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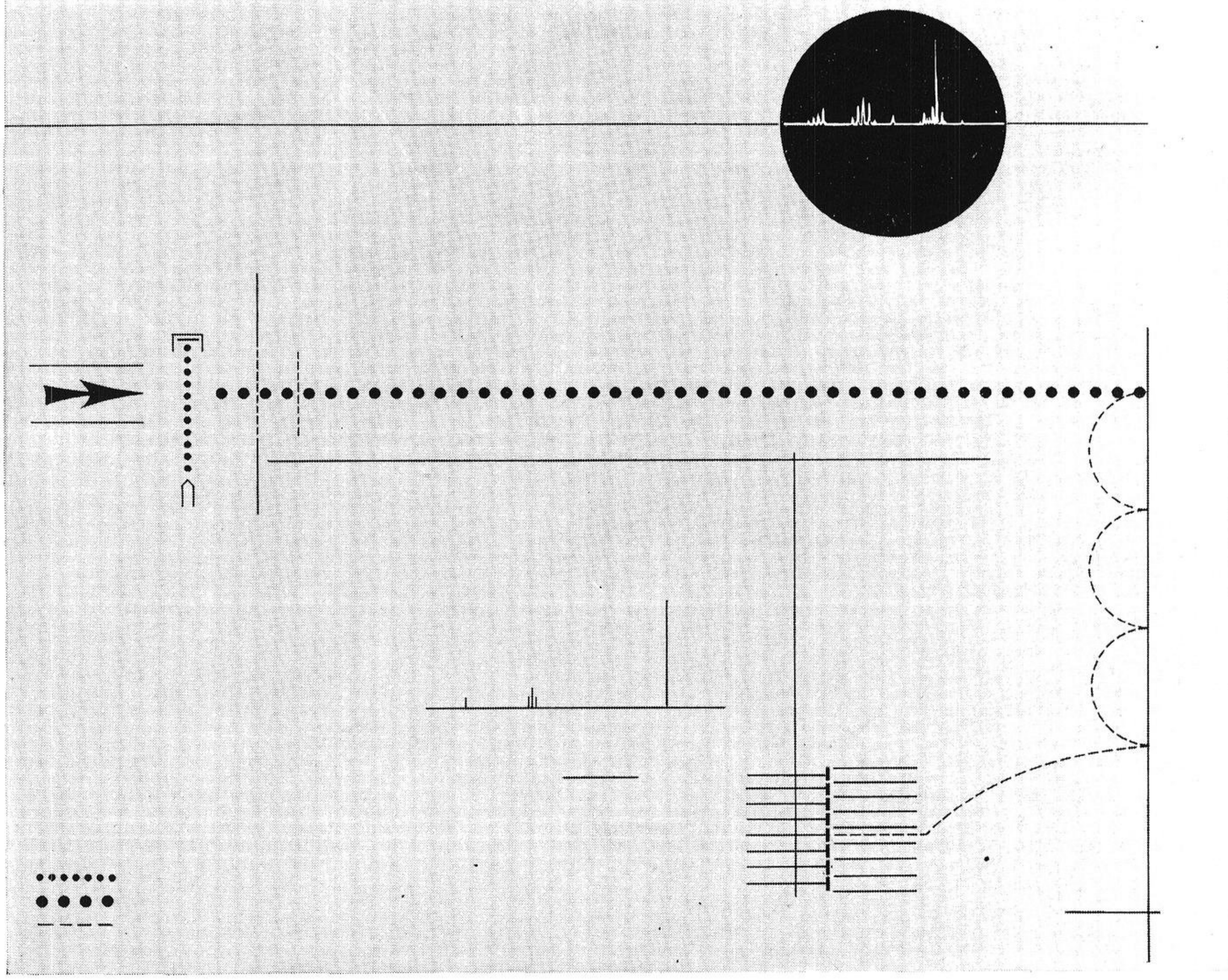
FEBRUARY, 1962 • 25 CENTS
MEMBER E.C.M.A.

THE WISCONSIN ENGINEER

HIGH SCHOOL ISSUE
ATTENTION GUIDANCE COUNSELOR

BENDIX IN SCIENCE AND ENGINEERING



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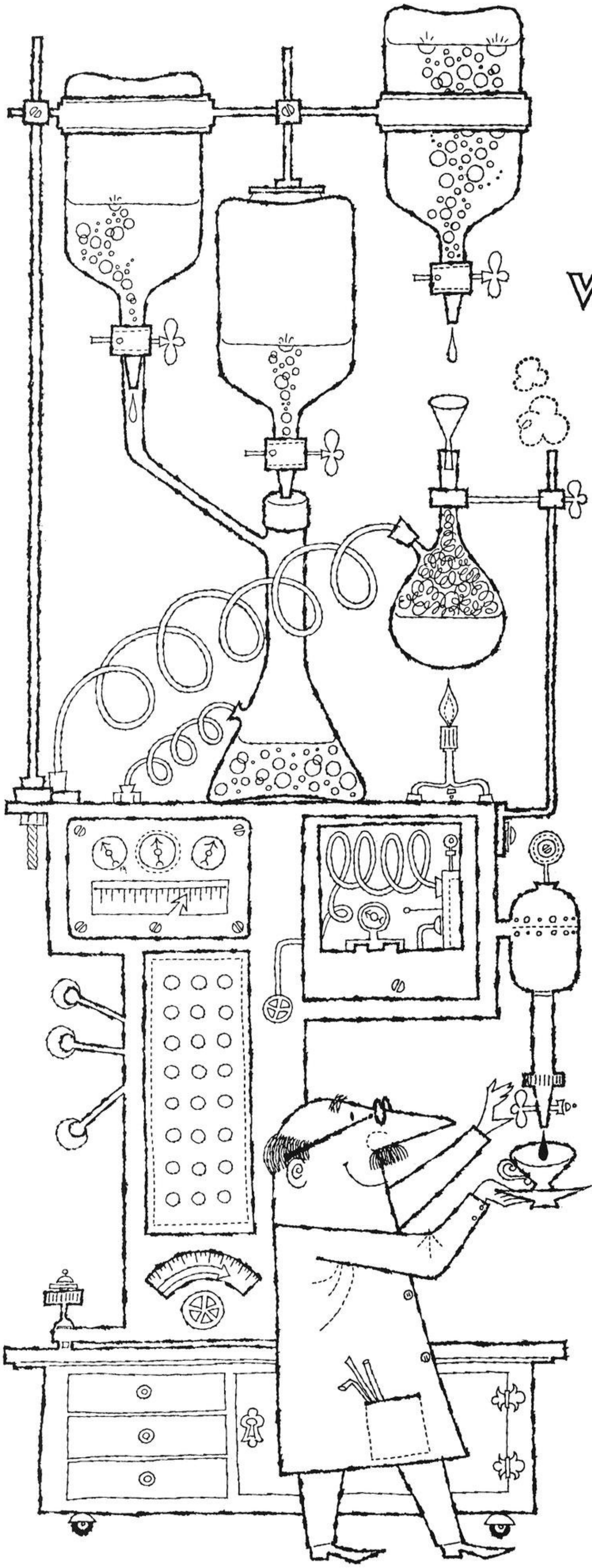

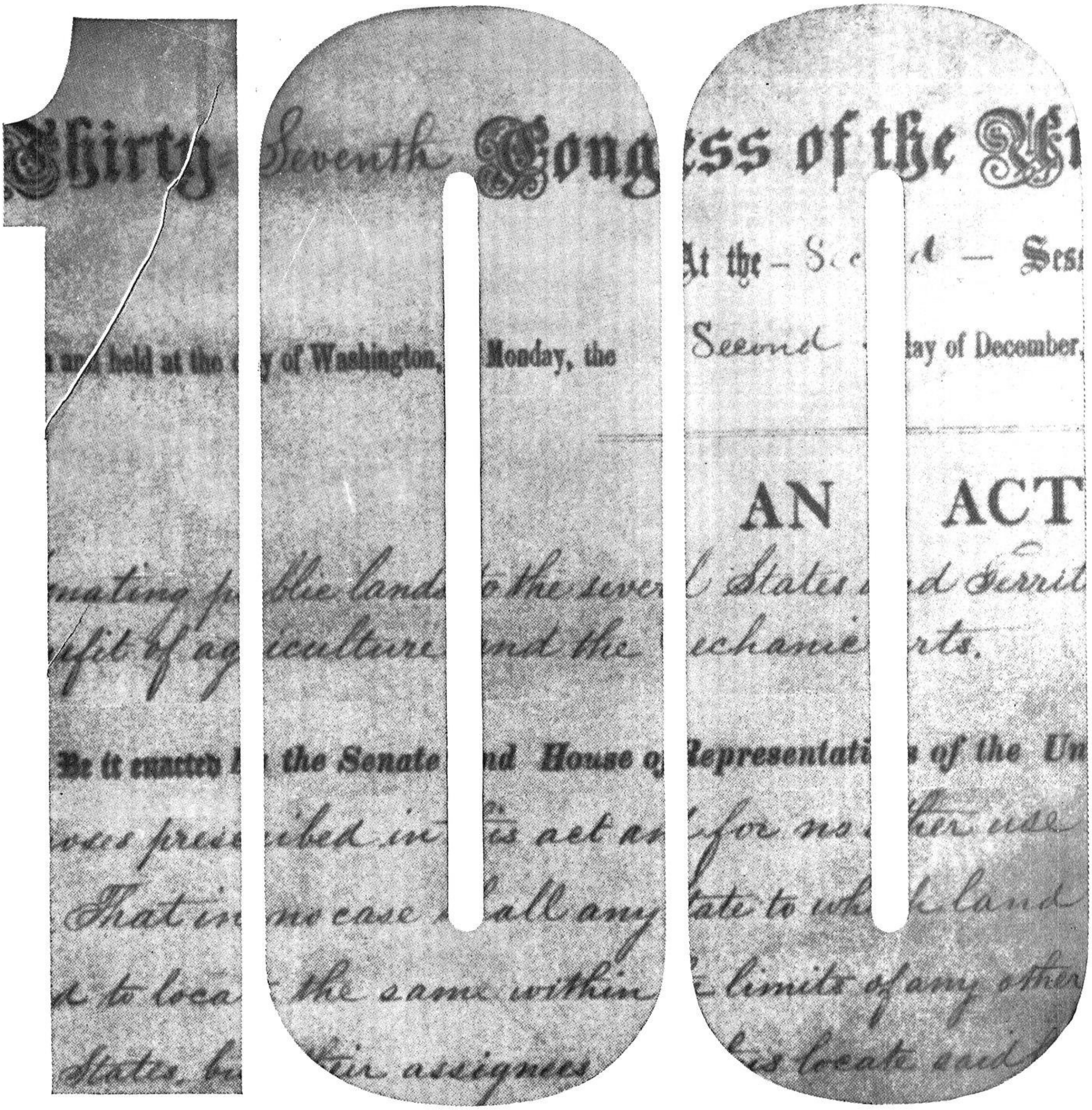
AN ACT
Be it enacted

COMING

THE 1962

ENGINEERING EXPOSITION

Where .... UNIVERSITY OF WISCONSIN, ENGINEERING CAMPUS

When .... MARCH 30, 31, APRIL 1, FRIDAY, SATURDAY, SUNDAY

What .... INDUSTRIAL & STUDENTS EXHIBITS OF LATEST ENGINEERING ADVANCES MADE IN MANY FIELDS

MEMBER OF ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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Publishers' Representatives: LITTELL–MURRAY–BARNHILL, INC., 369 Lexington Avenue, New York 17, New York.

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HIGH SCHOOL SECTION

THE WISCONSIN ENGINEER

The Student Engineer's Magazine Founded in 1896

DEPARTMENTS

THIS MONTH'S COVER

The cover was drawn by Dick Fry an education major.

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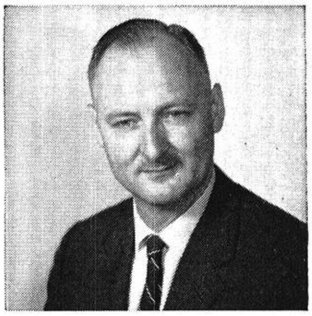
A MESSAGE FROM KEARFOTT TO DOCTORAL CANDIDATES WHO WILL BE RECEIVING THEIR DOCTORATES FOR STUDIES EITHER IN ENGINEERING OR SCIENCE DISCIPLINES WITHIN THE NEXT FEW YEARS.

ANNOUNCING A NEW RESEARCH CENTER FOR THE AEROSPACE SCIENCES

Under the Direction of Dr. Robert C. Langford



Dr. R. C. Langford, Director of the new Kearfott Research Center, has joined Kearfott after 18 years as R&D Director in a major electronics corporation. He was graduated with a Doctorate as a Swan Research Fellow from the University of London. He is senior member of IRE, a founder member of the American Nuclear Society and a member of the American Rocket Society. An author of technical articles and lecturer, he has also been a member of a U.S. Government committee analyzing Russian accomplishments in the electronic and solid state fields.

Your interest is enlisted in a new scientific community entirely concerned with scientific and technical investigations; totally divorced from administrative or development duties.

Studies will be related as closely as possible to urgent needs of government agencies, determined through personal consultation with their representatives. Particular (but not exclusive) emphasis will be placed on problems bearing on navigation, guidance and control of upper atmosphere, space and undersea vehicles, areas where Kearfott has long held a leadership position in the development of systems and components.

Recent doctoral candidates are sought who are interested in pursuing research programs under the technical guidance of eminent scientists in the following areas:

Oceanography — to investigate natural phenomena, in order to arrive at a more perfect understanding of the effect of earth sciences on systems required by government. (A vessel will be provided.)

Radiation Sciences — to increase understanding of plasmas, wave propagation; to fully explore energy conversion, infrared technologies.

Astrospace Environments — to study natural phenomena in order to provide a more perfect understanding of environmental boundaries of space systems.

Hydraulics & Pneumatics — to provide a fuller understanding of fluid technology in dynamic systems.

Guidance & Navigation — terrestrial and celestial — to develop a broader comprehension of the needs of future systems.

Physics — specialists in modern materials research pertaining to solid state, fluid, magnetic and dielectric materials.

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Metallurgy — to serve as authority on metallurgical properties of modern materials — function-wear, defect propagation and anelasticity.

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The 1962 University of Wisconsin

Engineering Exposition

ENGINEERING

FOR

"PEACE POWER"

Once again it is time for the University of Wisconsin's Engineering Exposition. This exposition is held once every three years and includes hundreds of exhibits of the latest scientific and engineering advances.

Industry provides many fine displays showing old concepts and ways of doing things, and then showing the new way that has been made possible through research and diligent work. The engineering students at the University also contribute many exhibits which have varied from a "hot rod" exhibit which showed the power drained off the motor to run various accessories to exhibits which feature such items as telescopes, transistor sets, and ham radio operations.

Many interesting exhibits come from the faculty members that are working on an interesting project such as a control system for the "Midas Satellite" or research on solar energy and its uses, and many other varied and interesting subjects.

The exposition covers the entire University of Wisconsin Engineering Campus with the exhibits dealing with a certain field in that related building. A guided tour is conducted around to the various exhibits to insure that you can see everything and not miss half of the exhibits.

The Exposition Committee and Faculty of the School of Engineering would like to take this opportunity to invite everyone to the exposition which will be held March 30, 31, and April 1. We would also like to extend a special invitation to the high school students to attend on Friday, March 30. This day has been set aside as high school day and special attractions and accommodations are being set up. More information to the high school will be mailed out in a letter before the exposition.

