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he Wisconsin **engineer**

EXPOSITION ISSUE

APRIL 10-11-12

Tight reins in the stratosphere

FOR YEARS the performance of bombers and fighter planes at high altitudes has been seriously handicapped by "mushy" controls due to slackness in the cables.

That's because, when flying in the earth's upper atmosphere where it's sometimes as cold as minus 70°F., the aluminum airframe contracts much more than the carbon steel control cables. To take up the slack, all sorts of compensating devices were utilized. They were expensive. Were costly to maintain. They added cumbersome weight. Created potential lags in control response.

Now this problem has been solved. By the logical step of basically improving the control cable itself . . . by developing a steel cable that would contract and expand at practically the same rate as the plane's aluminum frame. It took fifteen years to do it but it was worth the time and cost. We called this improved cable, HYCO-SPAN*.

HYCO-SPAN Aircraft Cable, with a coefficient of expansion 50% higher than high carbon steel, and 33% higher than stainless steel, comes *closest* of any steel cable to matching the expansion and contraction of 24 ST aluminum alloy air frames.

Even without temperature compensating devices, HYCO-SPAN provides positive, responsive control that won't loosen or tighten up, that will remain free of lag and mushiness, and that prevents the development of plane flutter—no matter what the altitude, no matter how big the plane or at what speed the plane is flying.

In addition, HYCO-SPAN Cable, being non-magnetic, has no effect on sensitive airborne electronic equipment. Having the corrosion resistance of stainless steel, HYCO-SPAN stands up well in service in any climate. Its low coefficient of friction permits lower tension loads and improves stability.

HYCO-SPAN Cable is another example of the many interesting products developed and produced by United States Steel. If you're interested in becoming a part of a progressive organization after graduation, why not look into the opportunities with United States Steel? For more details, ask your placement director or write for the informative booklet, "Paths of Opportunity." United States Steel Corporation, Room 2810-S, 525 William Penn Place, Pittsburgh 30, Pa.

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"True-or-False" Quiz on Business

Question	What Most People Believe	The Fact
How big are corporations' profits?	25% (or 25¢ out of each $1 of sales).	7%. In most years actually *less* than 7 cents of each sales dollar.
Who gets the largest share of the income of corporations?	Most people say the owners do.	Actually the workers—they get 86%.
Does war increase corporation profits?	Many people think so.	The facts are—NO. Compared to a good peace year, corporation profits on the sales dollar went down from 6.4¢ to 4.3¢ in the last war.
Do machines put men out of work?	Most people say yes.	NO. In the automobile industry, for example, one man and a machine do the former work of 5 men, yet 20 times as many men are employed. Machines well used reduce costs and prices which broadens markets and so provides more jobs.
Do top executives make too much?	Too many workers think, "If their salaries were divided among workers, our wages could be much higher."	If *all* the salaries of the three top men in the country's biggest company were divided among that company's workers, it would take each worker in that company about three weeks to buy one pack of cigarettes with his increase.
Should taxes on corporations be increased?	"Yes," say many. "Soak the rich."	Truth is that high taxes already take so much money which should be spent in keeping machines modern, that 43% of America's machines are too old to protect tomorrow's jobs.

So much falsehood has been spread about business by communists that workers in their own interest should promote the truth. The best interest of workers, business and all the people is the same.

* * *

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Naturally, this diverse activity calls for a varied array of engineering talents—mechanical, electrical, chemical, metallurgical and industrial. And it calls for all the imagination and ingenuity a young engineer can supply.

Moreover, the environment at General Motors is especially conducive to advancement and success. For all work is decentralized among GM's 33 manufacturing divisions, its 111 plants in 55 towns and cities throughout the country. And although each division operates as an independent unit with its own engineering department, each can draw upon the resources of GM's central research and engineering laboratories.

Thus is combined the friendly, intimate atmosphere of a small organization with the scope, facilities—and opportunities—of a large one.

So a young engineer, who has what it takes, can take what General Motors has—and fashion a noteworthy career for himself in his chosen field. Many engineering graduates now in top jobs at GM can vouch for that.

Why not check with your College Placement Office and arrange for an interview with our GM College Representative the next time he visits your campus? Or if you prefer, write direct to us.

GM positions now available in these fields:

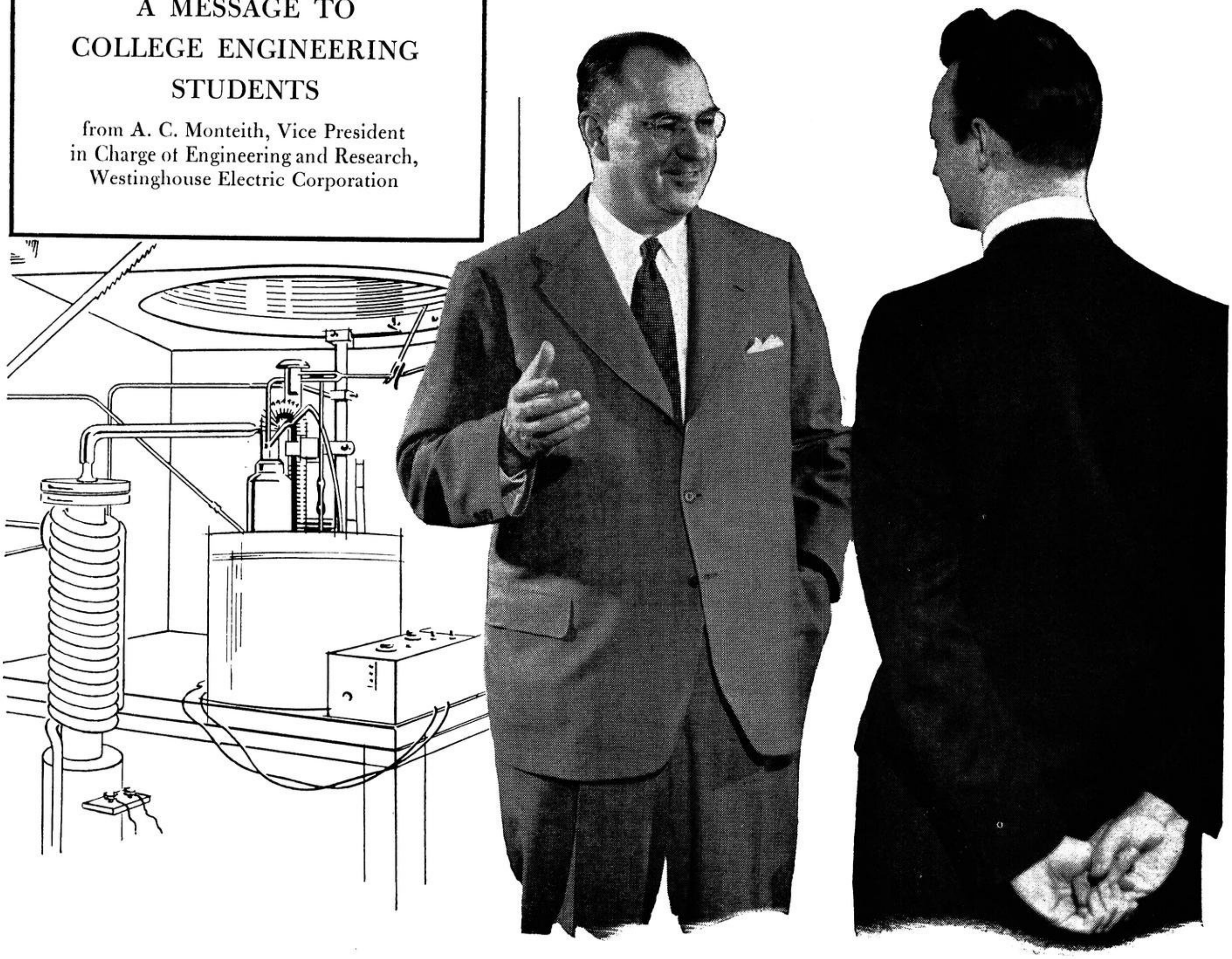
MECHANICAL ENGINEERING	ELECTRICAL ENGINEERING
METALLURGICAL ENGINEERING	INDUSTRIAL ENGINEERING
CHEMICAL ENGINEERING	BUSINESS ADMINISTRATION

GENERAL MOTORS CORPORATION

Personnel Staff, Detroit 2, Michigan

A MESSAGE TO
COLLEGE ENGINEERING
STUDENTS

from A. C. Monteith, Vice President
in Charge of Engineering and Research,
Westinghouse Electric Corporation



There's room to grow at Westinghouse

It's natural that you sometimes wonder about the "elbow room" in the field of engineering. Even though the past half century has witnessed great technological developments, they are only a prelude to the things to come. We have barely scratched the surface in the fields of engineering development and research. And that, most certainly for you, should mean there *is* room to grow.

But first you must find the right starting point—a company which will give you the opportunity you want in your career. Westinghouse offers you this kind of opportunity, for it is a growing company in a dynamic field. Energy is our business. Here at Westinghouse, well planned orientation and training, continued education, position rotation, and management development are all offered to provide you a favorable climate in which to grow.

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For information on career opportunities at Westinghouse, consult Placement Officer of your University, or, send for our 34-page book, *Finding Your Place in Industry.*

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Mr. L. J. Dunlap
District Educational Co-ordinator
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Chicago 54, Illinois

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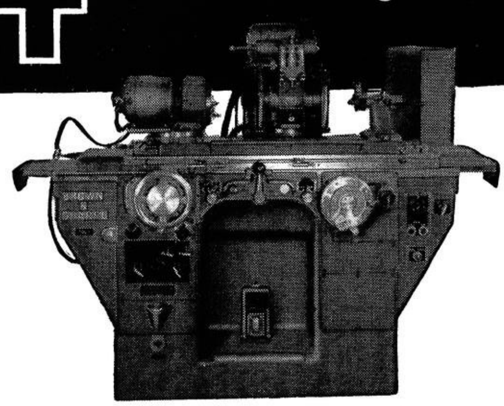
YOUR JOB

Wherever you're working—in office or shop,
And however far you may be from the top—
And though you may think you're just treading the mill
Don't ever belittle the job that you fill;
For however little your job may appear,
You're just as important as some little gear
That meshes with others in some big machine,
That helps keep it going—though is never seen.
They could do without you—we'll have to admit,
But business keeps on, when the big fellows quit!
And always remember, my friend, if you can,
The job's more important (oh yes) than the man.
So if it's your hope to stay off the shelf,
Think more of your job than you do of yourself.
Your job is important—don't think it is not,
So try hard to give it the best that you've got.
And don't ever thing you're of little account—
Rmeember, you're part of the total amount.
If they didn't need you, you wouldn't be there,
So always my lad keep your chin in the air.
A digger of ditches, a mechanic or clerk,
Think well of your company, yourself and your work.

—From Business Education Yearbook

4 Completely NEW Universal Grinding Machines



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In lighter-than-air, Goodyear Aircraft is the world's largest builder of airships, including the new Navy N-type—largest nonrigid airship ever built.

Long the leader in its field, Goodyear Aircraft is once again vitally concerned with National Defense projects. But we go far beyond anything of the past. Today, our output includes complete airships as well as many aircraft components. But we are also active in many new fields—ranging from plastics fabrication and design to guided missiles and electronic computers.

This wide variety of production, together with our desire to build and maintain an outstanding engineering staff makes Goodyear Aircraft a good place to grow. You'll find unlimited opportunities for advancement in the engineering field of your choice.

So plan NOW—take the first step by sending a brief resumé of your qualifications and experience. Or ask for an application blank and further information. *Address:*

Dr. K. Arnstein, Vice President of Engineering,
Goodyear Aircraft Corporation, Akron 15, Ohio.

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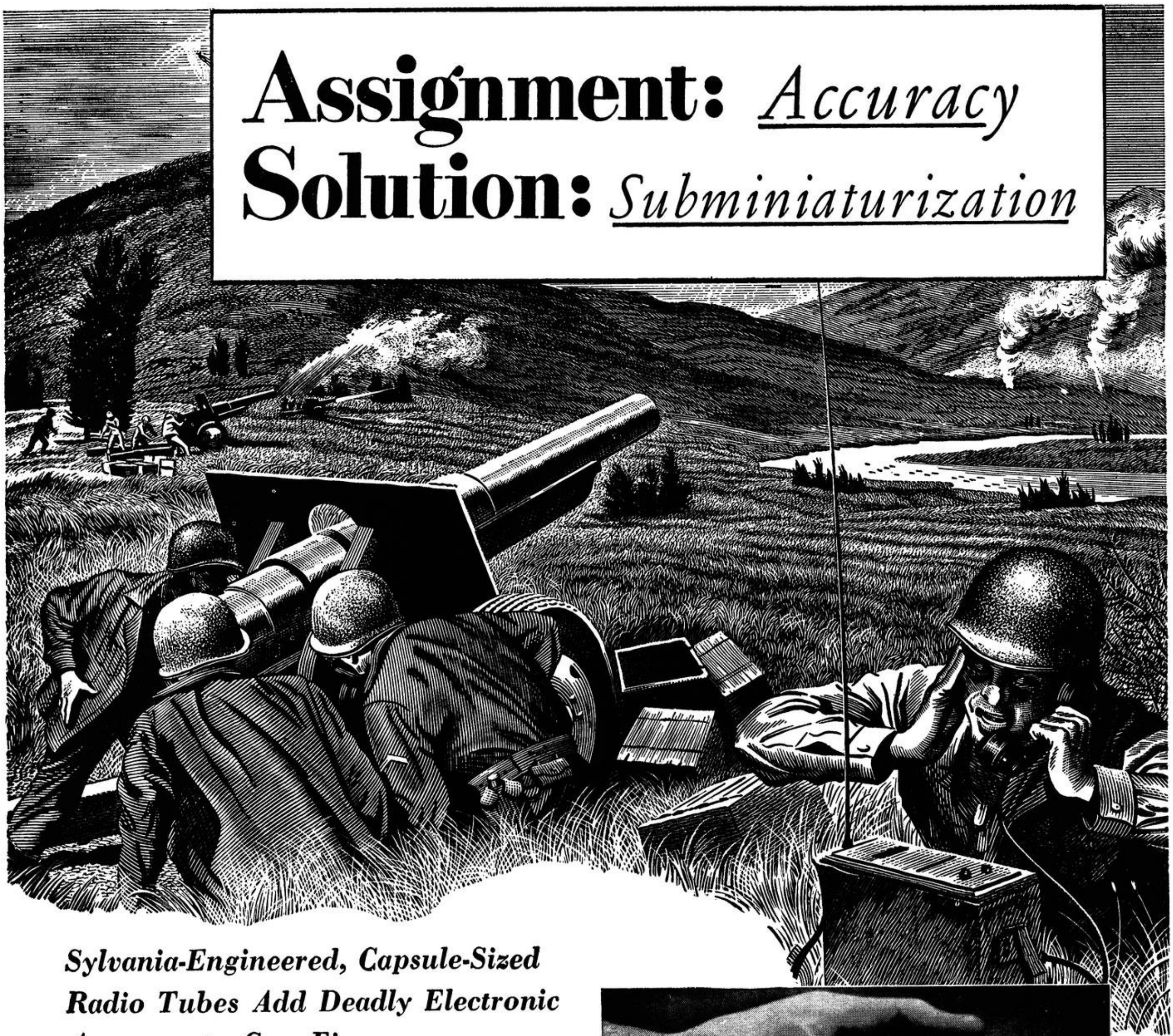

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Here, in every sense, is a forward-looking, growing concern—one which, by 1954, will have doubled its facilities of a decade ago. As one example of its foresightedness, Detroit Edison engineers are working with Dow Chemical Company as one of our nation's five atomic research teams. Intensive studies are under way concerning nuclear heat in relation to thermal electric generating plants.

And so numerous opportunities for advancement exist now and should continue to develop in every department of the Company. Detroit Edison is constantly on the lookout for graduates with initiative and ability who can be trained to fill positions of responsibility in the future.

On-the-job training forms an important part of the Detroit Edison picture. For the last 27 years the Company has operated a special College-Graduate-in-Training Program designed to acquaint new employees with the principal operating departments and company points of view. As you visit departments you are not only learning about the Company's business and organization but you also have a chance to select the right kind of work and department you desire. Here you will associate with men of long experience who are nationally recognized for their leadership in the public utility field. Thus, you will lay the groundwork for your advancement and career success.

Many men who now hold high ranking positions in The Detroit Edison Company got their start on training programs like those offered to you today.

DETROIT EDISON PLANS ENGINEERING FUTURES

Don Blodgett set his sights on advancement following graduation from the University of Wisconsin with a BSEE. Five years of Army service delayed his start with Detroit Edison until 1946. Since then his career has been filled with challenge and responsibility. Today finds Don a Senior Engineer directing the work of our high-power laboratory, which proves new equipment design and construction before integration in our Electrical System. Career planning in Don's case still goes on for his engineering future is bright at Detroit Edison.

For the full story of your career opportunities at Detroit Edison, simply call or write for a free copy of this new booklet, "What About the Electric Power Industry?"

The Detroit Edison Company

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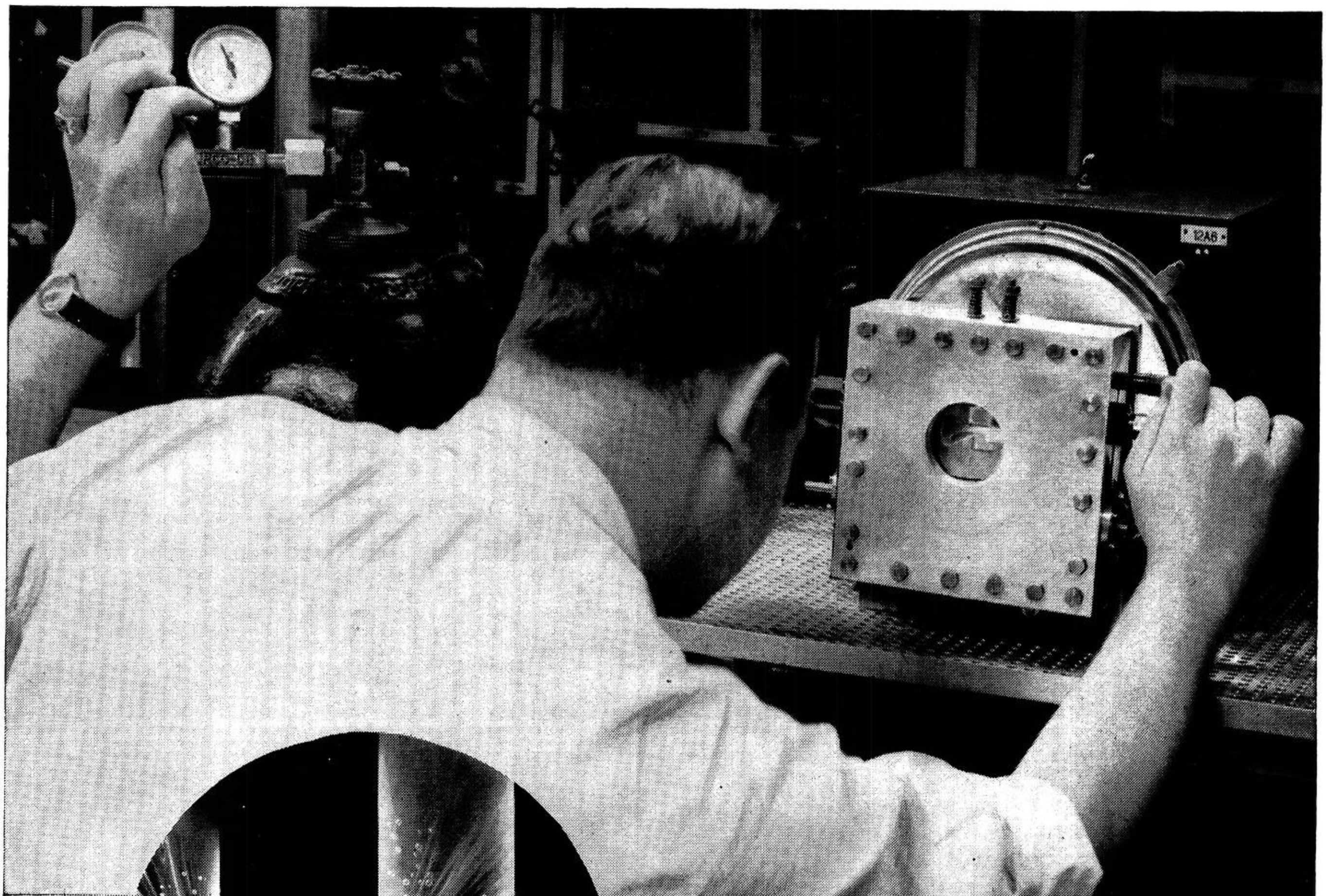
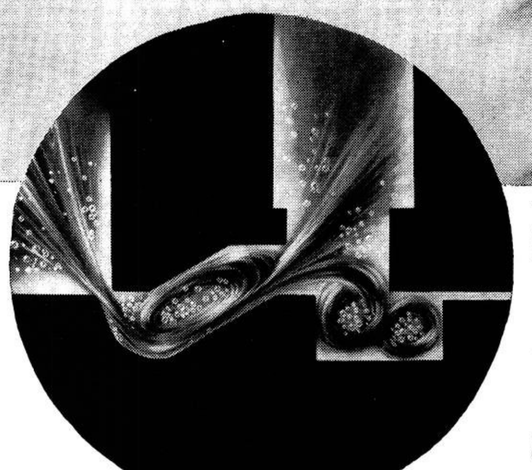
OPPORTUNITIES UNLIMITED

The NEW Collins Engineering and Research Building, containing more than 100,000 square feet of floor space, is now under construction. This modern structure, located on a 52-acre wooded tract in Cedar Rapids, contains the latest architectural refinements and will be one of the finest and best equipped Engineering and Research laboratories ever built.

Collins Radio Company
Cedar Rapids, Iowa





This Sperry engineer is applying the fundamentals of hydraulics to determine oil flow characteristics at high pressure. Here he introduces nitrogen to the hydraulic fluid in a complex valve to make flow patterns visible for study.

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The Student Engineer's Magazine

WISCONSIN ENGINEER

Founded 1896

Volume 57 APRIL, 1953 *Number 7*

In This Issue . . .

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The official 1953 Engineering Exposition button design — by Jan Jordaan, grad engineer from Pretoria, South Africa.

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Special Features
In This Issue

1953 Engineering Exposition

OFFICIAL PROGRAM

by Richard Groth
Special Features Editor

Dean Morton O. Withey

Dedication

To Morton Owen Withey, retiring after forty-eight years of service to the University of Wisconsin; author of text books, University Bulletins, and many technical articles; honored by five major awards including the Spaulding Prize, Wason Medal, Turner Medal, and Citation from Wisconsin Society of Professional Engineers; member of Phi Beta Kappa, Tau Beta Pi, Sigma Xi, Chi Epsilon, Phi Kappa Phi, Chi Phi, Theta Tau,—American Society of Civil Engineers, American Society for Testing Materials, American Concrete Institute, American Society for Engineering Education, Wisconsin Society of Professional Engineers, National Society of Professional Engineers, American Association of University Professors,—Dean of the College of Engineering from 1946-1953, and a staunch friend and supporter of the student —

WE DEDICATE THIS ISSUE.

Wisconsin Engineer Staff

The Faculty

and

Polygon Board

of the

College of Engineering

Welcome You

to

1953

ENGINEER'S DAY

Friday, April 10

The Following Program Has Been Arranged For Your Enjoyment

10:00 A.M.—Information Centers open at Memorial Union, Mechanical Engineering Building and new Engineering Building. Directions for parking will be given.

11:05 A.M.—Meals available in Breese Terrace Cafeteria.

11:45 A.M.—Meals available in Georgian Grill and Tripp Commons of Memorial Union.

2:00 P.M.—Opening of Exposition with special program on terrace of new Engineering Building.

2:30 P.M.—Exposition in engineering buildings open for visitation.

3-5:00 P.M.—Tea for Visitors to Engineer's Day, Student Lounge of new Engineering Building.

6:30 P.M.—Engineer's Day Dinner—Great Hall of Memorial Union. (Doors open at 6 P.M. Formal dress is optional).

7:45 P.M.—Musical Program.

8:15 P.M.—Engineer's Day Addresses.

9:00 P.M.—Presentation of Distinguished Service Citations.

Engineer's Day, 1953, will be under way Friday, April 10, when engineering alumni from all parts of the state and nation return to the U.W. campus. The added attraction of the first Student Engineering Exposition since 1941 is expected to draw an unprecedented number of visitors. Ten thousand invitations have been sent to engineers and industrialists for the event.

Engineer's Day activities will start at 2:00 p.m. on Friday when the Exposition is opened with a special ceremony on the terrace of the new Engineering Building. Following this, the Exposition will be open to visitors.

A tea will be held in the student lounge of the new Engineering Building from 3 to 5 p.m.

During the day, you may visit the new $885,000 Chemical Engineering Building which has gradually been put into use during this school year. Research projects, class rooms, and offices will also be open for inspection.

At 6:30 p.m., the annual Engineer's Day dinner will be held in Great Hall of the Memorial Union. Professor E. R. Shorey of Mining and Metallurgy will preside, President E. B. Fred will extend greetings for the University, and A. Matt Werner will extend greetings from the Board of Regents.

A musical program, conducted by Prof. E. B. Gordon of the school of music and Don Voegeli of Station WHA, will be presented. Short addresses by two of the citation winners will be "New Horizons for Mineral Resources" given by Julian D. Conover and "The Engineer and Distribution" given by Arthur C. Nielsen. President Fred and Dean Withey will present the Distinguished Service Citations to the six outstanding engineers and industrialists pictured on the next two pages.

On Saturday, a special program is arranged for high school faculty and students who are interested in engineering. This is a new idea at Wisconsin and through it, it is hoped that more high school students will consider engineering as a career.

(please turn the page)

DISTINGUISHED CITATION

These Outstanding Will Receive Their Engineers'

1. William E. Schubert

1. WILLIAM E. SCHUBERT

Power utility engineer and executive with a record of outstanding professional and civic service in his own community and Wisconsin, William E. Schubert, vice president and general manager of the Wisconsin-Michigan Power Co., Appleton, is a native of Wisconsin. Born in Milwaukee in 1897, he received his Bachelor of Science degree in Mechanical Engineering from the University of Wisconsin in 1925 after army service in World War I, and his professional mechanical engineering degree in 1932.

Schubert became chief engineer of the Wisconsin-Michigan Power Co., in 1927. His close association with river developments afforded him an opportunity to practice conservation, and his company was one of the first to engage in watershed control through reforestation. He is a director of the unique Wisconsin conservation project, Trees for Tomorrow.

2. JULIAN D. CONOVER

Born in Madison in 1895, Julian D. Conover received his higher education from the University of Wisconsin, gaining his Bachelor of Arts degree in 1917, and after serving in the field and heavy artillery division of the army in World War I, he returned to the Wisconsin campus to earn his Bachelor of Science degree in Mining Engineering in 1922, and his Master's degree in engineering in 1924.

Conover also served as geologist and mining engineer for various interests in Alaska, Idaho, Arizona, the Lake Superior region, Mexico, and in South America from 1915 to 1923, and was an instructor in engineering geology at UW while completing work on his engineering degrees.

He has served as secretary of the American Mining Congress, Washington, D. C., since 1935, and is publisher and editorial director of the Mining Congress Journal. He is known as one of the nation's leading geological engineers who, in his position as secretary of the Mining Congress for the past 18 years, has played an important part in the formation of a national policy concerning the mineral resources of the U. S. and their utilization.

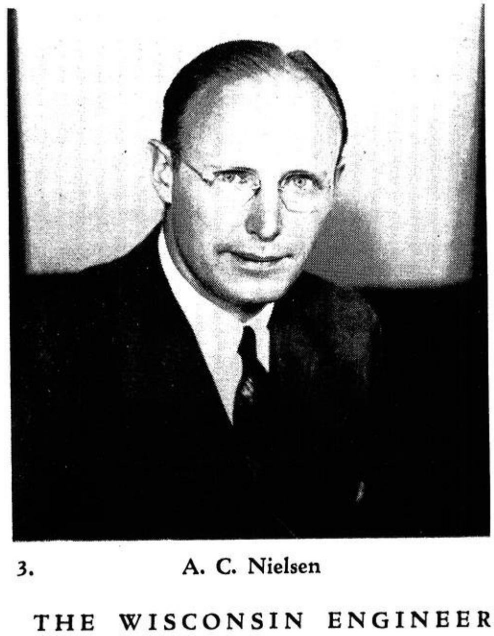
2. Julian D. Conover

3. A. C. NIELSEN

The name of A. C. Nielsen is known throughout the world, and the marketing research firm bearing it now has 2,000 full-time employes operating on three continents: North America, Europe, and Australia. Born in Chicago in 1897, Nielsen came to the UW for his higher education, receiving his Bachelor of Science degree in Electrical Engineering from UW in 1918. During his days on the Wisconsin campus, he was a leader in many student activities at the same time that he maintained a high scholastic record in the UW College of Engineering.

After World War I service as an ensign in the navy, Nielsen served as an electrical engineer for a refrigerating firm, then did field research for a business paper until 1923 when he founded the company bearing his name, now an international firm which has become the world's largest marketing research organization.

Nielsen has won a number of awards for his contributions to advancing the science of marketing, and in 1952 was cited by the Wisconsin Alumni Assn. for his distinguished contributions to the welfare of the University. He is a director of the DeMille Foundation for Political Freedom and a trustee of the Wisconsin Alumni Research Foundation.



3. A. C. Nielsen

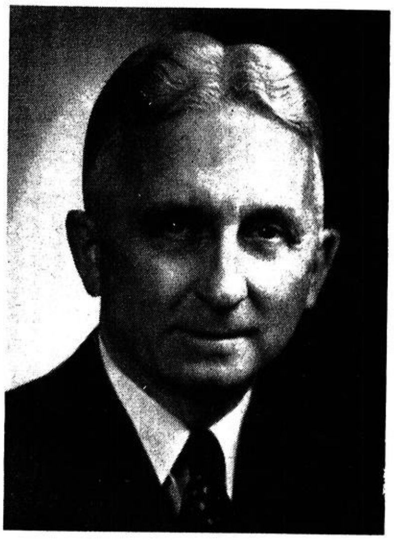
SERVICE WINNERS

Engineers and Industrialists Citations at the Annual Day Dinner

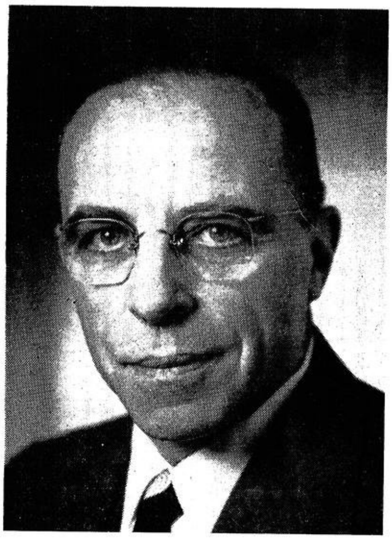
4. ALLEN ABRAMS

Born in Butler, Pa., in 1889, Allen Abrams adopted Wisconsin as his home state in 1926 when he joined the Marathon Corp. at Rothschild as its technical director. He received his academic degrees at Washington and Jefferson College and at the Massachusetts Institute of Technology, and is the recipient of the honorary degree of Doctor of Science from Washington and Jefferson.

Abrams has served as vice president and director of research at the Marathon Corp. since 1940. He is widely known in science and industrial fields for his valuable cotributions to the paper industry of Wisconsin, and has long been an active leader in the civic and educational affairs of the state. He was designated as one of the nation's 10 ablest chemists or chemical engineers in 1947 in a poll taken by the Chicago section of the American Chemical Society.



4. Allen Abrams



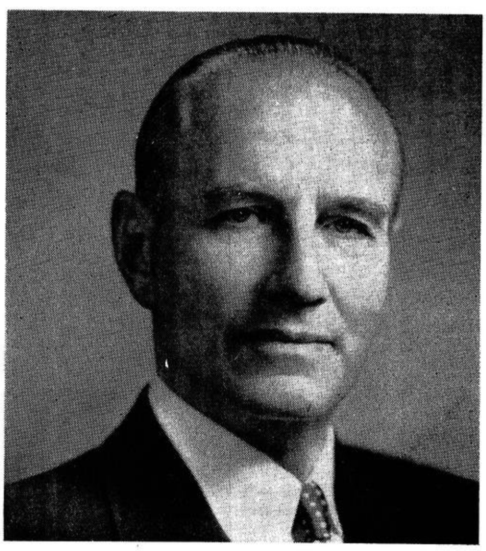
5. Lester C. Rogers

5. LESTER C. ROGERS

From water-boy and laborer to the presidency of one of the world's largest construction firms is the story of Lester C. Rogers, who has served as president of the 52-year-old construction firm of Bates & Rogers Construction Corp., Chicago, since 1937. Born in Elgin, Ill., in 1893, Rogers completed his secondary education there and then came to the UW, gaining his Bachelor of Science degree in Civil Engineering in 1915. During his student days at UW, he gained student honors in engineering and was a leader in student affairs.

Rogers' construction experience began during summer vacation months during his high school and UW days, when he worked as water-boy, laborer, carpenter, machine operator, and time keeper for the Bates & Rogers firm.

After service as an artilleryman in France during World War I, he became construction engineer and superintendent for the firm, climbing to its presidency in 1937. His firm has handled large construction jobs throughout the North American continent. During World War II it built shell-loading plants, blast furnaces, tank landing craft, floating dry docks, and the permanent bridges on more than 1,000 miles of Alaskan highway, and it is now engaged in the construction of U. S. air bases in French Morocco.



6. Armin Elmendorf

6. ARMIN ELMENDORF

Born in Texas in 1890, Armin Elmendorf came north for his higher education. He received his bachelor's degree in engineering from Illinois in 1914, then came to the UW to serve as an instructor in mechanics from 1914 to 1917 and to earn his Master of Science degree in 1917 and his professional mechanical engineering degree in 1919.

Later he served as research and consulting engineer with the Forest Products Laboratory of Madison, with the Celotex Corp., with Vickers, Ltd., in London, Eng., and with various firms throughout the U. S. in the field of wood products manufacture.

He has become nationally known as a manufacturer in the field of paper and allied wood products, and as an inventor of various wood products for building construction, a field in which he holds 70 patents. He is the author of many technical papers in mechanical engineering and on wood products, is a trustee of the Wisconsin Alumni Research Foundation, and in 1940 was the recipient of the "Modern Pioneer" certificate of the National Assn. of Manufacturers.

WISCONSIN SOCIETY OF PROFESSIONAL ENGINEERS

W. S. P. E.

Edited by

Stephen Carter, m'55

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WISCONSIN ENGINEERING

Engineers' Day, the student Engineering Exposition and the recent observance of Engineers Week on a state and national level all point towards the increasing importance that the engineering profession is playing in the state and nation. It is fitting therefore that this space be devoted to some of the highlights of the observance of national Engineers' Week in the state during the week of February 22-28. The observance was largely on a chapter level with full use of radio, television, exhibits, talks and special meetings and projects. Since space does not permit the presentation of complete details of all chapter activities, the well planned and highly successful program of the Northwest chapter is presented as typical of the chapter programs. The program was under the sponsorship of A. O. Ayres, chairman of the Northwest chapter public relations committee. A talk presented at Eau Claire by Pierce G. Ellis, WSPE vice president is presented in full in this issue.

The activities of the northwest chapter during Engineers' Week are outlined below:

(1) Speakers presented talks to high schools and service clubs.

(2) Tape recordings of interviews by member Pat Boyd and three top executives in Eau Claire were broadcast at intervals during the week over the radio stations.

(3) Four designed and complete window displays featuring Engineering were featured in the Eau Claire business district.

(4) Engineers' Week posters were displayed in show windows, busses and schools.

(5) Engineers' Week stickers were sent to the top executives of thirty seven industries in the Northwest area for placing on letterheads of important correspondence leaving the offices of these men during Engineers' Week. The stickers were sent out accompanied by a letter and in addition each executive was called personally by a member of the committee in order to insure proper use of the stickers.

(6) A letter from the committee calling attention to observance of Engineers' Week together with a copy each of Executive Research Surveys, No. 1 and 2 were sent to industrial and city executives, to high school principals and to the president of the Wisconsin state teachers college.

(7) A tape recording prepared by the national society was ordered and used by local radio stations.

(8) A special chapter meeting was held during the week.

Your Board of Directors is happy to announce an innovation which will insure the enjoyment and success of our fall meeting for 1953. This conference is going to be held at a resort instead of in a city as has been customary. The Fox River Valley Chapter will be host for this meeting to be held at the Schwartz Hotel, Elkhart Lake on Friday and Saturday, September 18 and 19. Negotiations already made insure reasonable rates. Mark these dates on your calendar now and prepare for an event long to be remembered. Watch for details in the May issue of the Wisconsin Engineer.

WALTER A. PEIRCE

Walter A. Peirce, Racine, was given the society's award as "Engineer of the Year" at the recent annual meeting in Milwaukee. Mr. Peirce received this award for his work as

"past director and president of the state society who since its inception has been an effective worker in behalf of the engineering profession and the welfare of professional engineers."

Mr. Peirce, who has been manager of the Racine water works since 1928, is a charter member of the society. He served the society as director in 1944-45, vice-president in 1946 and as president in 1947. He is also a member of the American Water Works Association, the American Society of Civil Engineers, and the Engineers Society of Milwaukee. Mr. Peirce was a youngster of 20 when he entered the University of Wisconsin in 1908 as a civil engineering student. Apparently he knew what he wanted for ever since then he has been active in engineering.

Mr. Peirce was city engineer of Columbus, Wis., from 1912 to 1916 and then went to Green Bay in the engineering department of the Green Bay and Western Railroad. For two years he was a consulting engineer for various Wisconsin communities. From 1918 to 1924 he was city engineer of Delavan, Wisconsin and then had charge of the design and construction of the first of the Nine Springs Sewage Disposal Works in Madison until 1928. On June 1st, 1928 he became manager of the Racine water works and has remained there ever since.

Congratulations, Walter, on the well earned recognition you have received from your fellow engineers. We hope that your services to the engineering profession and the state may continue for many years to come. It must be of great satisfaction to you that the occasion of this award was also recognized by those you serve as is indicated by the following sincere editorial tribute in the Racine Journal Times.

Recognition Well Earned By Water Dept. Head

The wheel that squeaks loudest traditionally gets the grease—and the public attention. This is true in business, in public life, in government, and almost every field of human endeavor. So it is gratifying, occasionally, to see recognition given to a person or an organization which does a job quietly and efficiently.

Recent recognition of this type was given Walter A. Peirce, who has managed the Racine Water Department for 25 years, and run it as well as any agency of the city of Racine has ever been operated. The water department's operation is so efficient that few Racine residents think of it often enough to give proper credit to those who make it run.

* * *

The tribute to Mr. Peirce came from the Wisconsin Society of Professional Engineers, who named him Wisconsin's outstanding engineer of the year. This must have been gratifying to the water department manager, because it came from men in his own profession who recognize his professional ability, his work on behalf of the profession, and his willingness to help train young engineers.

