VOLUME 9 NUMBER

Spartan Engineer

EIGHTH ANNUAL ENGINEERING EXPOSITION

- Planning for the Future
- Your Placement Bureau
- Transients and Trends
- The Knack and the Kidney Bean
- Danger Lurks: Over Population
- Education Made Easier

MAY, 1956

PRICE 25¢

Edward J. Stolic, class of '48

speaks from experience when he says . . .

"With U. S. Steel, my future holds interest, challenge and reward."

From his graduation in 1948 with a B.S. degree in Mechanical Engineering, until November of that year, Edward Stolic worked as an operating trainee in the Irvin Works of United States Steel. Following his discharge from the Army in 1950, he returned to work at U.S. Steel. In just 18 months, Mr. Stolic reached a management position as Engineer-Lubrication.

By mid-year 1953, Mr. Stolic was promoted to Foreman-Instrument Repair and Sub-Station. In a recent interview he said: "Opportunities for rapid advancement are almost limitless in U.S. Steel." At 27, Mr. Stolic is supervising a force of 30 men in mechanical and electrical tests as well as instrument repair and maintenance of gas generators, compressors and water purification units. He feels that, "The engineer finds many places to apply the knowledge he garnered in school." The men under Edward Stolic are called on to trouble shoot in any part of the mill. This calls for a wide variety of talents and leads Mr. Stolic to say: "The steel industry has expanded greatly, and with it the need for good men."

If you are interested in a challenging and rewarding career with United States Steel, and feel you are qualified, further information is available from your college placement director. Or, we will gladly send you our informative booklet, "Paths of Opportunity." Just write to United States Steel Corporation, Personnel Division, Room 1622, 525 William Penn Place, Pittsburgh 30, Pa.

SEE THE UNITED STATES STEEL HOUR. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

UNITED STATES STEEL

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6-02

If you're still on the fence—

FOR THE BENEFIT of the young engineer who is puzzling over his future—hasn't yet decided on a job—we'd like to mention some facts about General Motors.

GM gives young engineers a great chance to follow their natural bent—because GM makes a wide variety of products including cars, trucks, Diesel engines, Prop-Jet aircraft engines, road-building machines, home appliances, military equipment.

GM gives young engineers an opportunity to work with small, friendly groups of more experienced men, in a choice of locations. For GM is decentralized into 34 manufacturing divisions with 122 plants in 67 U. S. cities.

At GM, the young engineer finds prestige, security, the support of vast technical resources, including the research facilities of a multimillion-dollar Technical Center.

He is encouraged in his professional growth through training programs, publication of reports, material incentives, and assignment of additional responsibilities as rapidly as he is able to handle them.

Fact is, the way things are going now, 40% of GM executive posts will be filled by men with engineering backgrounds.

Think you can take the measure of a job with the world's largest and most successful industrial company—dedicated to producing "more and better things for more people"?

Then your very next step is a chat with your Placement Officer. Or else, write us directly—the sooner, the better.

GM Positions Now Available in These Fields:

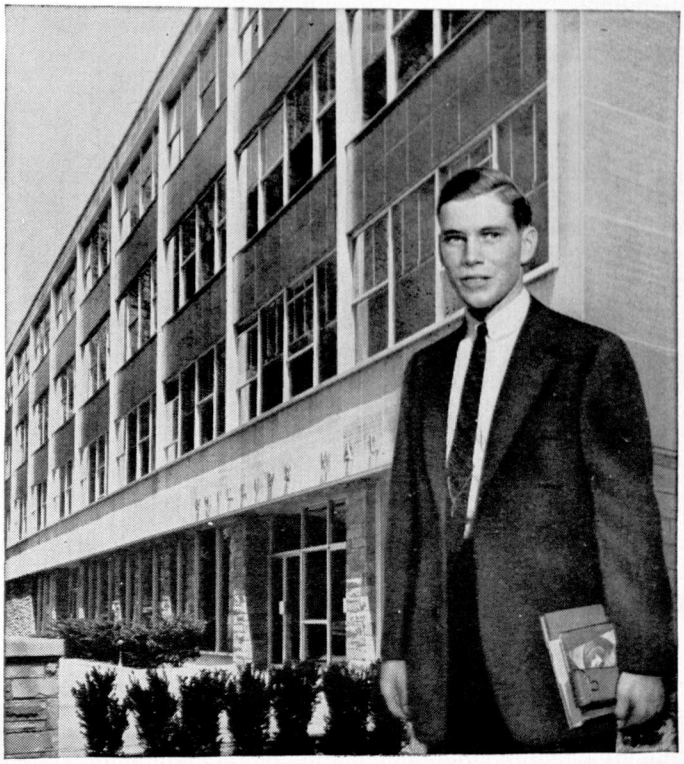
ELECTRICAL ENGINEERING
METALLURGICAL ENGINEERING
CHEMICAL ENGINEERING
AERONAUTICAL ENGINEERING
MECHANICAL ENGINEERING
INDUSTRIAL ENGINEERING

GENERAL MOTORS CORPORATION

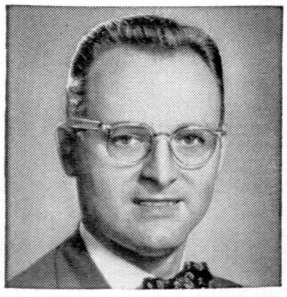
Personnel Staff, Detroit 2, Michigan

Herschel Loomis asks:

What are my chances for advancement in a large company like Du Pont?



Herschel H. Loomis, Jr., will receive his B.S. degree in electrical engineering from Cornell University June 1957. Herschel is a member of the freshman and varsity rifle teams, an associate member of Octagon, a dramatic group, and belongs to Theta Chi Fraternity. Like many other students, he's making employment plans early.



Peter J. Meshkoff joined Du Pont at the Jackson Laboratory in 1941, after obtaining a B.S.Ch.E. from the University of Detroit and an M.S. from the University of Michigan. He has had a wide range of Du Pont experience, from chemist in the Dye Works to chief supervisor and works engineer at several plants, with many opportunities to observe Du Pont personnel policies. Today Pete Meshkoff is works engineer at Du Pont's new Film Plant at Circleville, Ohio.

Peter Meshkoff answers:

Your question is a natural one, Herschel—one we hear quite often. Du Pont is unquestionably a large company in total number of employees and in all its operations. But, actually, Du Pont is made up of ten independent departments, almost as if it were ten companies under one management. And it is a fundamental policy at Du Pont to promote from within and on merit only.

That produces many opportunities for new men, but in addition there are proportionately more promotions at Du Pont each year—by reason of expansion and retirement—than you would find in most smaller companies. I say "proportionately more" because Du Pont has grown at an average rate of seven per cent a year for the past 153 years—a record that few companies can match.

And Du Pont is still growing rapidly. Take your field, electrical engineering. A host of novel and challenging problems have to be faced, both in new construction and in maintenance. There are plants to design with features that have never been applied before; there are new equipment-control problems to work out, and new engineering processes to pioneer. So, to answer your question in a word, Herschel, I'd say your chances of promotion on merit are extremely good at Du Pont!

WANT TO KNOW MORE *about the opportunities for growth touched on by Pete Meshkoff? Send for a free copy of "The Du Pont Company and the College Graduate," which discusses many of the employment policies and activities of DuPont in detail. Write to E. I. du Pont de Nemours & Co. (Inc.), 2521 Nemours Building, Wilmington 98, Delaware.*

DU PONT

REG. U. S. PAT. OFF.

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Spartan Engineer

of michigan state university

VOLUME 9 NUMBER 4 MAY 1956

ARTICLES

FEATURES

Cover:
THE PROPOSED NEW MECHANICAL ENGINEERING BUILDING:
for story see page 14.

MEMBER ENGINEERING COLLEGE MAGAZINES ASSOCIATED

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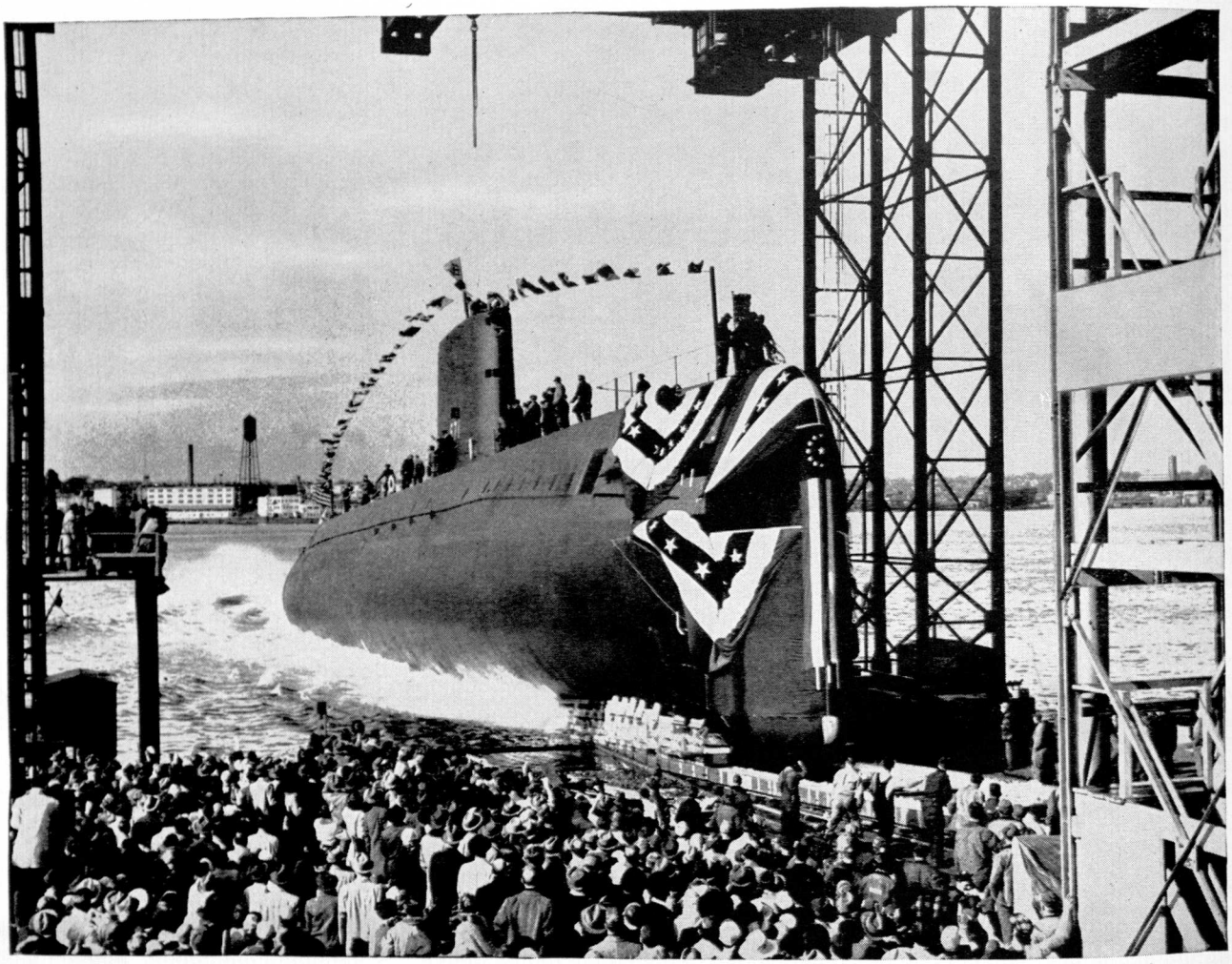

SLIDING DOWN THE WAYS at Groton, Conn., goes the USS Nautilus, newest and fastest member of our underseas fleet. During welding, Worthington heavy-duty turning rolls rotated the hull sections.

How the world's first atomic sub was welded

Welding the hull of the USS Nautilus, world's first atomic submarine, presented a tough problem.

Submerged-arc automatic welding seemed to be ideal for the job. Question was—could you rotate the hull sections of the Nautilus to take advantage of this fast, high-quality welding method?

Worthington's answer to General Dynamics Corporation's Electric Boat Division, builder of the Nautilus, was the largest turning roll ever built.

The result? Welding of the Nautilus hull was accomplished in record-breaking time — and cost less than originally estimated. Unchanged, the Worthington roll set-up is also being used in the construction of the nation's second atomic sub, the USS Sea Wolf.

Turning rolls for submarines aren't all that Worthington makes. The long list of Worthington-designed, Worthington-built equipment includes air conditioning units, construction machinery, compressors, Diesel engines, steam power equipment and, of course, pumps of all kinds. For the complete story of how you can fit into the Worthington picture, write F. F. Thompson, Manager, Personnel and Training, Worthington Corporation, Harrison, New Jersey. You may be glad you did.

4.25 B

See the Worthington representative when he visits your campus

See the Worthington Corporation exhibit in New York City. A lively, informative display of product developments for industry, business and the home. Park Avenue and 40th Street.

