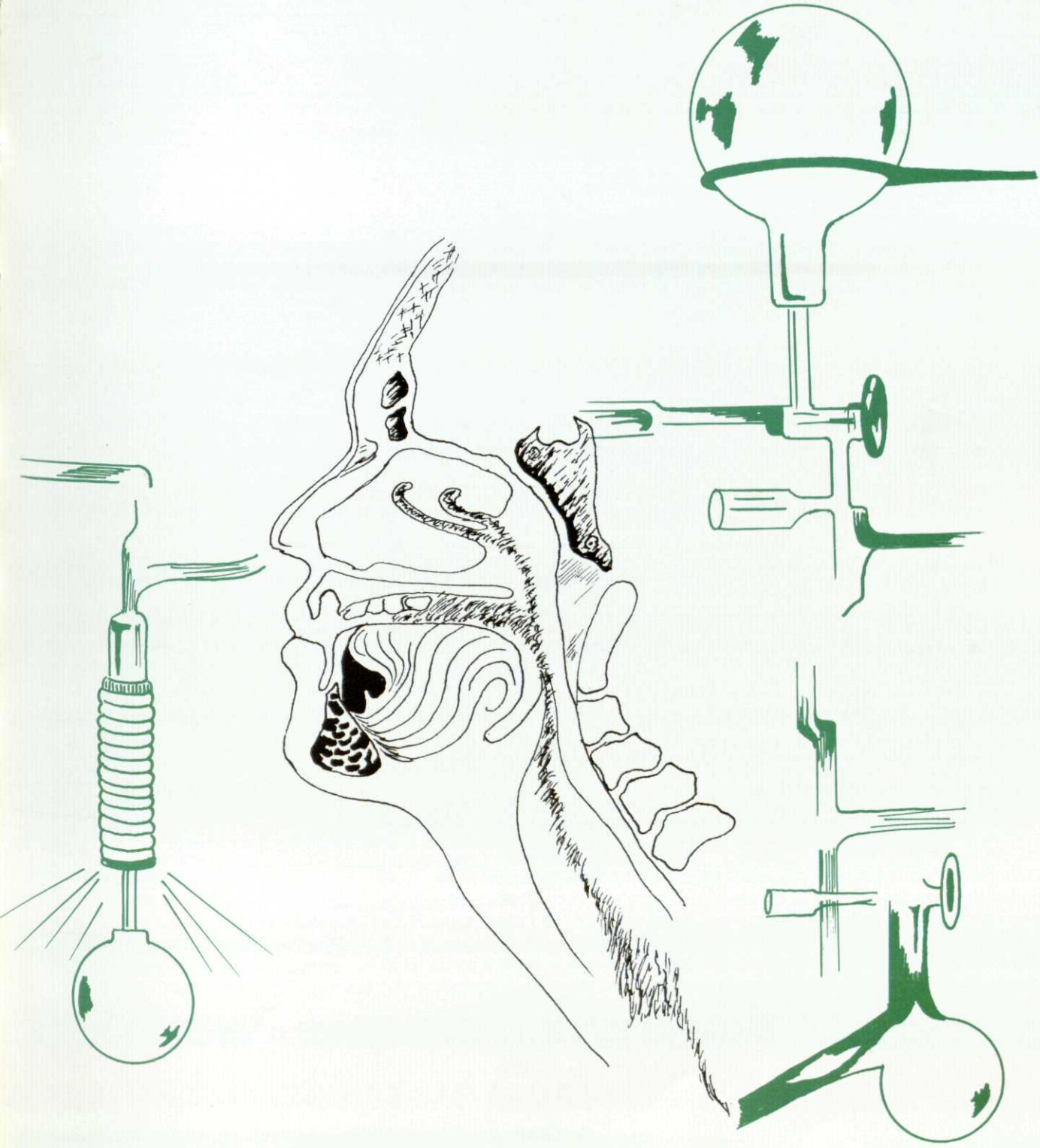
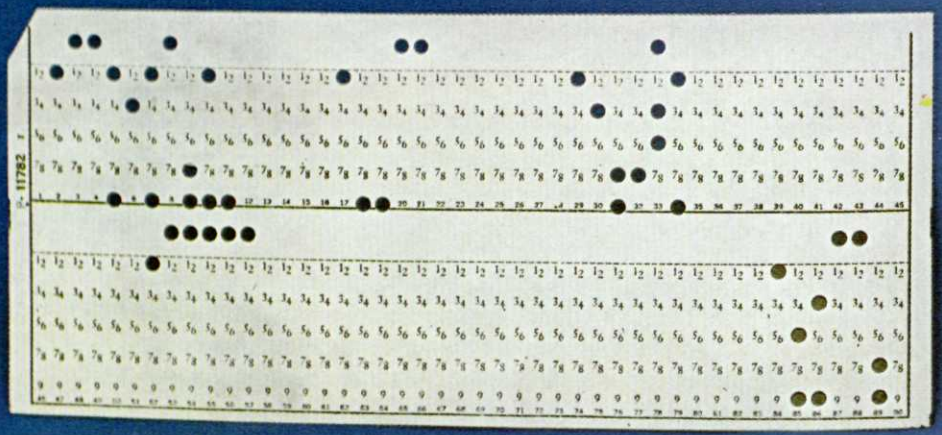
march, 1964

25¢

spartan ENGINEER



The captain commands a Westinghouse computer



The computer commands the ship

And the owner saves at least $1,000,000. Westinghouse has developed a computer-controlled system for doing almost everything on a cargo ship faster and better.

It can be made to load and unload cargo faster. Control speed directly from the bridge with no help from below. Keep the ship on course. Steer clear of navigational hazards. Navigate so accurately it saves fuel. Keep an eye on all dials and gauges. Control valves in the engine room. Keep records of operations. Analyze emergency situations and take corrective action. Even check on how the cargo is doing.

In this day of low-priced competition from ships under foreign flags, this development can add new strength to our Merchant Marine.

The Westinghouse computer-controlled system significantly reduces the annual cost of operating a ship.

You can be sure if it's Westinghouse

For information on a career at Westinghouse, an equal opportunity employer, write L. H. Noggle, Westinghouse Educational Department, Pittsburgh 21, Pa.

Is it true that the leading producer of oxygen for steelmaking had a hand in preparing Tricia McDonald's orange juice?

You'd expect that a company with 50 years' experience in extracting oxygen from the air would lead the field. You might even assume—and you'd be right—that it knows a lot about how oxygen can speed the making of steel. As a result, the company sells oxygen by the ton to steelmakers to help them produce faster and more efficiently.

You'd also expect that a leader in cryogenics, the science of supercold, would develop an improved process for making the frozen orange juice concentrate that starts Tricia McDonald off to a bright, good morning.

But there might be some doubt that two such activities as helping to speed steel production and helping to improve frozen orange juice could come from one company. Unless you knew Union Carbide.

For Union Carbide is also one of the world's largest producers of petrochemicals. As a leader in carbon products, it is developing revolutionary graphite molds for the continuous casting of steel. It is the largest producer of polyethylene, and makes plastics for packaging, housewares, and floor coverings. Among its consumer products is "Prestone" brand anti-freeze, world's largest selling brand. And it is one of the world's most diversified private enterprises in the field of atomic energy.

In fact, few other corporations are so deeply involved in so many different skills and activities that will affect the technical and production capabilities of our next century.

We're growing as fast as Tricia McDonald.

UNION CARBIDE

UNION CARBIDE CORPORATION, 270 PARK AVENUE, NEW YORK, N.Y. 10017. IN CANADA: UNION CARBIDE CANADA LIMITED, TORONTO
Divisions: Carbon Products, Chemicals, Consumer Products, International, Linde, Metals, Nuclear, Olefins, Ore, Plastics, Silicones, Stellite and Visking

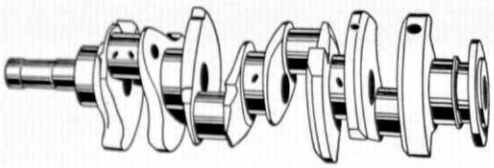
How To Solve Wear Problems With Pearlitic Malleable Castings

A little known but extremely valuable property of pearlitic Malleable iron is its excellent wear resistance. Pearlitic Malleable castings have good natural wear resistance and can be selectively surface hardened to 60 Rockwell C. Any of the common methods of hardening may be used — induction, flame, salt or lead bath, or heat-treating furnaces.

Properties of Three Representative Grades of Pearlitic Malleable Iron

Tensile Strength — P.S.I.	Yield Strength — P.S.I.	Typical Brinell Hardness Range	Selectively Hardenable To: (Rockwell C)
80,000	53,000	197-241	55-60
80,000	60,000	197-255	55-60
100,000	80,000	241-269	55-60

The current trend from steel to pearlitic Malleable castings for automotive crankshafts and connecting rods demonstrates the practicality of pearlitic Malleable for high wear applications.



Here are typical comparisons of the wear resistance of unhardened pearlitic Malleable crankshafts with unhardened steel crankshafts. These figures are based on 50,000 mile proving ground tests in 13 automobiles.

Wear Comparisons

Pearlitic Malleable Crankshafts vs. Steel Crankshafts

	Average Wear Reading — Steel	Average Wear Reading — Pearlitic Malleable
Wear on Journal Diameter —		
Manual Transmission	.0004	.0002
Automatic Transmission	.0003	.0001
Wear on Crankpin Diameters —		
Manual Transmission	.0005	.0001
Automatic Transmission	.0001	.0001

Other critical wear applications for pearlitic Malleable castings include transmission gears, pistons, spring hangers, chain links, rolls and rocker arms.

This pearlitic Malleable transmission gear with induction hardened teeth replaces a through-hardened steel gear. Important advantages of the pearlitic Malleable are reduced distortion during hardening, simpler method of hardening, lower purchase cost and lower machining costs.

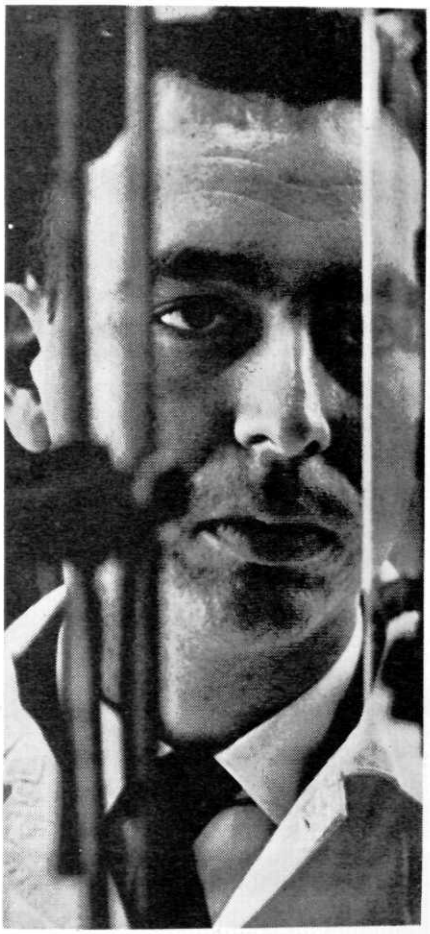
Excellent wear resistance, with or without hardening, combined with economy, quality, strength and machinability, place pearlitic Malleable castings at the top of the list of engineering materials for vital parts. Get complete information on how you can improve your products with Malleable and pearlitic Malleable castings from any company that displays this symbol —

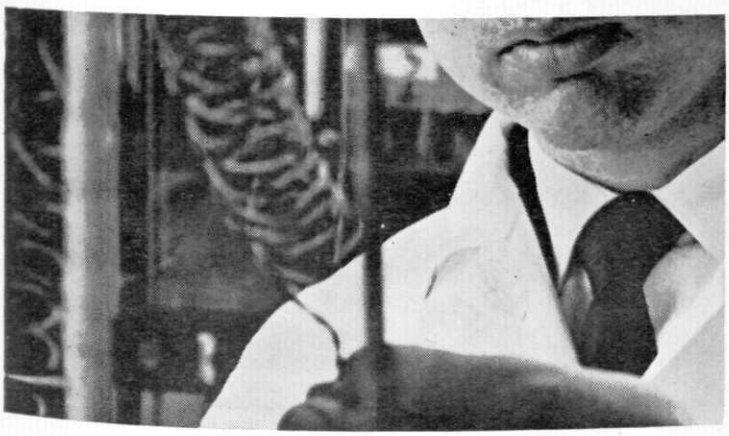
MEMBER

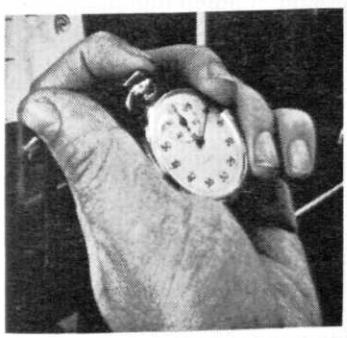
MALLEABLE FOUNDERS SOCIETY

Send for your free copy of this 16 page "Malleable Engineering Data File." You will find it is an excellent reference piece.

MALLEABLE FOUNDERS SOCIETY • UNION COMMERCE BUILDING • CLEVELAND 14, OHIO







Our gasoline isn't good enough for some people...us

We like to think that American Oil products are the best you can buy. And they are. We also like to think we can improve the quality of our products without increasing the cost to the consumer. And we do. Consistently.

A considerable amount of work is done in testing catalysts and searching for those which will help produce the types of gasoline our customers want at the price they can afford.

One of the people engaged in the research and development of our manufacturing processes is John Mitchell, 24, a graduate Chemical Engineer from the University of Texas.

The opportunities for bright young scientists like John Mitchell are virtually unlimited at American Oil. American Oil offers a wide range of new research opportunities for: Chemists—analytical, electrochemical, physical, and organic; Engineers—chemical, mechanical, and metallurgical; Masters in Business Administration with an engineering (preferably chemical) or science background; Mathematicians; Physicists.

For complete information about interesting careers in the Research and Development Department, write: J. H. Strange, American Oil Company, P. O. Box 431, Whiting, Indiana.