Congratulations of the whole city should go to Walter Peirce. And the whole city, as well as Peirce himself, should be congratulated upon his 25 years of service.

PIERCE G. ELLIS

Mr. Pierce G. Ellis is assistant to the president of the Wisconsin Public Service Corporation, Milwaukee and is president elect of the Wisconsin Society of Professional Engineers.

* * *

The following is a speech delivered by Mr. Ellis at Eau Claire, Wisconsin, February 23, 1953.

It is a real pleasure to be here today, and I would like to begin by expressing my appreciation for the opportunity to tell you of the role the engineering profession plays in the lives of all of us.

It is a vital role. Thanks to the science of engineering, everyone of us in this room can look forward to living many years longer than otherwise. We are also enjoying happier lives, filled with the comforts and conveniences which make life worth living—thanks to engineering. This week it National Engineers' Week, and as a part of its observance of this nation-wide celebration, the Northwest chapter of the Wisconsin Society of Professional Engineers has invited me to participate in their activities.

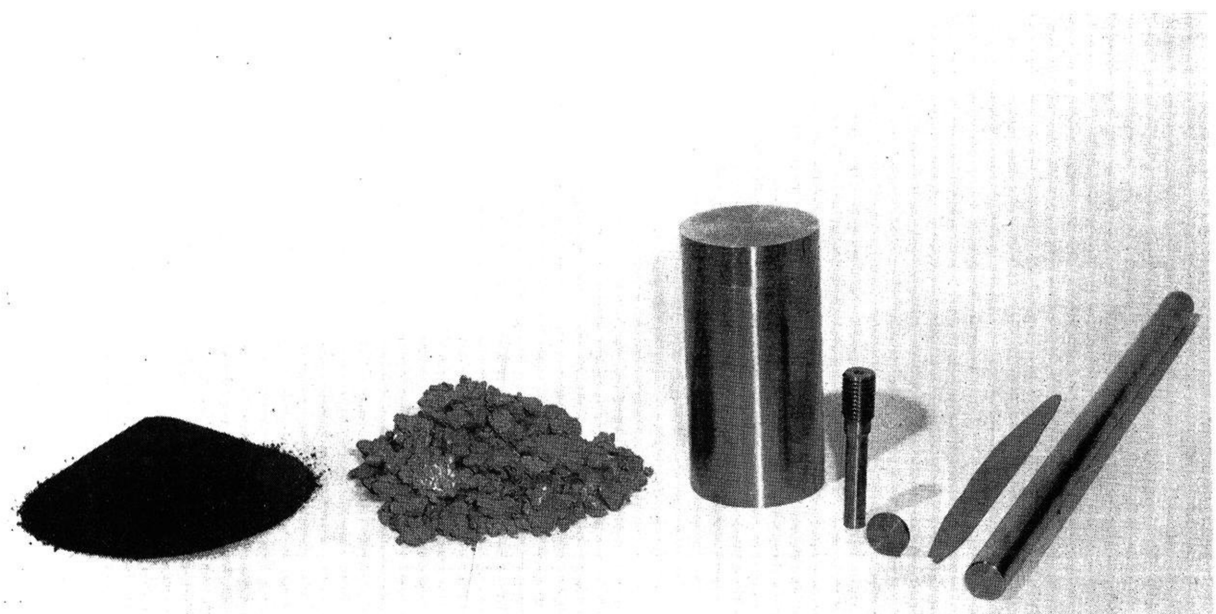
The week February 22-28 was set to coincide with the birthday of our first president, George Washington, who was himself an accomplished engineer. In fact, it is entirely accurate to say that Washington first started on the road to fame by his engineering feats. Had he not

(*please turn to page* 42)

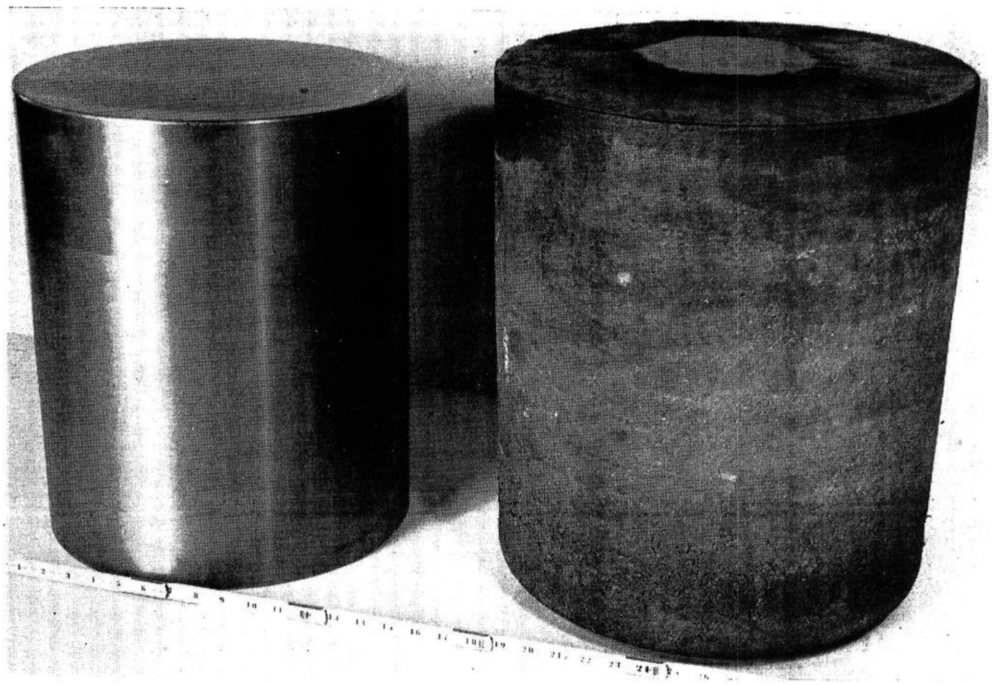
TITANIUM
PRODUTION and USE

by

Robert Bowen, m'53



Stages of production of titanium metal are illustrated here. Raw material for it is ilmenite (left), a black sand-like ore which is also the basic material for titanium dioxide pigments, the whitest white pigment made. First stage of the metal is in the form of sponge (second left) and next to it is an ingot of titanium. To the right are small fabricated pieces, used for test purposes. *Illustrations courtesy DuPont deNemours & Co.*



Titanium metal ingots. The one on the left has been scraped down to improve appearance. It weighs about 400 pounds. The other appears as it came from the furnace and weighs about 650 pounds. Both were cast by an induction furnace.

PART I

Titanium

The element titanium was discovered by the Reverend William Gregor in 1790. He first obtained the metal by a hydrochloric acid leaching process. Titanium ranks ninth in abundance of the earth's elements and occurs to some degree in all of nature's products. Examples in per cents are: soils, 0.85; clay, 0.5; coal and oil, 1-2; water, a trace; plants, 0.002; and animals, 0.0325.

It has a very strong affinity for carbon, oxygen, and nitrogen, and is found in nature as combinations with them. Its chief ore is ilmenite ($MgTio_3$), which is a heavy mineral of metalic luster and iron black in color. Most of the deposits in the United States are found in West Virginia, and contain about 18 per cent titanium. This ore may be easily concentrated to a richness of 43 per cent before it is shipped to the refining plants. Ilmenite-magnitite is another important ore of the metal and is found in the Adirondack Mountains, New York. Rich deposits are found along the Coast of India, South Africa and Australia. These deposits are because the minerals of the metal are insoluable in water, and have remained behind on the beaches as the rest of the shore line material has been carried out to sea. They are easily worked, contain about 75 per cent ilmenite, and are the sources for the mineral which is imported.

The production of the ore in the United States began in 1922 and originally was 5,000 tons per year. Production dropped to less than 1,000 tons annually from 1929 to 1935 and then steadily rose to a maximum of 336,533 tons in 1947.

The production of the metal is extremely difficult because of its high melting point and strong natural affinity for carbon, nitrogen and oxygen. After many years of experimenting it has been concluded that the best suited process for the production of titanium is the Kroll method. This involves the reduction of finely divided titanium oxide with natural gas. In September, 1948, the E. I. du Pont de Nemours and Company announced production of the metal in sponge and ingot forms of 99.5 purity. They originally produced 100 lbs. per day at a cost of $25.00 per lb., but have now increased production to 1000 lbs. per day and reduced the cost to $5.00 per lb.

Titanium falls into group four of the periodic classification, and its properties include burning with oxygen and nitrogen at temperatures 800 F. It is brittle and hard at room temperature but may be easily forged at a dull-red heat. It closely resembles steel in appearance.

A comparison of the properties of the metal titanium with those of its most important alloy are shown below.

NOMINAL MECHANICAL PROPERTIES

	Titanium;	3% Aluminum-5% Chromium Alloy
Ultimate Tensile Strength	126,000psi	175,000psi
Yield Strength	100,00	155,000
Proportional Limit	72,000	129,000
Elongation in 2″	4%	8-10%

Titanium is presently being used in the production of iron and steel alloys, particularly ferrocarbontitanium

(please turn to page 70)

Overhead Traveling Cranes

by

Edward Jagodzinski, m'53

I. Historical Background

With the beginning of the machine age in America after the Civil War, there was a need for hoisting machines of greater capacity to be used in the shops and mills. The early overhead hoisting machines consisted of block and tackle suspended from a jib or beam. This type of lifting equipment required that small parts be lifted with a large expenditure of human energy. In the early 1880's several American patents were issued for the first electrically driven overhead crane. One of the first American cranes was built in Milwaukee for the machine shop of E. P. Allis, which was the forerunner of the Allis-Chalmers Mfg. Co. This first crane was a crude machine compared to the modern overhead crane. It was, however, the first crane to have individual motor drives and control for the three basic motions, that of bridge travel, trolley travel, and hoist lift. This crane had a capacity of 10 tons and following its immediate success cranes of larger capacity were built, some with capacities of 80 or more tons. These heavier cranes were used in steel mills, which began to produce steel on a large scale for all industries.

The early crane girders were completely fabricated by riveting steel plates into I-sections. These girders were fastened to end carriages, which were made of iron castings riveted to steel-fabricated box sections. Cast-iron gears and wheels were used throughout. The entire hoisting mechanism was made of iron castings. Bearings were of the sleeved type, usually babbitted. Hoisting was done with a chain reeved on a specially grooved cast-iron drum. The motors used were large, inefficient d.c. motors; and the equally large motor controllers were mounted on a platform suspended at one end below the girders; this platform was the operator's cage.

The modern overhead-bridge crane is basically the same as the original, both in shape and purpose. To all shop men an overhead crane is a familiar sight but to the average preson a crane is something that lifts loads, with a long boom, and mounted on crawlers; this is the general description of a crawler-mounted crane used in outdoor construction.

II. Definition of an Electric Overhead Traveling Crane

For simplicity of design an overhead crane is separated into two component parts, the bridge and trolley. Cranes are designed according to dimensions and specifications which are submitted to the customer for his approval. There are numerous specifications governing the design of overhead cranes. The most rigid specifications are those of the American Institute of Steel Construction, American Iron and Steel Engineers and United States Navy. Each crane is designed on the basis of four factors. They are: (1) Span—the center to center horizontal distance between the runway rails. (2) Lift—the vertical distance the load is to be raised. (3) Capacity—the weight in tons of the load to be lifted. (4) Service—the application of the crane duty (light, heavy, mill, powerhouse, etc.) These factors determine the size and shape of all the parts of the crane.

The bridge is the assembly of two-parallel girders, usually of box-section design, mounted on two-end carriages or trucks containing wheels for moving the crane along the runway of the building. The front girder or G-1 is the machinery girder containing the bridge drive gear case and motor located at the center of the span, and the bridge drive-across shaft, mounted on several brackets, parallel to the girder. Another gear set is mounted in each truck to get the required gear ratio for a travel speed of approximately 300 ft. per minute. Bridge wheels are made of rolled steel in 15 to 27 in. diameters depending upon the wheel load of the crane. The wheel load is determined by the sum of the dead weight of the crane plus the live load at one end divided by the number of wheels at each end. The girders and end trucks are fabricated entirely by welding steel plates into box sections. The operator's cage is suspended from the bottom of the platform and can be located as shown on Figs. 1 to 4. Welded to the top of each girder is a rail for the trolley travel. Also welded to the top of the girder are stops which limit the travel of the trolley on the bridge. At each end of the bridge trucks, there are bridge bumpers which contact end stops on the runway limiting the travel of the bridge on the runway. These bridge bumpers contain springs to stop the crane when traveling 50 per cent of rated speed. Either inside G-1 girder or G-2 (rear girder), there are bridge span wires which conduct the electricity to the trolley and hoist motors. This is accomplished by collector shoes mounted on a bar or post suspended from the trolley.

The trolley is the assembly of motors, gear cases and drums; this comprises the hoisting machinery. The traveling trolley can be compared to the bridge, only the span is much shorter. The span on the trolley is called the spread; this is the horizontal distance between the rails in the bridge-top plate. This spread is determined by the number of grooves on the drum for the required lift (plus end clearance), or usually one-seventh of the span of the crane. The capacity determines the parts of rope required to lift the load for any particular size of wire rope. Drum diameters range from 12 to 60 in. with rope diameters of ½ to 1¼ inches. Diameter of the sheaves is approximately 30 times the rope diameter. The welded-trolley frame consists of two trolley sides separated by a girt. The bottom-block is the device from which the load is suspended, and the upper-block and equalizer sheave are mounted in the girt. Wire rope is reeved over these blocks and dead ended on the hoist drum to complete the hoisting tackle. Two types of hooks are used on cranes, a fish hook shape for most standard applications and a sister hook or double-fish hook for heavy loads. The upper hoof-lift travel is limited by a switch which prevents the bottom-block from striking the upper-block. Trolley travel is limited by trolley chocks capable of stopping the trolley when traveling 75 per cent of rated speed.

Crane wheels are mounted in two distinct ways: stationary or pin type and rotating axle or Railroad Type (MCB). Most cranes are furnished with roller or ball bearings throughout but some applications require sleeve bearings of bronze. Girders for the bridge are either in the shape of a box section of plates or large-wide flange rolled beams with welded-wing angles. Trolleys are built with a heavy capacity main hoist and an auxiliary hoist of light capacity mounted on the same frame. Many safety features are used in the design of cranes. Each state and some customers have special requirements for the installation of safety devices. All gearing must be enclosed. Electrical wiring is in conduits and exposed conductors both for bridge and trolley must be protected from the moving parts of the crane. Electrical resistance grids and control panels are mounted on the bridge platform suitably protected. The present trend is toward a.c. operated cranes but heavy industries prefer d.c. control on their cranes.

There are inuumerable combinations of bridge and trolley applications. Each application requires special engineering to design the crane for its specific operation. Cranes having two trolley on one bridge are common. For special applications an operator's cage can overhang the rear girder and be attached to the trolley. High speed travel cranes are more in demand for the high production cycles in most industries. The average speeds of 10 ton

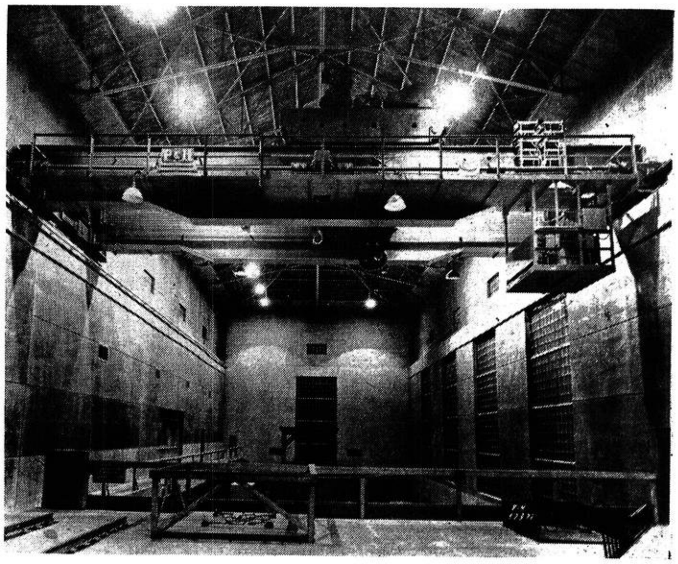


Fig. 1. 300 ton capacity powerhouse crane showing sister hook.

Cuts courtesy Harnischfeger Corp.

industrial type cranes are: bridge speed 300 fpm, trolley speed 125 fpm, and hoist speed 50 fpm.

Cranes are used for material handling in practically every industry. Capacities and number of lifts vary according to the type of service and the cycle of operation. Economically, the crane has the highest carrying capacity per pound of equipment. The initial investment in a crane is large but constant service rendered and ease of operation are definitely an asset. Basically a crane is a lifting, lowering and transporting machine over a fixed path, but it can be compared with other mobile equipment in the same applications. The characteristics of a crane are: (1) Lift and lower material in inaccessible positions, down into pits, up to balconies, etc. (2) Hoist supported from above, no weight on floor. (3) Supports a load in all areas. (4) Lifting mechanism not subjected to collision in most applications.

(please turn to page 60)

An Address by Herbert Hoover

I have said many times that if you want to know the truth about a man, ask the fellow-members of his profession. I now have your certificate to flaunt before some people.

Men never lose their love for the profession to which they have been trained and have given years of their lives. The recollection of its joys is the more vivid if one has back-slid onto the slippery path of public life.

The Engineers Can Help Save Our National Life

This is not a political speech. My first text comes from the agreement of both political platforms that the nation is mired down in a swamp of spending, inflation and taxes. Both parties disagree on who-done-it. They seem to agree upon the obvious that reduction of federal expenditures would be a good step to get out of the swamp but there is wide disagreement on where to begin and how much.

However I am suggesting something else which is a partial method of relief, and that is where the engineers come in. That partial remedy for our ills is with all our might to stimulate scientific discovery, invention and their application by our engineers. That would increase productivity per capita and thereby mitigate these burdens. I do not guarantee it can work fast enough to save the American way of life but it could help.

The basis of this hope lies in our experience from three great hot wars. By increased productivity after these wars the credit of our nation was restored and the prosperity of our people moved into high levels. That was true after the War of the Revolution, the Civil War, and the First World War. But this extension of the Second World War into six years of cold war is where my belief comes from that this is now only a partial remedy. Otherwise a continuation of these spending, taxing and inflation policies can have but one result. That is a national socialistic state.

After the War of the Revolution free initiative in expansion of our agriculture and the application of steam power in the factories increased our productivity, restored our national credit and gave a great lift to the standard of living.

After the Civil War the expansion of the railways brought millions of new fertile acres into productivity. With this, and with growing skills in free industry the nation again recovered and marched forward.

After World War I, scientific discoveries and inventions, and still more growth of skills and improved processes found expression in the expansion of motor transport and electrification, radio and airplanes. And from cheaper costs of production we remedied the ravages of war and rose to the highest average standard of living in all human history.

Since the Second World War we have again made great advances in science and invention. We have built many improved plants but we have not yet been able to catch up with the spenders and the tax-collectors.

One warrant for my hope lies in the fact that we, with only six percent of the world's population, have today more trained scientists and engineers than all the rest of the world put together.

The application of new scientific discoveries and new inventions is always a business speculation. It is based on venture capital and plowing in of profits until production is in full bloom.

There are two obstructions in the path of such a solution of our economic problems. The first is unintelligent taxation and the second a coming national famine in technologists. I could enumerate a dozen other destructors but I said this would not be a political speech.

An Example

There is no better exhibit of what ill-considered taxation can do to our economy than our non-ferrous metal industry in the West. That industry is founded wholly on venture capital and the plowing in of profits until a mine is equipped and producing. Today such venture capital from individuals is itself undermined and taxation prevents the necessary plowing in. That is not theory; it is fact. Twenty years ago there were about 3,000 operating non-ferrous metal mines in the Rocky Mountain area. Today there are only a few more than 1,000. I recently

(*please turn to page* 43)

Herbert Hoover was invited by ECMA Chairman Paustian to write a message to student engineers for simultaneous publication in all member magazines of ECMA. Mr. Hoover pleaded lack of time to write a special article, but offered this address which he delivered at the Northwest Engineering Centennial, Portland, Oregon, August 9, 1952.

ALUMNI NOTES

by

Eugene Buchholz, m'55

Magdsick, H. Herbert, e '10, has recently retired from General Electric's Lamp Division at Nela Park where he was executive engineer in the Application Engineering Department for the past 23 years. Last year he was awarded the Illuminating Engineering Society's highest honor, the I.E.S. Gold Medal, for "distinguished contributions conspicuously furthering the art, knowledge, and profession of illuminating engineering." In 1914 Mr. Magdsick designed floodlighting installations for the Woolworth tower and the Statue of Liberty. He has fostered numerous basic studies establishing the fundamentals for a wide variety of applications of visible, infrared and ultraviolet radiation and has also been notably successful in the selection and training of men for the lighting field.

HERBERT H. MAGDSICK

Vea, Olaf F., e '32, has been named general manager of General Electric's newly organized Medium Induction Motor Department at Schenectady, N. Y. Mr. Vea joined G.E. as a student engineer on the Test Program in 1936 and in 1948 he became assistant to the manager to the Small and Medium Motor Divisions where he was also named marketing manager. Mr. Vea is a native of Stoughton, Wisconsin.

Schneider, Henry C. m '98, died January 30 in Pasadena, California. Mr. Schneider moved to Chelsea, Michigan in 1936 from Beloit, Wisconsin, where he had been associated with Fairbanks-Morse Co. since 1909. While with Fairbanks-Morse he was in charge of windmill engineering and plant construction. An authority on windmills, he contributed a section on them to the Encyclopedia Brittanica. Mr. Schneider was born in Appleton and was graduated from the University of Wisconsin in 1898. At the time of his death he was secretary-treasurer of the Central Fibre Products Company of Chelsea.

OLAF F. VEA

Jordon, Roy D., e '27, has recently received the highest honor bestowed by the General Electric Co. upon an employee, a Charles A. Coffin Award. Mr. Jordon, who is advertising and sales promotion manager for the G.E. Commercial and Government Equipment Department at Syracuse, N.Y., was honored for his part in conceiving, developing and promoting an entirely original civil defense communication program, which has materially benefitted the General Electric Company and all local state and federal civil defense organizations.

ROY D. JORDAN

A CAR of the FUTURE

PORSCHE

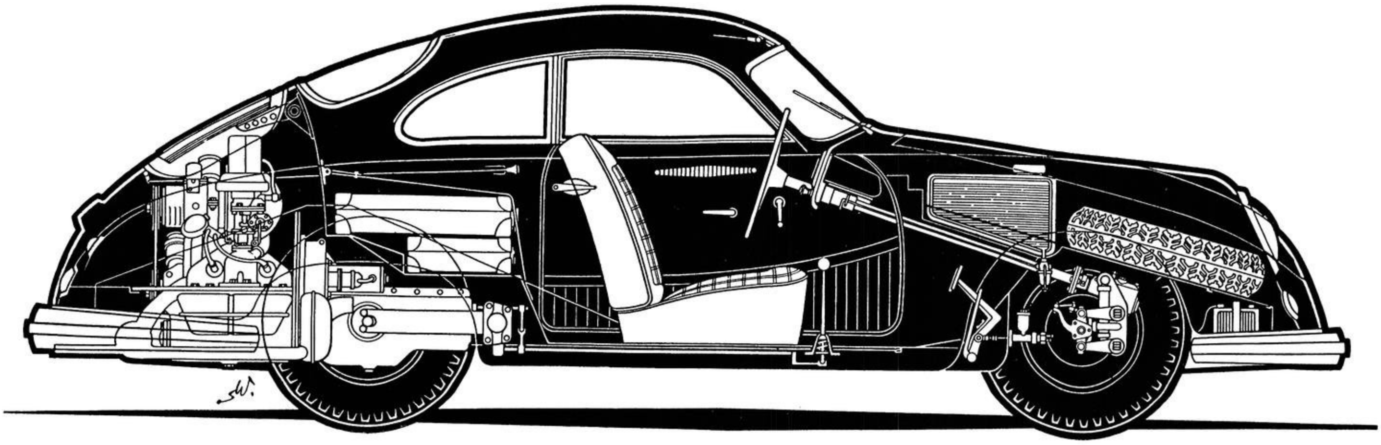
by Kneeland Godfrey, c'55

The Porsche

Dr. Ferdinand Porsche, who died in 1951, evolved the radical design of the new Porsche sports car during the 20 years that he worked on the Volkswagen—the long-promised German people's car. In fact, the Porsche is a highly developed offspring of the Volkswagen, as evidenced by the fact that the two have much in common. Dr. Porsche was a designer of the very powerful (500+h.p.) Auto Union Grand Prix racing car developed by the Nazis during the 1930's. He also built a six wheeled streamlined Auto Union with which the Nazis intended to break John Cobb's land speed record which now stands at 393 m.p.h. The Auto Union was built to approach 450 m.p.h., but was never run because of the war.

The Porsche was developed by the doctor in 1945-6 while in jail in France, shortly following the cease-fire. In 1947, he designed a 450 hp., rear-engined, horizontally opposed, twin-supercharged, 150 dc. Cisitalia racing car with power delivered to all four wheels. Although lack of capital prevented the Cisitalia people from ever entering the car in competition, the Porsche concern earned enough money from the designs to secure Dr. Porsche's release from jail. The first Porsches were built in Austria in 1948, but the firm soon moved to Stuttgart, Germany.

The newest car, called the model 356, is sold in either coupe or convertible form, with a choice of motors from 1100cc to 1500cc displacement and horsepower ratings of from 40 (87 m.p.h. top speed) to 70 (105 m.p.h.). The price, delivered in Chicago, is about $4,600 for the fastest car, equipped with radio and heater. Several highly modified Porsches now running in German sports car races have a top speed of nearly 125 m.p.h. The unmodified Porsche is in the same class in sports car events as the popular MG, and can easily defeat the British car in both acceleration and top speed. In fact, the Porsche's only conquerer (in



the 1500cc class) is the $9,500 Italian O.S.C.A., which has 98 hp. A Porsche placed eighth in the 1952 Mexican Road Race (sports car class) with an average speed of 83.1 m.p.h. over the 1,934 mile course. With its 70 hp. motor, it will accelerate to 60 m.p.h. in 13 seconds and go through the standing quarter mile in about 18 seconds, figures which are comparable to those possessed by the 200 hp. Cadillac and Lincoln. The 83.1 m.p.h. average of the Porsche is all the more remarkable when one realizes that the Lincoln which won the production class averaged only 7 m.p.h. faster!

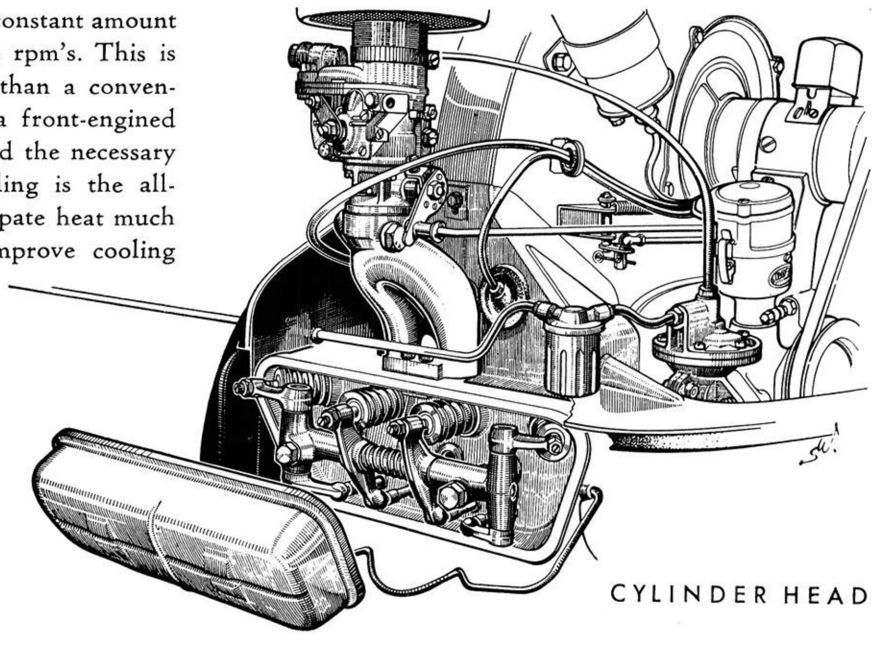
The car's engine is one of its outstanding features. In unit with the rear axle and transmission, the motor is constructed almost entirely of light aluminum and magnesium alloys so that its position behind the rear axle won't cause the car's weight distribution to deviate much from the desired 50-50 ratio on the front and rear wheels. As is, the horizontally opposed, overhead valve, four cylinder air cooled motor weighs only 160 pounds complete with accessories, or about one-tenth of the car's 1640 pound weight. Each bank of two cylinders has its own downdraft carburetor, thus assuring an even fuel distribution to all cylinders. A large fan, beside the motor, which is driven at constant speed by the generator, directs a stream of air on the oil radiator, thus supplying a constant amount of air to the motor irregardless of engine rpm's. This is found to provide actually better cooling than a conventional radiator, for in mountain driving a front-engined car may heat up because of high rpm's and the necessary low speed. Another aid to efficient cooling is the all-aluminum cylinders and heads, which dissipate heat much faster than iron or steel. To further improve cooling qualities, head gaskets aren't used, but the cylinders and heads instead are carefully lapped for a good compression seal. The cylinders are finned and made of forged aluminum, with the walls hardened and chrome plated. This further improves cooling over what is possible with steel sleeves inserted in the bores. In regard to cylinder wear, this type of construction has been shown to have very long life! The plated cylinder walls are next serrated with tiny holes in which oil from the 2½ quart supply is held for improved lubrication. The connecting rods are equipped with roller bearings which result in a smaller amount of friction loss than plain bearings allow. To provide vibration-free running the crankshaft is statically and dynamically balanced.

The cylinder bore is 80 mm. and the stroke 74 mm., making the stroke: bore ratio equal to 0.925:1. This stroke of less than three inches is so short that the oft-stated maximum reliable piston speed limit of 2500 feet per minute isn't reached until a theoretical 130 m.p.h.

In case major repairs necessitate the motor's removal, this task may be done in about thirty minutes. Since the motor is so light, it is possible for one man to handle it.

The car's fine performance is due to its aerodynamic design and the attention to detail used by the Germans in producing it. Few cars with so little power can exceed 100 m.p.h. Gas mileage varies from 25 to 35 miles per gallon, depending on the motor displacement and the speeds at which the car is driven.

(please turn to page 64)



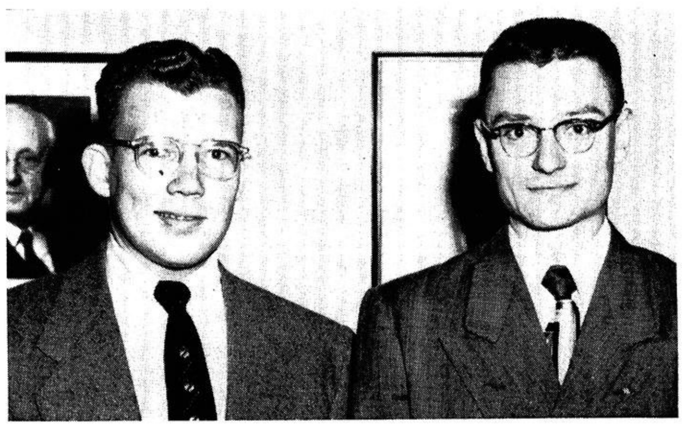
CYLINDER HEAD

POLYGON 19

Al Schmidley

Stories by Larry McCormick

Photos by Dave Dauterman



Don Pollock, Al Rabe

AL SCHMIDLEY

Hail to the chief! Here is THE WHEEL! Take a good look at him because you'll never see him with normal eyesight. This picture was snapped at 1×10^{-10} second. Al is so busy, busy, all day long, that he has to travel at almost the speed of light to keep all his appointments.

It would be impossible to list all of his activities here because any such list would be obsolete by the time it got to press.

After looking at his intelligent brow, it would be needless to mention that he is president of the Polygon board.

With an eye to the Engineering Exposition, Al is playing around with a little thing called "Therein", a sort of electronic musical saw.

If anyone should drag you into the Kappa Eta Kappa house and you see this gentleman with a deck of cards in his hand, don't sit down at the table with him. (He is the defending bridge champion of the University).

Al is still trying to decide which lucky company will get him. In the meanwhile he spends his "leisure" time running a liquid air machine for the physics department.

DON POLLOCK

Oh, how the breweries want our boy, but they can't have him, Don has his eye on an oil well!

Milwaukee's gift to Chemical Engineering has an expressed desire to turn his analytical mind to the great problems that daily beset the leading petroleum companies. Let him dip his fingers in the black, black, gold.

There is a rumor that Don has developed a low-viscosity, low temperature oil for the bottoms of those two barrel staves he rides so gracefully. This is the only feasible explanation for his sterling performance on skis under the auspices of the University Hoofers Club.

Mr. Pollock enters into his profession well qualified and has received much experience and top-notch advice from his work with Prof. Altpeter in designing and building the supporting structure for a fluid flow and process control project in the new Chemical Engineering building. He has picked his summer work with discretion, having been employed in pilot plant work by a malting plant. But that's as close to the brewed beverage as Don cares to go (it says here!)

BOARD 53

AL RABE

"Man, I come from the busiest metropolis in the U.S., New Holstein, Wis.," says Al.

Could you give us a brief rundown on the populace of this fair city?

"I believe the 1950 census gave 40 registered Guernsey cows, 3 dogs, a cat and 15 starved houseflies," extolled the president of AXE, calculating the results quickly on his triangular slide rule.

Do you like to meet people, Mr. Rabe?

"Well, I saw my first human being here at the University and I'm just getting used to them. Gee, I wish I was back in New Holstein."

Don't cry Al, (here use my handkerchief) why not get out and face people, try advertising the St. Pat's dance.

"I can't do that, I'm on the publicity committee," (between heartbreaking, homesick sobs).

Buck up old boy, really you should have become accustomed to college life by now, you're a junior aren't you?

"Yes, of course I was well adjusted until I took that horrible subject."

Which one was that?

"Quantitative Analysis."

(Here the interview was halted, Mr. Rabe being assisted to his room, babbling incoherently.)

DAVE MANNING

Those eyes in the portrait feel more at ease sighting through the lens of a high-powered rifle than looking at the photographer's birdie. This CiE must sometimes forget, and try to squeeze an imaginary trigger when taking a level with a transit. "I'm the rugged, outdoor type," quoth this member of the University rifle team. As a home specialty, Dave enjoys working with wood. He designed and did all the work on a knotty pine den. In fact, he built a knotty pine gun-stock and his next project is a knotty pine sport coat.

Three times in the past, our polygonic paragon has torn himself loose from his Little Wonder Home Workshop and ventured forth into the vast desolate regions of Canada. The call of the wilderness now has him making plans for an extended trip to Uncle Sam's Icebox, Alaska.

David S. Hanke, David G. Mynning

DAVE HANKE

Here we have the black sheep, the fallen one, the only married member of the Polygon board. In spite of this rather disquieting fault, Mr. Hanke has been invested in the robes of secretary of this group. He writes at such length that he begins each meeting with the phrase: "I shall now read the hours of the last meeting."

Not satisfied with this responsibility, he is also the treasurer of ASCE

Dave looks back with satisfaction to the work on land-surveying he has done with Professor Ray Owen.

Why this mature fellow bothers with school we don't know, for he has been employed by the State Highway Commission and has an Engineer I rating.

When interviewed, Mr. Hanke steered the course of the conversation to pre-stressed concrete within two minutes. It seems that he has expertly prepared for the Engineering Exposition, a model demonstrating the effects of the almighty pre-stressed concrete beam on strength, sway, and vibration in bridge construction.

Dave looks forward to accepting a "position" with the Army Corps of Engineers in June.

(please turn the page)

Roger Carlson, David S. Vinton, William Boyes, Kenneth Kulik

ROGER CARLSON

Meet the fellow who intends to make the pedestrian a thing of the past. Either by building him a car or by running him down with one. This motorized madman hails from Rockford, Ill. When he pulls his well-greased face from beneath the hood of same nameless auto, Rog goes domestic and helps in house-building, in particular his own home.

When placed on the rack and stretched to 2.93 times his original length, Mr. Carlson admitted having cultural tendencies. Upon application of a hot poker he confessed to tootling a clarinet.

This is no recommendation for his position as floor chairman at Turner.

Our stout mechanic says he received vocational inspiration from his mechanic father, and has assisted his dad on many overhaul jobs.

General Motors seems to have the most job appeal for Roger. He intends to go into engine design, and hopes to be enrolled in G.M.I.T.

DAVE VINTON

If you think you see the sun coming up in the west some day, don't call Washburn Observatory to report an astronomical phenomenon; just shade your eyes and beneath that flaming mop of red haid you will see David Vinton.

His personality fits his blushing top-knot. Seldom has the campus seen an engineer as bashful as Mr. Vinton. After chasing him for three blocks, we coaxed him into admitting he was the chairman of the St. Pat's dance. (He was frightened nearly out of his wits when the lights went out).

It seems that in high school he was a stage manager and specialized in sound effects (mostly disc and tape recordings). Listening to those blood-curdling screams has made him shy and retiring.

Dave professes to be a member of Sigma Alpha Epsilon fraternity and also is a representative of the Society of Automotive Engineers.

Right now he intends to go into aircraft engine design.

BILL BOYES

If this magazine should find its way into the hands of a woman (improbable but possible), this is the picture that will be secretly removed from the page and posted in the lady's boudoir. For, truly, here is a bundle of loving joy from the Almighty Himself. Bill is an import from Mexico City, but if you are rich enough to go to this southern capital, you won't find him on the streets, with a girl; he'll be at the bull-fights, with a girl.

Probably some of Bill's success with the fairer sex is due to his athletic prowess. In Mexico he played soccer. As this sport is not particularly populr on the University campus, he proceeded to demonstrate his skill with the tennis racket. Naturally, he became a member of the University tennis team. In addition, he and his brother are badminton co-champs on campus and challenge all comers.

Don't get the impression that Bill is just a playboy. He was a Gisholt trainee in 1950-51. A top-notch mechanical engineer, he intends to return to Mexico and either work on his own, or under his father.

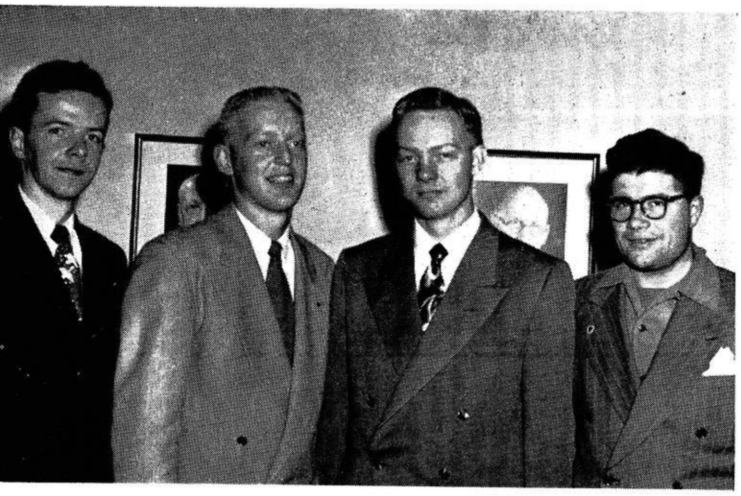
KEN KULIK

The following advertisement was submitted to the Engineer by Mr. Kulik.

