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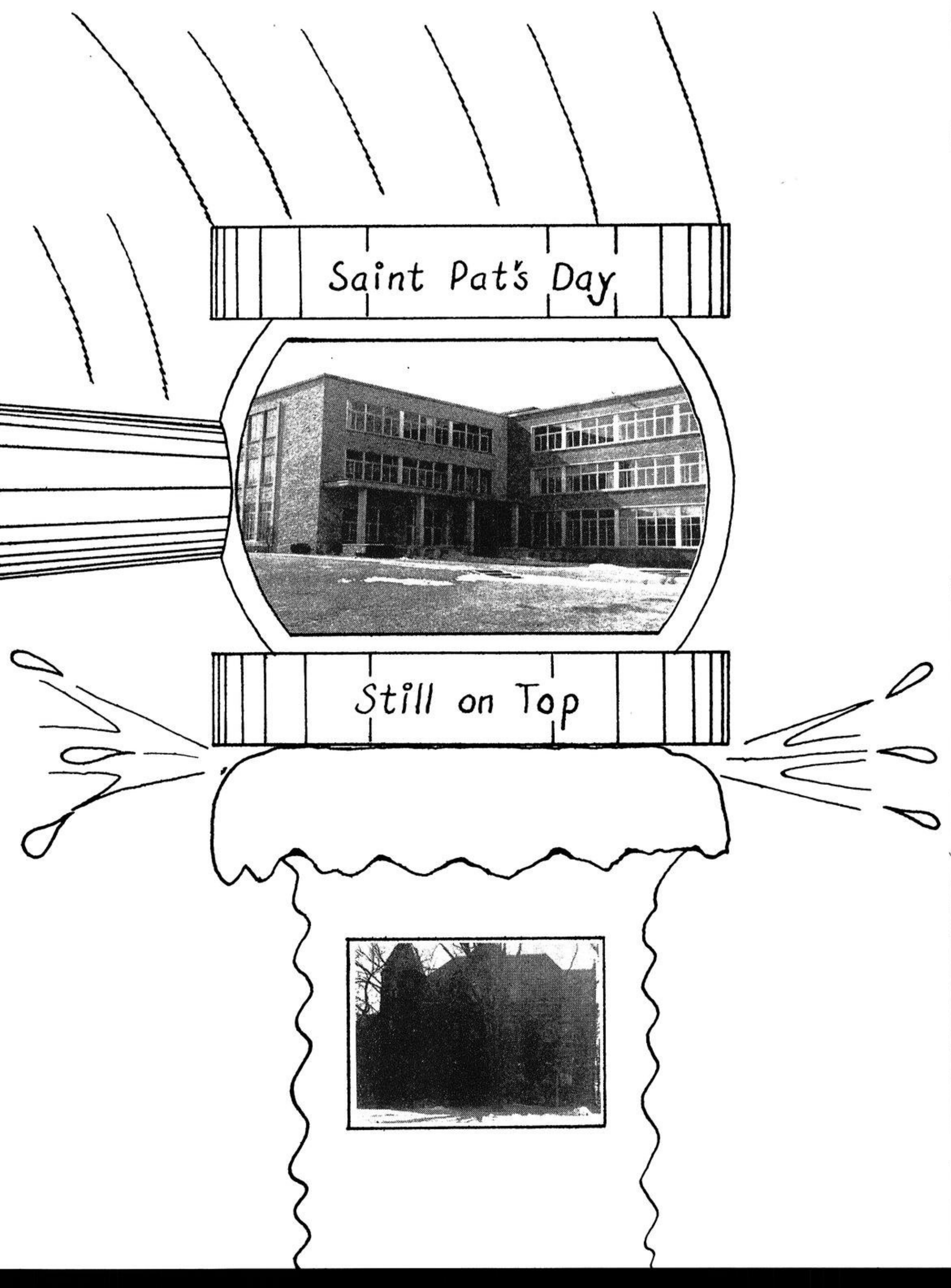
The Wisconsin **engineer**



MARCH, 1955

High School Section

Page 25

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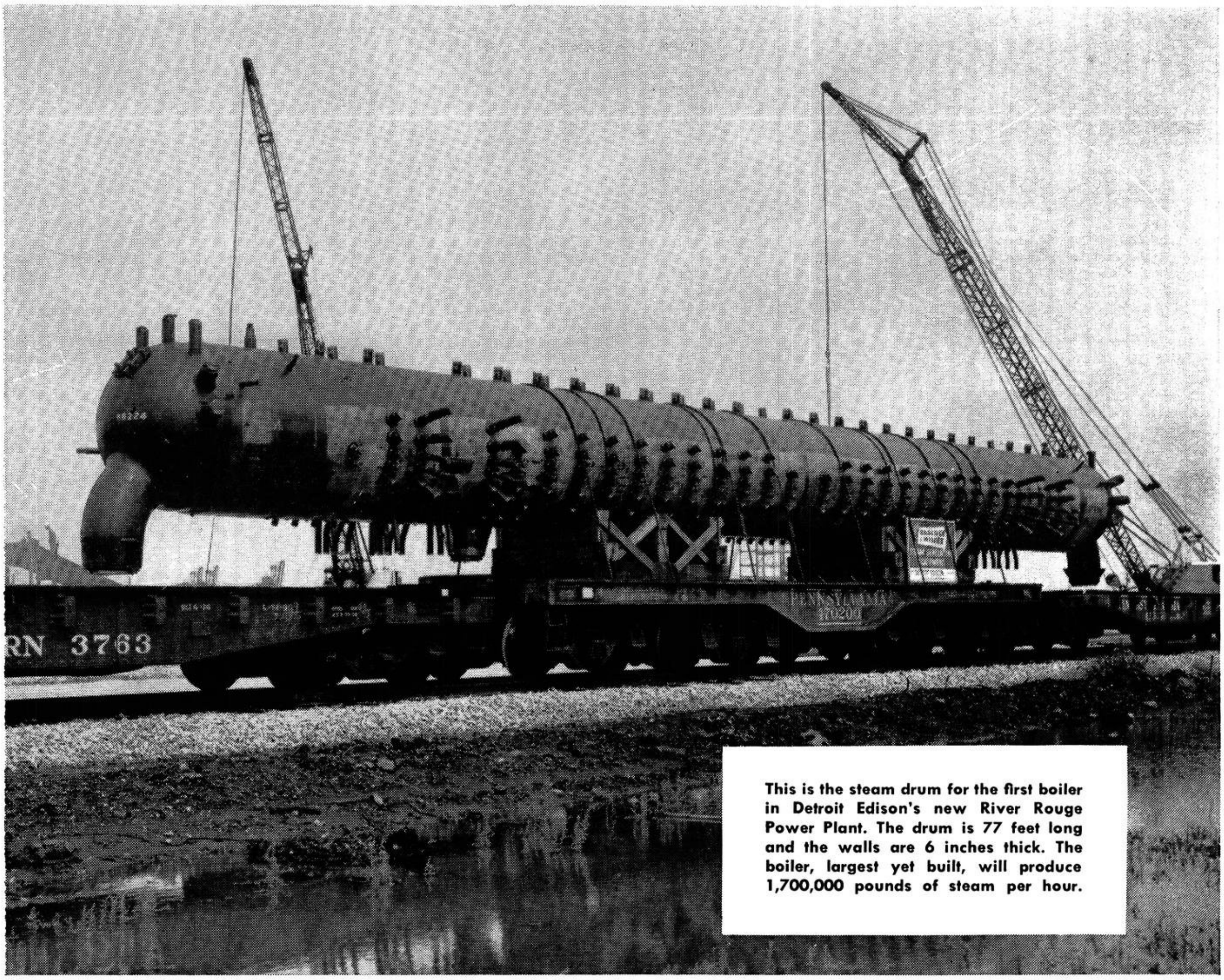

This is the steam drum for the first boiler in Detroit Edison's new River Rouge Power Plant. The drum is 77 feet long and the walls are 6 inches thick. The boiler, largest yet built, will produce 1,700,000 pounds of steam per hour.

Bright Future... **YOURS?**

Today, Detroit Edison is installing the world's largest boiler.
Soon the company will install the world's largest steam turbine-generator.
In the last ten years Edison has doubled its capacity to produce electricity—but it's not stopping there.
Opportunity comes with big plans like these. Big plans—bright futures for those engineers who create and carry them out.

Can this be your bright future? See our representative when he's on campus. Stop in at our office, or write . . .

THE DETROIT EDISON COMPANY

2000 Second Avenue, Detroit 26, Michigan

Volume 59 **MARCH, 1955** **Number 6**

MEMBER OF
ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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State University of Iowa
Iowa City, Iowa

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WISCONSIN ENGINEER

The Student Engineer's Magazine

FOUNDED 1896

Article

High School Section

Departments

Cover

It's been apparent now for some time (apparent to the Engineers, that is) that St. Pat was really an engineer. He obviously couldn't have been a lawyer, or he never would have permitted the act depicted on the cover to occur. As you can see (we hope) the Law School, along with those in it, is being driven into the ground by the mighty arm of St. Pat. Just who St. Pat is, we aren't sure at press time, but you can be sure he's more than a match for the Law School's best.

editorial

Greetings

"For the last several years, the effectiveness of our armed forces has suffered from the lack of technically skilled men. In recent months the shortage has become acute as men trained at government expense leave for better paying jobs in industry. The chiefs of staff are unanimous in their belief that action must be taken to curb this loss of valuable talent . . ."

So reads a front page story on any given newspaper at least once a month. But how shall we reconcile this dire pronouncement with the notices buried on page 29, before the obituaries? "Jim Jones has completed his basic training with B Company, Infantry, and will be stationed in Western Germany." Significant, because Jim graduated as an engineer in 1953 and received many employment offers. Among those he rejected were offers from the Hanover plant of the Atomic Energy Commission and a government ordnance works in New Jersey. At that time he was offered $400 per month as an engineer. After two years of successful engineering experience, Jim draws $75 a month for policing the grounds or dishing out stew. With his opinion of his new responsibilities, Jim probably isn't worth the $75.

This is the situation facing most engineering graduates. During their two year hitches, they will lose contact with new developments in the profession and in their own company. Employers find the constant turnover of personnel hinders plant operation and project development. The army surely gains no exuberant enthusiasm from such inductees.

The obvious answer is to place drafted engineers in technical positions in the armed forces or in government sponsored development programs—the essence of common sense—but this procedure is often disregarded. Is it impudent or imprudent to inquire why?

—J. H. B.

THE ALCAN PROJECT

The Aluminum Company of Canada wanted increased production, so they combined bauxite ore from Jamaica with British Columbia's plentiful hydroelectric power potential. The project, which will eventually provide about 450,000 tons of aluminum annually, involved several very costly steps, some of which are described here

edited by Norbert Lenius and Donald J. Beebe

Information for this article was obtained from a talk by F. T. Matthias, Assistant Manager of ALCAN's British Columbia Project. After receiving his BS degree in civil engineering at Wisconsin in 1931, he was connected with construction supervision on TVA, the Pentagon building, the Hanford, Washington, atom plant and a power project in Sao Paulo, Brazil.

DON BEEBE

Don is a senior in mechanical engineering from Sheboygan. Before coming to the University of Wisconsin, he spent two years at Ripon College and had ambitions of majoring in mathematics. But after his summer experience in maintenance work for the Wisconsin Power and Light Company, he has decided on plant engineering as a career.

Don is a member of Pi Tau Sigma and A.S.M.E. Hobbies include hunting, fishing, and photography.

NORB LENIUS

Norb is also a senior in mechanical engineering and a straggler from Ripon College. He is a member of Pi Tau Sigma and Tau Beta Pi.

He is considering going into Industrial Relations after graduation. During the summer his engineering skill is applied to installing turbines at the shipyards in his home town of Sturgeon Bay. Spare time is spent hunting and skiing, either water or snow type.

The British Columbia Project of the Aluminum Company of Canada, Limited, commonly termed the Alcan Project, has as its objective the production of aluminum ingot. This needs power, lots of it, so much that availability of cheap power is generally a more important factor than any other in selecting the site for the smelter. Hauling ore to the smelter is a simple matter compared to trying to produce power where the ore occurs. Thus, in British Columbia, they are building a hydro-electric power plant in the wilderness and a smelter plant on deep water as near to it as possible. It is in British Columbia because the power site is there. Far away in Jamaica, British West Indies, bauxite ore deposits are being developed and a plant to concentrate alumina from bauxite is being installed near the bauxite deposits. This concentration of alumina from bauxite reduces the volume by about 50 per cent and results in a fine powder—aluminum oxide. This aluminum oxide is reduced in the smelter to pure aluminum metal and it is here that about 3-h.p.-years of electric power is required to reduce 2 tons of alumina to 1 ton of aluminum.

Along the northwest coast of British Columbia, nature has built topography that permits economic development of extremely large blocks of hydro-electric power. Nature, offering this gift with one hand, with the other planted so many rugged peaks, deep and narrow valleys, precipitous canyon walls and glaciers, all liberally sprinkled with snow and rain, that the area is virtually unpopulated and undeveloped. A line of fishing and lumbering settlements along the coast, and an east and west line of small but growing towns along the Canadian National Railway to Prince Rupert, form an axis about which development can expand in this vast area 500 miles long between Vancouver and Prince Rupert and extending nearly 200 miles to the east of the coast. Small ranches and fishing and hunting camps dot this wild and beautiful region.

Nature's gift for the Alcan development is the topography. A group of finger lakes in the Tweedsmuir Park area lie on the east slope of the Coast Range, fed by heavy snow and rainfall. Together they extend from about 120 miles to the east where their discharges converge into Nechako River, a tributary of the Fraser. The 'fall' from the upper lakes to the Nechako is about 260 feet. A deep-water arm or inlet from the famous inland waterway along the B.C. west coast penetrates far to the east, nearly to the mightiest peaks of the Coast Range. Fifty miles to the north another deep-water inlet reaches the delta of Kitimat River beyond which is a comparatively wide valley suitable for industrial plant development. And so the stage is set and

This is the site on the Kemano River (foreground) chosen for the location of the underground powerhouse. It is situated at the level of the construction camp and about 1,500 feet inside the foot of the mountain at the left. The path cleared up the mountain side shows the location of the aerial tramway used to carry men and equipment to the camp 2,600 feet up the mountain. The road beside Horetzky Creek (right background) was built for access to the Horetzky adit, or access tunnel. From this adit, construction was undertaken toward both ends of the ten mile tunnel.

the Alcan Project is putting these natural conditions to work to make the aluminum for the hungry markets of the world.

A dam on Nechako River, the Kenney Dam, has been built, and the waters of the finger lakes are creeping higher to unite and form a 120-mile-long reservoir. This reservoir started filling on October 8, 1952. At the upper end of these chains of lakes is Tahtsa Lake, which lies in the shadow of the Coast Range.

Tahtsa Lake, being highest up the chain and closest to the Coast Range, was the logical selection for the intake. Having decided on Tahtsa Lake as the tunnel intake, the next major decision was that the powerhouse would be an underground plant. The principal advantages of going to an underground plant were reduction of the length of high pressure penstocks, freedom from maintenance difficulties due to the heavy snowfalls and relative freedom from danger of rock slides which would have menaced an outside power station at the foot of the project.

The fundamental decisions of project planning and design shaped up the construction problem as a difficult and complex operation. The program facing construction forces involved major structures and major work over a distance of about 170 miles, for much of it is in extremely difficult mountainous country. The Coast Range separated the job into two major parts and no access was possible between them except by air over the mountains.

The Kenney Dam is a rock-fill structure with an impervious clay rolled-filled core sloping downstream and lying on heavy rock-fill. The design of the dam was influenced by the limited amount of glacial till clay available for the core and by relatively plentiful supplies of gravel and quarry rock nearby. The dam is 345 feet high from the bottom of its foundations and will have a 280 foot depth of water upstream when the reservoir is filled. Over 4,000,000 cu. yds. of rock, clay, gravel and riprap were required to complete the structure. The filling operation by heavy rock trucks and scrapers was done between early May and early December, 1952. The dam was completed in December, 1952. As of November, 1954, the reservoir depth at the dam was about 230 feet. It is expected that it will take more than two years for the reservoir to fill to elevation 2800.

Roughly 110 miles farther up the reservoir is the west end of Tahtsa Lake where the intakes to the 10-mile tunnel are located. One of the four tunnel excavation headings operated from this location.

The intake structure has been completed to supply two tunnels to the powerhouse, although only the first tunnel is to be built as part of the first stage of the hydroelectric development. These tunnel intakes are equipped with gate controls that can be closed by remote control as they will not need to be operated except for emergencies or maintenance.

All of this work on the east side of the Coast Range was supplied by the Canadian National Railway and by trucks. The railhead for Kenney Dam was Vanderhoof and a 65-mile access road was built to the dam. The railhead for the Tahtsa work and the saddle dams was at Burns Lake, and these two operations required construction of 120 miles of access road. The access road to Tahtsa Lake was practical only to the east end of the lake and two self-propelled steel barges were used to carry supplies the 18-mile length of the lake. During the winters of 1951 and 1952 the supply line down the lake was handled largely by helicopter. During the winter of 1953 the tunnel was open and supply was through the tunnel from Kemano.

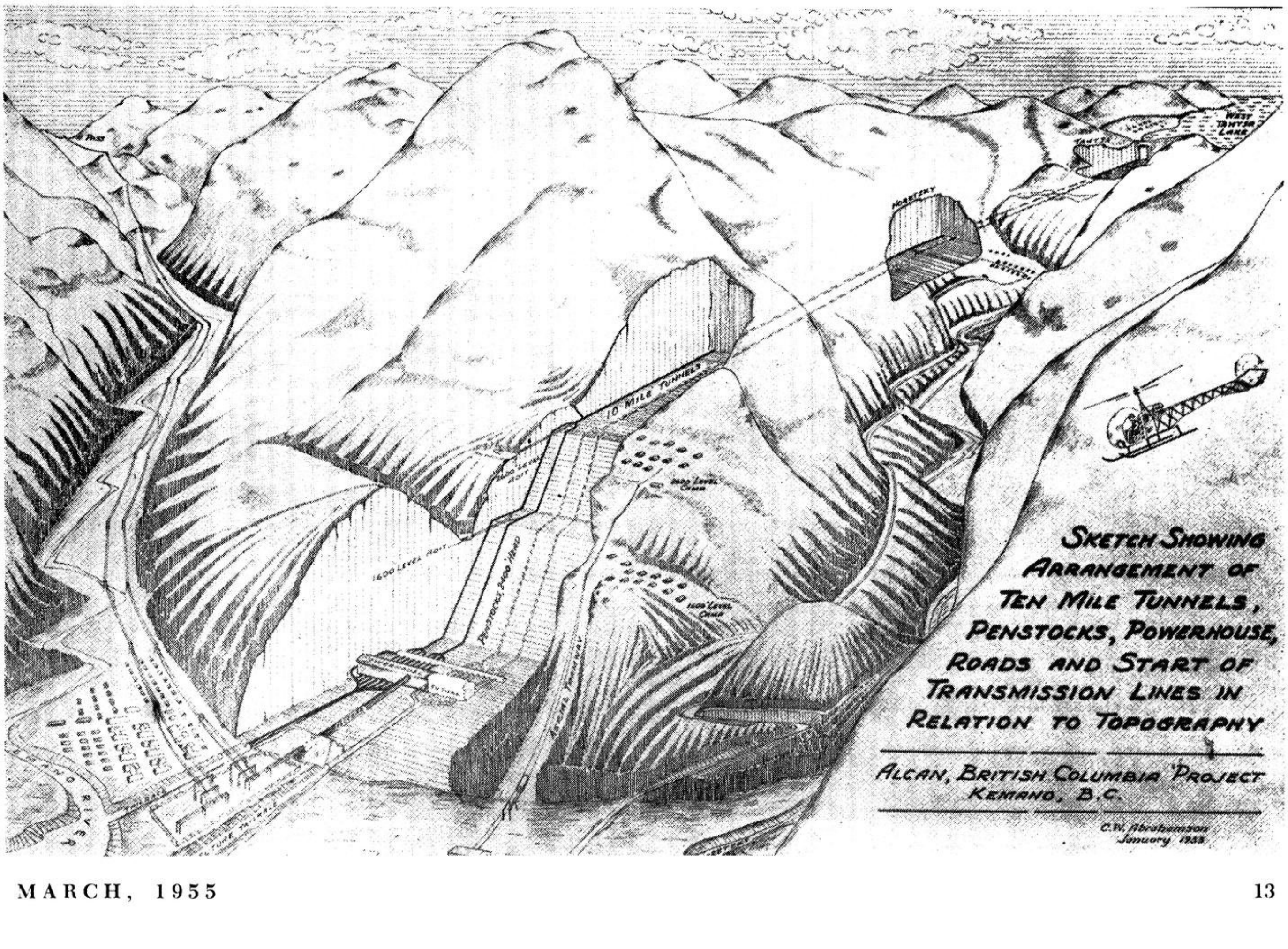
At the west end of the power project the first access was by boat and barge to the delta of the Kemano River. This point was accessible to tidewater shipping, and temporary dock facilities were started in March of 1951. All of the supply of materials to this location was by boat or barge and much of the personnel movement was handled by airplane from Vancouver.