CHARLES DOYLE

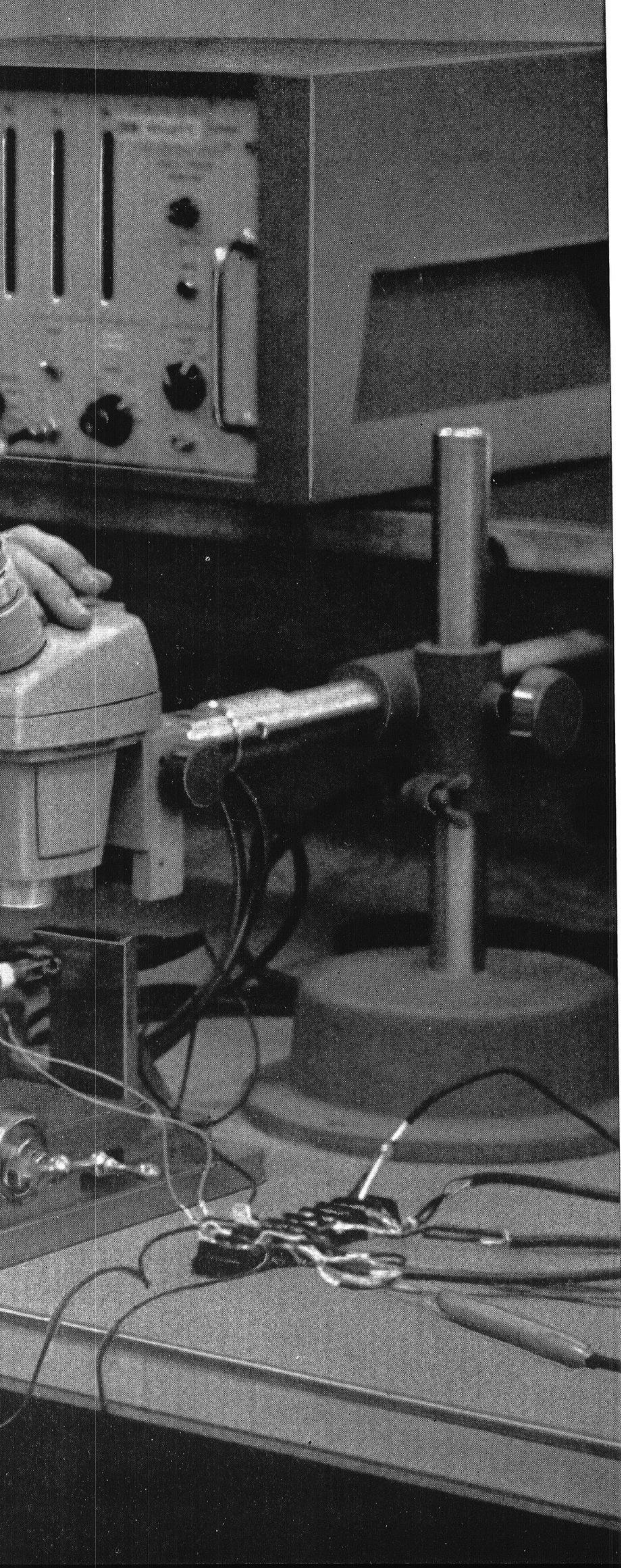
Rambling With The Editor

Will You Accept the Challenge?

You are being challenged every day, your right to the essentials of life—food, clothing, and shelter—is being continuously called into question by others who have less of these things. Many are presently searching for ways to spare you the bother of facing these challenges. I am not about to do the same, because I am convinced that the only way people grow is by accepting challenge. In line with this conviction I am about to offer you another: *The challenge of engineering.*

The accepted definition of engineering is, "The art OR science of applying the laws of natural science." Let me expand this definition somewhat. First note that the definition says that engineering is an art. This further implies that engineering is creative, and such is actually the case. The definition also mentions the natural sciences: physics, chemistry, bacteriology, biology, etc. This would imply that the engineer must know the laws of the natural sciences quite well for the same reasons that the painter must know his colors well. However, the key word in this definition is "applying!" This is to say that the engineer is interested in the further development of Einstien's theory of relativity, for instance, only as that development may solve his particular problem of hitting Mars with a rocket. Furthermore, as soon as a man becomes interested in knowledge for the sake of knowledge he ceases to be an engineer. This is not to say that the engineer never discovers any new knowledge. It is, however, to say that any new knowledge discovered by an engineer, while it may be indeed significant, remains incidental to the job at hand.

The engineering profession today finds itself faced by a rapidly expanding wealth of scientific knowledge, as well as a world population desperately needing food and fiber if it is to keep from starving or killing itself fighting over the supplies available. In the light of this challenge the engineering profession extends to you, the high school student of today and the adult of tomorrow, the invitation to study, to think, to learn, and finally to join the profession and accept your share of its challenge. The way is not easy but the rewards, both economic and spiritual, are great. WILL YOU ACCEPT THE CHALLENGE? GBB



Peter R. Schulz (B.S. in M. E., Lehigh University '58) is a project engineer in the Manufacturing Research Laboratory where he's developing new techniques to improve manufacturing.

HE PUTS RESEARCH TO WORK ON THE PRODUCTION LINE

Examining new phenomena in cryogenics, optics, information theory, data communications and photochemistry, IBM research engineers and scientists are developing new concepts for information processing.

Some of these developments have a far-reaching, fundamental influence on basic knowledge, while others may have a more immediate application to actual problems. Where technological advances have a specific bearing on data processing needs, they must be considered for application in manufacturing. At IBM, that's a job for Manufacturing Research.

As a project engineer, Peter R. Schulz has found Manufacturing Research a challenging and rewarding assignment. Translating today's scientific discoveries to meet tomorrow's production line needs is an important step in creating exciting new products. It requires imagination and ability to put new techniques, equipment and processes to work on the production line.

At IBM, Manufacturing Research is an area of activity that provides as much room for professional growth and advancement as the engineer is ready for. In his three years with the company, for example, Peter Schulz has already received three promotions to reach his present position of responsibility. But no matter what your field of interest may be, IBM facilities and professional guidance provide plenty of backing for building a rewarding career.

The IBM representative will be interviewing on your campus this year. He will be glad to discuss with you the many challenging jobs that are open at IBM—in development engineering, research, manufacturing research, programming or systems engineering. Your placement officer can supply information and make an appointment for you. All qualified candidates will receive consideration for employment without regard to race, creed, color or national origin. If you prefer, you may write, outlining your background and interests, to:

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High School Section

We of the Wisconsin Engineer staff would like to extend our greetings to all high school students, to whom this issue is dedicated. Our hope is that the following pages will inform the prospective college student about the different engineering fields in general, and about engineering at the University of Wisconsin in particular.

To give you this information we have asked a group of the top educators to comment on the facts and opportunities of their respective engineering fields. Also included is an article giving the views of a top engineering student.

We hope that this issue will help you in the selection of your future careers.

A Career Begins—The Freshman in the College of Engineering

by K. G. Shiels

Assistant Dean and Freshman Advisor

Professor Shiels was born in Baraboo, Wisconsin, and received his B.S. and M.S. in Mechanical Engineering from the University of Wisconsin. In addition to his duties as adviser for engineering freshmen, he is chairman of the Department of Drawing and Descriptive Geometry.

THE following outline of registration procedures, and preview of a typical weekly class program for a freshman engineer, is given to help the prospective engineer understand what some of the situations he meets will be like when he registers for and enters the College of Engineering.

To apply for admission to the University of Wisconsin, the prospective student must complete the application form, and submit a copy of his high school record. He then receives a permit to register. Advance registration is usually accomplished during the summer preceding the Fall semester in which the student plans to enroll in the University.

During this advance registration period, the student takes a variety of tests, including some which measure facility with mathematics, and determine placement in the correct mathematics course. The student discusses with an adviser the field of engineering in which he wishes to enroll, and the course choices open to him. Thus, at this time, most students will know exactly what courses they will be taking in the Fall.

Occasionally, results from the tests will suggest modifications in course choice, such as taking a more advanced English class or a less advanced mathematics course, or carrying a reduced load. Such modifications are made in an attempt to suit the engineering curriculum to individual differences. In another aspect of the attempt to meet individual differences, the University Student Counseling Center is open at the time of advance registration to advise students who are uncertain that they have made the correct choice of vocational endeavor. Students who are uncertain whether they wish to be engineers or lawyers, doctors or businessmen are urged to seek the assistance offered at the Counseling Center. Also, students who are uncertain whether they have the aptitude to pursue the career they have chosen, because of poor high school performance or difficulty with or dislike for certain subjects required in that career, may consult the Student Counseling Center.

On the next page is a sample of a typical work schedule for a freshman in mechanical engineering during his first semester. He is carrying 17 credits, an average credit load in the College of Engineering. Of the 168 hours in a week, this freshman spends twenty-seven hours in class. Approximately thirty-five hours should be allotted to out-of-class study. Fifty-six hours are assigned to sleep, twenty-one to meals and dressing, and twenty-six hours are free for personal activities such as dates, sports, church, and relaxation.

Students who must work for support, who plan to participate in a major sport, or who learn more slowly than their fellows must recognize that the hours for these activities must come from the fixed total of 168 hours per week. If a student needs more time for any of these activities, the time can be gained only through a curtailment of personal activities, or through a reduction of the academic work load. Cutting down on sleep, or missing class, or reducing study time most often leads to disastrous results. Even before coming to College, the student needs to recognize the importance of budgeting time carefully, organizing daily activities, and getting to work immediately, to insure success.

To examine the specifics of the weekly program, we see that our typical freshman begins his day by studying Chemistry. He reads the material to be covered in his lecture and laboratory periods later in the day, and uses this time for review of earlier work. On Friday morning during this first period he attends Chemistry Quiz, a discussion class. On three mornings per week our freshman reports to English class, where he learns principles of composition and gains facility in the use of language. Two mornings per week he attends speech class, where he finds an opportunity to develop skills in public speaking. Following his language courses, our freshman spends two hours, three times a week in drawing class, where he learns to read and write the language used in all engineering work. These skills of communication are considered most important for our would-be engineer.

On Tuesday morning at 9:55, all freshman engineering students attend Freshman Lectures, an orientation program designed to introduce freshmen to key members of the college faculty, and to acquaint them with various aspects of the jobs done by engineers. Two hours per week are spent in physical education class. During the first five weeks of the semester, one hour per week is spent in a ROTC Orientation program, where students are given an opportunity to learn about different reserve training programs and are given the information with which to choose whether or not they wish to pursue a reserve officer training program.

After lunch, our student has some free time three days per week, which he might devote, for example, to the completion of his drawing assignments. Twice weekly he attends Chemistry lecture. As a supplement to these lectures, he spends four hours per week in the chemistry laboratory and one hour in discussion, as noted above. Five days per week he attends mathematics class, to learn the concepts of calculus and analytic geometry, with two hours per week spent in lecture, and three spent in a discussion session where he receives help in applying mathematical theory to the solution of problems. Suggested study time for mathematics outside of class time is ten hours per week, since mathematics is such an important subject in any engineering curriculum. Evening hours are devoted to study, with the hours distributed to insure that no course will be neglected, and utilizing psychological principles of learning. Weekends offer the most free time, yet some weekend hours must be used for study and review if the minimum of thirty-five study hours is to be realized. College is in reality more time consuming than many "full-time jobs".

The Office of the Freshman Adviser is open at all times for freshman engineers to come for consultation about any special problems which might arise. Students may

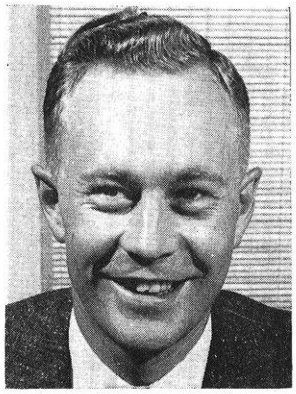
(Continued on page 49)

Hour	Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
7:00	Could Sleep Late	Get up, dress, eat, off to classes ---------------					Could Sleep Late
7:45		------------Study		Chemistry	-----------	Chem 2a	
8:50	Free time	Eng. 1a	Speech 8	Eng. 1a	Speech 8	Eng. 1a	
9:55	Free time	Drawing 12	Freshman Lectures	Drawing 12	ROTC Orient.	Drawing 12	Study English
11:00	Free time		Phy. Ed.		Phy. Ed.		
	---------	---------	--Noon	Meal ------	-----------	---------	---------
12:05		Study		Study		Study	
1:20	Free time	Drawing	Chem 2a Lab.	Drawing	Chem 2a Lab.	Drawing	Free time
2:25	Free time	Chem 2a		Chem 2aL		Study	Free time
3:30	Free time	------	--------	Mathematics 60 ----		---------	Free time
4:35	Free time	-------------	Study	Chemistry	-------------------		Free time
6:00	------------- Relax after evening meal ---------------------------						
7:00	--------------- Study Mathematics ---------------					D	
8:00	--------------Study Mathematics ---------------					A	Free
9:00	Study	Study	Study	Study	Study	T	
10:00	Speech	Speech	English	English	English	E	Time
11:00	Hit the Sack ! ----------------------------------						

Career Opportunities in Engineering

by James A. Marks

College of Engineering, Placement Director



Professor Marks received his B.S. degree in Mechanical Engineering from Purdue in 1948 following by an M.S. degree in Industrial Engineering in 1951. After working in industry for several years he came to the University of Wisconsin in 1954 as an instructor in Engineering Drawing and Descriptive Geometry. In 1956 he was appointed to his present position of Engineering Placement Director.

NEWSPAPER articles, news releases and general reports about the new shortage of engineers are becoming more and more numerous. During the next four years the almost inevitable increase in demand along with the known decrease in the number of new graduates is certain to make the future in engineering extremely bright. Looking ahead even further, probably no other field can offer more rewarding careers than engineering. But the baffling drop in enrollment in engineering indicates that high school students are somehow misinformed about the opportunities in engineering or the difficulty of studying engineering in college. There is some indication that high school students fear that engineering is very difficult and demanding, and that "too much" mathematics and science are necessary. No one will say that engineering is easy but for those with any interest in the field the potential rewards in an engineering career certainly make it one of the most promising if not the very best career choices a high school student could make.

The expected increase in demand along with the intense competition for better students has meant that starting salaires are not only staying as high as they have been in the past but in most cases are increasing. It is not unusual for the graduate engineer to receive a salary of $6,500 during his first year after graduation. There is every reason to expect that starting salaries will continue to rise at least as much, if not more, than general income levels rise. Certainly engineers can expect handsome financial rewards in the years to come.

Of course, salary should not be the prime reason for anyone choosing a career in engineering, or in any other field, for that matter. Instead, the individual should consider the kind of work he (or she) will be doing and whether or not he will be happy doing it. While this might imply that only those who have a deep interest in things mechanical, for example, would consider engineering, it should be pointed out that for many jobs normally considered to be non-engineering in actual practice virtually demand an engineering background. Sales, production supervision, management, and many other jobs have become exceedingly technical in nature and an engineering education is a real asset in almost any field. Under these circumstances the high school student who has the ability will find an engineering education to be better basic training than perhaps any other college program and a real asset in any field of endeavor.

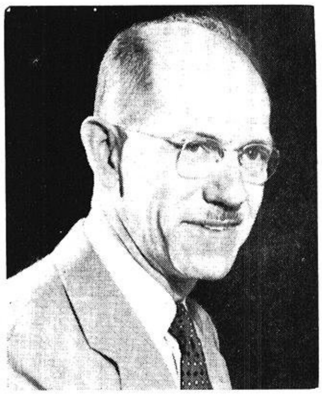
The individual who would enjoy a career in education and who has the ability and interest in engineering will find an extremely bright future in engineering education. The demand for engineers will create more and more opportunities in the teaching of engineering.

Because of the interest in engineering graduates, the Placement Office of the College of Engineering has become one of the busiest spots on the campus. Each semester up to five hundred representatives from companies throughout Wisconsin and all over the country visit the campus to interview seniors. These companies provide literature and other information

(Continued on page 49)

The Engineering Profession

by ***Kurt F. Wendt***
Dean, College of Engineering



Dean Wendt received his B.S. degree in Civil Engineering from the University of Wisconsin in 1927 and has taught in the College of Engineering since 1927. For twelve years he was in charge of the Materials Testing Laboratory, then served as Associate Director of the Engineering Experiment Station, and now is Dean of the College of Engineering and Director of the Experiment Station.

ON BEHALF of the entire faculty it is a pleasure to extend greetings to all students in our Wisconsin high schools and to invite those who may be interested in the field of engineering to visit us. You will find much of interest in our laboratories and the opportunity to discuss your plans for the future should prove profitable. Dean Shiels, who is in charge of our program for freshmen, and members of his staff and of the college will make you most welcome.