IN ADDITION TO FAR-REACHING PROGRAMS INVOLVING FUELS, LUBRICANTS AND PETROCHEMICALS, AMERICAN OIL AND ITS AFFILIATE, AMOCO CHEMICALS, ARE ENGAGED IN SUCH DIVERSIFIED RESEARCH AND DEVELOPMENT PROJECTS AS:

Organic ions under electron impact • Radiation-induced reactions • Physiochemical nature of catalysts • Fuel cells • Novel separations by gas chromatography • Application of computers to complex technical problems • Synthesis and potential applications for aromatic acids • Combustion phenomena • Design and economics: new uses for present products, new products, new processes • Corrosion mechanisms • Development of new types of surface coatings.

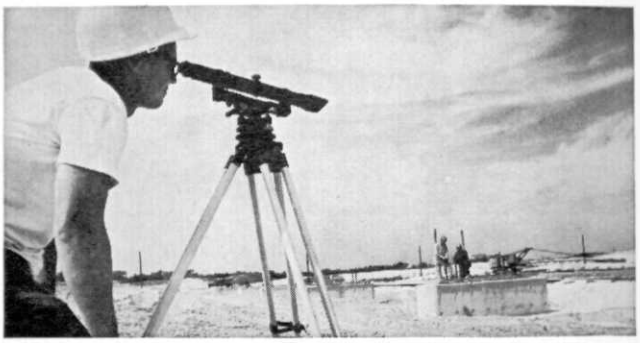
STANDARD

STANDARD OIL DIVISION
AMERICAN OIL COMPANY

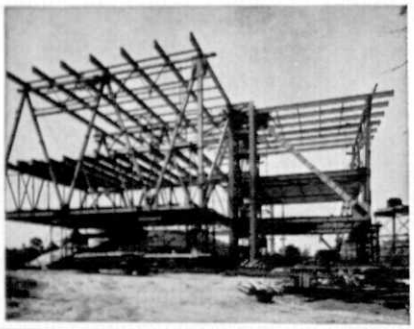
What's new at Bethlehem Steel?

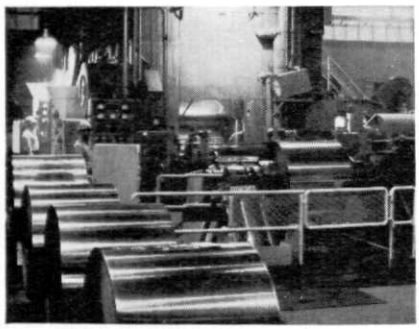
New $40-million research laboratories in Bethlehem, Pa.

Building a $250-million steel plant at Burns Harbor, Ind.



Fabricating and erecting steelwork for World's Fair structures, including the magnificent Federal Pavilion.

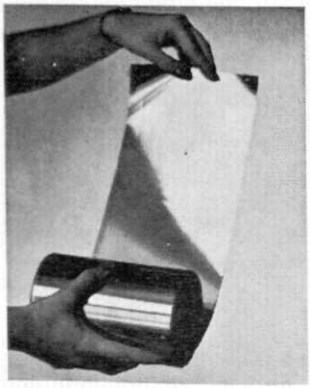




Producing thin tinplate on the nation's newest tin mill, at Sparrows Point, Md.

Building giant tankers at Sparrows Point.

Installing new oxygen steelmaking furnaces at Lackawanna, N. Y.



Developing such exciting new products as steel foil, far thinner than this page.

New facilities . . . new products . . . new processes.

All this means career opportunities for alert and aggressive college graduates . . . in steel plant operations, sales, research, mining, shipbuilding, fabricated steel construction, and many other activities.

You can get a copy of our booklet, "Careers with Bethlehem Steel and the Loop Course," at your Placement Office, or by sending a postcard to our Personnel Division, Bethlehem, Pa.

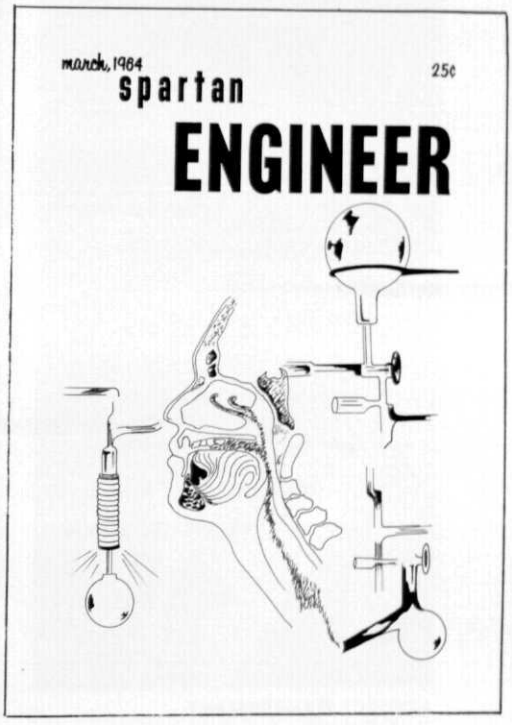
BETHLEHEM STEEL

BETHLEHEM STEEL

An equal opportunity employer

Spartan Engineer

Volume 17 NO. 3 March, 1964



The cover, by Carollee Hoffman, represents man and engineering or Bio-engineering.

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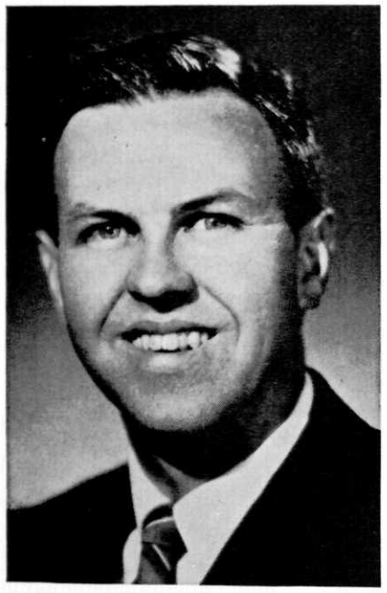
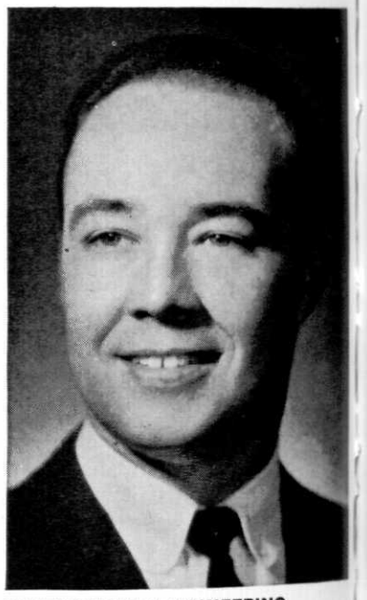
THESE GRADUATES THRIVE ON CREATIVE CHALLENGES...THEY'RE AUTOMATION PROBLEM SOLVERS

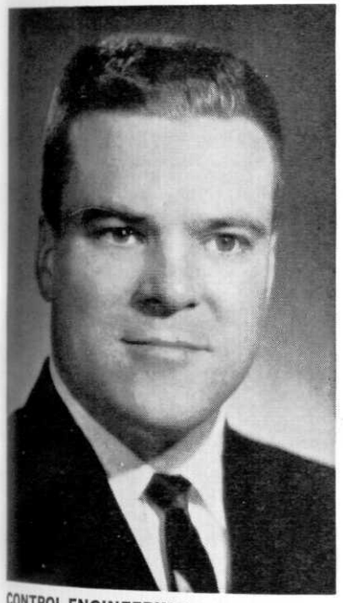
PROJECT MANAGEMENT
V. H. Simson
Iowa State University—BSEE—1948



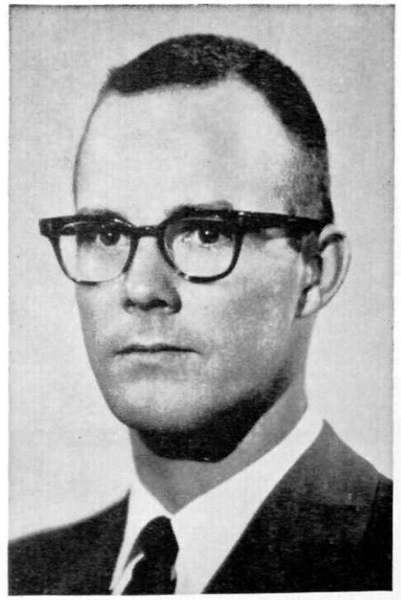
MANUFACTURING ENGINEERING
R. A. Busby
University of Michigan—BSME—1952



DEVELOPMENT ENGINEERING
R. P. Potter
University of Illinois—BSME—1959



CONTROL ENGINEERING
B. O. Rae
University of Wisconsin—BSEE—1957



SALES ENGINEERING
J. B. Hewitt
University of Colorado—BSME—1957

ANALYTICAL ACCOUNTING
D. R. King
University of Wisconsin—BBA—1957

There's an exciting challenge ahead for you, too, on a Cutler-Hammer automation team

K. M. Nelson, Manager—Industrial Control Sales, discusses the functioning of Cutler-Hammer's automation teams, and how creative graduates contribute to pioneering developments.

For over sixty years Cutler-Hammer has been a key contributor in planning automatic systems—now called automation.

To meet the pressing challenge of rapidly expanding industrial automation, we have formed a number of automation project teams. These teams combine the technical and manufacturing talents of versatile, seasoned specialists and young, creative-minded engineering and business administration graduates.

Their primary job: to make sure that a customer's automation investment pays an adequate return.

How do they meet this challenge? By working with customer engineers and consultants to isolate cost problems in manufacturing and warehousing operations. Then, by applying their individual disciplines and creative ingenuity to build common-sense automation proposals that can be justified economically.

Automation teams work together in a modern 500,000 square foot plant specifically designed to house every activity involved in the evolution of a system . . . in a creative climate that is conducive to imaginative planning and development.

This approach has paid off! Though industry has barely scratched the surface of the automation potential, our credentials already are quite impressive. Jobs such as the U.S. Post Office mail handling systems in 14 major cities; a pallet handling system for a mail-order firm; data accumulation systems for large steel producers; a number of automobile body-line systems; bundle-handling systems for 30 major newspaper mail rooms; and a package-handling system for a prominent publisher are just a few examples of our automation planning skill at work.

What are the advantages to the young, creative-minded graduate? Short range, it's an exceptional opportunity for the man who responds to the challenge of finding new solutions to tough manufacturing problems. Long range, being a key member of a Cutler-Hammer automation team is an excellent way to get the diversified experience so essential to steady career development and future advancement.

Want to know more? Write today to T. B. Jochem, Cutler-Hammer, Milwaukee, Wisconsin for complete information. And, plan to meet with our representative when he visits your campus.

CUTLER-HAMMER
AN EQUAL OPPORTUNITY EMPLOYER

WHAT'S NEW? ASK...

CUTLER-HAMMER

CONTROL

Cutler-Hammer Inc., Milwaukee, Wisconsin • Divisions: AIL; Mullenbach; Thayer Scale • Subsidiaries: Uni-Bus., Inc.: Cutler-Hammer International, C. A. Associates: Cutler-Hammer Canada, Ltd.: Cutler-Hammer, Mexicana, S. A.

EDITORIAL

Att'n: Students and Staff

Re: A Change

The Spartan Engineer Magazine is proud to exist. The administration of the College of Engineering is proud of us also. I fear, however, that the faculty and graduate students within the college are not very proud of us.

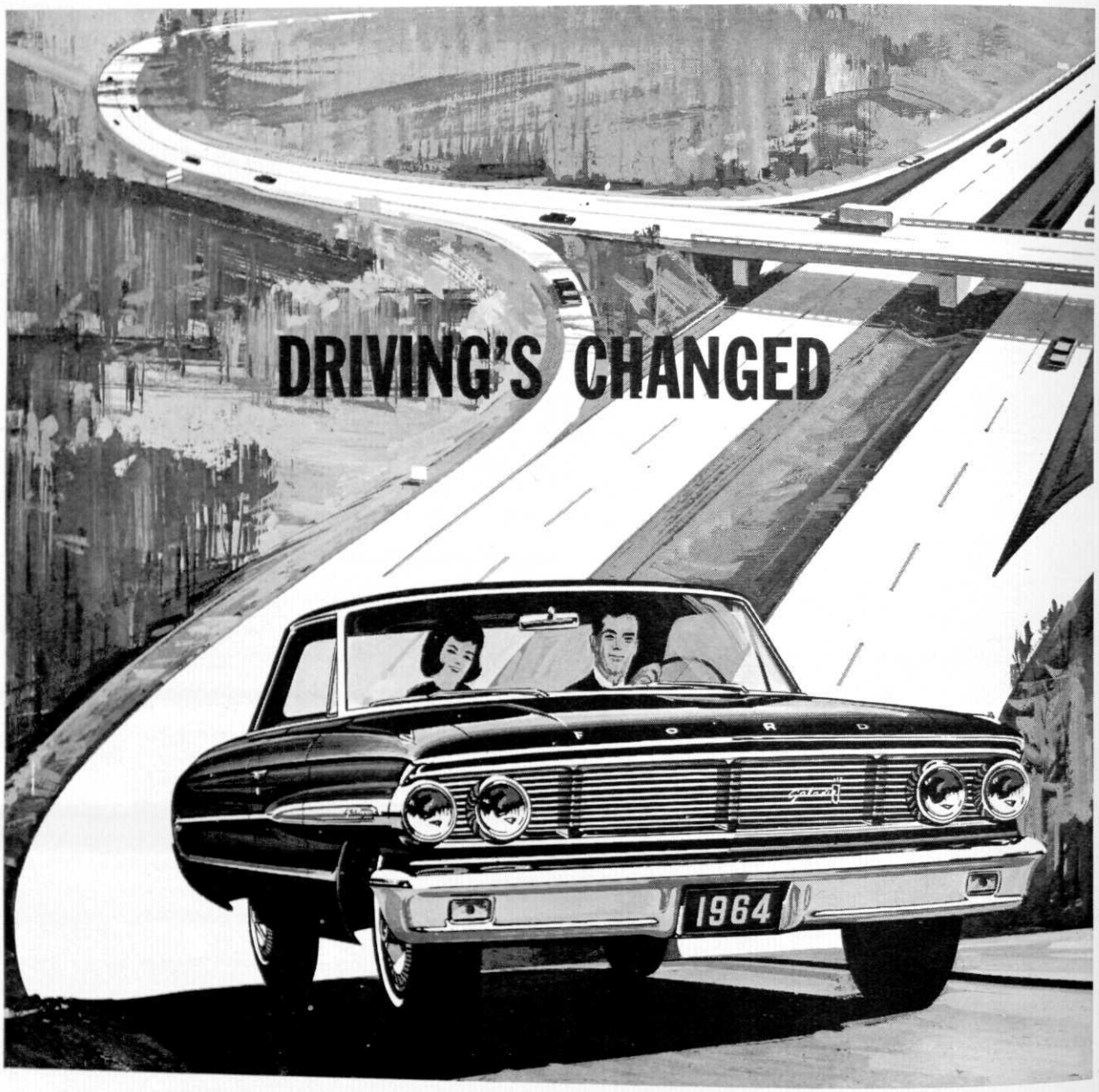
Many appeals have been made to the various people mentioned to obtain written matter that could be printed within this magazine. The effort, to date, has been useless. It has been a long time since the Spartan Engineer has printed an article not signed by a staff member.