The University of Wisconsin Auto Club (officially sanctioned) is looking for members and space with which it can accomplish its purpose, namely, to help members with work on their own cars and to act as an automotive information center. Ken is the treasurer of this worthy group and his status as an M.E. 3 doesn't seriously impair his ability to find out what causes the noise when his bumper is dragging.

This Madison man is one of few who doesn't enjoy watching the annual ice break-up on Lake Mendota. The thought of warm weather brings a chill to Mr. Kulik. The last few years have seen him hanging on a careening ice boat. This old hulk carried 160 feet of sail, was 21 feet long and was purchased with the assistance of two buddies. To enjoy this sport you have to be an all-around outdoor fiend, which Ken is.

During the summer, he has put in some hard labor at the burring and tapping bench at Kupfer Products.



Lawrence Strommen, Richard Potts, Don Dietmeyer, Robert Cody

LAWRENCE STROMMEN

Larry's four years of electrical engineering finish up a sequence which resulted in the education of all four of the Strommen children. Yes, he is the last of his family, which includes 2 brothers and a sister, to complete his education and receive a diploma from the University of Wisconsin. This is surely a credit to his parents.

This member of Kappa Eta Kappa is a floor chairman at Vilas dorm.

If, after a rough Saturday night, you are rudely awakened by a loud droning which changes pitch constantly and ends up with an ear-splitting crash, it was probably caused by model airplane addict Strommen.

Larry wants to specialize in radar or special applications of electronics in communication. In preparation he intends to put in a semester of grad work.

He already has experience gained in summer electrical maintenance work for the Milwaukee Falk Corp.

DICK POTTS

Two years of Richard Potts was too much for the Milwaukee Extension, whereupon the University of Wisconsin became host to this electronic wonder from Butler, Wis.

If you are walking down the street preoccupied with all the things that preoccupy people and are suddenly attacked without warning by a wild-eyed demon with a blond crew cut and a fistful of buttons, you have been informally introduced to the subject of this article. Dick is the energetic chairman in charge of button sales for the forthcoming Engineering Exposition.

Mr. Potts also puts on his TV space cadet suit and manipulates a flying saucer which you will be privileged to view, if you visit his booth in the Exposition.

In selling buttons, Dick is gaining valuable sales experience. Just wait till you hear his pitch. He can do that too, having pitched for intramural baseball teams.

Right now, the shadow in this stalwart Electrical Engineer's life is being cast by the draft board.

DON DIETMEYER

Out of the frozen north comes the aurora borealis and Don Dietmeyer. By north is meant Wausau, Wis., which any frozen resident will swear is colder than the north pole.

In order to establish communication between this frigid outpost and the rest of the civilized world, Mr. Dietmeyer has constructed a ham radio station in his home. (Notice to fellow hams, his call letters are W9HHE).

Don holds down the position of chief executive in two groups. He is prexy of Eta Kappa Nu fraternity and the president of his Jones Hall radio club.

This serious lad will try for his master's degree in E.E. and wishes to go into research. He is also casting his capable eye in the direction of Oak Ridge. (Attention U.S. government!! This could be a nuclear man.)

The decorations for the Saint Pat's dance were partly due to Don's labors.

BOB CODY

Grandpaw is a college man. Historians found that his trail began when roaring Robert graduated from high school in 1942. Immediately following this event, while he was still young and energetic, Bob flexed his biceps to good advantage in farm and war work.

But the pace was too much. As age began to take its toll, Mr. Cody decided to take it easy and just use his mind and a big soft chair to make his living. He designed and built a T.V. set in 1946 and by 1950 had constructed more than 50 units. But then the government caught on to his little game and the long arm of the draft snatched this doddering oldster from his bottle of Hadacol.

Then came Europe. Bavaria was the center of operations for our Bob. It seems that Elkhorn's Edison shocked even the sophisticated continentals. So it was no surprise when he was shipped back stateside in 1952. Then it was that Grandpaw became a freshman.

When you're browsing around the Engineering Exposition and see a horrible mess of tubes, wires, resistors, etc., you are probably gazing on one of Mr. Robert Cody's creations.

(please turn the page)

Jim Mullendore, John French

JIM MULLENDORE

How do you feel about the international situation, Mr. Mullendore? "No comment." What is your opinion on Senator McCarthy? "No comment." Well then, how about sorority women? "I have nothing to say." At this point, conversation was terminated by the unheralded entrance of two F.B.I. men pursuing a red-headed professor, much to the satisfaction of Mr. Mullendore.

Jim was not always the cautious, reserved type. Once he was a gay youth doing all the enjoyable things a gay youth does or doesn't do. Far from being anti-social, he was a defender of civilization, a protector of innocent young girls; in other words, a life guard. One of the humanitarian projects he engaged in was a sand research project for the Belle City Foundry. But something was eating away Mr. Mullendore's sociability. It was an aggravating interior corrosion. He slowly withdrew from social contacts, seldom speaking to his friends; took a room and, worst of all, began to get better grades.

The Wisconsin Engineer wishes to make a startling expose. The cause of Jim's withdrawal into a shell (a tortoise shell; engineers aren't psychiatrists) was the situation at Men's Dorms. A noisy roommate, and the screaming of women in the halls at all hours of the night have sufficed to place him in his present condition.

JOHN FRENCK

Although John will be taking a trip to the Westinghouse plant in Pittsburgh during spring vacation, he intends to go on and obtain a master's degree before taking a job. For his thesis, he expects to work on grey cast iron.

Mr. Frenck is a member of A.I.M.E. and also the American Society for Metals. He has a great interest in foundry work as is evidenced by his membership in the Foundry Educational Foundation. This group encourages writing on subjects that are pertinent to foundry work and supplies scholarships to worthy engineers who are interested in this line of work.

John enjoys outdoor activity, both intermural sports and sailing, at which he is most adept.

The Homecoming Decorations Committee was aided by his invaluable assistance, and he also was ticket sales chairman for the Saint Pat's dance.

GUIDING POTENTIAL ENGINEERS

By JOHN GAMMELL
Supervisor of Sales Training at Allis-Chalmers Manufacturing Company, Milwaukee, Wis.

During Engineers' Week (February 22 through 28) Mr. Edwin W. Seeger, P. E., while on a television program sponsored by the Milwaukee chapter of the Wisconsin Society of Professional Engineers told a story which many people, interested in advising young engineering prospects, should have found thought-provoking as well as amusing. Mr. Seeger's story was to the effect that someone called his wife on the phone and during the conversation, asked her what the family was doing. She said, "Well, Ed (who is an electrical engineer) is reading the newspaper and Jack (her son who is a mechanical engineer) is looking at the television and I am fixing the toaster."

It is hard to imagine that Mr. Seeger or his son could not fix the toaster, though it is entirely possible. My wife sometimes watches me, during my infrequent "fixing" moments and often after I have probed clumsily into the trouble she says, "Why don't you do this or that." Much to my irritation I do it and the gadget works.

Now there are some lessons in all this. People want to know what characteristics make a good engineer. The first is to be strongly motivated toward doing the job else it won't get done as most hardworking husbands know. The second is you must have a talent.

And, this brings me to a significant idea. As pointed out by Mr. J. Frank Roberts, P.E., on the same Engineer's Week television program, there are two doors by which a young man enters the engineering world. One is the door of technological competence in the area of abstract thinking when applied to such subjects as mathematics, physics and chemistry; the other, the door of mechanical ability in the material field as shown by the top-notch tool designer, electrician, or instrument maker.

Let me illustrate: graduate engineers with experience usually have considerable ability to plan and calculate structures—all on paper. A good engineer can sit in an isolated cell and design complicated machines that work, or imposing bridges that stay up. He may do all this and have no contact with the job in a wrench-and-hammer sense. Indeed, he may be "all thumbs" when it comes to such practical matters as putting a nut on a bolt.

Of course, such engineers would be useless without support from the more materially-gifted branch of engineering—the branch referred to in the profession as the "technicians." The late Dr. W. E. Wickenden, when president of the Case School of Technology gave as a definition:

(please turn to page 89)

A New Concept For Rust Prevention

When the Shell Development Company discovered VPI, a new milestone was made in the battle against corrosion.

by

Warren Easley

(Courtesy Monsanto Magazine)

Warren Easley is a technical sales representative with Monsanto's Organic Chemicals Division in St. Louis. A graduate of Purdue University, he came to Monsanto seven-and-a-half years ago as a chemist, but in recent years has forsaken the laboratory for work in technical sales.

Rust is so commonplace that most of us accept it with hardly a murmur. We expect almost anything made of iron or steel and many other metals to corrode in time, unless special precautions are taken. So we as a nation spend billions annually to prevent the oxygen in the air from combining with metals to form rust.

Losses from corrosion and rust, and efforts to control it, cost the nation over $5 billions annually. How to reduce this loss has plagued man ever since he discovered the arts of metallurgy.

But now a new development in corrosion control, a development so helpful and unlike present methods that it deserves to be called revolutionary, is at hand. While no cure-all, Vapor Phase Inhibitor, or VPI as it is more commonly known, is being heralded by industry and the military services as a real mile-stone in rust prevention.

VPI is being used today to protect such a variety of things as small machine parts, rifles, rocket and airplane engines, wire, tools—even tiny watch parts and huge diesel engine crankshafts. Not only does it afford greater protection than older methods of rust prevention, but it reduces costs and is more convenient.

But first a little history of the development of VPI, a fascinating story in itself.

The Shell Oil Company, like all firms transporting large quantities of petroleum through pipelines, was faced with a serious problem of corrosion on the inner sufaces of those thousands of miles of pipes. Trouble shooters from the subsidiary Shell Development Company were called in to wrestle with the problem. and their experiments, conducted over a period of several years, led them to add to the crude oil a new chemical named dicyclohexl ammonium nitrite and made from dicyclohexylamine, of which Monsanto is the only U.S. producer. Its effect was amazing. Not only did the pipe remain rust-free where it was bathed in oil, but inspection domes, out of reach of the flowing oil and presumably untouched by the chemical additive, remained bright and free from rust.

Practical tests showed that the chemical was evaporating from the oil and condensing on the exposed metal surface inside the steel dome. There it is dissolved into the thin film of moisture present on any exposed metal surface and which usually contains a small amount of oxygen. The chemical had the effect of preventing the oxygen's power to cause rust.

Thus, an entirely new concept of rust prevention was at hand. Shell dubbed its product Vapor Phase Inhibitor, a technical term describing its mode of action. VPI is the trademark for the product.

Does VPI mean it will be possible to protect machine parts from rusting during shipment or storage without having to resort to messy greasing or subsequent degreasing, as has been done to exclude oxygen in the past? Can military weapons or machine tools be stored for years, under varied conditions, with only a few crystals of VPI protecting them from the corrosive effects of oxygen?

Rigorous tests by industry and by the armed forces have shown the answer to be a very positive "yes."

The Shell Development Company makes VPI crystals available to industry, and it has licensed several firms to use VPI in developing another "darn good idea"—the use of paper and paperboard, coated with VPI, for packaging parts.

Picture, if you will, a small steel part, such as a gear, wrapped in a sheet of VPI-coated paper. You can't see the VPI-coated side of the paper because it is inside the package, next to the gear, but the VPI on it slowly vaporizes and diffuses all around the part, between the cogs and down the center hole. Oxygen present when the gear was wrapped is thus effectively neutral-

(please turn to page 56)

On The Campus

by

Kneeland Godfrey, c'55

ASAE

The February meeting of the Wisconsin chapter of ASAE featured a talk by Mr. Ed Suko, sales representative of International Harvester Company. Along with his talk, Mr. Suko showed movies on diesel power and also on future employment with IHC.

The March regular meeting featured Lynn Brooks, manager of the Wisconsin Electric Farm, as a speaker. His talk and accompanying slides showed many devices which may be used to reduce the farmer's labor. One of the most interesting devices was a "demand" chicken waterer which is operated by the chicken when thirsty. It was interesting to learn that the farm served both a research and demonstrative role and that, although many electrical devices were used, power consumption seemed reasonable.

PI TAU SIGMA

Pi Tau Sigma, the mechanical engineering honorary fraternity, held a smoker for students eligible for membership on Thursday, March 26, at the Heidelberg Hofbrau. A dinner for active members preceded the smoker.

During a genreal business meeting on Tuesday, March 10, the chapter voted to sponsor a service booth for the Engineering Exposition and to initiate an honorary member this spring. They also decided to set aside $15 each semester for an award to an outstanding M.E. sophomore.

Members and pledges are looking forward to formal initiations and a softball game with the M.E. faculty after spring vacation. New pledges for the semester are being given plaques to polish and mount during spring vacation for entry in the plaque contest. Also, all members are being urged to compete for the annual F. M. Young award given each year to an outstanding member of the chapter.

The following men were at the March meeting of ASAE: 1st row, left to right—James Doering, Sheldon Schieldt, David Hagen; 2nd row—Joe Johanning, Edward Lim, Dave Snoeyenbos, Joe Machuta, Larry Olson; 3rd row—John Balis, Marsh Burrows, Bill Chancellor, Darrlel Hartung, Richard Koegel; speaker, President Harold Brikowski; faculty members F. S. Moulton, G. P. Barrington.

SAM

With the warmer weather of the Spring Semester bringing its usual rush of events, employment interviews, and spring fever, tied in with the usual school activities, the Society for the Advancement of Management is planning its objectives for the term. The Society is making a concerted effort to bring into the group students in their sophomore and junior years, who wish to participate in and enjoy the fellowship of this management group during their stay at the University. It is an unusual group, unusual because it brings together students in engineering, finance, industrial management, personnel management, marketing, economics, and other fields, who are concerned with learning more of the management phase of industry.

It has been mentioned that industry is realizing more and more every day the importance of management. We have created for ourselves an industrial society, and must be prepared to manage our industries well, and for the good of all the people. This is the challenge the SAM offers to its incoming members.

The organizational meeting of SAM held in February stimulated much interest in the group and this interest is carrying over into the semester's activities. Among the events planned are a local and an extended field trip, a dinner meeting, and several speaker meetings to which men of industry have been invited.

A noteworthy event this month is the founding of a new senior chapter that will be known as the Madison Chapter of the Society for the Advancement of Management and which will be the sponsor of the student society.

SAM continues to extend a welcome to all students and their friends to attend any activities and events during the semester.

A group of ASCE members spotted after a March business meeting while enjoying refreshments.

ETA KAPPA NU

At a regular meeting on February 12, 1953, elections were held for the offices of Theta chapter of HKN. The new officers are: Donald Dietmeyer, president; John Scharf, vice-president; Charles Wittkop, recording secretary; Clyde Robbins, treasurer; Philip Howard, corresponding secretary; Lee Shaw, bridge secretary.

An HKN project for the Engineering Exposition was discussed, and the decision was made to set up a display on the Electronic Differential Analog Computer. The work will be undertaken by brothers Wayne Olson, William Miller, and Lee Shaw under the direction of Professor V. C. Rideout.

Plans are being formed for the second semester initiation into HKN.

THETA TAU

Xi chapter of Theta Tau, national professional engineering fraternity on campus, recently elected officers for the second semester. They were as follows: Dick Alberts, regent; Ronald Nelson, vice regent; Russell Myers, treasurer; and Jack Bokros, scribe.

Formal initiation ceremonies followed by the initiation banquet brought four new members into the organization. They were: Fred Barthenheier, Bruce Murray, Donald Markwardt, and Edward Wilkommen. E. Farber, the famous mountaineer, spoke on mountain climbing.

Recent meetings featured a movie on Mexico and an interesting talk and movie on the atomic bomb and its physiological effects.

The purpose of Theta Tau is to form brotherhood between engineers of all types. The fraternity is open to all engineers on campus. Any engineer interested in becoming a member of the group is invited to meet the members at the next meeting, March 25, in the Hydraulics Lab. Refreshments will be served.

TRIANGLE

Triangle, a fraternity of architects and engineers, is a group founded with the purpose of helping men planning to enter the engineering and architecture fields to get a greater reward from their work at school. Since the

At the recent installation of the new student chapter of the American Foundrymen's Society the following students were present: left to right, 1st row—Richard Gregory, Vice Chairman Carl Loper, John Hren, Chairman James Dance, S. C. Massari (Technical Director of AFS), John Walter, Roger Schluter, John Leer, Harold Shannon, Glen Reineman, Faculty Advisor Richard W. Heine. Back row—William Miller, Paul Bensun, Malcolm Graham, Carl Schoettler, Bruce Kramer, Secretary-Treasurer James Davies, Gordon Ullenberg, James Selle, and John Mead.

first chapter of Triangle came into being on April 15, 1907, at Illinois University, the fraternity has rapidly expanded so that today 17 chapters comprise the national body, together with the five additional groups now being organized.

The Wisconsin Chapter of Triangle was formally begun on February 7, 1913, when it was admitted to the national organization. Thus this year, 1953, marks the 40th anniversary of the local chapter. Plans are now under way for the celebration of the event.

Since 1924, when Triangle became a member of the Intrfraternity Council, it has won the IFC Scholarship Trophy, for having the highest grade-point average of all the fraternities on the campus, three times, a mark equalled by only a few groups. At present the fraternity holds a position of sixth out of forty fraternities scholastically.

Many men in Triangle are in outside activities. Members of the group serving on the **Wisconsin Engineer** staff are: James R. Collins, business manager, and Gordon E. Boettcher, the advertising manager of the magazine. All told, there are seven Triangle men working on the **Wisconsin Engineer.**

Several members of the chapter including Carroll Rands, who leads a flight in Mitchell Airmen, are active in ROTC. Outside the engineering field, Robert E. Knolinski holds the position of the University YMCA president and is also the Student Board representative of the IFC.

During the period of the past year the fraternity's social program has included rushing functions, and informal and semi-formal parties. The climax of this year's events occurs this spring when the Wisconsin chapter holds its annual Spring Formal, to be held May 9th at the Loraine Hotel.

At present the men of Triangle are looking forward to the national convention to be held at the Northwestern chapter at Evanston, on April 11th.

ASME

The February meeting of the student chapter of the American Society of Mechanical Engineers was held on Thursday the 26th, at 7:30 P.M. in the Top Flight at the Union. The feature of the evening was a talk on "Torque Converters and Fluid Couplings" by Mr. W. M. Sterling and Mr. George Bastian of Twin Disc Co. Refreshments were served after the meeting.

The Rock River Valley section of ASME were hosts to the Wisconsin student chapter on Tuesday, March 31. Mr. Den Hartog, noted vibration authority, spoke on the subject of mechanical vibrations.

Student speakers were given an opportunity to compete for prizes at the April 8 meeting. A movie and refreshments were also on the program.

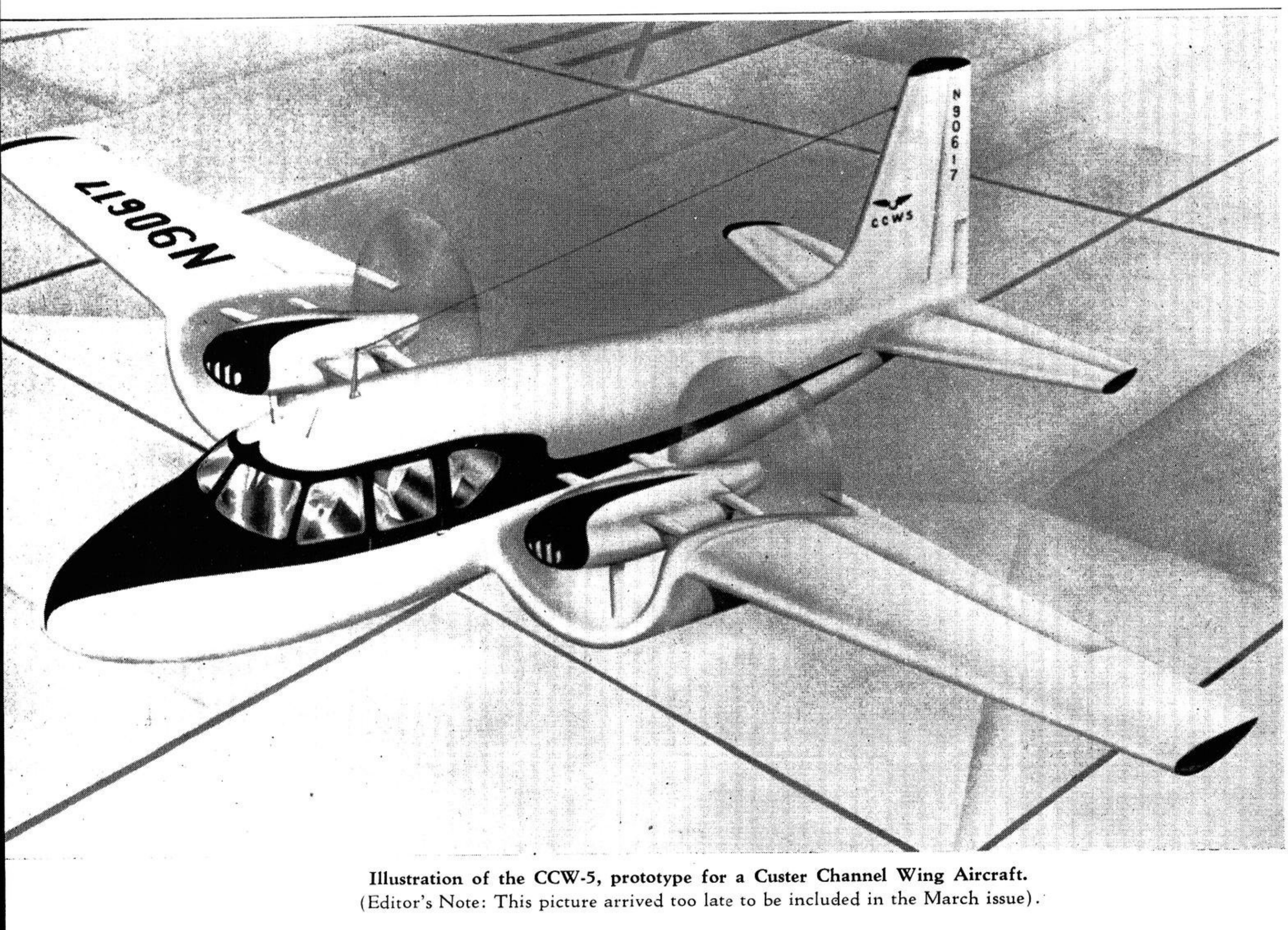
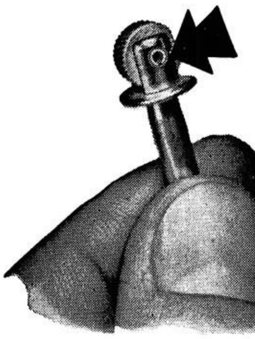
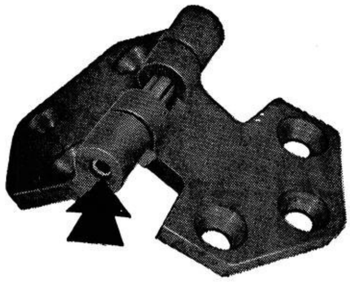


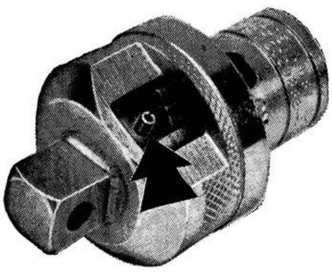
Illustration of the CCW-5, prototype for a Custer Channel Wing Aircraft.
(Editor's Note: This picture arrived too late to be included in the March issue).



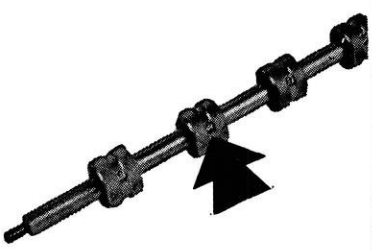
Replacing a rivet



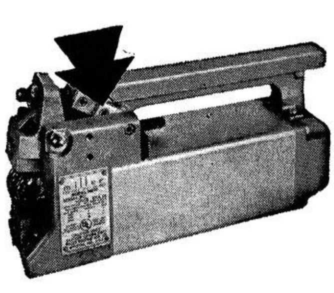
. . . a hinge pin



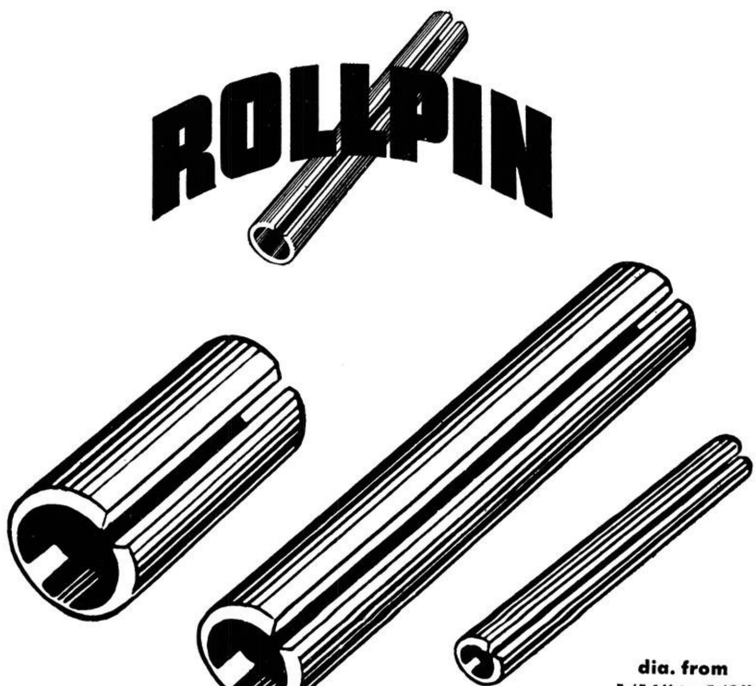
. . . a stop pin



. . . a set screw



. . . a bolt and nut



dia. from
1/16" to 1/2"

. . . a modern fastener that saves time and money on thousands of applications

Rollpin is a hollow, split, cylindrically formed pin with chamfered ends. It is simply driven into holes drilled to normal production tolerances. Because Rollpin is slightly larger than standard sized holes, it compresses as inserted. It is self-locking—and vibration-proof—because of the constant pressure it exerts against hole walls. Its shear strength exceeds that of a cold rolled pin of the same diameter. Rollpin is readily removed with a drift or pin punch—and can be reused.

Because of its versatility—and the production economies it makes possible—Rollpin is finding wide usage in almost every phase of manufacturing activity. Write for design information on the Rollpin. It will enable you to cut costs for many applications where use of rivets, set screws, dowels, and straight, serrated or cotter type pins create installation or performance problems.

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Elastic Stop Nuts with the famous red collar are another ESNA product

ESNA

Dr. DJorny - - On Entropy

The business of designing and building boilers is a pretty complicated one. There are technical terms galore, some of which are not fully understood by the engineer himself, let alone being understood by the layman. One such abstract term is Entropy—a term which has to do with heat unavailability and one that must be used in a wide number of engineering calculations.

From time to time during the past several months we have been asked by various members of our Engineering Department to run in COMBUSTION TOPICS an article that would explain Entropy in easy-to-understand non-technical terms. Naturally we were very flattered by the request but were reluctantly forced to admit that our knowledge of the subject was indeed very meager.

In an effort to wriggle off the horns of the dilemma on which we found ourselves, we contacted our good friend, Dr. Ignatzio Djorny, who is currently lecturing at the Institute of Advanced Atomic Research. The Doctor willingly agreed to help ut out. His reply is shown here.

Since the days of Pythagoras[2], much has been written on the subject of Entropy. Many of the earlier definitions of the term were confusing and were couched in evasive, pedantic language compounded by people of dubious character and questionable mentality. Entropy has been considered to be derived from an almost infinite series of incomprehensible formulas, calculated with micrometric precision from a number of vague assumptions, based on debatable figures taken from inconclusive experiments, carried out with instruments of problematical accuracy, by the aforementioned people of dubious character and questionable mentality.

It is therefore long past time to look at this term squarely—roll up our sleeves—and, if you will, strip the rind from this technological lemon in order to examine the fruit more carefully. Let us see what such an examination reveals.

Like many things profound, the Pythagorean observation[3] of the waterwheel waneshaft went unsung and unnoticed for almost 750 years—a not unreasonable length of time considering the reluctance of some engineers to accept things new—a facility sometimes euphemistically called "letting the idea jell." History shows tht the first person to fully appreciate the impact of the discovery by Pythagoras was that crusty old German scientist, Emil Zwiebach. For Zwiebach, such appreciation was natural since his feats in the field of the physical sciences[4] had long since attracted world-wide attention and acclaim.

Thanks to George E. Gandsey, of the Combustion Engineering-Superheater, Inc., for sending us this revealing excerpt from COMBUSTION TOPICS.

Today, Zwiebach's theorem, based on his now famous hypothesis, is a part of every college textbook dealing with the subject. In brief, and without mathematical frills, here is Zwiebach's hypothesis.

1. Entropy has something to do with unavailable heat.
2. Anything warmer than minus 460° F. has heat.
3. That includes just about everything.

3a. 100% of the heat of a substance is never available. (Or hardly ever).

3b. Everything has some unavailable heat. (Most of the time).

3b$_2$. Ergo Everything has Entropy.

The theorem of Zwiebach's that naturally followed as a result of this hypothesis: "Adiabatically speaking, Entropy is everywhere."

So far reaching was this profound statement that the slogan "Entropy is Everywhere" soon resounded throughout the corridors of Europe's greatest educational institutions. (Since almost all engineers speak adiabatically most of the time, the first part of Zwiebach's theorem was considered unnecessary and hence did not become part of the slogan).

Some three hundred years later, in a tiny village nestled in the Bavarian Alps, an unemployed alchemist, Vladimir Czolgotz by name, came across the outstanding discovery of Zweibach. So intrigued by the subject was Czolgotz, that he wrote a 1,784-page treatise elaborating on Zweibach's original hypothesis. We have just finished reading Vladimir's book[5]. To all those who are interested in the full and unexpurgated meaning of Entropy, Vladimir's book is a MUST. Get a copy.

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[1] En—from the French, meaning in. Tropy from the Greek, meaning tropics or heat. Entropy then, means—in heat.

[2] Inventor of the hypotenuse, who discovered Entropy while watching the waneshaft of a Greco-Roman waterwheel.

[3] See footnote 2.

[4] See Abstracts, Vol. 7, **Zweitchrifte und Schnitzeldriftzen** (Zweibach's paper on determining ambivalence with a radial refractive dactodimeter).

[5] Published by Suman & Shyster—$17.75 per copy retail.

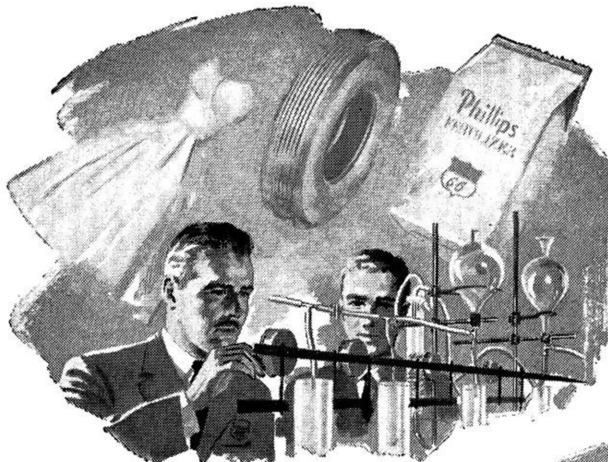
Opportunities in the Oil Industry

Prospects are good for young men who choose careers with Phillips Petroleum Company.

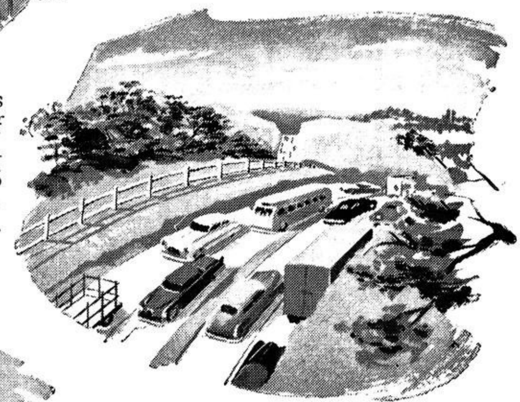
Phillips Petroleum Company has always been primarily a producer, refiner and marketer of fuels and lubricants. But today, thanks to the versatility of petroleum hydrocarbons, we offer many other opportunities for the technical graduate.

We are engaged in the manufacture of such diversified products as carbon black, butadiene, anhydrous ammonia, synthetic rubber, sulfur compounds, cyclohexane and vinylpyridines. Prospects are good for the still further diversification of products which we can manufacture from petroleum and petroleum gases.

Of the more than 22,000 employees of Phillips Petroleum Company, some 2,200 are technical graduates. Prospects for the technical graduate in the petroleum industry are better than ever. We invite you to write to our Employee Relations Department for information about opportunities with Phillips.

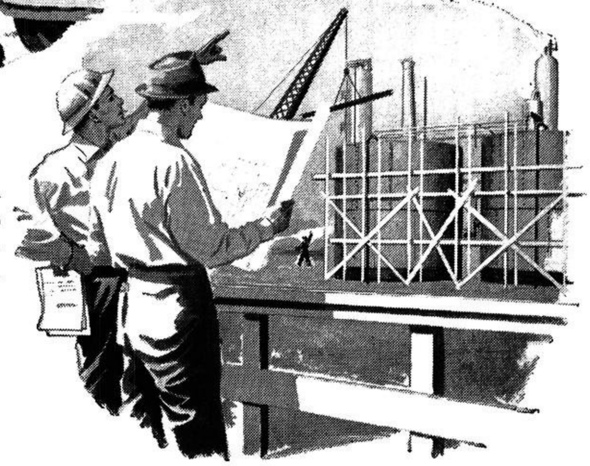


Dress fabrics, synthetic rubber, fertilizers, are a few of the many new products born of the science of petrochemistry as practiced by Phillips Petroleum Company.



Automotive fuels and lubricants are still the *primary* business of Phillips. The vast increase in automotive registrations since 1946 (from 33 million to over 51 million) means expanded opportunities for technical men in this field.

The tremendous consumption of petroleum products demands increased production of crude oil and natural gas. This provides good opportunities for geologists and production men.



Phillips has tripled its refining capacity in the past seven years. To construct and operate these refineries requires engineers and scientists of the highest competence.

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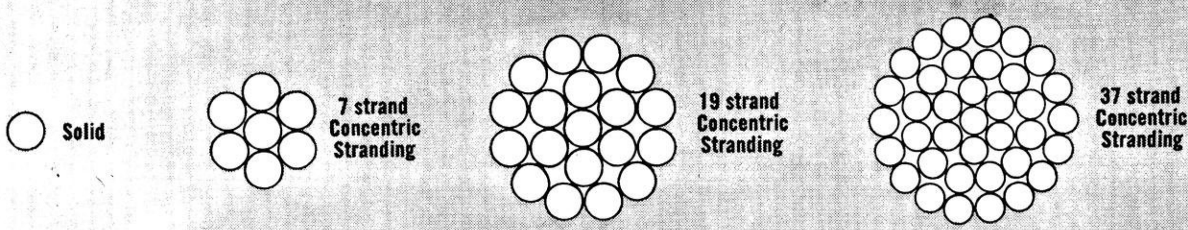
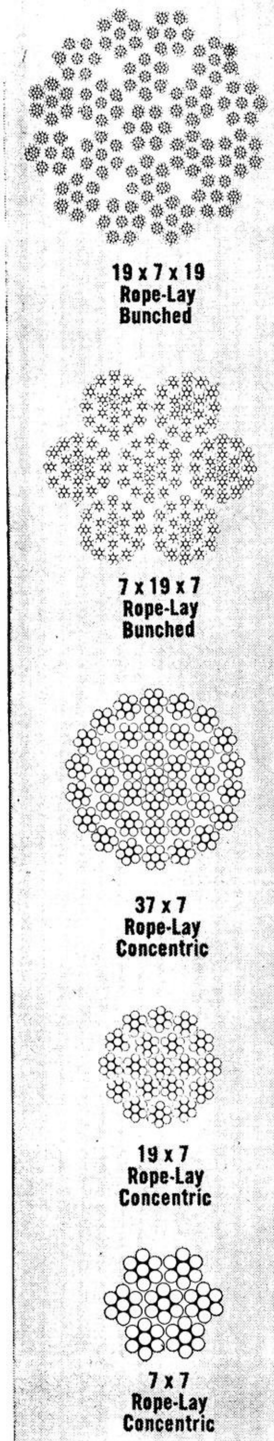




No. 2 in a series

The Importance of Electrical Conductors

In the ability to transmit electricity, all forms of matter may be divided into two general classes, namely, conductors and insulators. Conductors permit electric current to flow readily; that is, they offer little resistance to its flow, whereas, insulators offer relatively great resistance to the flow of electricity. All substances at normal temperatures offer some resistance to the flow of electric current. In general, the metals are good conductors, while glass, oil and most organic substances are classed as insulators. Although silver offers the lowest resistance to the flow of electricity of the common metals, its cost is such that it is not widely used as a conductor. The conductors most generally used in the cable industry are made of copper or aluminum.

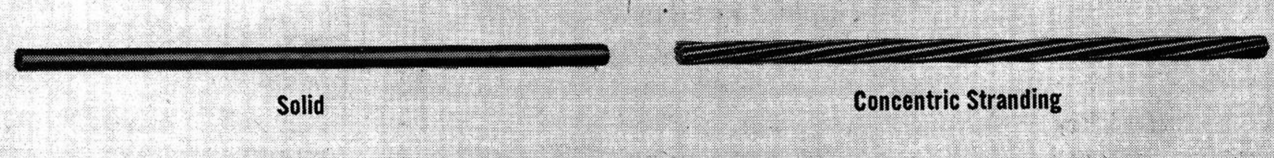
The manner in which electricity flows through elementary material may be readily visualized from the modern concepts of the structure of matter. According to these concepts all elements are made up of minute indivisible particles called atoms. These in turn are composed of a positively charged nucleus around which one or more very small negatively charged particles, called electrons, rotate at high velocity. In conductors, some of these electrons are free to move when only a small difference of potential is applied to the ends of the conductor and, since they are negatively charged, they flow to the positively charged end. This movement of electrons is electric current.