This year our students, under the sponsorship of Polygon, are again presenting an Engineering Exposition. The dates are March 30–31 and April 1, 1962. This occasion presents a particularly fine opportunity to see the facilities of the College of Engineering and to see in action many of the laboratories and much of the special equipment used in both teaching and research. Special invitations will be sent to your schools, and we hope that many of you can arrange to attend.

During the past century engineering has made great strides and its many contributions to our high level of economic well-being are universally recognized. You need only look around to see the products of engineering on every hand. The automobile, the airplane, trains, ships, bridges, buildings, roads, electric light and power, radio, television, water and sewer systems, machine tools, refrigerators, and heating systems, to mention only a few, all are the result of engineering research, design and production. Today engineers are making major contributions in the fields of nuclear power, rockets, missiles, satellites, and space technology.

The past decade has seen discoveries and applications in engineering increasing at an unprecedented rate and it is the considered opinion of scientists, engineers, and industrialists that we will see many more developments in the future than we have in the past. We have just begun to realize the potential in the fields of nuclear and solar energy, in solid state physics, in communications, in plastics, and in automation. The problems of space are only beginning to emerge. A great challenge and a most interesting and exciting future lie ahead for young men and women in all engineering fields.

Every week we receive many questions and among the most frequent are: What engineering courses are available at Wisconsin? Which courses are most popular? What does the engineer do? Should I be an engineer?

Wisconsin offers curricula in chemical, civil, electrical, mechanical, mining, metallurgical and nuclear engineering and has also recently introduced a curriculum in engineering mechanics to meet the demand for a broad basic course in engineering with strong emphasis on science. Both undergraduate and graduate work are available in each of these fields.

At the present time electrical engineering is the most popular program closely followed by mechanical engineering. Together these two account for about 60 per

(Continued on page 50)

University Extension

by Professor Paul J. Grogan
Chairman, Extension Engineering Department

GREEN BAY

KENOSHA

MANITOWOC

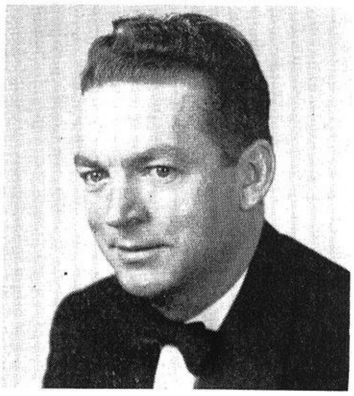
MARINETTE

MENASHA

RACINE

SHEBOYGAN

WAUSAU



Professor Grogan has served in the above capacity since 1951. Earlier, he taught mechanical engineering subjects at both The University of Wisconsin and The University of Notre Dame. His educational background includes a B.S. from Purdue and M.S. from UW. The professional field in which Professor Grogan has gained the greater amount of his practical experience is power generation. This has been reflected in his extensive writings on the subject in professional and trade journals.

THE University Extension Division is the off-campus arm of The University of Wisconsin. One of the units of the Extension Division is the Department of Engineering. Included among its responsibilities are the programs of undergraduate instruction in engineering at the several Extension Centers in the state. Centers are located at Kenosha, Racine, Sheboygan, Manitowoc, Marinette, Green Bay, Menasha and Wausau. The enrolment in these Centers in recent years has been increasing far more rapidly than the University as a whole. This may be due in part to the excellent new facilities now in use at Wausau, Menasha, Green Bay and Kenosha, or it may be due to a realization that the easier financing of the first two years of college may make possible a fifth and sixth year of college work.

Substantial blocks of credit toward a degree in any of the several fields of engineering offered by The University of Wisconsin may be obtained through the Extension Center System. It is only fair to mention at this time that The University of Wisconsin–Milwaukee (UW–M) offers an excellent opportunity for the study of engineering at both the undergraduate and graduate levels. There are further opportunities for beginning an engineering career at the State Colleges in several locations throughout Wisconsin. These latter operations are not a part of the University Extension Center system, but a great deal of harmony and accord exists within the entire state-supported system of higher education in Wisconsin.

Questions are often asked whether or not an individual is able to obtain "full credit" for work taken in an outlying institution, and whether or not an engineering program can be completed in a normal four years if one starts off campus.

(Continued on page 50)

Aiming for a Broad Education

by Kurt H. Wulff che'63
President of Polygon Board

AN OFTEN voiced criticism of newly graduated engineers is that they cannot express themselves well. Realizing that a trained technical man is worthless if he is unable to communicate his ideas, recruiters from industry look for engineering graduates who have trained themselves to work with others. In order that you, as a future engineering student, may become a well rounded college graduate, aim for a broad education which extends beyond the classroom.

Organized student activities provide an excellent means to achieve this end. Within the college of engineering there are four areas of extra-curricular activity. First there are honorary fraternities, whose membership is restricted; second we have professional-social fraternities of which there are four; third there is the "Wisconsin Engineer" staff and fourth you may join the student branch of a professional engineering society such as, the American Institute of Chemical Engineers, the American Nuclear Society, American Society of Mechanical Engineers, etc.

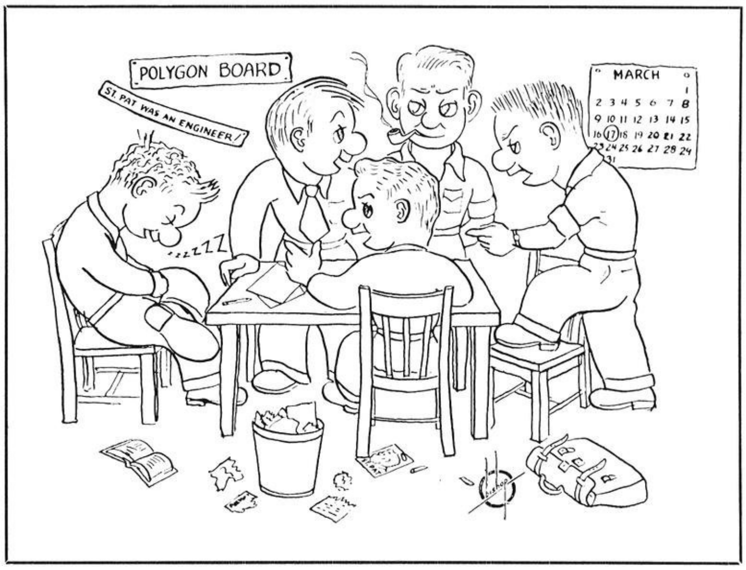
Benefits to be derived from engineering student activities are numerous. Most important, you will be meeting with fellow engineers and faculty members, learning to know each other and getting along together. In speaking before these groups you will naturally develop your ability to communicate, you will learn to manage people and to be managed by them, which will be very important in your professional life. Activities are beneficial in other ways, too. Learning more about your future profession will arouse your interest and in turn give you greater motivation. To succeed in college, motivation is as necessary as natural intelligence. Also, since these activities take time, you will be forced to budget your time and thereby become more productive. Lastly, your participation will provide healthy diversion from studies.

Not to be de-emphasized in the least is academic work. If grades suffer, the strong case for activities becomes a weak rationalization. For a successful college career a good start is a long step in the right direction. This means establishing yourself academically and gaining confidence in your technical ability. Therefore, as you begin college concentrate on getting good grades for the first semester and then extend your education to nonacademic areas. If you have a good first year you will very likely have a good four years.

Motivation is the key to a good start and a successful college life. Your "driving force" must be a keen interest in your profession and a strong desire to do well. If you are content to fulfill no more than the minimum requirements for a degree you will not be successful as an engineer. Make it your goal to be a good engineer, aim for a broad education.

When you receive a good job offer four years from now you will be able to look back upon your engineering undergraduate years with satisfaction. Your education extended beyond the classroom, you made a worthwhile contribution to your school and you have become more valuable to society in the process.

Good luck!



Above: Polygon board discusses the coming St. Patrick's Day activities.

R. G. Bell (above) was born in Ironwood, Michigan, April 22, 1933. He moved to Ladysmith, Wisconsin at an early age. He graduated from the University of Wisconsin with a B.S. Degree in Chemical Engineering in 1956 and joined the Du Pont Company following graduation.

He was employed by the company as an engineer in a process development group at their plant near Charleston, West Virginia. Since employment, he has worked as a development engineer in the Nylon Intermediates, Methyl Mthacrylates, and Ethylene Glycol processes.

In 1960 he was promoted to an Assistant Division Superintendent in the Technical Department. In this capacity he currently supervises a group of engineers who are responsible for the engineering development work in the Nylon Intermediates process at Du Pont's Charleston plant.

M. W. Butenhoc was born in Wausau, Wisconsin, July 20, 1918. He graduated from the University of Wisconsin with a B.S. Degree in Chemical Engineering in 1940. He joined the Du Pont Company in August of that year and has continued to make his career in engineering with that company.

He joined the company as an engineer in a process development group at their plant near Charleston, West Virginia. He continued in process development work in a wide variety of products at that location and was promoted into a supervisory position in a process development group in 1949.

His responsibilities and training in supervision increased with experience, including a period of duty at one of the Du Pont plants in Texas. In 1958 he was put in charge of the entire process development group for the plant at Charleston. He remained in this position until 1960, when he was given responsibility for manufacturing operations of the plant.

In his current position he is responsible for the supervision and handling of 800 wage roll people and 180 salaried people, many of whom are technically trained.

Chemical Engineering

by Professor R. A. Ragatz
Chairman, Chemical Engineering Department

Professor Ragatz is a true native of Wisconsin, born in Prairie du Sac, receiving his B. S., M. S., and Ph. D. degree at the University, the latter in 1931. He has done some specialty work in plastics, and is joint author of two widely-used texts in chemical engineering.

THE chemical engineers' function in industry is to translate the laboratory discoveries of research chemists into large-scale manufacturing operations. The research chemist generally makes the basic discoveries, and he almost always works with small-scale equipment in the laboratory. His apparatus usually is made of glass, and his product yields are small, usually a few grams at most. The chemical engineer, on the other hand, is assigned the task of designing and operating the large-scale apparatus required to produce the desired material in commercial quantities.

The chemical engineer finds employment with companies engaged in the manufacture of gasoline, fuel oil, lubricating oil, greases, asphalt, rocket fuels, synthetic rubber, rubber products, plastics, synthetic textile fibers, paper, synthetic detergents, soaps, insecticides, weed killers, sulfa drugs, and antibiotics. The chemical engineer produces a host of "petrochemicals" such as toluene, formaldehyde, ethyl alcohol, ethylene glycol, and benzene. In all of the foregoing manufacturing activities, research chemists and chemical engineers form a coordinated team.

The manufacturing processes in which the chemical engineer engages are usually quite complex and require a series of well-defined processing steps, some of which are chemical in nature and some of which are essentially physical in character. Typical chemical processes are polymerization, sulfonation, chlorination, nitration, hydrogenation, oxidation, reduction, hydrolysis, and alkylation. Typical physical operations are pumping of fluids, transport of solids, heating or cooling of materials, crushing and grinding, mixing, filtration, drying, absorption of gases by liquids, solvent extraction, crystallization, distillation, and evaporation. Chemical engineers select the various chemical and physical operations needed to make the desired product; they work out the best conditions for each step; they design the equipment needed for each step; they build and operate the complete plant.

In a large company employing many chemical engineers, the type of work carried out by a particular individual may be restricted to one of the following general lines of activity: development, production, maintenance, process control, inspection and testing, design, construction, technical sales and customer service, and administration. If a chemical engineer works for a smaller company, his duties probably will encompass several of the foregoing types of work.

The Department of Chemical Engineering has excellent instructional facilities. The Chemical Engineering Building has well-equipped undergraduate laboratories for instruction in unit operations, chemical manufacture, process measurements and control, applied electrochemistry, plastics, and technical analysis. Facilities for graduate MS and PhD thesis projects are also provided.

The curriculum in chemical engineering has, for many years, been accredited by the American Institute of Chemical Engineers and also by the Engineers' Council for Professional Development. The curriculum is constantly under scrutiny, and periodic changes are made as called for by new scientific discoveries and changed industrial conditions.

The tremendous growth of the chemical industry since World War II has created many employment opportunities for graduates from the chemical engineering course. Prospective students should bear in mind, however, that Wisconsin has relatively few chemical industries, with the result that most of our graduates secure employment outside of the state. A notable exception is Wisconsin's large pulp and paper industry, in which many of our graduates have secured employment. **THE END**

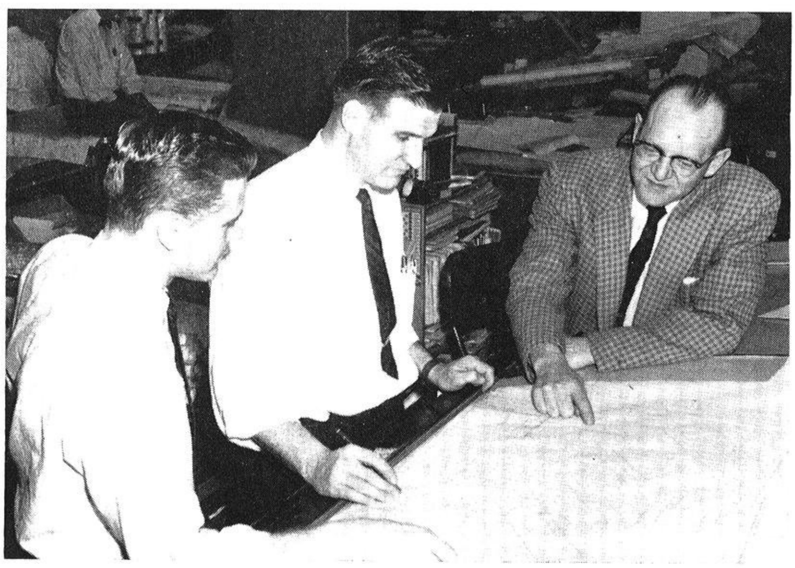
W. J. Kerttula, first man to the left of man with sun glasses, is a very successful University of Wisconsin Civil Engineering graduate. He is shown discussing an interchange on a recent Good Roads Tour.

Mr. Kerttula graduated in 1950 and since then he has risen at a phenomenal pace. He is presently a District Engineer and I am sure he has ambitions to get the next position on the ladder which is a top rung and held by another Wisconsin graduate W. J. Burmeister, Highway Division Director. Photo courtesy of The State Highway Commission.

The photograph at the right is one of the exchanges at the Milwaukee County Stadium. This erchange was designed by two University of Wisconsin Civil Engineering graduates. They are Don Gostomski and Charles Ingwersen.

Don graduated in 1957. His former home town was Milwaukee.

Charles graduated in 1954. He is presently a project supervisor for the State Highway Commission. His former home town was also Milwaukee. Photo courtesy of the State Highway Commission.



John Huppler ('39) talks with two of his staff men, Robert Safford ('51) and Dean K. Anderson ('61). L. to r., Anderson, Safford, Huppler.

John Huppler is a graduate in civil engineering and his home town was Muscoda, Wis. He is assistant chief engineer at Kimberyl–Clark Corporation's Staff Engineering. Mr. Huppler has worked at corporation plants in Neenah, Wis., Niagara Falls, N. Y. and Kapuskasing, Ontario, Canada.

Mr. Safford also is a graduate in civil engineering. His home town was Huron, S. D. He is a design engineer in manufacturing process design.

Mr. Anderson is a graduate in mechanical engineering. His home is at Amherst, Wis. He is an engineer in manuafacturing process design. Anderson worked for Kimberly–Clark as an undergraduate engineering while attending Wisconsin.

The Course in Civil Engineering

by **Arno T. Lenz**
Chairman, Civil Engineering Department

Professor Arno T. Lenz is in his second year as Chairman of the Department of Civil Engineering. He is a Wisconsin native, having been born in Fond du Lac, and has received four degrees from the University. The last was the doctorate in 1940. His professional work has been in Hydraulic Engineering with special Emphasis on water resources studies and model tests of dams. In addition to his teaching and research, he has spent several summers on engineering work for the Tennessee Valley Authority, the U. S. Burau of Reclamation and Wisconsin industries, and as a consultant in law suits concerned with water problems.