With the printing of this ussue, the old policy of having the staff members write all the copy, shall cease. Henceforth, all copy shall come from the faculty, graduate students, juniors, and seniors; or any other person -----exempting the staff.

I feel confident that the College of Engineering will not let us down, but will show a physical sign of support equal to the words of the past. Whether the Spartan Engineer lives or exists depends upon you of the College, now. There are only two departments at MSU which have a published magazine representing them. Let us not make it one.

J. B. L.

← Modified North American Aviation X-15 rocket plane, the X-15A-2, shows new elliptical windows that are designed to better transform thermal stresses into more uniform loading on the glass. Not melted like conventional glasses, it is made by Corning Glass Works by spraying a silicon–containing vapor compound through a flame.



ONLY FORD-BUILT CARS MEET THE CHALLENGE WITH TOTAL PERFORMANCE!

Something wonderful's happened to Ford Motor Company cars! Under the freshest styling seen in years, there's a new kind of durability and vigor that more than meets the demands of today's and tomorrow's high-speed turnpike driving conditions.

What's the secret? Quality engineering for **total** performance. Quality engineering so outstanding that Ford Motor Company received the NASCAR Achievement Award for engineering excellence which "superbly combines the prime essentials of great automobiles—performance, reliability, durability, comfort and safety."

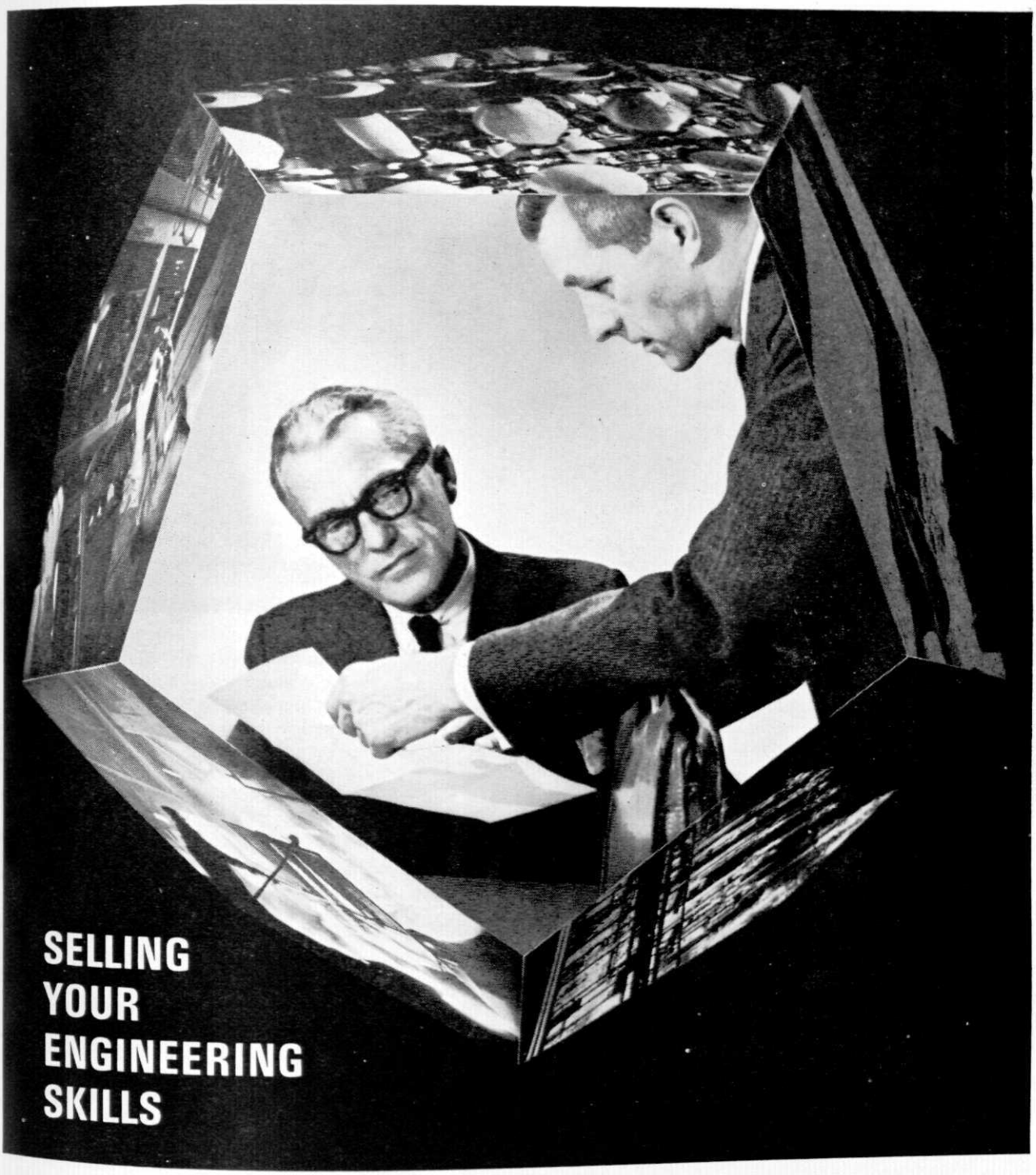
Total performance makes a world of difference. Bodies and frames are solid and quiet even on the roughest roads. The ride's so smooth, so even-keeled, it seems to straighten the curves and shorten the miles. And nothing matches the spirit, sparkle and stamina of advanced Ford-built V-8's and thrifty Sixes. Total performance is yours to enjoy in all our 1964 cars—from the frisky Falcon to the matchless Lincoln Continental.

Ford

MOTOR COMPANY

The American Road, Dearborn, Michigan

WHERE ENGINEERING LEADERSHIP BRINGS YOU BETTER-BUILT CARS



Another of your future's many facets at Monsanto

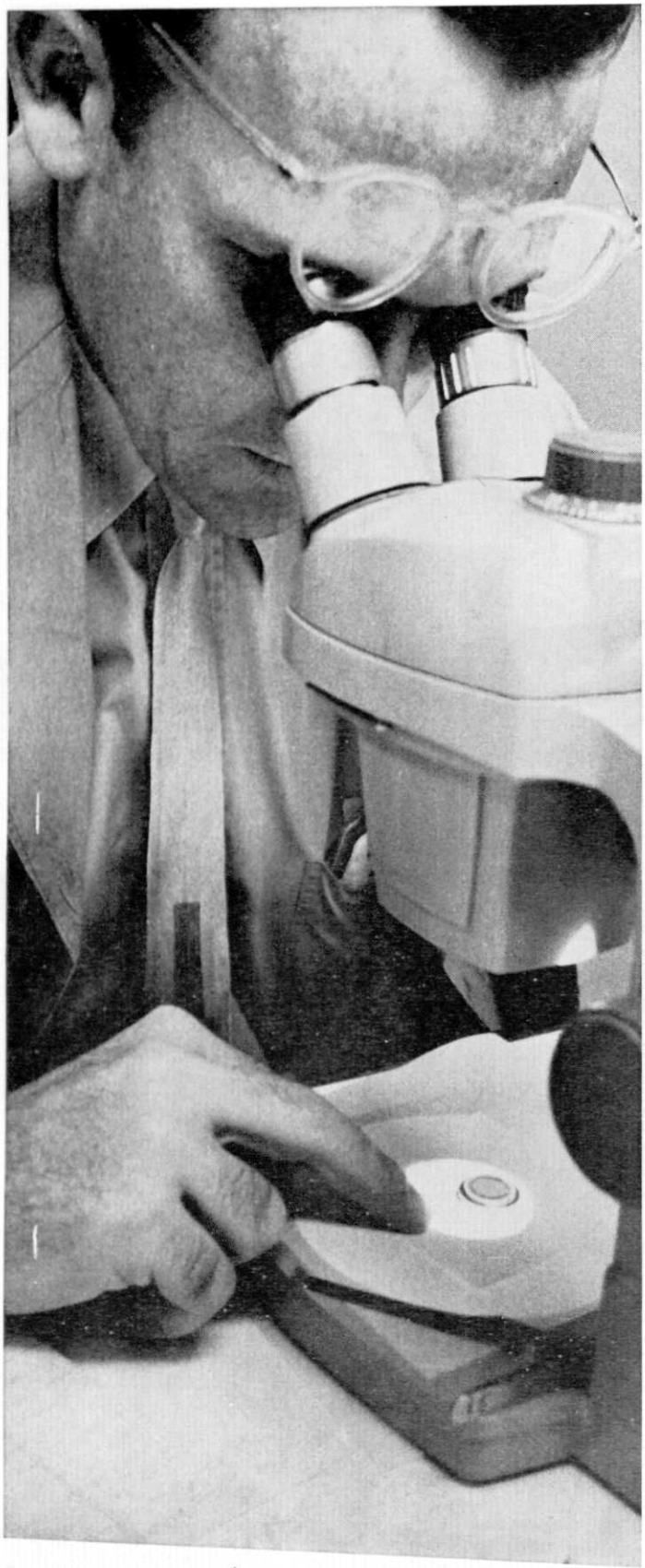
If you like the idea of proving your ability rapidly, consider marketing for Monsanto as a career. This worldwide company (represented in 70 nations), has quadrupled sales in the last twelve years, is expanding rapidly.

Monsanto needs men with sales talent who also have the creative ability to anticipate and generate demand for future products. You'll have the stimulation of pioneering with new, exciting products that demand full use of your professional skills.

See your Placement Director to arrange for an interview when we visit your campus soon. Or write for our brochure, "Your Future and Monsanto," to Manager, Professional Recruiting, Department ED, Monsanto, St. Louis, Missouri 63166.

Monsanto®

An Equal Opportunity Employer



Delco Means Opportunity to George Fitzgibbon

■ George Fitzgibbon is a Senior Experimental Chemist at Delco Radio. He's pictured here examining silicon rectifier sub-assemblies for microscopic solder voids during the development stage.

George received his BS in Chemistry from the University of Illinois prior to joining Delco Radio. As he puts it, "I found, at Delco, an opportunity to take part in a rapidly expanding silicon device development program. The work has proved to be challenging, and the people and facilities seem to stimulate your best efforts."

The young graduate engineer at Delco will also find opportunity—and encouragement—to continue work on additional college credits. Since our inception, we've always encouraged our engineers and scientists "to continue to learn and grow." Our Tuition Refund Program makes it possible for an eligible employee to be reimbursed for tuition costs of spare time courses studied at the university or college level. Both Purdue and Indiana Universities offer educational programs in Kokomo, and Purdue maintains an in-plant graduate training program for Delco employees.

Like George Fitzgibbon, you too may find challenging and stimulating opportunities at Delco Radio, in such areas as silicon and germanium device development, ferrites, solid state diffusion, creative packaging of semiconductor products, development of laboratory equipment, reliability techniques, and applications and manufacturing engineering.

If your training and interests lie in any of these areas, why not explore the possibilities of joining this outstanding Delco—GM team in forging the future of electronics? Watch for Delco interview dates on your campus, or write to Mr. C. D. Longshore, Dept. 135A, Delco Radio Division, General Motors Corporation, Kokomo, Indiana.

An equal opportunity employer

solid state electronics

DELCO RADIO DIVISION OF GENERAL MOTORS CORPORATION
KOKOMO, INDIANA

B-52. 8-engine jet bomber with range of over 9000 miles. Backbone of the Strategic Air Command.

Are you ready for a multi-million-dollar responsibility?

If you are, there's a place for you on the Aerospace Team—the U. S. Air Force.

No organization in the world gives young people a greater opportunity to do vital, responsible work.

For example, just a short while ago a 23-year-old Air Force lieutenant made a startling breakthrough in metallurgy. And a recent All-America tackle is doing advanced research in nuclear weapons.

If you have talent, you'll have a chance to show it in the Air Force. Your work can put you and your country ahead.

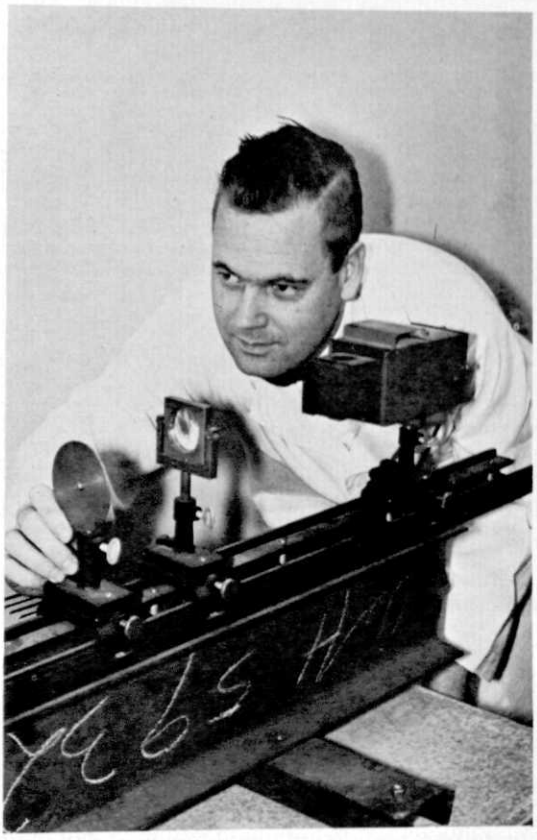
You can earn your commission at Air Force Officer Training School, a three-month course open to both men and women. To apply, you must be within 210 days of your degree.