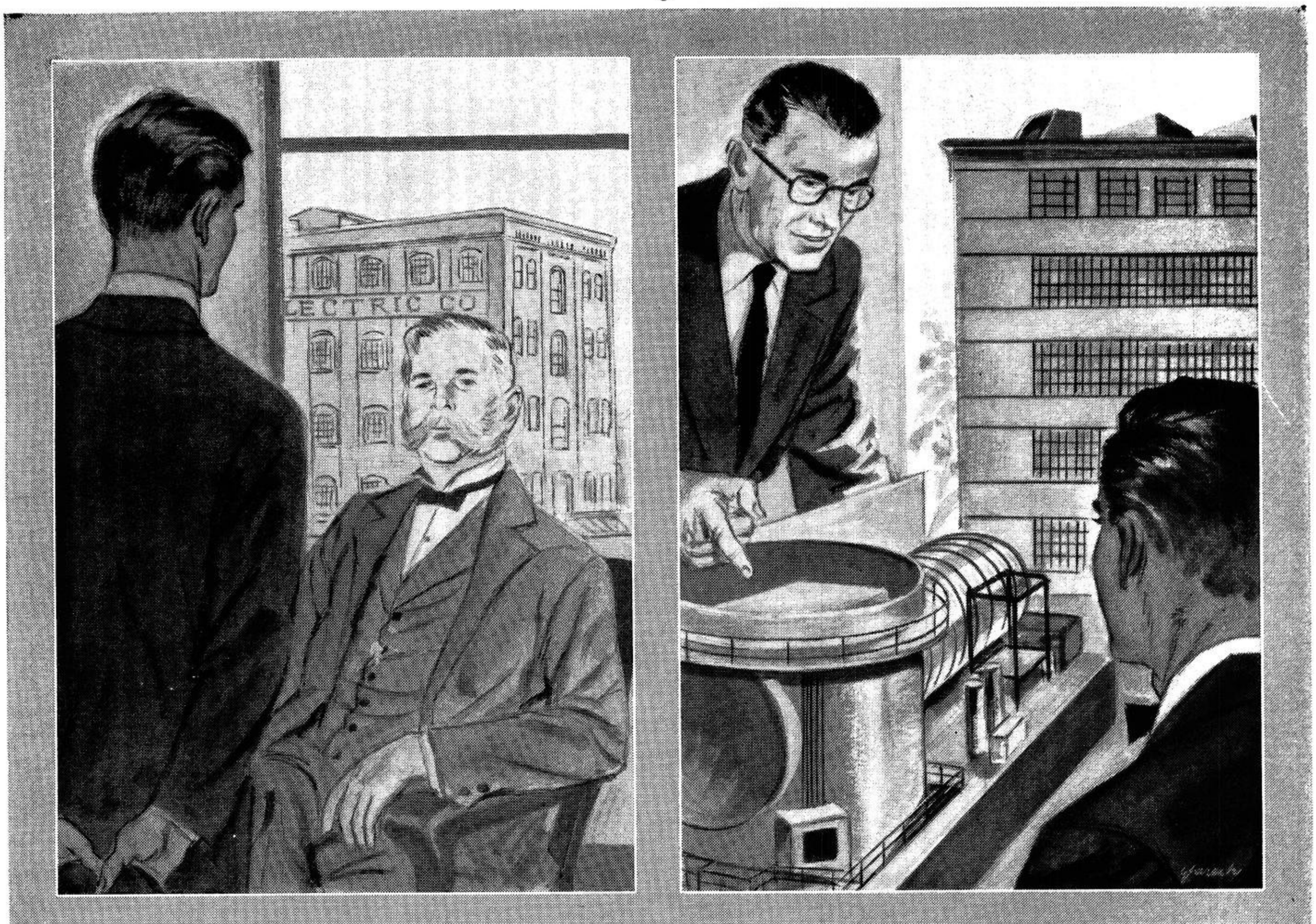
From the port at Kemano an eleven-mile road was built along the river to the powerhouse site. This road, through muskeg and in a confined valley subject to flooding, was an extremely difficult construction job in itself. At the base of the mountain through which the tunnel will bring the water, near the underground powerhouse, the main construction camp and headquarters for the power-development construction were established (see fig. 1).

From this camp an access road was built eight miles up Horetzky Creek to the point where a horizontal

(Continued on page 52)

Fig. 2.—This schematic diagram gives an idea of the relative location of West Tahtsa Lake which feeds the turbines, the tunnel, and the transmission lines up the Kemano River to Kitimat.





Engineering graduates being interviewed at Westinghouse

. . . IN 1896 **. . . IN 1955**

Now . . . as in 1896 . . .
there's always room for ambition at Westinghouse

George Westinghouse was the first recruiter of engineering college graduates . . . first to realize that ambitious young men, with the vision, drive and spontaneous enthusiasm of youth were the backbone of American industry.

Going further than recruiting, Westinghouse has led in developing programs for training and helping young engineers to reach their goals. Its famous Graduate Student Program first shows them the many opportunities open to them at Westinghouse, and then helps them take advantage of the one they choose. Its million-dollar Educational Center is the most advanced in industry.

Is it any wonder that much of the success of Westinghouse has been due to engineers who came as graduate students and later directed the Company's efforts.

Here's an example of Westinghouse leadership. The young engineer at the right is looking at the land-based prototype for our country's *first* atomic submarine engine . . . designed and built by Westinghouse . . . working with the Atomic Energy Commission and the U. S. Navy.

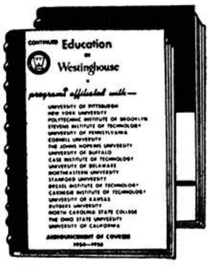
There can be a great future for you at Westinghouse. For professional development, Westinghouse offers its Graduate Study Program, available at 19 universities from coast to coast, and leading to Master's and Ph.D. degrees . . . plus other programs tailored to fit your needs and desires.

Yes, there's *always* room for ambitious men at Westinghouse . . . and we help them reach their goals. G-10284

YOU CAN BE SURE . . . IF IT'S
Westinghouse

Ask your Placement Officer about career opportunities at Westinghouse, or write for these two booklets: *Continued Education in Westinghouse* (describing our Graduate Study Program) and *Finding Your Place in Industry.*

Write: Mr. C. W. Mills, Regional Educational Co-ordinator, Westinghouse Electric Corporation, Merchandise Mart Plaza, Chicago 54, Ill.



WISCONSIN SOCIETY OF PROFESSIONAL ENGINEERS

W. S. P. E.

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Pierce G. Ellis, *Past President*
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Edwin J. Kallevang
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ENGINEERS' CREED

As a professional engineer, I dedicate my professional knowledge and skill to the advancement and betterment of human welfare.

I PLEDGE

To give the utmost of performance, to participate in none but honest enterprise, to live and work according to the laws of and the highest standards of professional conduct. To place service before profit, the honor and standing of the profession before personal advantage, and the public welfare above all other considerations. In humility and with need for Divine Guidance, I make this pledge.

Twelfth Annual Meeting of W.S.P.E. Held

The twelfth annual meeting of the W.S.P.E. was held in Milwaukee, January 27–29. The sessions began with a meeting of the board of directors on Thursday afternoon followed by the traditional get-together and a buffet supper in the evening. On Friday morning the functional groups met following a kickoff address by George P. Steinmetz, president of W.S.P.E. after lunch, the group was addressed by Dr. Allen Abrams, vice-president of the Marathon Corporation, Rothschild, Wisconsin. His talk, "Retire or Reorient?", was well received. There followed a business meeting during which time the various officer committee, and functional group reports were delivered. The annual banquet was held in the evening. During the banquet Hans P. Dahlstrand was presented with the "Outstanding Engineer" award. The highlight of the three day meeting came on Saturday morning when a panel of prominent engineers discussed vital subjects pertaining to the Professional Engineering Society. In the afternoon the group was addressed by Leo E. Brown, executive assistant in Public Relations, American Medical Association, and Don Hyndman, Director of Public Relations, American Bar Association. The group enjoyed both talks very much.

There were 175 registrations received for the meeting.

At their meeting on Thursday, the board of directors took care of the following business:

1. Passed a resolution commending the Wisconsin Bureau of Personnel and the Industrial Commission for making it a requirement that anyone applying for the position of Director of Safety and Sanitation, which was left open due to Mr. Nelson's retirement, be a Registered Professional Engineer.

2. Appointed John Gammell, director of graduate training at Allis Chalmers Manufacturing Co. in Milwaukee, as a member of the University Cooperating Committee.

3. Authorized Owen Ayres, first vice-president and president-elect for the coming year to represent W.S.P.E. at the various state societies presidents' conference to be held March 18 and 19 at Champaign, Illinois. George Steinmetz, present president of the society, attended last year.

4. The board accepted an invitation from the Fox River Valley Chapter to attend their chapter meeting at the Elks' Club in Appleton on February 24 at 6:30 P.M. The meeting was an anniversary meeting and honored Engineers' Week. Highlight of the meeting was an address by Virgil Gunlock, vice-president of N.S.P.E.

5. The board accepted an invitation from the Michigan State society to attend their annual convention being held June 9, 10, 11 at Port Huron, Michigan. One of the features of the convention will be the pay off on the new members contest between the Michigan and Wisconsin societies. Michigan eats cheese if Wisconsin loses and Wisconsin eats pancakes if Michigan loses.

6. The board accepted applications for 52 new members to the society, largest number ever approved by the board at one time. That, along with the 71 previously approved members this year makes a total of 123 new members as compared with 92 for last year.

Engineers, their wives, and guests were delightfully entertained at the traditional get-to-

(Continued on page 18)

Meet the Presidents

MERLIN A. EKLUND
Western Chapter

Merlin A. Eklund, president of the Western chapter, has worked for the Northern States Power Company since 1941 except for a two year period from 1943 to 1945 when he was a civilian instructor at the Virginia Military Institute, Lexington, Virginia. There he taught courses in physics, mathematics, and electrical engineering and also received a citation for outstanding instruction in an engineering problems course. Mr. Eklund is currently employed as an electric distribution engineer for the Northern States Power Company in La Crosse.

Born in Peshtigo, Wis. on September 9, 1918, Mr. Eklund studied electrical engineering at the University of Wisconsin where he received a B.S. degree in 1941. He is a member of N.S.P.E., Wisconsin Utilities Association, vice-president, past president, and program chairman of the Webster School P.T.A., a member of St. Paul's Lutheran Church, and a committeeman for the cub scouts of Webster School.

Mr. Eklund was married to Dolores Hering of Eau Claire in 1943 and they now have an 8 year old son, Steven. For recreation, Mr. Eklund enjoys fishing and woodworking.

W.S.P.E.

(Continued from page 16)

gether on Friday evening. An electronic trio orchestra composed of Theodore Canepa on bass viol, Carl Minor on sax and Edward Leidy, accordion provided enlightening music for the group as did the popular Milwaukee Police Quartet made up of Henry Kresnicka, lead, John Maher, tenor, William Brands, baritone, and Alvin Pfeiffer, bass. The group was also entertained by Fred W. Steffan, a commercial artist for the Schlitz Brewing Company, who sketched caricatures for it. Mr. Steffan recently designed the new city of Milwaukee flag.

'No Magic Retirement Age,' Engineers Told. "Reconversion, reorientation, or diversification—but never retirement."

That is the way older employees should look at the years ahead, according to Dr. Allen Abrams, vice-president of the Marathon Corp. who addressed the group after the Friday luncheon. Abrams believes advanced years is the time when men should realize:

"Good judgment suggests that we shift gradually from highly active pursuits to those which demand less and which follow our inclinations better."

Abrams pointed out there is no magic age which is best for retirement, because people are quite different in makeup. He suggested that a sensible criterion for retirement should be the physical and mental condition of the individual.

The greatest problem is preparing oneself for the change-over from active to passive business life, Abrams said. He stressed the need for sound and serious planning for retirement. Among the important facts to be considered long before the retirement date, he said, are:

Health. Act your age and begin to do everything at a slower tempo and in moderation.

Finances. Plan as far as is possible to have a little something to fall back on to augment your retirement pay.

Hobbies. Not necessarily the usual handyman tasks, but something or things which you've always wanted to do. This will turn you away from negative thoughts and stimulate your creative talents.

Abrams suggested that the newly retired person take a month's vacation with his wife away from home, just to get used to the slower routine. Then, upon return, move right into the interesting plans you've formulated and keep busy.

Convention Reports

At the business meeting on Friday afternoon, the following reports were given:

President's Report. President Steinmetz gave a full report of the year's activities. He commended the Interprofessional Committee on its work with the Architects Committee. He also mentioned the Ethics and Practice Committee in regard to the requirement of being a Registered Professional Engineer for certain public jobs. He commended the publicity chairman for the excellent publicity for the society. He made special mention of the excellent quality of the *Newsletter* and the work of the *Wisconsin Engineer* for the "Meet the President" series and the inclusion of the Engineers' creed in the magazine. To give some idea of the amount of work involved in publicizing the society, he mentioned that it was necessary in a two year period to write 90 letters to some 300 people and to collect and edit 62 pages in 8 issues of Newsletter material and 80–90 printed magazine pages in 16 issues of the *Wisconsin Engineer.*

Fees and Classifications Committee. The committee gave a report on salaries currently offered to graduating engineers and federal and state engineers. It also discussed the changes in wages paid to industrial workers and the influence of existing salary scales on the professional status of the engineer. The committee's full report will be published in the April issue.

National Representatives Report. The society's national representative, Edwin J. Kallevang, reported on the new headquarters building in Washington, D. C. He mentioned that the land has been purchased and paid for. Out of the $450,000 needed for the building, said Mr. Kallevang, $300,000 has been raised through the sale of bonds. The bonds are of $100 denomination and have an interest rate of 4%. He urged all who are in a position to buy them to do so.

Secretary's Report. Secretary Wagner gave a full report of his activities for the past year and stressed the amount of work necessary to take care of a growing society. He mentioned that it would be well to consider obtaining a full time secretary in the near future.

Treasurer's Report. Treasurer Cottingham gave the following statement of the financial condition of the society as of December 31, 1954:

FINANCIAL STATEMENT FOR THE YEAR 1954

Assets:		
Cash	$ 2,699.15	
Bond Purchase Value	2,866.00	
Total Assets		$5,565.15
General fund balance 1/1/54	$ 4,509.38	
1954 Net Gain	1,055.77	
Balance of Balance of gen- general fund 12/31/54		$5,565.15

SUMMARY OF OPERATIONS

General Operations:	
Receipts	$17,702.29
Remittances	10,823.25
Available for general operations	$ 6,879.04
Conventions:	
Receipts	$ 2,589.50
Expenses	2,703.53
Loss	$ 114.03
Net Gain:	
Bank account	$ 335.77
Bond purchase	720.00
	$ 1,055.77

ANALYSIS OF CASH

Balance, January 1, 1954 ..		$ 2,363.38
Receipts:		
General Receipts ...	$17,702.29	
Convention Receipts ...	2,589.50	
Total Receipts		20,291.79
Sub-Total		$22,655.17
Disbursements:		
Remittances ..	$10,823.25	
Convention Expense ..	2,703.53	
Expenses of Committees	1,937.38	
Expenses of Secy's Office	3,129.23	
Purchase of Bond	720.00	
General Expenses ..	642.63	
Total Disbursements .		$19,956.02
Balance, December 31, 1954		$ 2,699.15
Add:		
Outstanding checks		120.50
Bank Balance December 31, 1954		$ 2,819.65

Legislative Committee Report. Much of the report was confined to discussion of the Land Surveyors Registration Bill of which each member has a copy and which has been discussed much before. The committee reported on the various changes made in the bill in order that the bill will be supported by the society.

Nominating Committee Report. The committee gave a report on those nominated for office.

The following nominees were elected:

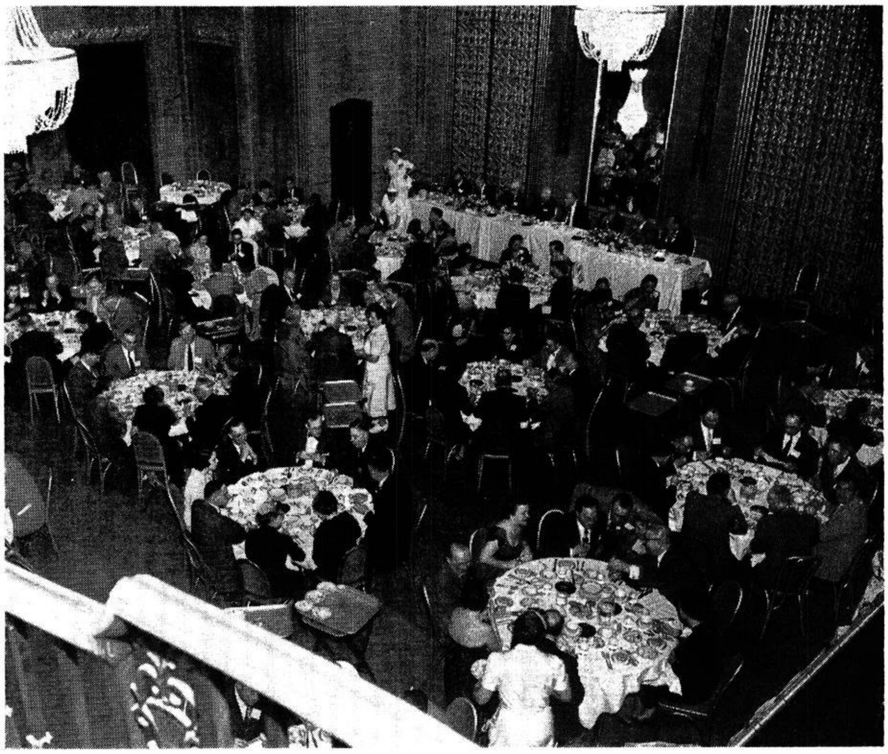
President—A. O. Ayres, Eau Claire
First Vice-President—Arthur G. Behling, Milwaukee
Second Vice-President—Anthony L. Genisot, Rhinelander
Secretary—Harold Kingsbury, Madison
Treasurer—Willard S. Cottingham, Madison
Director—Frank L. Carlson, La Crosse
Director—Harold Trester, Oshkosh

Membership Committee Report. The following report was delivered by the Membership Committee:

The objective of the Membership Committee is to enroll every resident Wisconsin P.E. and every Wisconsin E-I-T in WSPE at the earliest possible date. To do our share this year our first step was to prepare and send out our Membership Campaign Plan to all chapter chairmen. This was done in July which we hoped would be soon enough to retain some of the momentum gained last year. The Plan covered seven parts:

(1) A Review of Prospects.
(2) The Assignment of Chapter Quotas.
(3) Information on Use of Last Year's Working File of all P.E.'s and E-I-T's not yet in WSPE.
(4) Information on the Use of Promotional Material.
(5) Suggestions for Assignment of Prospect Cards to Solicitors.
(6) Filling out of Prospect Cards to indicate action taken.
(7) and Finally, as often and promptly as possible, the forwarding of the properly filled in application blank and appropriate fee to Secretary Wagner.