THE work of the civil engineer covers such a wide variety of problems that his basic training must be very broad. For that reason, some high school graduates who are not sure about which branch of engineering in which to specialize start their work in civil engineering and later select a specialty in that field or one related to it. Civil Engineering specialties include structures; highways, municipal engineering and city planning; hydraulics, fluid mechanics and hydrology; sanitary engineering; and surveying and photogrammetry.

This work is taken after he has secured a firm foundation in mathematics, physics, chemistry, engineering mechanics and the art of communication. Because engineers rapidly rise to positions where they are directing the work of others, training in communication is one of the most essential facets of an engineer's college study. This begins with the course in freshman English where the student receives additional training in writing the English language. It continues with courses in drawing where he learns to communicate ideas graphically. A course in speech teaches him to express his ideas verbally. Courses in engineering reports and contracts and specifications teach him how to apply communications skills to specific engineering needs. Courses in the humanities such as economics, political science, history, etc., broaden his training and background so that by graduation he has become educated as he should be to live and work in our modern complex society.

Civil engineering courses in structures cover the basic fundamental theory required for steel, concrete, and wood structural design. This instruction is based on mathematics courses through the calculus and differential equations. In these courses more than in some others there is growing emphasis on the use of electronic computers to make available more rapidly and with greater accuracy and detail the design of structural elements.

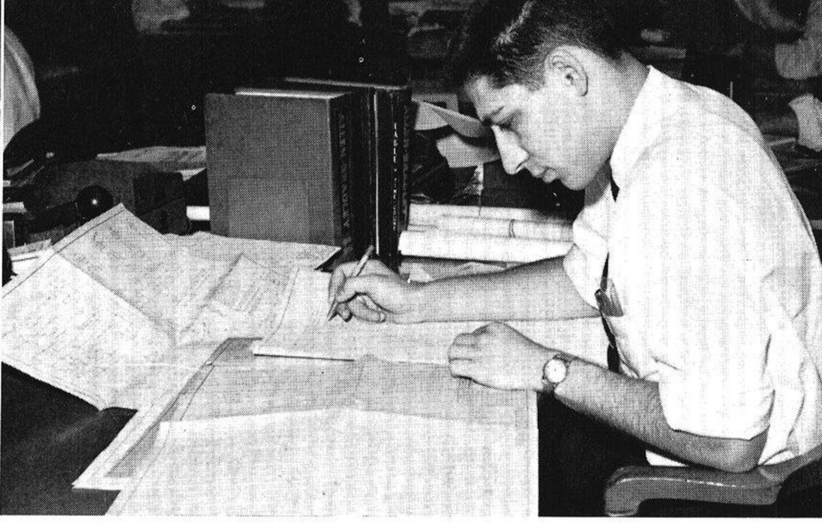
Highway engineering and related work may be continued with elective courses in such specialties as soils and aggregates testing, bituminous materials testing, highway administration, traffic control, and vehicle testing. Laboratories available include the large, well-equipped Wisconsin Highway Commission Laboratory on the University campus. Research is also done in the field both in the Madison area and at various locations throughout the state.

Surveying and photogrammetry is a very important part of civil engineering instruction. This includes not only work on campus but also at a summer survey camp at Taylor Lake in northern Wisconsin where the department has excellent camp facilities in a national forest area. A sterio plotter and related facilities are available on campus for both instruction and research in three dimensional measurement from aerial photographs. An interesting application of this work and surveying in general is now underway in the south polar region where Mr. James Clapp, Instructor, and Mr. William Heilman, senior student, are making measurements and laying bases for future measurements of glacial ice flow on Roosevelt Island between the bases at Little America and the South Pole.

Hydraulic engineering instruction includes basic hydraulics, fluid mechanics and the hydrology of water resources. Instruction and research is centered in the Hydraulic and Sanitary Laboratory on the shore of Lake Mendota. The low pressure water system supplied by lake water can supply up to 10 cubic feet of water flow per second to an assortment of flumes and channels of various sizes and shapes. A high-pressure water system with a head of 200 feet supplies water for hydraulic turbines, pipe line flow, and all sorts of hydraulic measuring devices. An oil ciriculation system with pressures up to 2,000 pounds per square inch

(Continued on page 51)

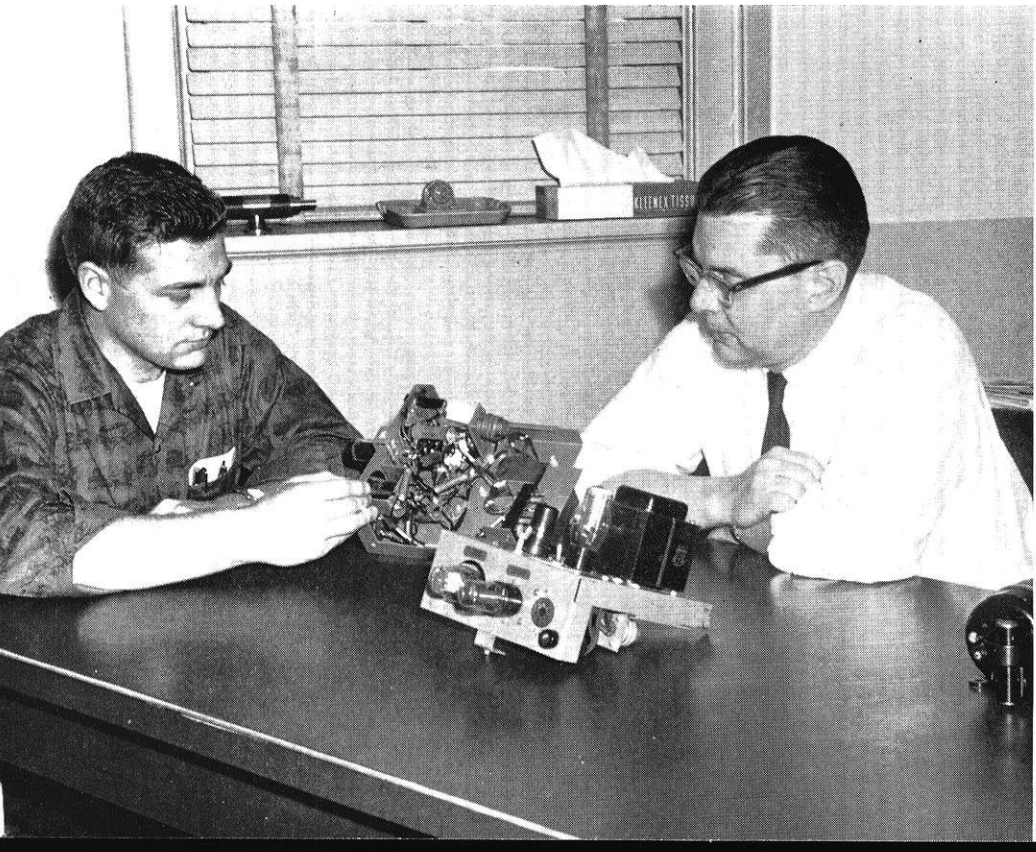
James N. Pearse hired in 1957 as an EE, hometown La Crosse, Wisconsin, started as a Research and Development Engineer Trainee then worked as a Development Engineer and is presently a Project Engineer. Photo courtesy Allen–Bradley Co.



Paul V. Raab hired in 1957 as an EE, hometown Freehold, New Jersey started as a Research and Development Engineer Trainee then worked as a Development Engineer and now is a Project Engineer. Photo courtesy Allen–Bradley Co.

Floyd R. Woldt hired in 1956 as an EE, hometown Oshkosh, Wisconsin started as a Sales Trainee then worked as a Sales Engineer and is presently in Sales Promotion. Photo courtesy Allen–Bradley Co.

Milan Damjanovich hired in 1957 as an EE, hometown Milwaukee, Wisconsin, started as a Application Engineer Trainee and now is a Application Engineer. Photo Courtesy Allen–Bradley Co.



Left to right, Don De Meuse ('58) and Richard Nelson ('38) Mr. De Meuse is a graduate in electrical engineering and his home town was Algoma, Wis. He is an electrical design engineer.

Mr. Nelson, whose home town was Madison, is a graduate in electrical engineering also. He is assistant to the vice president of engineering with responsibility for staffing utilities function of Kimberly–Clark.

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 B.S. and M.S. (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. With the characteristic vigor of youth, it is growing and expanding rapidly to meet the challenges of the profession in an era which is characterized by the growing importance of space technology, electronic computers, and increasingly complex communications systems.

Only eighty years ago, the first waterwheel driven electric generator in this country was put in operation at Appleton, Wisconsin. There was rapid growth and development of the profession in these early years. Even more phenomenal has been the expansion in more recent years. Today the American Institute of Electrical Engineers (AIEE) has over 67,000 members. The Institute of Radio Engineers (IRE) is even larger, with over 90,000 members. Both organizations are growing. The IRE is one of the fastest growing professional technical societies at the present time. There is now underway a well-organized movement to merge these two Institutes into one which, when completed, will have a membership of over 150,000 electrical engineers! It will be by far the largest unified engineering Institute in the world.

A few generations ago, electricity was available in the homes of only a few. Now, 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. Radio and television have been brought to most homes. These are some of the more obvious consequences of electrical engineering.

Electrical Engineering has expanded tremendously in scope in recent years. Automatic control theory, information theory, the transistor, new analytical techniques, analog computers, digital computers, extra high voltage power transmission, the tunnel diode, nuclear fusion and fission, and many other developments have been basically important in this expansion. The control of guided missiles, and the very special instrumentation problems associated with the recording of data and transmitting such data back to earth from satellites are largely the responsibility of the electrical engineer. The problems are fascinating and challenging, requiring much imagination and resourcefulness in obtaining solutions. Advanced training in engineering science and mathematics is generally required for creative work in these areas.

Graduate work in Electrical Engineering is encouraged. About 80 graduate students from many different states and foreign countries are currently enrolled in Electrical Engineering on the Madison campus. It is expected that more than 15 Ph.D. degrees in Electrical Engineering will be awarded in 1962. The employment opportunities for individuals with such engineering-science training are indeed challenging and exciting.

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 of industry. We have recently revised our curriculum in order to make it more suitable to the demands of our rapidly changing technology. This new curriculum applies to all those students entering as freshmen in September, 1959, and thereafter. It is fully ac-

(Continued on page 51)

JT3D

DIRECT ENERGY CONVERSION

TURBOJET

ROCKET

LIQUID HYDROGEN

LR-115

THERE'S CHALLENGE TODAY FOR VIRTUALLY

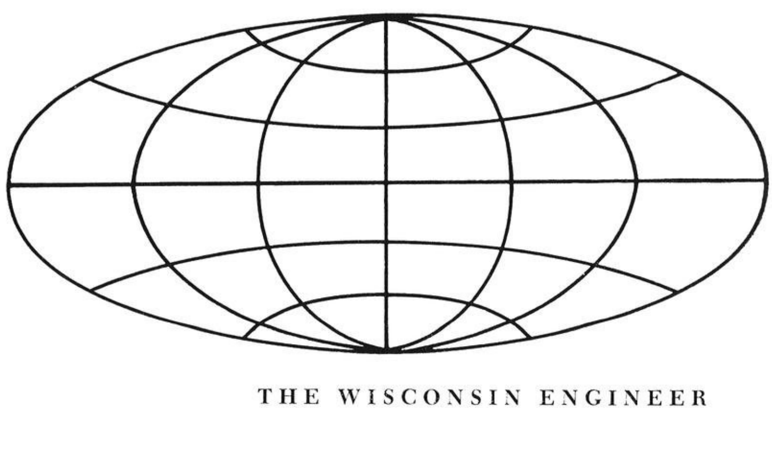
FUEL CELLS

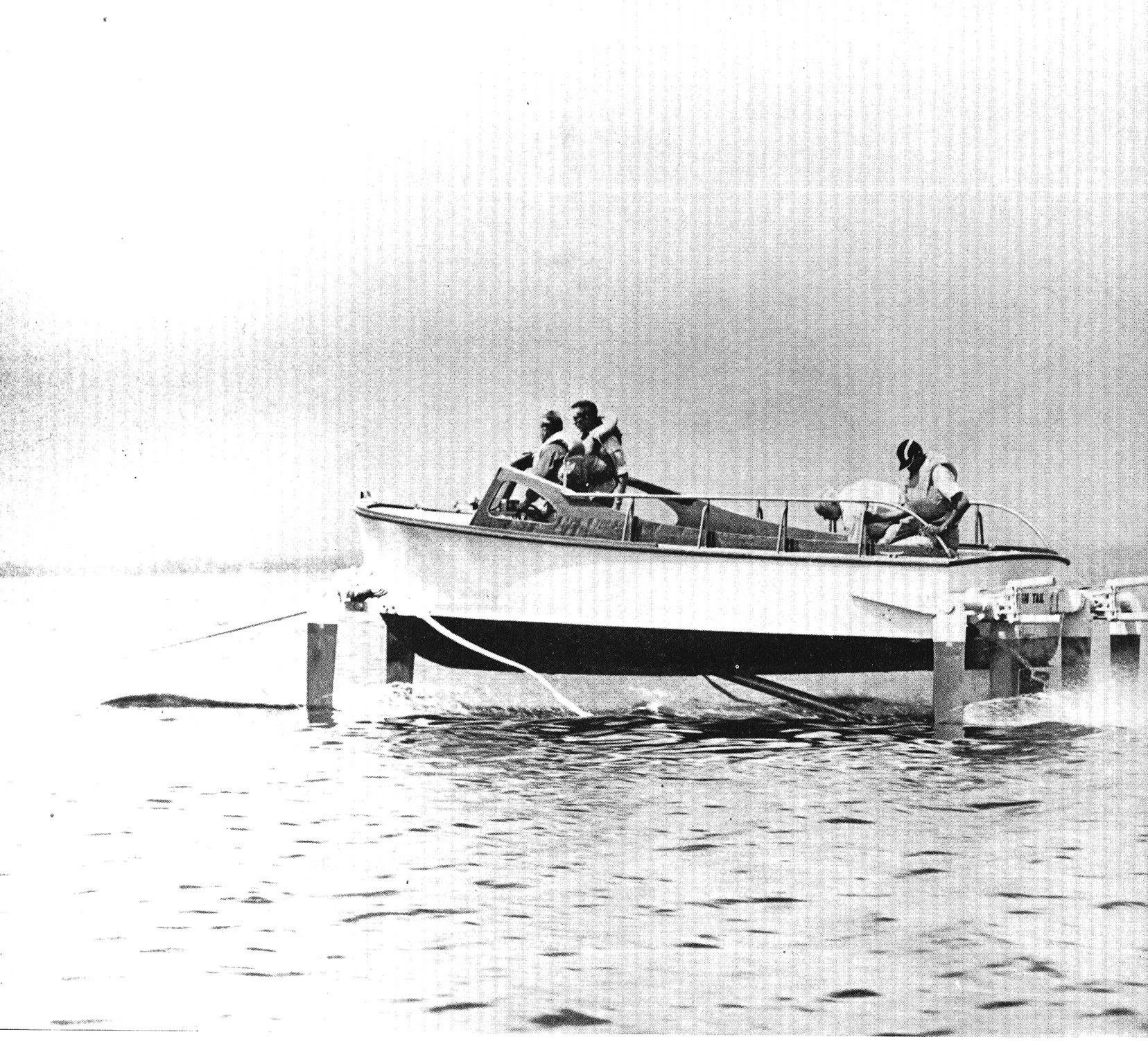
MACH 3

MAGNETOHYDRODYNAMICS

SATURN

NUCLEAR

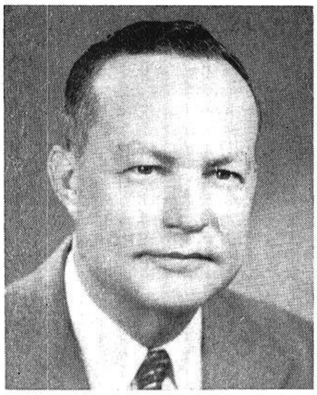




The design of a hydrofoil boat such as the one shown here involves to some extent the same problems in Engineering Mechanics that face the designers of ballistic missiles. These include problems in *Properties of Materials, Fluid Dynamics, Aerodynamics,* and *Experimental Stress Analysis.* Note the ski type sensor in front of the boat which is dynamically coupled through the control system to change the angle of attack of the submerged foil in order to keep the boat on a level course.

