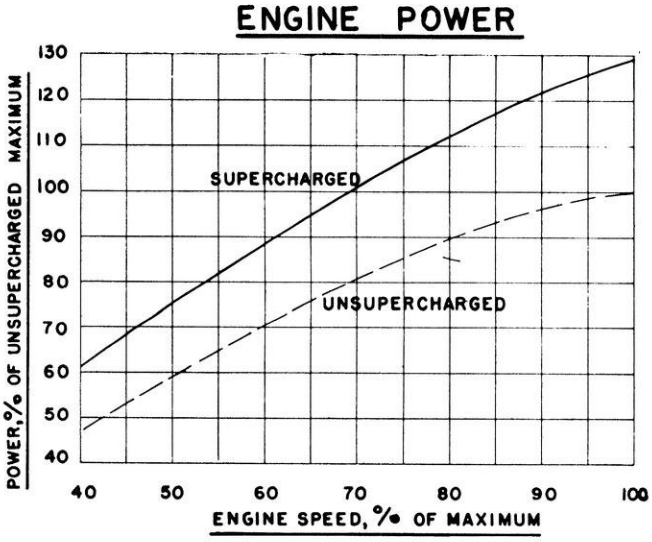


Figure 3 — Gear set, showing special gear design for ease in timing.

Definite advantages of this design exist over other constructions. The same standard parts can be used on a number of different sized units. By using different lengths of rotor and shaft assemblies and housings but the same end plates, gears, bearings, and drive parts, units of different capacities can be built.

The two-lobed rotor type compressors are used in applications where a great quantity of air is needed; a good example is the use on blast furnaces and cupolas. It is also used for the transmission of liquids. The three-lobed



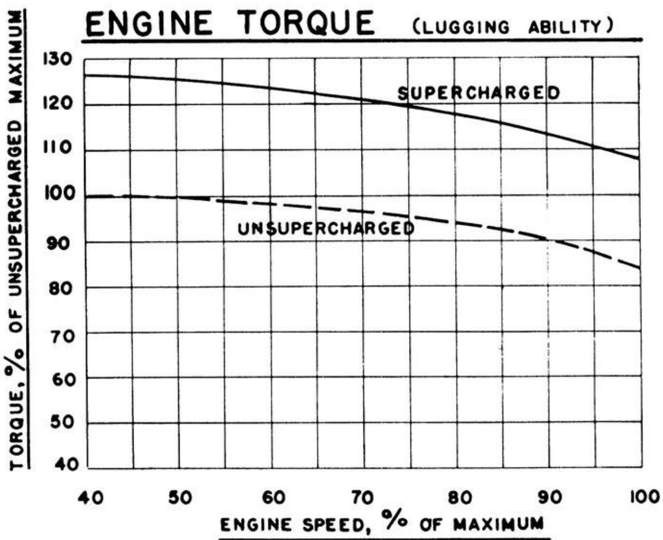


Figure 4 — Performance curves for a four cycle Diesel engine, illustrating advantages gained from use of a compressor for supercharging.

type compressor is employed extensively on Diesel engines, on the two-cycle engine for scavenging and on the four-cycle for supercharging. Figure 4 shows performance curves which illustrate the advantages of the use of a compressor for supercharging on a Diesel engine.

The Roots type compressor has definite advantages which have been recognized. However, problems still exist, particularly in the production of the unit. Cost of production is relatively high because of the many precision parts required for efficiency. New and improved designs, both in product and processes of manufacture, will, to a certain extent, solve this problem, making possible an even greater use of the compressor. Its use on small gasoline engines, particularly in the automotive field, is a goal constantly being strived for.

Science Highlights . . . (continued from page 35)

PNEUMATIC FATIGUE TESTER

Breaking, twisting and bending hard metals with compressed air is the new method developed to determine the strength of metals and alloys.

An air-pressure machine, the operating principle of which is similar to that of a slide trombone, is used to vibrate metals and alloys at their natural frequencies until they crack or break under the stress and strain, thus determining their durability for actual operating conditions.

Performed with a pneumatic fatigue-testing machine, the new method, which was developed by engineers of General Electric, is declared to be the most rapid method of fatigue testing, and it is expected to bring radical changes in that field.

Originally developed to test gas-turbine buckets, the device has proved so efficient and adaptable that it will undoubtedly have wide industrial application.

TIMES OPERATIONS FROM ⅛ OF A SECOND TO 60 HOURS WITHIN .005 ACCURACY

In the Series "2800" Industrial Timer, built by the Automatic Temperature Control Company, Inc., of Philadelphia, a synchronous motor-driven mechanism is coupled to a solenoid. This engages and disengages a clutch at the beginning and end of the time interval, which can be controlled within accuracy of .005 of dial range.

Even a small solenoid develops plenty of energy. The Series "2800" is equipped with a special shock absorber to stop the punch of the solenoid plunger at the end of its throw, and reduce the jarring vibration.

After several fatigue-resistant alloys failed in flexing tests at the 1,000,000 mark, A.T.C. engineers standardized on "Z" Nickel for the shock absorber. Tests and field reports now show that more than 5,000,000 operations fail to put "Z" Nickel "on the canvas."

MINIATURE PLANE RADIO

Storm-proof transmission to airport towers and radio range stations used in aerial navigation will be available to flyers of personal planes with the aid of a miniature radio transmitting set developed by General Electric. The set weighs only two pounds, nine ounces. It uses less than one-tenth the power of a conventional private-plane radio transmitter. It has a range of approximately 50 miles over level terrain from an altitude of 5,000 feet. Because of extremely high operating frequencies, the set is relatively free of climatic interference.