University Cooperating Committee. The committee reported on its work with U. W. concerning the possibility of increasing the engineering curriculum from the present 4 years to 5 years.



This photo, taken at the Friday night banquet, shows some of the members at the annual meeting of WSPE held in Milwaukee on January 27–29.

Ethics and Practice Committee. The committee gave its report on ethics relating to the engineering profession. The committee pointed out that over a period of years definite codes of ethics have been formulated to govern the professional practice of engineers. It also brought up several pertinent problems in ethics and practice.

Public Relations Committee Report. The committee gave a short report on the activities of the public relations committees of the various chapters in the state with reference to the news coverage of the society. Public relations activities are published frequently, so a complete review is omitted here.

Interprofessional Relations Report. The committee gave a report on the "Code of Interprofessional Practice" for the architects and engineers of Wisconsin which was adopted at the state meeting. The code, two years in the making, was developed by the Joint Committee on Interprofessional Relations which consists of six architects from the Wisconsin Architects Association and six engineers of W.S.P.E.

The functional groups also gave their reports at the Friday afternoon business meeting. The various group reports in brief follow:

Industrial Group Report. The general discussion of the group was built around the current problems of Professional Engineers in industry. The problem of engineers in key positions not being registered was discussed. Dean Wendt brought out that in most cases these people could qualify for the positions without taking exams if they are 35 years of age or over. The group commended the State Board of Registration for their work in the past year.

Education Group Report. The group concerned itself with the problem of whether the present engineering courses of 4 years be lengthened to 5 years. It was felt that in this way the students would be given a chance to take more liberal arts courses in order to broaden their backgrounds and learn better how to get along with other people.

Public Employment Group Report. The group talked about whether a requirement for some public positions be that the applicant be a P.E.

Consulting Group Report. The group discussed ethics in engineering practice and fees and classifications of jobs. It brought out that the engineering profession should strive to be more honorable such as the medical and law professions.

"MR AND MRS. ENGINEER"

Dr. Fred Replogle, of Rohrer, Hibler and Replogle, Chicago, Illinois addressed the Professional Engineers, their ladies and guests at their Annual Banquet held at the Schroeder Hotel in Milwaukee on Friday evening, January 29th. The subject matter of Mr. Replogle's most interesting talk, which concerned industrial psychology, was almost as broad as its title: "Mr. and Mrs. Engineer".

Mr. Replogle pointed out that there are no good measures of "intelligence" and that an individual's ability to get things done was not closely related to his so called "I.Q." Some people are very logical in their approach to a problem. Others don't think straight and are "just thrown together very loosely". Both may have a very high degree of intelligence and both may be very successful in their proper field. The important thing is that the individual has enough gray matter to do the things he is supposed to do.

Mr. Replogle stressed the fact that human relations start in the heart and not in the head, and that we can hardly expect to have good international relations until we learn to have good interpersonal relations. We need to exert more effort in finding out what the other fellow is trying to accomplish when he appears in opposition to our ideas, rather than ignoring or avoiding him. He also expressed some fear that we are developing such a high degree of specialization in dealing with "things" that it is hard to find good managers of people.

THE PROFESSIONAL ENGINEERING SOCIETY

WHAT IS IT DOING—
WHAT SHOULD IT DO—
FOR YOU?

Seven prominent engineers appeared as a panel at the state meeting on Saturday morning and discussed various activities of the Professional Engineering Society.

Kurt F. Wendt, Dean of the College of Engineering at the University of Wisconsin, discussed "Activities Relating to the Engineer in Education."

John Gammell, director of graduate training for Allis-Chalmers in Milwaukee talked about getting more students in high school to take more science and mathematics courses in order that they be better trained for the engineering profession.

Henry J. Hunt, vice-president of Mead and Hunt, Inc., consulting engineers, Madison, Wis., discussed the activities of the society relating to the consulting engineer.

William F. Steuber, assistant engineer for the Wisconsin State Highway Commission told of the activities of the society in relation to the publicly employed engineer.

Louis J. Larson, consulting welding engineer for Allis-Chalmers Manufacturing Co. in Milwaukee discussed the society's activities with reference to the industrially employed engineer.

Roy A. Griffith, director of engineering, Transistor Division of the Minneapolis Honeywell Regulator Co. talked about raising the Co. talked about raising the standards of the engineering profession. He brought out many good thoughts on getting young engineers to be less like laborers and to be more professional in their work.

"Unity Begins with You" was the subject of the talk given by Edwin W. Seeger, vice-president and assistant secretary of Cutler–Hammer, Inc., Milwaukee. Mr. Seeger told of the vital need for unity in the engineering profession saying, "We need common objectives in order to concentrate our activity and influence."

A full development of some of these talks will be presented in the April *Wisconsin Engineer.*

ENGINEERING EXAMINATIONS

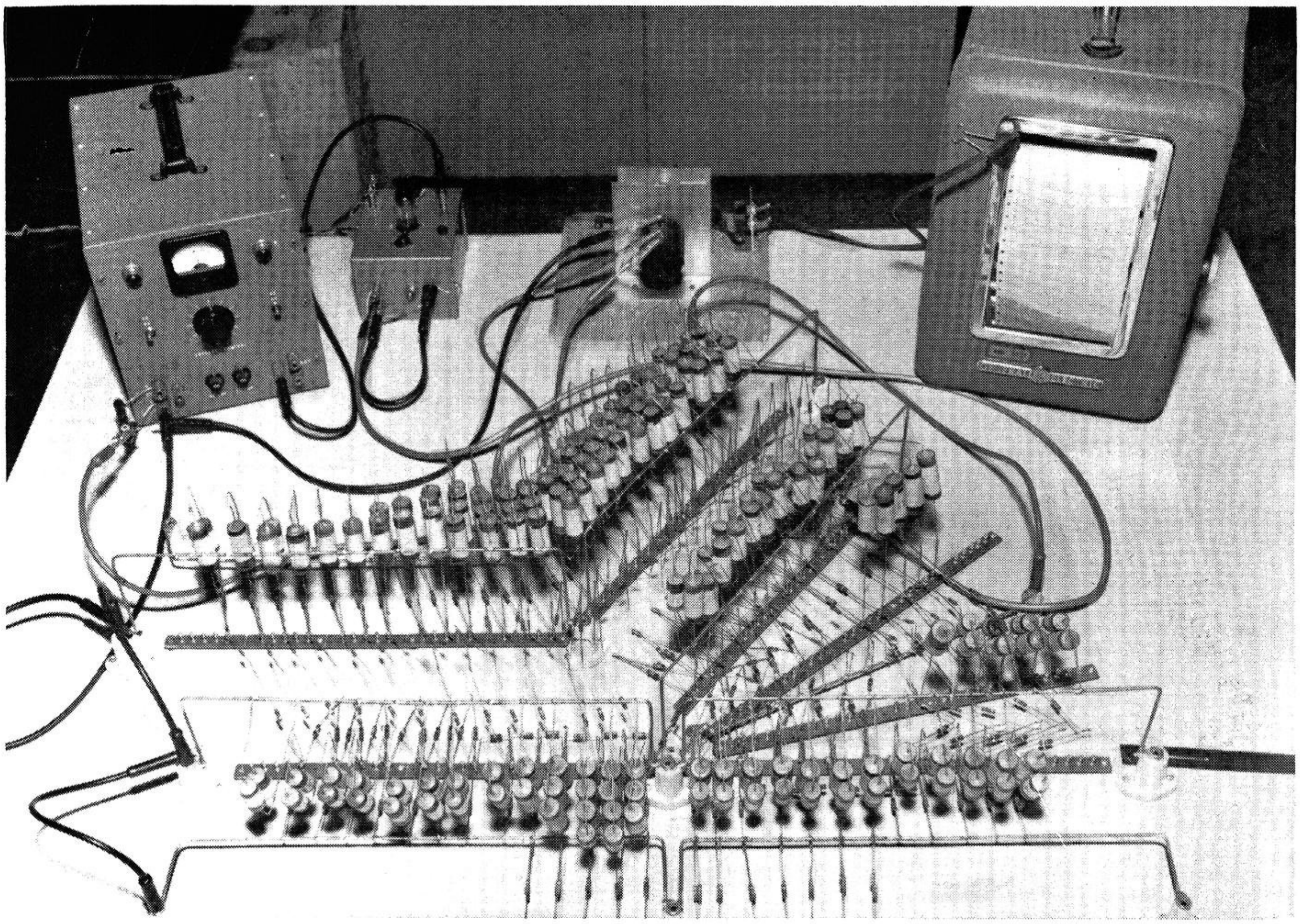
The Wisconsin Registration Board of Architects and Professional Engineers have announced the dates of their next Engineering Examinations as June 14 and 15, 1955. To be eligible for those examinations, application must be on file in the Board's office on or before April 15, 1955. Application forms and information may be obtained at or by writing to the Board's office, 1140 State Office Building, Madison, Wisconsin.

NEW MEMBERS

Following is the new list of members admitted January 27, 1955:

Fox River Valley	*Sponsored by*
Leonard A. Montie	George Martin
Walter Hirchert, Jr.	C. W. Rollman

(Continued on page 62)



This analogue computer, a pioneer in this age of "thinking machines", was developed by Standard Oil scientists.

New Electronic "Engineer" Solves Tough Refinery Problem

THE MEN who design modern oil refineries need specific information about temperature distributions in different parts of pressure vessels. Such information, essential to safety and efficient operation, is often extremely difficult to obtain by conventional mathematical methods.

Scientists at Standard Oil's Whiting laboratories recently developed and built an electrical analogue capable of simulating specific conditions within a refinery unit still in the design stage. Using this device, they could determine in advance the temperature distribution in the joint between two pressure vessels having a common head. Thus they were able to duplicate in 20 seconds the heat stress picture within the unit during an 8 hour start-up to shut-down period.

Creative scientific thinking made possible this constructive achievement by engineers who have chosen to build their careers at Standard Oil.

Standard Oil Company

910 South Michigan Avenue, Chicago 80, Illinois

STANDARD

Above: Chemical Engineering Building on the left, Electrical Engineering, right. The space between these two will eventually be occupied by the final section of the New Engineering Building.

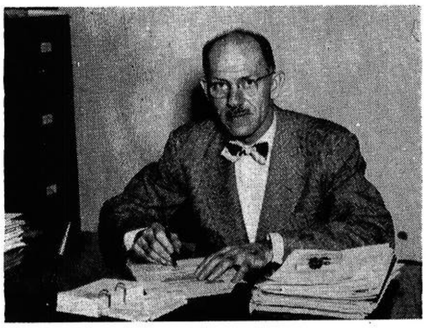
Right: Mechanical Engineering.

High School Section

When you look through the next fifteen pages of the *Wisconsin Engineer* you'll come across descriptions and explanations of interest to engineering students both present and future. The several articles point out the need for more engineers and also the significance of the engineer's role in our technical society. Each of the five engineering departments is represented by a photo of some representative phase of that branch, and by a piece from the department chairman on the training and jobs to be had in the branch. The Section is concluded with a series of questions typical of those asked by high school students thinking of enrolling in engineering school. The *Wisconsin Engineer* hopes that many of you high school seniors who read the magazine will decide to enroll in the college next fall.

The Engineering Profession

by Kurt F. Wendt
Dean, College of Engineering



KURT F. WENDT

What is engineering? What does the engineer do? Should I be an engineer?

Engineering is both an art and a science directed toward the adaptation of materials found in nature into useful forms, and the harnessing and conversion of natural forces into useful power by efficient and economical means.

The profession is divided into five major fields: chemical, civil, electrical, mechanical, and mining and metallurgical engineering, each with many subdivisions.

Manufacturing or processing of substances from raw materials through carefully controlled chemical and physical changes comprise the field of chemical engineering. The main divisions are: (1) unit operations, including such physical problems as transportation of fluids and solids, heat transfer, absorption of gases, drying, distillation and filtration; (2) unit processes which involve making changes through chemical reactions; and (3) process control and instrumentation.

Civil engineering is the oldest branch, and at one time included all engineering of a non-military character. The main divisions are structural, sanitary, hydraulic, and transportation engineering. Our great buildings, bridges, dams and tunnels are designed and erected by the structural engineer. Water supply and sewage disposal systems are the concern of the sanitary engineer. The control and distribution of water for power, irrigation, flood control, and water supply are in the field of hydraulics. The transportation engineer designs the roadways and terminal facilities for motor vehicles, railroads, and aircraft.

Electrical engineering has two main divisions: the generation, transportation, and application of electrical energy which is called power engineering; and the broad field of communications and electronics which includes telegraph, telephone, radio, radar, and television. The electrical engineer is responsible for furnishing much of the power used in industry, for lighting of all types, for the design of many labor-saving devices in our homes and for much of the control equipment of modern industry, for medical equipment such as x-rays, and for such interesting developments as the new high-speed electronic computers.

The mechanical engineer deals chiefly with the design and construction of machines for the generation or transformation of power, and for the production of other machines. Power generation, particularly steam power, internal combustion engines, tools and machinery, heating, ventilating, refrigeration and industrial planning are the common subdivisions within the field.

The mining engineer searches for and extracts all classes of minerals from the earth. The field naturally divides itself into three parts: mining geology, concerned with discovery and exploration; mining engineering proper, involving design, construction and operation of plants for the recovery of ore from the earth; and mineral dressing, dealing with the development and operation of processes for the separation of the valuable minerals from associated wastes. The metallurgical engineer is concerned with the extraction of metals from their ores and in the subsequent refining and combination of metals to produce alloys possessing special properties.

The functional divisions of engineering are: administration, planning and design, sales and consulting, construction and installation, production and operation, research and development, and teaching. Nearly one-third of all engineers rise to administrative positions where their primary task is to direct the work of others. About 40 per cent of all industrial executives are engineers. In such positions the ability to deal with human and business problems is of paramount importance. Supplementing engineering courses with training in commerce and law, either while in college or later, can pay handsome dividends.

Whether the division is by fields or by function there are no hard and fast lines of demarkation. Many areas of work and a large variety of duties are common to several divisions. For this reason you will find many courses common to all engineering curricula. As in any profession, success in engineering demands integrity, industry, perseverance, courtesy, and good personality. In addition, interest in and aptitude for mathematics, the sciences, and written and oral expression are of primary importance. If you possess these qualities and aptitudes and find the duties of engineers attractive you can become a successful engineer. The demand for men and women with sound engineering training is great. The rewards, materially and in personal satisfaction, are substantial. **END**

Stop and Think

by W. R. Marshall, Jr.
Associate Dean

It is a well known fact, which can be verified from anyone's experience, that there are many dissatisfied people in the world today. They change from one job to another in the hopes of finding more happiness and satisfaction as well as more income. Did it ever occur to you boys and girls to stop and to ask yourselves why there are so many people in this group? I will tell you one reason, a very important one, and one which many of them could have avoided. They did not take time in high school to investigate all the vocations available for them, and then, most important of all, to decide into which one of these activities they should enter to find their greatest happiness and success in terms of their abilities and interests.

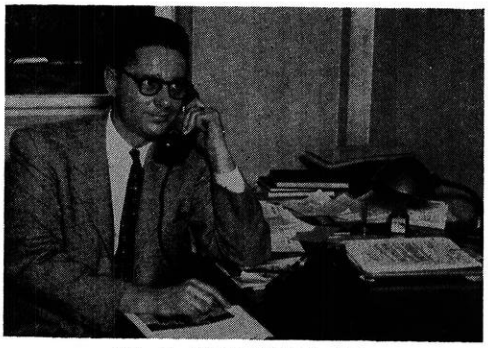
People have to settle on things for themselves. High school students usually delay this decision until college. College students never find time to arrive at a conclusion. The result is just what we have observed—dissatisfied and "drifting" men and women.

Today, my young friends, in this greatest of ages of rapid development, the first thing you should do is to be sure that you are taking the subjects in high school which will enable you to enter a general or specialized university course. You can do this without omitting any particular subject you may enjoy if you care to work hard enough. Now you may say to me, "I don't know what I want to be." My answer to you is that nobody else was 100% sure that he did, when he was your age. That is just why you should consider my suggestion very seriously.

Your vocation may be in a religious, technical, professional, or business field. At the last minute in high school, you suddenly make a positive and final decision, and then the question, Will you have the required credits in your high school course to enter the college or university which will prepare you best for your chosen vocation? My advice to you, based on the many years of experience of our freshman advisors with thousands of students like you, is: Take invoice NOW; be SURE.

Now let us assume that you make the decision to be an engineer and to come to the College of Engineering at the University of Wisconsin.

On your arrival one of the first things we will check with great care is your preparation in English. Engineers must be masters of English because technical reports must not only be informative, they must be concise and accurate; they must convince others. As an engineer you may have to address groups of people; you must guide the thinking and activities of others in carrying out important engineering projects. Your use of spoken English must, therefore, be of the highest



W. R. MARSHALL, JR.

quality, and your thoughts logically expressed. Mathematics is the language of the engineer in his specialized field. You will need at least three years of mathematics and, if you have four, your first year work in college will be easier. Science is important because you should have a knowledge of the laboratory method before entering college. A year of physics or a year of chemistry or both, if possible, are very desirable. Besides these technical prerequisites, an engineer should have as much foreign language, history, and social studies as his high school can provide. By all means have some sport as a hobby. Do you now see what a wide field is left open to you for making your own choice of subjects? Would it surprise you, were I to tell you that if you presented the above program you could fit into almost any vocational field? So you see that it is not difficult to be SURE now, and to be PREPARED to carry out any decision you may make, when you are ready.

To be an engineer requires special interests and abilities. The student must be willing to devote his time eagerly to intensive study and never give up regardless of how hard the work becomes. Not everyone has the determination and perseverance required to do this. Unless you have, you will never be an engineer.

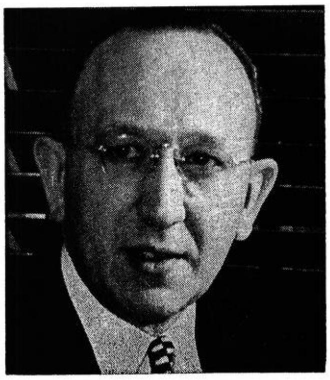
An engineer must also be willing to accept the great responsibility he must assume for the welfare of others. He is devoted to the study of the best-known engineering methods, to the discovery of better ways to protect his fellow man in time of danger, and to develop his sources of supply and leisure for more purposeful, satisfactory, and happy living in times of peace. I am sure you can readily see that to do this an engineer needs the most rigorous type of specialized training. Without a good high school foundation, no one can start such a program in college.

Besides the specialized training which is required of an engineer, it is essential that he have a broad general education. People do not always reason out that

(Continued on page 56)

Jobs for the Engineer

by H. G. Goehring
Placement Director



H. G. GOEHRING

During the past several years there has been an increasing demand for engineers. The supply of engineers decreased annually during this period, reaching the low point with the graduating class of 1954. During that year it appeared the demand was becoming stabilized. However, the demand for the 1955 graduate is greater than at any time in the past, and from all indications will continue to exceed the supply for several years. Salaries for inexperienced engineers are continuing to show a slight increase, but give indications of leveling off at a slightly higher figure than that offered during the spring of 1954.

Let us look first at the supply. In 1949 approximately 600 students were awarded Bachelor of Science degrees in Engineering at the University of Wisconsin; in 1950 there were 800 such awards; in 1951, approximately 555; in 1952, slightly more than 400; in 1953 about 330, in 1954 about 275 and in 1955 there will be approximately 325. Similar conditions exist in engineering colleges throughout the country. Enrollment in the class entering in the fall of 1951 showed an increase over the preceding year and that of 1952 exceeded that of the previous year by approximately 50%. Enrollment in the fall of 1953 showed an increase of approximately 15% over 1952 and in the fall of 1954 another increase of about 17%. The interest evidenced by high school seniors indicates continuation of high enrollment in engineering. The first substantial increase to be felt through larger graduating classes will be experienced during 1956 when it is anticipated the class will approximate 450.