Engineering Mechanics

by Professor George W. Washa
Chairman, Mechanics Department



Professor George W. Washa has been chairman of the Department of Engineering Mechanics since 1953. He was born in Milwaukee, Wisconsin, and received his B.S., M.S., and Ph.D., degrees from the University of Wisconsin. He has been very active in ASTM and ACI. He has served as chairman of several ACI committees and has also served on the Board of Directors. He is co-author of two textbooks in Engineering Mechanics.

THIS undergraduate engineering curriculum of the University of Wisconsin has been started to meet the current need for training in the more fundamental aspects of engineering. It is matched by similar curricula in many of the leading engineering colleges throughout the country. They may not always be called Engineering Mechanics, but similar aims and objectives are present in many curricula such as Engineering Physics and Engineering Science.

What Is Engineering Mechanics?

Engineering Mechanics serves as a bridge between work in the basic sciences—mathematics, physics and chemistry—and the various engineering curricula. The mechanics courses common to all engineering curricula are: *Statics*, concerned with forces and equilibrium of bodies under the action of forces; *Dynamics*, concerned with the motion of particles and bodies and the forces necessary to cause such motion; *Mechanics of Materials*, concerned with the stresses and strains within beams, shafts, columns, and other elements performing their usual functions in structures and machines; *Properties of Materials*, concerned with understanding and measuring the mechanical and physical properties of materials such as metals, plastics, concrete, soils and wood. The new curriculum in Engineering Mechanics provides for more courses in physics, chemistry and mathematics than required in most engineering curricula along with advanced courses in Engineering Mechanics. It includes a course in *Experimental Stress Analysis* which is concerned with the use of photoelasticity and various mechanical and electrical strain gages for the purposes of determining stresses when theoretical calculations are not practical. Graduate courses leading to the Master of Science and Doctor of Philosophy degrees, which have been given by the Department for many years, consider further such fields of study as elasticity, plasticity, plates, shells, and elastic stability.

Why Was This New Curriculum Started?

There are many reasons and a few of the more important are listed below:

First, many engineers now frequently work as a team with chemists, physicists, and mathematicians and must be able to understand them.

Second, many returning graduates have indicated that they thought an undergraduate curriculum in Engineering Mechanics would have been of great benefit to them in their professional activities and recommended strongly that such a curriculum be activated.

Third, most industrial organizations, both large and small, prefer that their men come to them with a broad fundamental scientific background. Generally they themselves prefer to teach the details relating to their specific activities.

Fourth, recent studies of the American Society for Engineering Education have recommended a strengthening of the work in the basic sciences.

Fifth, perhaps the most important reason for the formation of the curriculum in Engineering Mechanics has been the great changes that have taken place in science and engineering during the past years. Among the most important of these have been the rapid diffusion of scientific knowledge and disciplines into engineering, the increasing use of the analytical approach to the solution of practical problems, and the need for a better understanding of the properties and mechanics of materials. While engineering is still both an art and a science, some fields are based

(Continued on page 51)

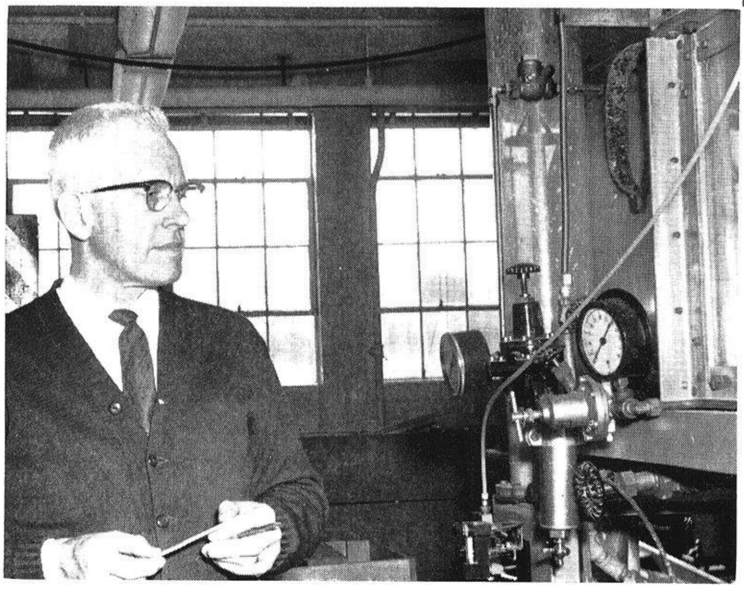
Left to right: Arthur Antonissen ('52) and John Ashenbrucker ('50) are checking operation of the supercalendar in the Kimberly, Wis. plant.

Mr. Antonissen is a graduate in mechanical engineering and his home town was Niagara, Wis.
Mr. Ashenbrucker is a graduate in electrical engineering and his home community was Racine, Wis.

Both men started at Staff Engineering as design engineers and were transferred to Kimberly–Clark's Kimberly, Wis. plant. Mr. Antonissen is a maintenance engineer, Mr. Ashenbrucker a development engineer.

(Sitting) Douglas P. Cleereman hired in 1961 hometown Kenosha, Wisconsin Sales Trainee EE.

(Standing) Robert D. Wiedenhoefer hired in 1961 hometown Milwaukee, Wisconsin Sales Trainee ME. Photo Courtesy Allen–Bradley Co.



Gilbert Bayley ('33). Mr. Bayley is a graduate in mechanical engineering and his home town was Beaver Dam, Wis. He is a senior engineer, design-project in the Research Services section of Staff Engineering. Photo Courtesy of Kimberly–Clark.

Mechanical Engineering

by Professor Ralph J. Harker

Chairman, Mechanical Engineering Department

Professor Ralph J. Harker is completing his third year as Chairman of the Department of Mechanical Engineering. He is a native of Madison, Wisconsin, and received his B.S. and M.S. from the University of Wisconsin. His field is machine design, with particular interest in vibration and balancing. He has had considerable experience in the aircraft industry, and is vice-chairman of the Rock River Valley Section of the American Society of Mechanical Engineers.

MECHANICAL engineering is that phase of engineering which deals principally with the conception, design, analysis, test, production, and utilization of mechanical equipment. Engineers in this profession have been a major factor in the development in this country of the highest standard of living in the world, which has been largely achieved by the effective mass-production system which has been developed. The mechanical engineer, although contributing to our present technology in every industry and in every phase of design, development and production, has played a dominant role in the transportation, power generation, and manufacturing fields.

In the field of transportation he has been largely responsible for the development of modern aircraft, including the turbo-jet engine, landing gear, hydraulic controls, and inertial navigation systems. Our current cars, trucks, and buses are the result of his extensive efforts in the development of engines, brakes, transmissions, steering mechanisms, chassis structures and the associated mass production technology by which they are manufactured. Railroad and marine equipment is also designed and built by the mechanical engineer, as well as the many types of heavy earth-moving equipment which make possible our expanding superhighway systems.

In power generation the mechanical engineer is responsible for the conversion of fuel energy, nuclear energy, or water power, to mechanical energy. This involves the design and construction of turbo-machinery, steam generators, pumps, and condensers, which are essential components of our tremendous electrical power generating capacity.

In the field of production machinery, the mechanical engineer has designed and developed the automated equipment now used in the manufacture of castings, stampings, extrusions, forging, and of machined parts of all kinds. As this equipment becomes more complex, various types of hydraulic, pneumatic, electrical, and numerical controls must be understood and applied by the mechanical engineer.

Mechanical engineering is perhaps the broadest in scope of all branches of engineering. An individual mechanical engineer may design products or production methods, he may supervise production, he may administer business operations or technical projects, he may test individual machines or complete plants, or he may conduct research. Although many special areas exist in the profession the field is traditionally divided into three broad activities. They are heat power, design, and industrial engineering.

In the heat power field, engineers are interested in the analysis of liquids, gases, and vapors, as they are used in all types of engineering applications. Thus, the internal combustion engine, the steam turbine, the refrigerator, and the rocket engine are but a few examples of equipment requiring this type of engineering. To be proficient in this area, the engineer must have a knowledge of thermodynamics, heat transfer, fluid flow, gas dynamics, combustion, and other related subjects.

In the design field, mechanical engineers are called upon to conceive new devices and machines, and to refine and improve existing designs. Perhaps no phase of mechanical engineering places greater demands upon the imagination, ingenuity, and judgement of an engineer than that of mechanical design. Design requires the conversion of ideas to physical reality, which is the essence of engineering. The design engineer must be well grounded in kinematics, ele-

(Continued on page 53)

The metallograph shown provides for inspection and photograph of metals magnified to 50 to 3000 times.

A huge self-powered vehicle, as shown to the left, provides one answer to the problem of providing the raw materials needed by our industry.

Mining and Metallurgical Engineering

by Professor P. C. Rosenthal

Chairman, Department of Mining and Metallurgy

This is Professor Rosenthal's fifth year as department head. He received his B.S. and M.S. in Metallurgical Engineering from the University of Wisconsin. He has been very active in the AFS and ASM, being chairman of several committees. He was co-author of "Principles of Metal Casting."

OUR industrial technology is based on a complex array of alloys and non-metallics which involve almost every known element. Even the inert gases are used in metal processing. While physics and chemistry are the basic sciences underlying the production and development of these materials, there are so many problems that lie outside the normal scope of these subjects that it is common nowadays to think in terms of "materials science" as well. This is the science which deals with the relation between the structure and properties of matter. It is a relatively new science and has deep roots in such fields as metallurgy, ceramics, and solid state physics. It bears directly on such problems as the development of materials for higher strengths, high temperature resistance, extremely low temperature properties, nuclear power application solid state electronics devices, etc.

The broadened scope of activities that is indicated by the materials science approach as well as the extensive engineering problems associated with the production of materials from ores to the finished product, suggested to our staff that a department name more appropriate to these and future activities would be warranted. Concurrent curricula changes and other considerations also were instrumental in reaching this decision. Consequently, this year the departmental name has been changed from Mining and Metallurgy to Minerals and Metals Engineering. While no name can be completely satisfactory in defining the range of the instructional program, the department members believe that the new title not only covers the present but also the future role of the department in the College of Engineering. Furthermore, the inclusion of the word "engineering" in the title emphasizes the importance of the engineering approach in the processing and utilization of materials.

Since this department offers courses covering the engineering problems which begin with the discovery of the original source of materials—the ores—and end with the final metallic or non-metallic products, one undergraduate curriculum cannot cover the entire spectrum of subjects. For this reason, the undergraduate program is divided into two general categories beginning with the Junior year. One of these is directed toward mineral procurement and mineral processing including petroleum as well as metallic minerals, while the other curriculum involves extractive metallurgy, physical metallurgy and materials science. There is some necessary overlap in the curricula. The first one leads to a B.S. degree in Mining Engineering and the second to a B.S. degree in Metallurgical Engineering. Again, these are generalized titles and do not represent all aspects of the programs. Some idea of what is involved is indicated by the following descriptions.

Utilization of metals begins with the discovery and development of mineral wealth. This is the work of the *mining engineer*. The curriculum for mining engineering includes, in addition to courses in mine evaluation, development, and ore removal, related courses in geology, mineral concentration and chemical processing. There are also courses in related fields such as hydraulics, surveying, electrical engineering, and heat and power.

One option of the curriculum in this field concentrates on the geological aspects of mining. The graduate from this program is referred to as a *geological engineer* and would be primarily concerned with finding and exploring new ore bodies or oil fields. He would estimate the economic value of the ore and determine how it might best be extracted from the earth.

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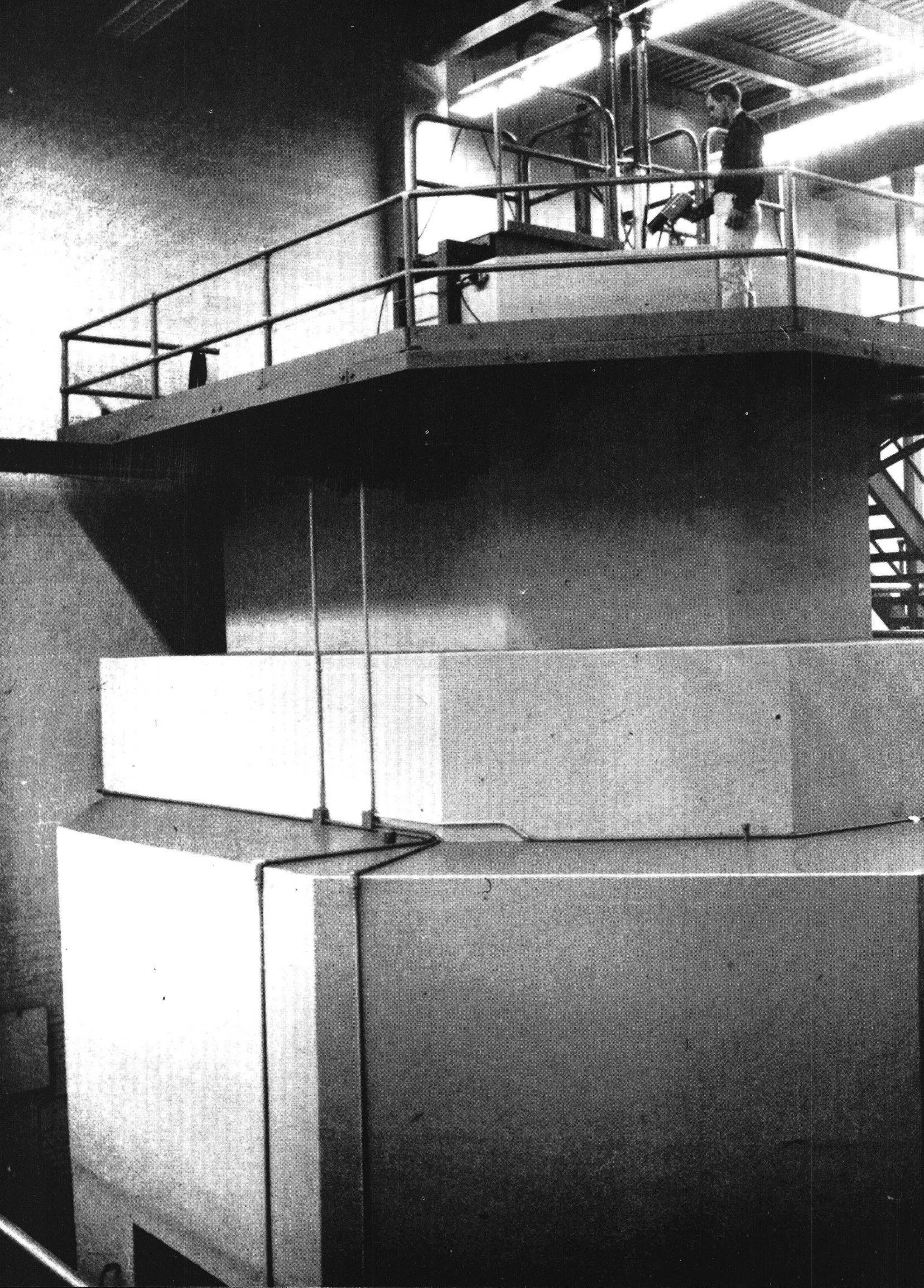
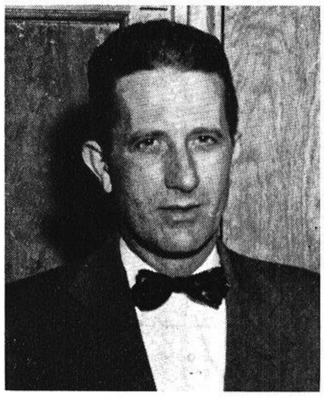


Nuclear Engineering

by Prof. Max W. Carbon

Chairman of Nuclear Engineering Committee



NUCLEAR Engineering is a modern profession concerned with the release of energy from the nucleus by fission or fusion and with the utilization of the properties of radiation. Since the discovery less than 25 years ago that a uranium nucleus could be made to split (or fission) and release energy, a vast new field has developed. In former times, generations frequently elapsed between discovery and application; for example, Hertz demonstrated radio waves in the 1880's, but they received very little practical use for over 30 years. In contrast, nuclear fission was discovered in 1939, plutonium was being manufactured on a large scale in 1943, an atomic bomb was tested in 1945, electricity was generated from nuclear energy in about 1951, and nuclear engines to propel space vehicles were tested in about 1959.