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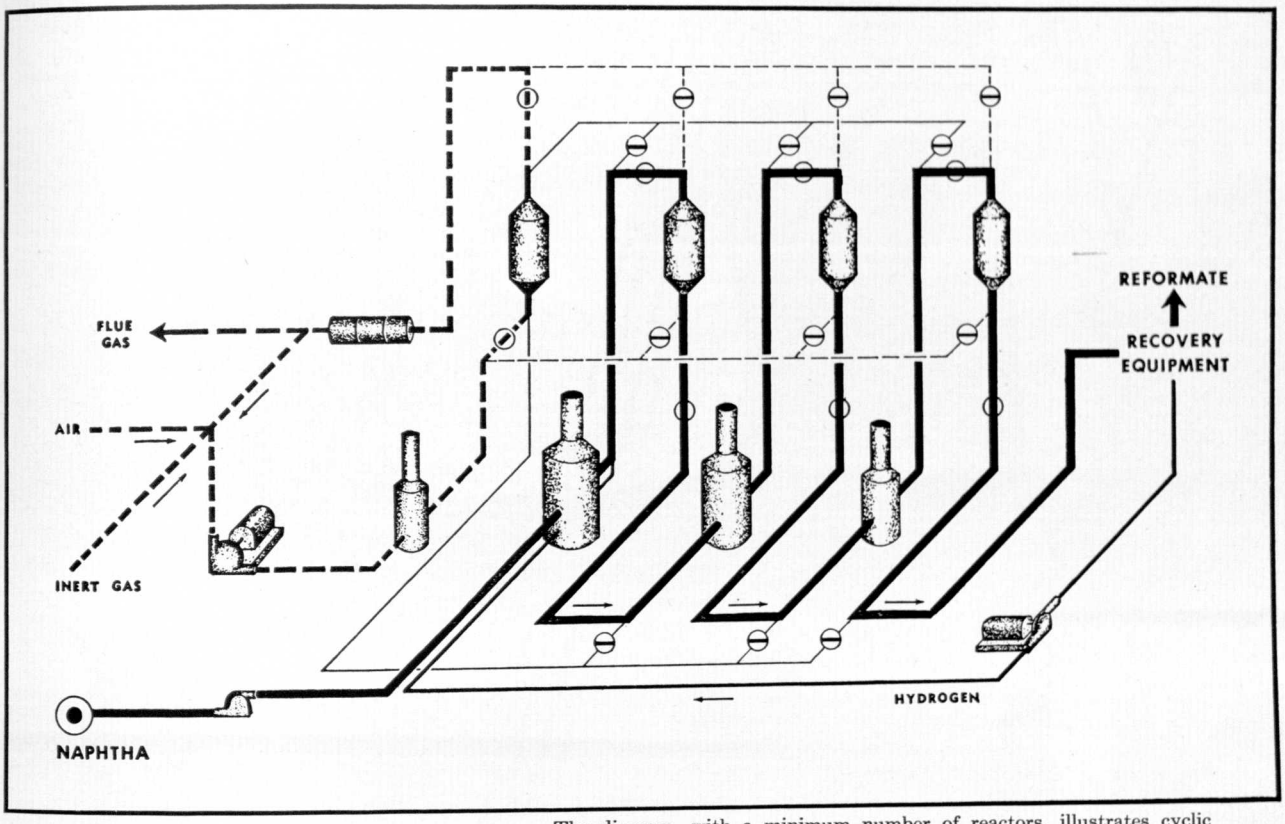


The diagram, with a minimum number of reactors, illustrates cyclic regeneration. Piping arrangement permits the swing reactor to substitute for any other reactor in the system. High activity of catalyst is maintained —without interrupting production—in the ULTRAFORMING process.

HOW TO KEEP $1,000,000 WORTH OF CATALYST ON THE JOB

When you have a million dollars' worth of platinum catalyst in a single refinery unit, you hope you can keep it steadily on the job. That's too much money to be standing around idle. Also, you'd like to keep the catalyst working at high efficiency.

Most catalysts lose activity with use. The platinum that "reforms" 40-octane gasoline to 100-octane gasoline is no exception. And the higher the octane number, the faster the catalyst loses activity.

For years activity could be restored only by taking the catalyst out of the unit and sending it away for special treatment. To keep from having too many of these shutdowns, refiners had to operate at relatively low octane numbers.

Standard Oil research scientists came up with a better answer. They developed a new type of platinum catalyst, and they learned how to regenerate it repeatedly—while it is still in the unit. When a swing reactor is provided, the unit need not even be shut down. The new process is called ULTRAFORMING.

During a year of ULTRAFORMING at Texas City, one reactor was regenerated 53 times. The unit is still producing 100-octane gasoline.

ULTRAFORMING also gives high yields of by-product hydrogen. The hydrogen can be used in upgrading other oil products. Or, it can be reacted with nitrogen from the air to make ammonia.

ULTRAFORMING is only one of the many major achievements credited to the scientists who have made careers at Standard Oil.

Standard Oil Company

910 South Michigan Avenue, Chicago 80, Illinois

STANDARD

Editorial

The Important Factors

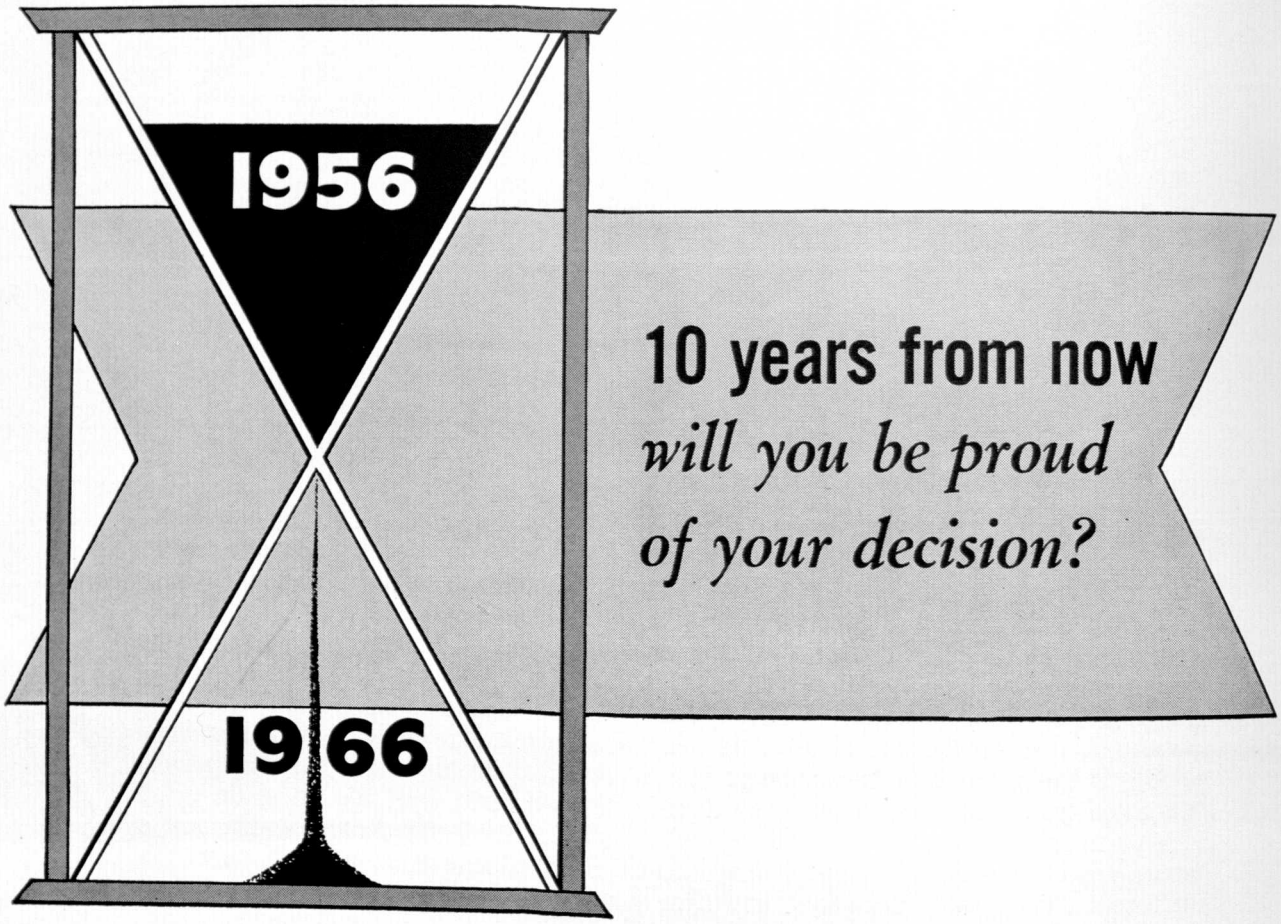
We pity a man without a home. We sympathize with the man without a country. But a man without a goal in life is in no better a position. Every man must set his aims in life and strive to achieve his goals. Every human has different wants and aspirations. He must define these wants and aspirations in terms of aims and goals in life. Once he has decided upon them he must never lose sight of them. It will light the path along the way if he also establishes intermediate goals. As each one is achieved, the next looms as the immediate challenge. All are directing him toward his final goal. If the man was pessimistic in his original evaluation and achieves his final goal, then he must re-evaluate himself and set up another goal. There must always be a goal in sight but out of immediate reach; for a man who considers his life complete upon attainment of a goal, soon deteriorates and will loose ground that has already been won.

Enthusiasm and determination serve as propellants along this road to success. Enthusiasm turns work into play. This provides for a tremendous increase in the man's capacity to do constructive work. The speed with which he moves toward his goals is a direct function of enthusiasm. As with most roads, however, there are rough spots. They will impair progress and may even possess the potential to stop forward movement. It will be here that determination will save the cause. Like a steamroller that crushes all that may oppose, it will ride you through to the open road ahead. We have all experienced these low ebbs that curtail ambition. It may take only a good night's rest to prepare you to attack the problem with renewed enthusiasm and determination the next day. Conquering the rough spots will add that much more value to the success you do eventually attain. Success is contagious. Once it is tasted, if only in the form of satisfactory completion of a college course or assignment, the next problem will be attacked with even more vigor.

Confidence is also contagious and needed. Confidence builds itself with progress. With each major step it is needed to a higher degree. For a stable situation it must be compatible with the immediate status. The fake arrogant confidence is not a substitute. A confidence based on experience and success must be compiled with time. It will then make the acceptance of increased responsibility possible.

We cannot buy these essentials to success. They must all stem from ourselves. Rational thought will provide for setting up our goals. Enthusiasm and determination can be learned with concentration. Confidence can be built upon faith in oneself. Men who will accept nothing but success will be granted—success.

H.N.



The right decision now, at the launching of your career, can do much to influence your success.

Pittsburgh Plate Glass Company has a host of fine young men who are holding responsible positions in the PPG organization. Ten years ago, many of them were faced with the same decision that now faces you: "Which company shall I select?"

They chose PPG because it offers unlimited opportunity. PPG has never stopped expanding or growing in its 73 years of existence. Its markets are constantly increasing. PPG's management is progressive. It seeks men who can grow with the company . . . men who can take over responsibilities. In PPG, it isn't necessary to wait for a man's retirement or death before you move up in the ranks. Opportunities are opening up all the time in all of its important divisions: Paint, Glass, Chemicals, Brushes, Fiber Glass.

This is your year of decision. We invite you to look into Pittsburgh Plate Glass Company. To help you become better acquainted with PPG, we suggest you get a copy right away of the booklet entitled, "Toward New Horizons with Pittsburgh Plate." Ask your placement officer for a copy or write directly to the Pittsburgh Plate Glass Company, General Personnel Director, One Gateway Center, Pittsburgh 22, Pennsylvania.