Looking at the demand, a survey conducted by the Manpower Committee of the American Society for Engineering Education shows that this country needs a minimum of 30,000 new engineers annually and that the total number graduated in 1953 was slightly over 22,000 and less than 20,000 in 1954. According to this study, the engineering profession needs 20,000 engineering graduates annually for civilian peacetime needs alone. In addition, the military needs must be added to civilian requirements.

What does this mean to the high school students about to select a college program? All young men to be graduated from high schools should carefully consider their capabilities in Mathematics and the Physical Sciences, their interests in these areas, and their overall high school records. Those who have made above average records in these studies should give considerable thought to engineering as a profession in the light of the excellent long range opportunities presented.

To the college graduate it should mean an excellent opportunity to find out by personal consultation the variety of opportunities available. Companies from all industries are sending representatives to the campus. During the first semester of the 1954–55 year 300 companies sent representatives to talk to approximately 100 mid-year graduates. Approximately 350 companies will be represented on the campus during the current semester. Here is an opportunity for the graduating engineer to learn about employment possibilities in practically any field. Many of these employment opportunities are with Wisconsin employers located both in large and small towns throughout the state.

Although many seniors are expecting to enter the armed services shortly after graduation, it is emphasized that the great majority of companies will offer employment regardless of the imminence of induction. Men so employed are granted military leave and their employment continues unbroken during this period. Even though induction into the armed services immediately follows graduation, the opportunity to establish contacts is available right on the campus. Such contacts can be renewed upon separation from the service much more easily than new contacts can be made.

Opportunities for summer employment are available in many sections of the country. Some of this work is correlated directly with training programs for the graduate and students electing these opportunities will gain worthwhile experience and receive good remuneration for their efforts. Other companies offer shop experience which provides an excellent background for engineering work in the future. Information on engineering opportunities including summer employment is available in the Engineering Placement Office, Room 261, Mechanical Engineering Building. **END**

Friend of the Freshman

by Prof. K. G. Shiels and Mary R. O'Keefe

PROFESSOR SHIELS AND MISS O'KEEFE

The academic affairs of the freshmen in the College of Engineering are administered by the freshman advisor office which is responsible for the registration, advising, counseling and scholarship of the freshmen students. When the prospective engineers report for Freshman Period at the University of Wisconsin next September, they will find that their advisor office has been anticipating the student's arrival with considerable interest.

In following the schedule of events arranged for Freshman Period, the students will be given a variety of tests including the placement examination in mathematics. The advisor office tells all prospective engineering students to review their algebra during the summer before their freshman year so as to be ready for this important test which covers the material presented in one and one half years of high school algebra. Those failing this test are required to enroll in a non-credit course in algebra for one semester. The week of Freshman Period will clarify many questions paramount in the minds of students. Group meetings with their dean and with their freshman advisor will be helpful and enlightening. High school records will have been examined and students with need for special counsel will be called aside for individual conference before their program of studies is finally set up. Those with four units of high school mathematics and high achievement on the placement test may be called for group conference and informed of the opportunity to start in an advanced mathematics course. Finally every student has a schedule of classes arranged and Freshman Period comes to an end.

With the start of classes the engineering student finds that his lectures, recitations, laboratory periods, etc. fill up the most of his daytime hours and that his normal program of studies requires about thirty hours per week of preparation outside the classroom. He then realizes that the advice he has received to apply himself diligently to his studies and to organization of his time and efforts is sound. We might say that it is at this point the real work of the Freshman Advisor Office begins. Many students will need further conference to answer questions regarding financial problems, difficulty in a subject, or the need of a reduction in load due to the necessity of outside work for support. Some will feel the need of a place to come just for a friendly visit. At the six week point in the semester, all freshmen will call at the Advisor Office to receive their six weeks grades and conferences will be held with all students who are not doing satisfactory work. At these discussions every effort will be made to help the student make a successful adjustment to his college studies. Some will be referred to the Student Counseling Center for special help in developing better study techniques, in improving reading ability or in finding an educational objective. The student will learn that although every instructor stands ready to give him extra help, he must take the initiative.

Once each week throughout the first semester the freshmen engineers meet as a group for a series of lectures arranged by the Freshman Advisor Office and designed to help the students in their adjustment to college and to improve their understanding of the fields of engineering. Here the freshman will meet faculty members from all the departments of the engineering college and hear about the activities of engineers in the various branches of engineering.

The Freshman Advisor Office is sincerely interested in each individual student and in making their brief visit with you now while you are still in high school, we would like you to know that no question of a prospective engineer is too trivial to be given consideration and thought. We are looking forward to meeting you next September and to having your assistance in allowing us to know you and to help you with your problems. If you are on the campus at an earlier date, we would be pleased to have you call at the office located in Room 22 of Temporary 24 building for a visit.

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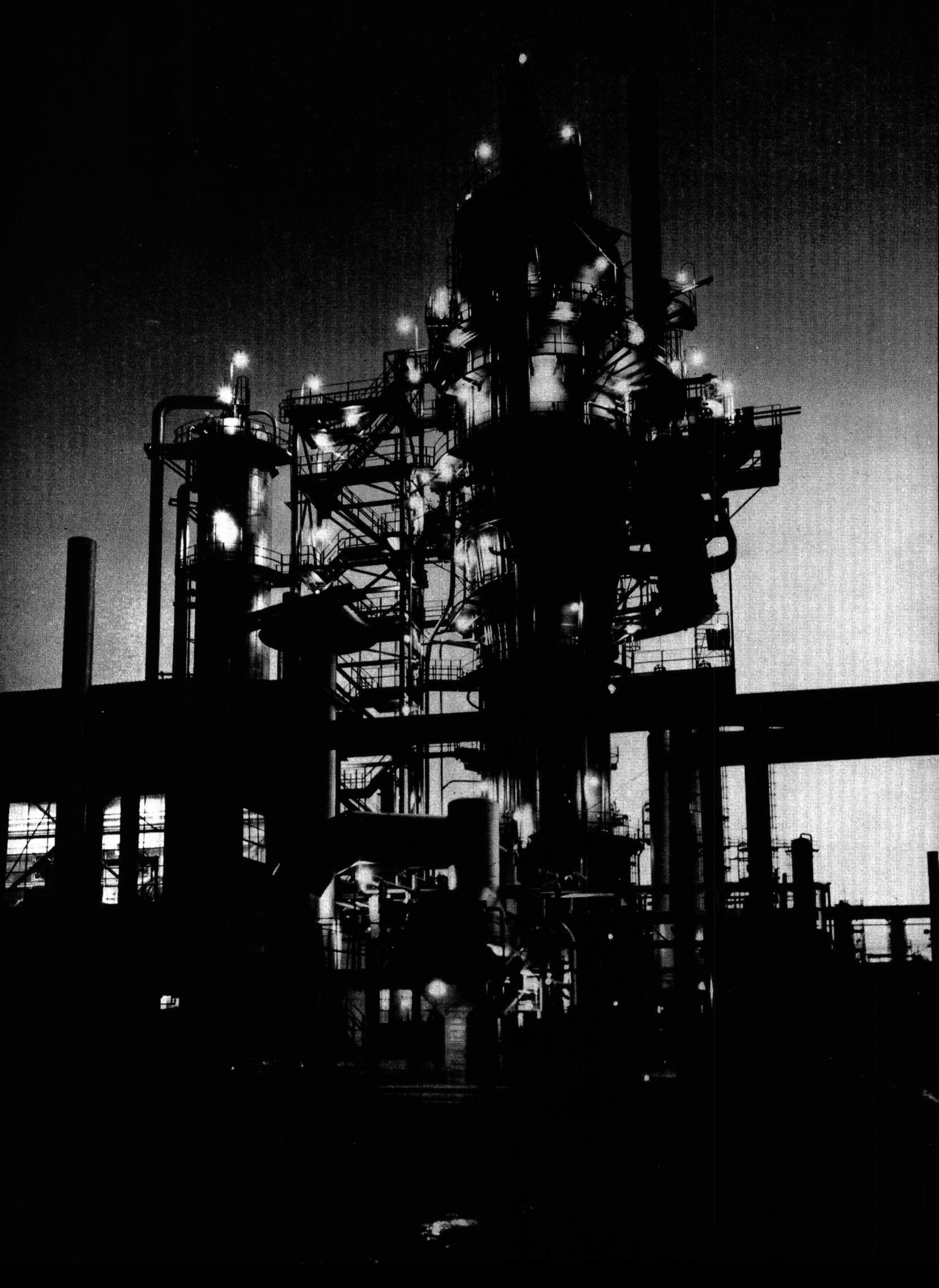
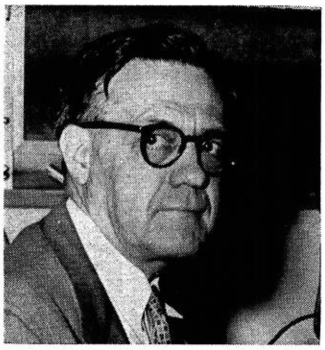


Chemical Engineering

by Professor Olaf A. Hougen
Chairman, Chemical Engineering Department



Prof. Olaf A. Hougen has been Chairman of the Department of Chemical Engineering since 1946. He is from Manitowoc, Wisconsin, and received his BS (cum laude) in ChE from the University of Washington. He has been with the University of Wisconsin since 1917, and received a degree of ChE and his PhD here. He is a member of AICHE, ACHS, and numerous other engineering societies.

This is a chemical age! During the past ten years the chemical industries of the United States have been expanding nearly three times as fast as the average of all other industries. For all industries in America the increase has been 1.75 fold; for the chemical industry the increase has been 4.5 fold. During these ten years, chemical production in the United States has increased from 4.3 to 17 billion dollars per year.

Another significant advantage of the chemical industries is that they are scattered among many small companies where personal initiative and responsibility count, and where the opportunities for personal gain are commensurate with individual enterprise. Contrary to common notions, the four leading chemical industries of America—E. I. duPont de Nemours and Company, Monsanto Chemical Company, Celanese Corporation, and Dow Chemical Company—control only 15 per cent of our chemical industry as compared with the steel industry, where four concerns control 75 per cent of production.

The average age of the chemical engineer in industry is only 30 years. This means that his responsibilities come early in life.

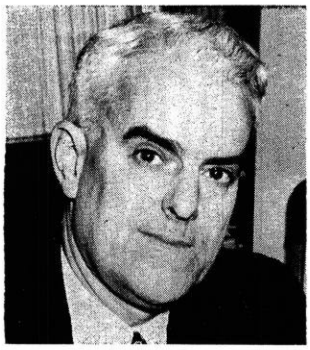
Chemical engineering deals primarily with the problems of chemical production and with any manufacturing process where chemical changes occur, as in the production of coal products, petroleum products, paints, pharmaceuticals, plastics, rubber. This list can be extended to a thousand products.

One prominent duty of the chemical engineer is to translate the work of the chemical laboratory into large-scale production, to design and operate a chemical plant under profitable conditions.

←——— Plate courtesy The Cornell Engineer

Civil Engineering

by *Prof. James G. Woodburn*
Chairman, Civil Engineering Department



Prof. James G. Woodburn has been Chairman of the Department of Civil Engineering since 1949. He was born in Bloomington, Indiana, and received his BA and MA from Indiana University, his BS from Purdue, and his PhD from the University of Michigan. He taught at the State College of Washington for several years before coming to Wisconsin. He has specialized in Hydraulic Engineering and the legal phases of engineering, and is co-author of the Hydraulics text used in several university courses.

The profession of civil engineering offers many employment opportunities for college graduates. Moreover, the number and variety of such opportunities are increasing with the growth of our population and the development of new inventions and processes.

Civil engineers have always been connected with the development of transportation systems. The great advance in the nineteenth century was in the building of our railroads, which still employ many engineers in both operation and maintenance. The mid-twentieth century sees continued expansion of highways, airlines, and pipelines. The growth of highway traffic that has resulted from population growth and establishment of new cities and industries has led to the rapid building of expressways and tollroads. The development of airports and allied facilities, not only in this country but all over the world, has been phenomenal. Pipelines are coming to be a highly favored mode of transportation for petroleum products and natural gas. The civil engineer occupies a prominent place in the planning, surveying, designing, constructing and operating of all these transportation facilities.

Another field that continues to be very attractive to civil engineers is that of structures. There is increasing demand for more housing, shopping centers, office space, public buildings, factories, and other structures of all kinds, both large and small. Civil engineers are associated with architects in the design and construction of large steel and concrete buildings, with contractors in the design and building of homes and apartments, and with public agencies in city planning, redevelopment of slum areas, and laying out of parks and playgrounds. Most spectacular in the field of structural engineering is the construction of great bridges. Many have been built, others are under construction, while still longer and larger ones are being planned for the near future.

With growth in population comes also increased demand for civil engineers to provide safe and adequate public water supplies and to build sewerage systems and treatment plants which will return waste waters to the streams in a form least harmful to fish and other wild life and most satisfactory from the standpoint of use of the lakes and streams by the public. Civil engineers design and build flood control works to prevent or reduce damage from floods, improve river channels for the benefit of navigation, and provide port facilities for both inland and foreign shipping. Water power plants are designed by civil engineers and built under their guidance. Many engineers are engaged in land reclamation, either by the draining of low swampy lands or by bringing irrigation water to dry lands from rivers or reservoirs through miles of canals and aqueducts.

Many civil engineers also find work as surveyors. Surveying is one of the first jobs to be done when an engineering project is undertaken. Surveys must be made to aid in determining the most economical and feasible routes for highways, irrigation canals, and pipelines. Such surveys have been greatly speeded by aerial mapping. There must be surveys of sites for bridges, buildings, dams, and airports. The proper laying out of housing and other municipal developments depends largely on detailed surveys of the proposed sites. Surveyors also locate property lines and determine areas, and thus help to settle disputes between land owners. Much of our country's area still remains to be mapped in detail and many surveyors are engaged in that work.

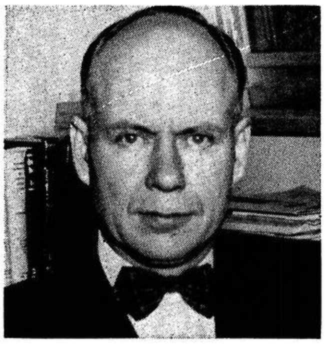
As with any profession, the future of civil engineering depends on maintaining a continuing supply of young persons who are eager and qualified to enter that profession. The usual road to becoming a civil engineer leads through years of training in a college of engineering. The colleges cannot operate without teachers, and there are many opportunities these days in the engineering teaching profession for young people who have done well in their college work, who have gone ahead to take graduate work, and who also have acquired some practical experience. **END**

← **Plate courtesy Georgia Tech Engineer**


Westinghouse

Electrical Engineering

by Professor H. A. Peterson
Chairman, Electrical Engineering Department



Prof. Harold A. Peterson has been Chairman of the Department of Electrical Engineering since 1947. He is from Essex, Iowa, and received his BS and MS (with high distinction) from the University of Iowa. He is a Fellow in AIEE, a Senior Member of IRE, and a member of several other engineering societies. He also holds eight patents in the field of electrical engineering.

Electrical Engineering is a young profession and, therefore, a young man's profession. In 1882 the first electric generators were put in operation. The first electric generator driven by a waterwheel was put in operation in Appleton, Wisconsin, on September 30, 1882. Since that time growth and development of the profession have been phenomenal. Today the American Institute of Electrical Engineers (AIEE) has over 45,000 members. This is more than any of the other founder societies. In addition there are over 37,000 members of the Institute of Radio Engineers (IRE).

A few generations ago, electricity was available in the homes of only a few. Today it is available in almost every home. Electrical engineers have been largely responsible for bringing this about. Today heavy tasks around the farm home, and other tasks in all homes, can be done quickly, efficiently, and without drudgery. The benefits of radio and television have been brought to many homes. These are some of the more obvious consequences of electrical engineering. Many others are less obvious and very complex such as the control of guided missiles, gunfire control, automatic pilots, transistors, and high speed electronic computing devices. Much imagination and keen insight along with advanced training in science and mathematics are required for creative work in these areas.

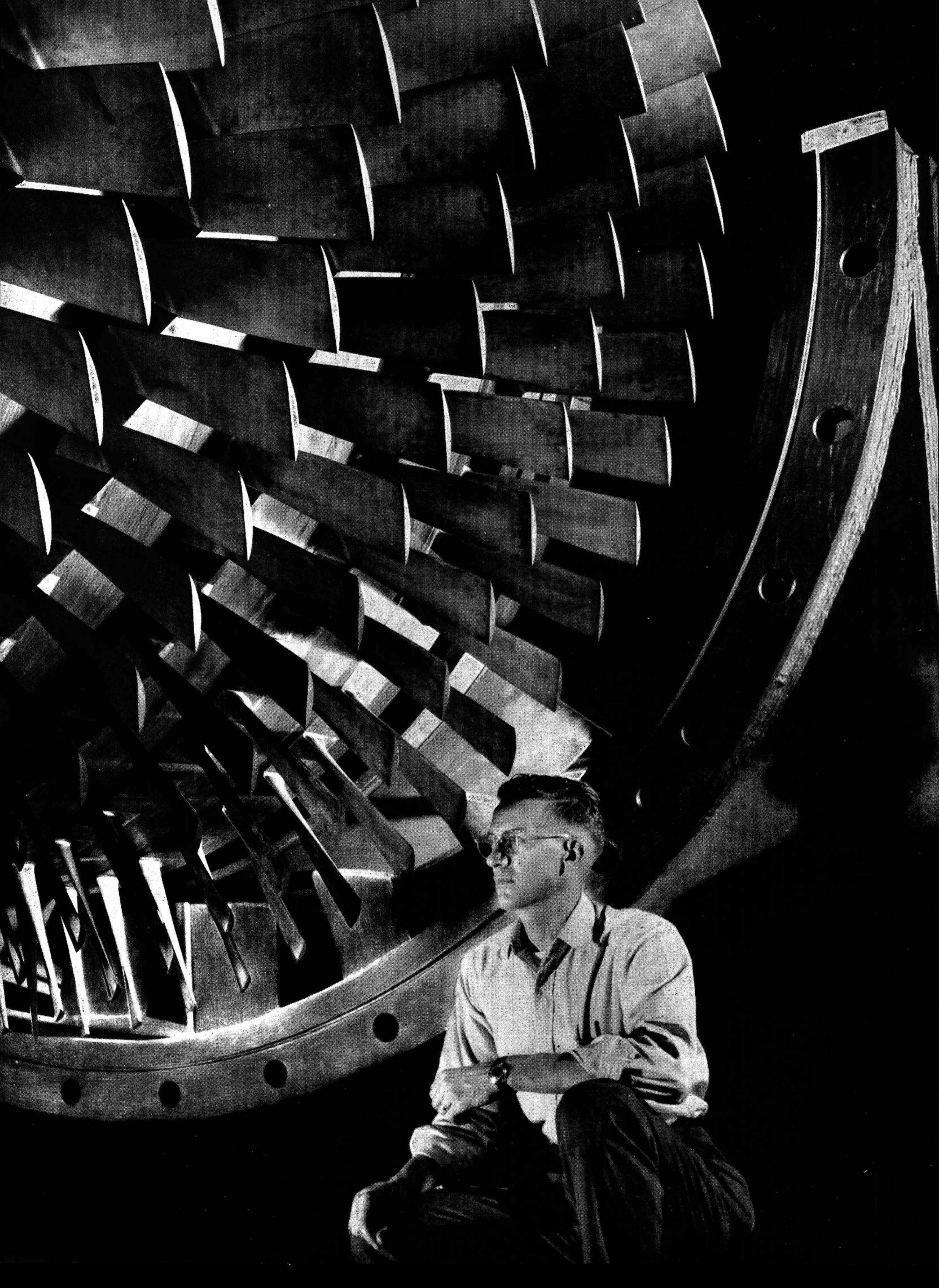
At the University of Wisconsin our facilities in the Engineering Building are among the best in the country. Our course of study in electrical engineering is constantly under surveillance so that improvements can be made from time to time to keep in step with the needs and demands of industry.