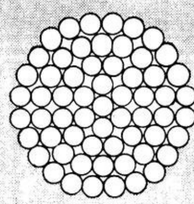
In passing through conductors, *the electrons must pass through the electron fields of many atoms. They thus collide with the atomic nuclei and other electrons. These collisions obstruct the flow of electrons and result in electrical resistance.*

The resistance of a homogeneous conductor of uniform cross-sectional area varies directly as its length and inversely as its cross-section, the length being in the direction of current flow. That is, $R = \rho L/A$ where, R is the resistance in ohms, L is the length in the direction of current flow, A is the area perpendicular to the length and ρ is a constant of the particular material known as its specific resistivity. When the length and area are expressed in the same units such as L = one inch and A = one square inch, $R = \rho \times 1/1$ or $R = \rho$, the specific resistance of the material in ohms per inch cube.

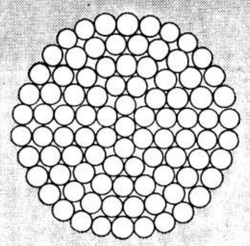
The length and area of a conductor are generally expressed in other units than inches. The most commonly used unit of cross-sectional area used in the cable industry is the circular mil, usually designated as cir. mil or CM. This

UNITED STATES RUBBER COMPANY

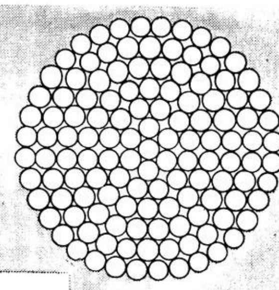




61 strand Concentric Stranding



91 strand Concentric Stranding



127 strand Concentric Stranding

is the area of a circle whose diameter is one mil, 0.001 inch. The area of a circular mil is $\pi/4$ or 0.7854 of a square mil. The unit of length usually associated with this unit is the foot and the resistance becomes ohms per CM-foot. The resistance of annealed copper and aluminum per circular mil-foot at 20C are 10.371 and 17.011 ohms respectively. The resistance of a copper conductor 64 mils in diameter and one foot long thus becomes $10.371 \div 64^2$ or 0.00253 ohms.

The sizes of electrical conductors *are expressed in the United States in terms of the American Wire Gauge. This was originally set up on the basis of a geometrical progression of 39 steps or sizes between a wire 460 mils in diameter (Size 4/0) and a wire 5 mils in diameter (Size 36). The ratio of the diameter of a wire to that of the next larger size in this series is* $\sqrt[39]{460/5}=1.12293$. *This ratio has since been used to extend the American Wire Gauge (AWG) to sizes smaller than 36 AWG (5 mils). The sizes of conductors larger than 4/0 are expressed in circular mil area. The size of a conductor made up of a number of wires is determined from the sum of the circular mil areas of the individual wires.*

When current flows through a conductor there is, according to Ohm's law, a voltage drop of $E = IR$, where E is in volts, I is in amperes and R is in ohms along the conductor and power equal to EI watts is converted to heat. Since $E=IR$, this power converted to heat becomes I^2R watts. These two factors, voltage drop and conductor heating, are of prime importance in the design of conductors. Conductors must be sufficiently large in cross-sectional area, that is, must have sufficient low resistance that the voltage drop does not become excessive. In good design this voltage drop should not exceed 3 per cent for power circuits or 1 per cent for lighting circuits. The conductors should also be large enough that their temperature does not exceed that for which their insulation is designed. This is referred to as the current carrying capacity of conductors. The current carrying capacities of the various sizes of conductors, conductor insulations and installation conditions have been established. It should be noted that the temperature attained by a conductor depends not only on the amount of heat generated but also on the thermal resistance of its surroundings.

In addition to providing satisfactory voltage drop and current carrying capacity, conductors must be designed to provide adequate flexibility during installation and service. This is accomplished by building up the conductor from one or more adequately small wires depending on the flexibility required. For example, the conductor for heater cord or welding cable which is subject to repeated flexing in service is usually made up of copper strands having a diameter of .005" or .0063" while the conductor for overhead weatherproof cable may be a single wire.

For reprints of these pages write to address below.

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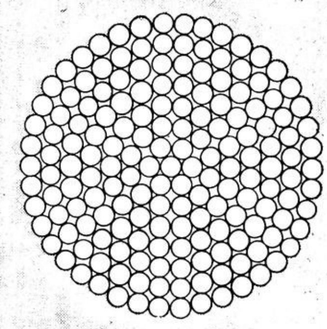
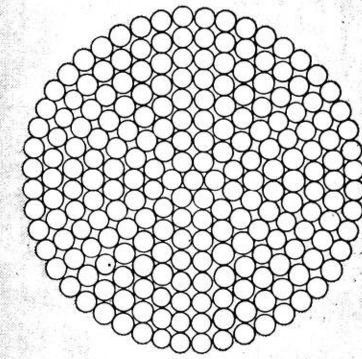
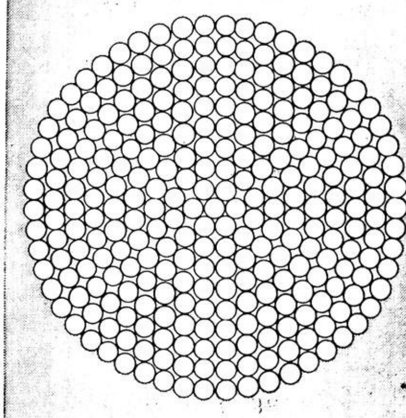


169 strand Concentric Stranding



217 strand Concentric Stranding



271 strand Concentric Stranding

Rope Stranding

Bunched Stranding

W.S.P.E. - -

(continued from page 19)

achieved renown early in his youth as a military engineer, it is entirely possible that he would never have been president. More about Washington's career as an engineer a little later. It is an interesting footnote to our history as a nation.

Few members of the public come in direct contact with an engineer as they do with members of other professions—like the ministry, medicine, teaching, or law. Therefore, there is some confusion as to just what an engineer is, and what he does. The confusion is heightened by the fact that there are many definitions of engineering and few of the experts can precisely agree on the matter. I won't bore you with a technical definition of engineering, but one interesting fact will probably illustrate pretty well what an engineer is, and what he does.

The engineer is a kind of middleman between the scientist and the public—a man who takes inventions and the discoveries of the laboratory, devises means of mass-producing them at a price the public can afford to pay, and makes them available to all.

Role of the Engineer In Healthful Living

Take the matter of penicillin, sulfa drugs, and the other "wonder drugs," aureomyacin for example. The first pound of penicillin took several years to make and millions of dollars to produce. Although medical men were aware of its tremendous potential as a life-saving drug, it was not until the engineering profession devised methods of producing it in enormous quantity that it played much part in the lives of the sick.

That roughly, is the job of the engineer. He works on the discoveries of science and on the forces and materials of nature and puts them to work for mankind.

I mentioned a little time ago that all of us in this room can expect to live longer and healthier lives because of engineering advances. Let me point out a few specific facts. According to mortality figures, today each of us can expect to live to an average of 68 years. Just 25 years ago, our life expectancy was only 60 years—a full eight years less.

A great deal of credit for this advance belongs to the medical profession—but a great deal of it also belongs to the engineering profession. For engineers carry away man's sewage, purify his water, drain his swamps, lead in the fight against insect and bacterial disease carriers, and design and make possible the construction of better homes to live in and buildings to work in. The progress of the science of safety engineering is also an important fact in lengthening the lives of all of us.

The Engineer Increases Our Standard of Living

In fact, almost everything we do is, in one way or in many ways, tied up with engineering. The labor-saving devices that the modern housewife has available to lighten the household chores—a truly backbreaking burden in grandma's day—are legion. These include automatic clothes washers and dryers, dishwashing machines, garbage disposals, modern cooking ranges, and a thousand and one other mechanical servants which take most of the drudgery out of homemaking. It is truly said that today's housewife has the services of thousands of engineers at her beck and call.

The food we eat comes to us mostly engineered. Not many people realize it, but the engineer can legitimately take a bow with the American farmer in making our nation the best-fed on earth. 'Way back when George Washington was a boy, it took the labor of almost seven farm persons to produce enough food to support one person living in a town or city. Today, one farmer can produce enough food to support 17 city persons.

Those simple facts explain, in large measure, why America's standard of living is the highest in the world. Man has been freed from grubbing to eke out a bare existence—freed by machines designed by engineers. Time has been gained to raise our standard of living, and to pursue the arts and cultural activities.

Not only does agricultural engineering enable farmers to grow immensely larger crops from the same land today than formerly, but the entire face of the earth has been changed by the huge dams, lakes and reclamation projects of the engineer. Then, too, engineering advances have made possible new forms of food—frozen fruits and vegetables and dehydrated foods. New methods of transporting foods, refrigerated cars and air transport (made possible by engineering design) have literally opened up new gastronomical vistas to all of us.

Mr. John Q. Citizen lives in an engineered world. His home contains hundreds of items dependent upon the work of an engineer for their construction. It is very likely to contain engineering air-conditioning or heating. Mr. Citizen drives to work in an automobile that required many millions of engineering manhours. The fuel that makes it run has been passed through many engineering processes. The office he works in, the streets he drives over, even the manufacture of the clothes he wears, are dependent upon engineers.

So you see, even though Mr. Citizen seldom, if ever, has occasion to deal directly with members of the engineering profession, his daily life is vitally dependent upon them.

Civil vs Military Engineers

It might be interesting to note that the science of engineering first developed as an adjunct to military operations. From the dawn of history until the recent past, the main, if not sole, function of the engineer was to smooth the path of the military conqueror or defender. Approximately one hundred and fifty years ago a group of engineers calling themselves "civil" engineers, were distinguished from military engineers. Since that time we have

(please turn to page 44)

Speech - -

(continued from page 24)

made a canvass of the operators of many of the large mines which were developed in a more favorable economic climate. I asked a simple question—Could this enterprise have ever been developed and equipped under present taxation and other restrictions on freedom? The answer was No in every case but one, and that case had been a bonanza so rich as to defy even the tax-collector. But today even in most of these surviving enterprises the government takes from the stockholder about $85 out of every $100, earned before taxes, and if he received the remaining $15, there would be no fund left to plow into constantly needed improvements to treat decreasing grades of ore.

From it all, the nation is becoming short of these domestically produced metals.

By stimulated scientific research and invention looking to new engineering methods we can reduce costs and thus do something to aid this industry. But more intelligent taxes on mines such as those in other countries would sustain the industry. It would be cheaper than government subsidies.

The same problems apply to the other industries where venture capital and plowing in are their craracteristics.

But there has arisen an alternative application of new ideas which bodes little good to our society. The established industries can and do undertake such risks in their fields. They can write off their losses against taxes, and the venture costs nothing. The inventor, the prospector or the individual has little chance of this relief. The consequence is that existing enterprises absorb the new discoveries and inventions. They grow in size and monopolistic strength but the opportunity for the individual to establish his independent and competitive business is greatly diminished.

We Are Running Short of Engineers

We have in our profession another great national problem. We do not have enough engineers in incubation to carry on the nation's work. We need 60,000 new technologists a year to supply national needs. Our engineering graduates have dropped from 50,000 in 1950 to 38,000 in 1951, and the students in training indicate less than 30,000 next year. Yet our universities have ample facilities to fill the demand.

One reason for this drop is that a young mechanic with three years of training, during which he is paid, can earn more take-home pay after taxes than a young engineer with six years of training and three years more of experience. Too often the financing of engineering training is too expensive for his Dad. And with increased tuition and living costs it is more and more difficult for boys by off-time work to make their way through college as many of you did.

(please turn to page 58)

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Engineering ***Contracting***

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REINFORCED CONCRETE WORK
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BUILDING CONSTRUCTION

•

W.S.P.E. - -

(continued from page 42)

seen the rise of electrical engineering, chemical engineering, mechanical engineering, mining engineering and many other kinds of engineering.

The Engineer in War

Our civilization, for better or for worse, has become geared to the engineering profession for the means of its existence and protection. Take the matter of national defense, for example. A whole galaxy of new weapons, the rocket, the guided missile, the atomic bomb, the hydrogen bomb—all have sprung up within the last decade. The destructive and devastating potential of these weapons is almost beyond conception. They are all products of engineering. While many people will debate whether such weapons accomplish any useful purpose, they have enabled us to maintain our freedom in an arms race with the Iron Curtain countries that we dare not lose.

The history of engineering makes it obvious that war and preparation for war has engaged much of the time of engineers since the dawn of history and before.

Unfortunately, this is still true today. Jet airplanes, guided missiles, atomic submarines—all require the services of enormous numbers of engineers. The situation is constantly requiring the efforts of large numbers of engineers. The first new B-47 jet engine intermediate range bomber, for example, took nearly three and half million engineering manhours for its construction. This compares with only 85,000 engineering manhours for the first B-17 of World War II. Already we learn that the B-47 is obsolete and that the new B-52 jet-engine, long range bombers which will replace it will require still greater numbers of engineering manhours.

As war becomes more and more complex, it requires the use of the talents of ever-increasing numbers of engineers.

Opportunities in Engineering

What is true in the field of national defense is equally true in our civilian economy. As life becomes more and more complex, the gadgets we depend upon require more and more engineers. Today, there is an estimated shortage of 50,000 professional engineers and that number will become larger in the next few years. Even without the shortage of engineers, the increasing dependence of our nation upon technology is assurance that there is, and will be, ample opportunity for qualified young men and women in engineering.

Before I leave the subject of the opportunities in engineering and shortage of engineers I want to touch upon one grave aspect of the problem. Russia is outstripping the U.S. in engineer graduates. Last year Russia turned out 30,000 engineers while only 23,000 were graduated from U.S. schools. Russia's goal is to produce 50,000 engineers by 1955; the U.S. only 30,000 per year, and then not until 1956. We would like to believe that their engineers are inferior in training to ours, but if we are honest with ourselves, we must admit that from the facts and information available such is not at all the case. Keeping ahead of Russia technologically is an absolute must!

Engineers Play a Part in Community Affairs

Thus far I have been speaking to you about the technical work that engineers do. But we, as a profession, realize that we owe a responsibility to our communities far greater than just to be technically able at our work. We professional engineers are trying out best to be good citizens, to cooperate in every way possible to make our community a better place in which to live. The special training of engineers makes it possible for us to give our cooperation in safety campaigns, civil defense preparation, fire prevention drives, cooperation with city and state boards of health and other public bodies, and in many other ways.

George Washington—The Civil Engineer

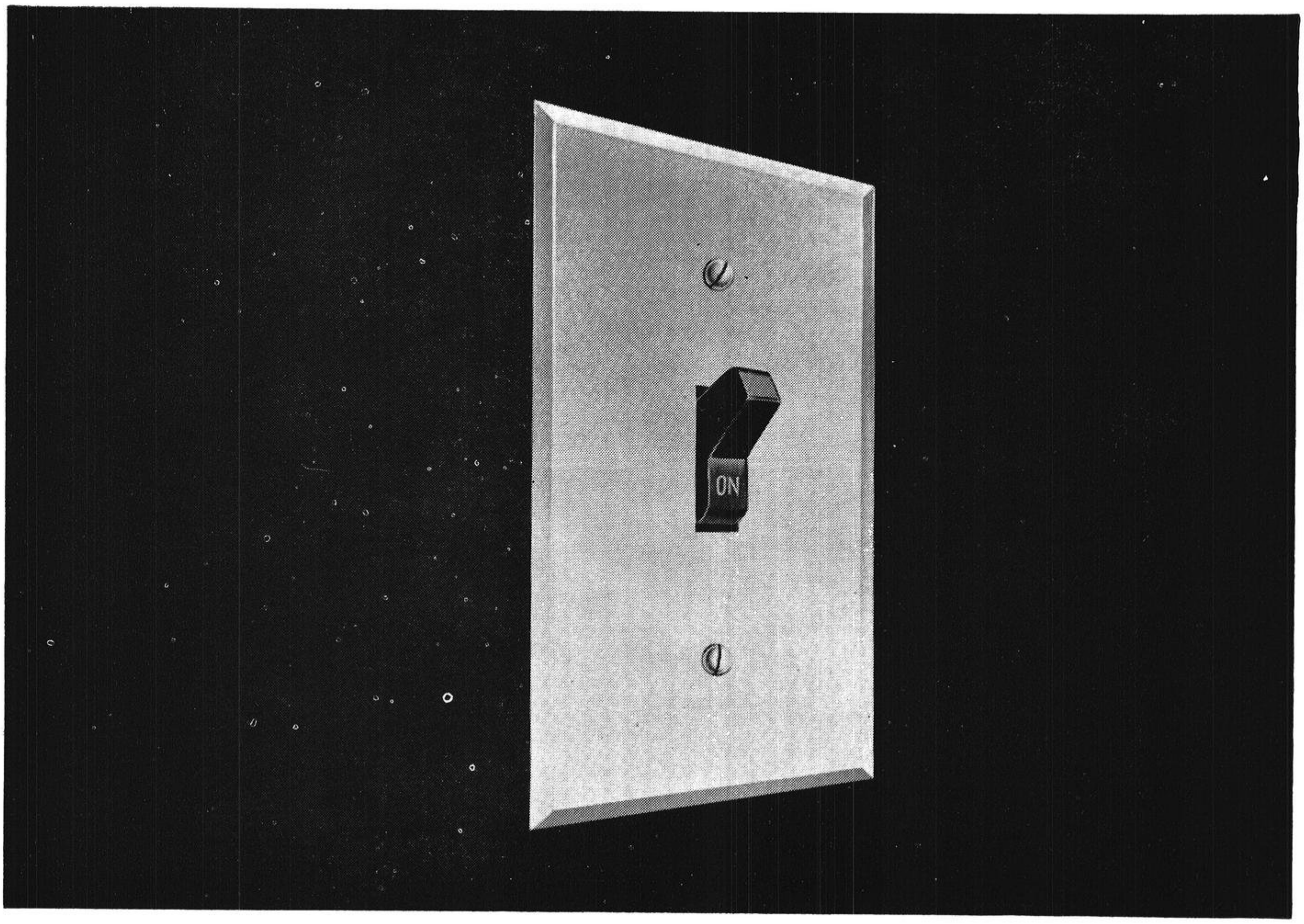
Now with George Washington so much in the news these days—I promised to tell you about his career as an engineer. There is no better way than to tell you a few stories about the father of our country. Washington is remembered for many services which he so unselfishly gave for America, but few people know that our first president, in addition to being a farmer, soldier and statesman, was also an engineer. As an engineer, Washington had many dreams for the improvement of the country he loved so well. Among the blue mountains and the gently rolling green hills, Washington grew up loving the soil and the way of life that belonged to the gentleman farmer, unaware of the part he was to play in the destiny of his country.

One morning young Washington received a message to which he promptly replied in person. The call had come from Lord Fairfax, who had extensive property holdings in the state of Virginia lying between the Potomac and Rappahannock rivers which the British nobleman called Belvoir. Some years before Dutch settlers came from Pennsylvania, settled there, and seemed to regard the land as their own.

It was Fairfax's intention to form a surveying party, of which young George, then only 16, would be a responsible party. The nobleman had abundant faith in the ability and integrity of this young engineer and surveyor. How highly he was regarded by his prospective employer can be seen by his pay—a gold doubloon a day—about $16 a day then and equal in purchasing power to about $50 today.

And so, just after he had passed his sixteenth birthday, George Washington set out on an expedition into northern Virginia, on as great a journey as a trip into Africa would be now. His well-kept journal testifies to the harsh conditions under which he lived and worked on

(please turn to page 48)



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It's just a simple switch. Yet it is the key that will unlock the energy generated by America's 20-billion dollar electric power industry.

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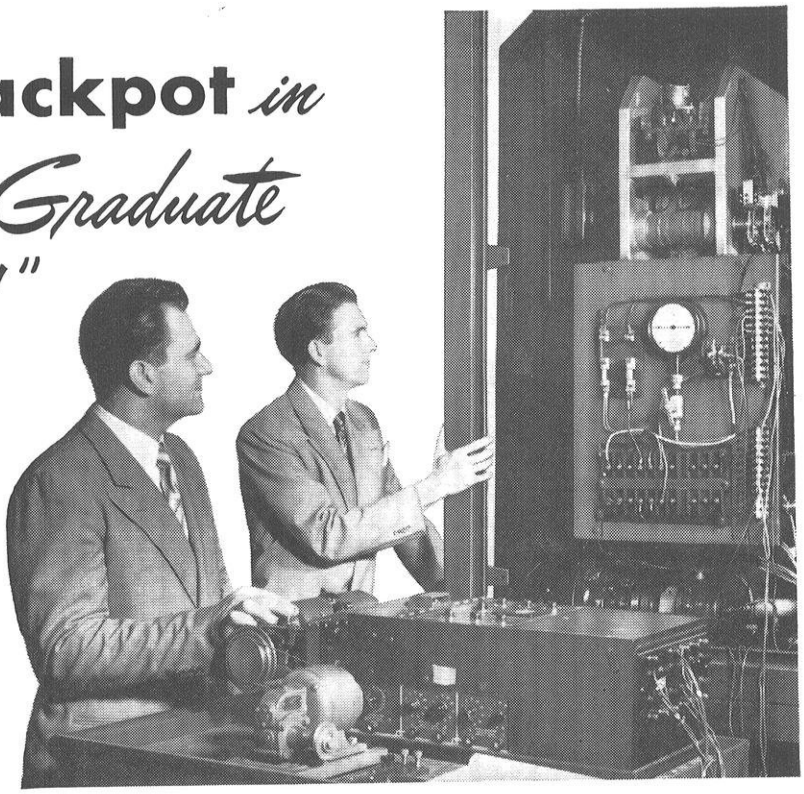
HEADQUARTERS FOR BUSINESS INFORMATION

McGRAW-HILL FOR BUSINESS

"We Hit the Jackpot *in Allis-Chalmers Graduate Training Course!*"



say **N. W. MORELLI**

Oregon State College, B.S.,M.E.—1950

and

E. R. PERRY

Texas A. & M., B.S.,E.E.—1950

WHILE taking the course, two engineers developed a revolutionary new circuit breaker mechanism.

"Our experience shows what *can* happen if you work with people open to suggestion. We found men of this kind at Allis-Chalmers, and it has given us a special pleasure in our job.

"We started out like most other graduates with a hazy idea of what we wanted to do. After working in several departments, we requested that part of our training be at the Boston Works of Allis-Chalmers, where circuit breakers are made."

New Design Principle

"Circuit breakers soon became an obsession with us, and we got the idea of designing a hydraulic operator and triggering mechanism for these breakers. Most operators for big breakers are pneumatic.

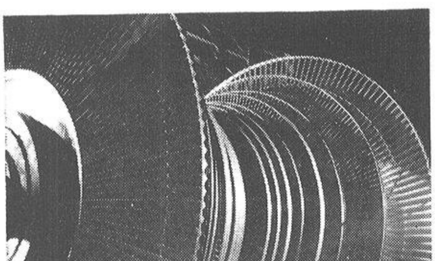
"Unsuccessful attempts had been made in the past by all circuit breaker manufacturers to build hydraulic operators. The important thing is that no one at Allis-Chalmers said, 'Don't try it—it won't work.' "

Start New Era

"To make a long story short, our study of the problem led us to the hydraulic accumulator and high speed valves being used by the aircraft industry. These had not been available when earlier attempts were made to build a hydraulic operator. With these highly developed devices to work with, we were able to build an operator that combined the best features of pneumatic and hydraulic operation. We call it the *Pneu-draulic* operator. Engineers are saying it starts a new era in circuit breaker actuation.

"This fact is important to us, but it is even more important to know that Allis-Chalmers Graduate Training Course is full of opportunity . . . and as we found out, there's opportunity right from the start."

Pneu-draulic is an Allis-Chalmers Trademark.



Low-pressure spindle for a 120,000 kw steam turbine generator. Said to be one of the largest ever built in the United States, this spindle is nearing completion in the Allis-Chalmers West Allis shops.

Facts You Should Know About the Allis-Chalmers Graduate Training Course

1. It's well established, having been started in 1904. A large percentage of the management group are graduates of the course.

2. The course offers a maximum of 24 months' training

3. The graduate engineer may choose the kind of work he wants to do: design, engineering, research, production, sales, erection, service, etc.

4. He may choose the kind of power, processing, or specialized equipment with which he will work, such as: steam or hydraulic turbo-generators, circuit breakers, unit substations, transformers, motors, control, pumps, kilns, coolers, rod and ball mills, crushers, vibrating screens, rectifiers, induction and dielectric heaters, grain mills, sifters, etc.

5. He will have individual attention and guidance in working out his training program.

6. The program has as its objective the right job for the right man. As he gets experience in different training locations he can alter his course of training to match changing interests.

7. For information watch for the Allis-Chalmers representative visiting your campus, or call an Allis-Chalmers district office, or write Graduate Training Section, Allis-Chalmers, Milwaukee 1, Wisconsin.

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W.S.P.E. - -

(continued from page 44)

this and other trips which he was to later conduct for Lord Fairfax. Thus, he was more of an engineer than is generally known, in a period when surveying was almost the only form of civil engineering being praticed in America.

Washington—
The Military Engineer

The civilian expeditionary days of George Washington ended about this time, when he inherited Mount Vernon upon his brother's death in 1752. The next year found the 21-year-old Washington, now a major in the militia, on an errand for Governor Dinwiddie of Virginia. He was commissioned and appointed by the governor to visit and deliver a letter to the commandant of the French forces on the Ohio. After a trip beset with bitter weather and dangerous terrain, Washington returned with a reply less than three months later.

Immediately, Governor Dinwiddie ordered the young soldier to return with troops to the fork of the Ohio and there construct a fort as quickly as possible. Thus began the military engineering career of George Washington. When Washington and his small band of men reached their destination, they found that American troops had been forced to withdraw from the junction of the Allegheny and the Monogahela where the fort was to be constructed. Imagine the feelings of this vanguard of Dinwiddie's army as they thought of the task before them—to drive on to the Ohio, drive off the French army and build a fort. To add to their difficulty, the only road open to them was an Indian path, scarcely wide enough for a packhorse.

One night, the young Washington faced his men around a campfire, "Gentlemen, we are here on what some of you may think a fruitless journey. That may well be. I only know my orders from our governor were to reach the fork of the Ohio and build a fort. I know too well the task that lies before us, and the forces that work against us, both of nature and the French. You are my captains, but there is not one of you who is not old enough to be my father. I know the well-loved wives and children that you leave at home, and cannot bring myself to order our advance alone. So, if you will, let us cast a ballot to determine if we turn back to Virginia or advance to the Ohio."

When the vote was taken, the decision was to advance—to widen the Indian path, build bridges as far as the Monongahela and there build a fort and await reinforcements. The journey was slow and hard. Only twenty miles were covered in the first ten days. Still counting on Dinwiddie's support, Washington pushed on into the wilderness, opening a road and building bridges for a colonel and an army which were never to arrive.

The ill-fated campaign which followed is only a portion of his military history, but for nearly half a century after Washington capitulated, his road from the Potomac was the route taken by weary travelers to the West, many of whom camped where Washington had fought his first battle for it. Washington was the first man in America to see the great value of improved communications and this road was the first step in his dreams of uniting the country by means of better transportation.

Washington Aids
Establishment of Army Engineers

Throughout the French and Indian War, and later in the Revolution, Washington was to become more and more aware of the importance of engineers in war, but few commanders ever suffered from a greater lack of them.

Later, Washington was to be instrumental in the formation of the Army's Corps of Engineers, which was officially established by the Continental Congress in 1779. Unfortunately, however, the colonies had very few civil or military engineers, but Benjamin Franklin solved this problem by securing 20 French engineers, who had been trained by some of the leading military engineers of Europe. The lack of military engineers which Washington has experienced as commander-in-chief led him to recommend, when president of the United States, that a military academy be established as a school for engineers. Washington was never to see the completion of his idea, however, for the plan was put into operation in 1802, after his death.

Washington—The Planner

But military engineering was only one of George Washington's many contributions to the development and preservation of America. Perhaps his greatest single achievement toward the economic development of the colonial United States was his plan for internal improvement. He had traveled extensively and knew the crying need for roads and waterways to unite his beloved country. His diaries are full of complaints about the terrible conditions of the roads and his great concern for the lack of communication between the various parts of the country.

Washington's unselfish devotion to the interests of his country finally began to have the effect he desired. In 1784 a bill was passed by the Virginia legislature providing for the incorporation of the Potomac Company and the James River Company, for the improvement of the navigation of those vital rivers. In testimony of the people's appreciation for the service Washington had rendered to them, the legislature of Virginia passed a bill vesting in him 50 shares of the Potomac Company and 100 shares of the James River Company. Washington, with the interests of his country at heart as usual, asked that this gift be made to him only in trust, so that he might by will devise it for public purposes.

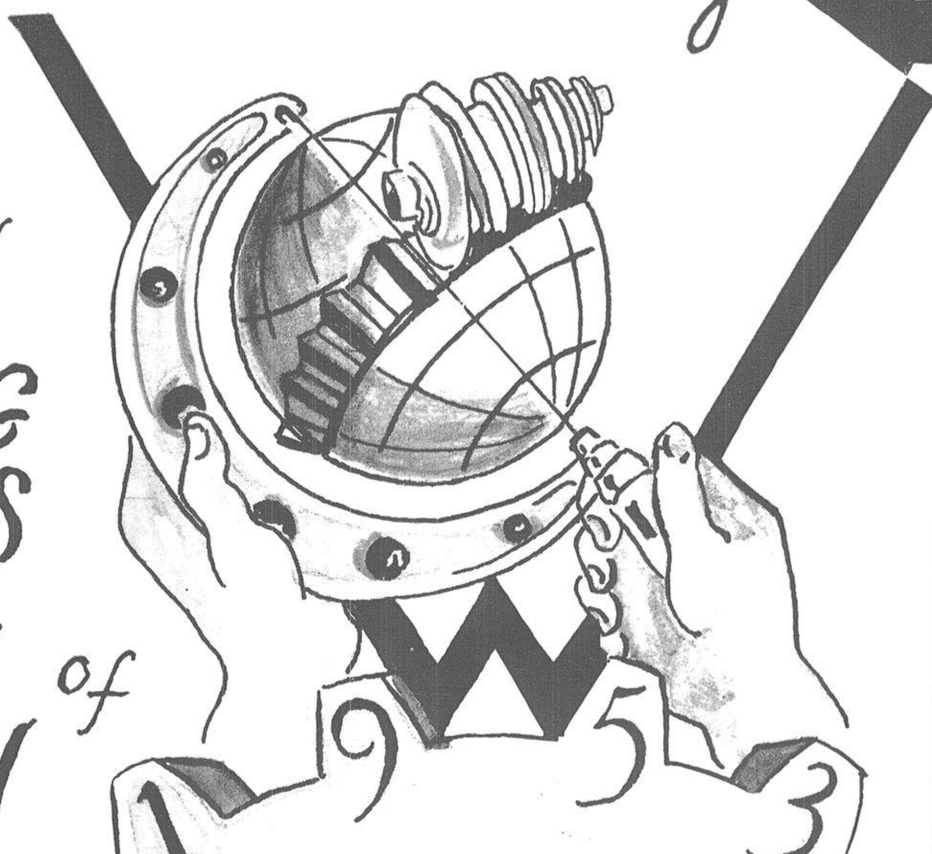
But there remained one more service for Washington to do for Am-

(please turn to page 56)

ENGINEERING EXPOSITION

Official Program

Presented by the ENGINEERING STUDENTS of the UNIVERSITY of WISCONSIN



April 10-11-12

PROGRAM OF EVENTS

Exposition Hours

Friday, April 10 .... 1:00 - 10:00 p.m.

Saturday, April 11 .... 10:00 a.m. - 10:00 p.m.

Sunday, April 12 .... 1:00 - 7:00 p.m.

Opening Program

Friday, April 10 .... 2:00 p.m.

Location—Outside front entrance of Electrical Engineering Building, or, in case of rain—Ag Hall Auditorium

Cannonade

Selections by the University of Wisconsin Band—Directed by Prof. Dvorak

Presentation of Service Plaque

Opening address by G. E. Watson, state superintendent of public instruction

Demonstrations

The following demonstrations of engineering laboratory equipment will be given:

The foundry will pour in the Mining & Metallurgy Building.

In the Machine Shop (Mechanical Engineering Building), turret lathes will be in operation, and a display of machine shop projects will be shown.

Movies

Continuous movies will be shown in the auditorium of the Mechanical Engineering Building. For names and times of movies, see schedule posted outside of auditorium.

The 1953 E

EXPOS

History

Twelve years ago, in April, 1941,
engineering exposition. The idea for th
over St. Pat's occupation — was he engi
the two claimants of St. Pat began to g
their talents in a more constructive cel
ing Exposition. A second exposition was
and an end to all plans.

This year Polygon Board, an organi
student engineering societies, felt that th
to give everyone a picture of the rapidly

Industrial Exhibits

Thirty-five progressive industrial or
depends on engineering principles, are
ing processes. All of these industrial ex
gineering Building.

Student Exhibits

Exhibits designed to show that cla
times spectacular, have been constructe
students. They are competing for over
gon Board.

These student exhibits are on disp
lurgical Engineering Buildings. Students
equipment used in their training.

Air Conversion Research Corp.

Allen Bradley Co.
Manual and automatic starters, switches, timers, for control mechanisms.

Allis-Chalmers Mfg. Co.
Operating units, including clear plastic coal washing pump.

Armco Steel - Bark River Equipment Co.
Models of corrugated metal products.

Beech Aircraft

Beloit Iron Works

Berlin Chapman, Berlin, Wis.
High speed paper making machines.

Commonwealth Edison
Scientific and engineering principles as applied to everyday problems in industry. Question and answer game.

Continental Can Co.
High speed closing machine in operation, sealing up to 400 cans per minute.

Cutler-Hammer, Inc.
Electric motor controls.

Deere & Co.
Cutaway model of new John Deere #60 Heavy Duty Three-Plow Tractor.

E. I. Du Pont de Nemours & Co.
Research, development, and production carried on by Du Pont.

Gisholt Machine Co.

General Electric

Hamilton Standard

The Heil Company

Johnson Service Co.
Automatic temperature and air conditioning control systems in actual operation.

GINEERING TION

College of Engineering held its last
itions evolved from the annual feud
lawyer? When the contests between
hand, the engineers decided to use
; the result was the 1940 Engineer-
ed in 1941. Then came World War II,

omposed of representatives from the
Engineering Exposition should be held
ing engineering field.

ons, desiring to show how production
g special products and manufactur-
re housed within the Mechanical En-

heory is not only very real, but many
th engineering and non-engineering
rth of prizes being awarded by Poly-

e Electrical Engineering and Metal-
demonstrate some of the technical

High School Day Events

Saturday, April 11 .... 1:30 p.m.

Location—Temporary Building T-16, one block directly north of Mechanical Engineering Building.

Opening address by University of Wisconsin President E. B. Fred

Incidental music by Woodwind group

"A Solution to the Draft Problem" by Lt. Colonel Jack Jeffries of the ROTC Combat Engineers

Introduction by Dean Morton O. Withey of the College of Engineering

"The Future of An Engineer" by Mr. H. E. Schubert, vice president, Wisconsin Michigan Power Co.

Honorary mechanical engineering fraternity will conduct tours of the exposition for high school students.

---

adish Co.
Custom forgings and pipe fittings.

eRoi Co.
Self-propelled air compressor and automotive type V-8 engine developing 290 horsepower.

eeds & Northrup
Electrical measuring instruments, temperature controls and recorders.

ink Belt Co.
Modern methods of conveying, and mechanical power transmission.

he Louis Allis Co.
Adjustable speed electric motor drives, Eddy current clutch drive, magnetic amplifier control.

linneapolis-Honeywell
Precision electrical switches, for electronic, industrial and commercial uses.

Modine Mfg. Co.
Cutaway models of steam and gas unit heaters.

Philco Corporation

Research Products Corp.
Air filtration and water conditioning.

A. O. Smith

Sundstrand Machine Tool Co.
Constant speed drive, using hydraulic, mechanical, and electrical components simultaneously.

Waukesha Motors
Heavy duty 6 cylinder, 4 cycle, full diesel engine with exhaust turbocharger.

West Bend Aluminum

Wisconsin Motor Corp.
Heavy duty air-cooled engines.

Wisconsin Power and Light
Business operation, policies, and territory covered.

Wisconsin Telephone Co.
Audience participation devices.

Quicksand Apparatus
Terry Mueller, Norman Peterson

Weight of a Person by Deflection of Beam
William Zeeb, Herbert Hellen

Height of a Person by Triangulation
Sylvester Hamshire, Harry Williams

Studies About the Illinois Central Parkway in Madison
Mr. Tain

Manufacture of Plastic Ashtrays
(Available for souvenirs—10c each)

Turret Lathe Demonstration
Tom Haug

High Speed Movies of Cutting Tool Action
Walter Hougas, George VanDewalle

Hot & Cold Air Tube (Hilsch Tube)
Erv Koth

P-V Diagram Shown on Oscilloscope
Ray Hafemeister

Strain Gage Demonstration
Glen Smelcer

Auto Club Exhibit
William Douglas

Gear Trains, Corner Drives, and Stop Mechanisms
ASME Society

Effects of Sulphite Liquor on Bituminous Roads
Donald Lang, Milton Engel

Performance Test of Diesel Truck Engines
Walter Schoof
Real Estate & Home Builders Assoc.

Civil Defense
Student Civil Defense Committee

Mechanical Engineering Department:
Display of Machine Shop Projects
Army Ordnance Gage Lab.
Welding Exhibit
Ben Logerquist also working on turret lathes.

Van De Graff Generator
Wayne Olson, Keith Buchanan

Controlled Swimming of Fish
Tom Zander, Don Rasque

Lighting Exhibit
Jack Johnson, Bob Frank

Theremin (Music electronically)
KHK

Electronic Computer
KHK

Fire Assaying
Clark Willick

Fluorescent Minerals
Rod Roeske

Magna Flux Inspection
Dale Bartholomew

Refractory Alloys, Refractories, Thermocouples
Jack Bokros, Jan Raymond

Metallograph
George Leist

Spectrograph and X-ray
Edward Wilkommen

Heat Treatment and Induction Heating
Al Eichler, Don Domrose

Magnesium Innoculation
Donald Gehr

Ore Concentration
Robert Cnare, John Berryhill, Harold Lampert

Movie on Production of Steel
Art Williams

Compression Molding (Plastics)
James Healy

Nylon Process
Arthur Mees

Electroplating
Ed Reuter

Distillation
William Walker

How Strong is Concrete?
Dick Bastian, Gordon Steiner

Dam Stress
Fred Culver, Isaac Senior

Water Going Up Hill
Jack Binning, Don Otto

Photogrametry
Bill Taylor, Ronald Fiedler

Tacoma (Wash.) Bridge
Gerald Marr, Robert Reese

Prestress and Poststress Bridge
Robert Kampmier

University of Engineering Mall
E. Jackson

Traffic of Johnson Street
Howard King

Cotrell Precipitator
Jack Buchanan

Cyclone Separator
Jack Buchanan, Clay Bossart

Material Classifier
George Rasmussen

Fluidized Catalyst
Art Straub

Paper Making
Bill Weiberg

Tractor Safety
John Balis

Barn Hay Drying
Joe Wachuta

The Plow
Joe Barr

Forestry Management
Richard Zimmerman

Heating & Ventilating Exhibit
John Lord

Tesla Coil
John Verga

Gieger Counter and Stroboscope
Delaine Sather, Reuel Philips

Slide Rule
Don Lang

German V-1 Buzz Bomb
Bob Weiss, Richard Koegal

Television
Les Thelaner, Robert Cody

Flying Saucer
John Smith, Harold Gattie

Jacob's Ladder
Charles Wittkop, Victor Muth

Air Entrained Concrete
Ross Ketchum

Euler Column
Richard White

Liquid Air
John Zahn

The Auto-Stabilizer
Attilio Campanile

Production of Bucky Badgers
American Foundry Society

Zone Plate
Donald Liebenburg

Drawing Exhibit
Jim Hill

Home Builders Exhibit

Program cover by Marian Cattoi.