For more information, contact the Professor of Air Science. If your campus has no AFROTC, see your Air Force recruiter.

U.S. Air Force

FACULTY REVUE

by Phillip Kraushar



Dr. Donald K. Anderson

In one of the little laboratory rooms near the end of the corridor on the second floor of the Engineering Building is a steel I-beam with a light source, special filters, various lenses and half mirrors, a large wooden box, and a metal tube mounted on it. What is it? Why, a Mach-Zehnder interferometer which is being used to study diffusion, of course. Extremely accurate measurements of the rates and amounts of diffusion of each liquid into the other at a constant temperature are computed from measurements made on photographs of the interference patterns of light passed through the diffusion cell.

Mutual diffusion of liquid mixtures has been one of Dr. Donald K. Anderson's major interests for some time, as a glance at his list of publications will show. However, his current areas of research also include such subjects as foam fractionation and properties of polyelectrolyte solutions. In the latter area, knowledge of the behavior of polymers that ionize may give us clues about the behavior of such natural substances as the proteins in living organisms.

Dr. Anderson was born in Iron Mountain, Michigan. His undergraduate years were spent at the University of Illinois and he received his M.S. and Ph.D. in Chemical Engineering from the University of Washington at Seattle. In April, 1960, he returned to his native state as Assistant Professor of Chemical Engineering at Michigan State University.

Here he teaches graduate courses in Transport Phenomena and Advanced Chemical Engineering Mathematics. He also teaches undergraduate courses in the areas of thermodynamics and control systems. Another portion of Dr. Anderson's time goes into advising the Student Chapter of the American Institute of Chemical Engineers, and the serving of Program and Education Projects Committees of the national organization.

Dr. Anderson is a member of the American Chemical Society and the American Society of Engineering Education.

In addition, he holds a research contract with the Upjohn Company for study on liquid chromatography and is a consulting author with the Resources Development Corporation.

Dr. Anderson is writing a series of programmed learning instruction manuals for the American Petroleum Institute. These manuals reduce the basic chemistry and operation of petroleum refineries to the level of the high school graduate in order to make possible rapid self-training of new workers in the petroleum industry.

The diffusion laboratory mentioned earlier is financed by a research grant from the American Chemical Society using money from the Petroleum Research Fund.

Standing in a research laboratory or just looking through the pages of this magazine, one considers the phenomenal advances being made in all fields of engineering and wonders how engineering education can possibly keep up. Dr. Anderson explained: "The increasing complexities of modern technology requires the engineering student to spend a greater proportion on his time on the fundamental laws of Nature. Since these laws do not change, the useful lifetime of the engineer's education is indefinite."

BIOCHEMISTRY AT MSU

by John P. Stokes

During the 19th Century, leading chemists pondered this puzzle: Are the substances found in animal and plant tissue the products of some mysterious "vital force"? Or do they obey the ordinary laws of chemical combination? And can they be synthesized in the laboratory?

The 19th Century scientists discovered that there was nothing mysterious about the substances. They found that many had very simple structures that could be duplicated in a test tube by synthesis from such elements as carbon, hydrogen, nitrogen, oxygen, phosphorus, and sulphur. By 1895, scientists were aware that all organic substances contain carbon. And from that time on, the field of organic chemistry became primarily the study of compounds of carbon, whether natural or synthetic in their origin.

At the beginning of the 20th Century, biochemistry had emerged as a separate discipline. It concerned itself not merely with the chemical content of natural products, but also with the chemical reactions that occur in living systems -- reactions that are fundamental to the various manifestations of life, including growth, reproduction, and movement.

In the past 20 years, knowledge has grown at an unprecedented rate. But the solution of one problem always shows that other problems exist. As a result, much vital work now lies ahead. For some time to come, biochemistry will be one of the most rapidly growing fields of science, both in the rate of accumulation of new knowledge and in the growing number of new research areas.

HOW RESEARCH IS CONDUCTED IN BIOCHEMISTRY

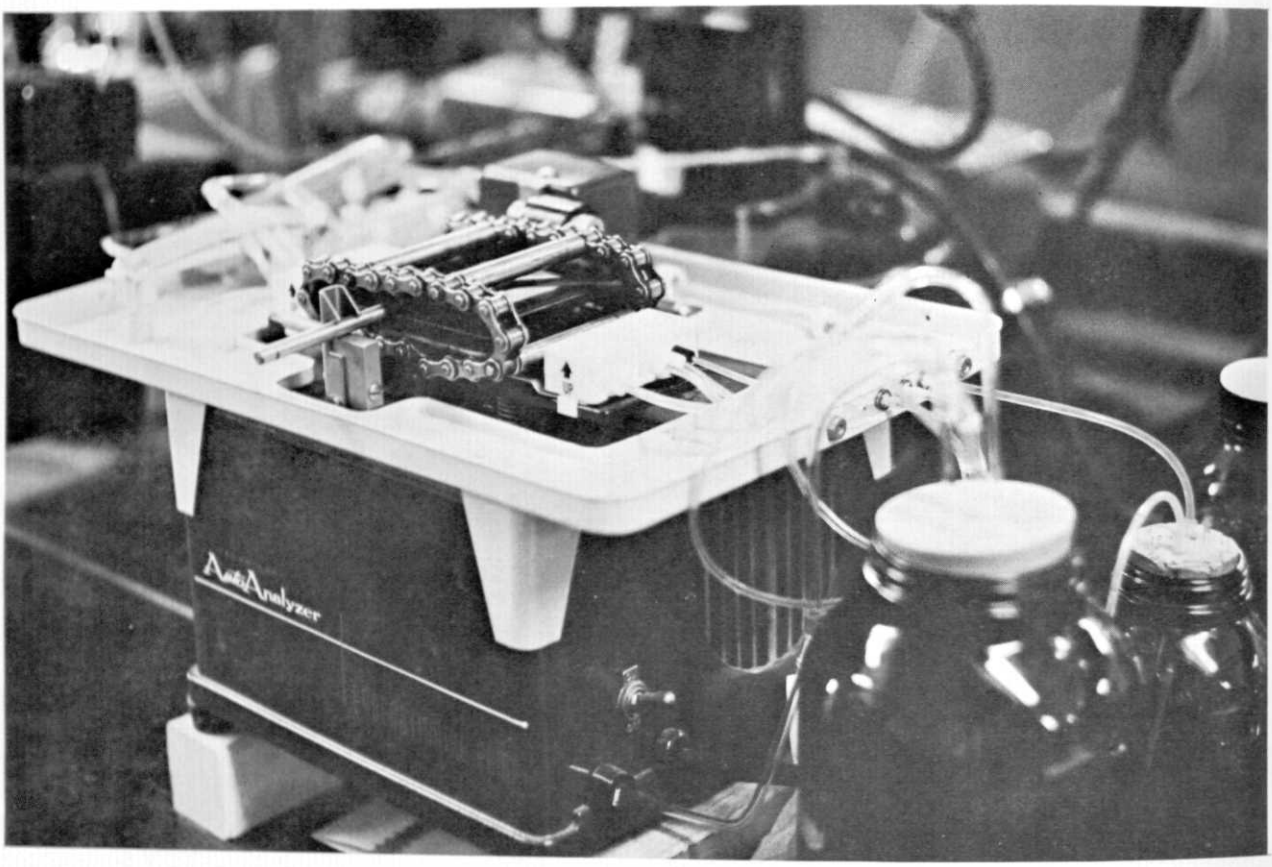
To analyze the sub-microscopic molecular pattern of the protoplasm -- and thus understand the structure and function of cells -- the biochemist makes use of highgly developed physical and chemical tools.

Research in physical biochemistry has contributed greatly to the understanding of the structure of large molecules of biological origin. This branch of biochemistry throws light on biological phenomena by using the methods and concepts of physical chemistry.

An important phase of this work is the development of ways to purify biological compounds and the development of criteria by which purity may be judged. Many purification methods are based on the fact that, in a given medium, molecules of different substances move at different speeds under appropriate conditions: under the influence of an electric field, for instance (electrophoresis), or under the influence of a gravitational field (ultracentrifugation), or under the influence of a concentration gradient (diffusion), or when placed in contact with a moving solvent (counter-current distribution, chromatography). All of these methods serve not only to purify a compound but, in many cases, to indicate its degree of purity, its molecular size, and the quantity present.

Interactions of light with matter are widely used for the characterization of biological compounds. Among these is the spe-

(Continued)



Proportioning Pump Used for Biochemistry Analyzing.

cific absorption of light of certain wave-lengths by particular compounds; this forms the basis of infra-red, visible, and ultra-violet spectrophotometry. This princple is used widely, both for identifying compounds and for determing their concentration and purity. Studies of X-ray diffraction by crystals provide information about the internal structure of molecules, small and large.

Another phase of physical biochemistry is concerned with the realtive ability of various biological substances to take part in oxidation-reduction reactions. This is determined electrometrically, by the potential of the reacting system. Such measurements are important for the understanding of the process of hydrogen or electron transfer, as it occurs in fermenting or respiring systems. A closely related subject deals with the regulation of a biological system's acid-base balance. The acid-base relationships are of great importance in maintaing all of the substances in the cell (including the enzymes) in the form that is most compatible with proper biological function.

Dealing with the chemical structure of biological compounds, and particularly with methods for synthesizing biological compounds in the laboratory, is the field of biochemistry called organic biochemistry.

From the days of Woehler and Emil Fischer down to the present, more and more of the natural compounds have yielded the secret of their structure. And many of them have been made in the laboratory. Recent, and exciting, discoveries include the synthesis of the adrenocorticotropic hormone (ACTH) and chlorophyll.

Only the most complex of biological compounds, such as proteins and nucleic acids, still resist the attack of the organic chemists. Even here, much is now being learned about the structure of these substances, and the possibility of eventually synthesizing them in the laboratory is no longer an idle dream.

THE NEED FOR BIOCHEMISTS

In academic institutions, hospitals, industry, and government, the demand for biochemists is great and the opportunities are numerous.

In academic institutions, opportunities exist in a variety of departments such as biochemistry, biology, chemistry, and agricultural biochemistry. A person with advanced training in biochemistry would be qualified to teach and conduct research in any of these areas. And at institutions with agricultural schools, opportunities are offered to biochemists who have a particular interest in applying their knowledge to the problem of agriculture.

BIOCHEMISTRY AT MICHIGAN STATE UNIVERSITY

1.2 million dollars in the form of a grant towards the construction of the new Biochemistry Building from the National Science Foundation says that M.S.U. has a staff competent to teach biochemistry and conduct research important to science, according to Dr. R. G. Hansen, Professor and Chairman of the Department of Biochemistry at M.S.U. M.S.U. also received a 1.4 million dollar grant for the new building from the National Health Institutes. This, Dr. Hansen says, reflects on the fact

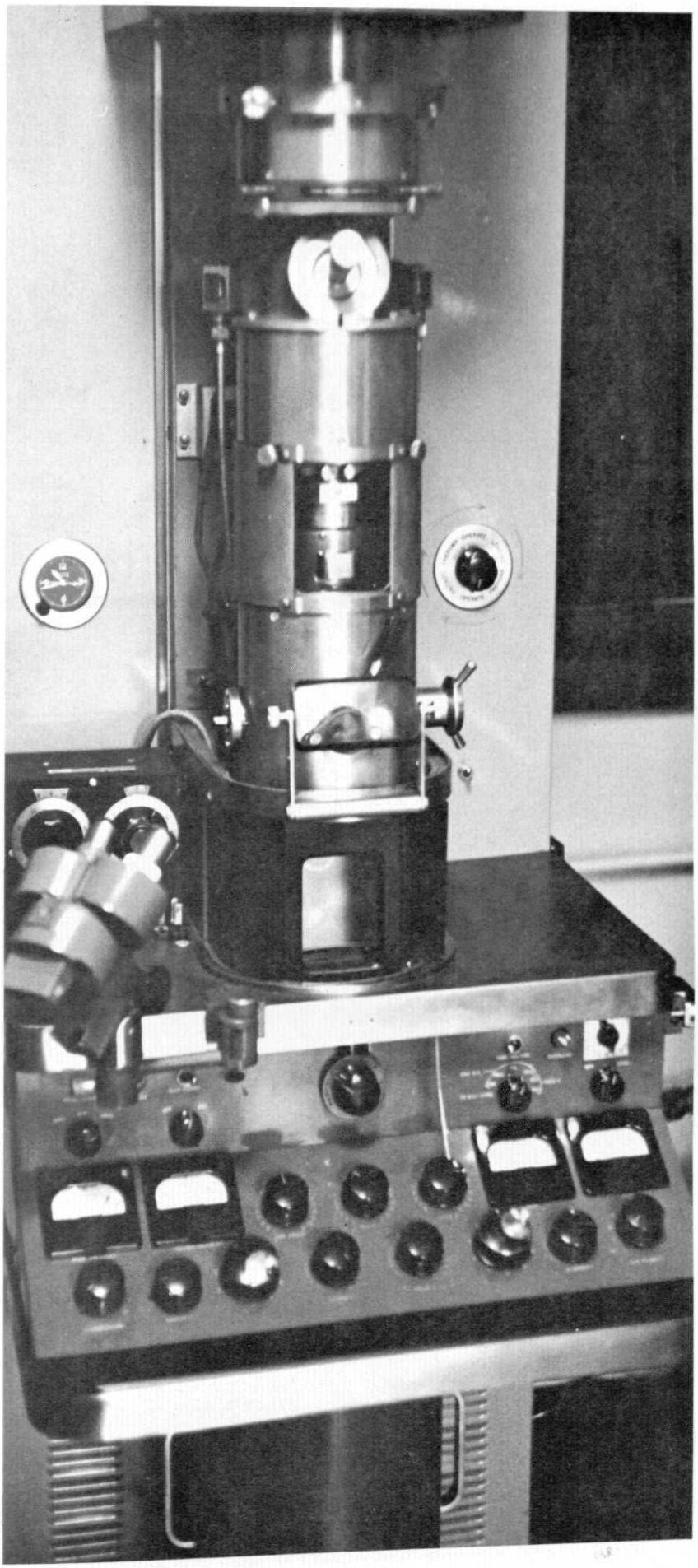
that the M.S.U. Biochemistry Department is doing health related research. The biochemistry of information storage and transmittal is an area where the M.S.U. department excells. Progress has also been made at M.S.U. in the biochemistry of metabolism.