There is a joint student branch of the AIEE–IRE on the campus with a faculty member in charge as branch councilor. This student branch elects its own officers, holds regular meetings, and sponsors activities of interest to student engineers. It affords a means for orienting students with regard to professional activities within the AIEE and IRE following graduation.

The University of Wisconsin offers excellent opportunities for study in electrical engineering. Young men and women with good high school records and a real interest in science and mathematics would do well to consider enrolling in this course of study which leads to a most interesting professional life of basic importance to our economy and security.

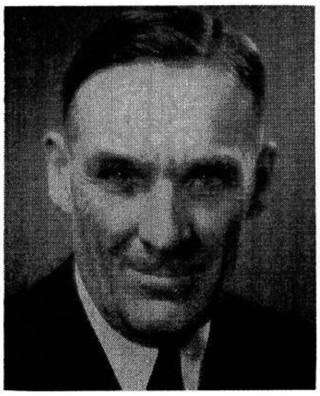
END

← Plate courtesy Westinghouse Electric



Mechanical Engineering

by Benjamin Elliott
Chairman, Mechanical Engineering Department



Prof. Ben G. Elliott has been Chairman of the Department of Mechanical Engineering since 1948. He was born in North Platte, Nebraska, and received his BS and MS from Rose Polytechnic Institute, and a degree of ME from the University of Wisconsin. A Fellow in ASME, he has been vice-president of this society since 1953. He was Director of the National Society of Professional Engineers from 1951 through 1954, and is active in numerous other engineering and civic organizations. He has also written several textbooks on the automobile.

Mechanical Engineering is concerned with the design, manufacture and operation of all types of machines and equipment. It may truly be said that the mechanical engineer is a "builder" of machines and equipment for all industry.

The mechanical engineer designs and produces the "machine tools" which are the prime requirements in our huge industrial system. He also designs, manufactures and operates our many power plants for the production of the ever-increasing quantities of energy which constitutes the life blood of our present day economic and industrial society. He also plays a major part in designing, manufacturing and operating the elements in our vast transportation system—automobiles, trucks and buses, locomotives and trains, aircraft and rockets.

The Mechanical Engineer is also an important factor in the great process industries—in the production and processing of petroleum, coal and gas; the making of paper, and in the handling and packaging of the almost endless list of the everyday articles known as "consumer goods". He is revolutionizing our domestic life by bringing the products of research and development into the home—heating, air conditioning and refrigeration equipment, dish washer, laundry equipment and power tools of all types. He is mechanizing the homes, as he has the farms of America.

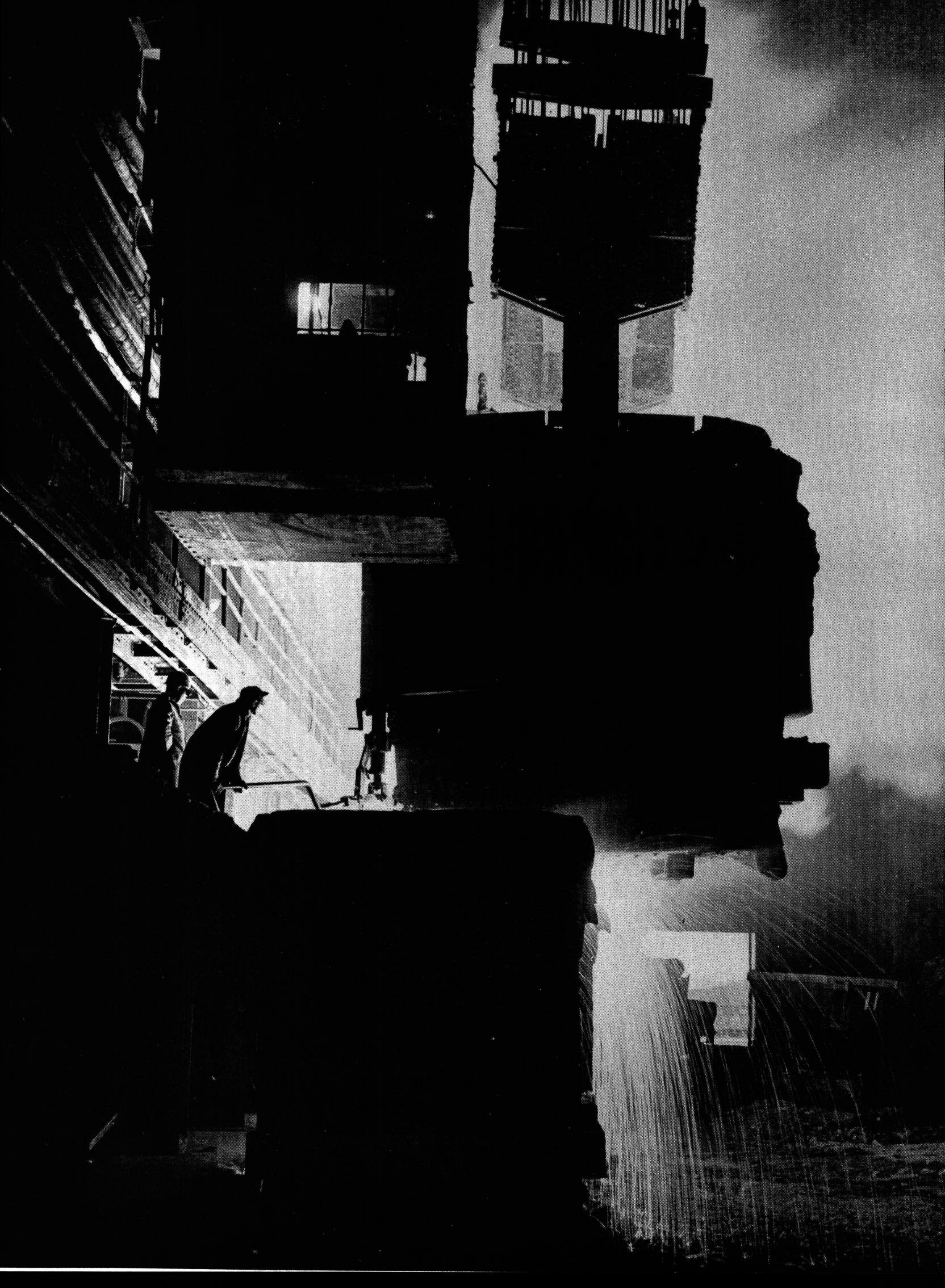
Entrance into a mechanical engineering career is usually through an accredited college of engineering. The subject matter studied consists of basic courses in mathematics, mechanics and materials, chemistry, physics, thermodynamics, drawing and design, industrial organization and management, shop practice, economics and accounting procedures, language, speech and technical writing and human relations.

A prospective student in mechanical engineering should have a pronounced interest and proficiency in mathematics and the physical sciences. In addition, should have the latent ability to use both oral and written English effectively, and the knack of working with and getting along with people.

In addition to preparing a young man or woman for an interesting and profitable technical career, the engineering curriculum provides a training which is valuable in many other lines of activity. Many mechanical engineering graduates go into business, commerce, agriculture, law and public service. During recent years, many engineers have been selected for administrative and executive positions. In the future, it is expected that an increasing number of these positions will be filled by engineers.

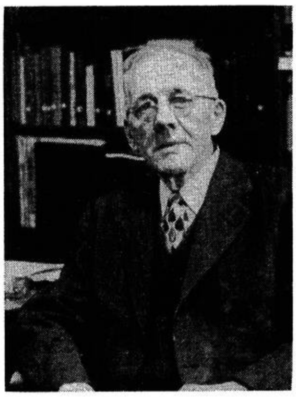
How about the future in mechanical engineering? It appears just now that the demand for properly trained graduates will continue at a high level for a considerable period in the future. Starting salaries are good, and advancement depends largely upon the ability and capacity of the individual and the determination to work.

← Plate courtesy Michigan Technic



Mining and Metallurgical Engineering

by Edwin Shorey
Chairman, Department of Mining and Metallurgy



Prof. Edwin R. Shorey has been Chairman of the Department of Mining and Metallurgy from 1937 to 1940 and from 1952 to date. He was born in Appleton, Wisconsin, and received his BS and EM degrees from the University of Wisconsin. He has been with the University since 1919, and has done considerable research for the Wisconsin mining industry, including work on the application of floatation to lead and zinc ores in Southwestern Wisconsin, and the treatment of taconite from the northwestern part of the state.

This department is concerned with the discovery, extraction and utilization of the world's mineral resources. These concerns fall into two major classifications: mining engineering and metallurgical engineering.

In the general field of mining engineering there are several areas of specialized effort open to the young engineer. The mining geologist studies the genesis, the structural and physical relationships of orebodies and guides the search for extensions to known deposits and for new orebodies. The tremendous acceleration in the exploitation of known and easily discovered mineral resources during the last quarter century due to rising standards of living and two world wars has made thorough scientific training for those who will discover our minerals for future use a prime necessity. Thorough geological training must be a part of the preparation of these engineers. And it should be remembered that these considerations apply not only to metallic minerals but solid and liquid fuels and natural gas as well.

The mining engineer designs, builds and operates the plants which make the exploitation of ores possible, selects and applies the mining method best suited to the individual or body and delivers his ore to the mineral-dressing plant and/or smelter where it is reduced. Peculiarly he must appreciate the political and social problems his industry sets up and play his part in solving all of them.

The mineral dressing engineer is concerned with the development of processes and plants in which the valuable constituents of ores are separated from waste and prepared for smelting. With the exhaustion of high grades ores and the necessity to treat low grade material developing everywhere this phase of the mineral industry is rapidly growing in importance. Such operations as the beneficiation of low grade iron bearing material to produce millions of tons of high grade concentrates annually are cases at point.

The metallurgical engineer, too, will function in a specialized area in the field of metallurgy. He may extract the metals from the raw ores or concentrates and refine and purify these metals. To do this he must know the principles and practices of pyrometallurgy, hydrometallurgy, and electrometallurgy available to him. He may be called upon to develop new and better alloys of known metals to develop superior physical properties for various uses. Particular emphasis will continue to be placed upon light weight, high strength alloys for the automobile and the airplane. Alloys which retain their high strength and utility at extremely high temperatures will require more and more of his efforts. And he may operate in the cast metal industry with the same objectives as those of his brother in the field of fabricated structures.

The various curricula in Mining Engineering and the curriculum in Metallurgical Engineering reflect the department's awareness of the problems facing the young engineer and its determination to train him adequately to solve them.

← Plate courtesy Wayne Engineer

What's Your Question?

by John Albrecht, cie '56

High school students have many questions concerning requirements and activities of college life. Following are questions and the respective answers pertaining to student life at the University of Wisconsin.

What educational program does the University of Wisconsin offer?

Students have the opportunity to study in almost all major areas of endeavor, including the humanities, arts, sciences, and social studies. In addition, preprofessional and professional opportunities are available in engineering, commerce, teaching, medicine, law, pharmacy, and many allied fields. All told, the University offers over 1,200 courses from which to choose.

What are the admission requirements?

The general method of admission is by presenting a certificate of graduation from an accredited high school with the recommendation of the principal. Sixteen units are the fundamental requirement, which must include one unit of algebra and one unit of geometry.

Does the University have an official grading system?

The University of Wisconsin marks on an alphabetical basis with the grade points per credit as follows:

"A" (Excellent)	4 grade points per credit
"B" (Good)	3 grade points per credit
"C" (Fair)	2 grade points per credit
"D" (Poor)	1 grade point per credit
"F" (Failure)	0 grade point per credit

What are the semester fees?

In all colleges and schools except Law and Medicine the fees are $90 per semester for a resident of the state and $250 for a nonresident.

What housing arrangements are available?

Housing accommodations for single students include:

University Residence Halls, Co-operative houses, sororities, fraternities, the University YMCA, International House for graduate men, and rooms in private homes throughout the residential sections of the city. The University Housing Bureau is the clearing center for all student housing information and is located at 434 Sterling Court.

Does the student have any supervision in the planning of his courses and program?

Yes, the University operates on an advisory system whereby each new student is assigned a faculty adviser. The adviser is expected to help the student in the choice of his course and in the selection of a well-balanced program.

Is there additional counseling service available to students?

A trained staff is available to counsel students regarding personal, vocational, or academic problems. The Student Counseling Center is located at 740 Langdon Street.

What provisions do the University provide toward the maintenance of the health of the student body?

The services of the Department of Preventive Medicine and Student Health are available to students who are regularly enrolled in the University of Wisconsin. The Student Clinic and Infirmary are located in the West wing of Wisconsin General Hospital.

Are scholarships available for undergraduate students?

There are many scholarships available to deserving students. Scholarship information and application forms may be obtained from the Office of Admissions, 166 Bascom Hall.

Is there an ROTC program?

Freshman and sophomores are required to take basic Army, Navy, or Air Force ROTC. Eligible Junior students may apply for advanced training.

Are student loans available?

Loans for educational purposes in amounts up to $250.00 are made for periods of less than a year to students in good standing, who have established a satisfactory academic record of at least one semester at the University of Wisconsin.

What are the possibilities of obtaining part-time work?

The Student Employment Bureau is often able to locate some kind of part-time work for those who desire it. Its address is 435 N. Park Street.

Does the University operate any Extension Divisions?

The University of Wisconsin operates Extension centers in Sheboygan, Milwaukee, Racine, Wausau, Green Bay, Kenosha, Manitowoc, Menasha, and Marinette.

How are the library facilities?

There are more than a dozen libraries, the chief among them being the Memorial Library and the Library of the State Historical Society.

Are there sororities and fraternities on campus?

There are sixteen sororities and thirty-four social fraternities on campus, with all but one maintaining resident houses for their members. In addition, there are many professional fraternities.

(Continued on page 56)

Farm-fresh to you...

How a remarkable plastic helps bring fresher food to your table

A WONDERFULLY useful plastic called polyethylene* is now giving a new kind of protection to food that is on its way to your kitchen.

WHEN FOOD IS PACKED in thin, strong bags of polyethylene, it is able to "breathe," and yet not dry out. Because polyethylene has this peculiar advantage, apples, carrots, and other fruits and vegetables—as well as poultry and meat products—can reach your table more nearly farm-fresh than ever.

POLYETHYLENE IS ONLY ONE of a number of plastics produced by the people of Union Carbide to help bring foods to you in prime condition. Some of these plastics coat cardboard for milk cartons and frozen food packages, while others line the tins for canned foods and beverages.

SCIENCE "SETS A GOOD TABLE" These and other materials produced by UCC help protect food while growing, in storage, during preparation, when packaged for your use, and when stored in your pantry or refrigerator. This protection helps provide a more healthful diet for all Americans.

STUDENTS AND STUDENT ADVISERS: *Learn more about career opportunities with Union Carbide in* ALLOYS, CARBONS, CHEMICALS, GASES, *and* PLASTICS. *Write for booklet A-2.*

*Pronounced pol'y-eth'ĭ-lēn

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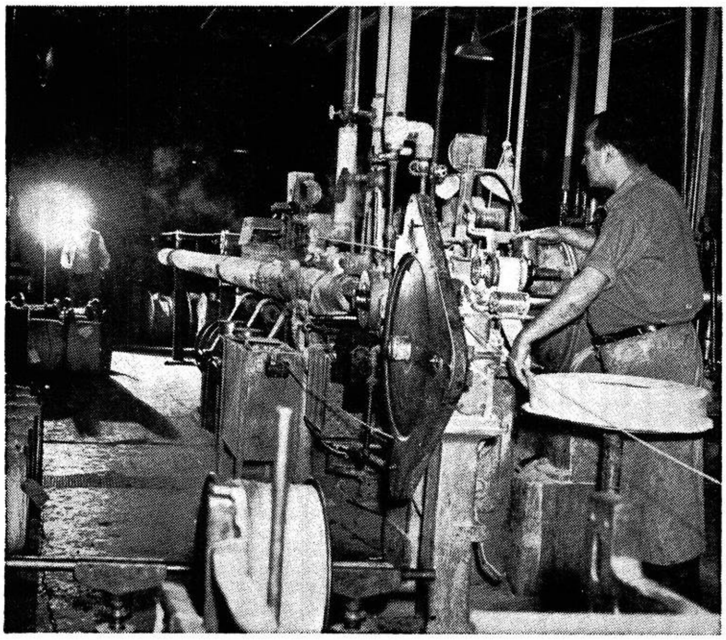
is adjustable with respect to the guide so that proper centering can be obtained. The guide and die are so located that there is an annular space between them through which the rubber compound reaches the conductor.

The driven screw of the extruder forces the unvulcanized compound through the guide and die assembly around the conductor. The equipment is provided with a driven take-up capstan which pulls the conductor through the machine and a revolving pan in which the rubber-covered conductor is laid. Successive layers of the covered conductor are separated with finely divided talc to prevent adhesion of successive layers during vulcanization. A tape may be applied over the insulation on larger conductors before vulcanization to assist in maintaining concentricity of the insulation with the conductor.

Rubber or rubber-like jackets are applied to rubber insulated single conductor cables or over the assembly of multiple conductor insulated cables by the extrusion process. Such jacketed cables are taken up in pans of talc as described for insulated conductors. A continuous lead sheath is applied over the unvulcanized jacket compound and the lead covered cable taken up on reels for vulcanization.

Continuous Cure Process



VULCANIZATION — The pans or reels containing the unvulcanized rubber insulated conductor or jacketed cable are then placed in a vulcanizing chamber where they are subjected to steam at the required pressure and for the required time to suitably vulcanize the rubber. The pressure is then slowly reduced to atmospheric pressure and the pans or reels removed from the vulcanizer and allowed to cool. The insulated conductors are then removed from the pans. This handling of the insulated conductor in pans through the extrusion and vulcanizing processes accounts for the term "pan cure process". Non-permanent tapes are then removed from strip insulated conductors and the lead tube from the jacketed cables.

CONTINUOUS CURE PROCESS—The continuous cure process employs a standard extrusion machine similar to that used in the pan cure process, but equipped with a modified head to which a vulcanizing tube is attached and provided with means for automatically controlling the temperature of the cylinder, screw and head.

The head differs from that used in the pan cure process in that the guide and die are mechanically centered with respect to each other and the compound space surrounding them is smaller. Centering of the guide and die is obtained by the use of accurately machined holders which fit snugly into perfectly centered openings in the head. This provides centering of the insulation or jacket compound at all times without adjustment by the operator. The compound space in the head is reduced to prevent premature vulcanizing of the highly accelerated compounds used in this process. Automatic control of the temperature of the cylinder, screw and head is required for successful extrusion of such compounds.

The vulcanizer attached to the tubing machine consists of a 2-inch steel pipe jacketed with a properly insulated 3-inch pipe and is approximately 125 feet in length. Vulcanizing steam pressure is maintained in the annular space between the vulcanizing tube and jacket to insure immediate attainment of the vulcanizing temperature when steam is admitted to the vulcanizer tube. The vulcanizer is provided with a splice box adjacent to the tubing machine and a suitable seal at the opposite end.

The driven screw of the extruder forces the unvulcanized compound through the guide and die assembly around the conductor or cable and directly into vulcanizer containing steam at 225 pound pressure. Highly accelerated compounds capable of vulcanizing in a few seconds are used so that the process can be operated at economical speeds. The speed of travel of a covered conductor or cable and the acceleration of the compound are so adjusted that the insulation or jacket is properly vulcanized while traveling the length of the vulcanizer. The vulcanized insulated conductor or jacketed cable is taken up on a suitable reel directly from the vulcanizer. The term "Continuous cure process" follows from the fact that the insulation or jacket is applied and vulcanized in one operation.