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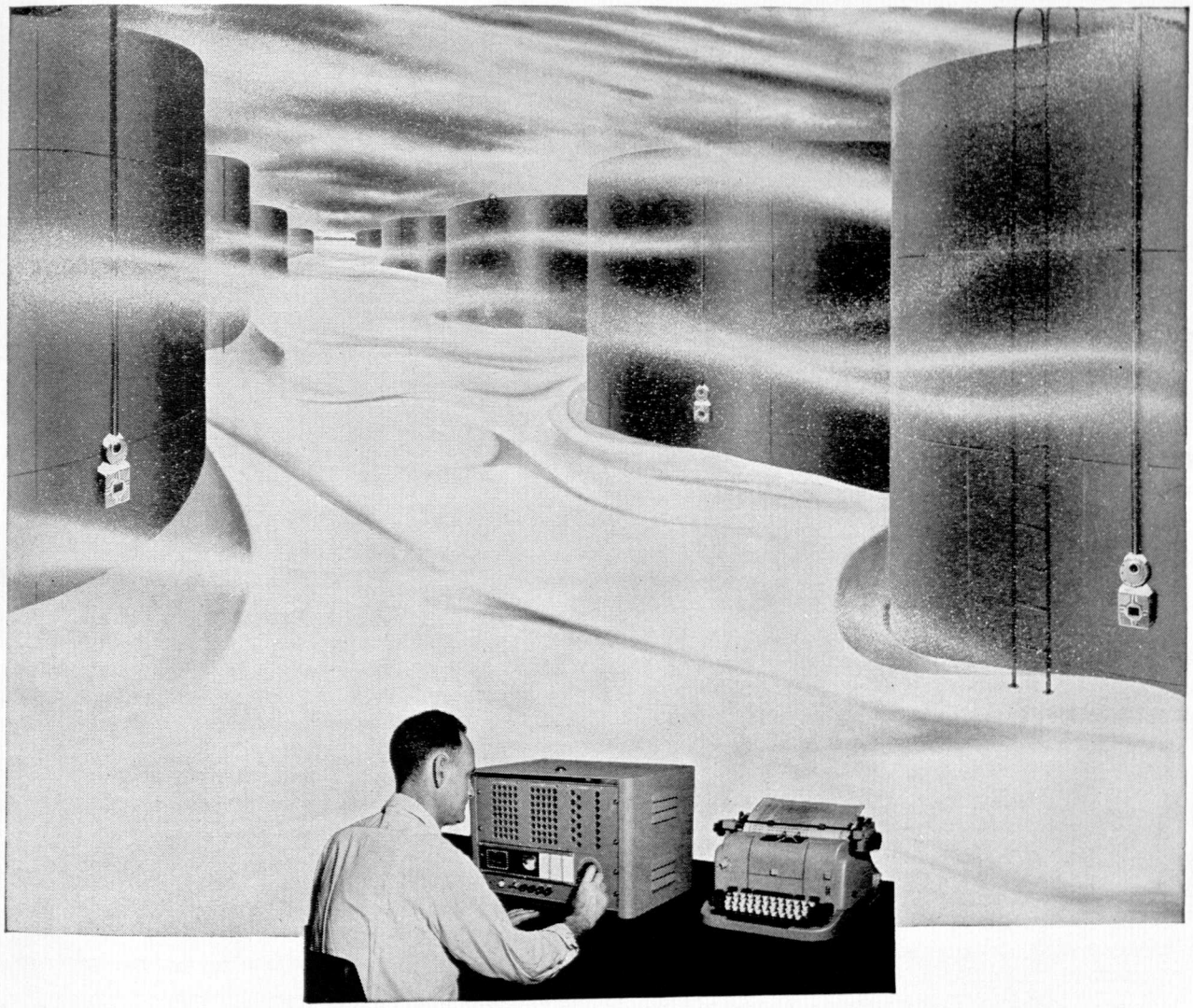

Bendix ELECTRO-SPAN provides telemeter control of industrial operations from hundreds of miles away

Important storage reservoirs for water, crude oil, gas, brine and other liquids are located in many remote and isolated sections of this country. In the past it has required crews of men stationed at these points to keep a constant check on volumes and to open and close valves to balance supply and demand. The work is lonely, expensive to maintain, and sometimes dangerous.

Now Bendix ELECTRO-SPAN, made by Pacific Division of Bendix Aviation Corporation in North Hollywood, California, can take over the entire job. It's a completely automatic, remote measuring and control system that takes measurements in oil storage tanks, controls flow in water systems, completely operates unattended power and weather observation stations—all from a central location. Liquid level, flow, temperature, electrical quantities, pressure or shaft position are types of information which ELECTRO-SPAN delivers immediately.

The system also acts in reverse, enabling the operator to control pumps, valves, motors and circuit breakers at remote locations. It can be used over any communication link such as telephone or telegraph lines, radio or microwave.

ELECTRO-SPAN is just another of the million Bendix ideas to be converted into a vital product for American industry. It is because of exciting, new products like this that talented engineers find a job with Bendix a challenging and stimulating experience. Then, too, they know that Bendix combines the opportunities of a large corporation with the advantages of small, autonomous divisions where skill and ingenuity are never overlooked. No matter what part of the country you prefer, Bendix deserves your attention when you plan your engineering future. See your placement director or send for the brochure "Bendix and Your Future".

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Engineering Leads Expansion at MSU . . . .

PLANNING FOR THE FUTURE

Information Obtained from
The Office of the Dean of Engineering

At the present time the United States has about 21 engineers per 1000 of productive industrial workers. Past experience and indicated trends show that by 1970, just 15 years hence, this number will increase to 40 engineers per 1000 industrial workers. However, at the same time, while the number of industrial workers increases by only about seven per cent, the value of goods produced will increase by 50 per cent. Thus we are going to increase our industrial output 50 per cent with almost no change in the number of industrial workers. This is going to require an increased effort on the part of the engineer to improve production machinery and methods and this is reflected in the fact that in the same 15 years we will have to nearly double the number of engineers in this country.

At the present time it is estimated that we have around 400,000 graduate engineers and the above reasoning indicated that this number must increase to 800,000 by 1970. Using these figures indicates that we need an increase of 27,000 a year to build up to this total number of engineers. In addition, we must supply replacements for retirements, deaths, and other factors that remove engineers from the profession and these will be not less than 12,000 a year; so that to build up towards an engineering profession of 800,000 in 1970 requires that we should currently be producing 39,000 to 40,000 engineers per year. To meet this requirement, the engineering schools in 1954-55 graduated 23,500 and in 1955-56 will graduate about 27,500. In fact, it will be the year 1970 before our graduation even approaches the demand.

The MSU Building Plan

The publicity given to the shortage of engineers and to the fact that Russia is rapidly outstripping us in efforts to build up a scientific and engineering professional staff is now succeeding in attracting additional students into the engineering colleges. In addition to the publicity which attracts students, we also can look forward to the effects of the rapidly increased birth rate which began in 1940 and which will result in increased numbers of students reaching our campuses in 1957 and 1958.

Already, Michigan State University has seen the engineering enrollment increase from about 1800 in 1953-54 to 2200 in 1955-56, and estimates based largely on the birth rate since 1940 indicates that we should have 2,700 students by 1960, 3200 by 1965, and 4000 by 1970. Still, while other engineering colleges are following the same pattern, we will not be able to meet the demands of our growing science-based civilization.

Because the available land area surrounding the present engineering buildings, the major one of which was built in 1916, is not sufficient to provide buildings with floor space for a student body of this size, President Hannah has recommended that the College of Engineering move south of the river into an area of ground of approximately 20 acres, bounded by Shaw Lane, the west side of the Animal Industries Building, the Grand Trunk Railroad tracks, and the railroad siding supplying the Power Plant. This will be directly across Shaw Lane from the College of Business and Public Service, the Basic College, and the Education Buildings now planned for. The College of Engineering has asked for initial development of this site with buildings having a total area of 650,000 square feet, which could care for a student body of 4,000 students, plus the research activities which must be made part of an expanded graduate student program at that time. Architects have prepared a plan for ultimate development of the site including roadways, ample faculty and visitor parking spaces, and freedom from crowding of the buildings. Currently in the request to the legislature is an appropriation for starting the first unit which will house the Departments of Mechanical Engineering and Applied Mechanics, as well as the Dean's offices. These areas are indicated in the dark shading on the site plan, and the larger of the two parts of the unit is illustrated by the building elevation prepared by the architects. These buildings will require a total expenditure of $4 million and will provide housing of about 175,000 square feet for the two departments now most seriously limited by space and increasing enrollment. It may also be noted that Mechanical Engineering and the Department of Applied Mechanics, which deals with engineering materials, are departments of great concern to the automotive industry in the State of Michigan.

The second unit of the ultimate development will be a building approximately 100,000 square feet for the Civil Engineering Department and the Engineering Drawing Departments, and will also contain a separately financed wing to house the research laboratory of the State Highway Department now occupying space in the basement of Olds Hall. The last two buildings to be added to the development of the site under the present plan will house the Electrical Engineering Department and research activities of the Engineering College with approximately 150,000 square feet, and another unit to house the Chemical and Metallurgical Engineering Departments with about 100,000 square feet. The total cost of the de-

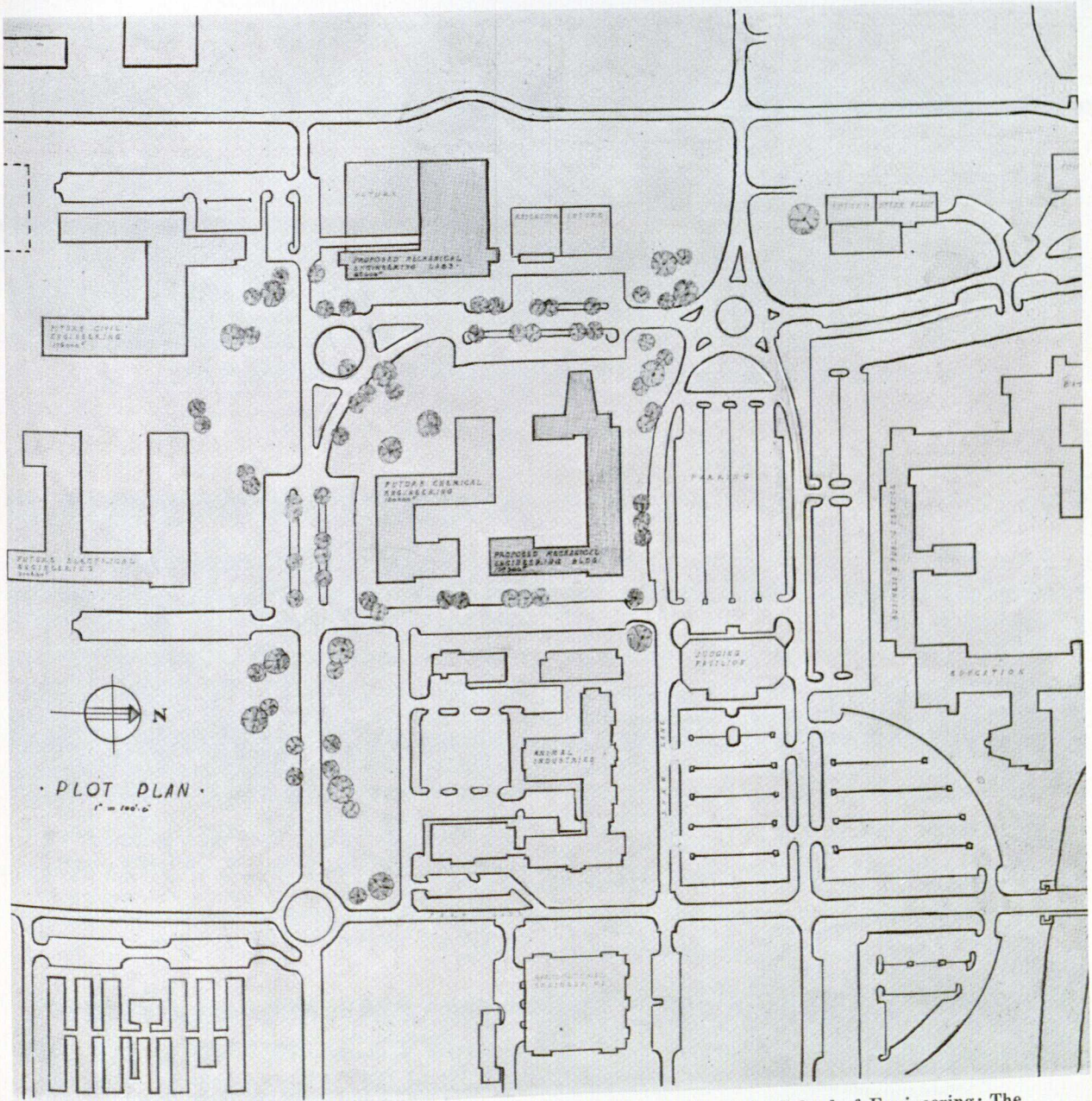
velopment to this point has been estimated at $13 million and this space when completed will give Michigan State University a thoroughly up-to-date engineering college well suited to training engineers for the future.

All of the above items are included in the so-called five year plan for construction proposed by the Board of Agriculture in August, 1955.

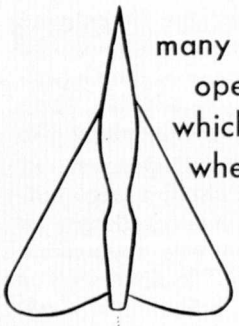
The plans for the first unit to house Applied Mechanics and Mechanical Engineering call for a strictly functional building of brick and glass of a style generally similar to that of the new library, and to include three floors without basement. The central portion of the building will house small laboratories and classrooms and offices; one large wing will house the laboratories and classrooms for the Department of Applied Mechanics. A smaller wing will house the offices of the Dean of Engineering and of the Department of Mechanical Engineering. In addition, there will be a separate small auditorium seating about 300.

Within the laboratories of the Department of Applied Mechanics, they hope to install a large testing machine of very novel and modern design on which can be tested specimens of new engineering designs and to which can be applied loading, such as due to the impact of a truck on a bridge or of a collision upon an automobile frame. No such machine as contemplated is yet available anywhere in the world.