However, even though the application of nuclear energy has progressed at an extraordinary rate, Nuclear Engineering is only in its infancy and much remains to be done. Improved power reactors must be developed which will permit us to generate electricity from nuclear energy as cheaply as from coal throughout the United States and in undeveloped countries throughout the world. (Power reactors, incidentally, are large "machines" in which tremendous numbers of nuclei are fissioned and from which the resulting energy is extracted in the form of heat.) The adaptation of similar reactors for the propulsion of ocean-going vessels and space vehicles must be accomplished. Later programs for space exploration will likely be severely limited unless nuclear energy can be utilized to power ion and electric propulsion systems as well as satellite communication systems.

Research is needed on methods to control the fusion process for the generation of power. (Whereas fission is the splitting of a nucleus with the release of energy, fusion is the combining of nuclei with the release of energy.) Since fusion takes place only at temperatures in the millions of degrees, resort must be made to the use of plasmas, and plasma physics becomes an important study. Other research is needed on means to convert nuclear energy more directly into electrical energy than the decades-old technique embodying turbines and electrical generators which is used at present. In addition, work is only beginning on studies of the use of radiation to fabricate materials having superior strength and thermal characteristics.

The use of radiation in industrial applications such as tracing, nondestructive testing, and thickness measuring is reported to result in savings to the country of $200,000,000 per year. Yet it is felt that the surface has only been scratched. The use of radiation to sterilize foodstuffs may revolutionize the food-packaging industry.

A serious study of the use of nuclear explosives to build harbors and canals, to allow extraction of petroleum from oil sands, and to assist in mining operations is just beginning. And the physicist needs help in the design, development, and use of high-energy particle accelerators for the unexplored ranges above a few billion electron volts.

Certainly not the least nor last, the development of improved nuclear weapons for the defense of the free world must continue unabated.

Although the applications cited above are numerous and diverse, no one can predict with certainty which particular one will prove

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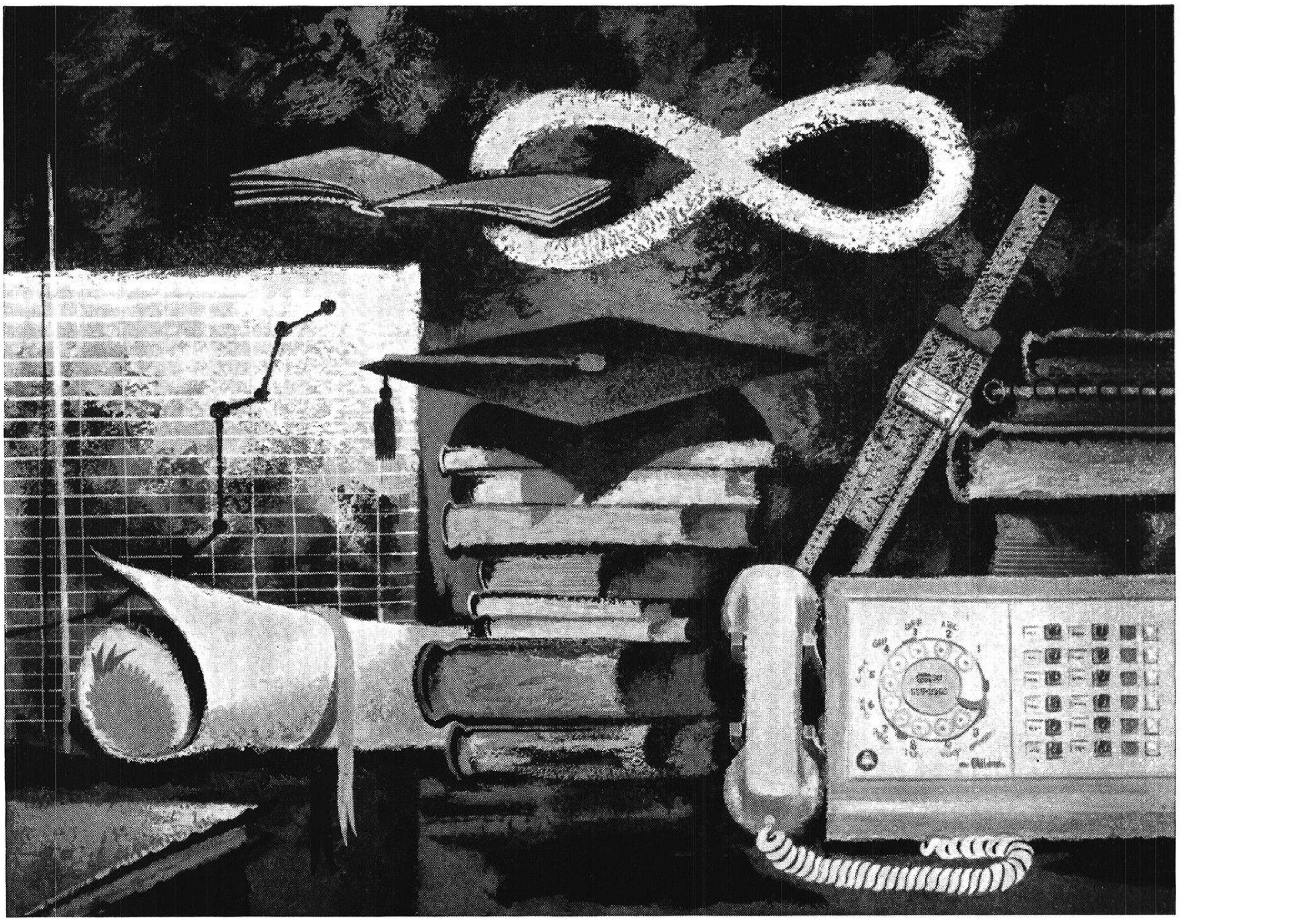
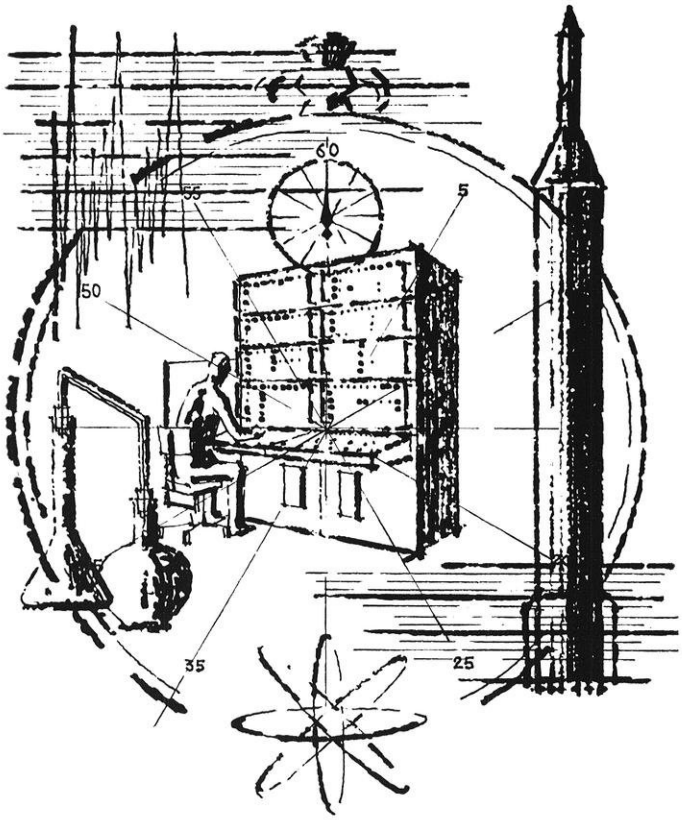
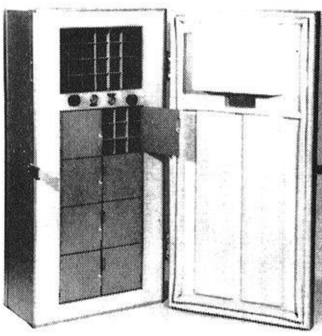
THE NEW U. W. REACTOR





SCIENCE HIGHLIGHTS

by John C. Ebsen 3A'64



WESTINGHOUSE THERMOELECTRIC REFRIGERATOR USED IN AIR FORCE LIFE-SUSTAINING SPACE TEST

A compact one-cubic-foot thermo-electric refrigerator, designed and built by the Westinghouse new products laboratories, was one of the key components of a manned capsule that housed an Air Force scientist on a simulated week-long mission into space.

Designed to operate in the weightless environment of orbital flight, the Westinghouse refrigerator is a complete food storage system. It was one of six life-sustaining devices sealed inside an airtight nine-foot capsule resembling an Atlas (ICBM) missile nose cone. The equipment permitted Courtney A. Metzger, ARDC laboratory engineer and project coordinator, to remain inside the capsule during the week-long test.

Throughout his stay, Mr. Metzger's menu consisted of squeeze tubes of liquids; semisolids; solids in diced portions; some bite-size solids; and an assortment of dehydrated, frozen, and stable articles, ARDC announced.

Chris J. Witting, Westinghouse vice president-consumer products, described the thermoelectric refrigerator as the ideal type of unit for applications in space.

"Thermoelectric refrigeration is achieved simply by passing an electric current through the proper kinds of semiconductor materials," he pointed out, "and requires no compressor, refrigerant, or apparatus with moving parts. To achieve warming instead of cooling, it is only necessary to reverse the flow of electric current by flipping a switch.

"Being a solid-state device, a thermoelectric refrigerator would not have its performance impaired by zero gravity, high acceleration, or other conditions imposed by space travel. Its ruggedness, simplicity and freedom from maintenance are other characteristics that make it particularly attractive for space applications."

TINY MICROWAVE TRANSISTOR USES COAXIAL MOUNTING

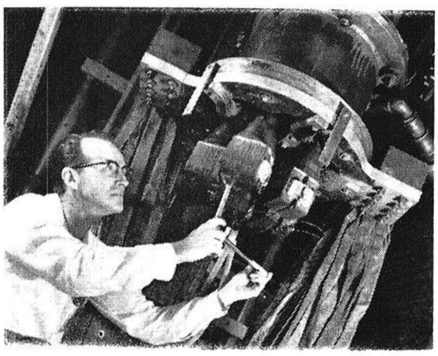
A new germanium mesa transistor which operates for the first time in the low microwave frequency region and a very wide band amplifier employing this transistor have recently been developed at Bell Telephone Laboratories. In order to achieve such high frequency operation, the dimensions of the new transistor have been cut down so that the total area of the active region is less than the cross-section of a human hair. The amplifier employs transmission line construction, consistent with the transistor encapsulation.

The device is a diffused-base, alloyed-emitter, PNP mesa transistor, designed for application as an oscillator at 3 kmc, or as an amplifier at 1 kmc and below. The mesa is only 1.8 mils (thousandth of an inch) long, and 1.5 mils wide. Three metal stripes, each 3/10 mils wide by 1½ mils long, are evaporated onto the surface of this tiny plateau and alloyed into the semiconductor. Gold wires 2/10 of a mil in diameter are used for making connections. The diffused base of the transistor is only 1/50 mil thick.

Since conventional encapsulating methods for transistors would introduce too much parasitic capacitance and inductance to allow the realization of the full capabilities of this new device, it is mounted in a coaxial shell which electrically matches a 50 ohm coaxial line. (The germanium wafer is gold bonded to the inner conductor of the output section; the emitter stripe is connected to an internal shield integral with the encapsulation shell; the base stripes are connected to the center conductor of the input line.)

Wide-band and narrow-band feedback amplifier circuits using the new transistor were described to the Solid States Circuits Conference in Philadelphia today by Bell Laboratories engineers. The three-stage amplifiers were constructed using transmisison line principles, with a channel-type line for easy access to the center conductor. The amplifier has a gain of 18 db, flat within 1 db over the frequency band from below 1 mc to over 750 mc. Higher gain, with correspondingly lower band-width can also be achieved.

The amplifiers have shown excellent stability, and the noise figure measured at 200 mc is 5.5 db with the feed-back loops open.



WESTINGHOUSE VACUUM ARC-MELTING FURNACE ADAPTED FOR ULTRASONIC GRAIN REFINEMENT

A production line vacuum arc-melting furnace at the Westinghouse metals plant at Blairsville, Pa., has been adapted with a transducer assembly for ultrasonic grain refinement in large ingots. This photo was taken before removal of the ultrasonic unit and withdrawal from the furnace of a 5-foot long, 12-inch diameter, 316 stainless steel ingot. The ingot weighs about 2000 pounds and is removed from the bottom of the furnace which is shown here. Previously, rotor steel ingots of this size and smaller heats of Refractoloy® and Discaloy® alloys and 316 stainless have been successfuly refined using ultrasonics. The power input to the vacuum arc furnace is about six kilowatts and it operates at pressures from 10 to 40 microns.

The combination of vacuum arc melting and ultrasonic grain refinement greatly improves the properties and yield of metals. Vacuum arc melting generally increases the yield from an arc-melting furnace; and the use of ultrasonic vibration causes a small "equiaxed" structure in the ingot. This structure is highly desirable since it ensures better mechanical properties in the material. The ultrasonic equipment was designed and constructed at the Westinghouse new products laboratory at Cheswick, Pa.

Nuclear Engineering

(Continued from page 37)

most useful. In fact, it is quite possible that the long-range predominate application will prove to be one undreamed of today.

Thus, it is the job of the Nuclear Engineer to apply the principles of nuclear physics. This point is ill-appreciated by the general public, and much confusion exists regarding the distinction between the work of the scientist and the engineer. However, science is the search for knowledge, and the physicist is engaged in attempting to understand the make-up of the physical world. When the physicist learned how uranium nuclei would fission, he was satisfied and ready to move on to a new subject. The engineer, in contrast, wished to apply the knowledge of fissioning to generate electricity, to advance space exploration, to protect the free world, to make new materials, and so on; and he is doing so.

To train engineers for work in the nuclear field, Wisconsin initiated a graduate-level program in the 1950's and offered studies leading to the M.S. and Ph.D. degrees. However, it was realized that the students could be offered significantly better training if they began nuclear studies earlier in their careers. Consequently, an undergraduate curriculum in Nuclear Engineering was developed and offered for the first time in September 1961. This new curriculum is an engineering-science type course tailored to give the student the background for the activities described above. The first three years of the program give him training in science, engineering, and liberal arts. Just as the scientist wants to know how and why something works, the engineer must also; thus, considerable emphasis is placed on science, and the Nuclear Engineering student will study essentially as much physics and mathematics as the physics student. He must also receive training in the liberal arts because he will usually work with other people, he must communicate his ideas and inventions to others, his promotions may come faster if he is able to organize and direct the activities of others, and he must take an active role in our citizen society. Finally, he must be trained in engineering since his aim will usually be to create some kind of device or design. In the fourth year, he receives specialized training in Nuclear Engineering so that industry and government will desire his services or so that he will be especially well prepared to go on to graduate work. And, although you are only in high school now, you should already be giving serious thought to devoting at least a year to graduate study, regardless of the profession you choose.

The Nuclear Engineering student receives an important, additional dividend in that his training is also ideal for a career in general research and development work. During the past few years, both industrial and governmental laboratories have greatly increased the emphasis on research and development activities which cut across many fields of specialization. In this work, it is frequently more important that the engineer understand the basic principles of a wide number of technical subjects than that he be a specialist in any one. The undergraduate curriculum is particularly suited to give the student the broad, fundamental back-

(Continued on page 54)

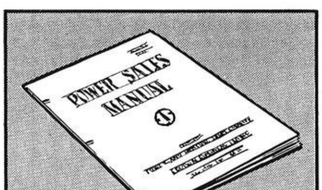
HOW IS YOUR SALES QUOTIENT?