John Hickman
Program

Walter Pasciak
Finance

John Burke
Incidentals

Dick Groth
Publicity

Jack Miller
Student Exhibits

Ken Schneck
General Chairman

Dick Crago
Industrial Exhibits

It took a lot of engineering to make a better "grasshopper"

Engineers at Western Electric's St. Paul Shops are well pleased with their new-style "grasshopper" fuse—a small fuse used in Bell telephone central office equipment. The former model—in production for years—had been gradually refined 'til it seemed almost beyond further improvement. It was simple, inexpensive, efficient, came off the line fast. But . . .

It's an old Western Electric engineering custom to keep trying to make Bell telephone equipment still better, at still lower cost. The "grasshopper" was studied by a young engineer out of the University of Minnesota, Class of '40, who joined the Company in 1946. His studies indicated the most effective way to improve efficiency and cut costs further was to change the design.

Pursuing this lead the engineer and his group saw their opportunity to make an important contribution. They investigated the latest tooling techniques, new metals, finishing materials and methods, all of which are constantly under study by engineers at Western Electric plants. A simplified design, which permitted the use of the most modern tooling methods, resulted in a better fuse at lower cost that is saving thousands of dollars a year for Bell telephone companies.

There's an endless stream of such challenging assignments at Western Electric. Engineers of varied skills—mechanical, electrical, civil, chemical, metallurgical—find real satisfaction in working together on the important job of providing equipment for the best telephone service on earth.

How the grasshopper fuse works

Small fuses like this are used by the millions to protect certain telephone central office circuits against current overloads. Odd in appearance, the fuse is called the "grasshopper" because of its spring which is released when the fuse blows, displaying an indicator "flag" in open view and tripping an alarm so the trouble can be spotted and corrected at once.

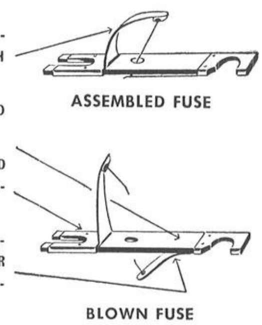
NEW DESIGN

ONE-PIECE FORMED SPRING WITH INDICATING FLAG—MADE BY STANDARD PUNCH PRESS METHODS.

FIBRE STRIP SPRAYED WITH COLORED LACQUER FOR CODE IDENTIFICATION.

INDICATOR SPRING HELD BY AND STAKED TO FLAT TERMINAL—SOLDERING ELIMINATED.

PRE-FORMED RADIAL BEND IS NOT VULNERABLE TO DEFORMATION BY IMPROPER HANDLING—NO ADJUSTMENT FOR TENSION NECESSARY.



• *Engineer and punch press operator check production of parts for newly designed grasshopper fuse.*

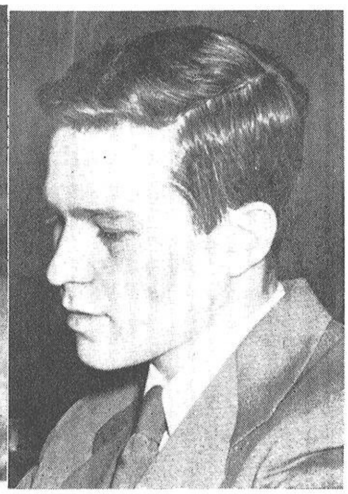
Western Electric

A UNIT OF THE BELL SYSTEM SINCE 1882

1953

1. KEN SCHNECK
General Chairman

2. WALTER PASCIAK
Finance



3. DICK GROTH
Publicity

1. General chairman of the Exposition is Ken Schneck, a metallurgical engineer from Wauwatosa. His job is to plan the Exposition program with the Faculty Committee, composed of a member of the faculty from each engineering school, and to coordinate that group's work with the plans of the six student chairmen.

Before entering school he served in the Army for four years with the rank of 1st lieutenant. Although he is not decided on what he will do after graduation, Ken feels he can secure a good position because of the many jobs available to engineers.

2. As finance chairman of the 1953 Exposition, Walter Pasciak was busy largely with the innumerable details connected with the job. He received booth fees from the many exhibitors, doled out money to be used for advertising purposes, and worked with the University accountant to keep the books in good order.

Walter, an accounting major from Wisconsin Rapids, served on the Men's Halls Association's Central Social Committee, and also last year was chairman of the Freshman Convocation during New Student Week. Although he will go into the army for two years after graduation, Walter hopes to become a Certified Public Accountant after he is discharged.

3. Dick Groth is publicity chairman for this year's Exposition. His duties consisted of arranging announcements of the Exposition on local and Milwauke radio stations and planning the television show in Milwaukee on April 7 at which movies of Exposition displays and activities were shown. He and his assistants, Bob Cnare, Lee Budahl, and Frank Holmes, also planned the special Daily Cardinal Exposiiton Edition which is now being sold.

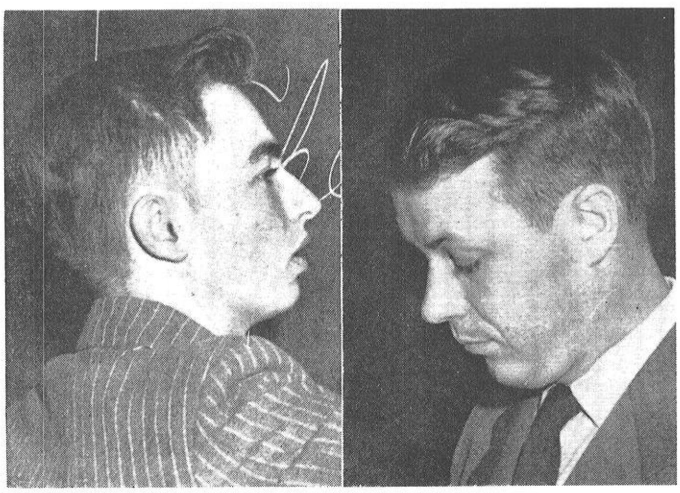
Dick is an EE 2 from Appleton. He enjoys playing baseball, but has expressed fear that the Air Corps may demand most of his time for two or three years after graduation.

by
Dave Dauterman & Kneeland Godfrey

Exposition Chairmen

4. John Hickman is program chairman for the three day 1953 Engineering Exposition. He sent out letters to the state's high schools to inform them of the Exposition and also arranged to have Mr. Watson, state superintendent of schools, and Mr. Schubert speak. His assistants are: Dave Hagen, who set up the loudspeaker system; Bruce Peterson, who planned publicity to the high schools; and Robert Jeresek and Marshall Burrows, who arranged to get the speakers.

John is an ME student from Hales Corners. Besides the BS degree he hopes to receive, John is now planning to work for a second degree in psychology. He is a member of Alpha Phi Omega and Pi Tau Sigma, honorary mechanical engineering fraternity. John went to Juneau High School in Milwaukee and later to the University Extension Division of the State University.



4. **JOHN HICKMAN** **Program** 5. **JACK BURKE** **Incidentals**

7. The industrial exhibits chairman is Dick Crago, a MetE 4 student from Fox Point. He contacted many firms to inform them of opportunities to exhibit their products and surveyed the space available in the Mechanical Engineering Building for the booths. His assistants are Al Thate and Leo Foxwell.

Dick was house president in Chamberlin unit last year. He spends his spare time playing tennis and also has an interest in model railroading.

5. Jack Burke is incidentals chairman for the Exposition. He, with assistants Lawrence Strommen and Ken Kulik, planned ticket sales and took care of many small jobs.

Jack, a CiE 4, was formerly vice-president of the local ASCE chapter. He lives in Milwaukee now, but is planning to take a job in the West in either city planning or sales work.

6. Jack Miller, student exhibits chairman, is another MetE 4 student. He approved requests for approximately 60 student displays, decided on their placing in the Electrical Engineering building, and appointed a chairman from each engineering society to plan his own group's exhibit.

Jack is married and a Navy veteran from Browntown.

6. **JACK MILLER** **Student Exhibits** 7. **DICK CRAGO** **Industrial Exhibits**

W.S.P.E. - -

(continued from page 48)

erica. This last, crowning piece of engineering to be performed by our first president was the selecting of the site and the planning of the capitol of the United States, the city which was later to bear his name.

An act establishing the permanent seat of the government of the United States was passed by congress and approved by Washington on July 16, 1790. This act, called the Residential Act, left Washington with the task of building in ten years, out of absolute wilderness, a city equipped and ready for the national government. With the assistance of Jefferson and Madison, Washington began at once to weigh every factor in the situation. He again rode over the territory, although he was familiar with it, as he had both hunted on it and surveyed it for Lord Fairfax as a young man. An act of congress made Washington engineer-in-chief of the project, and as such he took a direct part in the operations.

And so the city of Washington began to take shape until in 1793 on September 18, President Washington personally laid the cornerstone of the capitol. With Jefferson, he also prepared fire regulations for the various buildings, and saw to it that buildings would be restricted as to stories and that they be constructed of brick or stone. Washington loved the capitol, that was so fittingly and appropriately named after its great planner, and gave to it the last ten years of his life, never losing faith in its future greatness.

The example of our first president has so impressed the engineers of this day that they have set aside and observe the week of his birthday as National Engineers' Week.

Rust - -

(continued from page 33)

ized. The wrapping might not be air tight, but even so VPI protection will be good for several months at the very least. And if a barrier paper (made waterproof by laminates such as asphalt, aluminum foil, wax or polyethelene) is used to make the package air tight, protection may be good for as long as 15 years.

The armed forces are using VPI papers to wrap many of their weapons. The M-1 rifle, for example, is now slipped into a sleeve of barrier material lined with VPI paper before it is shipped off to the warfront. There the weapon is ready for action when the sleeve is removed.

Before VPI paper was available, the rifle had to be coated with cosmoline, a type of grease, which then had to be removed in the field—a task no soldier looked forward to.

(please turn to page 90)

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and Supplies
for
All Your Courses

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Seniors—
This is for you!

The Lincoln College Plan is a money saving life insurance i d e a designed especially for college seniors. It will pay you to investigate its many unique advantages.

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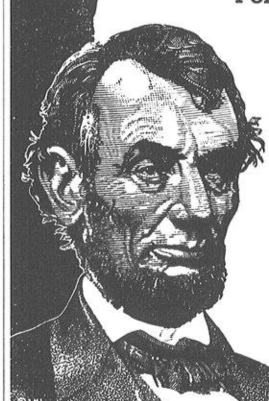
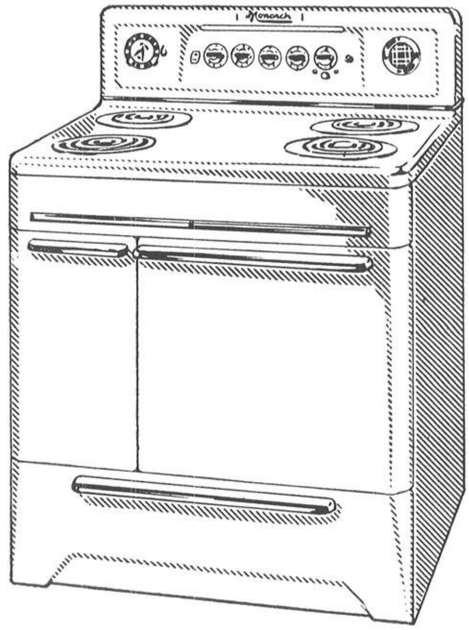
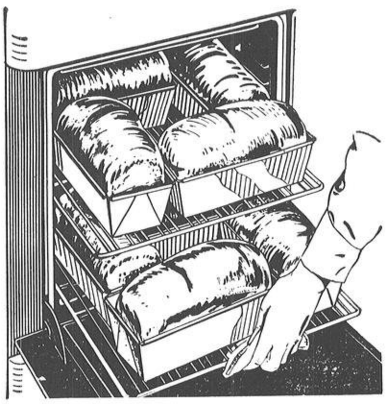


The New "32" by Monarch



Largest Oven Made! 6102.86 cubic inches! 38% more storage space — 5341 cubic inches!



Bakes ten loaves of bread at one time.

Also lots of capacity for pies or casserole dishes.

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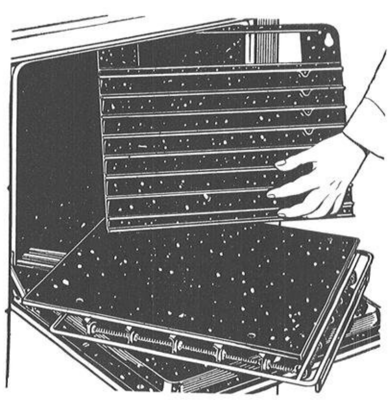

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Speech - -

(continued from page 43)

The answer must come from the industries. They must consider their responsibility to aid promising boys. For it is upon such boys that future existence of industry depends.

The Engineering Profession

But there are more cheerful subjects for discussion among engineers. I have reviewed them many times in the past.

Within a little more than my lifetime, the training of engineers has risen from apprenticeship to a trade or secondary technical schools to the dignity of a university-trained profession.

As indicative of the distance the engineers have risen in public repute, I might recall that some years ago while crossing the Atlantic, I took my meals at the same table with a cultivated English lady. As we came into New York harbor, at breakfast she said: "I hope you will forgive my dreadful curiosity, but I should like to know what is your profession." I said that I was an engineer. Her involuntary exclamation was: "Why, I thought you were a gentleman."

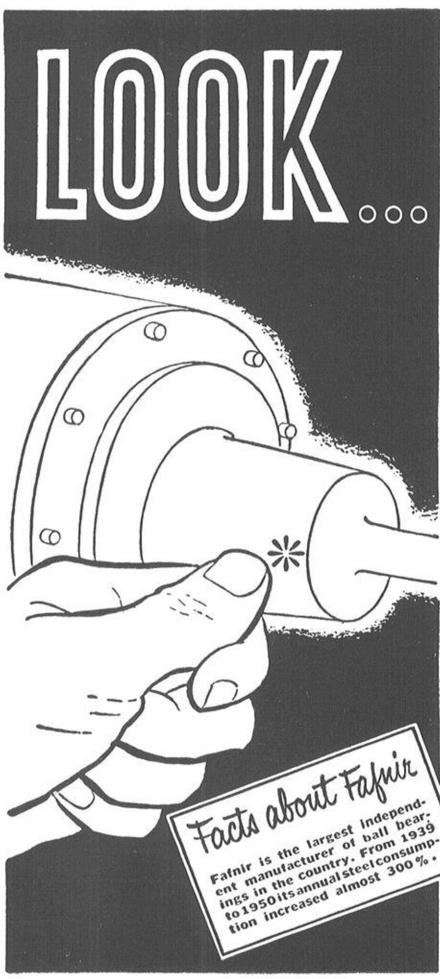
The engineer has a high privilege among professions. He has the fascination of watching a figment of his imagination emerge with the aid of science to a plan on paper. Then it moves to realization in cement, metal or energy. Then it adds to the security and comfort of homes.

Engineering training by our universities has other great values to the country than its industrial consequences. It instills character in those who would join its ranks, for high ethical standards are the essential of all professions. Technology without intellectual honesty does not work. Construction without conscientiousness soon crumbles. Here is the invocation of veracity in a world sodden with intellectual dishonesty. These are the reasons you have seen no engineers before the Kefauver committee. Nor in the headlines which these days pour forth from grand juries and district attorneys' offices. The engineers' main appearance in public is only to sit on juries and committees for reform.

From the work of the engineers comes the lifting of men's minds beyond the depressing incidents of the day. And here is the rejuvenation of spirit and confidence in the future of our country.

In any event you will agree that the engineer is an antidote to evil and the bearer of blessings. Even including his antidote to inflation.

In closing, let me repeat a statement from a good engineer of just exactly four hundred years ago. He referred to the mining engineers but his general tolerance is warranty for its application to all engineers. "Inasmuch as the chief callings are those of the moneylender, the soldier, the merchant, the farmer, and miner, I say, inasmuch as usury is odious, while the spoil cruelly captured from the possessions of the people innocent of wrong is wicked in the sight of God and man and inasmuch as the calling of the miner excels in honor and dignity that of the merchant trading for lucre, while it is not less noble though far more profitable than agriculture, who can fail to realize that it is a calling of peculiar dignity?"



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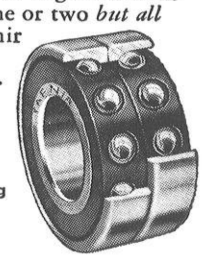

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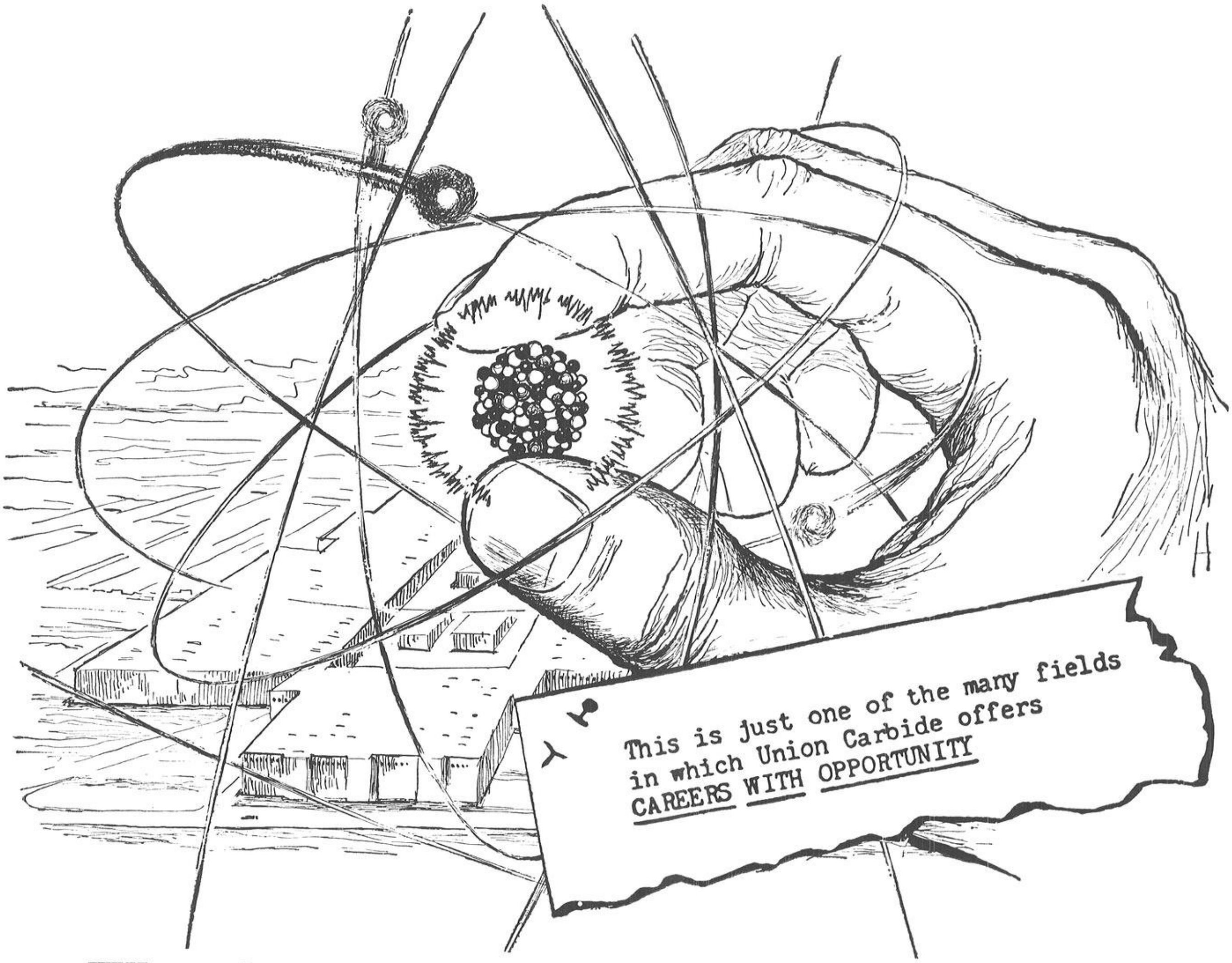

What does Atomic Energy really mean to you?

Dramatic new developments in medicine, agriculture, and industry promise long-time benefits for us all

Scientists have long known that the secret core of the atom concealed vast stores of concentrated energy. Evidence that man had unlocked the secret came with the atomic bomb.

Then came the task of developing methods to release this unbounded energy slowly, gradually, in ways of lasting benefit to all of us.

ISOTOPES AN EXAMPLE—When uranium atoms are split they emit a barrage of highly active particles. Certain chemicals placed in this barrage become radioactive and shoot off particles from themselves. Substances thus treated are called radioactive isotopes.

When these chemicals are made radioactive their paths can be traced through plants and animals, showing the organs they affect. This may increase our understanding of the processes of life itself.

FUTURE UNLIMITED—Atomic energy is also proving useful in industrial research and production. It promises to be even more valuable, however, in providing concentrated power for transportation, home, and industry.

UNION CARBIDE'S PART—From the beginning UCC has had a hand in the mining and treatment of uranium ores, the development of engineering processes, and the production of special materials for the atomic energy program. Under Government contract Union Carbide manages and operates the huge research and production installations at Oak Ridge, Tenn. and Paducah, Ky.

All of this activity fits in with the continuing efforts of the people of Union Carbide to transform the elements of the earth into useful materials for science and industry.

STUDENTS and STUDENT ADVISERS: *Learn more about the many fields in which Union Carbide offers career opportunities. Write for the free illustrated booklet "Products and Processes" which describes the various activities of UCC in the fields of ALLOYS, CARBONS, CHEMICALS, GASES, and PLASTICS. Ask for booklet D-2.*

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Overhead Cranes - -

(continued from page 23)

III. Types of Overhead Cranes and Service

Each crane is designed for a specific operation according to specifications for the type of service, which includes the cycle of operation over a definite period of time and the load to be lifted and transported. All cranes can be classified into five general groups covering all types of service. The groups are: (1) Powerhouse—heavy capacity in turbine or generator room with several rated lifts a year. (2) Industrial—light capacity in light manufacturing or warehousing with rated lifts during an 8-hour work day. (3) Machine Shop — medium capacity in heavy-machine production and assembly with several rated lifts a year. (4) Industrial—light capacity in light manufacturing foundries and incinerator plants with repeated rated lifts sustaining impact loads in a cycle of bucket or magnet operations. (5) Steel Mill—all capacities with a continuous operation at rated loads with impact and under extreme conditions of heat and abrasion.

Cranes are used in operations which are a combination of two or more of the general classifications given above, and must be designed accordingly: high speed cranes of light capacity in outdoor conditions at shipyards and lumber yards, repair cranes in cement mills and foundries with extreme conditions of abrasive dust and heat, high-lift cranes for accurate spotting of loads, low-head room cranes to fit into old existing buildings, and light-capacity cranes with heavy-duty operational cycle.

IV. Examples of Crane Applications

The largest overhead crane built to date is at the Mare Island Navy Yard near San Francisco. The rated capacity of this outdoor crane is 600 tons. It was tested with a load of 630 tons of concrete and steel. Previous to this the largest overhead cranes were located at the T.V.A. Dams and Hoover Dam powerhouses. These cranes are used for service and repair of the heavy water-turbine rotor shaft and wheel, or the generators which are located in the powerhouses at the bases of the dams. Each of the two cranes at Hoover Dam is rated at 300 tons. Two trolleys of 150 tons capacity are on each bridge. By means of lifting beams connecting the two trolleys on each crane and a lifting beam connecting the two cranes, a total load of 600 tons can be raised at a speed of two feet per minute. Locomotive repair shops have need for cranes with large capacities. Many railroads have overhead cranes with capacities of 250 tons, using two trolleys, in their steam locomotive erecting or repair shops. Steel-mill ladle cranes have the largest capacity of any continuous operating hoisting machine. These cranes have one trolley of 350 tons capacity with a high lift, operating with special ladle-handling hooks. Two auxiliary hoists are included on the trolley for tilting the ladle in the pouring of molten tseel. In steel mill service overhead cranes are used in all phases of handling steel through the mill. Scrap is prepared and broken up by repeatedly dropping a large diameter steel ball from great heights. This is known as skull cracking, one of the most rugged uses of overhead cranes in the amount of impact imposed on all parts of the machinery. Soaking pit cranes, in the rolling mill, are used to lift the cover from the pits so that a second crane of larger span and capacity can remove the steel billets or ingots for processing. Smelter cranes are similar in construction to steel-mill ladle cranes but they are used for more severe service, that of breaking the ingot out of the ingot mold by repeated swinging blows of the bottom block. Steel mill and smelter crane applications require an insulated and air conditioned operator's cage as a protection from the heat and dust encountered in the metal processing.

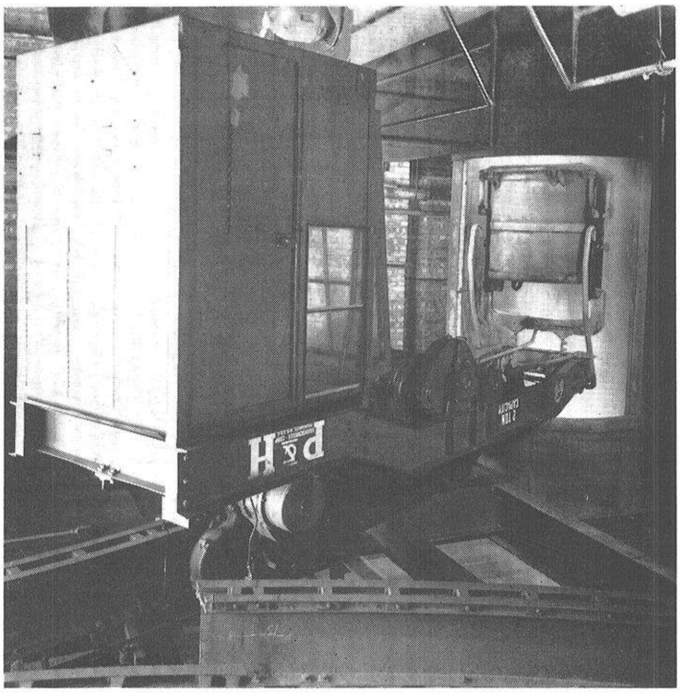
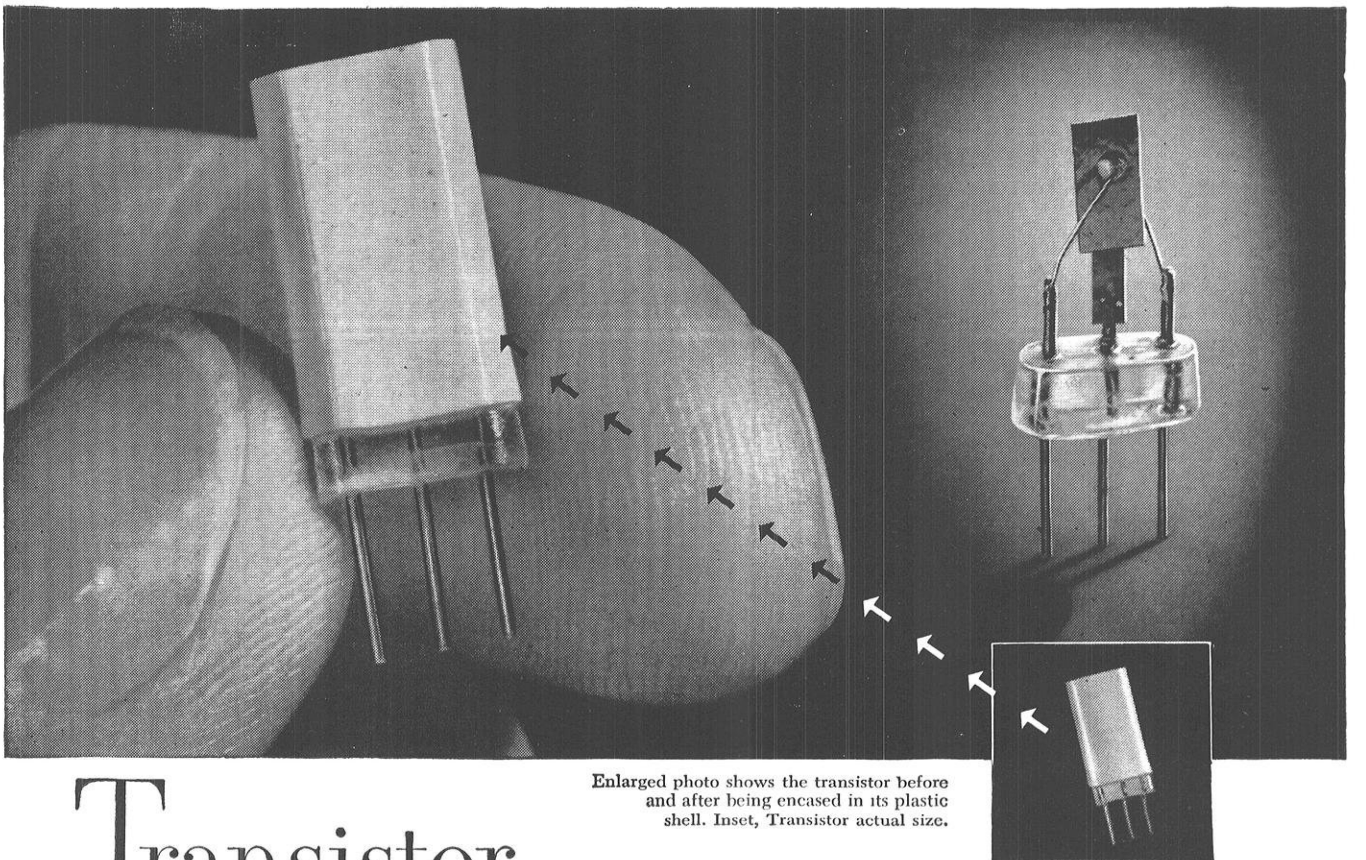


Fig. 2. Monorail-type cupola charging crane showing covered operator's cage.

Foundry and machine shop overhead cranes are used in all phases of production, some having a constant cycle of operation especially during the pouring operation in the foundry. Many of these cranes are equipped with lights suspended from the bottom of the platform to illuminate the area of operation. Most of the foundry cranes have covered insulated cages to protect the operator from the heat and molten metal in the event that a mold might explode. Cranes of this type are also used in dusty cement mills. The extreme wear by abrasion is reduced by providing double seals on all machine drive parts. This application also requires an air-conditioned closed cage for the operator with a complete air-filtering unit mounted on the platform. Cranes in a machine shop are used for loading and unloading large machine tools with casting or weldments for machining purposes. The large-capacity cranes are applied to machine erection or assembly and also for loading large finished products to railroad flat cars for shipment.

(please turn to page 68)



Enlarged photo shows the transistor before and after being encased in its plastic shell. Inset, Transistor actual size.

Transistor–

mighty mite of electronics

Because of growing public interest in transistors, RCA—a pioneer in their development for practical use in electronics—answers some basic questions:

Q: ***What is a transistor?***

A: The transistor consists of a small particle of the metal germanium imbedded in a plastic shell about the size of a kernel of corn. It controls electrons in solids in much the same way that the electron tube handles electrons in a vacuum. But transistors are not interchangeable with tubes in the sense that a tube can be removed from a radio or television set and a transistor substituted. New circuits and components are needed.

Q: ***What is germanium?***

A: Germanium is a metal midway between gold and platinum in cost, but a penny or two will buy the amount needed for one transistor. Germanium is one of the basic elements found in coal and certain ores. When painstakingly prepared, it has unusual electrical characteristics which enable a transistor to detect, amplify and oscillate as does an electron tube.

Q: ***What are the advantages of transistors?***

A: They have no heated filament, require no warm-up, and use little power. They are rugged, shock-resistant and unaffected by dampness. They have long life. These qualities offer great opportunities for the miniaturization, simplification, and refinement of many types of electronic equipment.

Q: ***What is the present status of transistors?***

A: There are a number of types, most still in the development stage. RCA has demonstrated to 200 electronics firms—plus Armed Forces representatives—how transistors could be used in many different applications.

Q: ***How widely will the transistor be used in the future?***

A: To indicate future applications, RCA scientists have demonstrated *experimental* transistorized amplifiers, phonographs, radio receivers (AM, FM, and automobile), tiny transmitters, and a number of television circuits. Because of its physical characteristics, the transistor qualifies superbly for use in lightweight, portable instruments.

* * *

RCA scientists, research men and engineers, aided by increased laboratory facilities, have intensified their work in the field of transistors. New applications in both military and commercial fields are being studied. Already the transistor gives evidence that it will greatly extend the base of the electronics art into many new fields of science, commerce and industry. Such pioneering assures finer performance from any product or service trade-marked RCA and RCA Victor.

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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:

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- Design of component parts such as coils, loudspeakers, capacitors.
- Development and design of new recording and producing methods.
- Design of receiving, power, cathode ray, gas and photo tubes.

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MARINE CORPS BODY ARMOR

U. S. Marine Corps body armor is being produced in quantity at the Westinghouse subsidiary, Plywoods-Plastics Corporation in Hampton, S. C.

The shrap jackets get their life-saving properties from three things—the way they are made, and their two basic ingredients, glass cloth and a synthetic resin. This combination enables the material, known as Doron, to actually stop deadly mortar and grenade fragments and similar low velocity missiles.

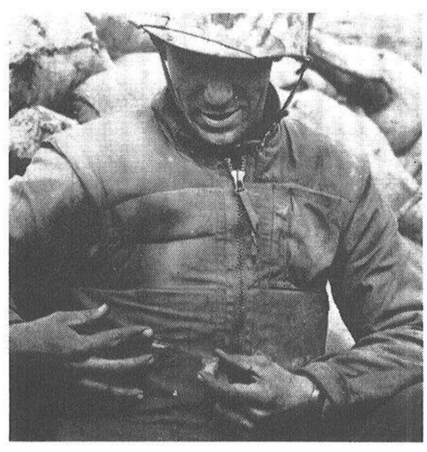
When a fragment or a small caliber bullet strikes the material, the layers of impregnated glass cloth separate as the missile attempts to smash its way through. This delamination actually sets up a cushioning effect that instantly reduces the velocity of the fragment to practically zero.

Doron, however, has been in post World War II volume production for only about two years but it has already won the confidence and gratitude of the thousands of American soldiers and Marines who wear it for protection in the front lines.

Early versions of the armored vests consisted of flat Doron plates. Some of the flat material was used in utility jackets worn by Marines in mopping up operations at Okinawa during the war in the Pacific. However, tests proved that the flat plates afforded less mobility. As a result, Doron is now curved so that it fits the contour of the body. The plates themselves, one eighth of an inch thick and 5¼ inches square, are sewn into the pockets of heavy nylon vests. About 20 plates go into each vest and overlap each other like fish scales.

Doron is made by applying heat and pressure to layers of resin-impregnated glass cloth. While the exact details of manufacture are withheld for security reasons, it can be revealed that the layers are not pressed together tightly, if they were, the plates would lose some of their effectiveness against missiles they are intended to stop.

The present model of the armored vest weighs less than eight pounds.



—Illustrations courtesy Westinghouse

Marine owes life to "Shrap Jacket".

LIGHTS

FREEZING ALUMINUM

Freezing, a modern new tool of aircraft manufacturing, took on bigness as well as quickness at Lockheed Aircraft Corporation today when the company put into operation a cavernous, 5000-cubic-foot ice box where metal can be kept in cold storage.

Larger than two box cars, the refrigerator deep-freezes metal plane parts to keep them soft—to hold their molecules in suspended animation—between two steps in fabrication.

Main benefits from the manufacturing freeze treatments are easier shaping, reduced breakage and smoother production flow.

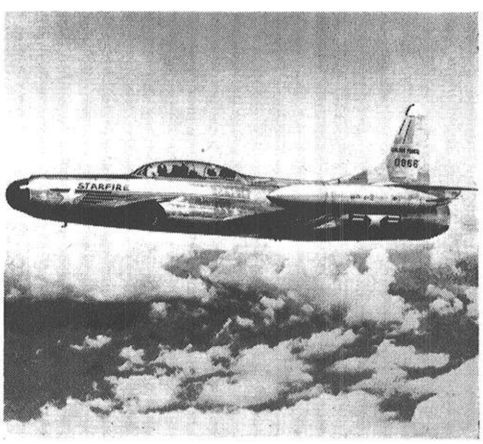
Metallurgists explained the chill technique this way:

Metal parts become soft (semi-hard) when they are subjected to high heat in a process which, in the end, gives them extra hardness and strength. If they are allowed to cool at normal room temperature they harden rapidly. Such hardness would be a hindrance during forming and shaping operations. But, it has been discovered, quick-freezing keeps the metals soft indefinitely.

HIGH-SPEED "BRAINS" FOR HIGH-SPEED PLANES

The more that jet planes increase in speed, climbing ability, and in other aspects of performance the more assistance that must be given the pilot in the way of automatic controls. These devices—such as the Westinghouse autopilot—are almost as amazing as the planes themselves. This autopilot flies the plane automatically, whether cruising leisurely or at high-speed, fast maneuvering combat. Although the autopilot contains a few tubes, its operation is based primarily on the Magamp magnetic amplifier.

Among the airplanes making use of the autopilot is the lockhood F-94C Starfire, most powerful of all single-engine jets now in production. It is a two-man aircraft in the 600 mph class and can climb to 45,000 feet or higher. After take off, ground radar observers direct the airplane by radio toward the target. When near the target, the pilot turns on instruments which electronically track down the enemy, aim the airplane, and fire up to 24 rockets from a ring of tubes in the nose.



Starfire

The autopilot works through this same system in automatically piloting the aircraft. It is tied into the plane's radar and instrument landing system, helping it to track enemy targets automatically and to land in bad weather.

The autopilot is suitable for both large and small commercial airplanes as well as military aircraft. Radio-controlled, it can also serve to direct the flight of guided missiles and pilotless aircraft.

The autopilot is unique in the use of rapidly spinning "rate" gyroscopes as primary sensing elements for following the movements of the airplane during all maneuvers. They differ in this respect from ordinary "position" gyros, which are not locked to the airplane and hence resist any effort to change their direction of motion. Position gyros are sensitive only to changes in the attitude of the airplane, whereas the "rate" of gyros of the Westinghouse autopilot respond only to the rate at which such changes take place.