(Continued on page 37)

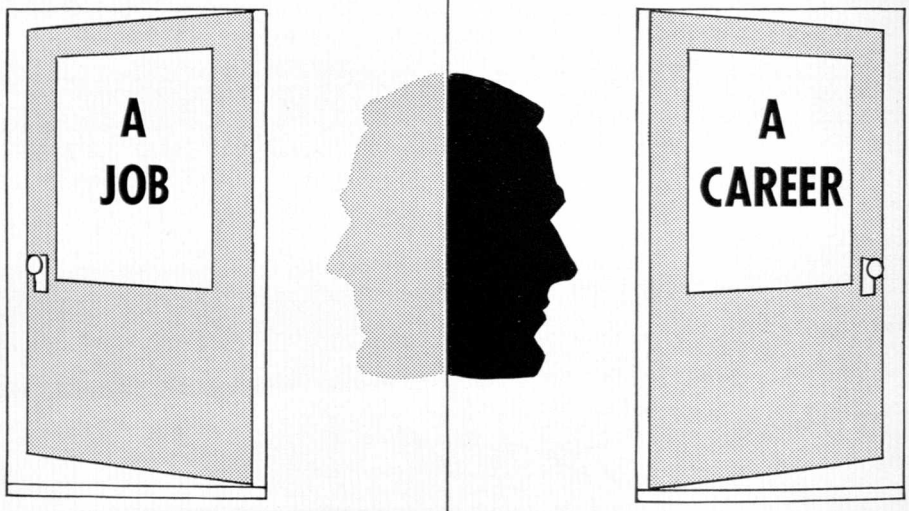


Shown here is an architect's ground plan for the proposed expansion of the School of Engineering: The plans include a building for the School of Business and Public Service, Education and Basic College. It will occupy the area known as South Campus. The Engineering Buildings will be located South of the parking lot next to the Judging Pavilion. Farm Lane and the railroad tracks form the East and West boundaries respectively.



many doors will be
opened to you...
which will you enter
when you become an

engineer



OPPORTUNITY KNOCKS for engineering careers at this magnificent new jet aircraft equipment plant

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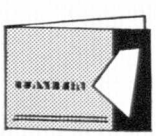
GRADUATE PROGRAM . . . while at Hamilton Standard you will be encouraged to take advantage of the company's liberal tuition assistance plan and to pursue postgraduate studies at nearby Hartford Graduate Center of Rensselaer Polytechnic Institute.

HAMILTON STANDARD



Send for "YOU AND YOUR FUTURE"

. . . a colorful brochure picturing and describing all of the activities and opportunities at H-S . . . plus information on the graduate engineering program. Write Mr. T. K. Bye, (key no.) Bradley Field Road, Windsor Locks, Connecticut.

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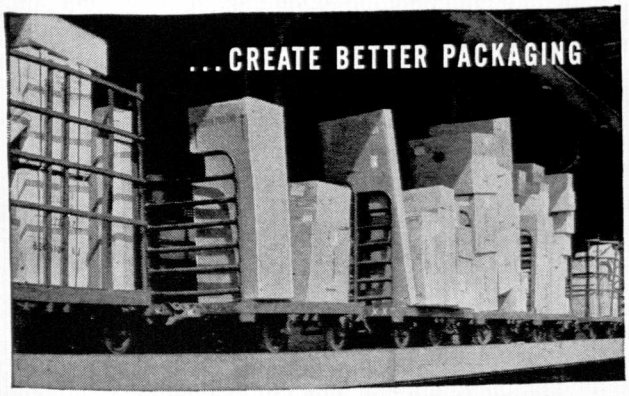
CONSISTENCY, FIRMNESS AND STABILITY; important characteristics not only for toothpaste but for many pharmaceuticals, cosmetics, and other preparations, can be obtained with purified Hercules® cellulose gum. An unusually effective water-binder, Hercules cellulose gum has exceptionally high purity (99.5+%) and meets the specifications of the Toilet Goods Association.



FROM SHIPPING CONTAINERS to individual packages, Hercules paper making chemicals play an important role in improving performance. Kymene® wet-strength resin, for example, can "weather-proof" corrugated boxes while Aquapel® or one of Hercules' many grades of rosin size provide water resistance and an improved printing surface. Solving difficult paper sizing problems has been a Hercules specialty for more than forty years.

PLASTIC-COATED DUPLEX WIRE is used in this type of electric blasting cap assembly. The insulation has to be particularly tough since the wire assembly is used to lower charges of explosives into blast holes 100 feet or more in depth. The plastic coating on these wires is Hercules Hercocel® E, providing excellent insulating properties, good flexibility, and other physical characteristics to meet rugged field requirements.

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YOUR PLACEMENT BUREAU

By Jack Breslin

JACK BRESLIN
Placement Bureau Director

Before this school year is over, approximately 8500 private student interviews will have been conducted at the Placement Bureau by approximately 900 different companies. This basically will be the story of Placement for the school year of 1955-56. However, closer examination will show that for the first six months of this school year, 8 out of each 10 companies coming to Michigan State University for interviews requested to talk with engineers. It is anticipated this demand for engineers will continue and even increase over the next 4-5 years.

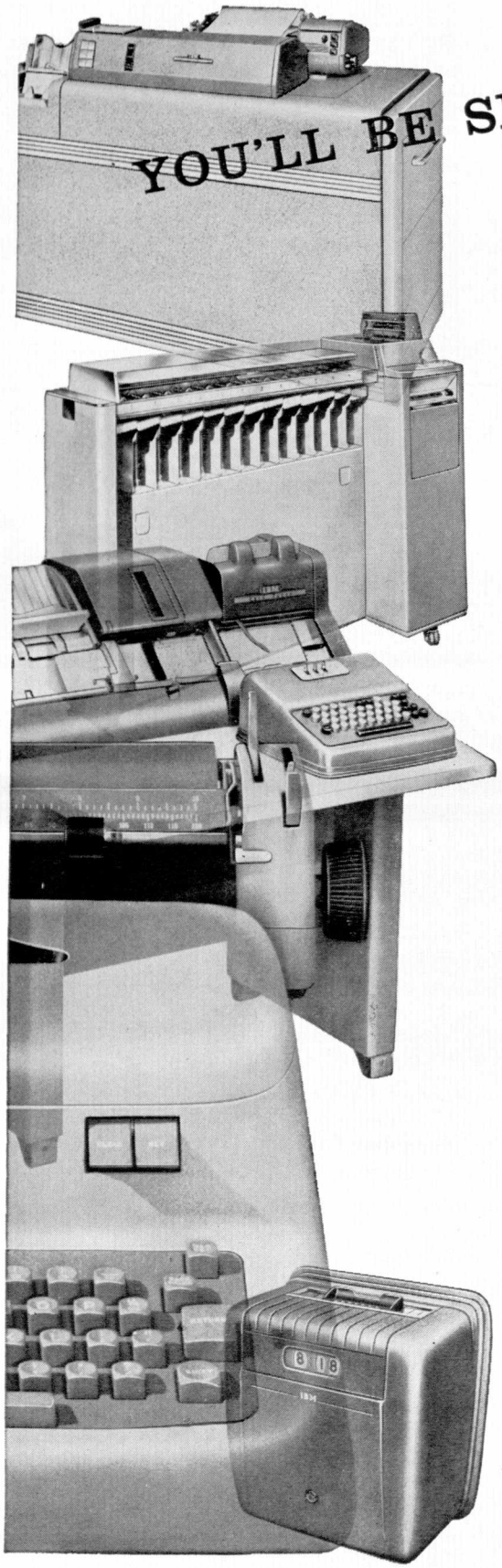
Because this may be the last time I will have the opportunity to discuss placement with many of our senior engineers, I would like to discuss briefly our alumni placement service which is available for your use at any time. Approximately three years ago the Michigan State University Placement Bureau reorganized its alumni placement operation. This Bureau made a concerted effort to advise all former alumni who were seeking new or better situations to register with us so we could in turn help them find a better job. At the same time, Business and Industry was advised of this anticipated large pool of trained manpower (both technical and non-technical) and they were instructed to list jobs with the Placement Bureau that could be filled by experienced personnel. The results have been amazing. Where industry used to find it necessary to go to management consulting firms for experienced manpower, they now also list these outstanding positions with our Alumni Division. Also, hundreds of our alumni who normally would have been happy to pay a fee for new and better placement have used our services free with outstanding results. I sincerely hope that each senior graduating this June or August will be most happy in the job he accepts and that promotions and all other things follow in good order. In other words, I hope you all are so successful in your placement that you will never need the service of our Alumni Placement Division: However, we are here to serve you if you ever desire our help. To you seniors who are slated for almost immediate induction into the Armed Forces and have not consummated your placement, you should register with our Alumni Division approximately 90 days prior to your service separation if you wish our services.

Now something about the over-all services of your Placement Bureau. Michigan State University is rather unique because of its completely centralized operation. This is the most efficient kind of placement for the following reasons:

1. The employer has to contact only one University official in establishing the interviewing date. He states his interview requirements to only one office, eliminating the possibility of errors in his visit.
2. Convenience for the interviewer while on campus. All interviews are conducted at one spot, thus eliminating the necessity of going from department to department.
3. Convenience for students because all their records are at one location as well as all interviews are taken at the same location.
4. Publicity of coming company interviews is uniform and regular.
5. Because of the large volume of credentials used in a centralized placement operation, it is possible for the Placement Bureau to purchase duplicating equipment which eliminates the necessity of the student giving the Placement Bureau more than one copy of his credentials. This is a real saving to the student both in time and expense.
6. Deans and Department Heads as well as all

(Continued on page 49)

(A message from **IBM**—*where progress is engineered)*



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In your work, IBM equipment can solve, in minutes, engineering problems that once demanded long weeks, months, and even years!

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Better shelter and lower-cost fuels can come your way aided by the many IBM data processing and accounting machines in mining, steel fabricating, and utility companies.

In health matters, too—in medical research, government health statistics and hospital administration —IBM methods make important contributions.

You'll travel better because IBM equipment is speeding improvements in all forms of transportation.

You'll get better buys, better service with the widespread and growing use of IBM techniques in manufacturing, distribution, retailing.

National defense, law and order, voting registration, paycheck preparation—even weather prediction—are other areas in which IBM techniques get things done better, faster. You'll be seeing a lot of IBM—working, living . . . wherever facts and figures help you prosper.

IBM's world leadership in data processing has been achieved largely through creative engineering. At IBM's modern laboratories, creative freedom in a professional atmosphere stimulates young engineers to make important and rewarding contributions. If you would like further information about engineering at IBM, talk with your college placement director, or just drop a line to William Hoyt, IBM, 590 Madison Ave., New York 22, N. Y.

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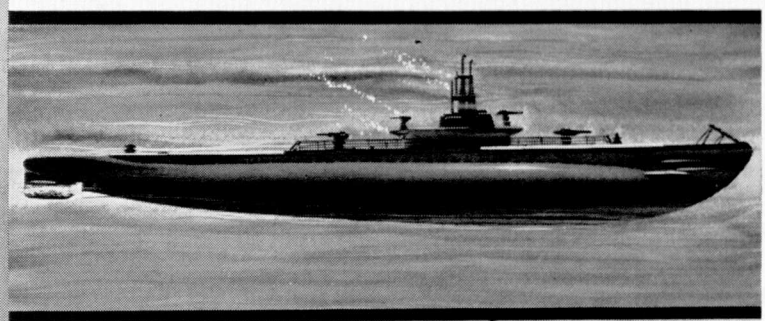

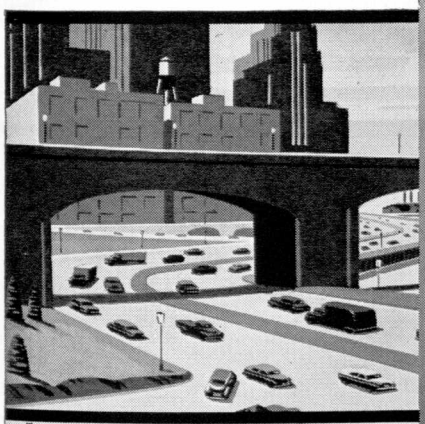

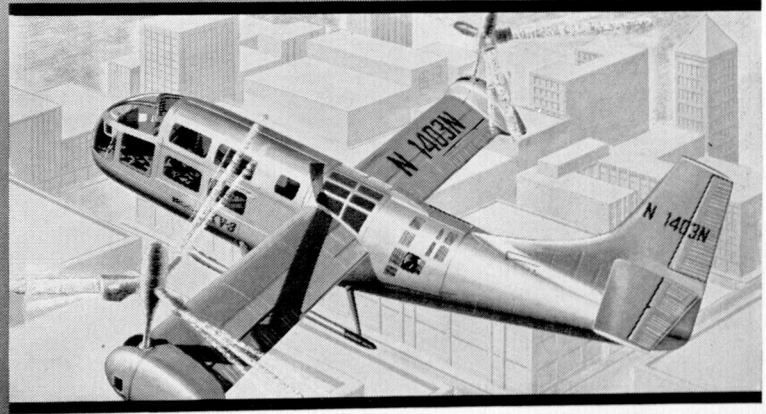

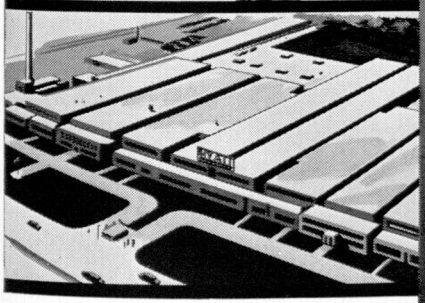

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You'll have an opportunity to concentrate in special fields, for Harrison blankets the market in the manufacture of heat control equipment: car air conditioning, heaters, radiators, thermostats—heat exchangers for ultra-modern aircraft, marine, diesel and industrial equipment. For further information, contact your placement office or write Salaried Personnel,