You are a Power Sales Engineer. A major industry in your area is planning to build a new plant. They are contemplating generating their own power because they can utilize process steam. Obviously your Company would like to supply this customer with power. You have prepared a detailed analysis of cost of investment, operating cost, reliability, flexibility of service, etc. You are presenting this material to the executive board of the customer's company and have just reached your major selling point — reliability of service — when suddenly the lights go out. What would you say?*

The power sales engineer needs technical knowledge, good economic sense and the ability to communicate clearly. To solve human problems in selling he needs the additional qualities of diplomacy, good humor and understanding.

You will find challenging variety in power sales throughout the Wisconsin Electric Power Company System. The Milwaukee area is a veritable industrial variety shop — the nation's eighth largest industrial area. The central section includes many highly productive farms and a number of the nation's leading paper mills. The northern section includes important timber, mining and recreational industries.

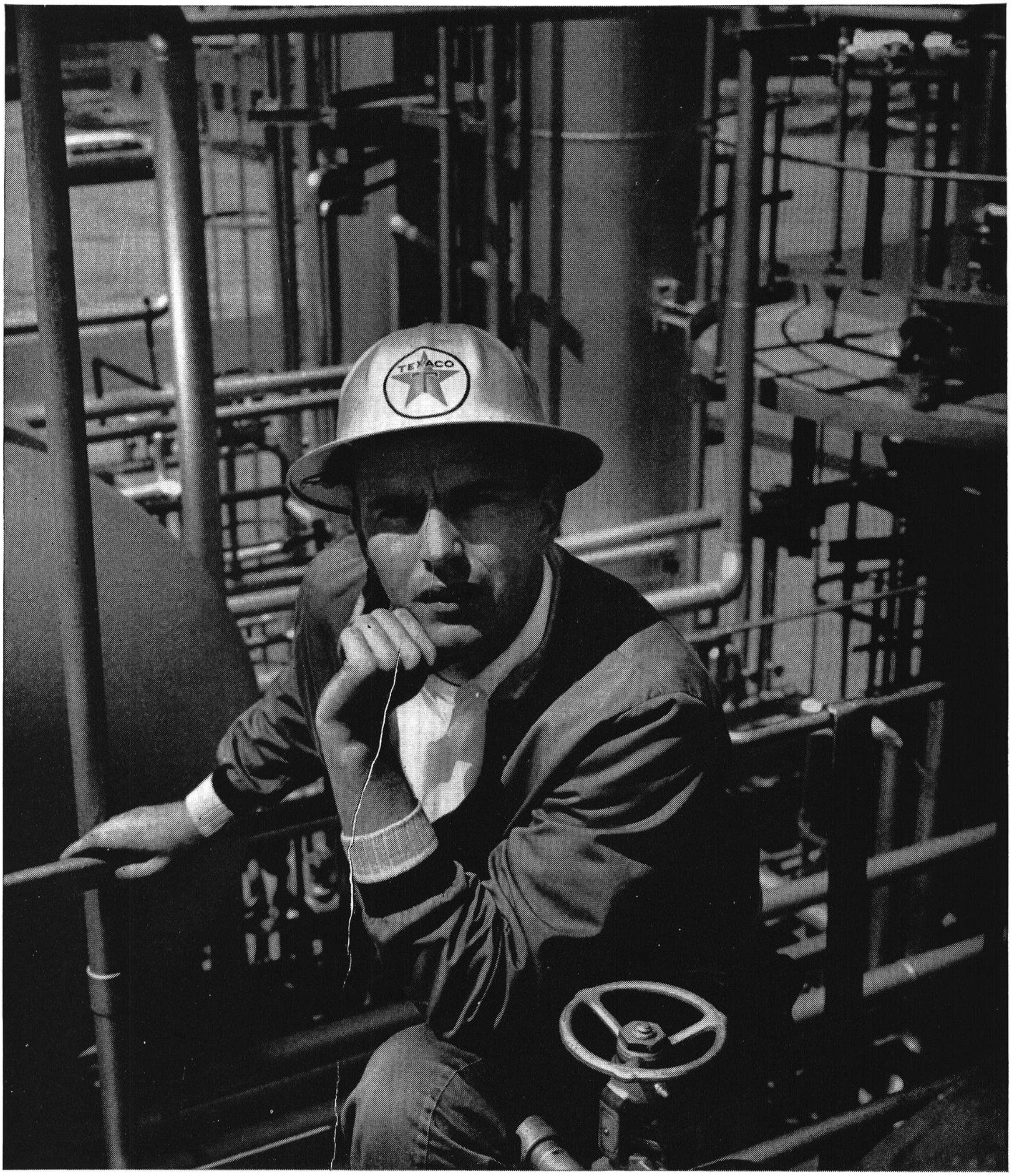
We have openings for power sales engineers as well as for qualified engineers in other fields. May we hear from you?



*Although we would enjoy receiving your comments on this problem, we are not soliciting a "correct" answer or offering a prize. But if you are interested in learning more about the power sales engineer, we will gladly send you a manual free of cost which will introduce you to his activities. Write to D. C. Cowie, Employment and Placement Division, 231 W. Michigan St., Milwaukee 1, Wis.

WISCONSIN ELECTRIC POWER COMPANY SYSTEM

Wisconsin Electric Power Co.	**Wisconsin Michigan Power Co.**	**Wisconsin Natural Gas Co.**
MILWAUKEE, WIS.	APPLETON, WIS.	RACINE, WIS.


TEXACO

A Career Begins

(Continued from page 17)

need and receive help with financial problems, with scholastic difficulties, and with redefining their vocational objectives. If more specialized help is needed, the adviser can refer the troubled freshman to the proper person or agency. The Freshman Adviser is sincerely interested in the welfare of each student.

Inquiries from interested high school students are welcomed by the Freshman Adviser. If you should visit the campus and wish to talk over your plans before enrolling in college, you will be welcome to come to Room 22 of T24 Building for a visit.

Career Opportunities In Engineering

(Continued from page 18)

about the opportunities available. The seniors examine this material and interview companies that are interesting to them and which have expressed a need for people with their particular qualifications. If, after the campus interview there is mutual interest between the company and the student, he will very likely receive an invitation to visit the company to further discuss employment possibilities. In some cases, seniors must enter military service after graduation, but some companies will hire these individuals and grant military leave when they are called to active duty. If the graduate prefers, he can use the Placement Office after returning from service. At any time after graduation, College of Engineering alumni can use the Placement Office if they wish to relocate.

New opportunities are also developing in terms of summer employment for engineering students while still in college. Even after the freshman year it is possible to find summer work in some phase of engineering. Besides just providing the chance to earn money, the student can gain worthwhile

(Continued on page 50)

Career Opportunities In Engineering

(Continued from page 49)

experience in summer work and see how engineering theories are applied to industry. And he may discover special interests in a particular phase of engineering and tailor his selection of courses accordingly. As a result, he will be better prepared to continue his career after graduation.

What do the companies look for in the new engineering graduate? Scholastic achievement is one of the most important factors, but by itself doesn't mean everything. Companies are just as much interested in personality, character, and all-round potential. The student who demonstrates these attributes through such things as extra curricular activities along with scholastic ability is the most sought after college graduate.

These are some of the things that should be considered by the high school student interested in engineering. But most important, any high school graduate with ability and interest in things technical should seriously consider engineering. Careers in engineering have never had a brighter future—and probably surpass career opportunities in any other field.

The Engineering Profession

(Continued from page 19)

cent of our enrollment. Note, however, that the demands of industry and government are high in all areas of engineering and it behooves you to investigate the entire field to determine your special interests before choosing a particular branch. To assist you in this task the chairman of each of our engineering departments has an article in this special issue of the Wisconsin Engineer briefly describing the field.

Combined courses in engineering and agriculture, commerce, city planning or law are also possible and are becoming more popular. Such programs should be planned carefully during the first year at the University.

A recent comprhensive study by the National Science Foundation predicts that the need for engineers in the years ahead will seriously exceed the supply unless many more young men and women prepare now to enter the field. Industry is already taking all available graduates, and the National Science Foundation predicts that by 1970 the number of engineers needed will be almost double the total number of engineers in the United States today.

It should be recognized that engineering is demanding a much stronger grounding in chemistry, physics, and mathematics than ever before. To handle adequately the increasingly complex problems confronting the professon requires that engineers be able to understand and apply the most advanced concepts of the basic sciences. Consequently you will find all curricula giving greater emphasis to these subjects at the expense of informational and application courses.

Every profession demands of its members integrity, industry, perseverance, courtesy and good personality. Success in engineering requires all of these and, in addition, a strong aptitude for mathematics, the sciences, and written and oral expression. If you possess these qualities and aptitudes you can and should become an engineer. The opportunities today, and in the years ahead, are almost limitless. The rewards, materially and in personal satisfaction, are substantial.

University Extension

(Continued from page 20)

Transfer of Credit

Credits earned at the eight University Extension Centers may be "transferred" to the University at full grade-point value. The quotes on the word "transferred" are purposeful. Actually, Extension Center credits *are* UW credits and no "transfer" ever takes place. The original and permanent record card of the Extension Center student is maintained among residence student records in Bascom Hall, the main administration building of the University. Transfers from UW–M are at full grade-point value, although the record card in this instance actually transfers from Milwaukee to Madison.

Transfers from the State College System may be made on a "credit-for-credit" basis where the course work is applicable to any part of the requirements for the degree program of particular interest. Grade points, however, are entered on the same basis as transfers between any pair of accredited institutions; this being a nominal "C" or 2.0 grade points per credit for all work of "C" quality or better. Grades originally below a nominal "C" are entered on the transfer record at the lower value.

Full applicability of credits available for transfer towards the requirements of the particular degree in mind requires wise selection of program within the offering of the outlying institution of choice. Student counsellors are generally very well informed on matters of local course selections applicable to the degree program of choice. Any doubtful matters may be cleared up quickly by a telephone call, a letter, or a personal visit to the appropriate departmental chairman in Madison.

Years to Completion

The first point of understanding about the time it takes to graduate in engineering is that the engineering programs at Wisconsin vary from 146 to 152 semester credits. This means that you will have to earn an average 18 hours per semester just to stay abreast of the schedule. If your freshman and/or sophomore programs contain a sufficient number of courses in the required areas of English, mathematics, chemistry, drawing, physics, economics, history, speech, shop, mechanics, you stand a good chance of maintaining pace with your contemporaries in Madison. An excess of credits in music, sociology, philosophy, will simply mean that your total credits upon graduation will exceed the numbers spelled out above by virtue of courses taken outside of the rather rigid engineering requirements. There is not space here to spell out the particular requirements of each degree program or some of the allowable course substitutions that may be made. Nevertheless, it is easy for you to visualize a course in geology being useful to a mining or metallurgical engineer, and a third course in physics being useful to an electrical or a mechanical engineer.

A recent study completed here showed that the average time required to complete a course in engineering is very close to nine semesters. This figure was quite standard from curriculum to curriculum and varied little whether the student spent all of his time on the Madison campus or transferred here after one or two years at Milwaukee, the State Colleges, or the Extension Centers. Returning then to the typical degree requirement of 146 to 152 credits, the average semester load becomes more like 16 to 17 credits. This would appear to be a sensible approach to consider when undertaking an engineering program.

The current favorable career prospects for engineering graduates should supply the incentive for the additional semester's work that is required on the average. The opportunity to effect some overall economies by two to four semesters' study close at home where living costs are lower and part-time and summer employment prospects are better should go a long way toward financing the extra semester's study so many engineering students find to be inescapable. A study of your personal situation may strongly suggest to you that you begin work in one of the Extension Centers or the State Colleges. If you do, there is every reason to believe that time will bear out the overall wisdom of your selection.

The Work of The Civil Engineer

(Continued from page 25)

is quite unique in university laboratories.

The sanitary engineering laboratories of the department are among the finest in universities in the United States. Because the sanitary and hydraulics laboratories are in the same building, it is possible to study such problems as the flow in sedimentation basins, etc. where both facilities and staff of these two divisions are used jointly.

In general the civil engineering department aims to provide undergraduate instruction with a firm foundation in all the fundamentals required for:

1) Engineering practice in the civil engineering profession;
2) Graduate study of moderate depth over a wide range of activity;
3) Graduate study of much greater depth concentrated in the most advanced work in theory and research leading to the Doctor's degree for those who desire to truly specialize.

Electrical Engineering

(Continued from page 27)

credited by the Engineers' Council for Professional Development.

There is a joint student branch of the AIEE-IRE on the campus with a faculty member in charge as branch counselor. 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.

Engineering Mechanics

(Continued from page 31)

largely upon empirical data and experience while others have a highly organized scientific basis. The empirical approach necessar-

(Continued on page 53)

Engineers who qualify to fill these chairs...

are on the road to filling responsible jobs with a growing company in a growing industry

● American Air Filter Company is one of the world's pioneers in the field of "better air." Starting in 1929 as a manufacturer of air filtration equipment only, it has, through a planned program of product development, attained the unique position of being the one company in its industry that can take the complete over-all approach to the customer's air problems. In brief, this means supplying and coordinating all the proper products to filter, cool, heat, clean (control process dust), move, exhaust, humidify and dehumidify air.

"Better Air", while a big business today, is still in its infancy. Name any industry, any building type, and you have a present or potential user of AAF equipment. Other well-known trade names in the AAF family are Herman Nelson, Kennard and Illinois Engineering. At present, AAF operates nine plants in Louisville, Moline, Ill., Morrison, Ill., Rock Island, Ill., St. Louis, and Montreal, Canada.

THIS KIND OF ENGINEERING DEGREE . . .	. . . QUALIFIES YOU FOR THIS KIND OF JOB
Mechanical	*Engineering, Sales or Manufacturing*
Electrical	*Engineering or Sales*
Industrial	*Manufacturing or Sales*
Civil	*Sales*

FORMAL THREE-MONTH TRAINING COURSE

Your first job at AAF will be to complete a full three-month course in its technical training school. This is a complete and carefully planned course covering every phase of this business of better air and is under the direction of Mr. James W. May, a recognized authority on air handling problems and presently a member of the board of directors of ASHRAE. Classes, held in special, air conditioned quarters, are supplemented by field trips to visit AAF plants and observe on-the-job applications of equipment.

YOUR FUTURE IS ALL-IMPORTANT TO AAF

AAF prides itself on attempting to match the man to the job. During your training period you will have contacts with key company personnel. Your personal desires as to type and location of job are given every consideration. AAF is big enough to provide opportunities galore—small enough to never lose sight of the personal touch that adds satisfaction along with success.

A representative of AAF will be on your campus soon to interview students interested in learning more about the opportunities with this company. Consult your Placement Office for exact date.

AAF American Air Filter
BETTER AIR IS OUR BUSINESS

EQUAL EMPLOYMENT FOR ALL QUALIFIED APPLICANTS OPPORTUNITY

Engineering Mechanics

(Continued from page 51)

ily involves specialization since the results are usually closely related to the specific problem. The methods of the analytical approach are general. For example, problems in electronics, fluid mechanics, elasticity, heat transfer, thermodynamics, and others show remarkable similarity in the form of the differential equations that result from analyses. The analytical phases of engineering are therefore broad and not highly restricted by subject barriers.

What are the Opportunities Open to Graduates to the Engineering Mechanics Curriculum?

This curriculum is designed to prepare engineers for graduate work and for careers in research, industrial product and process development, and teaching in engineering colleges and universities. Publications such as CAREER which list job opportunities indicate special requests from such companies as Aerojet-General Engineering Corporation, Astronautics Systems, Inc., Bell Aircraft, Chrysler Engineering, Chrysler Guided Missiles, Lockheed Missile Systems, Northrop Aircraft, Inc., Ramo-Wooldridge, and Space Technology Laboratories. In the Government, opportunities exist in such organizations as the U. S. Atomic Energy Commission, National Bureau of Standards, and the Naval Ordnance Laboratory.