The flight controller of the autopilot, a single knob, affords virtual finger-tip control of the movement of the airplane. To climb, the pilot pulls the knob back and the plane responds at a constant rate, regardless of external conditions. To turn, he rotates the knob either right or left. The turn is executed at once

(please turn to page 82)

Porsche - -

(*continued from page 27*)

The car may be described as nimble, for its short 83 inch wheelbase is a factor in keeping its weight to 1640 pounds. Steering is light and fast, and constant correction for "wander" is unnecessary, for there is little or no play in the steering gear. Although greater than 50% of the car's weight is on the rear wheels, the sloping hood is so designed that at 60 m.p.h., 160 pounds of air pressure is exerted on the front wheels, making the weight on the front wheels about equal to that on the rear! An advantage in placing the powerplant at the rear of the car is that the driving wheels have a fairly constant amount of weight on them, largely independent of the number of passengers and the amount of gas carried. The Porsche has a rear tread of 49.3 inches and a front tread of 50.3 inches. This wide front tread helps give the car good lateral stability on turns.

The Porsche has a platform chassis of pressed steel with large box-section frame members on either side, and arches over the rear axle to support the motor. This light, yet sturdy chassis, in unit with the stressed steel body, is a very rigid unit. The floor of the car also acts as a belly pan, which greatly decreases air tubulence between the car and ground, and thus increases maximum speed. The individual leather-upholstered seats are very comfortable and fully adjustable, so that the driver and passenger may tilt the seats in either direction. Slight readjustment of the front seats from time to time has been found helpful in postponing fatigue on long drives. As a further comfort, plenty of leg room is provided. Because of the rear location of the engine, the driveshaft is eliminated, so the seats may be placed lower in the frame and the car's frontal area reduced. Heat, engine noise, and gas fumes are to the rear and are eliminated by the undercoated firewall back of the seats. The spare tire, gas tank and battery are placed under the hood in front. Behind the seats a space is provided for several suitcases. To further illustrate the thought which goes into the building of each car, the wheels are balanced both statically and dynamically.

The Porsche's suspension is another of its outstanding features. The front wheels are independently suspended by parallel trailing arms, and the rear wheels, also independently sprung, have swing axles. This four wheel independent suspension provides the Porsche with roadholding qualities surpassed by few cars. Laminated torsion bars on all four wheels absorb road shock. This type of suspension was pioneered by Dr. Porsche and is actually stronger, although less expensive, than the conventional torsion bar.

In conclusion, the Porsche is an entirely new and carefully designed car which breaks with tradition in a convincing manner. It's quality and reliability are well-established—one recently averaged 98.6 m.p.h. for 24 hours at the Montlhery track in France. It will probably be some time before an equally radical car design will meet with such success as the Porsche is experiencing.

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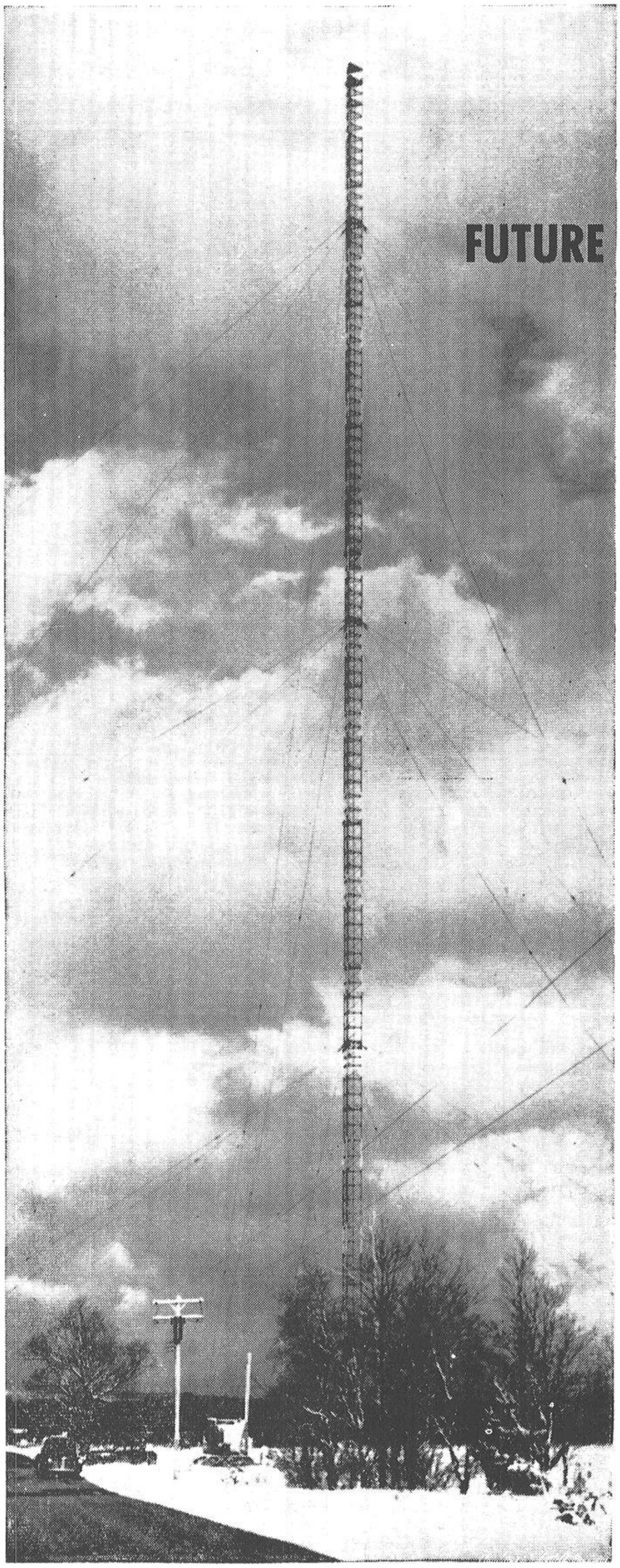

A Quarter Mile Up
FUTURE JOBS ARE BEING ENGINEERED

Your future lies not in the obvious, the complete, the established. It is forming on the drawing boards, in the laboratories and within the minds of men.

Don't look to what is, but to what shall be. Fortune comes from the new.

This Air Force Radio tower, a 1218-foot equilateral steel triangle, is the tallest in the world; second among man-made structures only to the Empire State Building. It was designed and fabricated by Republic's Truscon Steel Division. The operation of this tower is government business. But its stresses and its resistances are Republic's. The engineering of this lacy pinnacle will find adaptations in the near future. They are being shaped now in the metallurgy and design departments of Republic. A quarter mile above the earth, the steel toys with gales and totes an unpredictable burden of ice. And the facts of these achievements shall be translated by men of your generation into the still higher pinnacles of the future.

Republic's Truscon Steel Division leads the world in radio towers. Republic's other divisions push forward other frontiers. No manufacturer makes more kinds of steel, nor any better. But the making of steel is only one phase of Republic. Our many divisions design innumerable products, fabricate thousands of items.

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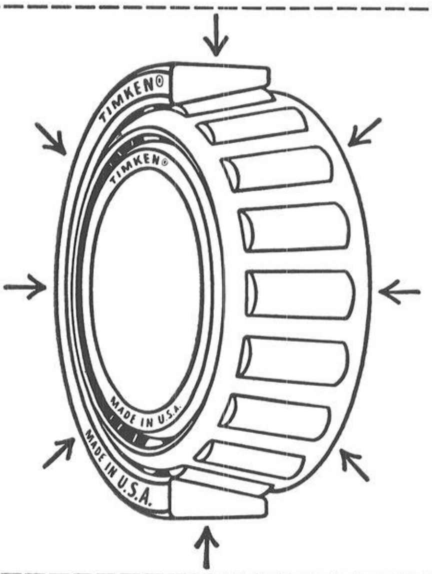
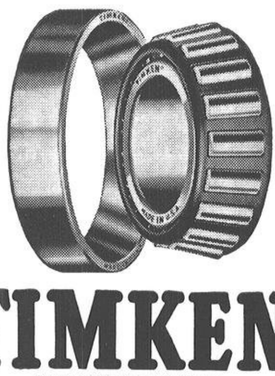
All loads are the same to a TIMKEN bearing

The tapered design of cup, cone and rollers of Timken bearings enables them to take radial loads, thrust loads, or any combination of the two from any direction. Timken bearings do away with the need for auxiliary thrust bearings or plates. They simplify design, cut costs, save space.





TIMKEN

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NOT JUST A BALL ○ NOT JUST A ROLLER ⊂⊃ THE TIMKEN TAPERED ROLLER ⊂⊃ BEARING TAKES RADIAL AND THRUST LOADS OR ANY COMBINATION

Overhead Cranes - -

(*continued from page 60*)

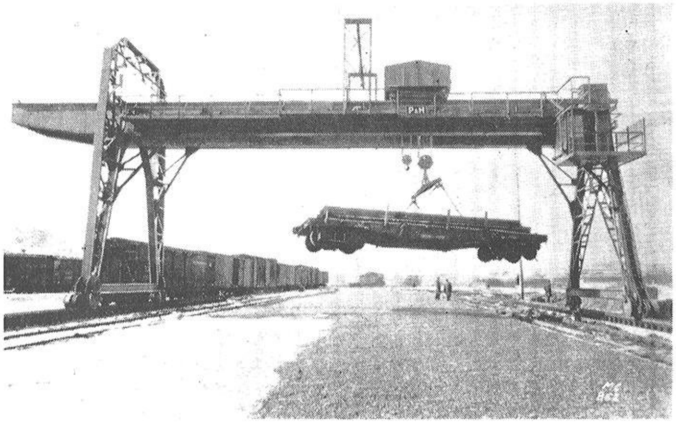

Fig. 3. Gantry-type crane with cantilever at one end.

Light industrial and warehouse cranes are usually of long span operating on a continuous cycle over a short period of time every working day. An overhead crane, in a warehouse, can place or remove a load from anywhere within the area covered by it. Many special-handling devices are used to facilitate handling of odd-shaped items. Crapples are used to handle rolls of paper, bolts of cloth, pallets and skids. In steel storage, long lifting trusses with a series of hooks on the lower chord are used for handling bundles of long steel angles, strips and rods.

Cranes are designed for many special and unique applications. The basic design must be modified to suit the application. Low headroom cranes are used in existing old buildings designed for light capacity loads. The trolley is built in a flat shape or a design having the hoisting machinery suspended below the trolley rail. Cage suspensions are at times unusual; often the cage is attached to the trolley and suspended between the girders; this provides the operator with a good view of the load area and the load at all times. In some steel heat-treating operations the cage is a few feet from the floor; this gives the operator a good view of the load as it enters the tanks. Several cranes, used in the large lumber industry of the Northwest, are equipped with telephones connected to the operations office. These outdoor-crane runways are about one half mile long and a telephone is the best way to issue orders to the crane operator for the section where the crane is needed.

Fig. 4. Lumber-handling crane showing lumber grapple, bridge and trolley collectors.

During World War II, an experimental project was started for equipping cargo ships with overhead cranes for loading and unloading. Crane runways were built over the hatches, across the beam of the ship, with large swinging jibs, which extended the crane runway over the side of the ship. Using a crane, the cargo could easily be unloaded into lighters or barges in locations where no dock facilities were available. The bridge and trolley drive had a gear that meshed with a rack welded to the runway and bridge girders along its entire length to insure a positive drive in a rolling sea. Due to increased weight in the superstructure and loss in cargo capacity this idea was abandoned by the U. S. Maritime Commission.

Heavy, rugged cranes are used for bucket service in incinerator, power plants, and sand-storage yards. The cubic-yard capacity of electrically or mechanically operated bucket varies with the weight of the material handled. This service is severe because of the impact loading on the entire crane in the rapid unloading of the bucket.

Magnet service cranes are used in steel-scrap yards, and foundry or steel mill operations. Impact also is very destructive to the crane in this type of service.

A new device, called a weighing-bottom block, has been added to increase the efficiency of crane operations. In the weighing-bottom block the hook load is applied to a load cell, which contains a strain gage, the amount of strain is electrically transmitted to a gage, calibrated in pounds, located in the cage, giving the operator a direct weight reading of the load. This is very important in rapid loading operations of ralroad flat cars or motor trucks.

V. Future Desgn and Application of Overhead Cranes

The future of the overhead crane is assured with many examples of efficient material handling operations. Old cranes will have to be replaced or modified to increase their speed of operations to conform with the high-speed

(*please turn to page 74*)

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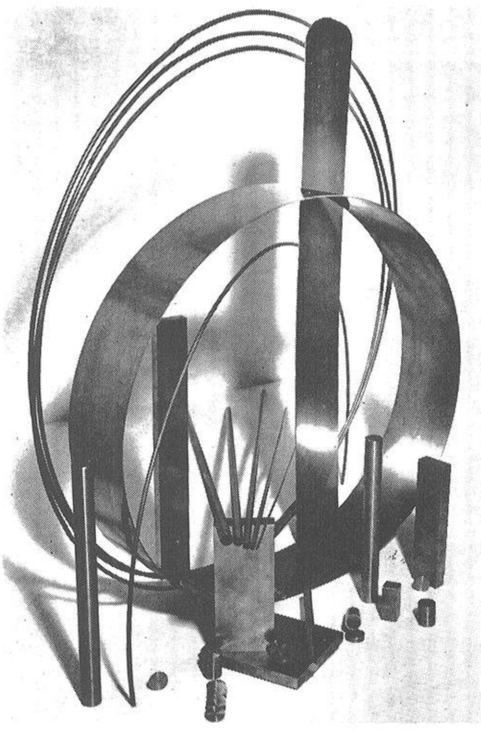
SQUARE D COMPANY

Titanium - -

(continued from page 21)

which is used in producing sheet metal for the deep stampings required in the automotive industry. Previously the metal was used in the production of iron and steel as a deoxidizing agent, or was added to cast iron to improve its strength and casting properties. It is presently used in the production of stainless steel as an agent to remove carbon.

Other current uses include: metals industry, manufacturing hard alloys, particularly titanium carbide, permanent magnets, and refining the grains in aluminum; in the electric industry, manufacturing lamps, electron tubes, insulators and condensors; in the ceramic industry as heat resistant enamels and lacquers, glass, refractories and special stones; and in the mordant industry to die textiles, leathers and metals.



Titanium metal is ductile and readily workable, as illustrated by these sample sheets, tubes, and bars which were fabricated from Du Pont metal on normal steel working equipment. Titanium has excellent strength-weight ratio and outstanding corrosion resistance. It is expected to find extensive use in fields where strength and light weight are needed, such as aircraft, and in areas where corrosion is a problem, such as marine and chemical equipment.

In the past years the government and research laboratories have freely spent money and time to develop the metal and its alloys. The reasons for this interest are based upon either its resistance to corrosion—comparable to the stainless-steel group of alloys—or upon its high strength to weight ratio. The higher melting point of titanium as compared to the other light weight metals is an additional advantage. Although the metal is very active chemically, the first film of oxide that forms will protect it against further deterioration.

Only a small amount of the ilmenite being produced is used in the manufacture of titanium metal, the remainder being used in the pigment industry which is discussed in Part II. The limitations and the divisions of research currently being studied have been listed by H. J. Boertzel, Metallurgist, Bureau of Aeronautics, Department of the Navy, in his report to the Symposium on Titanium held in Washington, D. C., November 8 and 9, 1950 on the research progress and problems in the development of the metal. The list includes:

(1) Improved ductility in the high-strength alloys (150,000 to 200,000 psi ultimate tensile strength range), both longitudinally and normal to the direction of grain flow.

(2) Improved notched impact resistance. At present titanium has a tendency to be weak in this respect.

(3) Notched and unnotched fatigue-strength data for all wrought forms of titanium alloys.

(4) Additional creep data on promising alloys at temperatures up to 1000 F.

(5) Improvements in present fabrication processes are required. At the present time it is impossible to weld thicknesses of the metal over 0.1 in. and considerable difficulty has been experienced by the aircraft manufacturers in that the sheets of the metal are not in conformance with the flatness standard.

(6) Closer controls of chemical composition, fabrication methods and improved heat treating practices. These are necessary to insure more uniform mechanical properties and reasonable design factors.

(7) Surface coating for titanium, particularly for wear and abrasion resistance. These will be needed immediately. Several possibilities exist, but a practical solution to the problem is yet to be developed.

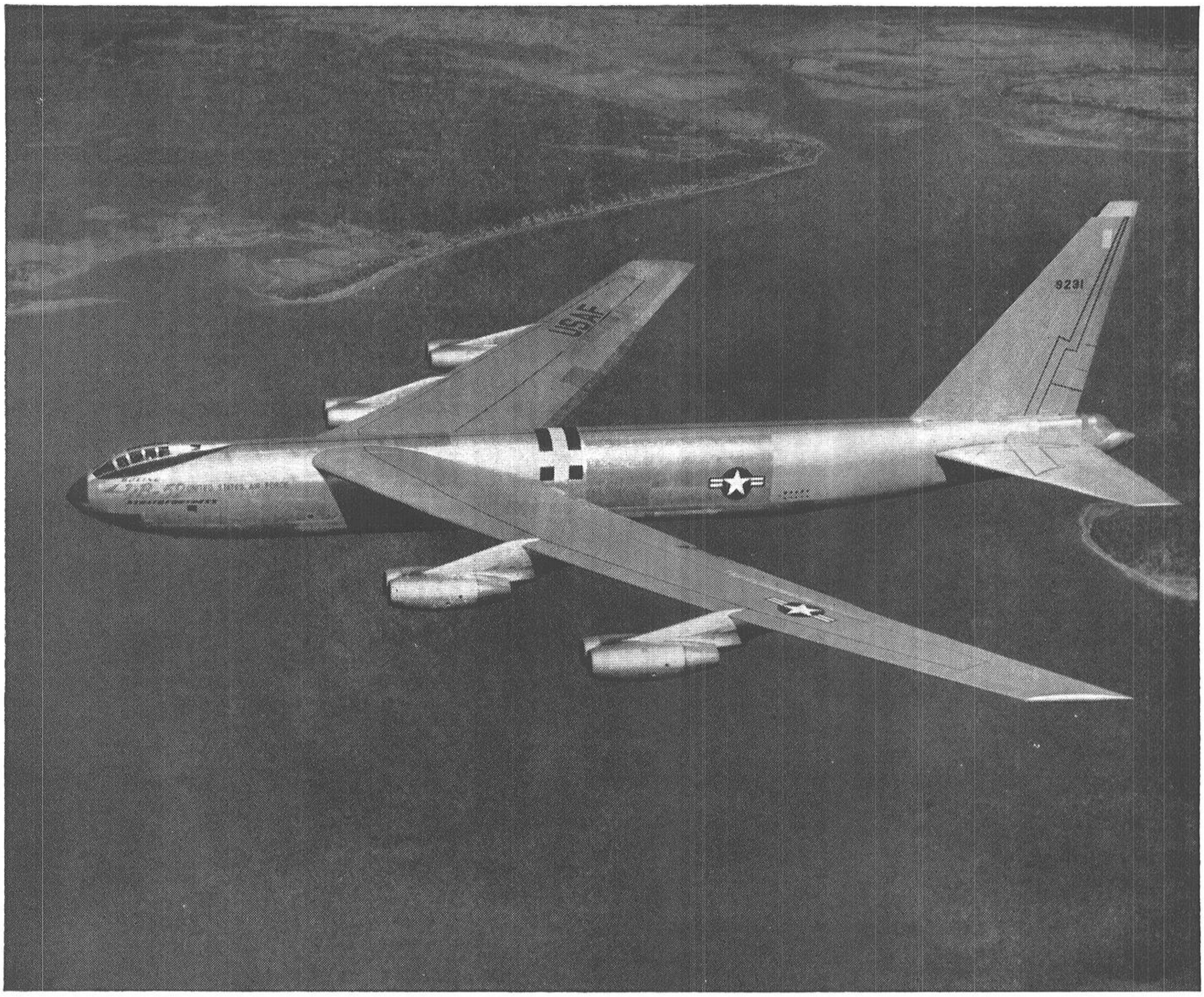
(8) Methods for producing castings. If the metal could be easily cast, the scope of use of the metal would be greatly increased; also further development of the application of extruded titanium is also needed.

(9) Scrap disposal includes the development of a remelting process.

(10) The development of standard control methods for the metal.

These are the reasons titanium is not now being produced and used in large quantities. It is estimated that when these problems are solved this country could use 400,000 tons of the metal each year, if the price could be brought down to that of a high-quality steel. The people presently working on the titanium research projects feel that they are close to a solution of making the "wonder metal" a reality. They believe that the next decades will bring what is now in a research stage into practical use, and titanium and its alloys will take their place among the leading materials of construction.

(please turn to page 72)



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Titanium - -

(continued from page 70)

PART II

Titanium Dioxide and Pigments

The most important use commercially of the metal titanium is in the production of titanium dioxide, which is used in the production of pigments to be used in the paint industry. Ninety-eight per cent of the ilmenite mined is used in the production of these pigments.

The processes used to obtain titanium dioxide are precipitation from a titanic salt solution by dilution, heating, or by adding an alkaline agent. It is also produced by direct oxidation of titanium at high tempartures. The product from these processes is a yellowish color because of impurities, which if removed would change the color to pearl white or a very light blue. Most of the material produced commercially, is a product of a process developed by Blumenfield, which involves the precipitation of titanium dioxide from a sulfate solution. The product from this process is purified by a calcination step which will remove the water from the crystals and increase the opacity or covering power of the material. Pigments produced from titanium dioxide made in this way have a clear, white color, excellent brightness, covering power and resistance to discoloration in light. Pigments are generally produced by the fluoride, nitrate or sulfide processes.

Titanium dioxide pigments were first used in the production of paint in 1869 when Ryland, in England, pulverized a sample of ilmenite and mixed the dried material with a linseed-oil vehicle to produce a black paint. This was the beginning of the industry and the research that has been connected with it over the past 40 years. Production of titanium dioxide for use in manufacturing pigments has risen from 4,000 tons in 1925 to 275,000 tons in 1947.

In the past, one of the disadvantages of titanium pigments was that when mixed alone with paint, lacquer or enamel films, a failure called chalking occurred in outside service. This is a process of the surface layer disintegrating to a powdery chalk; the weather then removing this chalk and exposing a new surface to attack. The eroded surface then becomes dull in appearance and easily collects dirt and mildew.

Titanium dioxide pigments of distinctive colors may be produced by calcining the oxide obtained from the ilmenite ore with small proportions of heavy metals having atomic weights between 50 and 64 inclusive. Examples of metals added are: vanadium, chromium, iron, cobalt, nickel, manganese and copper. The colors that may be obtained from this process range from the extreme of red to the extreme of green with shades possible as: gray, buff, yellow, brown and tan. The addition of these coloring agents to the paint has no great effect on the chemical properties of the paint, but they do greatly decrease the tendency of the paint to fade or chalk.

The reasons for using titanium pigments in paint production are the high opacity due to its reflective index, and its excellent covering power which is a measure of a paint's ability to cover a black surface and make it appear white. It takes approximately one pound of titanium dioxide pigment to cover 170 to 220 square feet of black surface, while one pound of zinc oxide or white lead will cover between 20 and 28 square feet. The brightness or the light reflecting properties of the material closely approach those of magnesium, which is the universally accepted standard; values ranging from 96-98 per cent are generally obtained for this property. Because the pigment is relatively inactive, it may be mixed with practically all of the vehicles used in the manufacture of paint.

The fact that the specific gravity of the pigment is low is of economic importance, because it may be purchased by the pound and sold as a volume measure (gallon).

The estimated consumption of titanium dioxide pigments by industries are shown below:

Industry	Per cent
Paint, enamel, lacquer	75
Paper	10
Rubber	2
Floor Coverings	2
Leather	2
Textiles	1.5
Welding rod coatings	1.5
Others	6
Total	100

The major use of titanium dioxide is the production of pigments for the paint industry, 75 per cent being used in this field. All the other industries combined consume the remaining 25 per cent.

CONCLUSION

The problems facing introducing wide-spread use of titanium are not unsolvable. In the 1950 Titanium Symposium it was generally agreed that as soon as the research grants are let, the results will show quickly. It is believed that most of the problems involved can be solved by intensive research within the next two decades. When these problems are solved, industry will have available a metal combining the strength and heat resistance of steel with the light-weight and machinability of aluminum.

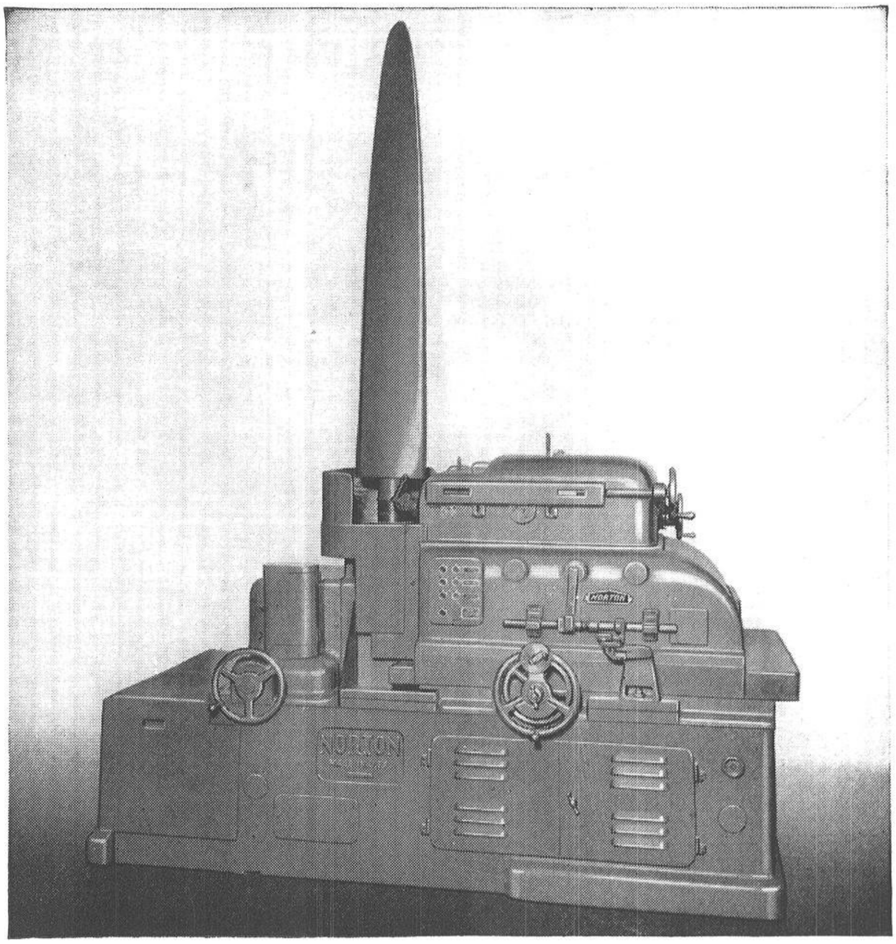
REFERENCES

Barksdale, Jelks: Titanium, its Occurrence, Chemistry and Technology. New York, The Ronald Press Company.

Department of Defense Research and Development Board: Symposium on Titanium. Washington, D.C. The U. S. Government Printing Office.

What Is this Machine?

- ☐ *a vertical miller*
- ☐ *a grinding machine*
- ☐ *a broaching machine*
- ☐ *a contour shaper*



It is a grinding machine — specifically, the new Norton Propeller Blade Hub Grinder, used to grind the external surfaces of the hubs of aircraft propeller blades

A Typical Norton Development

This specialized Norton machine brings unusual efficiency to propeller grinding operations. As shown, the propeller blade is held *vertically* — by a workholding fixture on a work spindle with an anti-friction bearing — a new departure that avoids the errors normally caused by deflection when the blade is held *horizontally*, as in conventional methods.

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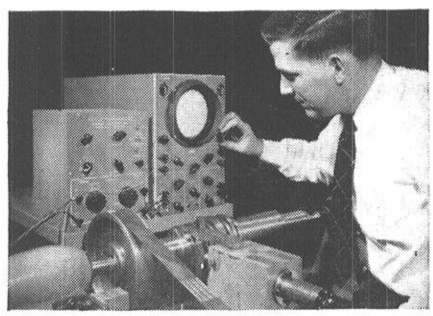
Free Booklet describes and illustrates representative types of Norton grinding and lapping machines. Write for your copy.



Guy D. Metcalf, B. S., E. E., Worcester Polytechnic Institute '49, checks smoothness of master cam spindle with specially designed electronic equipment — in connection with his work on Norton cam and contour grinders.

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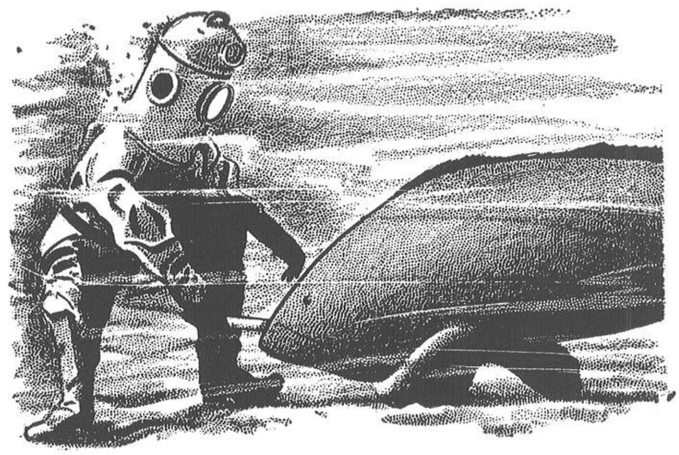
Overhead Cranes - -

(continued from page 68)

production activities in most industries. Basic crane design cannot be changed but many refinements in design of the machinery and electrical control can be made depending on the applications and materials of construction which will be available in the future. A scarcity of steel may necessitate a change in girder design from the box type to the lattice type which is the standard crane-girder design in Europe. A change in girder design may increase the span of the cranes, and in most applications decrease the capacity. At present the trend is toward the use of more mobile equipment in the light manufacturing and warehousing operations but in the heavy industries the overhead crane will not be replaced. With better materials for most component parts of the crane a more efficient and lighter unit can be built. Special drives with better bearings and gears have been contemplated and will be designed to meet the changing high-speed production rates. Every new overhead crane application is a challenge to engineers to build a unit for more efficient material handling. Only the practicability of an overhead crane limits its span and capacity. The capacity of a crane is directly dependent on the strength of the runway. This can be best summed up as to the future capacities of overhead cranes by a statement from a bulletin of a large crane builder, "You build the runway, we'll build the crane."



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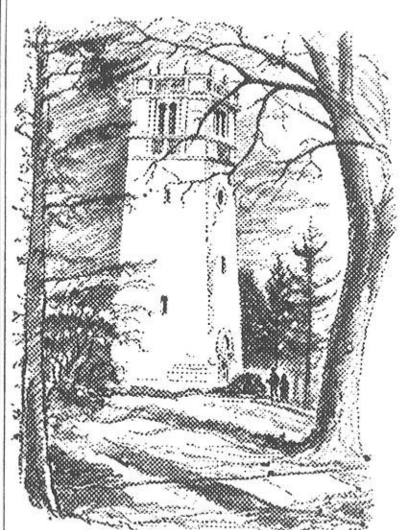

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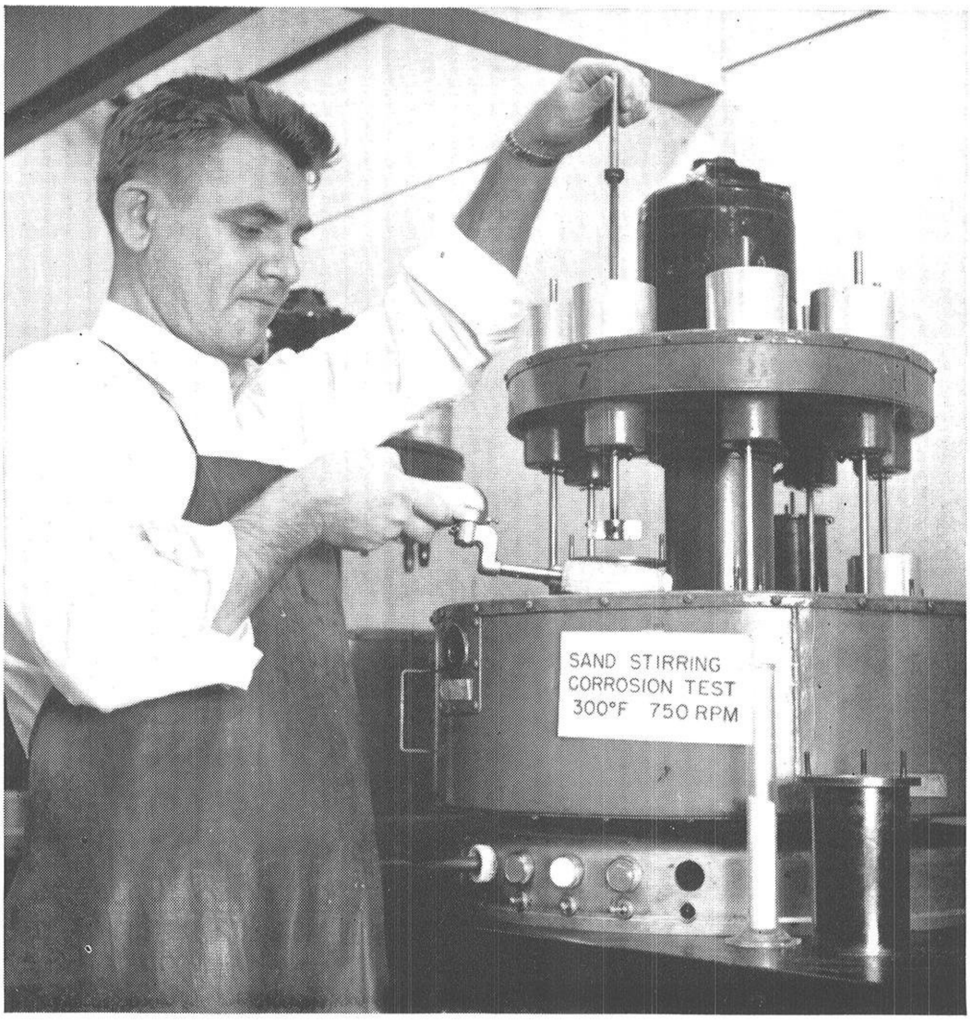

INDIANA STIRRING SAND Corrosion Test, developed in Standard Oil laboratories, is operated by Technician John Becich. It measures the corrosion of bearings due to oxidation of motor oil.

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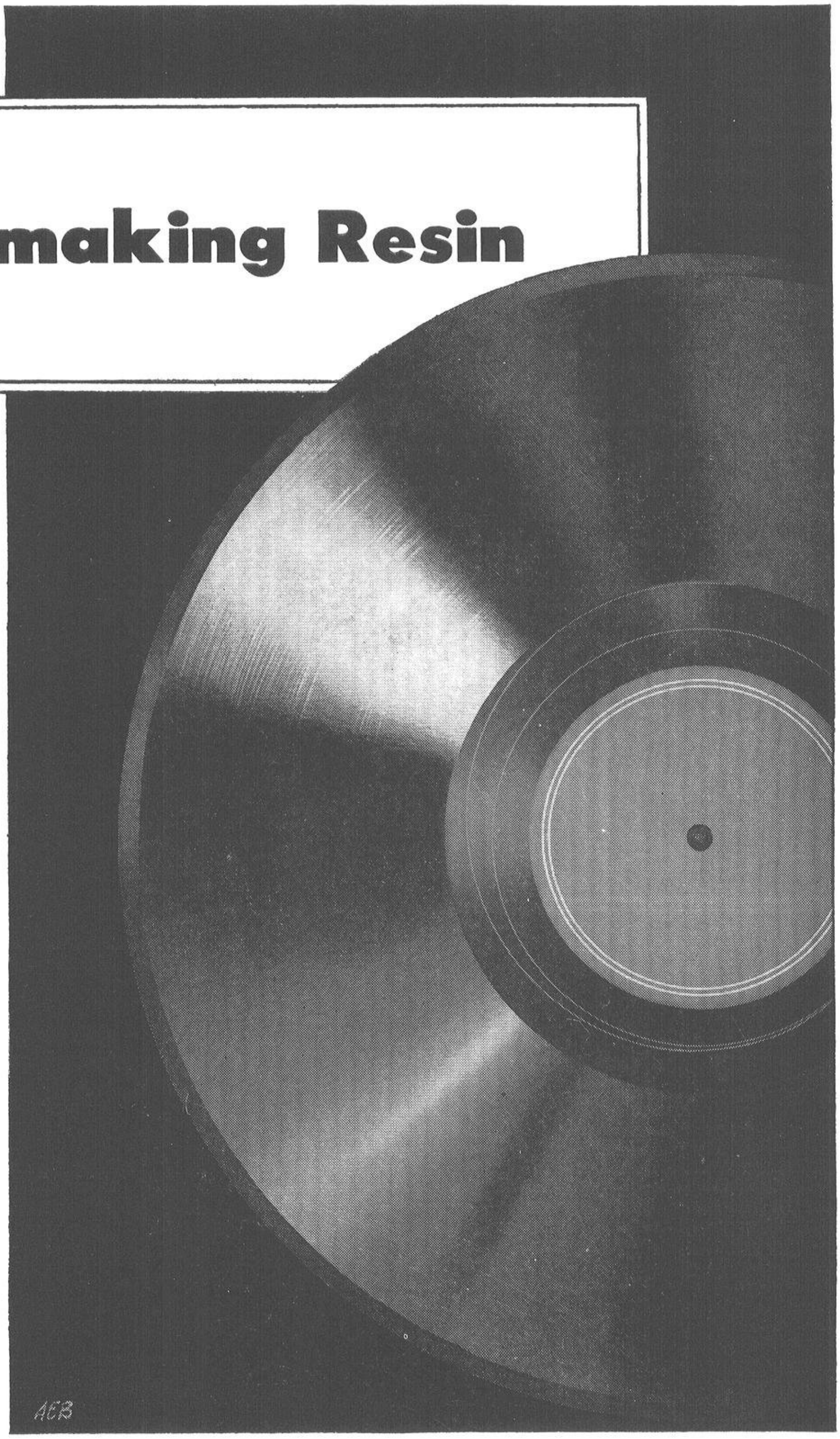

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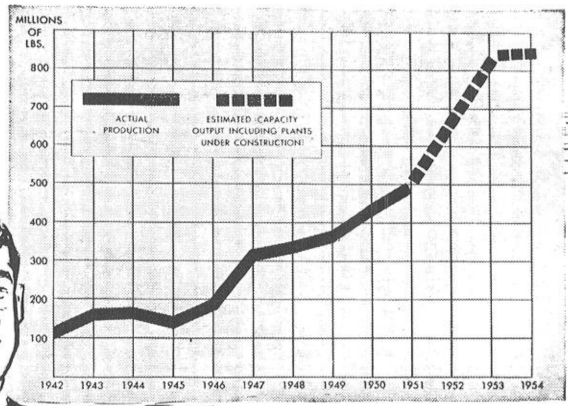

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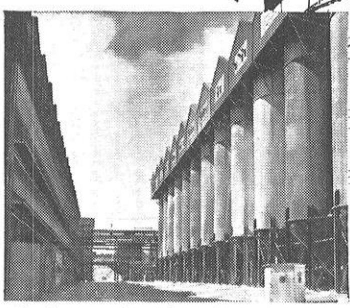
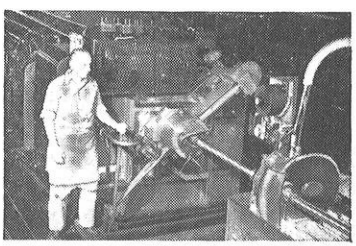
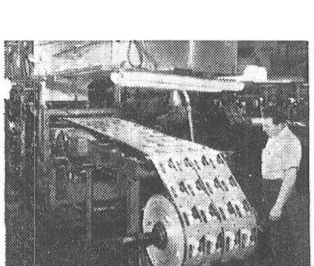


Settling tanks, where impurities are separated from sodium aluminate



Tube drawing, one of many mill operations at Reynolds

REYNOLDS ALUMINUM



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Application of the Negative Delay Line

The negative delay line finds application wherever it is desired to have a voltage change cause another change just slightly before it occurs. The line itself consists of a conventional delay line with its terminations reversed, i.e., it is fed from the other end.