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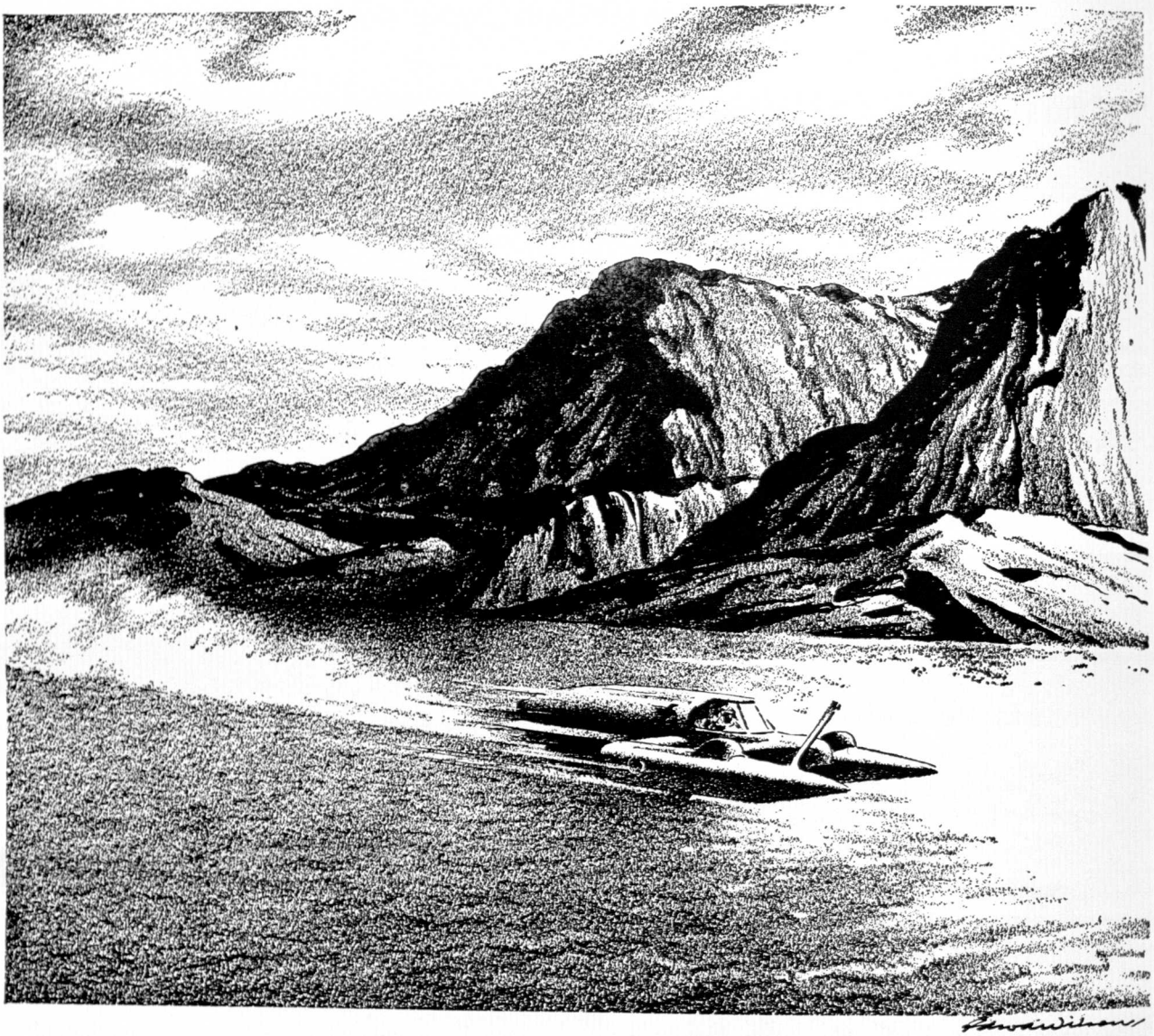

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Danger Lurks :

Over Population

By Harlow Nelson, M.E., '56

Every second there are two more people in the world; one hundred thousand additions every twenty-four hours. Each year there are thirty-six and one-half million more people crowded into this jam packed world. A demographic study forecast a total population of over 6 billion from our present 2.8 billion in just 32 years, with the underdeveloped areas slated to increase the fastest. Asia is expected to gain a billion within thirty years. In the same span, Latin America will double.

In the next few decades, the problem of overpopulation will become the most serious threat known to mankind. Demographers predict the explosion point will be reached around 1987—just 30 years from now. That is, at this point, there will be insufficient food for the people of the world, even if the existing supply were to be equally distributed. Of course, there will be some who will have plenty, but vast numbers will starve. Although the United States and Russia reported bumper crops last year, the pinch is being felt by many already. A year of drought or pestilence now kills millions by famine in India and China.

In man's beginning, population grew annually by .02%-.04%. At .02%, it would take 100,000 years to build up to the present population. Since 650,000 years have passed, there were obviously many centuries marked by a decrease in population.

In the early Christian era, the rate was estimated to be around .1%. The 19th century was marked by a .3% increase. With the industrialization and improved living standard, the rate jumped to its present 1%.

The world can be divided into three groups: North America, Western Europe, Australia and New Zealand, in which 500 million people reside and with half the world's income, occupy the most enviable position. The increase in these countries is approximately 1.1%. Russia, East and South Europe, Japan and Argentina, with 500 million people typify the second group. The present increase in this group is 1.5%. The have-not nations of Africa, Asia and Latin America, with 1.5 billion mouths to feed, labor under an increase rate of 3%. The diseases, hardships and distress of early years no longer will keep the population within bounds. With one-half of the world already overcrowded, overpopulation looms as a serious problem for the future.

The problem is not too distant from us here in the United States. Government statiticians tell us we will number 190 million in 25 years. That raises a question of whether we will have enough food, water, fuel and other resources to supply our own people. Not only will there be 30 million more stomachs, but the populace will want more elaborate goods. At present, the average American uses 18 tons of our natural resources annually. Predictions have estimated us to be short 70 million acres of farm land in 1975.

It is a fallacy to believe each country is involved in only the problem at home. The interrelationships among countries is complex and they are all an integral part of our problem. We need surplus produce abroad to carry on our trade. We could not ignore it when Germany overflowed and Hitler demanded "living space." During Italy's expansion in Africa, Mussolini preached a country with "empty cradles" must yield to the dynamic populations. Japan's plan for a "new order in East Asia" was conceived to alleviate their overcrowded land. With two-thirds of the world starving and one-half of it overcrowded, pressures are bound to build up and must be remedied by other means than expansion. Our Latin American friends are promising the fastest growth rate in the world. Mexico can support 50 million people. The present 25 million will soon reach that mark with their increase of 3.4% annually. It is only natural that these people will look to the land of abundance to the north with envy. Illegal immigration is already a major problem in the southwest United States. The far reaching effect of this one specific problem can be felt here in Michigan. The Michigan Farm Labor Office could elaborate on many specific incidents that arise during the influx of migrant farm hands from the southwest for the several Michigan harvests.

This problem deserves immediate attention, and some strides have been taken towards a solution. Aris-

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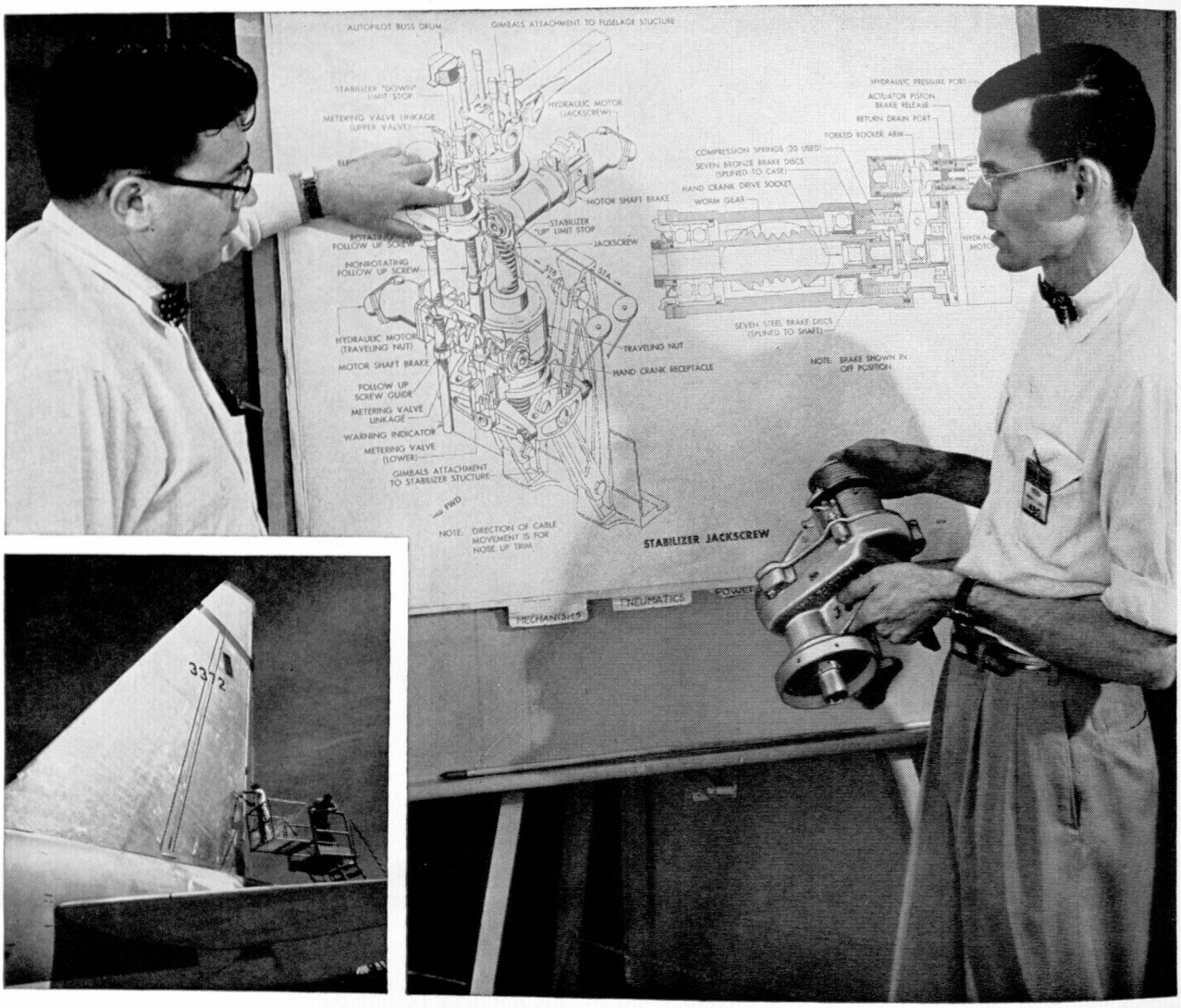

B-52 jack screw—a typical Boeing design challenge

On Boeing B-52 bombers, the horizontal tail surface has more area than the wing of a standard twin-engine airliner. Yet it can be moved in flight, up or down, to trim the aircraft.

The device that performs this function is a jack screw, which, though it weighs only 255 pounds, can exert a force of approximately 225 *tons!*

Many kinds of engineering skills went into designing and developing a jack screw so precise that it automatically compensates for stretch and compression under load. Civil, electrical, mechanical and aeronautical engineers, and mathematicians and physicists — all find challenging work on Boeing design projects for the B-52 global jet bomber, and for the 707 jet tanker-transport, the BOMARC IM-99 pilotless interceptor, and aircraft of the future.

Because of Boeing's steady expansion, there is continuing need for additional engineers. There are more than twice as many engineers with the company now as at the peak of World War II. Because Boeing is an "engineers' company," and promotes from within, these men find unusual opportunities for advancement.

Design engineers at Boeing work with other topnotch engineers in close-knit project teams. They obtain broad experience with outstanding men in many fields, and have full scope for creative expression, professional growth and individual recognition. And they find satisfaction in the high engineering integrity that is a Boeing byword.

In addition to design engineering, there are openings on other Boeing teams in research and production. Engineers like the life in the "just-right" size communities of Seattle and Wichita. They may pursue advanced studies with company assistance in tuition and participate in a most liberal retirement plan. There may be a place for *you* at Boeing-Seattle or Boeing-Wichita.

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

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

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NEW DEVELOPMENTS

Edited by JOHN BOYD

U. S. Satellites

The U. S. Navy and the Martin Company today released photographs of an artist's conception of the Vanguard three-stage rocket vehicle being designed and built to place the world's first man-made satellite in its orbit. Also released is a drawing depicting the trajectory (flight path) of the vehicle from its launching point to its orbit established some 300 miles above the earth.

In physical appearance, the satellite launching vehicle will resemble a giant rifle shell complete with bullet. It will be the first liquid fuel rocket designed to be controlled without the use of fins, a scientific break-through by engineers.

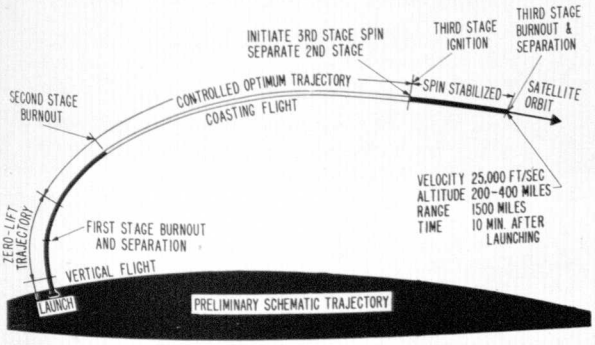
The first-stage rocket, approximately 45 feet in length, resembles the Navy Viking research rocket which attained an altitude of 158.4 miles, a world's record for a single stage rocket.