APPLICATION OF LATEX—The application of latex insulation consists of passing the coated conductor beneath the surface of a latex compound from which it is brought vertically into a suitable drying chamber. It continues to travel vertically in the chamber until the film is dry. It is then returned for the application of a second layer of compound. This alternate dipping and drying is continued until a wall of the required thickness is applied and dried. The amount of insulation deposited per application depends on the conductor size, the viscosity and temperature of the latex compound and the speed to which the conductor travels.

The conductor, covered with the required thickness of dried unvulcanized latex compound then passes through a vulcanizing chamber where the insulation is vulcanized and continues through a talc applicator to the take-up reel. This process is thus a continuous one in that the application of the insulation to the conductor and its vulcanization are accomplished in one operation.

Application of Latex

ENGINEERS' WEEK
1955 and before

About 57 years ago "Remember the Main" were fighting words, and not so long ago "St. Pat was an Engineer" could bring on a fight at the University. Things have changed to be sure, but there is still a standing feud between the Lawyers and the Engineers as to who has the right to claim St. Pat. No one quite knows where the dispute started, but, since St. Pat obviously engineered the snakes out of Ireland, the reader can draw his own conclusions.

Back in the days when all the engineering schools held sway up on the hill in the old engineering building across from the law school, things could get violent and often did. Catcalls and verbal brickbrack flew back and forth across the snow covered lawn until the higher authorities took notice (usually with a dim view) and put a stop to it.

Another method of gaining glory (?) for the engineers occurred during the annual St. Pat's Parade down State Street. Organized houses and engineering societies would sponsor floats which generally ridiculed the lawyers and the results approached carnage. The main float was reserved for St. Pat to ride. And ride he did, pelted with showers of rotten eggs thrown by lawyers from roof tops along the way. It used to be a fine sight to see St. Pat riding in all his majesty and glory, sitting bolt upright, staring straight ahead—with eggs dripping off his beard. The Police Department, probably on complaint of the Street Cleaners Union, decided that such goings on had to stop and, not on charges of cruelty to animals as one might suspect, but rather on claims of destruction of property, and did put a final stop to it.

With spirits running so high things often broke out in violence. The last time this happened was in 1950 and it was decided between the Legislative Council "representing" the Lawyers, and Polygon Board, "for" the Engineers, that each year the rivalry would be decided by a basketball game between the two schools. This year it was held Wednesday, March 16.

For several weeks previous to St. Pat's day buttons and beards start appearing all around the engineering campus. Since each button sold and each beard grown counts points towards the election of St. Pat each engineering school tries to outdo the other in sales of buttons and tickets and in the growing of beards. This year prizes will be given for beards which are the longest, curliest, best colored, most Lincoln like, most devil like, most distinguished, most bushy, and puniest. The button design this year was won by Ronald Gollhardt, EE–2, first place; Donald Rasque, EE–3, second place; and Alf H. Sorensen, CE–4, third place. Due to copyright laws, however, the third place design was used on the button.

The highlight of the whole thing is, of course, St. Pat's Dance was held March 12. This semi-formal dance has been a tradition at Wisconsin for more years than most professors wish to remember. This year a feature that has been held in the past is being revived in that the final judging of beards was done at the dance along with the traditional crowning of St. Pat.

Tempers have settled down and some of the old rivalry has died, but still, deep down in their hearts, engineers know "ST. PAT WAS AN ENGINEER."

END

Members of Polygon Board, which sponsors Engineer's Week, are: top row (l to r) Dick Krueger, EE 55; Bruce Marggraf, ChE 55; Gene Kramer, ChE 55; Bill Kramer, M&M 56; Earl Brinkman, M&M 55; Don Kueny, ME 56; Lee Reese, ME 55; front row (l to r) Lyle Hird, CE 55; Bill Huegel, CE 55; John Leiker, EE 55; John Pugh, Treasurer, EE 56; Gil Johnson, Secretary, EE 55; Milo Swanson, ME 56; and Joe Murray, ME 56. President Jim McNaul, EE 56, was not present. Joe Murray was General Chairman of Engineers' Week. Assisting him were: Brinkman, Prizes; Kueny, Advertising; Reese, Beards; Hird, Program; Huegel, Tickets; Leiker, Buttons; Pugh, Decorations; and Swanson, Basketball Game.

CAMPUS NEWS SECTION

ENGINEERING INSTITUTES

TRAFFIC ENGINEERING

March 22 and 23, 1955

The problems of rapidly and safely moving vehicles through the congested areas and the provision of necessary parking facilities for those vehicles which must stop will be considered in this Institute. The discussions will be, in as far as possible, directed toward the conditions prevalent in Wisconsin communities.

Fee: $15: Leonard F. Hillis, Institute Co-ordinator.

* * *

WORK MEASUREMENT

March 24 and 25, 1955

This institute will be of interest to industrial engineers and other supervisory personnel interested in work measurement problems. Considerable time will be devoted to a discussion of various predetermined time systems that are now in use. Since any method of work measurement is concerned with the determination of a fair day's work, there will be a discussion of this subject by a panel composed of representatives of labor and management. Recent statistical techniques in time study will be presented.

Fee: $15: Robert A. Ratner, Institute Co-ordinator.

* * *

MATHEMATICAL METHODS

April 5, 6 and 7, 1955

This meeting on the application of mathematical methods to the solution of engineering problems has been arranged for educators, engineers, executives, researchers, and scientists with more than a passing interest in mathematics. Many useful, powerful, and fascinating techniques in the solution of engineering problems will be presented. Some of the underlying influences of mathematics upon our cultural, economic and technological advancement will be discussed.

Fee: $20: Ralph D. Smith, Institute Co-ordinator.

* * *

FLUID MECHANICS

April 12 and 13, 1955

This is a new institute and will be of interest to engineering personnel responsible for the storage, handling and transmission of fluids and gases. Latest developments in design, application and use of equipment related to the foregoing will be discussed.

Fee: $15: Ralph D. Smith, Institute Co-ordinator.

* * *

ENGINEERING ECONOMICS

April 14 and 15, 1955

This institute will consider various aspects of the economic analysis such as: development and promotion cost, depreciation cost, valuations, operating cost patterns, and criteria for making a decision. Special methods such as the break-even chart will also be presented. Chief engineers, contractors, supervisors and administrative personnel will be interested and concerned with the problems that will be studied in the institute.

Fee: $15: Robert A. Ratner, Institute Co-ordinator.

* * *

GRAPHIC SOLUTIONS METHODS

April 21 and 22, 1955

Graphical presentations of mathematical material enable the reader to more easily visualize the relationships involved and frequently are of value to the user in obtaining shortcut solutions to complex or cumbersome equations. Topics that will be discussed are: fundamental equations and curves, families of curves, statistical analysis of data, curve fitting, network charts, alignment charts, nomographs and special slide rules. This institute will be of interest to all technical personnel having need to represent physical data. Research findings, presentation of standard data, report writing, economic analysis and sales devices are but a few areas where these methods will apply.

Fee: $15: Robert A. Ratner, Institute Co-ordinator.

* * *

RECENT FACULTY CHANGES

The College of Engineering has seen quite a few changes in its full-time faculty since last semester. Perhaps, the most notable of these being in the Mechanical Engineering Department with the addition of Mrs. Lillian Gilbreth to the faculty. Mrs. Gilbreth is very widely traveled and is considered to be one of the world's five most famous women. She will be at Wisconsin for the next semester and will conduct the Mechanical Engineering Graduate Seminars this spring.

In the Civil Engineering Department, Mr. Robert F. Sell has resigned to take a position with the American Institute of Steel Construction. Completing the roster, however, is Instructor Norman Bruce Hanes, a former University Fellow and graduate of North Dakota State College.

Assistant Professor G. W. Lawton, also of the Civil Engineering Department, is now on leave of absence to teach at the University of North Carolina. He is replacing a professor of that university who is on service in Peru.

The Electrical Engineering Department welcomes to its fold three new instructors this semester. They are: Mr. R. A. Jacobs, Jr. Mr. Harry Ludwig, and Mr. A. T. Fredemann.

As was reported last month, Dr. Aksel Lyderson of the Norway Institute of Technology has returned to that country after two years of project and research work at Wisconsin. While at this University he was connected with the Chemical Engineering Department.

END

Schroeder's

ENGINE-EARS

by Ron Schroeder m'57

A.I.Ch.E.

A.I.Ch.E. continued its program with a talk by H. W. Bremer of Procter and Gamble. Mr. Bremer, a former University of Wisconsin Ch.E. graduate, is employed as a patent attorney with P & G, and his talk outlined the opportunities for Chemical Engineers in the field of Patent Law.

In addition, A.I.Ch.E. presented its annual award to the outstanding sophomore Ch.E. of the year. The award—consisting of the official A.I.Ch.E. pin, a subscription to the magazine *Chemical Engineering Progress*, and a certificate for high scholastic achievement—went to John Baumgartner, who ranked near the top of the sophomore scholarship standings for the whole College of Engineering. Good work, John!

ASAE

At the January meeting of the Wisconsin Chapter of the American Society of Agricultural Engineers, Professor Stan Witzel gave a talk and showed slides on the subject of irrigation. The usual business meeting was held and plans were made for the selling of concessions at the University of Wisconsin Little International on February 26, 1955.

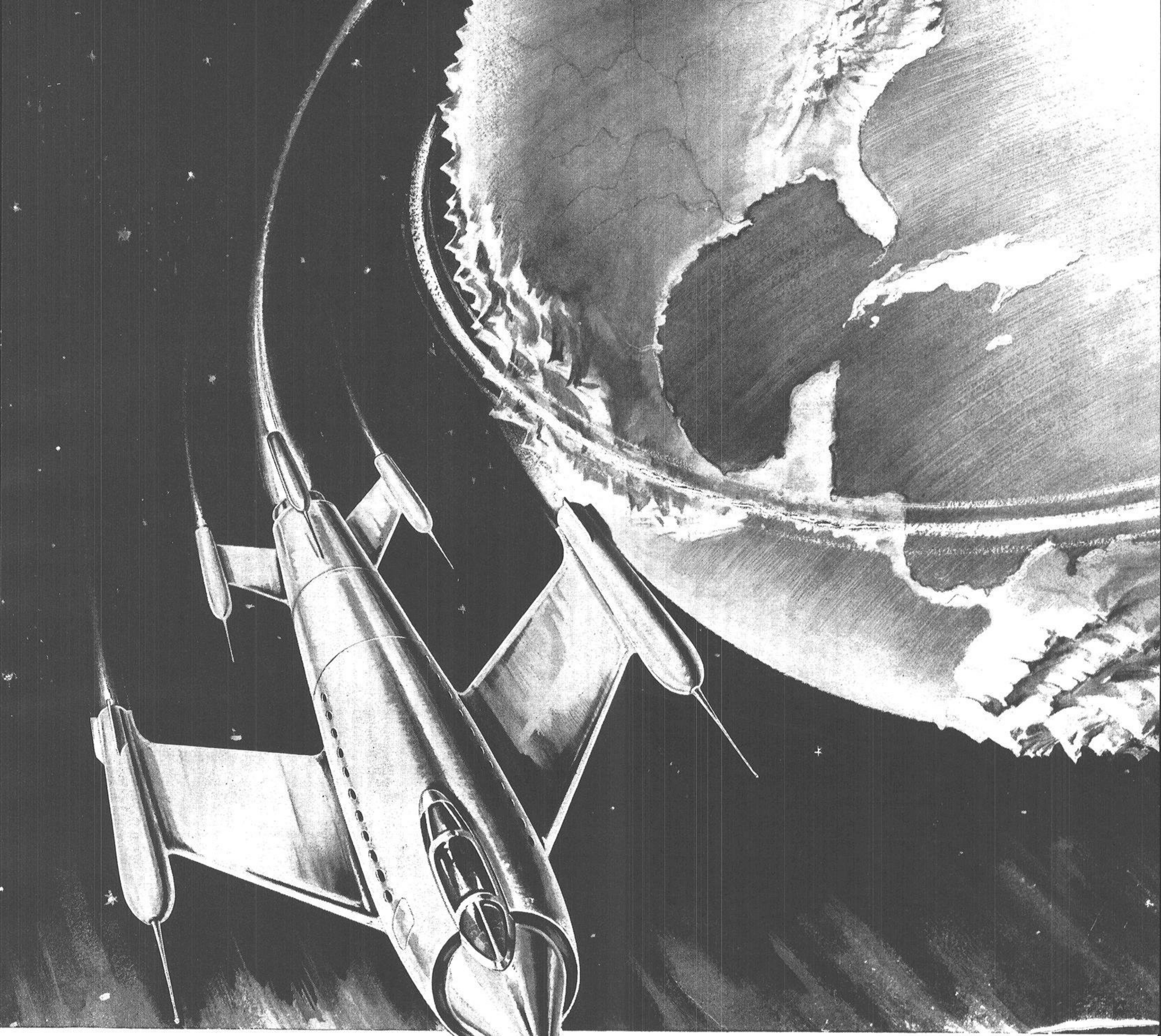
On Friday, February 4, the members of ASAE boarded a chartered bus and traveled to Rockford, Illinois where they were guests of the J. I. Case Company. They went on an extensive tour of the plant in the forenoon and enjoyed a noon dinner in the plant cafeteria at the company's expense. Before leaving for home in the afternoon, the Chief Engineer of the Case Company talked to the fellows and answered any questions they had about the operation of the plant or about the engineering facilities of the Case Organization.

AIEE–IRE

The Joint Student Branch of the American Institute of Electrical Engineers—Institute of Radio Engineers held elections for the second semester on January 12. The following men were awarded offices: John W. Pugh, Joint Chairman; Algimantas Dargis, Vice-chairman; Charles Luebke, Secretary-treasurer; John Leiker, IRE Corresponding Secretary; Dick Kraemer, AIEE Corresponding Secretary; John Leiker, Polygon Board Representative. The officers are all certain that the second semester program will be the best the club ever had. The first meeting of the semester was held on Thursday February 17. The editor of the General Electric Review, Everett S. Lee, talked on the subject, "What's New in Science Engineering. In March the society is planning a sound and slide program with the theme being, "Electrical Engineering, a Creative Profession."

ASME

The big news from the portals of the Student Branch of the American Society of Mechanical Engineers is the announcement of the winner of the ASME membership contest. He was Sylvester Hoersch, M.E. 4, and his winning total of memberships was eighteen. Sylvester was awarded a *Mark's Mechanical Engineers Handbook.* Here's "Hat's off" to Sylvester from *Engine Ears.*



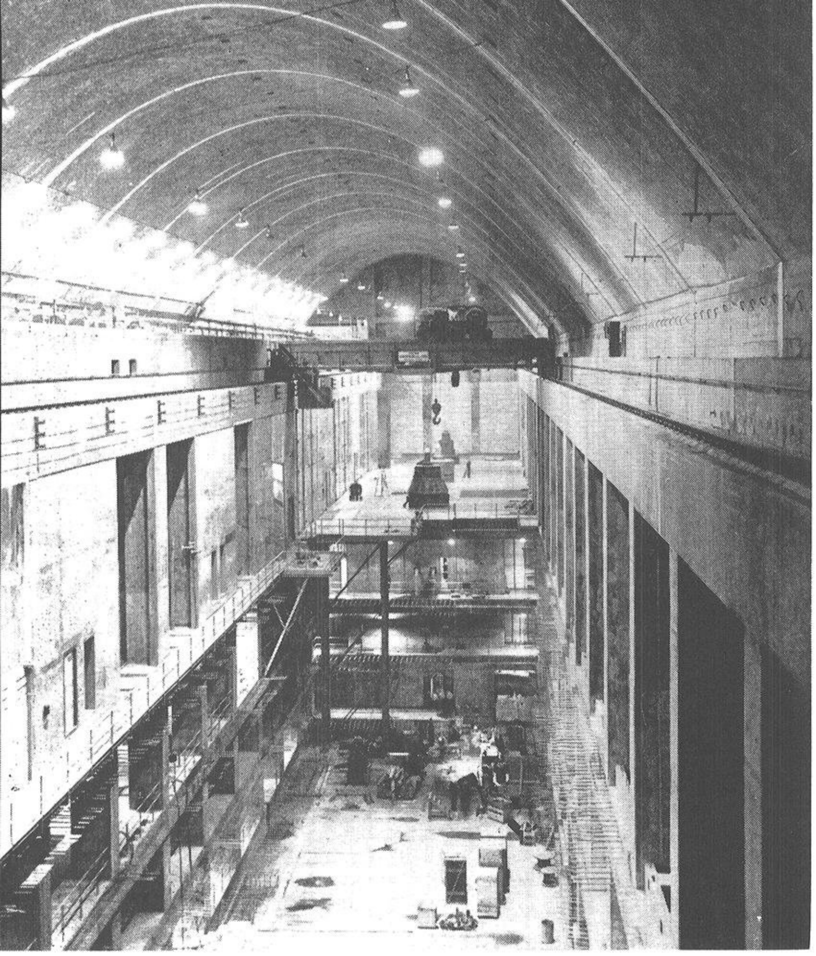


Fig. 3.—275,000 cubic yards of rock were removed from a mountain to make this 700 foot long, 120 foot high powerhouse. Three of eight generators are shown in position.

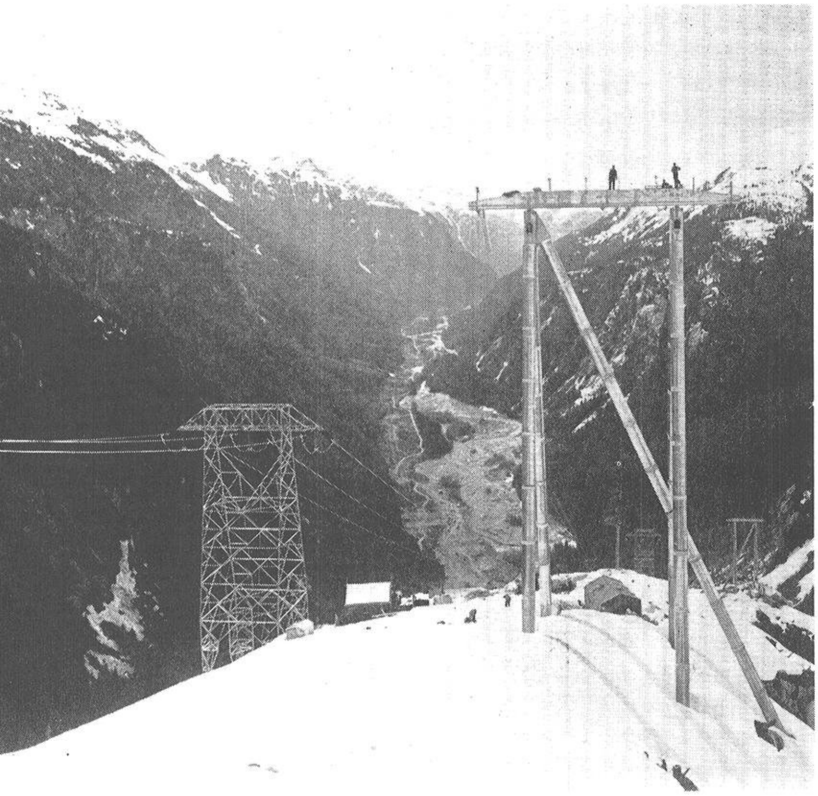


Fig. 4.—This is the point at which the 50 mile Kemano-Kitimat transmission line starts up over 5,300 foot high Kildala Pass. The Kemano River valley can be seen in the background.

Alcan Project

(Continued from page 13)

center adit was driven into the tunnel line (see fig. 2). From this Horetzky adit to the main tunnel, headings were driven in two directions.

The 10-mile tunnel from the Tahtsa intake to a point near the top of the powerhouse site slopes downward at a $2\frac{1}{2}$ feet per 1000 feet of grade. This tramway has a capacity of about 25 tons, and except for helicopters, provided the only means of transportation of men and materials to the tunnel camp up the hillside.