Studying in the department are 15 post-doctoral reseach trainees and 45 graduate students. Undergraduates number 56 in biochemistry, approximately one third of which are doing research work in the department on a self-learning basis. This research work adds an important element to the undergraduate students' backgrounds.

Present course requirements for the undergraduate biochemists include on year of physics (277-78-79), one year of calculus as well as a term of differential equations. New admissions are attaining even more extensive mathematical backgrounds. This would indicate that biochemists at M.S.U. are equipped to extend into bioengineering fields with little additional training and with extensive biochemical backgrounds.

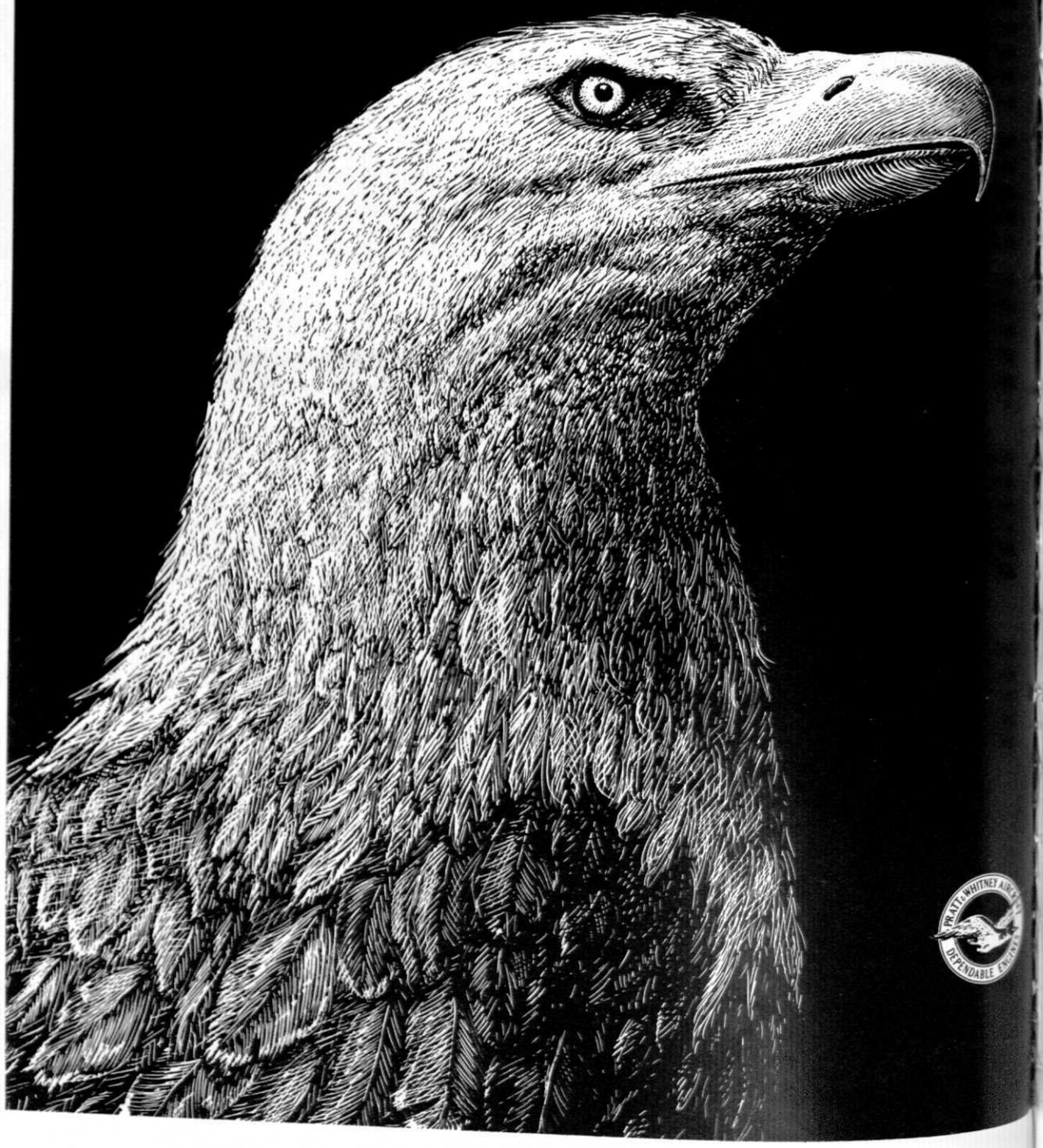
Made possible by the new Biochemistry Building is a modest staff expansion. The Biochemistry Department has been interviewing major scientists and is hoping to attract two or three to the East Lansing campus. There are hopes to double or triple the post-doctoral research training program, as well as double the number of graduate students. There is also an anticipated expansion of the undergraduate research training program.

September of 1964 is the anticipated date of completion of the new facility.



Electron Microscope Used for Biochemistry Research.

THERE WILL BE AN EAGLE



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ETA KAPPA NU

SALUTES

Dr. Lawrence J. Giacoletto

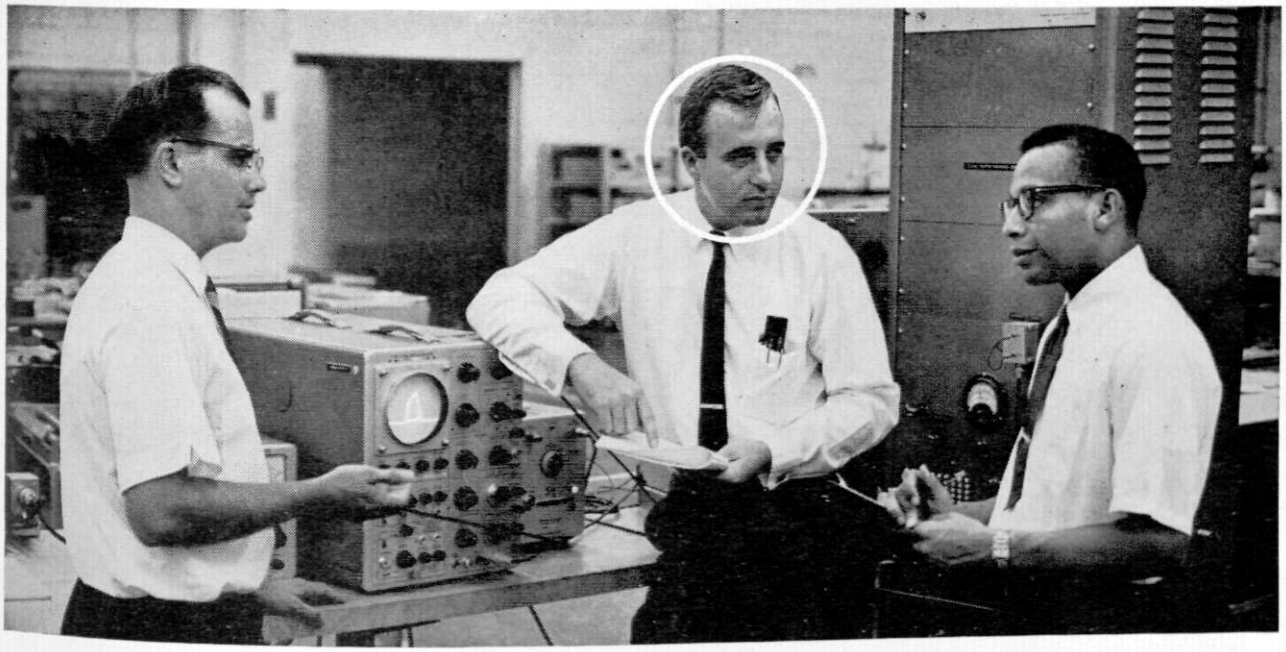
by Martin M. Scholl
Eta Kappa Nu
Gamma Zeta Chapter

Due to his great achievements to the electrical engineering profession, the Gamma Zeta Chapter of Eta Kappa Nu, wishes to honor Dr. Lawrence J. Giacoletto, Professor of Electrical Engineering, Michigan State University. Dr. Giacoletto attended Rose Polytechnic Institute, Terre Haute, Indiana, on a McGregor Scholarship, from 1934 to 1938, and receiving his B.S. in Electrical Engineering there in May of 1938, he went on to the State University of Iowa, where he was granted a Research Assistantship. After attaining his Masters in Physics at Iowa in August of 1939, he proceeded to the University of Michigan, where he was granted a Teaching Fellowship from 1939 to 1941, and where he did research work on various aspects of frequency modulation. In June 1941 he entered the Army Signal Corps and attained the rank of Lieutenant Colonel. While in the service he was the Officer in Charge of Radio Direction Finding research and development on navigational systems communications, direction finders, meteorological direction finders and radio modes, and related apparatus. He was directly responsible for and actively participated in the development of a direction finder of novel design. He received the American Service, Victory, Japanese Occupation, Asiatic-Pacific Theater, American Theater and Reserve Officers' medals. After his discharge from the Army in 1946, he went to work as a research engineer for the RCA Laboratories in Princeton, New Jersey. While there he was engaged in research work of various kinds. Most significant was his work in transistor theory, fabrication, measurement, and circuit applications. He developed the widely used transistor equivalent circuit, and participated in the development of transistor noise theory. He also did original research work on the non-linear semiconductor capacitor for parametric amplification. While working for RCA he received his Ph.D. in Electrical Engineering, from the University of Michigan, in February, 1952. In 1956 he moved to the Scientific Laboratory of Ford Motor Company, where he was Manager of the Electronics Department, until in November 1960 when he left Ford, and was granted a Professorship in the Department of Electrical Engineering, and the Department of Engineering Research at Michigan State University.

Dr. Giacoletto is a member of various academic, scholastic and technical societies, including Tau Beta Pi, Blue Key, Gamma Alpha, Phi Kappa Phi, Iota Alpha, Sigma Xi, American Association for the Advancement of Science, American Physical Society, Institute of Electrical and Electronic Engineers, and the American Ordnance Association. He was a judge at the Metropolitan Science Fair in Detroit, Michigan in April 1960; President of the Detroit Rose Technical Club, 1960-61; and a Member of the Penns Neck, New Jersey Lions Club, 1954-56. He is listed in American Men of Science, Who's Who in Engineering, Who's Who in Science and Industry, National Engineering, Register of Engineers Joint Council, and National Register of Scientific and Technical Personnel. He has been very active and has held several positions in the Institute of Radio Engineers, and holds over twenty patents. He has published over forty-three technical articles, and contributed to several books including, "Electricity", Chapter 8 of Vol. I of "Methods of Experimental Physics, Clasical Methods", (with M. Ference), Academic Press, 1956, and "Transistor I", RCA Laboratories, March, 1959.

Dr. Lawrence J. Giacoletto is truly a prime example of an outstanding Electrical Engineer, and we the members of the Gamma Zeta Chapter of Eta Kappa Nu are proud to have him as a member of The Michigan State, Electrical Engineering Faculty.

Tom Huck sought scientific excitement



He's finding it at Western Electric

Ohio University conferred a B.S.E.E. degree on C. T. Huck in 1956. Tom knew of Western Electric's history of manufacturing development. He realized, too, that our personnel development program was expanding to meet tomorrow's demands.

After graduation, Tom immediately began to work on the development of electronic switching systems. Then, in 1958, Tom went to the Bell Telephone Laboratories on a temporary assignment to help in the advancement of our national military capabilities. At their Whippany, New Jersey, labs, Tom worked with the Western Electric development team on computer circuitry for the Nike Zeus guidance system. Tom then moved on to a new assignment at WE's Columbus, Ohio, Works. There, Tom is working on the development of testing circuitry for the memory phase of electronic switching systems.

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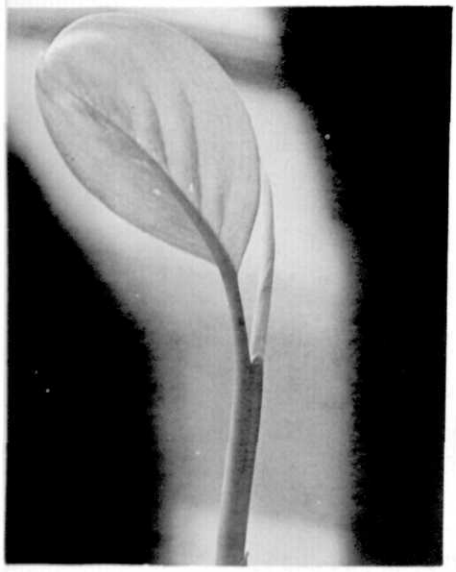
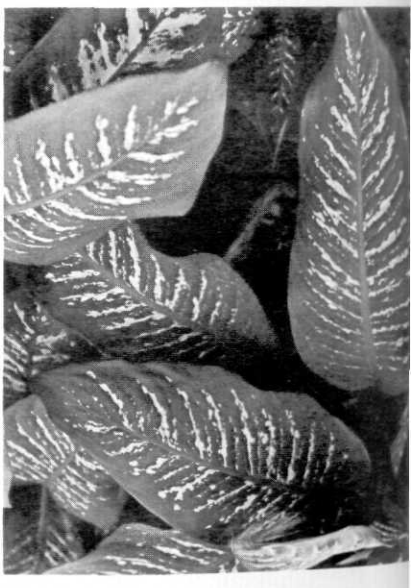
BIO-SCIENCES EVOLVING