The second stage rocket, mounted above the first stage, has a cone shaped nose section. It also uses liquid propellants. The third stage rocket, with the satellite attached to its nose, will be carried completely enclosed within the second stage rocket. The third stage uses a solid propellant because of its simplicity.

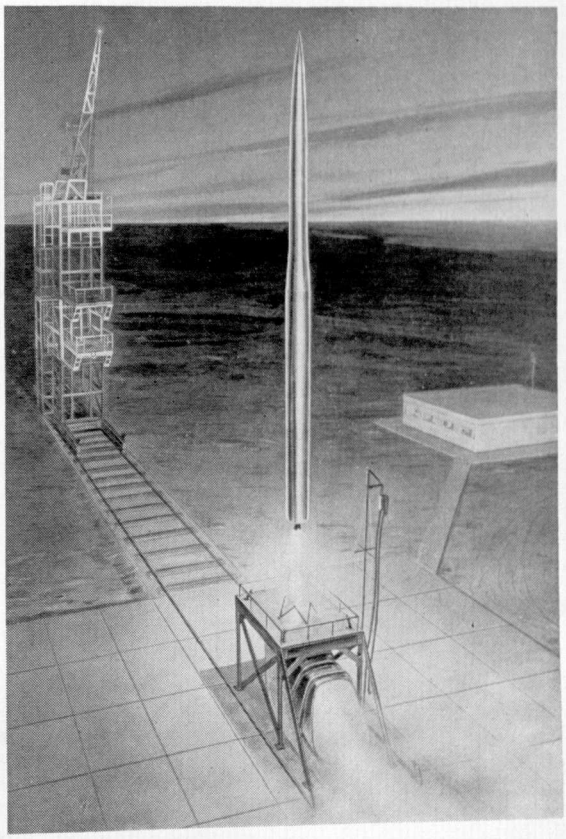
The first stage, which launches the entire assembly, will burn out its fuel at an altitude of between 30 and 40 miles. Then it will separate and drop off.

The second stage will start firing, and at a certain time during the second stage burning will jettison its nose streamlining, leaving the third stage and the satellite exposed.

The second stage rocket will tilt in the direction of the satellite's predetermined flight path. After its burnout, the second stage will continue to coast upward until it attains the satellite's intended orbital altitude.



A drawing of the trajectory (flight path) of the Navy Vanguard research vehicle, depicting burnout positions of the three stages of the vehicle in its flight to place a satellite in its orbital altitude of between 200 and 400 miles above the earth. This is part of U. S. participation in the International Geophysical Year, 1957-1958. It is a triservice project under Navy management.



Artist's conception of the Navy Vanguard research vehicle which will place the world's first man-mande satellite in its orbit around the earth. The vehicle will be launched from Air Force Missle Test Center, Cocoa, Florida. In background is the gantry used to place the vehicle on its launching stand; and the concrete blockhouse from which scientists will fire the rocket and record its course.

There a spinning movement will be imparted to the third stage rocket to insure directional stability. By that time, the third stage will be set on its course; the second stage will drop off; and the third stage will start firing.

The third stage rocket carrying the sphere has no guidance system, no electronic brain to direct its flight. Its job is to boost the satellite's speed to approximately 18,000 miles per hour. This high speed, necessary to counteract the earth's gravitational pull, will be attained at the rocket's burnout.

At burnout, the satelite may be nudged ahead by means of a releasing device in the nose of the rocket. Therefore, its speed will be slightly greater than that of the rocket shell, which will not drop to the earth, but will trail the satelite until atmospheric drag causes both gradually to slow down and spiral toward a lower atmosphere.

Through friction induced by passing into this denser atmosphere, both satellite and rocket will burn briefly and disintegrate after the manner of meteors.

(Continued on next page)

NEW DEVELOPMENTS

Rubber Hose Outwears Steel

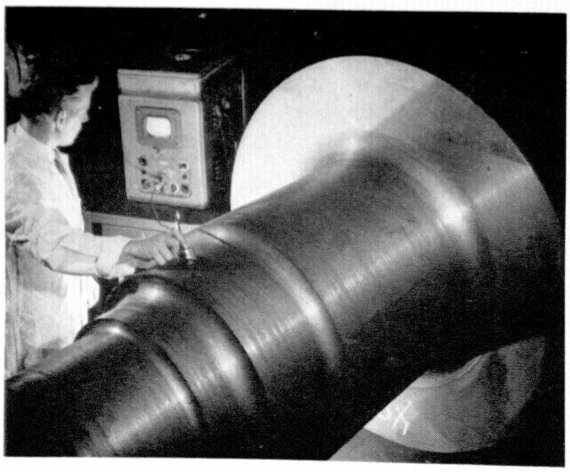
A new rubber hose, fortified with a "stomach" made of the toughest abrasion-resisting rubber known, swallows 10-pound chunks of iron ore and coal without wincing.

Heavy chunks, up to eight inches in length, are borne along inside the hose, carried in a stream of water at pressures as high as 250 pounds per square inch. The tough new hose conveys its load from mine to processing plant and through the various processing operations.

Designed primarily for use in the mining industry, the new hose will find general use in industry to convey metal shavings and chips, sand and gravel, ground or powdered chemicals and a variety of other sharp and abrasive materials. The hose, known as Convertapipe, moves such loads with about the same ease as other hose handle liquids.

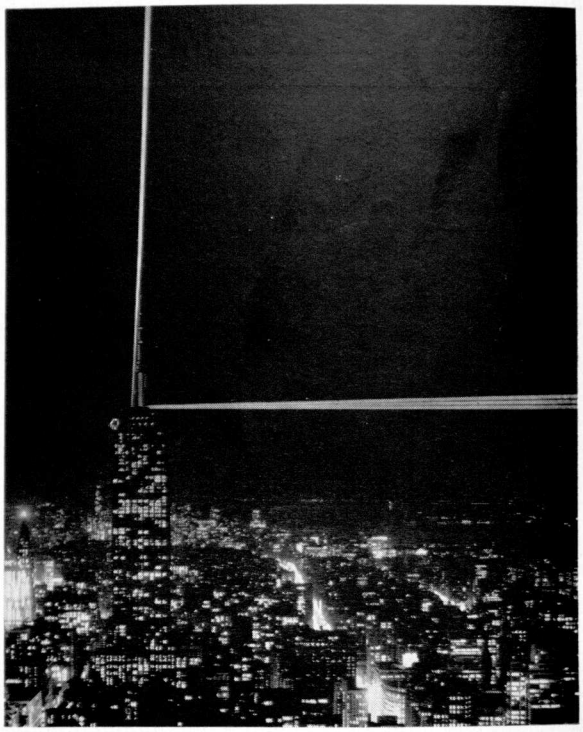
The secret of the hose's durable insides is a special rubber compound, which is said to outwear steel 20-to-1 in many applications.

Where metal pipe is now installed to convey abrasive materials, the new hose may be used to advantage wherever the pipe system must turn a corner or negotiate a bend. Abrasive particles traveling at high velocity cause severe wear on metal pipe at such points. Short lengths of hose with the new tough tube flex easily around corners, thus eliminating the need for curved pipe. Unlike curved pipe, hose used to negotiate corners can be rotated to distribute the wear at these points.



"Stethoscope" at Work!

An engineer is using an ultrasonic device to inspect a massive forging from which a turbine-generator shaft will be machined. Sound waves at the rate of 2,250,000 cycles per second are set up in the machine, and if the slightest flaw is detected an "echo" will indicate its exact location. Formerly, the only way of determining the quality was by boring a hole through the center of the forging. But now, with ultrasonics, the quality can be determined. With this method, it is possible to easily detect fine holes, slag, inclusions and other imperfections.



Giant Beacon

The Empire State Building will light up the skies of much of the northeast through the addition of four mighty searchlights. Installed just above the observation platform, 1,092 feet above the streets of New York City, these beacons will be powerful enough to be seen under ideal conditions as far away as Boston and Baltimore.

One of the five-foot beacons will point straight up. The three others on the world's tallest building will be directed outward at an angle of five degrees above the horizontal. They will revolve counterclockwise at the rate of one revolution per minute from sundown to midnight.

"Electrical Roadblocks" Built into Insulation

Millions of tiny "electrical roadblocks," which increase the resistance of molded electrical insulation to electric arcs as much as 1000 percent, now can be built into the plastic-type material from which plugs, sockets, switches and a host of other electrical devices for home and industry are made.

Arcing occurs when electricity "skips" across electrical insulation on or near its surface, thus causing a "short" between two electrical connections. Resistance to such arcing is an important requirement of electrical insulation. The new technique greatly improves the arc resistance of the most widely used types of molded insulating material. The small, inert particles introduced into the insulation effectively break up the con-

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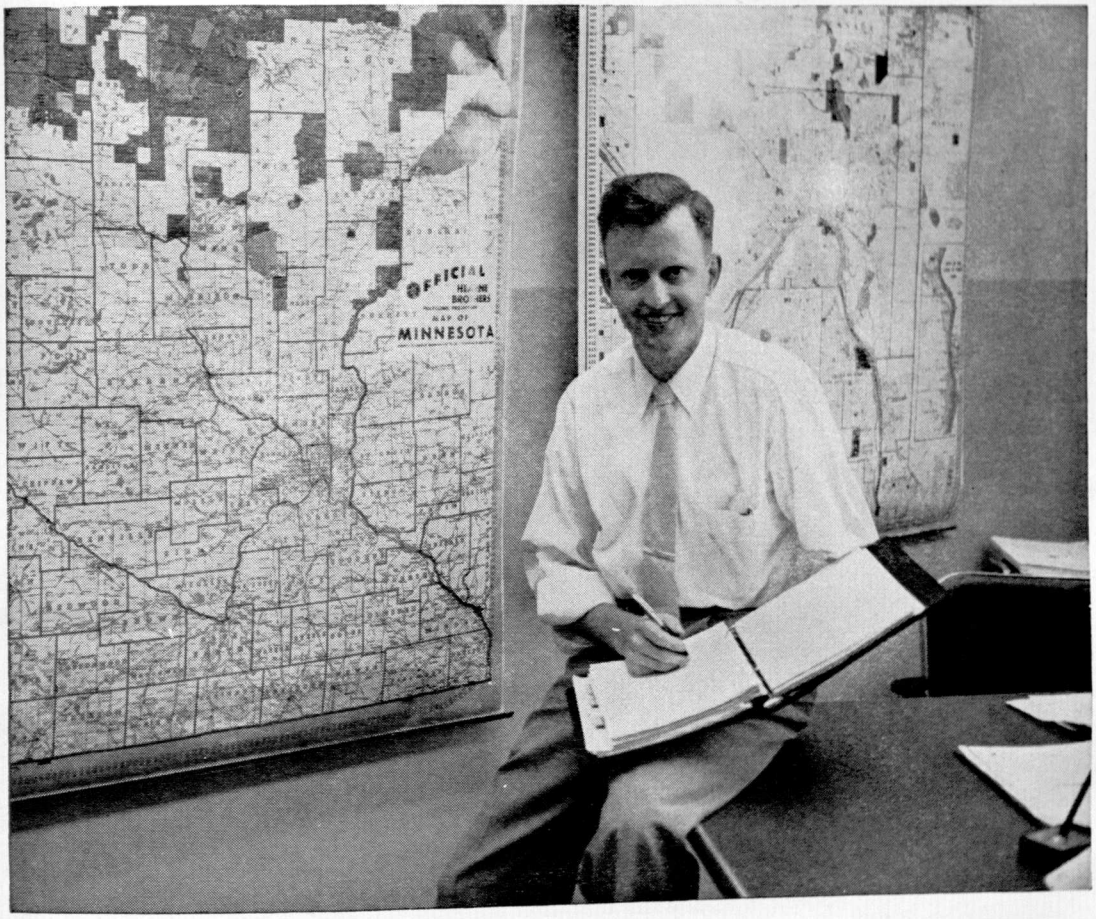
A Campus-to-Career Case History



"One open door after another"

"When I joined the telephone company," says Walter D. Walker, B.E.E., University of Minnesota, '51, "I felt I could go in any direction. And that's the way it has been.

"For the first six months I was given on-the-job training in the fundamentals of the telephone business—how lines are put up and equipment installed. Learning those fundamentals has paid off for me.

"Then I had the opportunity to go to the Bell Laboratories in New Jersey. I worked on memory crystals—ferro-electric crystals—for use in digital computers. I learned how important research is to the telephone business.