One application being investigated would put such a line to use on the major radio networks. It has always been a problem since the emanation of many shows from Hollywood as to account conveniently for the change in time zones across the country. With this network inserted in the line the programs could be received on the east coast three hours earlier than presented, if a line of sufficient delay could be constructed. Early research along this line indicated that the attenuation along such an experimental line was excessive, and early attempts to overcome this with booster amplifiers resulted in a rather peculiar phenomenon, viz. whenever there was a pause in the program the anticipation increased, since the a.v.c. employed took hold rather vigorously. This made it rather difficult to insert station breaks.

Thus it was no problem at all to achieve adequate negative delay, but with the gain that had to be supplied, the circuit was in somewhat of a dilemma when there was nothing to anticipate. No doubt negative expectancy feedback could be incorporated to minimize this somewhat, but this would reduce the required anticipation proportionately.

With proper sensitive signal elements such a negative delay network could be used to perform a multiplicity of duties, such as closing barn doors just before the horse is stolen, etc. Because of existing security regulations, its military applications may be only implied.

R. W. Brandt

As presented before the last joint meeting of the Institute of Radio Engineers and Pure Milk Dealers.

(From the Engineer files)

THE DU PONT DIGEST

Paul D. Kohl (*left*), *B.S. in M.E., Purdue '46, checks the assembly of an experimental control instrument.*

A GROWING FIELD—

Instrumentation

Modern manufacturing trends at Du Pont bring ever-increasing opportunities for technical men

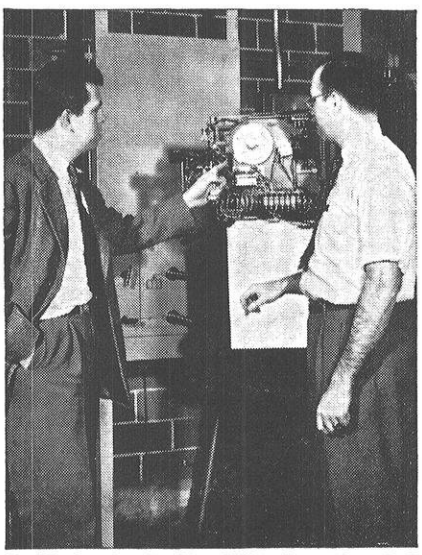
Do you think of instrumentation as applying only to work in electricity and electronics?

Or would you also include problems in chemical processing, materials of construction and materials handling, as well as application of equipment — both mechanical and hydraulic—for measurement and control systems?

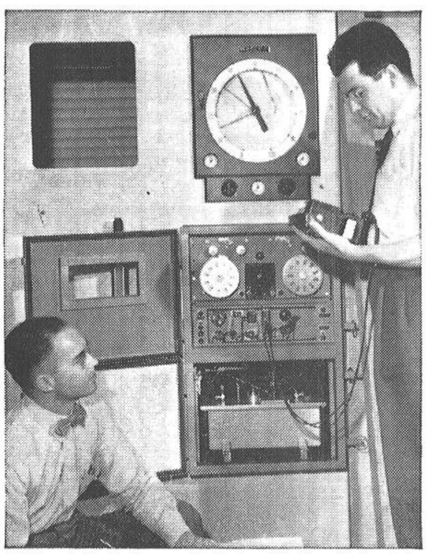
At Du Pont, instrumentation is applied to widely diverse areas of manufacturing operations. It calls for many different technical backgrounds. In a typical instrument group there may be men whose formal training has been in mechanical, chemical, electrical or metallurgical engineering, or in physics, etc.

Instrumentation is becoming more and more important in the chemical industry. In fact, many of today's processes and products would not be possible without modern measurement and control systems. The trend toward continuous processes means challenging and constantly increasing opportunities for instrumentation men.

Du Pont's instrument program includes research, development, design, and supervising installation of process control equipment. Some of the work is done in the central Engineering Department at Wilmington. However, most of the major plants across the country now have their own organized instrument groups.



Fred R. Struder, *B. Metal W., Rensselaer P.I. '50, examines a pressure strain recorder with Allen R. Furbeck, E.E., Princeton '39.*



Richard G. Jackson, *B.S. in Ch.E., Columbia '42, and Gregory L. Laserson, Ph.D. in M.E., Columbia '49, test an infrared gas analyzer.*

So you may visualize the scope and diversity of the work, here are examples of instrumentation recently developed and designed by Du Pont technical men:

1. A device to measure flow of approximately 30,000 lbs. per hour of gas at more than 10,000 p.s.i. To give 1.2% accuracy and be responsive to flow-changes of five cycles per second.

2. A device to monitor continuously 1200 similar temperatures. Equipment to record temperature and sound alarm at a deviation of 1°C. from desired point.

3. An automatic control system to maintain a predetermined pressure-temperature relation in a large-batch autoclave during spontaneous reaction between two chemicals.

Thus it can be seen that Du Pont instrumentation is limited to no single avenue of engineering. Men with an aptitude for the work get experience in many phases of the Company's technical activities—and an excellent background for positions in management and administration.

ASK FOR "Chemical Engineers at Du Pont." New illustrated booklet describes initial assignments, training and paths of promotion. Just send post card to E. I. du Pont de Nemours & Co. (Inc.), 2521 Nemours Building, Wilmington, Delaware.

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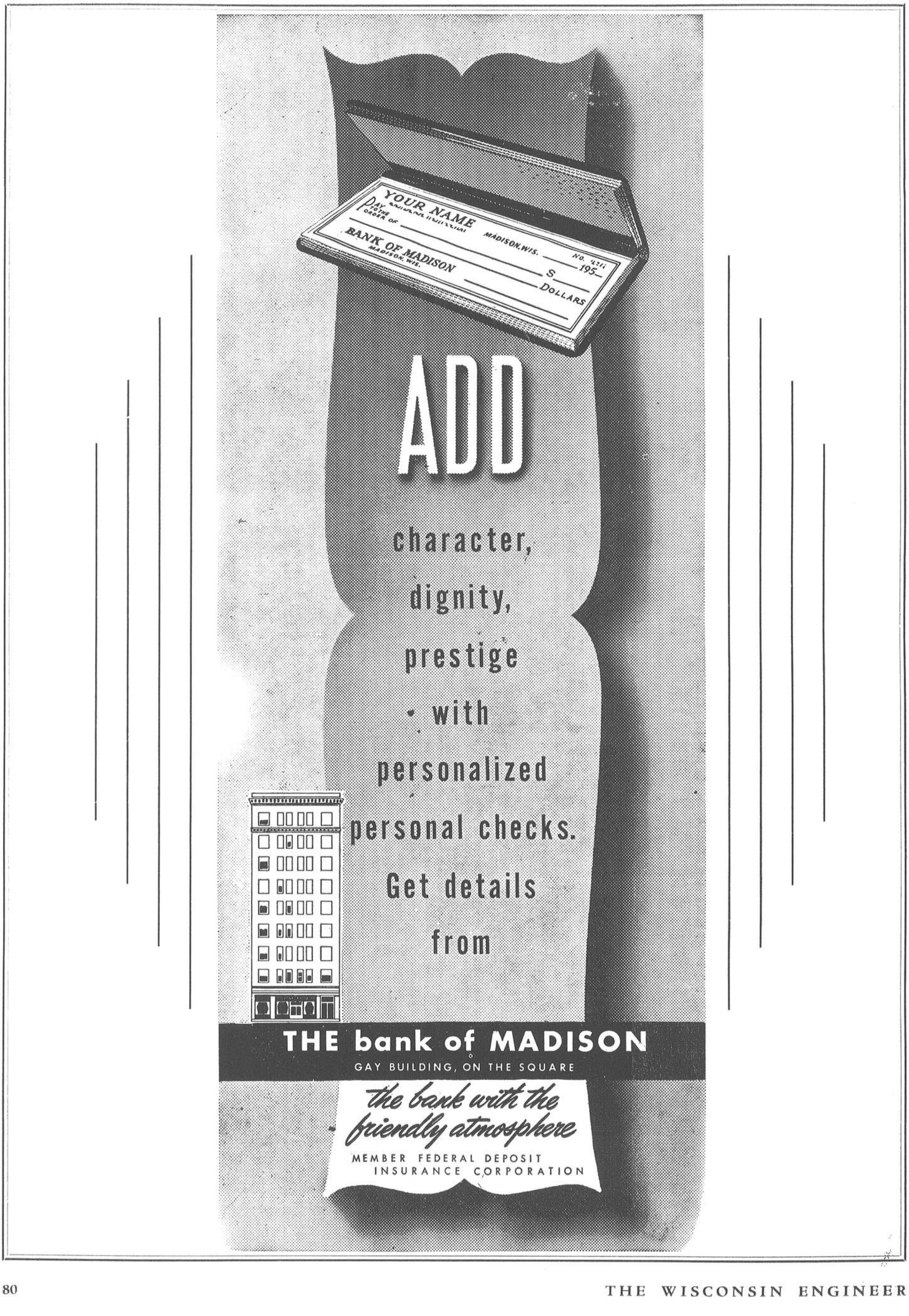
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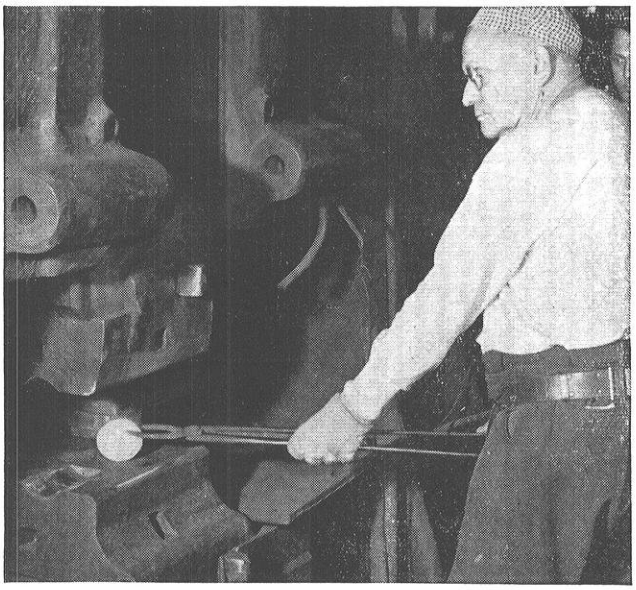
What's Happening at CRUCIBLE

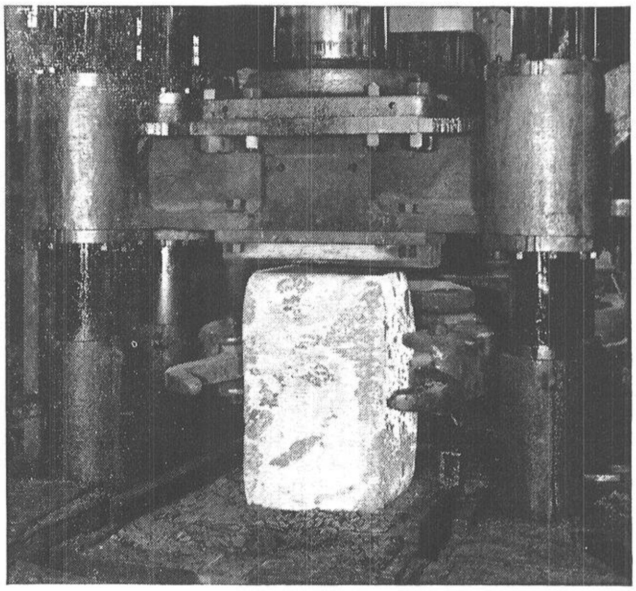
about tool steel forgings

Whether 1½ pounds or 7 tons . . . forgings get the same sensitive handling

Crucible's reputation as the specialty steel leader is built on a devotion to the smallest detail . . . regardless of the size of the order.

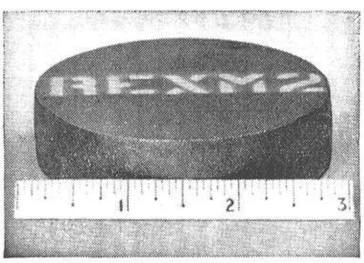
These forgings are good examples of Crucible specialists at work:

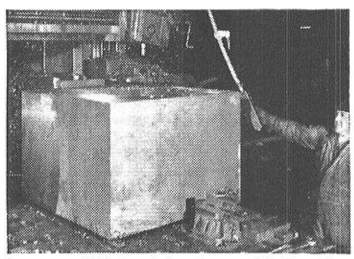




Rex M-2 High Speed Steel Disc Forging (1½ pounds)

Pancake forgings such as these are used extensively by small tool makers. Extreme care is taken in the preparation of the slug stock. The upsetting insures proper flow lines. Milling cutters, gear shavers and similar cutting tools that require maximum toughness, coupled with the best cutting ability, are made from these forgings.





CSM-2 Plastic Mold Forging (14,000 pounds)

This CSM-2 plastic mold steel forging was made from a 25,000-pound ingot. This block will be heat-treated and worked to produce a mold for the manufacture of large plastic parts. The finished weight of the forging is 14,000 pounds. And it is the largest mold forging yet produced by Crucible.

Engineering service available

Crucible's engineering service is geared to meet your research and development problems. If you use special forgings, or any special purpose steel, check with Crucible. Crucible Steel Company of America, General Sales and Operating Offices, Oliver Building, Pittsburgh, Pa.

CRUCIBLE first name in special purpose steels

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Midland Works, Midland, Pa. • Spaulding Works, Harrison, N. J. • Park Works, Pittsburgh, Pa. • Spring Works, Pittsburgh, Pa. National Drawn Works, East Liverpool, Ohio • Sanderson-Halcomb Works, Syracuse, N. Y. • Trent Tube Company, East Troy, Wisconsin

Science - -

(continued from page 63)

at a rate depending on the amount the knob is turned, with the correct bank angle automatically set for proper coordination.

For combat maneuvers, the pilot switches the autopilot to a mode of operation which gives him complete manual control, but which introduces the necessary rate damping to eliminate the hazard of making a maneuver too rapidly for the high-speed aircraft. The control reacts to the pilot's signal in less than one fifteenth second, and the hydraulic flight controls "boost" the pilot's effort some 15 times.

•

GAS TURBINE

After three years and 23,000 hours of operation of a General Electric gas turbine without service repairs, the Oklahoma Gas and Electric Company has placed a second 4,000 kilowatt gas turbine unit in service at its Belle Isle generating station.

With the two gas turbines in operation, maximum output of the steam units has been increased from the former capability to a gross output of 65,000 kilowatts. The two gas turbines are credited with 9,500 kilowatts of this output.

The gas turbines contribute not only their own 9,500 kilowatts, but boost the output of the steam units by 4,500 kilowatts, or nearly 10 per cent, by heating boiler feed water used in the station.

In the case of steam turbines, natural gas is used to heat water and make steam at high pressure and temperature which is directed through nozzles to turn the turbine connected to a generator.

With the gas turbines, natural gas is used to heat air to a temperature of 1400°F. The hot air is then expanded through turbines to develop power for turning the generators.

Remaining heat which would otherwise be wasted after turning the turbines, is used to heat boiler feed water for the steam units, increasing their efficiency.

The installation of the original gas turbine unit three years ago was the first commercial use of a gas turbine for electric power generation in the United States.

Although the first unit has a rated capacity of 3500 kilowatts, the average load for the three-year period has been over 4400 kilowatts, or more than 120 per cent of its rating.

The second unit, which began commercial operation in July, is essentially a duplicate of the first. Improvements in design and manufacture have made possible the rated capacity of 4,000 kilowatts. It is expected that under favorable conditions, the new machine will deliver up to 5,000 kilowatts.

The two gas turbine units and two larger steam turbine-generators in the Belle Isle powerhouse use natural gas as fuel. The exhaust of the two gas turbines is used to heat boiler feed water for the steam units whose total rated capacity is 5,000 kilowatts.

(please turn to page 90)

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ELECTRONICS

Hughes Research and Development Laboratories, one of the nation's leading electronics organizations, are now creating a number of new openings in an important phase of their operation.

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THE COMPANY

Hughes Research and Development Laboratories, located in Southern California, are presently engaged in the development and production of advanced radar systems, electronic computers and guided missiles.

THE NEW OPENINGS

The positions are for men who will serve as technical advisors to government agencies and companies purchasing Hughes equipment—also as technical consultants with engineers of other companies working on associated equipment. Your specific job would be essentially to help insure successful operation of Hughes equipment in the field.

THE TRAINING

On joining our organization, you will work in the Laboratories for several months to become thoroughly familiar with the equipment which you will later help users to understand and properly employ. If you have already had radar or electronics experience, you will find this knowledge helpful in your new work with us.

WHERE YOU WORK

After your period of training—at full pay—you may (1) remain with the Laboratories in Southern California in an instructive or administrative capacity, (2) become the Hughes representative at a company where our equipment is being installed, or (3) be the Hughes representative at a military base in this country—or overseas (single men only). Compensation is made for traveling and moving household effects, and married men keep their families with them at all times.

YOUR FUTURE

In one of these positions you will gain all-around experience that will increase your value to our organization as it further expands in the field of electronics. The next few years are certain to see large-scale commercial employment of electronic systems. Your training in and familiarity with the most advanced electronic techniques now will qualify you for even more important future positions.

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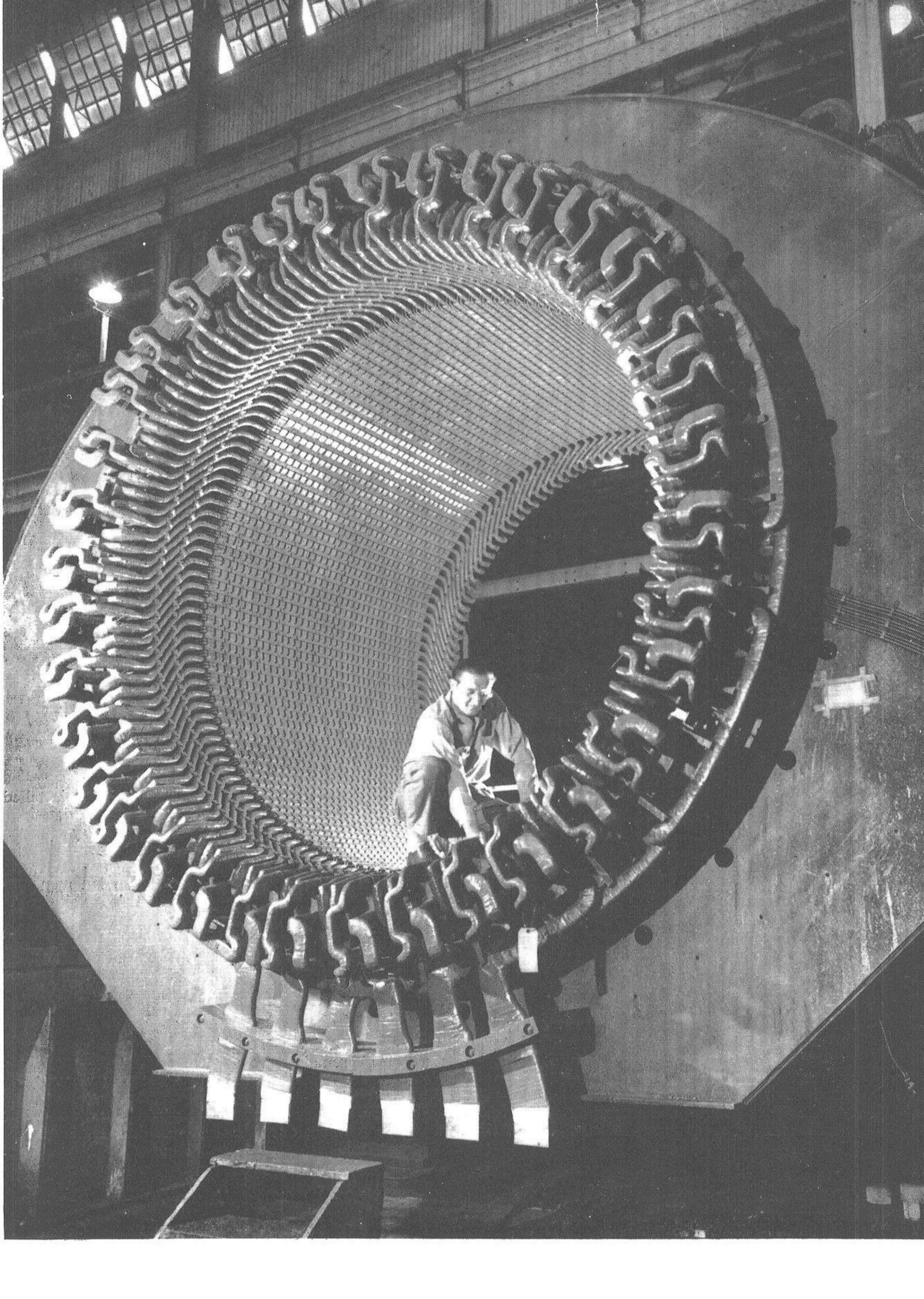
HUGHES

RESEARCH AND DEVELOPMENT LABORATORIES

Scientific and Engineering Staff
Culver City, Los Angeles County, California

See your Placement Office for appointment with members of our Engineering Staff who will visit your campus. Or address your resumé to the Laboratories.

WIND TUNNEL DRIVES



Courtesy Westinghouse

The World's Largest Rotating Machine

The Pyramids of Cheops, the Panama Canal, and Hoover Dam are all-time great landmarks in the history of engineering. A machine is being put together now that will rank as a classic in rotating machinery. No other rotating machine man has built comes close to it for size. It is the Gargantua of rotating machines. From end to end it will measure 575 feet. It weighs 1000 tons and its inertia amounts to the astronomical figure of 77 million pound-feet squared. The stored energy at a speed of 600 rpm is 2400 hp-hours. Four motors with a combined power of 216,000 hp are required to drive it. Two of these are synchronous motors, each being nearly one third larger in horsepower than ever the 65,000-hp pump motors recently installed at Grand Coulee, which themselves were at least twice as large as any synchronous motors previously built.

This prodigious machine comprises the five compressors and drive for the transonic and supersonic wind tunnels being built at Tullahoma, Tennessee. This tunnel will be operated by the Arnold Engineering Development Center, which is under the command and supervision of the Air Research and Development Command, and is responsible for the overall United States Air Force research and development program.

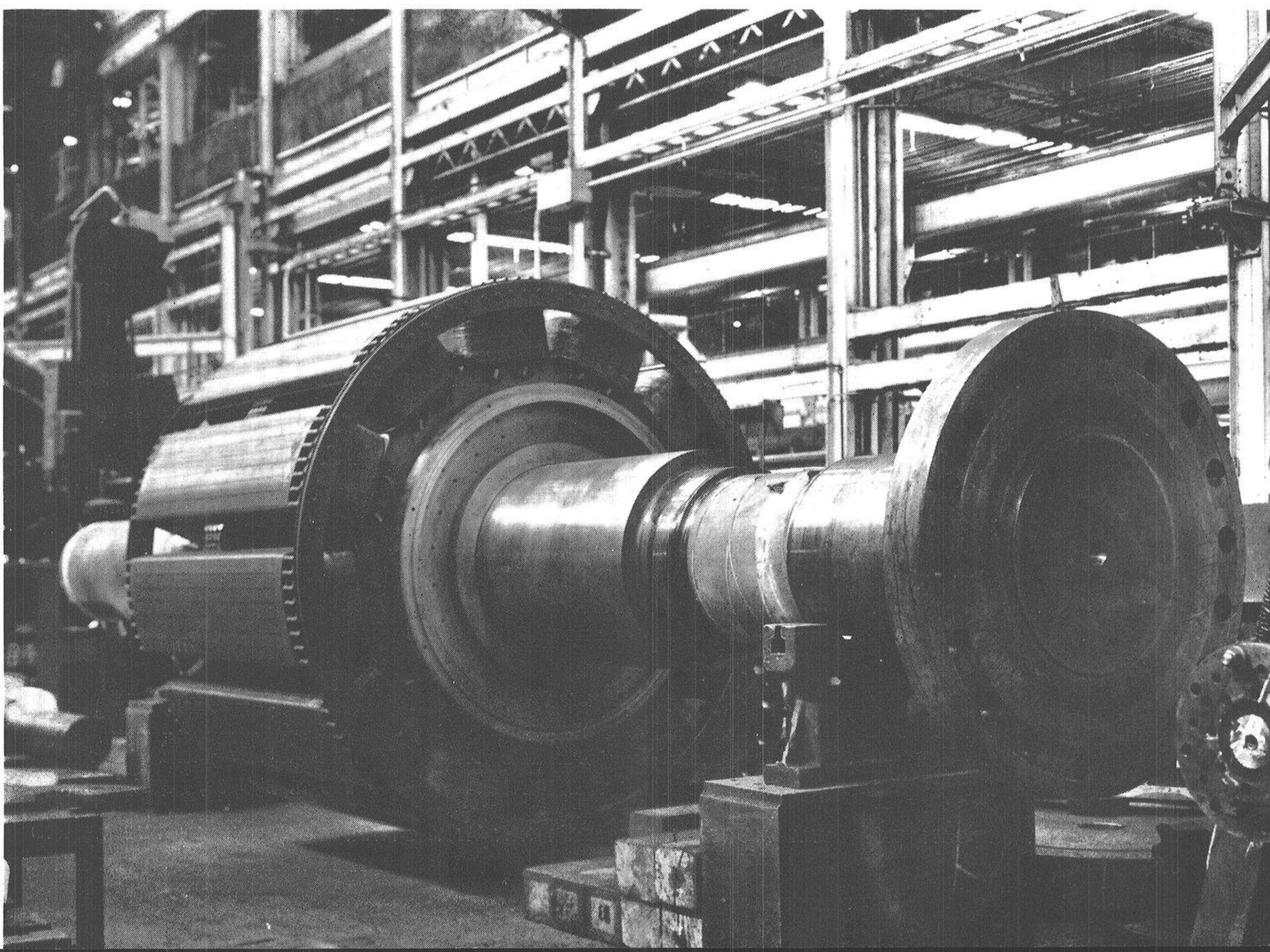
The transonic compressor will be a single unit. The supersonic compressor, however, will be four compressors in series. Statistics on the inlet-stage blades of the transonic compressor suggest the scale of this super wind maker. The blades are more than two feet across the face, six feet long, each weighing almost two thirds of a ton, and rotating at 600 rpm on a spindle 18 feet in diameter. The tip speed for this great mass is 650 mpph and the centrifugal force tending to pull each blade from its roots is 800 tons.

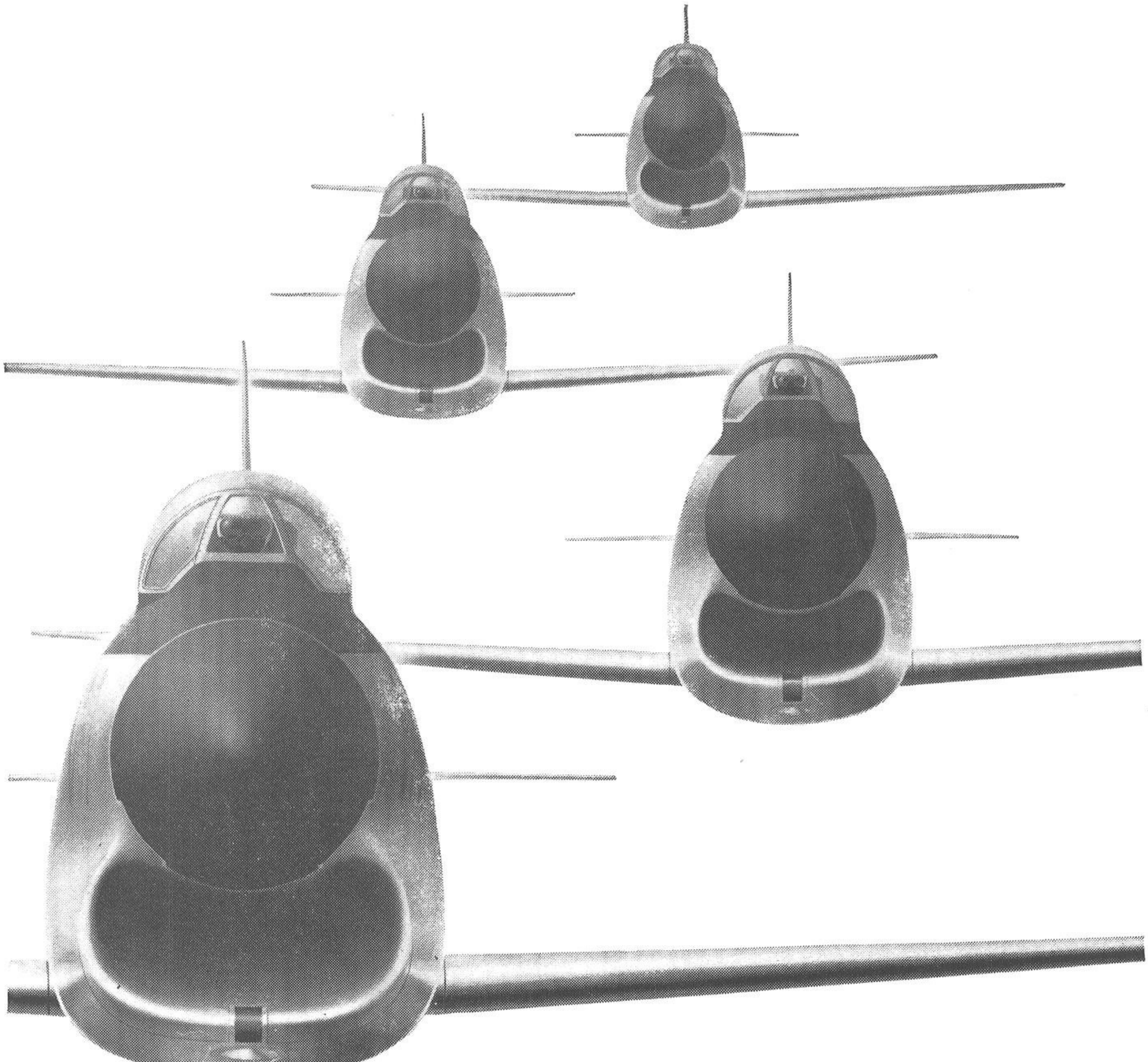
A quarter-scale model of one of the multiple-stage compressors has been built. This model underwent exhaustive tests to insure that these outside blades will not develop resonance at operating speed. Resistance strain gauges and an associated electronic circuit were used for observation of the vibratory characteristics of the blades under normal conditions.

The two liquid rheostats for motor speed control are also the world's largest. These will be used for secondary control of the wound-rotor machines during starting, load transfer, etc., and each is capable of a peak dissipation of about 25,000 kw. The nickel-clad steel electrodes are three feet in diameter. Although the machine represents the highest stored energy of any rotating mass ever built, it can be brought to a halt in about three minutes by using the wound-rotor motors as brakes.

The problem is not only to get energy into the air stream but also to get it out again. The air stream would become extremely hot without the large cooling system provided by Stacy Brothers. Even with 100,000 gallons of water per minute flowing through coolers the air discharge temperature is above 600 degrees F. The air in the test chamber, on the other hand, will be cold, down to about −100 degrees F.

Four motors in tandem drive the compressors. Here are the rotor and stator of one 83,000-hp synchronous motor.





How would you like to make history?

The men who designed the F-86D *Sabre* Jets you see above made history. And so did the North American engineers who designed and developed the leading planes of World War II—the B-25 Mitchell and F-51 Mustang—and the other advanced planes in the *Sabre* Jet series. For 24 years North American engineers have been making history, because North American thinks in terms of the future. That's why North American always has career opportunities for young engineers who do fresh thinking, for young engineers with new ideas.

Today, North American engineers are making history in exciting new fields, including aircraft, guided missiles, jet engines, rocket development and research, electronics, atomic energy. Why not consider joining them when you complete your engineering training? In the meantime, feel free to write for any information you might want concerning a career in the aircraft industry.

Write D. R. Zook, Employment Director, 5701 W. Imperial Highway, Los Angeles

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Richard J. Conway, Lehigh '51, selects Manufacturing Engineering at Worthington

RICHARD CONWAY checks cutting tool with machinist before milling a pump casing.

After completing his general training which brought him in contact with all departments, Richard J. Conway decided that manufacturing engineering was his field. He says, "I chose the Manufacturing Engineering Department after completing my general training at Worthington because as a graduate in Industrial Engineering I can learn the practical aspects of my field while applying theory I learned in college.

"The personnel of this department work together as a team toward the solution of the numerous problems which arise daily. We have the cooperation of all other departments in the corporation in getting the necessary facts pertinent to the solution of these problems. In the course of our day it may be necessary for us to meet the Plant Manager, Chief Engineer, Comptroller, several department heads, clerks, foremen, machinists and many others throughout the company.

"I have contributed to the solution of many problems handled by this department including metal spraying, machining procedures, purchasing new equipment and designating proper dimensions to obtain desired fits between mating parts.

"I enjoy my work because I'm doing the work I want and my formal education is being supplemented with practical knowledge gained from the tremendous wealth of knowledge available to me at Worthington. I know from personal contact with many other departments in the Corporation that Worthington can and will find their young engineers a spot which will give them the same opportunities as have been afforded me."

When you're thinking of a good job, think *high*—think *Worthington*.

FOR ADDITIONAL INFORMATION, see your College Placement Bureau or write to the Personnel and Training Department, Worthington Corporation, Harrison, N. J.

WORTHINGTON

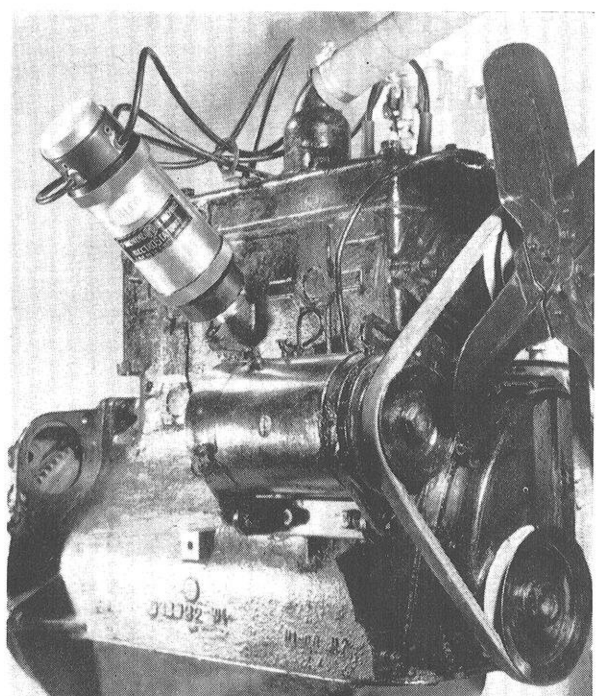
The Sign of Value Around the World

Electro Static Automobile Ignition

— News Item —

A new system which for the first time generates and harnesses static electricity for ignition, was announced recently by D. E. Buchanan, president of the Heckethorn Manufacturing & Supply Company of Littleton, Colorado, at its annual sales conference.

Mr. Buchanan explained that, following months of negotiations with the Societe Anonyme de Machine Electrostatiques of Grenoble, France, commonly known as S.A.M.E.S., license agreements were recently completed, giving the Heckethorn Company the right to manufacture and distribute the new ignition system in the United States and Canada for use on automobile, stationary, and marine engines.



New electrostatic ignition system is shown mounted on motor.

Dr. Noel Felici, scientist at the Centre National de la Recherche Scientifique at Grenoble, made the original discovery of the unique generator which is the heart of the new ignition system. Dr. Felici, the Centre, and S.A.M.E.S. collaborated in completing development of the invention for use as an ignition system.

W. R. Heckethorn and Raymond Duboc visited Grenoble during negotiations to satisfy themselves regarding the product and its commercial possibilities. Dr. Henri Perrot, president of the French Society of Automotive Engineers, along with Dr. Roger Morel, chief engineer of S.A.M.E.S., in turn came to Littleton, Colorado, to demonstrate the invention and to satisfy S.A.M.E.S.

"As everyone knows, static electricity is the kind that sparks when a cat's fur is stroked or when a comb is passed through your hair," Mr. Buchanan explained. "The electrostatic ignition system combines all the advantages any automobile designer or user could dream of. Tests performed at Heckethorn's Research Center show these advantages to be a reality: the small, self-contained generator-distributor is tamper proof, requires no adjustment or timing throughout it entire life, and eliminates coils, condensers, and breaker points.

"Fouled spark plugs and shorts due to moisture, grease and dirt will be a thing of the past, as the high intensity low-amperage current of electrostatic ignition is virtually unaffected by these conditions," Mr. Buchanan continued.

"No interference is created to radio, television, or radar with the new system. Anyone who has gotten a jolt while testing sparkplugs will be pleased to know that he can not get a shock from electrostatic ignition due to the high intensity, short duration, and infinitesimal amperage of the spark.

"These same qualities virtually eliminate misfirings regardless of the condition of the sparkplugs."

Electrostatic ignition differs greatly from the two methods now in common use. Battery ignition, employing coils, condenser, and distributor, produces a more intense spark at low speed than at high speed, resulting in poor performance and gasoline economy at high speed. Magneto ignition, although producing a strong spark at high speed, is very weak at low speed, making starting difficult.

Electrostatic ignition produces the same high voltage at any speed. Consequently, maximum performance of high speeds is assured as well as slower and smoother idling. With battery ignition much power is needed to crank the motor at sub-zero temperatures leaving little current to energize the ignition system, making starting difficult. Electrostatic ignition requires no current from the battery and assures instant starts in extremely cold and moist conditions.

"The high amperage of existing systems is a major factor in burning spark plug electrodes. The low amperage of electrosatic ignition causes virtually no deterioration of spark plugs and the plugs should last the life of the motor," Mr. Buchanan said. "As a matter of fact, accumulated carbon and improper spacing of spark plug electrodes does not affect the efficiency of the electrostatic system.

"When you shoot a 25,000 volt electrostatic spark through your finger with no decrease in its density and feel only a slight sting or when you shoot it through a piece of paper without burning the paper, you realize why an electrostatic spark can not burn the electrode of a spark plug.