by Dick Steiner
Thomas Sampeer
John B. Locke

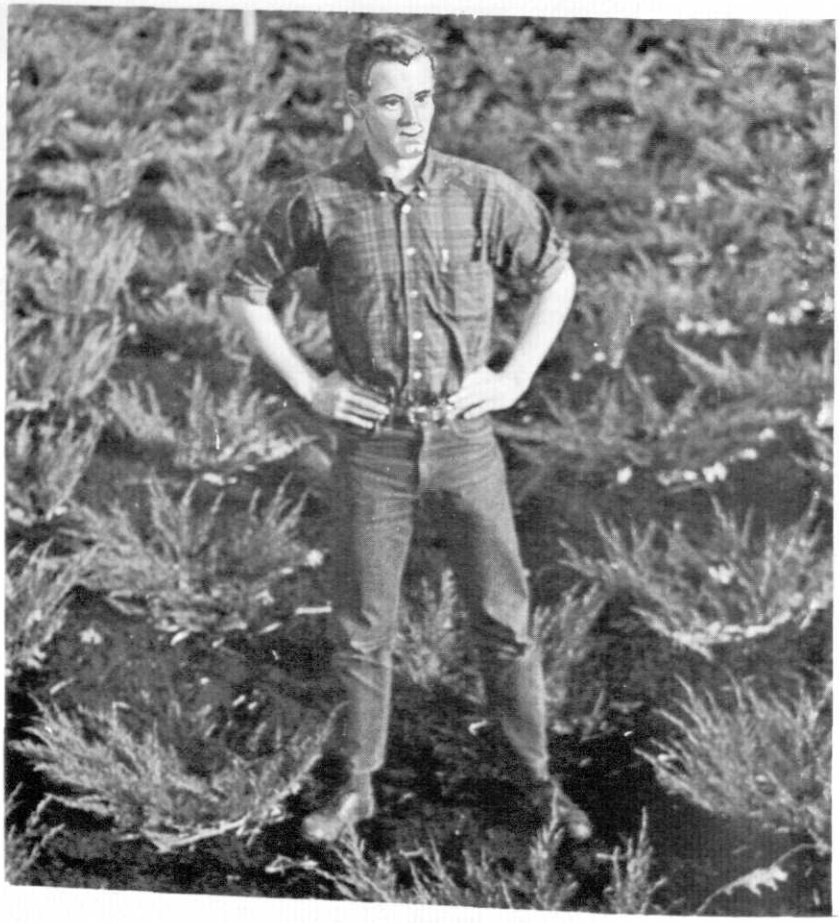


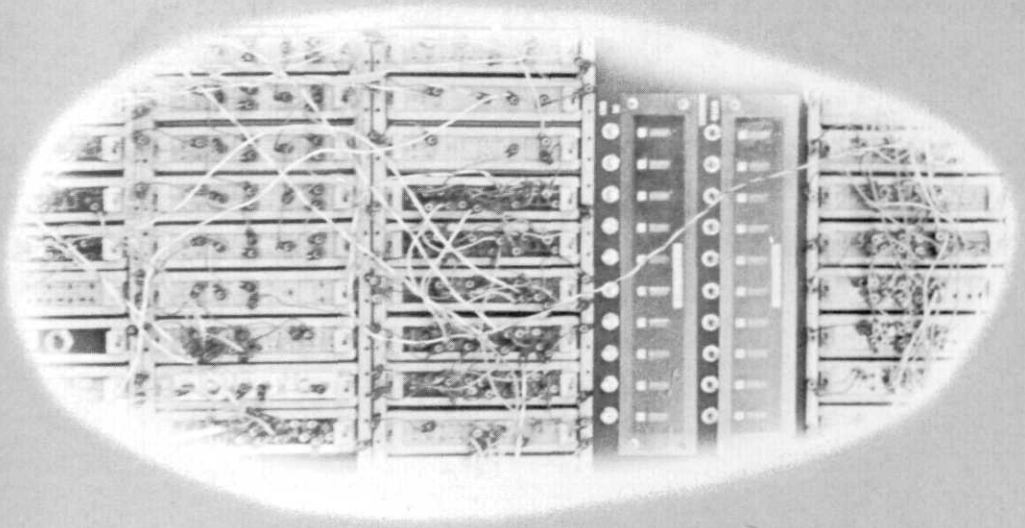


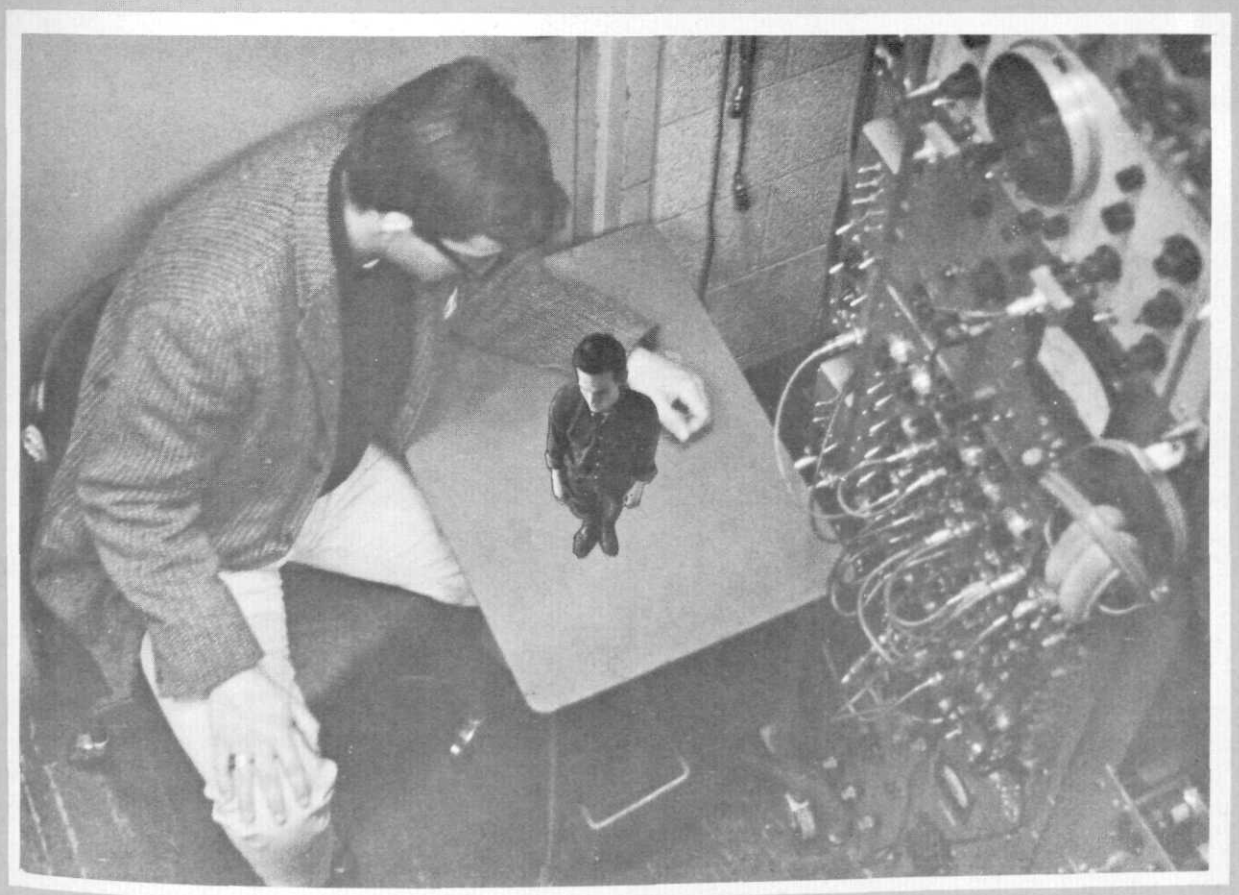
"IN THE BEGINNING . . ."

THEN CAME

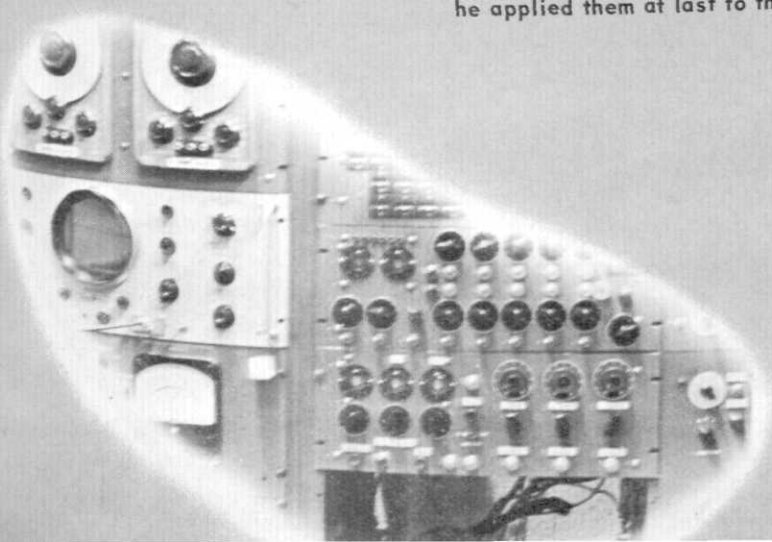
MAN

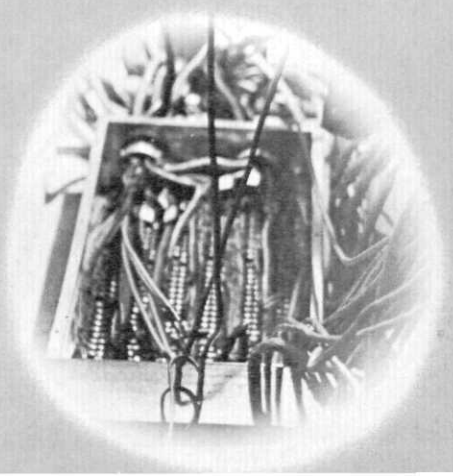


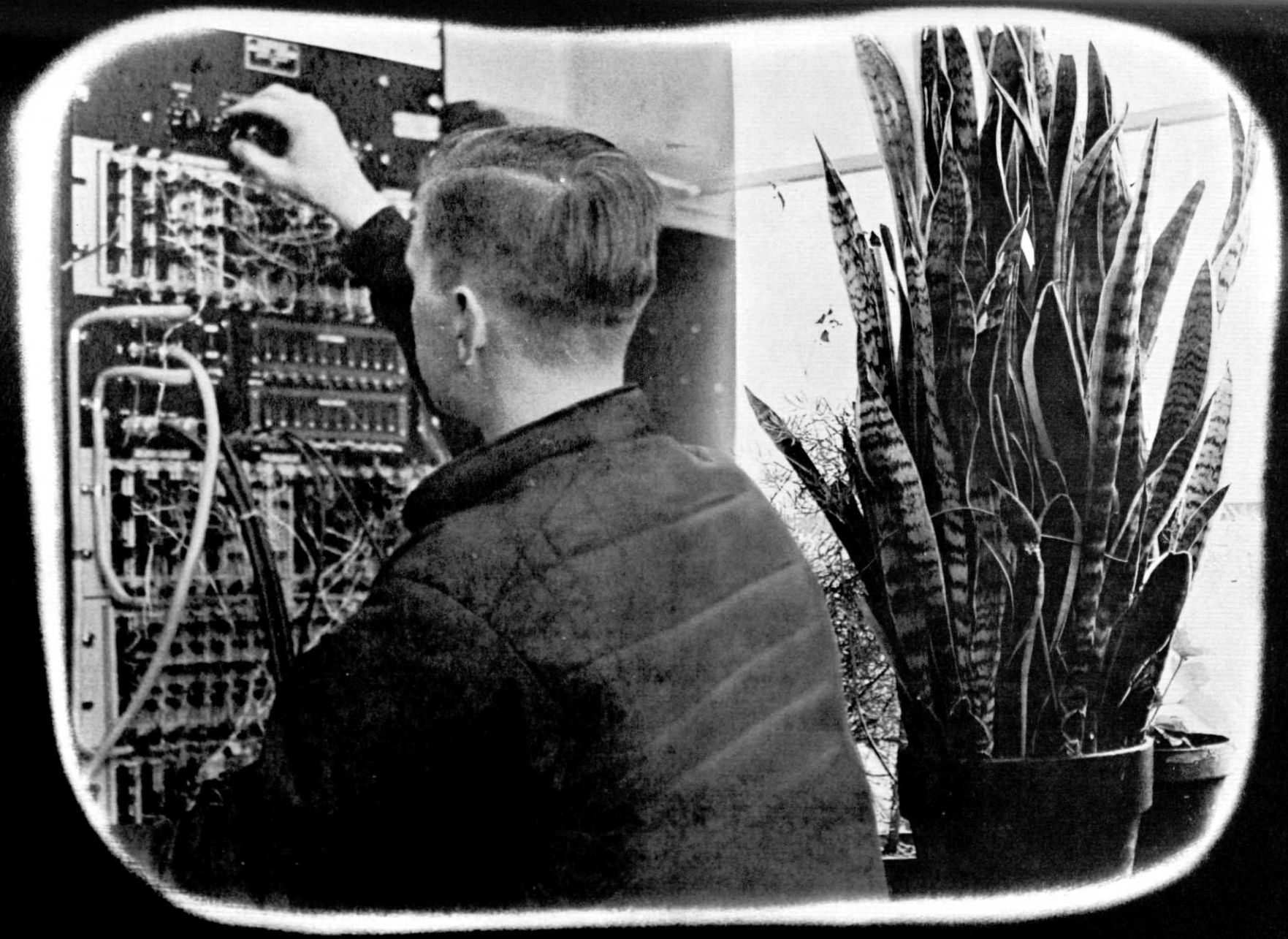




Developing his instruments and theories for the inanimate world,
he applied them at last to the living.







He examined the "bio" and developed the "engineering".

He made the "bioengineering" preserve him.

Then, clad in a satellite suit, he left.