The 10-mile tunnel, driven through four headings, was one of the major items of work in the program. Most of the tunnel is a 25-foot high by 25-foot wide horseshoe section. Early geological advice indicated generally sound rock that would require little structural support. Driving operations encountered a large percentage of rock requiring structural support and finally concrete lining. The better hydraulics of concrete-lined tunnel permitted a reduction in tunnel size, and in the bad rock headings the tunnel excavation was reduced to provide width of 20 feet inside of concrete.

Four times during the tunnel driving world records were broken. The last record, which now stands, was 282 feet in a week of 6 working days and 61 feet advance in one working day. The average day's advance per heading for the four headings was slightly under 30 feet per day.

To carry the water from the tunnel down to the powerhouse, pressure shafts were driven at a 48° slope with a horizontal section at the 1600-foot elevation adit. The tunnel (see fig. 2) separates into two pressure shafts at the top of the hill, and at the power house level each pressure shaft splits into four penstock pipes each to supply one unit. Thus one main tunnel can handle eight units in the powerhouse and only one pressure shaft is required for the first stage of development which will include three powerhouse units.

The penstock pipes branch out from the pressure shafts and run through an underground valve chamber in which spherical valves will control each separate penstock. Half of this ultimate valve chamber, enough to accommodate eight valves, has been built under the first stage of the program. Overhead gantry cranes are mounted in the valve chamber to handle these valves which are 51 inches in diameter, weigh 100 tons each, and which must carry about 2600 feet of static head. Separate steel penstocks run from each valve to feed each unit in the powerhouse. These penstocks are 5 feet in diameter; upstream from the valve chamber they are embedded in the rock and downstream they are not embedded.

The underground powerhouse excavation was one of the major job problems (see Fig. 3). Two hundred seventy-five thousand cu. yd. of rock were taken out to make the 700-foot long chamber for the first stage.

The excavation was made to accommodate eight units plus an erection and service bay which is at the center of the ultimate power chamber. The extension of the powerhouse for the next two stages will be in line with the present power chamber and ultimately will have space for 16 units.

The chamber excavation was 81.5 feet wide, 700 feet long and 120 feet from the top of the arch to the rock floor with turbine pits and tailrace inverts 20 feet deeper. Access to the powerhouse was at three points: The tailrace tunnel, initially driven as a 26-foot high tunnel and later benched down to develop its 40 ft. height, the permanent access tunnel to the power chamber, and the ventilation tunnel. A tunnel was driven the length of the power chamber from the initial tailrace tunnel bench at elevation 202 and another tunnel driven the length of the power chamber from the ventilation tunnel at elevation 276.

Excavation of the power chamber was done by long-hole diamond drilling from slots excavated in the arch section 10 feet wide and 120 feet apart. Blasting of successive rings expanded the arch from the upper longitudinal tunnel. Muck was fed by bulldozer or scraper to shafts that dropped it to the tailrace level where it was hauled out by trucks. After the arch section was completely excavated, the concrete arch was built. The main body of the powerhouse was then drilled out the full height with 80-foot vertical diamond drill holes. The blasting of this rock started by expanding the longitudinal tunnel at tailrace level to a slot down the center of the powerhouse. This slot was widened by slabbing off sections the full 80-foot height. This blasted rock was loaded by electric powered shovels and hauled out by truck to make area fill and bank protection along the Kemano River. The rock in the power house was blocky and slips that occurred during construction indicated that permanent reinforcing was necessary. Nearly 2,000 steel dowels, from 30 to 40 feet long, were placed in diamond drill holes and anchored at the far end with wedges. They were then prestressed and grouted.

The three initial powerhouse units have a rating capacity of 140,000 h.p. each. The hydraulic turbines are impulse type wheels with four jets designed with needle valves for nozzle control and with jet deflectors for each nozzle. Generators operate at 327½ rpm and produce at 13.8 kv. Transformers located inside the powerhouse chamber in enclosed galleries step up the voltage to 287 kv. The single phase transformers have a 90,000 KVA rating, and a bank of three transformers will carry two units.

High voltage power is taken out of the powerhouse chamber through oil-filled cables about 2,200 feet to

(Continued on page 58)

So You Think You're SMART!

by Sneedly, bs'59

Horray! horray! Sneedly got his hair cut. If you have seen a short fellow that looked like Hemingway's "Johny Bear" (Yes, Sneedly reads PLAYBOY too.), that was Sneedly. Well while I was sitting in the chair of this one chair barber shop in some one horse town west of Madison, I asked the barber if he had much competition. "None at all," he replied, "of all the men in the town, I naturally don't shave any of those who shave themselves, but I do shave all those who don't shave themselves." I am still trying to determine whether or not the barber shaves himself.

° ° °

This month we shall institute a new device to stimulate the interest of the engineers. For their own good I shall attempt to pry them away from their books in return for a little money. I found a problem which causes me to reminisce about my high school geometry. This problem is worth $5 to the first correct answer to be mailed in (c/o Sneedly, *Wisconsin Engineer*). All solutions become the property of Sneedly, and none can be returned. The deadline for answering this problem is April 15, 1955.

Given the following equation:

$$a^n + b^n = c^n$$

Prove, formally, that there is no solution where a, b, and c are rational numbers, and where n is an integer greater than two. Note of warning: The proof is tricky and very elusive, so work slowly.

° ° °

At the end of last semester, one of the chem engineers taking Electrochemistry put one of his pennies in a copper sulfate bath and set up an electrochemical reaction in which copper was either dissolved from or deposited on the penny. He didn't have time to discover how he had arranged the electrical leads, for an instructor surprised him in the act. He was fortunately able to grab the penny from the bath and put it in his pocket without the instructor seeing him. The following day he discovered twelve pennies in his pocket but couldn't determine which was the faulty penny. He found it by weighing all of them; however, his journalism room-rate told him it could have been done in only three weighings on a simple balance. What is the procedure to be used? Remember that you don't know whether the penny is under- or over-weight.

Here are the answers to last month's problems. The telephone poles which were to hold the wire around the earth had to be 15.9 feet high. In the problem about the chairs and stools in the chemical engineering building, in one room there were 10 chairs and 2 stools, and in the other there were 5 chairs and 6 stools. The farmer actually died in the forest fire, because while he sat down to figure out how to beat the blaze, the fire had completely surrounded him and his family and they all perished. It just goes to show that the world's problems cannot be worked out using the ideal gas law when the hot air is blowing down your neck. Assuming ideal conditions, and that there is no friction, and that the farmer is a genius and can work out the solution to the problem in less than two seconds, here is the solution to the problem.

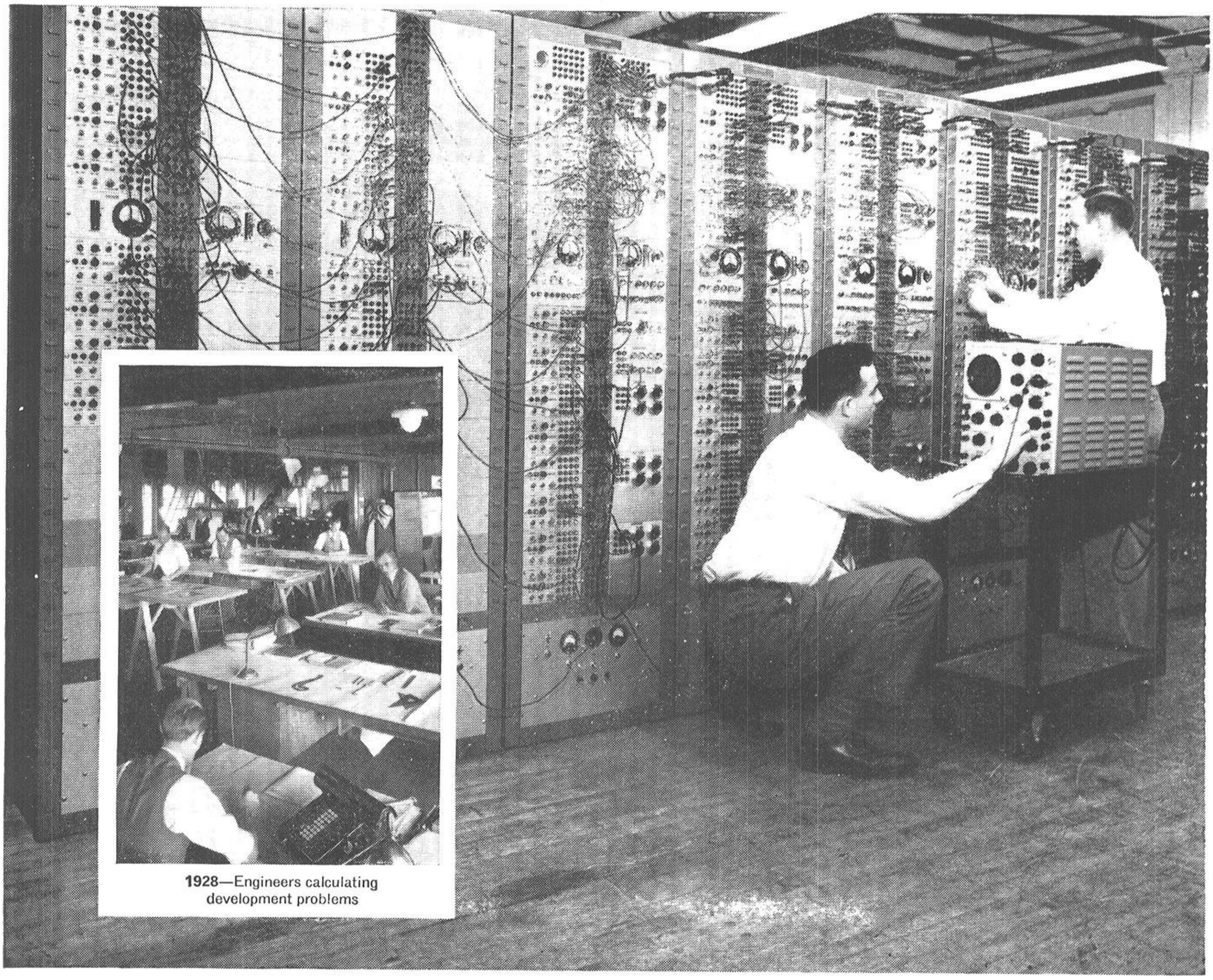
° ° °

Yes, the farmer and his family can be saved, but there is not a second to spare. The farmer carries the girl and takes his wife's arm, traveling at the rate of 4½ MPH for 1¼ miles. Then he hands the baby to his wife and runs back for the boy, who has been running on behind. The boy collapses at the end of his mile run just as his father gets to the spot, and then the father picks him up and starts after his wife. After 3/28 of an hour, he overtakes his wife, since he makes 4 MPH to her 3 MPH. He then gives her his arm and both go at the rate of 3½ MPH, covering ½ mile by the time the boy has recovered.

At the end of this first half hour they have covered 1-13/14 miles, and then begin the whole cycle all over again. At the end of 1½ hours, they are slightly less than 1 mile from the boat; and the boy makes the boat 140 yard ahead of the fire. While the father casts loose, the fire covers 132 yards, but is then still 8 yards away and all are safe.

Obviously, the only way the problem could have been answered was by trial and error with some intelligent guessing. As a result, I don't suppose many engineers figured it out. But then, they can always say that they study too hard to work on such trash as good ole Sneedly puts out.

END



1928—Engineers calculating development problems

1955—Solving complex engineering problems with Boeing computer

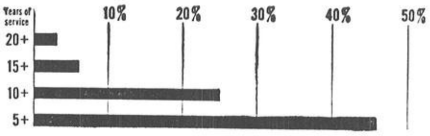
The best research facilities are behind Boeing engineers

The Boeing-designed electronic computers shown above solve in seconds problems that once required weeks—typical of the advanced "tools" that help Boeing engineers stay at the head of their field.

Boeing engineers enjoy such other advantages as the world's fastest, most versatile privately owned wind tunnel, and the new Flight Test Center—the largest installation of its kind in the country. This new Boeing Center includes the latest electronic data reduction equipment, instrumentation laboratories, and a chamber that simulates altitudes up to 100,000 feet. Structural and metallurgical research at Boeing deals with the heat and strain problems of supersonic flight. Boeing electrical and electronics laboratories are engaged in the development of automatic control systems for both manned and pilotless aircraft. Other facilities include hydraulic, mechanical, radiation, acoustics, and rocket and ram-jet power laboratories.

Out of this exceptional research background engineers have developed such trend-setting aircraft as America's first jet transport, and the jet age's outstanding bombers, the B-47 and B-52. Research means growth—and career progress. Today Boeing employs more engineers than even at the peak of World War II. As the chart shows, 46% of them have been here 5 or more years; 25% for 10, and 6% for 15.

Boeing promotes from within and holds regular merit reviews to assure individual recognition. Engineers are



encouraged to take graduate studies while working and are reimbursed for all tuition expense.

There are openings at Boeing for virtually all types of engineers—electrical, civil, mechanical, aeronautical and related fields, as well as for applied physicists and mathematicians with advanced degrees.

For further Boeing career information consult your Placement Office, or write:

JOHN C. SANDERS, Staff Engineer — Personnel
Boeing Airplane Company, Seattle 14, Wash.

BOEING

SEATTLE, WASHINGTON   WICHITA, KANSAS

Stop and Think

(Continued from page 27)

if the engineer is going to use his specialized training to the highest degree of efficiency in serving his fellow man, that he should also know something of history, politics, psychology, economics, and all the other fields which affect the potential needs of the engineer's neighbor. To say that an engineer has a very narrow restricted education is not true; exactly the opposite is the case.

It may interest you young women in high school to know that engineering is no longer a man's world. This semester at the College of Engineering at the University of Wisconsin we have as a visiting professor, Mrs. Lillian Gilbreth who is a recognized professor of engineering and industrial consultant. She will give courses to our students in mechanical engineering this semester.

The time for my visit is ending. Don't forget what I told you—get ready for ANY vocation or profession by taking *basic* requirements NOW. Next, inform yourself about what a future in all vocations that seem to interest you will provide in service to others and in success and happiness for yourself. Lastly, make a wise decision in terms of your abilities and interests under the direction and guidance of someone equipped to give you counsel. And, of course, I am hoping you decide to be an engineer and come to the College of Engineering at the University of Wisconsin. END

What's Your Question?

(Continued from page 40)

Is there a student governing body on campus?

Yes, every student is a member of the Wisconsin Student Association which has played an important role in representing the views of the student body on campus issues.

What religious facilities are available in the vicinity of the campus?

Many religious denominations have student centers and organizations in the university community. These centers not only provide worship services, but also offer a wide variety of cultural, intellectual, and recreational activities.

Does the University have any place where students may spend their recreational hours?

Every student becomes a member of the Wisconsin Union upon registration. The Union has lounges, ballrooms, a theater, library, workshop, music listening rooms, art galleries, bowling alleys, meeting rooms, guest rooms, and dining facilities.

Does the University allow automobiles on campus?

Yes, but with some restrictions. Also, all privately owned motor vehicles operated in Madison by students must be registered with the Department of Protection and Security.

To whom does one write for application blanks?

Office of Admissions, 166 Bascom hall, University of Wisconsin, Madison, Wisconsin. END

Fig. 5.—At the Kitimat smelter alumina shipped in by boat from Jamaica is refined into pure aluminum. Power used here is generated at the Kemano station 50 miles away.

Alcan Project

(Continued from page 53)

an outdoor switching structure through a separate cable tunnel. High tension air blast breakers are installed in the outdoor station.

From the outdoor switch station near the Kemano powerhouse a 287 kv transmission line carries power to Kitimat 50 miles away (see fig. 4). In the low valley sections of the location, roughly 40 miles of the total, the ultimate installation will be two double circuit lines of aluminum conductor steel reinforced. The 10-mile section in the high altitudes will have two single circuit lines of aluminum conductor which is believed to be the largest conductor of its type ever built (2.3 inches in diameter). Through this critical mountainous section, difficult of access, both tower lines were built as part of the first stage work to insure dependable service to the smelter at Kitimat.

The access road to the high section of the transmission line was one of the most difficult construction operations of the entire project. The road rises nearly 5,000 feet in 5 road miles and much of it is cut out of sheer rock cliffs. The high point on the transmission line is 5,300 feet elevation and heavy snow and extreme winter weather limits the construction season there to between June and November. While the access road in the pass section passed near the tower sites, many of them were still accessible only by "high lines", aerial cables to take materials to the sites. Nearly half of the single circuit towers required this method of material supply. Helicopters carried men and camp supplies to many of these inaccessible points.

At Kitimat the initial landing for construction operations was made about the same time as Kemano was started, in early 1951. The plant site selected is at the mouth of the Kitimat River at tide water and was desirable because of the wide valley which made room for smelter plant, housing and community facilities (see fig. 5). Four million yards of fill material were used to build the initial smelter site above high tide and flood levels. About half of it was hydraulic dredged, the material coming from the channel in front of the wharf location, and the other half was hauled from a very exhaustive gravel deposit about five miles up the Kitimat River.

The initial construction at the Kitimat smelter involves a deep water wharf 750 feet long, two smelter potlines with production capacity of about 90,000 tons of aluminum per year, numerous service buildings for the smelter plant and the initial construction of housing and community facilities required to operate the plant. The ultimate plan of development is 12 potlines, and city planning has been aimed at an eventual city of 50,000 people. It is not anticipated that the smelter plant will ever require that much population to support it, but the overall planning has considered the possibility of extensive industrial installations coming into the area because of electric power availability.

The first stage of construction at Kitimat involves about 12 acres of industrial buildings, not including any of the community facilities. The townsite is located about eight road miles away from the plant on high ground overlooking the plant area. The municipality of Kitimat has been organized and is taking over the townsite facilities so that Kitimat will operate as soon as possible like a normal town, not a company town.

Power generation and smelter plan operation started on July 15, 1954, and has been continuous since that date. It has taken a little more than three years since the initial landing to put the first unit in operation.

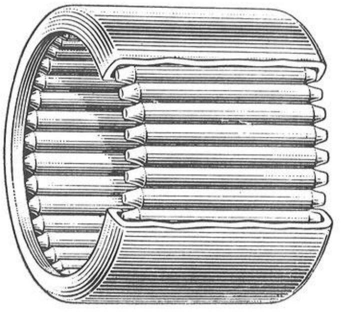
The construction of the Alcan Project was and is a full-scale pioneering invasion of the remote wilderness with modern construction equipment and methods.

END

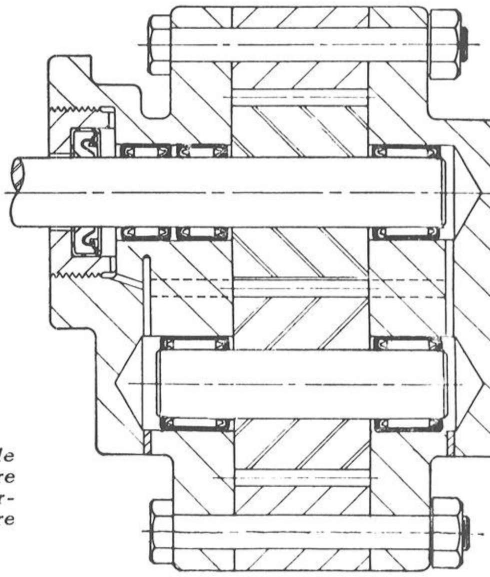
The Torrington Needle Bearing

proper housing design is essential to proper performance

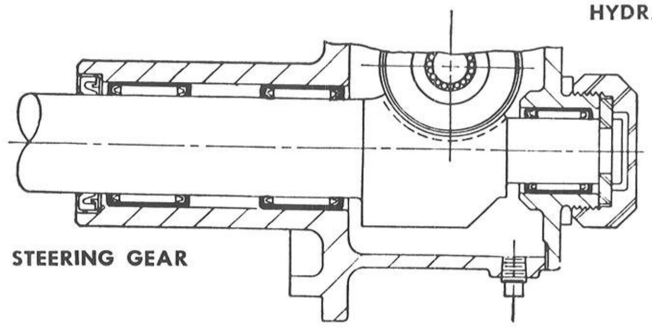
The Torrington Needle Bearing offers many design and operational advantages for a great variety of products and equipment. For example, a Needle Bearing has greater rated radial load capacity in relation to its outside diameter than any other type of anti-friction bearing. It is extremely light in weight. And it is easy to install and lubricate.