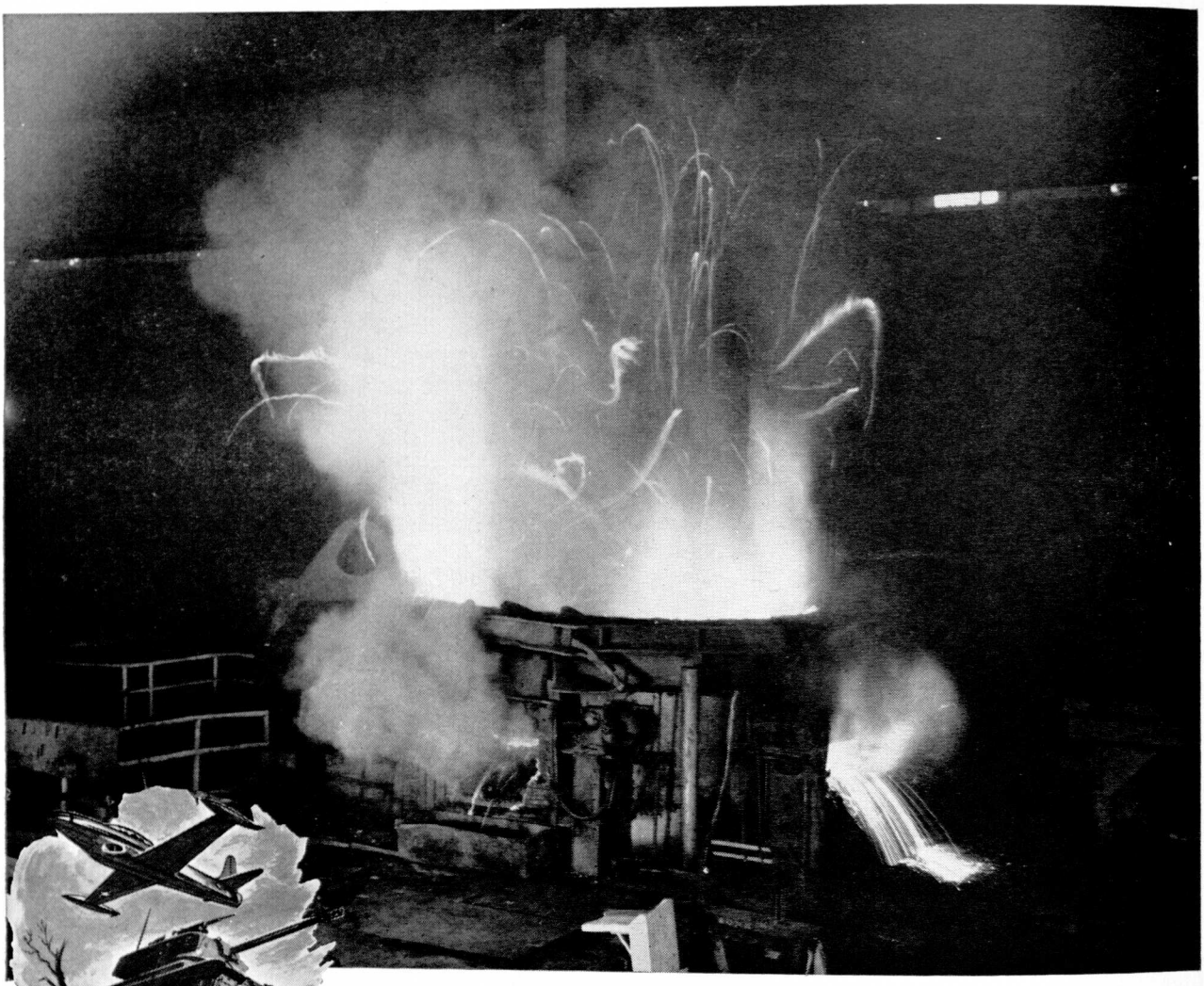
"After two years I came back to Minnesota, to St. Cloud, to work in the District Plant Engineer's Office. There I made field studies of proposed construction projects and drew up plans to guide the construction crews. This combination of inside and outside work gave me invaluable experience.

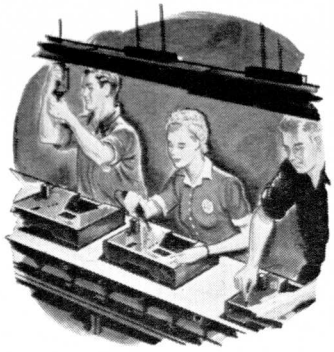
"In July, 1955, I came to Minneapolis as an Engineer in the Exchange Plant Extension Engineer's Office. We do forecasting—not of the weather, but of future service needs. Using estimates of growth and economic studies, we make our plans for the years ahead. We figure out where and when new facilities will be needed to meet future growth.

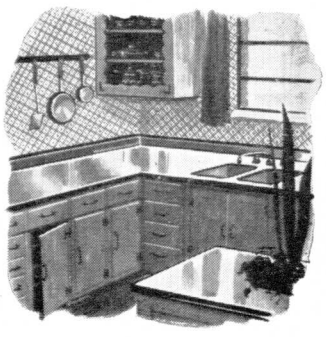
"All this has been preparing me for a real future. You see, the telephone company is expanding by leaps and bounds. That's why it offers a young man so many open doors."

Wally Walker's career is with Northwestern Bell Telephone Company. Many interesting career opportunities exist in other Bell Telephone Companies, Bell Telephone Laboratories, Western Electric and Sandia Corporation. Your placement officer has more information regarding Bell System companies.

Bell Telephone System







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Transients and Trends

J. D. RYDER
Dean of the School of Engineering

By Dean J. D. Ryder

If you, as an engineering student, have heard of the advent of a new freshman year, of new courses, of new course numbers, of new curriculums and rumors of new curriculums, of the reduction of engineering drawing and the elimination of shop courses, of increases in mathematics and chemistry—then you must believe that a transient situation exists in engineering education on our campus.

Actually, what you are seeing at close hand—living through as best you can, in fact—is not a transient but a part of a long-time trend in engineering education. From the time the first stone was laid in the first pyramid in Egypt, up to 1956, engineering teaching has been moving consistently in one direction—away from the applied teaching as given to the apprentice, and toward the scientific knowledge of nature available only from the learned master.

This trend away from the practical and applied is a necessity of our modern fast-moving jet and electronic age of science and engineering. What was practical and good application in 1940 is out-of-date and unusable in 1956. Many of our engineering products of today were unheard of and even unnamed in 1940! We are trying to orient our engineering education toward tomorrow—the future todays of your undergraduates—and to prepare you through knowledge of scientific fundamentals and concepts to undertake the development and design of the as yet unknown and unnamed engineering products of 1970, 1980, or 1990.

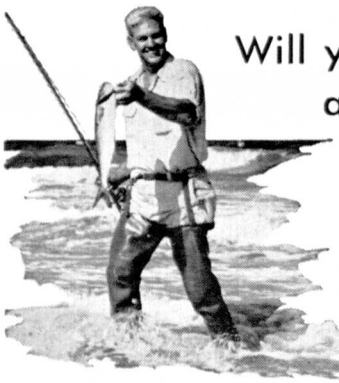
Can we say our source of energy of that time will be coal, oil, the atom, or the sun? Should we, for example, teach you of the design of coal-fired steam boilers and the turbine, or should we teach you of the fundamental dynamics and energy transfer of any system? These are the questions engineering educators and industrialists have answered by saying, "Look to the future; the past can take care of itself." And so our transient actions are part of this giant trend.

As another part of its efforts to move forward, the College of Engineering is looking to a complete new campus development, a new engineering area of buildings and research laboratories. The site chosen for this is the area south of Shaw Lane, and west of the Agricultural Engineering and new Animal Industries buildings. Now in the planning stage are buildings to house the Departments of Mechanical Engineering and Applied Mechanics. These will be followed by structures for Civil Engineering, Chemical Engineering and Metallurgical Engineering, and for Electrical Engineering and Engineering Research. The present buildings will be taken over by other non-engineering departments.

In all this we are trying not to be content to follow the trend—we are trying to get out in front and lead it!

ENGINEERS...
LOOK TEN YEARS AHEAD!

A Douglas engineer lives here



Will your income and location allow you to live in a home like this...spend your leisure time like this?

They can...if you start your career now at Douglas!

Take that ten year ahead look. There's a fine career opportunity in the engineering field you like best waiting for you at Douglas.

And what about the Douglas Aircraft Company? It's the biggest, most successful, most stable unit in one of the fastest growing industries in the world. It has giant military contracts involving some of the most exciting projects ever conceived...yet its commercial business is greater than that of any other aviation company.

The Douglas Company's size and variety mean that you'll be in the work you like best—side by side with the men who have engineered the finest aircraft and missiles on the American scene today. And you'll have every prospect that ten years from now you'll be where you want to be career-wise, money-wise and location-wise.

Brochures and employment applications are available at your college placement office

For further information about opportunities with Douglas at Santa Monica, El Segundo and Long Beach, California and Tulsa, Oklahoma, write today to:

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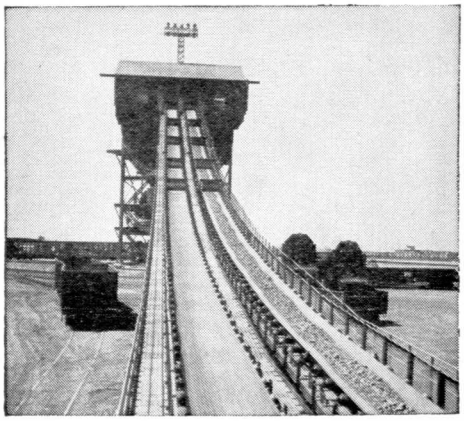
Santa Monica, California

DOUGLAS **First in Aviation**

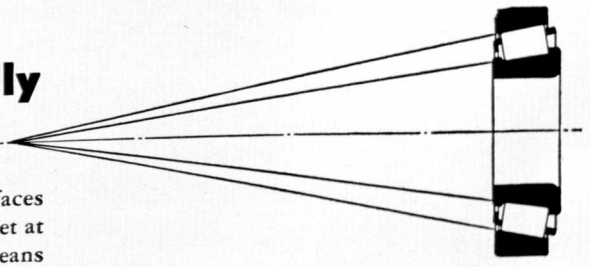
Another page for **YOUR BEARING NOTEBOOK**



How to get longer roller and belt life in a conveyor system

Engineers had to find a way to reduce costly friction and wear on rollers and idlers in designing this big conveyor system. It handles up to 3,300 tons of ore per hour on each of two 54″ belts traveling at more than 500 feet per minute. Their solution: Mounting the idlers on Timken® tapered roller bearings. Result: reduced friction, less sliding and scuffing between idlers and belts, longer roller and belt life.

True rolling motion, high precision practically eliminate friction

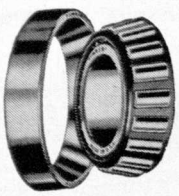


All lines drawn coincident with the working surfaces of the rollers and races of Timken bearings meet at a common point on the bearing axis. This means Timken bearings are designed by geometrical law to have true rolling motion. And they're manufactured with great accuracy to live up to their design. Result: Timken bearings practically eliminate friction, give longer bearing life, keep conveyors rolling smoothly.

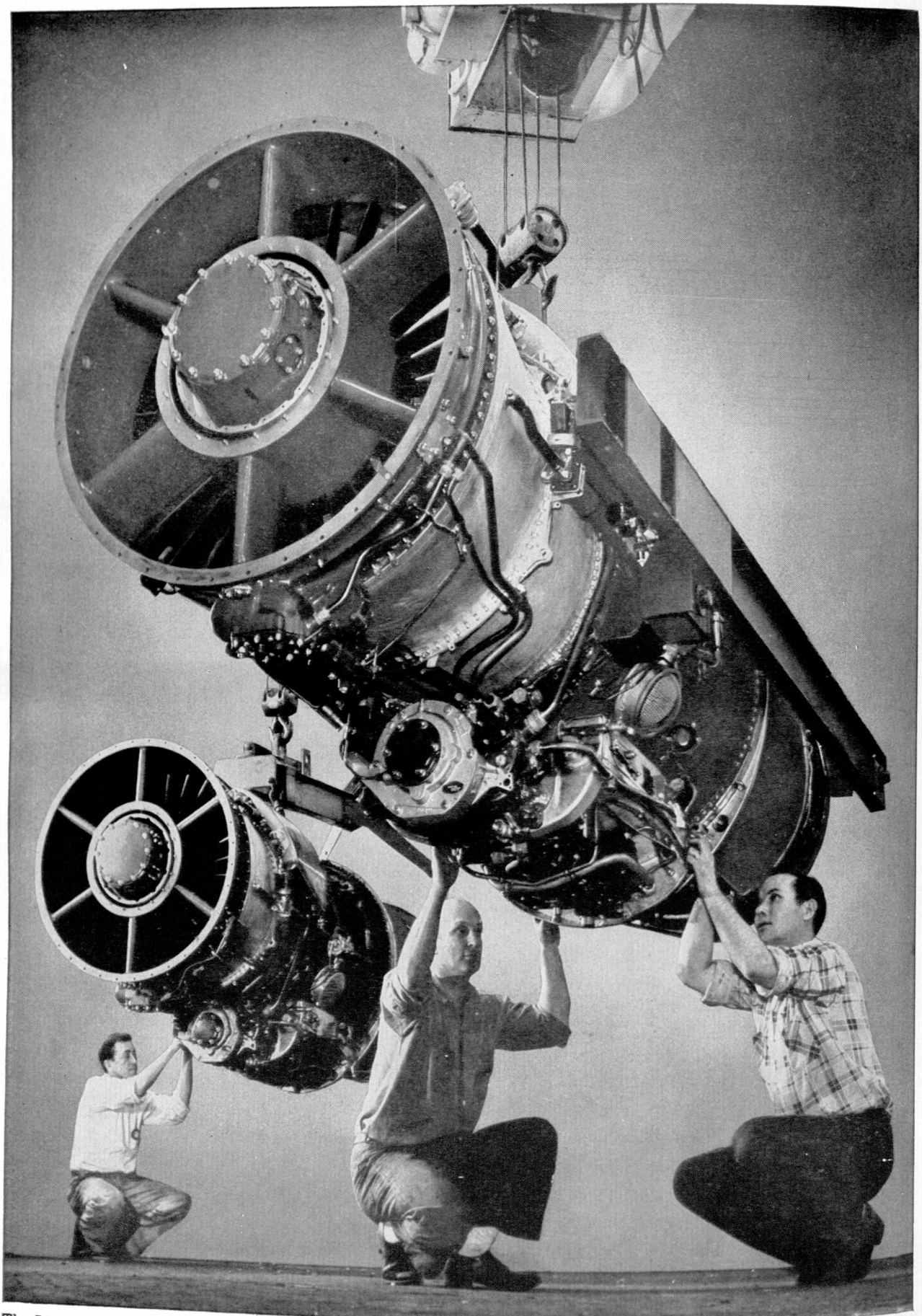
Want to learn more about bearings or job opportunities?