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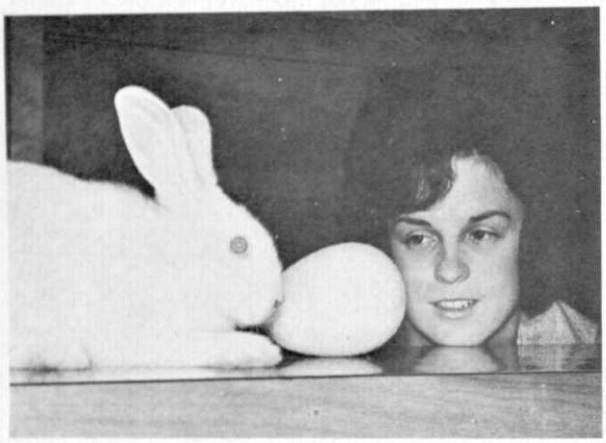

MISS ENGINEER

Marie Smith

Photographs by:
Hicks Studios
Dick Toth

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ENGINEERING AND THE MSU DAIRY PLANT

by Fred George

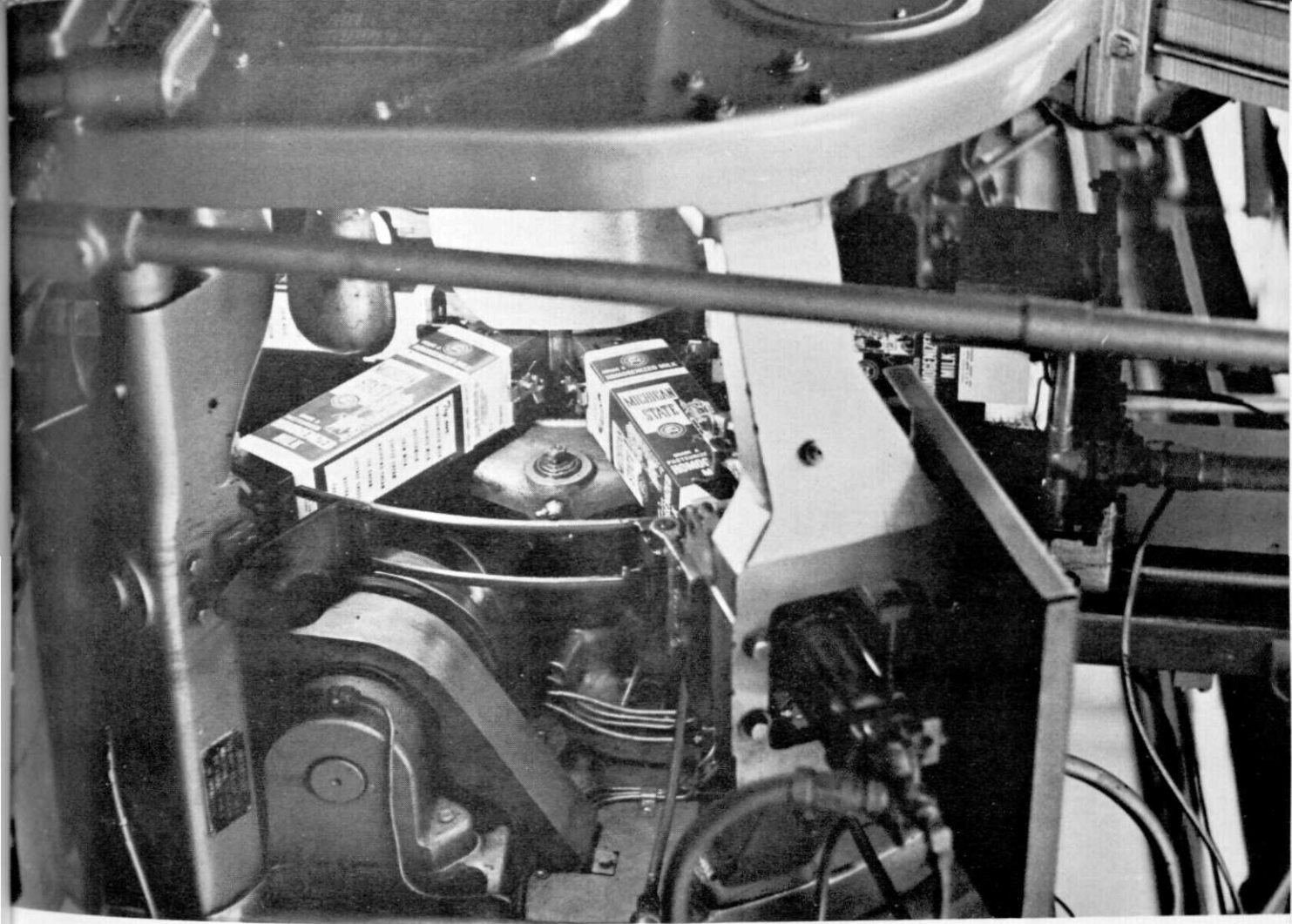
More than once Michigan State has been referred to as "Moo U." or as a "Cow College" in a derogatory manner as though the scientific approach to improved agriculture was to be looked down upon. However, if serious thought is given to the subject, it becomes apparent that the advances made, resulting from work at M.S.U. have far-reaching consequences. For a specific example, the engineering improvements made at the Michigan State Dairy Plant are extremely interesting.

Michigan State produces and processes all of the milk and other dairy products which are consumed on the campus. The milk is brought onto campus from the university dairy farms. It is then processed entirely at the M.S.U. Dairy Plant which is located on Farm Lane adjacent to Anthony Hall. Viewed from the outside, the Dairy Plant is not a very impressive building but once you go inside you get an entirely different picture. The maze of equipment spread throughout the building is awesome. When the plant was equipped in 1956, it was the most modern of its kind in the world. Since then, improvements in the engineering and design of the dairy industry have changed this status. For the sake of brevity, let us look only to the advances of the last five years.

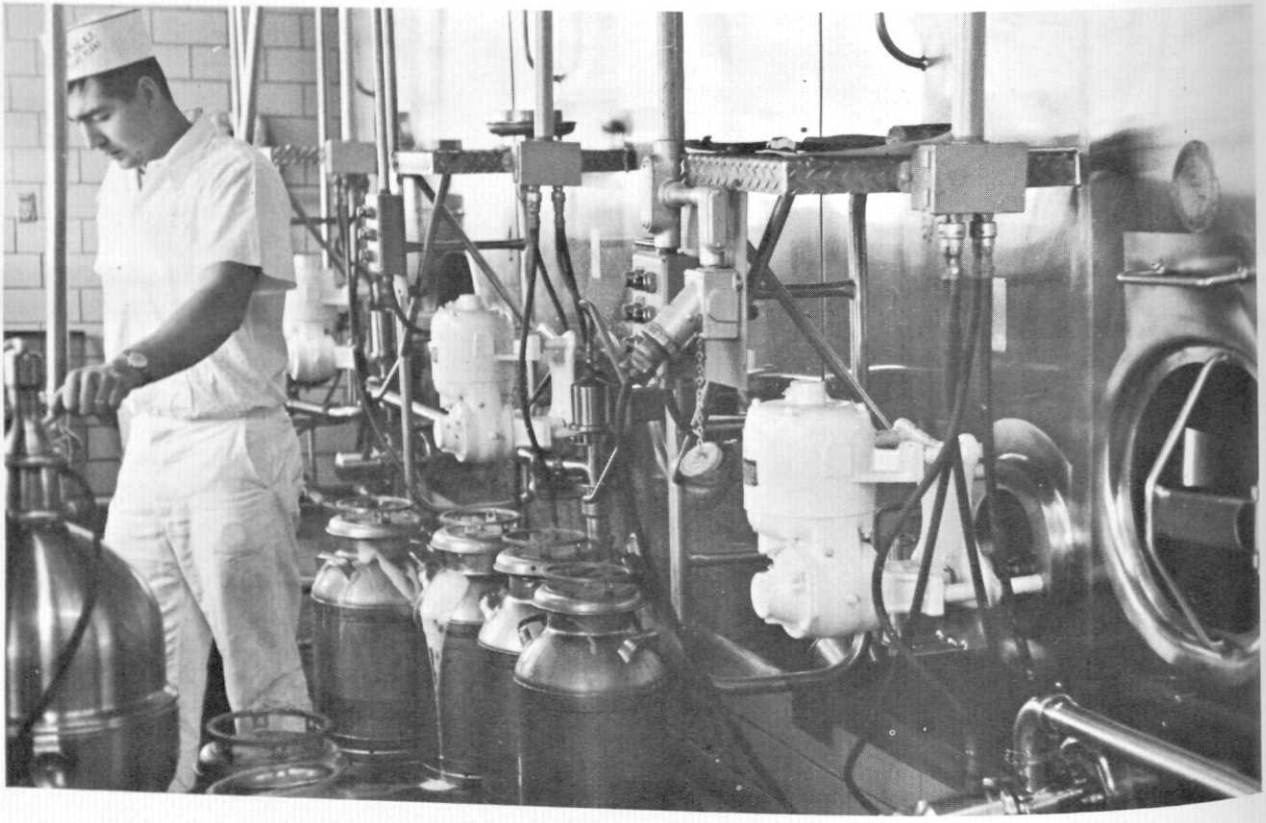
Engineering is important in all phases of the dairy industry, production on the farm, transportation of the product from the farm to plant, methods of processing the product to its finished state, and in a small way, distribution to the consumer. The part which engineering plays in the industry basically has to do with improving production efficiency and thereby lower costs. Automation, for instance, has provided far greater production efficiency and, moreover, for a higher quality and more uniform product. Returning to the M.S.U. dairy plant we find work being conducted here which applies engineering to the diary industry.

Milk has for some time now been able to travel from cow to consumer without ever being touched by human hands. This provides for more efficient and therefore more economical production and also for a purer product. However, since itis essential for the milk to be as pure as possible, the processing equipment must be cleaned often. At one time this required a dismantling of the equipment and cleaning by hand. Now, however, by a new method cleaning solutions are pumped through the apparatus and it is cleaned in place (CIP in the dairy industry) without dismantling. This results in a great savings of time which can be put to good use in production.

Automation, which has become a big word in all industries, has contributed to dairy production in proportion. Through automation milk can be treated for sterilization at higher temperatures. Less training is required for employees in the dairy industry. Thus, the high wages of specially trained and experienced men can be avoided. Automation has also been used for improvements in refrigeration. Instead of needing a man to watch a temperature guage, an auto-control does a better job by a direct



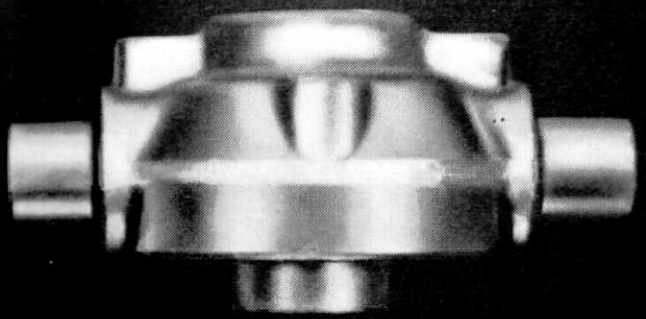
Milk Cartons Are Formed and Filled by These Machines.



connection to the equipment compressors. Computers have been put to good use in the ice cream industry. The computers calculate the amount of each ingredient which should be bought according to prevailing prices in the market. They can also be used to keep track of inventories and when the supply of a certain ingredient falls below a predetermined level, the computers can point out a supply order.

Presently, work and experiments are being conducted at the Michigan State Dairy Plant in several fields in the dairy industry. Studies are being made concerning the direct hardening of ice cream to replace the present system of hardening it in a cold atmosphere, and on the mechanical conveyance of butter as by pumping. Only recently the dairy plant has succeeded in experiments on cutting down the time necessary to cure some cheeses. Blue cheese, which once took three months to cure, can now be prepared in ten days.

Through engineering the dairy industry is producing a superior product at a low cost. But the end is not yet in sight. Dr. T. J. Hedrick, manager of the M.S.U. Dairy plant has said, "There is no limit as to how far we can automate. Let them call us a "cow college" but don't let them forget that because we are a "cow college" they eat better at lower cost.



FORGINGS—HOW THEY IMPROVED THE RELIABILITY OF THIS CROSSHEAD . . .

yet cut cost 20%

Originally, this crosshead for a lift truck was not a forging. Now it is **forged** in steel. Here's why . . .

The lift truck builder wanted to increase the safety factor to meet greater bending and shear stresses. He also wanted to increase the fatigue strength of the part. And all without any increase in weight or cost. He also wanted to reduce tool breakage caused by irregularities, voids, and inclusions.

He changed over to FORGED crossheads.

Now the crosshead has the required strength and stress-resistance, costs 20% less when machined and ready to assemble, increases production rates 14% by reducing tool breakage and increasing machining speeds.

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Memo to future engineers:

"Make it lighter and make it stronger" is the demand today. No other metalworking process meets these two requirements so well as the forging process. Be sure you know all about forgings, their design and production. Write for Case History No. 105, with engineering data on the lift truck crosshead forging shown above.

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Passing a door in the wee hours of the morning, a drunk noticed a sign which read, "Ring the bell for the caretaker." He did just that, and a sleepyeyed man came to the door.

"What do you want?" asked the man.

"I wanna know why you can't ring the damn bell yourself."

The human brain is wonderful. It starts working when you get up in the morning and doesn't stop until you get called on in class.

Heard from a University instructor at Penn. State: "There are three reasons why a girl wears sweaters -- the first is to keep warm and the other two are obvious.

Two goldfish in a bowl looked at each other and one said: "Well, if he isn't God, then who feeds us?"

A doctor, a computer programmer and a lawyer were talking.

"My profession is the greatest," said the doctor, "because Jehovah took a rib out of Adam to give to Eve and that was the first operation."

The programmer said his profession was the greatest since he had made order out of chaos.

But the lawyer replied: "Aha, but who made the chaos?"

"Just one more kiss, darling."

"On an empty stomach?"

"Of course not, right where the last one was."

A nurse in the maternity ward asked a young medical student why he was so enthusiastic about obstetrics. He replied sheepishly: "Well when I was on medical rotation, I suffered from heart attacks, asthma, and itch. In surgery, I was sure I had ulcers. In the psychiatric wards I was sure I was losing my mind. Now, in obstetrics, I can relax."

The scene was in the University library.

A young fraternity man was reading birth and death statistics. He turned to the cute co-ed sitting next to him and said, "Do you know that every time I breathe, a man dies?"

"Very interesting," replied the co-ed. "Why don't you try Sen-Sen?"

Nothing gives you that run down feeling like being hit by a truck.

The lady riding upon the train was amusing herself with a crossword puzzle. The train was crowded. One word she simply couldn't make out so she turned to the man beside her. "I wonder," she asked, "if you could help me with this puzzle?"

"I might," he replied, "what is it?"

"Well," the lady said, "All I know is it's a four-letter word ending in the letters IT and it says that it is found in the bottom of a bird cage and that Churchill's full of it."

"Hmmm, that must be grit."

"So it is," exclaimed the lady. "Do you have a pencil with an eraser?"

Arriving home earlier than usual, he found his wife in the arms of his friend.

"I love your wife," said the friend, "and she loves me: I'll play you a hand of bridge for her. If I win, you divorce her, and if you win I promise never to see her again. Will you play?"

"Okay by me," said the husband, "But how's about a penny a point to make it interesting?"

A drunk was doing his best to spear an olive with a toothpick. Time after time the olive eluded him. Finally a man nearby became annoyed, took a toothpick and said, "This is the way to do it," and speared the olive on the first try.