Needle Bearings require simple housings. If the housing bores are held to proper size, accurate operation and high radial capacity are assured.



HYDRAULIC PUMP



STEERING GEAR

Housing Maintains Bearing Roundness

The housing is an essential part of the Needle Bearing assembly. Care should be taken to provide a straight, round housing bore to the recommended tolerances.

The thin, surface-hardened outer shell of the Needle Bearing acts as the outer race surface as well as a retainer for the rolls. This shell assumes the shape of the housing into which it is pressed. Consequently, the housing bore should be round, and the housing so designed that it will carry the radial load imposed on the bearing without distortion.

Housing Material Determines Bore Size

The specified housing bore dimensions for any given material should be maintained in order to give the proper running clearance between the needle rollers and the shaft, and to assure sufficient press fit to locate the bearing firmly.

When designing housings of materials that are soft or of low tensile strength, allowance should be made for the plastic flow of the material when the bearing is pressed into place. Bore dimensions in such cases should be less than standard. Needle Bearings can be pressed directly into phenolic or rubber compounds, although metal inserts are recommended.

The new Needle Bearing catalog will be sent on request.

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ALLISON Engineers Break Ground for New Turbine Engine Test Facilities

E. B. NEWILL, Georgia Tech, '15, now General Manager, Allison Division and Vice President of General Motors Corporation, breaks ground on another addition to our turbine engine test facilities.*

Allison Jet engine designers soon will have even larger and improved test facilities to use in developing turbo-jet engines.

Performance requirements for future military and commercial aircraft make necessary the development of new turbo-jet engines far more complex and powerful than present types. New and specially-designed test equipment is required to accurately determine performance of the principal engine components—compressors, turbines, and combustors—before the complete engine is tested.

For instance, capacity for 75,000 horsepower is being established to pump air at the rate of 300 pounds per second. This air must be compressed and heated to 1000 degrees, or cooled to a minus 67 degrees, enabling Allison to test combustors at simulated altitudes up to 65,000 feet.

With our expanding and long-range engineering program, we need additional young engineers. Allison, a leader in the design, development and production of turbo-jet and turbo-prop engines, NOW offers young graduate engineers unusual opportunities for progress where future development is unlimited.

Write for information:

R. G. Greenwood, Engineering College Contact
ALLISON DIVISION, General Motors Corporation
Indianapolis 6, Indiana

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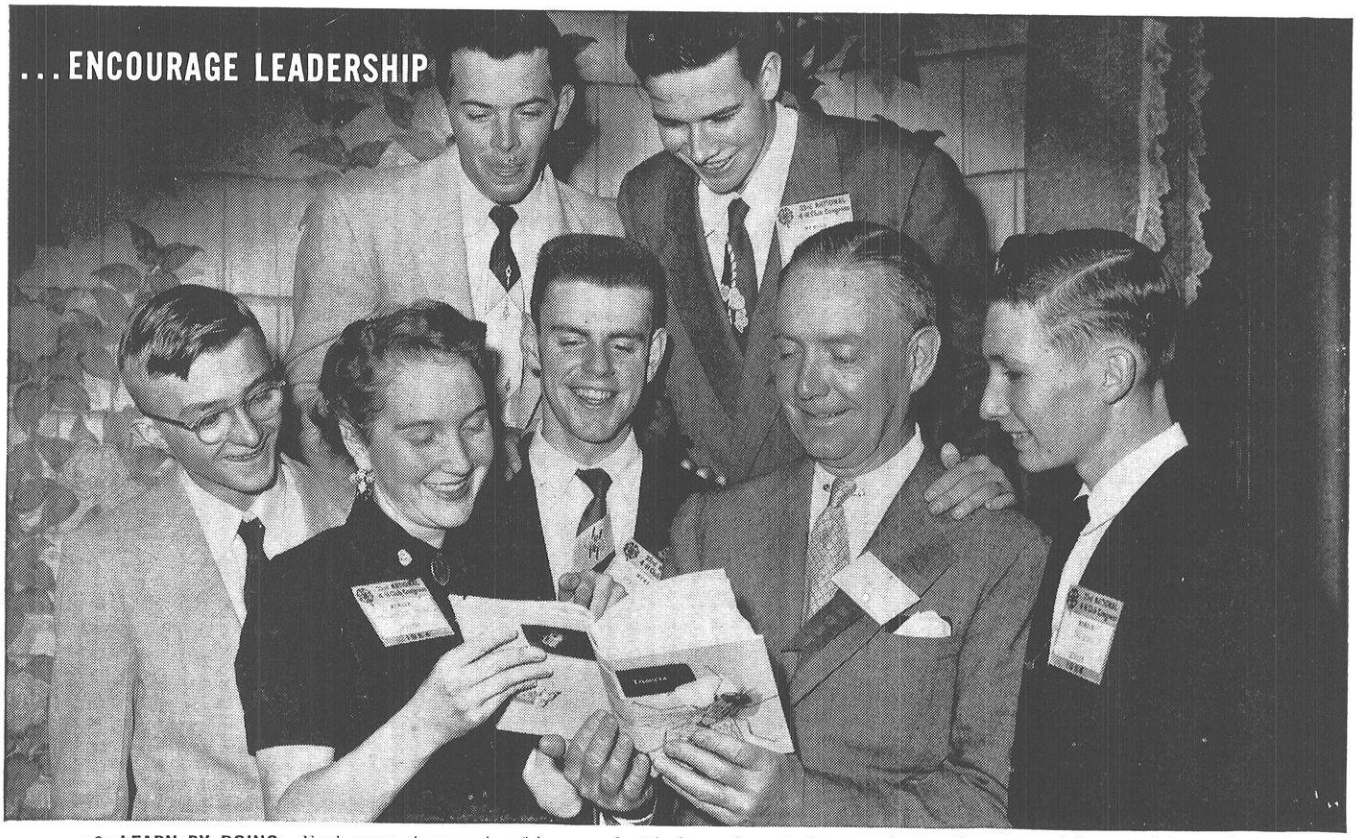
* Left to right—Dimitrius Gerdan, Chief Engineer, Turbo-Jets, U. of Michigan, 1932, BS in Mechanical Engineering and Industrial Engineering; T. W. Meeder, Chief Test Engineer, U. of Michigan, 1932, MS in Aeronautical Engineering; R. E. Settle, Assistant Director of Engineering, Purdue University and Indiana Central College, BS in Mathematics; Paul Hunt, representing Huber, Hunt & Nichols, Inc., contractor; E. B. Newill, Georgia Institute of Technology, degrees in Mechanical and Electrical Engineering; Harold H. Dice, U. of Illinois, 1929, BS Business Administration; Col. S. A. Dallas, USAF Plant Representative; R. M. Hazen, U. of North Dakota, U. of Michigan, 1922, BS in Mechanical Engineering and attended graduate school, U. of Minnesota, majoring in Metallurgy.



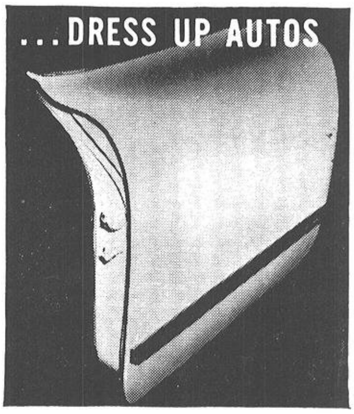
▲ **LEARN BY DOING**—Each year thousands of boys and girls learn how to become better farmers and better citizens through 4-H Awards Programs, such as the Entomology Program sponsored by Hercules. Top awards are college scholarships. Hercules' interest in improved farming methods stems from its development of agricultural chemicals, notably toxaphene for insecticides.

HOW HERCULES HELPS . . .

Most businesses are helped today by Hercules' business . . . the production of synthetic resins, cellulose products, chemical cotton, terpene chemicals, rosin and rosin derivatives, chlorinated products, and many other chemical processing materials—as well as explosives. Through close cooperative research with its customers, Hercules has helped improve the processing or performance of many industrial and consumer products.

▲ **WHITER, BRIGHTER CLOTHES**—Hercules® CMC is a key ingredient in detergents . . . suspends soil, prevents its redeposition on clothes. This excellent property of suspension enables Hercules CMC to serve in a variety of consumer and industrial products.

STANDARD MODELS and plastic-bodied sports cars alike rely on nitrocellulose lacquers for durability and beauty. In the manufacture of these polyester laminates, such as this car door, Hercules hydroperoxides act as the catalyst in their polymerization. ▶



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W.S.P.E.

(Continued from page 20)

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Wisconsin Valley

Steven Koszarek .... A. I. Genisot

Chapter News

NORTHWEST CHAPTER

WM. ROSENKRANZ
Reporter

The Northwest Chapter W.S.P.E. held its January meeting at Reiter's Steak House, Chippewa Falls on Wednesday evening, January 5. Total attendance at the meeting numbered approximately 50, members and wives. Following a complete turkey dinner served family style, Mr. James E. Garvey, Assistant Division Chief, U. S. Internal Revenue Department, Eau Claire, gave a talk on the changes in the income tax code which will be in effect when filing the 1954 returns. There are about 3,000 changes in the code.

Following Mr. Garvey's talk, a business meeting was held at which time officers for the 1955 year were elected as follows:

President—Roderick F. Bott, Chippewa Falls
Vice President—Virgil Dufek, Eau Claire
Secretary-Treasurer—Walt Hestekin, Eau Claire
Director for 3 years—T. E. Thoreson, River Falls

Mr. Donald H. Zillman, engineer with the Northern States Power Company and a new member of the Northwest Chapter, was presented with a membership pin by Mr. William Baumgartner, Chairman of the Membership Committee.

The Northwest Chapter WSPE held its monthly meeting at the Eau Claire Hotel on Wednesday evening, February 2. Guest speaker was Eau Claire County Judge Merrill R. Farr, who addressed the group on the activities of the Traffic Safety Committee of the Legislative Council. He has been a member of this committee since its organization in 1951.

New chapter members George Barland of the Barland Agency in Eau Claire and Herbert Hagg of the Northern States Power Co. in Eau Claire were presented membership pins by William Baumgartner, chapter chairman of the Membership Committee.

SOUTHEAST CHAPTER

JOSEPH H. KURANZ
Reporter

K. Gocht, chairman of the membership committee appointed county chairmen in each city in the district to organize a dinner meeting in their respective communities to be held during Engineers' Week. Local prospective members were invited. Messrs. L. Hogansen, F. Vilen, J. Trebilcock, L. Jensen, and A. Stemper were appointed county chairmen of this activity. Waukesha held its meeting at 7:00 p.m. Thursday, Feb. 24 at the Avalon Hotel in Waukesha.

MILWAUKEE CHAPTER

ROBERT J. MENDENHALL
Reporter

The following officers were elected for the coming year:

President—Orrin E. Andrus
Vice President—Wesley C. Lollier
Director—Robert W. Smeaton
Secretary-Treasurer—J. Randall Meyer

FOX RIVER VALLEY CHAPTER

JOHN K. PRIMM
Reporter

Antone G. Prasil, P.E., 175 Church Street, Oshkosh, a professional engineer for the Wisconsin Public Service Corporation, was recognized at a luncheon at Chicago as one of 27 winners in a nationwide essay and jingle contest. The contest was on "planned meter retirement programs in the gas industry".

WISCONSIN VALLEY CHAPTER

JESS HOLDERBY
Reporter

The postponed meeting of December 1954 was held January 22 at the Pied Piper Club, Rhinelander. The following officers for the year 1955 were elected:

President—Frank Henry, Wisconsin Rapids
Vice President—L. M. Lembcke, Tomahawk
Secretary-Treasurer—Wm. H. Doyle, Wisconsin Rapids
Trustee—Paul Schroeder, Rhinelander

The following meeting dates were announced.

April 16—Tomahawk
July 16—Antigo

END

SENIOR STAFF

at Ramo-Wooldridge

The Senior Staff of The Ramo-Wooldridge Corporation, shown above, is comprised of scientists, engineers, and science administrators with outstanding records of past performance in positions of responsibility. By means of meetings of the entire group, supplemented by frequent smaller sessions, these key men participate actively in the establishment of company plans and policies.

Existing project commitments require that the current rapid rate of expansion of the company continue throughout the coming year. Unusual opportunities, encompassing a wide variety of challenging research and development problems, exist for *additional* scientists and engineers who would like to participate in the development of a company in which, from the outset, all features of the organization and of the operational procedures are designed to be as appropriate as possible to their special needs.

1. Dr. Burton F. Miller
2. Dr. James C. Fletcher
3. Robert B. Muchmore
4. Dr. John M. Richardson
5. Dr. Howard S. Siefert
6. Robert J. Barrett, Jr.
7. William B. Hebenstreit
8. Dr. Ralph P. Johnson
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13. Dr. Milton U. Clauser
14. V. G. Nielsen
15. Dr. Eugene M. Grabbe
16. Marion F. Thorne
17. Dr. Robert R. Bennett
18. Robert J. Hight
19. Dr. Andrew Vazsonyi
20. Emory Lakatos
21. Richard A. Hartley
22. Dr. Howard L. Engel
23. Dr. Donald L. Drukey

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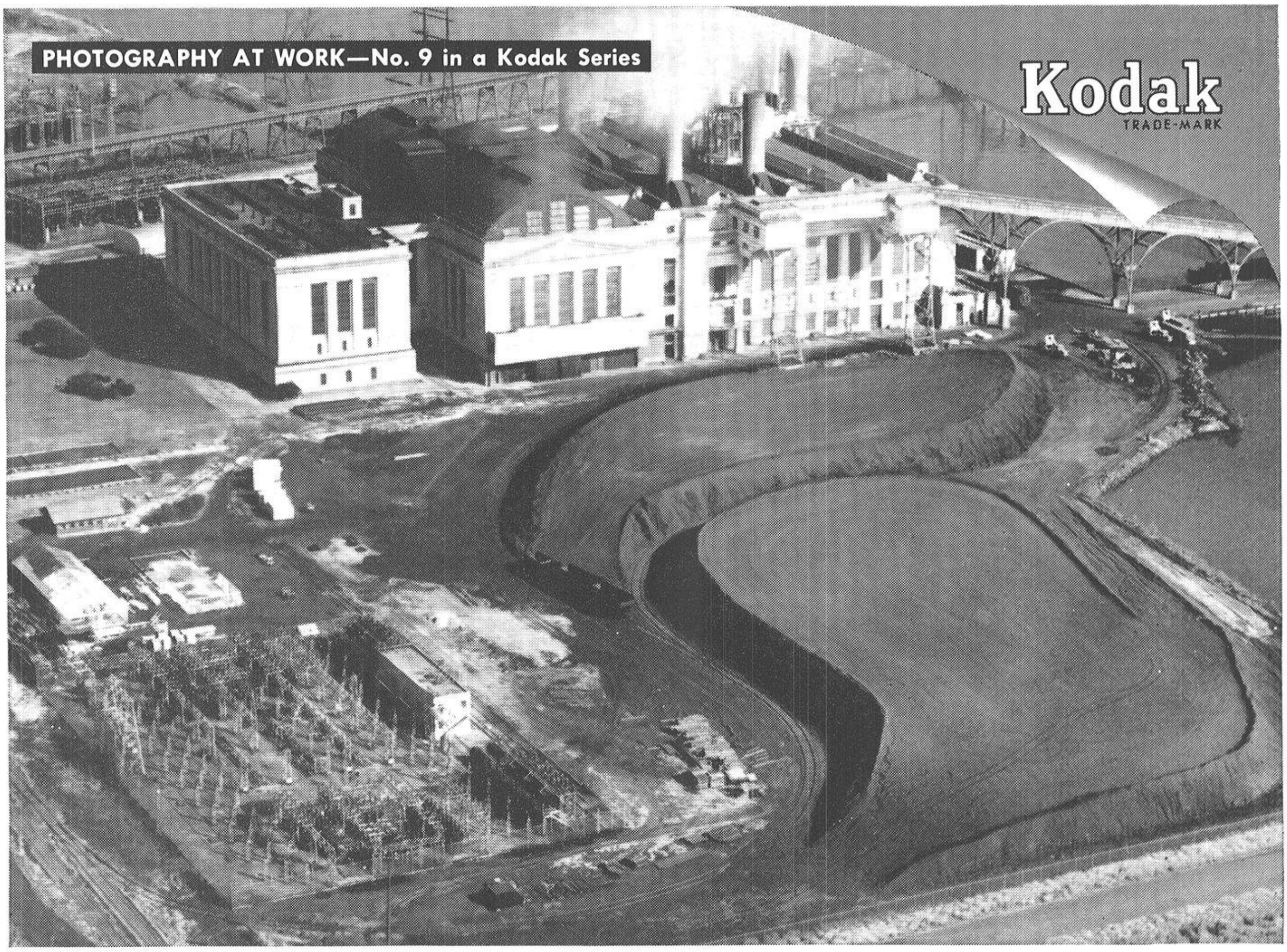


Richmond Station of the Philadelphia Electric Co.

Weeks of work shrink to days as

photography weighs mountains of coal

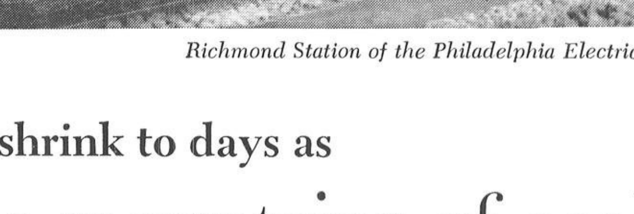
Aero Service Corporation takes stereo pictures of the coal piles at a utility's 10 storage sites—reports the fuel reserves on a single inventory date at 25% lower cost than with other methods

It used to take a surveying crew weeks to measure and figure the contents of the Philadelphia Electric Co.'s big coal piles. Now a camera and an airplane work together to cut the time to days. Overlapping pictures are taken from the air. Then with stereo plotting equipment the volume of the heap is calculated.

Streamlining the inventory job is a natural for photography. It's being used to count metal rods, automotive parts, telephone calls as well as tons of coal. But photography works for business in many other ways as well—saving time, reducing error, cutting costs, improving production.

Graduates in the physical sciences and in engineering find photography an increasingly valuable tool in their new occupations. Its expanding use has also created many challenging opportunities at Kodak, especially in the development of large-scale chemical processes and the design of complex precision mechanical-electronic equipment. Whether you are a recent graduate or a qualified returning service man, if you are interested in these opportunities, write to Business & Technical Personnel Dept., Eastman Kodak Company, Rochester 4, N. Y.

Aero Service Corporation takes its stereo photographs and translates them into a contour map of 1-foot intervals. Each 1-foot stratum of the coal pile can then be measured with a planimeter and its volume computed.



Eastman Kodak Company, Rochester 4, N. Y.

WHERE PROGRESS IS UP TO YOU . . .

What will you add to jet engine progress?

New, dramatic advances being made at General Electric's aircraft gas turbine operations bring into clear focus the vital role recent college engineering graduates play throughout the company. Typifying such responsibility are R. W. Bradshaw, ME, Lehigh, '48, responsible for design of development engine controls and accessories, and B. C. Hope, EE, UCLA, '49, supervisor of test programs for development of aerodynamic and mechanical components.

In every field from electrical, mechanical, metallurgical and aeronautical engineering to physics and chemistry, young men like these broaden their technical background in GE's after-college program of practical engineering assignments. In this program, as in his ultimate career, the engineer chooses the field and location—from the entire range of G-E activities including plastics, large electrical apparatus, electronics, jet propulsion, automation components and atomic power.

Working with world-renowned G-E engineers, you—like Bradshaw and Hope—can make important contributions early in your engineering career. For full details on the G-E career suited to your talents and interests, see your college placement director, or write General Electric Company, Engineering Personnel Section, Schenectady 5, New York. TR-1A

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