Mechanical Engineering

(Continued from page 33)

ments, mechanics, strength and properties of materials, dynamics, vibrations, experimental stress analysis, and many other subjects which relate specifically to design.

In the industrial engineering field all types of production problems are encountered. This is the domain of the engineer interested in the manufacture of finished products, usually on a mass production basis. It is here that engineers are concerned with how a part or machine may be produced in the most economical manner. There are many subjects related to this field, including industrial organization, plant layout, cost analysis, time-and-motion study, personnel management, materials handling, and inspection methods. With the increasing complexity of the mass-production techniques, industrial engineering is a rapidly expanding field.

Because the training of a Mechanical Engineer is rather broad, he is in demand in practically every type of manufacturing organization, and in many research and governmental organizations. He may be employed in the electrical, chemical, petroleum, metal-processing, paper, plastics, or any other of a host of industries which require his services in connection with especially engineered production equipment, for plant engineering, or for administrative responsibilities.

Although the achievements of the mechanical engineering profession in the past are apparent, what does the future hold? What will the mechanical engineer of tomorrow do? With the rapid advances in science and technology such predictions are indeed difficult; however, from all indications industry will continue to require an increasing number of competent, well-trained mechanical engineering graduates to staff the many technical and administrative positions which are continually developing. In addition, with the ever increasing emphasis on scientific research, many mechanical engineers with advanced theoretical training will be required in this field. It is apparent that an increasing proportion of our students will undertake graduate study towards the M.S. or Ph.D. degree, and students with the necessary aptitude and ability are encouraged to plan on a program of academic training which includes graduate study.

Mining and Metallurgical Engineer

(Continued from page 35)

The *mining engineer* designs, constructs, and operates mining properties. He, in effect, begins where the geological engineer leaves off because his principal tasks are associated directly with the mining operation. He plans the method of removing the ore, designs the transportation system and handles related problems of ventilation and power supply.

In the petroleum field, the counterpart to the mining engineer is the *petroleum engineer.* His job is to plan and operate the oil-drilling and pumping equipment and arrange for the storage of the crude petroleum. He should also be familiar with methods used to locate new petroleum fields.

The geological, mining and petroleum engineering options are all available at Wisconsin.

Once the ore is removed from the earth, it must be processed further before the metal can be extracted. This is called mineral beneficiation, mineral dressing or mineral concentration. This field represents the link between mining on the one hand and metallurgy on the other. The *mineral dressing engineer* designs and operates plants for the separation of the valuable minerals from the waste products. This field is becoming increasingly more important as the richer ore deposits become exhausted and lower grade ores must be utilized. In Wisconsin, for instance, the use of the available low grades ores awaits development of economical methods for concentrating these ores to higher iron contents. The mineral dressing engineer uses many methods and devices for concentrating ores such as gravity separation, "heavy media" separations, and flotation. His program of study is much the same as that of the mining engineer but usually contains less mining and more metallurgical engineering subjects.

After the mineral dressing engineer has completed his work of concentrating the ore, the metallurgical engineer steps in to reduce the ore to the metallic state. In this work he may utilize heat, electricity, chemicals or a combination of these factors. Since this treatment usually involves chemical reactions, this metallurgical engineering field is called *chemical or extractive metallurgy.* An example of an extractive metallurgical operation is the reduction of iron ore in the blast furnace to produce pig iron, the pig iron being subsequently refined to steel. The large metal refineries scattered through the country all depend upon metallurgists for their design and operation. New processes, increasing use of low grade ores, and new metal requirements, have all added to the scope and importance of the work done by the extractive metallurgists. When the extractive metallurgist has completed his job of reducing the ore to the metallic state, the *physical metallurgist* or materials engineer takes over to improve the product.

The alchemists of old were constantly striving to change base metals to noble metals. Had their efforts succeeded they probably would be no less spectacular than the efforts of the present day *physical metallurgists* who have succeeded in greatly improving the mechanical and physical properties of metals by alloying and special treatments. The physical metallurgist finds opportunities in a wide variety of industries.

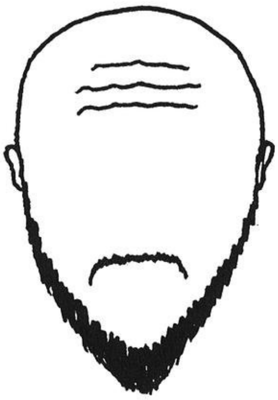
For example, he may be employed in the automotive industry to specify the composition and properties of metals and other materials to be used for the various parts. He may be engaged in the nuclear field to design fuel elements, study corrosion problems, or to carry on research on radiation damage. He may be employed in the electrical industry to work with physicists and electrical engineers in the manufacture of solid state devices. Other opportunities exist in such fields as metal casting, welding, production of such metals as aluminum, copper and steel, and the production of rare or refractory metals like beryllium or tantalum. The possible areas of employment are almost unlimited because the advancements in our technology have required more and more attetion to materials. Although work in ceramic engineering is usually handled by *ceramic engineers,* it is not difficult for metallurgists to function in this area also because of the similarity of the fundamental science underlying both of these fields. As a matter of fact, training in physical metallurgy is such that it serves as an excellent background for employment in the general area of materials science or engineering.

Nuclear Engineering

(Continued from page 43)

ground needed for that kind of job; and the graduate, if he chooses, may find himself moving into work having little relation to Nuclear Engineering. Thus, the undergraduate curriculum is not one aimed only at turning out specialists in one narrow field.

In summary, Nuclear Engineering is a growing, exciting field which offers excellent professional opportunities. The undergraduate curriculum has been designed to train students for active participation and, with further graduate study, for leadership in the field. The curriculum is designed for the serious student who intends to apply his efforts diligently, and the graduate will find that he has chosen a very satisfying and worthwhile career.



BRAIN BUSTER

by L. L. Chambers

1. The ABC literary society decided to have an all school hayride. When they started to the picnic grounds, every wagon carried exactly the same number of persons. Half way to the grounds ten wagons broke down, so it was necessary for each remaining wagon to carry one more person. When they started for home it was discovered that fifteen more wagons were out of commission, so on the return trip there were three persons more in each wagon than when they started out in the morning. How many people attended the hayride?

2. A bag contains a bean, known to be either white or black. A white bean is put in, the bag is shaken, and a bean drawn out, which proves to be white. What is now the chance of drawing a white bean?

Jim usually gets out of lab at six and his wife is there to pick him up. Last Tuesday, however, Jim got through at five and decided to start walking home. On the way he met his wife on her way to get him. Jim and his wife arrived home 20 minutes earlier than he usually does. Assume that his wife drove her normal route at her normal constant speed. How long did Jim walk?

During a surveying exercise, four C. E.'s discover the pot of gold at cide to divide the money the next morning. During the night, however, one of the C. E.'s begins to worry that the division will not be fair so he decides to take his share then. He divides the coins into 4 equal stacks and finds that one coin is left over which he pockets. He then hides his stack. Later another C. E. divides the remaining gold into 4 equal stacks and again pockets the extra coin and hides his stack. Before morning the other two C. E.'s have made a similar division. In the morning, the rest of the gold is divided equally. One coin remains, which is left in the pot. What is the fewest number of gold pieces that the pot could have contained?

A 12 ft. square box stands in a corner. How high on the wall will a 35 ft. ladder reach if the ladder touches the edge of the box and the floor?

An M. E. is standing at a point on the circular base of a cylindrical tower. He finds that he can just see a distant flagstaff by walking along the tangent line to the base a distance 10 feet to the right or a distance of 20 feet to the left. The radius of the base is five feet. How far is the flagpole from the center of the tower? The radius of the tower is four feet.

Three engineers, a ME, a ChE, and an EE and their wives, a Wisconsin girl, an OSU girl and a Purdue girl though not respectively, go shopping. Afterwards each finds that the average cost in dollars of the articles he or she purchased is equal to the number of his or her purchases. The ME has purchased 23 more articles than the OSU girl, and the ChE has purchased 11 more than the Wisconsin girl. Each husband has spent 63 dollars more than his wife. Who is married to whom?

A CE, required to lay out a triangular plot with a piece of string, cut it into three pieces. What are the chances that the three pieces will form a triangle if two cuts were random.

A hole six inches long is drilled clear through the center of a solid sphere. What is the volume of material remaining. (The length of the hole after it is drilled is six inches.)

Kodak beyond the snapshot...

(random notes)

Grateful but cautious

More spectrographic plates and film are used each year than the year before. This goes on despite new fashions in elemental analysis by physical methods and by new Eastman Organic Chemicals. The civilized world is analysis-happy and that makes *us* happy.

To betoken the happiness a small pamphlet has been issued under the title "Spectrum Analysis with Kodak Materials." Its words may prove less useful than its graphs and numbers, though the words devoted to a warning against taking the graphs and numbers too seriously must be taken seriously. That's life.

Life lived with the photographic emulsion as a measuring instrument for radiation intensity must be filled with gratitude for its simplicity, versatility, and economy and filled with caution against glib assumptions. Those who live that life have learned that:

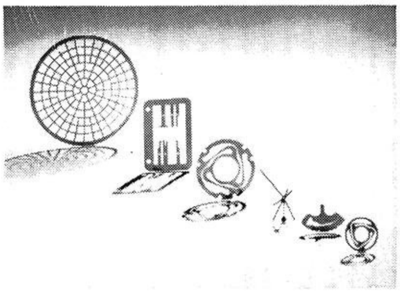
1. *Kodak Spectroscopic Plates and Film, Type 103-0* work fast, capture quick-vanishing spectra.

2. *Kodak Spectrum Analysis No. 1 Plates and Film* are contrasty and good for trace-element lines against heavy background, for semi-quantitative comparison, and for all-out quantitative jobs.

3. For cutting corners on how many wave lengths you calibrate at, resort to the new *Kodak "SA-3" Plates or Films.*

(If you still want the pamphlet, write to our Special Sensitized Products Division.)

Never say "die"?



These metal parts are not stampings. They are too fussy and tricky for knife or milling machine and needed too fast and in insufficient numbers to justify the fabrication of dies. They are products of photo-etching, which is catching on.

Some outfits photo-etch for themselves, and some do it for hire. The method uses either *Kodak Photo Resist* or *Kodak Metal-Etch Resist,* depending on the metal. Both are light-sensitive liquids. The object is drawn to enlarged scale and photographed. The metal is coated with *KPR* or *KMER* and exposed to light through the negative. Where the negative protects from the light, the resist will subsequently flush away; where light-struck, it becomes resistant to etchant. Etchants leave no burrs. The thinner the metal the closer the tolerances an etchant can work to.

Photo-etching speeds execution of design ideas. With fewer punch-press tenders needed nowadays anyway, more of the population has to earn a living in the idea business.

Chemical tuning

We make optical interference filters on a custom basis. In seeking customers one must be creative. Why not advertise them to chemists?

To a chemist, a color filter is what he slips into a colorimeter. If he is an enthusiastic photographer, he may know of dyed-gelatin Kodak Wratten Light Filters. We take it from there:

"Suppose, for fantasy's sake, that you wanted to flood a reaction *preferentially* with energy of exactly that frequency to which a certain carbon-nitrogen bond responds. An interference filter could probably be made for the job.

"An interference filter is tunable in manufacture for wavelengths from 0.4μ to 12μ. Unlike gelatin or glass filters, its curve doesn't depend on what colorants happen to be available. It can provide a single spectral spike of transmittance but is not limited to that. It can also be designed to cut out energy below a stated frequency or above a stated frequency. It can cut very sharp. It is thermally, chemically, and mechanically rugged. It costs a great deal less than a laser (which, while it can emit Niagaras of monochromatic energy, must work with the quantum states that Nature has in stock). It can be large. It can be designed to monitor a process stream continuously for the presence or absence of any substance possessing a suitable energy-absorbance curve."

Maybe something clicks somewhere.

INCREASING EXPLOITATION OF PHOTOCHEMICAL REACTIONS DEMANDS GOOD CHEMICAL ENGINEERS, AMONG OTHERS

From portrait lenses to polishing waxes, plenty of lively careers are to be made with Kodak in research, engineering, production, marketing.

And whether you work for us or not, photography in some form will probably have a part in your work as years go on. Always feel free to ask for Kodak literature or help on anything photographic.

EASTMAN KODAK COMPANY
Rochester 4, N.Y.

Kodak
TRADEMARK

One of a series

Interview with General Electric's

Francis J. Boucher

Manager-Manufacturing Personnel Development Service

How Good Is Your Best Job Offer . . .

Q. Mr. Boucher, with all the job interviews a graduating engineer goes through, how can he be reasonably sure he has made the right choice?

A. This is a good question because few seniors have enough work experience in industry, government and educational institutions to allow them to make a fully reasoned choice. However, I think the first step is to be sure that short-term factors like starting salary and location don't outweigh long-range factors like opportunity and professional growth. All of these factors should be evaluated *before making a final commitment.*

Q. But you do feel that starting salary is important?

A. Very much so. If you are married—it may be an even greater consideration. But you should also look beyond starting salary. Find out, for example, if the company you are considering has a good salary administration plan. If there is no way of *formally* appraising your performance and determining your appropriate rewards, you run the risk of becoming dissatisfied or stalemated due to neglect of these important considerations.

Q. What considerations do you feel should be evaluated in reaching a job decision?

A. Let me refer you to a paper written by Dr. L. E. Saline, now Manager of Information Systems in our Defense Systems Department. It is titled "How to Evaluate Job Offers." (Incidentally, you may obtain a copy by writing as directed in the last paragraph.) In it, Dr. Saline proposes six questions—the answers to which should give you much of the information you'll need for an objective job-offer evaluation. He suggests you determine . . .

- to what degree will the work be challenging and satisfying?
- what opportunities are available to further develop abilities?
- what opportunities are there for advancing in the Company (and how dynamic the Company is in the marketplace is an important aspect of this question).
- what salary potentials are possible with respect to the future?
- what about geographical location —now and in the future?
- what effort does the Company make to establish and maintain a professional climate?

There is more to these questions than meets the eye and I think you would enjoy reading Dr. Saline's paper.

Q. What about the openings on defense projects that are listed in the various magazines and newspapers?

A. Presumably, there will always be a need for technical manpower in the defense business. But I want to point out to you that most of these opportunities are for experienced personnel, or personnel with specific additional training received at the graduate level.

Q. How do you feel about training programs? Do they offer any particular advantages over any other offer I might accept?

A. I feel training programs are particularly helpful in easing the transition from an academic to a business environment. Of course they provide formal training designed to add to the individual's basic fund of knowledge. They also provide working experience in a variety of fields and a broad knowledge of the company concerned and its scope of operations. Upon completion, the individual is generally better prepared to decide the direction in which he will pursue his professional career.

General Electric conducts a number of training programs. Those that attract the greatest number of engineers are the Engineering and Science, Manufacturing, and Technical Marketing Programs. Each combines a formal, graduate-level study curriculum, on-the-job experience, and rotating assignments. There is little question in my mind that when an engineer completes the Program of his choice, he is far better prepared to choose his field by interest and by capability. I might also add that because of this, he is more valuable to the Company as an employee.

Q. Then you feel that a training program is the best alternative for a graduating engineer?

A. Not always. Some seniors have already determined the specific field they are best suited for in terms of their own interests and capabilities. In such cases, direct placement into this specific field may be more advantageous. Professional self-development for these employees, as for all General Electric technical employees, is encouraged through a variety of programs including the Company's Tuition Refund Program for work toward advanced degrees, in-plant courses conducted at the graduate level, and others designed to meet individual needs.

Q. For the record, how would you rate a job offer from General Electric?

A. I've tried to get across the need for factual information and a long-range outlook as the keys to any good job evaluation. With respect to the General Electric Company, seniors and placement offices have access to a wide variety of information about the Company, its professional environment and its personnel practices. I think qualified seniors will also discover that General Electric offers professional opportunity second to none—and starting salaries that are competitive with the average offered throughout industry today. From the above, you can see that I would rate a job offer from General Electric very highly.

Want more information about General Electric's training programs? You can get it, together with a copy of Dr. Saline's paper "How to Evaluate Job Offers" by writing to "Personalized Career Planning," General Electric Company, Section 959-15, Schenectady 5, New York.

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