"Because of the great efficiency of electrostatic ignition, it can solve some of the problems of very high compression engines not yet on the market. The system has no breaker points to limit the speed of the engine. Engine speeds of more than 6,000 revolutions per minute and compression ratios greater than 12 to 1 can be a reality."

Guiding Engineers - -

(continued from page 32)

"Engineering is an art and a profession upon which we depend for our prosperity in peace and for our survival in war. It is based partly upon science, but chiefly upon personal qualities, the technological judgment, wisdom and enterprise of its professional members, and upon the skill, experience and reliability of its craftsmen."

A few years ago, I had some dealings with a fine engineering firm engaged in surveying an Oriental country with regard to its possible industrial development. They found no trouble in overall planning. Top native engineers of high theoretical ability were available to help. However, when it came to finding skilled technicians, native mechanics, or machinists of any kind, the shortages were appalling. Their problem was akin to that of an architect who has to build a great edifice without carpenters, bricklayers, plumbers, or electricians.

Without a Sir Isaac Newton and, more recently, a Charles P. Steinmetz, engineering would still be in the dark ages. Yet, without such men as James Watt, Eli Whitney and, perhaps, Thomas Edison, who were essentially technicians, industry would have no way to take advantage of the splendid abstract thinking of the theoreticians. The answer is, of course, that in the field of engineering so essential to our well being and national security we need the highest development of the characteristic ideas of both the engineer and the technician. Excellent careers of great renown are possible in either field. Education and motivation of the highest order should be encouraged to fit both talents.

I would like to close by quoting one of Aesop's fables which, while written twenty-six hundred years ago, finds application today:

"The Bee and the Spider"

The Bee and the Spider once warmly disputed which was the better artist. The Spider asserted that no one knew so well as herself the construction of lines, angles, and circles; that her web was the product of her own bowels; whereas, the boasted honey of the Bee was stolen from every herb and flower of the fields, even to the meanest weeds. To this the Bee replied she hoped the art of extracting honey from the meanest weeds would at least have been allowed her as an excellence; and that as to her stealing sweets from the herbs and flowers, her skill was there so conspicuous that no flower ever suffered from so delicate an operation. Then, as to the Spider's vaunted knowledge of the construction of lines and angles, she believed she might mention the regularity of her combs; but since she could add to this the sweetness of her honey, and the various purposes to which her wax was applied, she had nothing to fear from a comparison of her skill with that of the weaver of a flimsy cobweb."

Rust - -

(continued from page 56)

Now, thanks to VPI, the cost of rust prevention has been greatly reduced for the military, packaging time is saved, damage that sometimes occurs during the degreasing operation is eliminated, and finally, an enormous saving in shipping weight is effected. The M-3 machine gun, for example, weighs five pounds less when packaged for shipment overseas in VPI-coated barrier paper than when protected by grease-type preservatives.

VPI paper has been chosen to protect hand tools shipped to Europe by the Mutual Security Agency. VPI crystals are used to protect the inside and VPI paper the outside of aircraft engines during storage by such airlines as Pan American, All-American, Colonial and Capital. A measured amount of crystals is blown into each cylinder through the spark plug hole, which is then capped. And when the time comes to put the engine to use there is no need to clean out the cylinders to free them from VPI—it vaporizes when the engine is started and is blown out the exhaust. The crystals are soft—they don't scratch cylinder walls.

Another use of VPI crystals, by Wheeling Steel Corporation, is to spray them inside new steel drums in an alcohol solution. This protects the drums until they are put to use, and greatly reduces the number of inspections required to be sure no rust damage is occurring.

The Electro-Motive Division of General Motors, which makes engines that drive huge diesel trains across the country, did much work in pioneering the application of VPI. When it found its grease tanks too small for dipping a 17-foot crankshaft weighing 3,500 pounds, the Electro-Motive Division turned to VPI. This proved so practical that much of the firm's production —ranging from huge engines to small parts—is now VPI protected. An important saving is that diesel parts, when packed in grease, must be stored and transported in containers strong enough to support both the part and the grease. Usually that requires a wooden box. But now, thanks to VPI paper, the wooden boxes have been replaced by economical fiber containers.

In addition to its more efficient rust prevention, its savings through reduction of application, transportation and packaging costs, VPI offers these additional advantages to its users: 1) No fire hazard as when inflammable solvents must be used to remove rust-inhibiting grease. 2) Floor space is saved because the need for elaborate degreasing equipment is done away with. 3) VPI does a better job of penetrating to hard-to-reach, irregular surfaces—giving greater protection.

Even so, VPI is not a cure-all. There are some things it won't do. But fortunately, Shell and its licensees have gathered enough data to insure against its misuse and to help users apply VPI in the most beneficial way.

VPI is not stable when subjected to temperatures about 150 degrees Fahrenheit. Another limitation is that it takes about two hours for enough of it to vaporize to give protection, and the vapors will travel only about 12 inches. VPI does not protect against corrosive chemicals, and it does not give significant protection to cadmium, copper, magnesium and zinc. Fingerprints are notoriously corrosive and although VPI reduces their corrosiveness, they still must be removed to insure thorough protection.

If you're one of those who has been dismayed to find his shotgun rusted at the start of the hunting season, or his golf clubs rusted in April, you're probably wondering when VPI paper will be available at the corner hardware store. The answer is that all concerned have been busy establishing its use in industry and the military. But they do have the hardware store angle in mind, and it's a good bet that one of these days you'll be wrapping your tools, ice skates, and so forth in a piece of VPI paper.

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Science - -

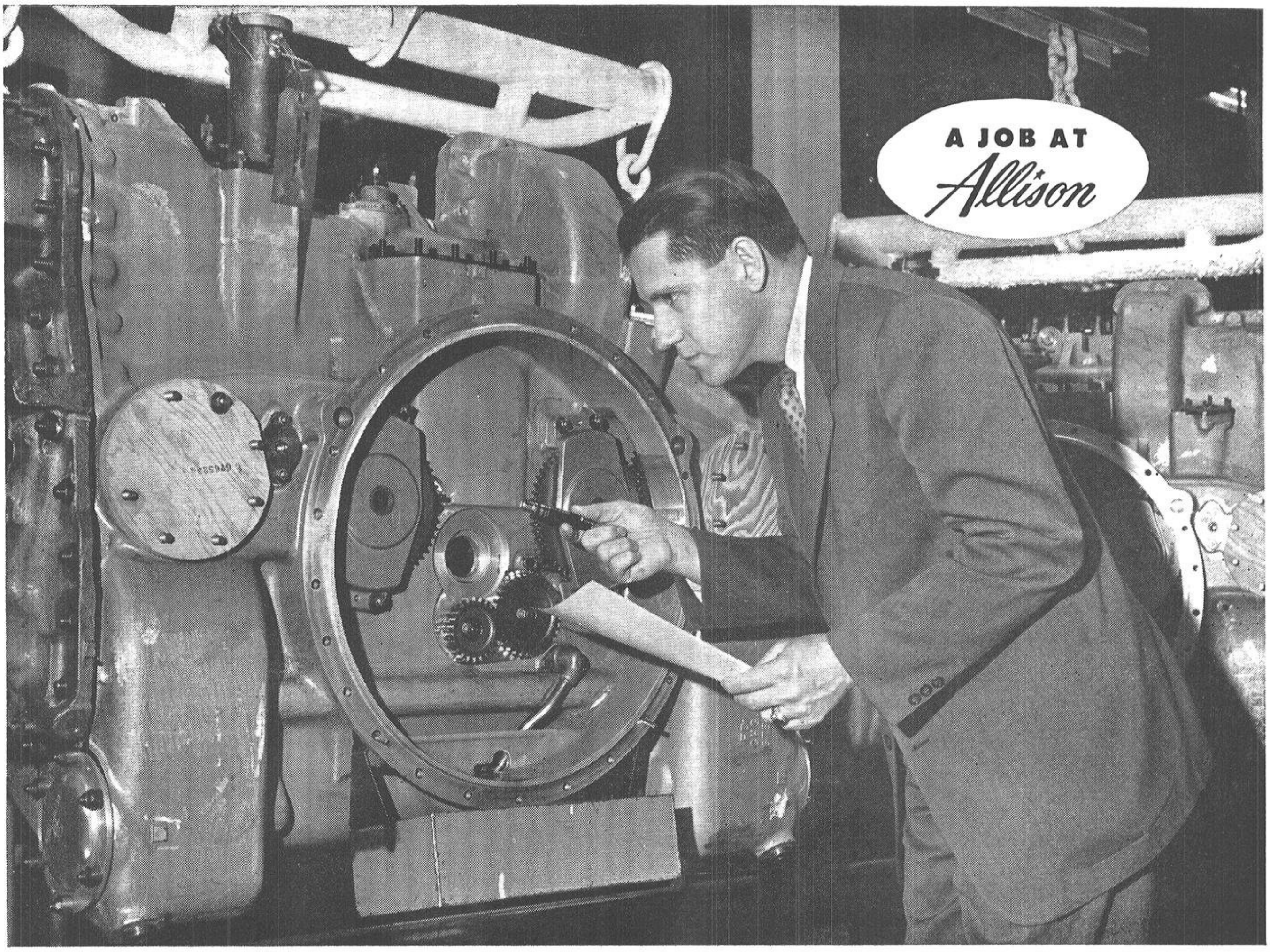
(continued from page 82)

ELECTRONIC BRAIN

A new electronic computer with one of the largest "memories" yet incorporated in any computing device is ready for shipment at the General Electric Company's Electronics Park plant.

The brain of the computer is a metallic drum which can hold pulses representing ten-thousand ten-decimal numbers on its magnetized surface until the numbers are called into use.

The new digital computer, known as the "OARAC," (which stands for Office of Air Research Automatic Computer) can deliver rapid-fire answers in typewritten form to mathematical puzzles which would take expert mathematicians years to solve. It can make as many as 100 calculations per second.



● B. F. "Bernie" Hartz received his B. S. degree in Mechanical Engineering in 1937 from the University of Notre Dame and today is a Senior Project Engineer in the Allison Transmissions Operation.

Bernie's job is to correlate the design, drafting, testing, and installation of the CD-850 cross drive transmission in Army Ordnance vehicles. This big 3000 pound transmission has more than 4000 parts and is used in the M-46 and M-47 General Patton tanks, cargo carriers, gun motor carriages and landing vehicles. It actually combines power steering, automatic torque multiplication, hydraulic quick-shifting and braking in a single unit.

One of Bernie's recent assignments was to guide and direct the design, test and development of a more efficient steering system. The CD-850 transmission steers the 47 ton Patton tank by means of hydraulically actuated multiple disc clutches. This makes it possible to steer the massive vehicle, through the control valve body assembly, with a minimum of driver effort. The change required a vast knowledge of all of the components of the transmission which were affected by the new method. New designs had to be drawn and checked and many tests were run at Allison, General Motors Proving Ground and Aberdeen Proving Ground.

This is another of the engineering problems that Allison engineers are called upon every day to solve. Through new designs and improvements, Allison men are helping to give the Ordnance Department the best military vehicles in the world. Allison also has a progressive commercial heavy duty Torqmatic converter and transmission program which offers new fields for young men who want lifetime careers in engineering.

Allison is looking for young men with degrees in* MECHANICAL ENGINEERING, ELECTRICAL ENGINEERING, AERONAUTICAL ENGINEERING. *There are also a number of openings for majors in Metallurgy, Electronics, Mathematics and Physics. Write now for further information: R. G. Greenwood, Engineering College Contact, Allison Division, General Motors Corporation, Indianapolis 6, Indiana.

Allison **DIVISION GENERAL MOTORS CORPORATION • Indianapolis, Ind.**

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ENGINEERING INSTITUTES

by Richard Bond, m'55

Motor Vehicle Fleet Supervisors — **April 13-17**

This meeting will place principal emphasis upon training the driver. Fleet owners, personnel men, supervisors, and driver trainers will find subjects such as effective speech, training aids and methods, and standard testing procedures very useful in maintaining a good safety record.

Engineering Organization — **May 5-6**

Problems of organization, operation and control of an engineering department will be considered. Methods for the orderly preparation, processing, recording, and releasing of engineering information will be demonstrated. Chief engineers, engineering managers, and persons responsible for engineering organization will find this institute valuable.

Nuclear Technology — **May 12-14**

Topics to be given attention in this institute are: development of nuclear fission as a source of useful energy; fission products and irradiated elements; production, preparation and shipment of radioactive materials; possible uses of radioactive isotopes; tracer techniques; radiation hazards and their control; air and water pollution; disposal of radioactive wastes; and safe handling of radioactive materials. This institute will be of special interest to engineers in the chemical and related industries, to public health officials and sanitary engineers, and to men engaged in research.

Corrosion Control — **May 19-21**

The various types of corrosive action will be defined and the mechanics of the processes will be discussed. Out of this will arise a greater understanding of the theoretical nature of the problem. Information will then be made available with respect to various control practices and techniques. This latter phase of the training will include corrosion testing procedures and evaluation, predictions of corrosion rates, selection of the proper materials for various environments, the aspects of cathodic protection, and protective coatings. This program will be of interest and value to persons charged with the design, operation and maintenance of systems subject to corrosion in any of its forms.

Technical Report Writing — **May 26-27**

An institute in which the fundamentals of scientific and technical writing will be presneted. Emphasis will be placed upon the writing of scientific articles and the preparation of technical reports. Techniques of organizing facts and ideas, recognizing the statistical significance of data, preparation and revision of drafts, and crisp presentation of written and graphic information will be discussed.

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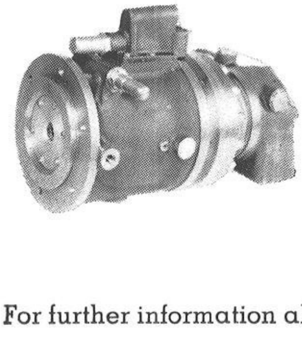

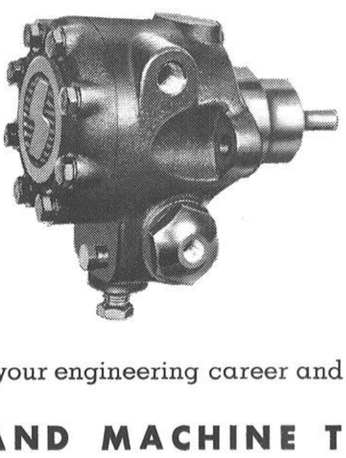

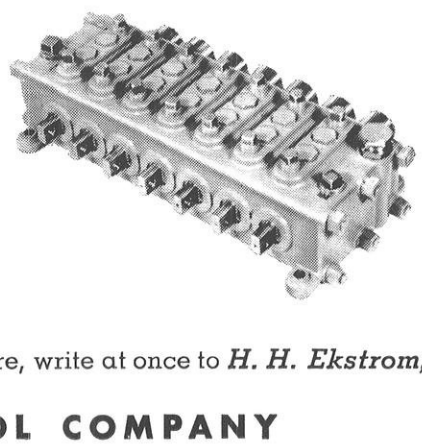

For further information about your engineering career and future, write at once to *H. H. Ekstrom,*

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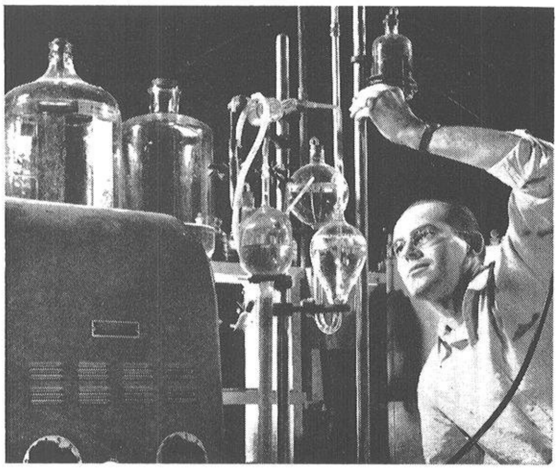

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The 1953 Engineering Exposition

Herbert Hoover, in his recently-published memoirs, said of engineering: "Its training deals with the exact sciences. That sort of exactness makes for truth and conscience . . . It is a great profession. There is the fascination of watching a figment of the imagination emerge through the aid of science to a plan on paper. Then it moves to realization in stone or metal or energy. Then it brings jobs and homes to men. Then it elevates the standards of living and adds to the comforts of life. That is the engineer's high privilege."

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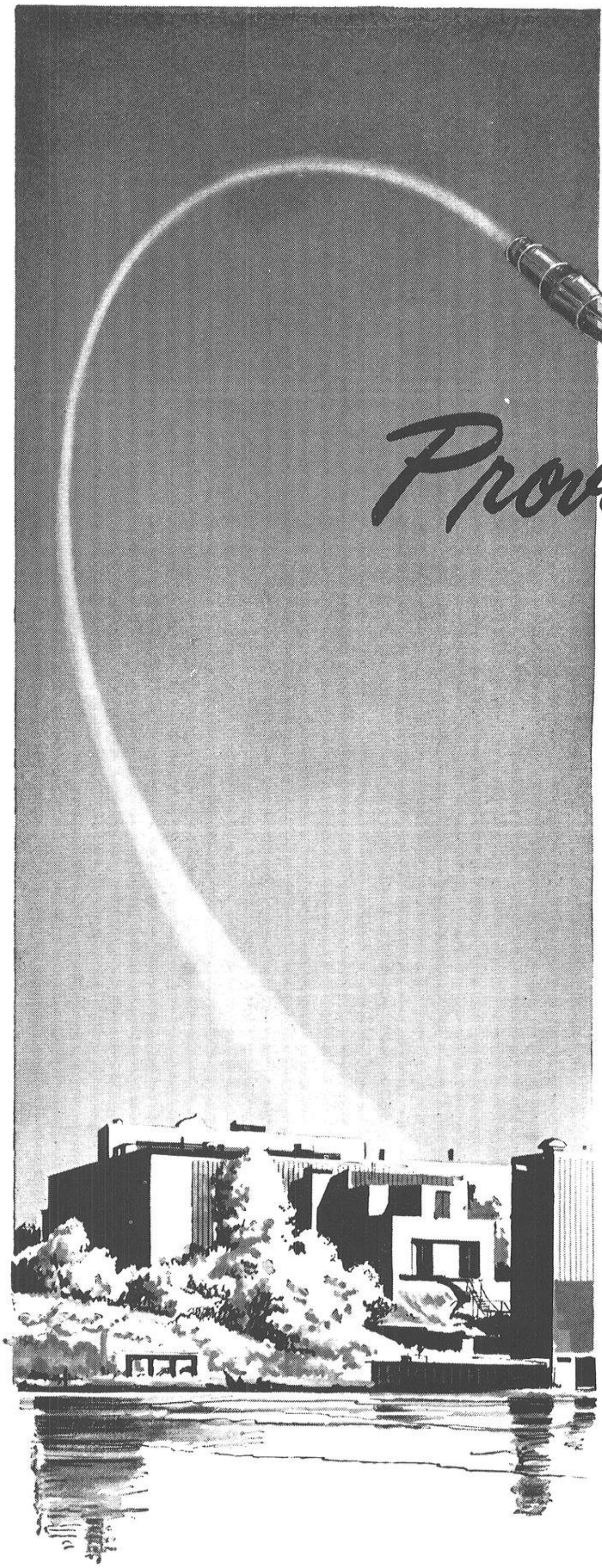

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STATIC

BY I. R. DROPS

One of the questions asked in an examination on stock-raising was, "Name four different kinds of sheep."

An inspired student answered "Black sheep, white sheep, Mary's little lamb, and hydraulic ram."

* * *

"If the Dean doesn't take back what he said this morning, I am going to leave college."

"What did he say?"

"He told me to leave college."

* * *

From life's book of tears and laughter I have gained this bit of lore — I'd rather have a morning after than never have a night before.

* * *

Mother: "What are you doing, Junior?"

Junior: "Nothing, Mom, just eating the raisins off the flypaper."

* * *

Salesman: "Sir, I have something here that's guaranteed to make you the life of the party, allow you to win friends and influence people, help you forge ahead in the business world, and in general make life a more pleasant and invigorating experience."

Engineer: "Good, I'll take a fifth."

* * *

The distinguished speaker turned to the chairman of the meeting and asked for a glass of water.

"To drink?" inquired the chairman.

"Oh, no," replied the speaker with a sweet smile, "I do a high dive."

* * *

A minister advertised for a handyman and the next morning a neat young man rang the bell.

"Can you start the fire and have breakfast ready by seven o'clock?" asked the minister.

The young man thought he could.

"Can you polish all the silver, wash the dishes and keep the house and grounds neat and tidy," was the next question.

"Look, Reverend," protested the young man. "I came here to see about getting married, but if it's going to be anything like that, you can count me out right now!"

A grave digger, absorbed in his thoughts, dug the grave so deep he couldn't get out.

Came nightfall and the evening chill, his predicament became more and more uncomfortable. He shouted for help and at last attracted the attention of a drunk.

"Get me out of here," he shouted, "I'm cold."

The drunk looked into the grave and finally distinguished the form of the uncomfortabl grave digger.

"No wonder you're cold," he said, "you haven't got any dirt on you."

* * *

"Boys," said the clerkyman to the Sunday School class, "you must learn never to lose your tempers under the most vexing circumstances. To illustrate, while I've been talking, a fly has landed on the end of my nose; I do ont swear, I do not blaspheme, I merely say, 'Go away, fly. MY GOD, IT'S A BEE'!"

* * *

Bus Driver: "All right back there?"

Feminine Voice: "No, wait till I get my clothes on."

Then the driver led a stampede to the rear and watched the girl get on with a basket of laundry.

* * *

Drunk: "Ho Lady, you got two ver' beautiful legs."

Girl: "How do you know?"

Drunk:" Because I counted them."

* * *

Wife (to husband who is standing before an open window doing setting-up exercises): "John, pull down those shades. People will think I married you for your money."

* * *

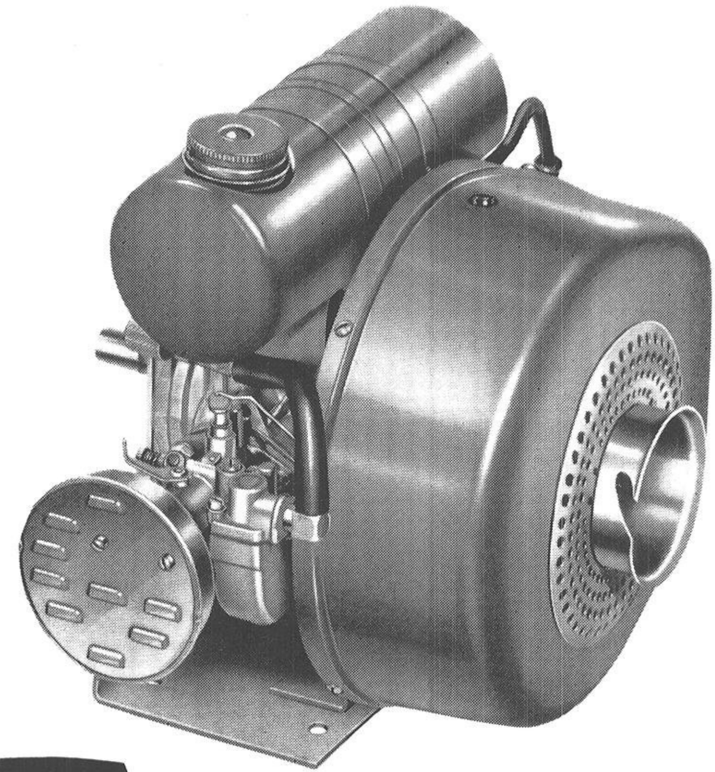
"Let's organize a fraternity."

"Why?"

"I've just discovered a new grip."

* * *

A report being circulated in Munich has it that a thief recently broke into the chief propaganda office in the Soviet Zone of Germany and made off with the complete results of next year's elections.



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light-weight aluminum gasoline engines

Features

- ✓ COMPACT DESIGN
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- ✓ EASILY ADAPTABLE

See this 2-cycle engine at the 1953 Engineering Exposition.

Engineered with a minimum number of parts, and made of aluminum, the West Bend is a feather weight among gasoline engines. These light-weight engines are especially tailored for power devices which must be lifted or carried. Basic models weigh from 15 to 19 lbs.

The West Bend engine gives you a smooth flow of power because (1) precise carburetor calibration insures smooth 2-cycle operation regardless of loads and (2) the 2-cycle principle provides a power stroke with every rotation of the crankshaft. It is designed to provide ease of service, safety, trouble-free operation and durability in one package.

The West Bend Aluminum Co. also manufactures housewares, giftware and electrical appliances.

WEST BEND *Aluminum Co.*

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Bendix Aviation Corporation

Research Laboratories

DETROIT, MICHIGAN

The Bendix Aviation Corporation operates 24 divisions located from coast to coast and in three foreign countries. Engineering activities are carried on in each Bendix division with specific emphasis on the products of that particular division. However, the fields in which Bendix is active embrace many of the newer arts and sciences and the need for broader research activities is met by the operation in Detroit of a separate division known as the Bendix Aviation Research Laboratories. Here, in an atmosphere physically removed from manufacturing and productive activities, Bendix scientists and engineers attack on a broad front problems whose solution will be of value to present and future Bendix activities in many old and new fields.

Some indication of the scope of the Bendix Aviation Research Laboratories interests may be

- ELECTRONICS
- MAGNETICS
- COMPUTERS
  - Analog
  - Digital
- SERVOMECHANISMS
  - Electric
  - Hydraulic
- RADAR RESEARCH
- METALLURGY
- SOLID-STATE PHYSICS
- HIGH ALTITUDE INSTRUMENTATION
- RADIATION DETECTION
- NUCLEAR PHYSICS
- MASS SPECTROSCOPY
- GUIDANCE AND CONTROL SYSTEMS
  - Aircraft
  - Missile
- DESIGN AND ANALYSIS OF ELECTRO-MECHANICAL SYSTEMS

Opportunities now exist for college graduates with interests in these fields and with academic training or experience in

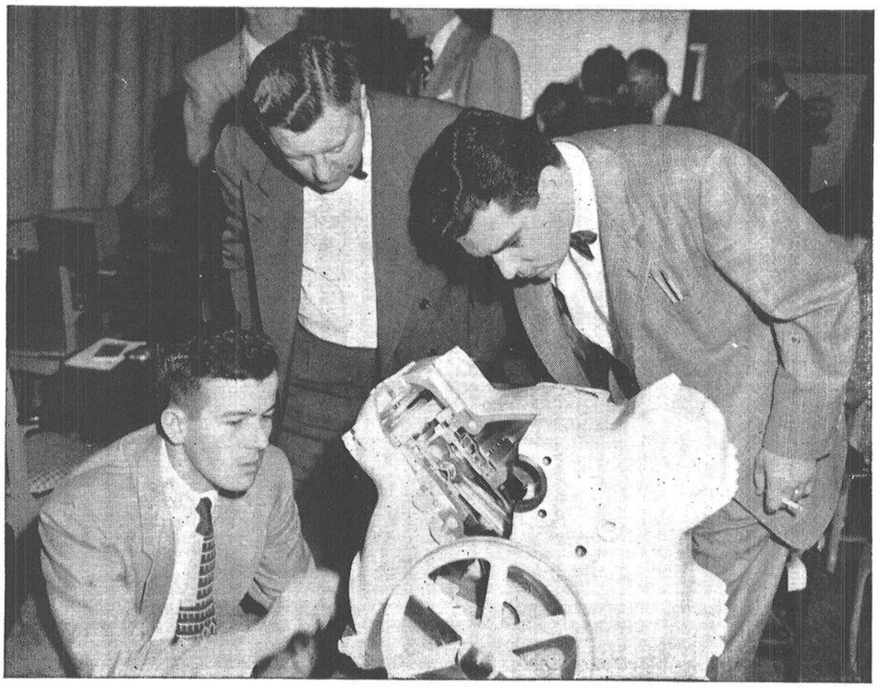
- ELECTRICAL ENGINEERING
- AERONAUTICAL ENGINEERING
- MECHANICAL ENGINEERING
- PHYSICS
- ADVANCED MATHEMATICS

For Further Information, Please Contact:

FRED A. BARRY, Personnel Director

BENDIX AVIATION CORPORATION
RESEARCH LABORATORIES

4855 Fourth Avenue **Detroit 1, Michigan**



Preparing for specific responsible positions with Trane in sales, research and product design, these graduate engineers are attending a streamlined six-month training course at full pay. This interesting course moves rapidly and adapts the graduate's knowledge of engineering to the position he has chosen.

Trane Offers Engineering Graduates

OUTSTANDING OPPORTUNITIES IN AIR CONDITIONING

Qualified graduate engineers can step quickly into an interesting and prosperous career in the rapidly growing field of air conditioning. The Trane Company, leading manufacturer of air conditioning, heating, ventilating and heat transfer equipment, is seeking graduates for responsible positions in sales, research, product design and production.

Those selected will join the Trane Graduate Training Program in La Crosse at full pay. Each man will receive a specialized course to assure personal success in the position he has chosen.

He will learn how Trane equipment is used in jet aircraft, tanks, submarines, ships, skyscrapers, factories, industries, homes and buildings of all types. He will see how rapidly air conditioning is becoming a necessity . . . how it is destined to become a standard requirement in homes, automobiles, schools, offices . . . everywhere.

Graduates move quickly into responsible, well paid positions. Men who joined the company through this training program include the president and numerous company officers, managers of most Trane sales offices and home office sales divisions.

Trane's record has been one of steady growth and leadership for nearly forty years, during both peace and war. Today, new Trane products are being developed constantly . . . creating new departments and promotions . . . assuring continued growth and business opportunities.

For an outstanding career in one of the fastest growing industries, consider your future in air conditioning with Trane. Write immediately to Milton R. Paulsen, Training Department Manager, for the brochure "Trane Graduate Training Program". Next six-month class starts in July.

WHAT OTHERS SAY ABOUT TRANE

How much can graduates of their training program earn? What about competition? Is Trane strong financially? Does the company offer outstanding opportunities to young men?

For the unbiased answers, read FORTUNE magazine's report on Trane in their August, 1951 issue. Your library should have a copy. A reprint of this report is included in the "Trane Graduate Training Program" brochure which is in your Placement Office.

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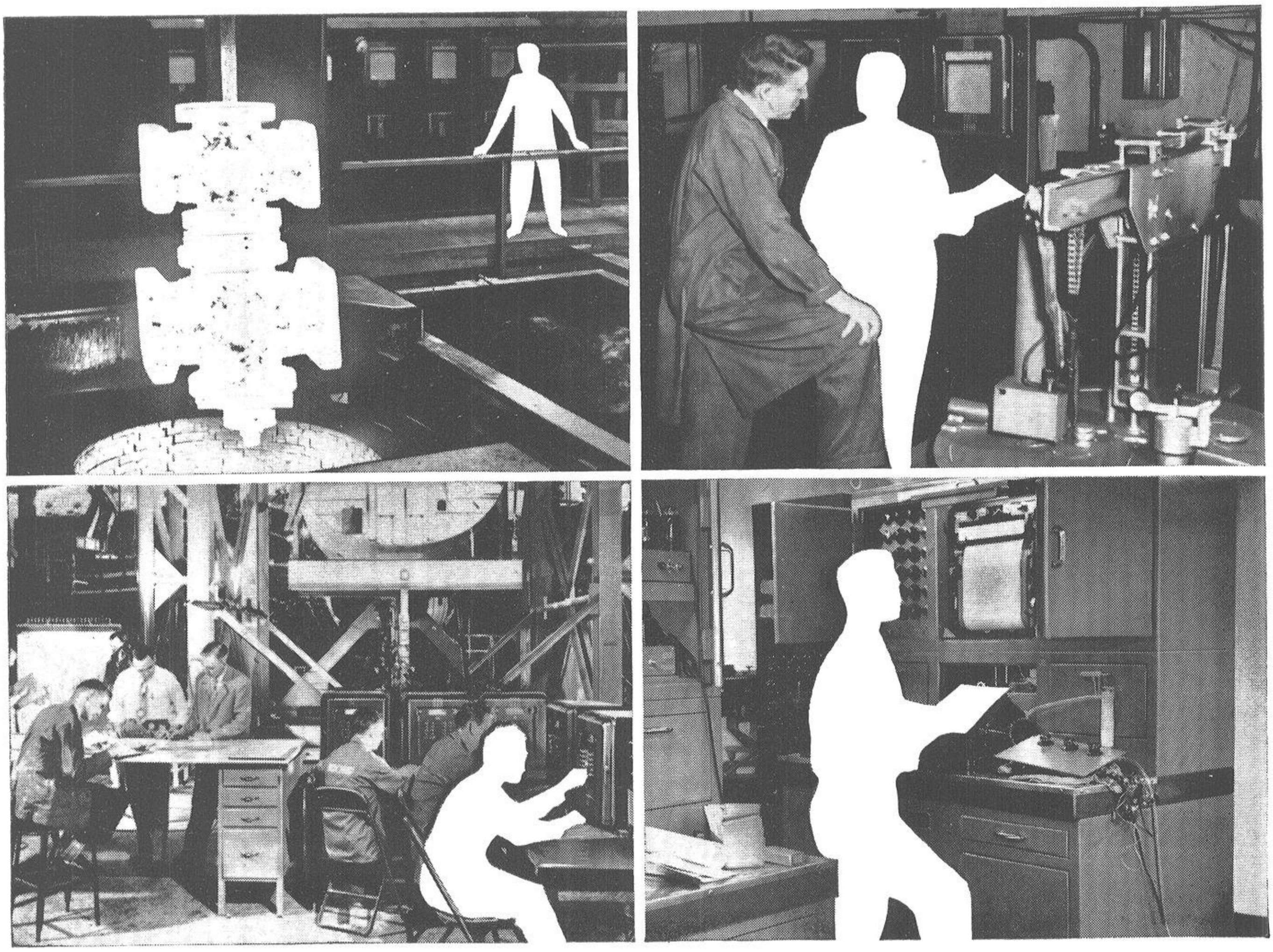

Engineers:

THERE'S A YOU MISSING IN INSTRUMENTATION

If you're still undecided . . . aren't sure which engineering career you'd like . . . still wish you could apply your ability to *more* than just one area of science and industry . . . the expanding instrument and controls field may offer just the career you've been looking for.

Vital to modern technological progress, the instrument field cuts laterally across every segment of industry and research. Here at Leeds & Northrup, for example, we help meet the instrumentation needs of steel mills, auto and aircraft plants, refineries, power generating and distribution stations, atomic energy plants, chemical and pharmaceutical companies. And these are but a few of our more important market areas.

It's this challenge and variety . . . the feeling of playing an important, creative part in many enterprises . . . that makes working for L&N so interesting to engineers.

Our team includes engineers in the field, in product and application work, in research, manufacturing, inspection and other activities.

Why not investigate the *YOU* in instrumentation? Talk over the openings which now exist in our organization with our nearest District Office Manager. Or, if your prefer, write our Personnel Manager, 4915 Stenton Ave., Phila. 44, Pa.

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. . . to speed production, cut costs, here's how the Douglas Aircraft Co. uses Photography throughout its plants

LIKE thousands of other manufacturers and businesses—large and small—Douglas knows the camera is a short cut to greater production at lower cost.

So, from the time a new employee is welcomed to a plant by motion pictures, until a finished plane is on the ramp ready for delivery, photography is hard at work—training workers, testing metals, checking stresses, reproducing drawings, making records, and speeding work in the business offices.

There are countless ways photography saves time and cuts costs. Any business profits when photography gets to work.

There are so many ways photography aids engineering and so many new applications being found, that many well-qualified graduates in the physical sciences and in engineering have been led to find positions with the Eastman Kodak Company.

If you are interested, write to Business and Technical Personnel Department, Eastman Kodak Company, Rochester 4, New York.

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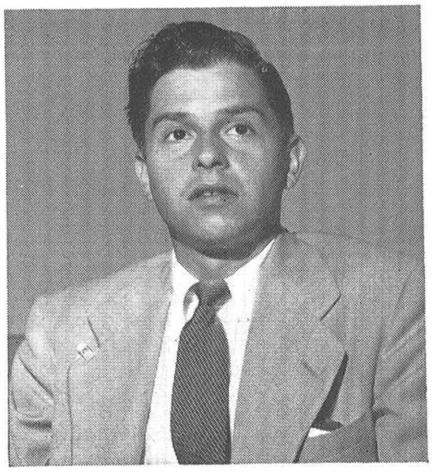
MY QUESTION TO THE G-E STUDENT INFORMATION PANEL:

"What opportunities are available in General Electric for a career in manufacturing?"

. . . EARLE E. WARNER, U. of Illinois, 1952



The answer to this question, presented at a student information meeting held in July, 1952 between G-E personnel and representative college students, is printed below. If you have a question you would like answered, or seek further information about General Electric, mail your request to College Editor, Dept. 123-2, General Electric Co., Schenectady, N. Y.

G. C. HOUSTON, *Manufacturing Services Division* . . . In General Electric manufacturing operations involve supervising and administering the activities of more than 100,000 men and women in more than 100 plants. This includes the operation of approximately 75 distinct product businesses, producing some 200,000 different products ranging from heavy industrial equipment to precision instruments and consumers' goods.

The cost of manufacturing our products represents 70% of the total expenditure for all operations including research, engineering, marketing and other administrative functions.

With these activities and expenditures in the field of manufacturing one can readily visualize the breadth of opportunity in the area of manufacturing. This wide scope of manufacturing activities and the importance of their integration into an effective organization provide opportunity for challenging and rewarding careers in such areas as follows:

Manufacturing Supervision: The most important part of any manufacturing organization is men—those who apply their varied skills and talents to perform the many tasks involved in the manufacturing process. To direct the activities of these men, to inspire performance, co-operation and teamwork, to provide fair and equitable treatment, to see that work is done in required quantity—on time—and at the lowest possible cost, is the responsibility of Manufacturing Supervision. It offers a challenging and satisfying career for individual growth and development.

Manufacturing Engineering: This is the creative portion of modern manufacturing. It involves interpretation of initial product designs into good manufacturing practices through planning the methods by which a product will be manufactured, specifying and designing machine tools and equipment, and planning and developing new processes. It is vitally concerned with such subjects as plant layout, materials handling, operation planning, and quality control. It requires a thorough knowledge and broad understanding of how these subjects influence the manufacture of a product.

Purchasing: General Electric is one of the most diversified purchasers in the country today, buying material from every industry. Much of this purchasing involves technical problems, and requires a knowledge of sources of supply, market trends, and new products. Many items purchased are components or finished products of other technical industries. Constant contact with price, as well as evaluation of current and long-range raw material supply situations, is another phase of this activity. It is becoming more and more important as a career opportunity for young men.

In addition to the above described areas of opportunity in manufacturing, such manufacturing services as wage-rate determination, production control, inventory management, production planning and development, and materials handling offer opportunity for highly trained specialization and for competent management supervision.

These areas of manufacturing, together with many others, offer the college graduate of today a wealth of opportunity for a challenging and rewarding career.

You can put your confidence in—

GENERAL ELECTRIC