"Sure, sure," replied the drunk, "after I got him so tired he couldn't get away."

"What did the professor say this morning?"

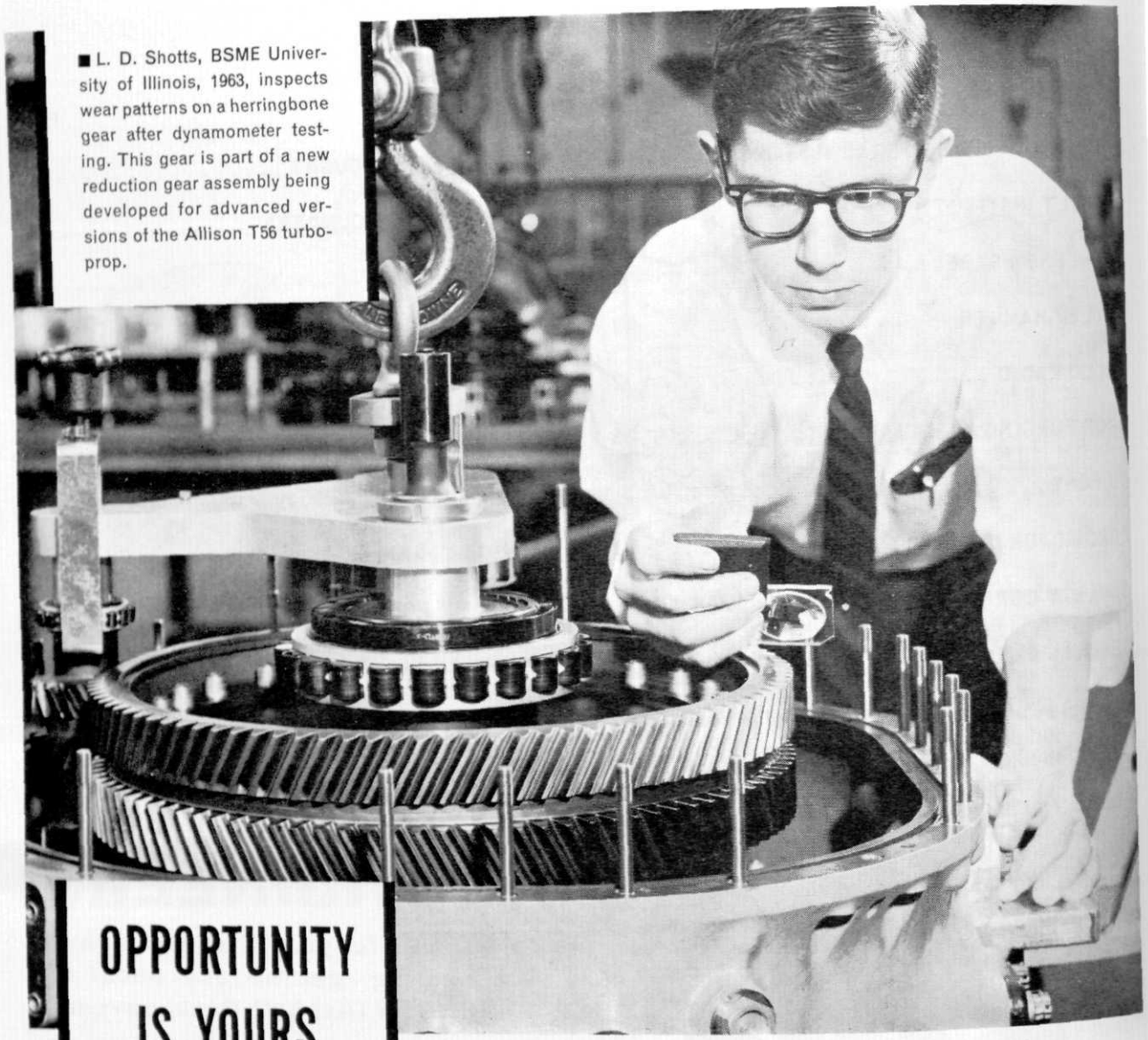
"Nothing."

"Of course. But how did he express it this time?"

The farmer gave his prospective purchase a thorough going over from head to foot, poking and pinching the animal very carefully. "You see, son," he explained, "When you buy a cow you want to be sure it's a sound one."

A week later the boy ran breathlessly up to the farmer and reported, "Better come quick, Mr. Abernathy. A traveling salesman pulled up behind the barn and it looks like he's trying to buy your daughter."

THE ADVERTISER'S INDEX



■ L. D. Shotts, BSME University of Illinois, 1963, inspects wear patterns on a herringbone gear after dynamometer testing. This gear is part of a new reduction gear assembly being developed for advanced versions of the Allison T56 turboprop.

OPPORTUNITY IS YOURS AT ALLISON

■ For L. D. Shotts, the move from the University of Illinois was a natural. L. D. had learned of the work Allison is doing in advanced turbine engine development. Particularly, he was impressed with Allison's assignment to develop the T78 regenerative turboprop engine.

The T78—selected by the Navy for anti-submarine aircraft—utilizes turbine exhaust heat to raise the temperature of compressor discharge air, resulting in increased fuel economy for extended long-range and on station aircraft capability.

Air-cooled turbine blades, another Allison achievement, mark a significant advance in turbine engine state of the art. And, the workhorse of turboprops, the Allison T56, continues to set new standards as our engineers find additional means of improving performance and reliability.

In addition to leadership in the turboprop area, Allison also is making great strides in the development of nuclear energy conversion projects, including a compact, mobile nuclear reactor and an energy depot concept which will permit manufacturing of fuel "on the spot" for military field units.

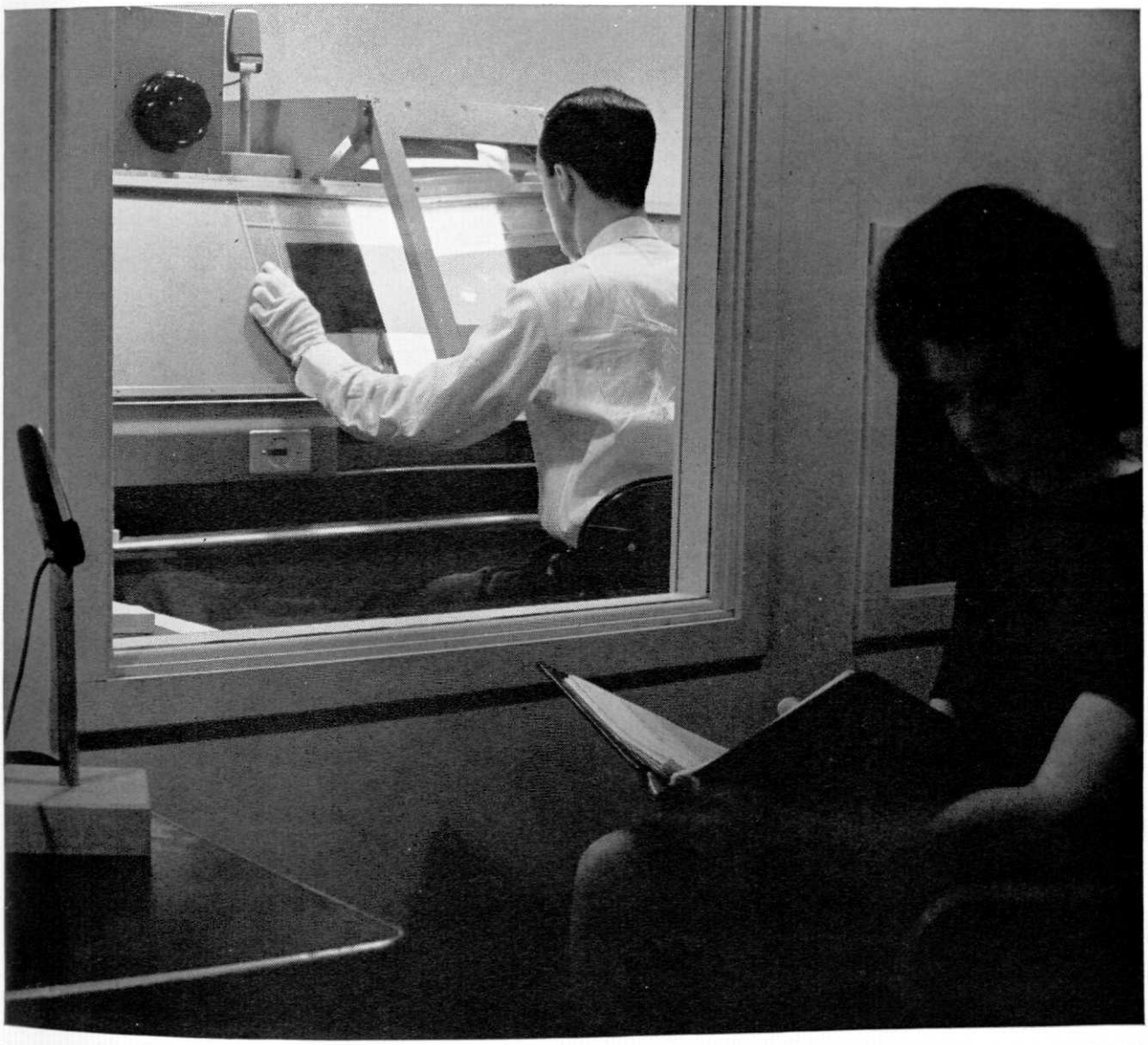
Well-qualified, young engineers will find unlimited opportunities in the long-range, diversified energy conversion programs at Allison. Talk to our representative when he visits your campus. Let him tell you what it's like in the creative environment at Allison where Energy Conversion Is Our Business.

An equal opportunity employer

Allison

THE ENERGY CONVERSION DIVISION OF GENERAL MOTORS, INDIANAPOLIS, INDIANA

GM GENERAL MOTORS



WE MAKE INDUSTRIAL ENGINEERS SWEAT

Might as well scare off the ones who wouldn't like it. Some of the unscared will in a few years be referred to as "they" when people say, "At Eastman Kodak, *they* can afford to do it this way—"

The reason we can afford to do things the best way is that we are successful. The success can be attributed in part to a fear worth fearing: of failing to deliver the best possible performance that the customer's hard-won dollar can buy.

Sheer devotion on the part of the work force, though beautiful to see, will not of itself deliver the goods. Somebody must first come up with a sensible answer to the question, "Exactly what is it you want me to do, mister?"

Thus a young industrial engineer may find himself acting as his own first subject in a study he has set up to find the physical and psychological conditions that best favor alertness against film emulsion defects. If he saw the need, sold his boss on his approach, and has earned the approbation alike of the pretty psychologist who will be running the experiment, the industrial physicians (who study what is humanly possible, feasible, and healthful muscularly and perceptually), the cold-eyed man from the comptroller's office, the Testing Division chief (who has dedicated his division to the descent of an asymptote), and the inspectors (who will find a month after switching to the new method that at home they are shouting at their kids less often)—then we know ways to make him glad he chose to learn the profession of industrial engineering at the company which the leaders of the profession often cite as its ideal home.

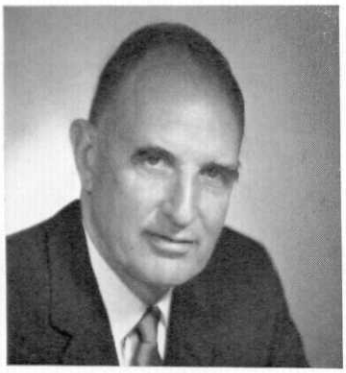
Naturally, industrial engineers aren't the only technical people we seek. Not by a long shot.

EASTMAN KODAK COMPANY,
Business and Technical Personnel Department, Rochester, N. Y. 14650
An equal-opportunity employer offering a choice of three communities:
Rochester, N. Y., Kingsport, Tenn., and Longview, Tex.

Kodak

Define Your Career Objectives!

An interview with W. Scott Hill, Manager—Engineering Recruiting, General Electric Co.



W. Scott Hill

Q. Mr. Hill, when is the best time to begin making decisions on my career objectives?

A. When you selected a technical discipline, you made one of your important career decisions. This defined the general area in which you will probably begin your professional work, whether in a job or through further study at the graduate level.

Q. Can you suggest some factors that might influence my career choice?

A. By the time you have reached your senior year in college, you know certain things about yourself that are going to be important. If you have a strong technical orientation and like problem solving, there are many good engineering career choices in all functions of industry: design and development; manufacturing and technical marketing. If you enjoy exploring theoretical concepts, perhaps research—on one of the many levels to be found in industry—is a career choice to consider. And don't think any one area offers a great deal more opportunity for your talent than another. They all need top creative engineering skill and the ability to deal successfully with people.

Q. After I've evaluated my own abilities, how do I judge realistically what I can do with them?

A. I'm sure you're already getting all the information you can on career fields related to your discipline. Don't overlook your family, friends and acquaintances, especially recent graduates, as sources of information. Have you made full use of your faculty and placement office for advice? Information is available in the technical journals and society publications. Read them to see what firms are contributing to advancement in your field, and how. Review the files in your placement office for company literature. This can tell you a great deal about openings and programs, career areas and company organization.

Q. Can you suggest what criteria I can apply in relating this information to my own career prospects?

A. In appraising opportunities, apply criteria important to you. Is location important? What level of income would you like to attain? What is the scope of opportunity of the firm you'll select? Should you trade off starting salary against long-term potential? These are things you must decide for yourself.

Q. Can companies like General Electric assure me of a correct career choice?

A. It costs industry a great deal of money to hire a young engineer and start him on a career path. So, very selfishly, we'll be doing everything possible to be sure at the beginning that the choice is right for you. But a bad mistake can cost you even more in lost time and income. General Electric's concept of Personalized Career Planning is to recognize that your decisions will be largely determined by your individual abilities, inclinations, and ambitions. This Company's unusual diversity offers you great flexibility in deciding where you want to start, how you want to start and what you want to accomplish. You will be encouraged to develop to the fullest extent of your capability—to achieve your career objectives, or revise them as your abilities are more fully revealed to you. Make sure you set your goals realistically. But be sure you don't set your sights too low.

FOR MORE INFORMATION on G.E.'s concept of Personalized Career Planning, and for material that will help you define your opportunity at General Electric, write Mr. Hill at this address: General Electric Co., Section 699-10, Schenectady, N. Y. 12305.

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