Many of the engineering problems you'll face after graduation will involve bearing applications. For help in learning more about bearings, write for the 270-page General Information Manual on Timken bearings. And for information about the excellent job opportunities at the Timken Company, write for a copy of "This Is Timken". The Timken Roller Bearing Company, Canton 6, O.

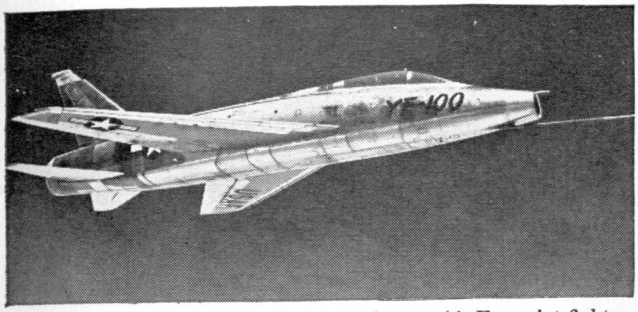
TIMKEN
TRADE-MARK REG. U. S. PAT. OFF.
TAPERED ROLLER BEARINGS



NOT JUST A BALL ○ NOT JUST A ROLLER ⬭ THE TIMKEN TAPERED ROLLER ⬭
BEARING TAKES RADIAL ⊕ AND THRUST —◎— LOADS OR ANY COMBINATION ✳

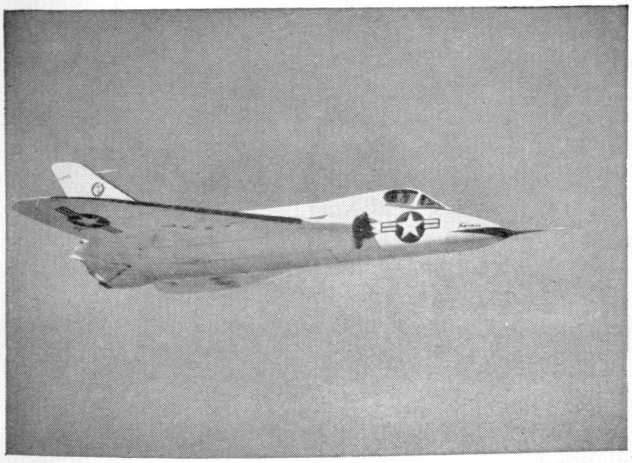


The J-57, in the 10,000-pound thrust class, is the most powerful turbojet engine now in production. A new generation of U.S. air power has been designed around this mighty new Pratt & Whitney Aircraft engine.

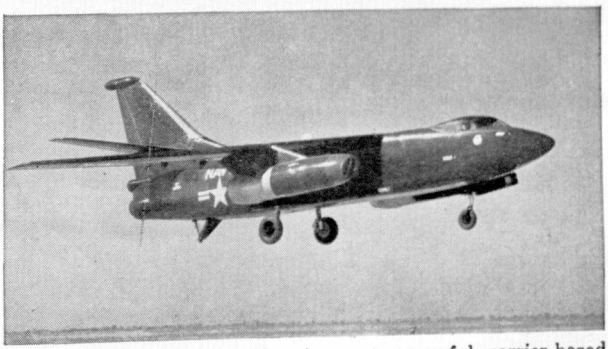


North American's F-100 Super Sabre, fastest Air Force jet fighter, is powered by Pratt & Whitney Aircraft's J-57 engine.

First all-jet heavy U. S. Air Force bombers are the huge Boeing B-52s, powered by eight J-57s mounted in pairs.



The Douglas F4D Skyray, fastest Navy jet fighter, will be powered with the big J-57 engine.



The Douglas A3D, the Navy's most powerful carrier-based attack airplane, has two J-57 engines.

Blazing the Way for a New Generation of Air Power

The most powerful turbojet engine in production is blazing the way for a whole new generation of American aircraft.

That engine is Pratt & Whitney Aircraft's J-57, the first turbojet to achieve an official rating in the 10,000-pound thrust class.

But the J-57 provides far more than extreme high thrust. Its unique Pratt & Whitney Aircraft design, achieved after years of intensive research and engineering, offers as well the low specific fuel consumption so vital to jet-powered bombers and future transports, plus the additional important factor of fast acceleration.

The importance of the J-57 in America's air power program is clearly shown by the fact that it is the power plant for three of the new "century series" fighters for the U. S. Air Force—North American's F-100, McDonnell's F-101 and Convair's F-102—as well as Boeing's B-52 heavy bomber. The Navy, too, has chosen the J-57 for its most powerful attack aircraft, the Douglas A3D, the Douglas F4D fighter and for the Chance Vought F8U day fighter. And the J-57 will power the Boeing 707 jet transport.

The J-57 is fully justifying the long years and intensive effort required for its development, providing pace-setting performance for a new generation of American aircraft.

Engineering graduates who can see the challenge in this new generation, might well consider a career with the world's foremost designer and builder of aircraft engines.

PRATT & WHITNEY AIRCRAFT
DIVISION OF UNITED AIRCRAFT CORPORATION
EAST HARTFORD 8, CONNECTICUT

The Knack and the Kidney Bean

By Stephen Prokopoff
(Stephen Stevens)
Engineering Drawing Department
Author of "The Prophet and the Miracle"

"What sort of luck have we run into this time?" A comparatively young, long man whose movements suggested the premeditated precision of a flamingo, asked the question and slouched his six-foot-three frame in the red leather lounger that flanked his accountant's desk.

"We've struck oil, sir!" Back of the desk the buttonhole shaped mouth of an elderly man popped open like the entrance to a tunnel.

"Have any idea what it would amount to in cash?"

"Ay, Mr. Egerton, you caught me in a weak moment," Mr. Hagenbush was not quite yet ready to lay down hard figures.

Smiling, Paul Egerton picked a paper clip from the desk and bent it one way and then the other. "How so?" he casually but warmly looked in the bookkeeper's dim eyes. To him they were like the road map. He could read them just as well. Therein he saw "yes" or "no" which meant either, not like in some that would mean neither. Paul liked the man, even though he looked as fearsome as a bald headed eagle. He had a talent of money making for others but not for himself. Other world rocking problems to him were meaningless unless they got on the financial page by mistake.

"Did not have time to clear up the value of the stocks," the man back of a large teakwood desk replied. "But from the looks of it, may I assure you, sir, it's quite an impressive sum. You must have leaped across thirteen barrels. . . . A crushing sum, sir. . . . A-hoo, a-hoo!" The man, an inch over five feet and thin to the point of boniness, coughed and blinked pale blue eyes as his snow white head slightly shook.

"In other words, it should keep us going till the ripe old age?" Paul stood up, brushed back the locks of coral-colored hair that had a way of falling over his broad forehead. In that posture his high cheek bones, gay, green eyes, and reserved smile showed him at once a humble and important man.

"Sir, it's not that it will keep us going, it's your genius," Mr. Hagenbush said fondly.

"Some folks stick to their diet, Mr. Hagenbush, because they know that figures don't lie. I stick to my fate. Without it, I could not have solved some problems which other men claimed impossible of solutions. At times it seems as if all avenues are open to me and answers put in my mind. All I need is only to utter words; and you call that a genius?"

"Sir, don't give fate the whole credit, your animated spirit must have quite a bit to do with the amassed fortune, too," the aged one professed his undying faith in the man's ability to unravel mysterious secrets.

"Then you disparage the popular opinion which has it that inventors are queer little men who scurry around disorderly laboratories and working on crackpot ideas?"

"But people are not with you like I am, sir. They have not seen you at work, they only know you by reputation, or by your earning capacity. . . ."

"Mr. Hagenbush, you are drilling your way to a particularly sensitive nerve."

Horace Hagenbush's grizzled sparseness had given way to a gray, almost cadaverous thinness that had drawn his cheeks into hollows. When he saw a smile in his boss's face, he shrugged his shoulders and with it shook off his subdued look.

"Mr. Hagenbush," Paul sat down again and wanted to be amicable, "do you know that minnows can see ultra-violet rays invisible to the human eye?"

"No, sir, but what has that got to do with fate?" Mr. Hagenbush suddenly laid his pencil on the desk and stood up as if from anticipation of another shock.

"Trouble with you is, you don't believe in fate. The things that are happening to you, to me, must have been planned by some one, some where. The money you have alluded to, I have never planned for or even dreamed of." The young capitalist spoke idly as his two fingers reached for the watch in his vest pocket. Then leaning back in the chair and raising his eyebrows, he glanced at its dial and a amicably continued. "No, not the money. The two other things that I wanted at the time seemed unattainable. I believed I could get either, but not both. 'Which was it going to be?' I asked myself."

While still a teen-ager and in one of those propitious moments Paul poked his fork at the fiercely evading kidney bean on the dinner plate before him, and dreamed a dream. In that suspended animation, his imagination was reaching for signposts that could lead him down to a trail of great discovery.

"Are those eyes yours to-day, Paul? Open them a little wider," his mother was finally tired watching the contest between the bean and the subconscious mind.

"Huh, I am not sleepy." He jumped from his pink cloud.

"Then why the longing you know not for what?"

"Just thinking."

"What about, for instance?"

"About Daddy and the black Angus, about this miserable bean and myself."

"Wonderful thoughts. Must be. I surely would like to hear more about them," she invited him to purge his heart.

"I heard daddy say he packs in Angus some special food ingredients with energy enough to drive all our fleet ten times around the earth."

"So?"

"So, I am thinking along the same line."

"Oh?" Mr. Egerton, senior, was pleasantly surprised. Speaking slowly and enunciating with awe-ful pride, he prodded, "Astonish me some more, son."

"Why can't I pack enough energy in a bean, so it could propel a man, let's say, a year, or . . . or even all of his life? As the matter stands today, a plateful of them is hardly enough to move him around four hours at a stretch. Just a grain more than it required to trap them and chew them down."

"My boy," his dad said, "You have the knack and the kidney bean. If other men could produce seedless grapes, salty celery, mashed potato . . ." He stopped for a moment, scratched his head back of his ear and then resumed, "nope, the last one has not yet been discovered," he corrected himself, "but before long, someone will." Then he wiped his wild strawberry-colored moustache on a napkin and told his son, "It might as well be you."

"Let me tell you this, if some screwball could find ways to distill the elixir for an old, broken-down scrubwoman to drown her sorrows in, why can't I discover something more important for her life?" Paul continued considering his allusion.

"All right, all right, son. Thoughts are like buses, if you wait, the right one will come along . . ." Mrs. Egerton stepped in.

"Oh, goat feathers! Buses don't stop unless you flag them down." Paul was aroused even more.

"Lad," Mr. Egerton said, he always called his son lad, when he was proud of him and then he gave his son such a hearty slap on his back that it nearly slapped the breath out of him, "you will outlast corduroy pants. I am with you one hundred and one per cent. Go right ahead. Generate your own cocoons." A slight glitter and wonder was in the senior's eyes.

A while later Paul had enrolled in a College of Agronomy. Some how his old zeal was diverted to soil mechanics and farm machinery design. Even so, he was not forgetting the kidney bean. A thought that he was laying a good background for it had always stood out in the back of his mind. He expected to tackle it in due time. It was going to be his project which eventually would earn him a doctoral degree.

Thereafter, he managed to carry all his plans to a successful conclusion. Then there was left an interval of seven days before he was to receive his B.S. But before the fateful day had arrived fate made him run into a girl on the street. The one he once made acquaintance of and subsequently endured sleepless nights debating in his mind what to do about her. And that was not reacting to a skirt like a bird dog to a shotgun, either. The daze actually began with their first formal date. Now she became that other great interest that had curiously over taken him.

"O, Paul! Hi!" she hailed him and went on, like a wheel down the hill. "I wanted so many times to see you, to talk to you. . . . You appear inaccessible . . . what gives? . . ."

"It's good to hear your cold, calculated voice, Vivian," he responded, pretending she was not much wanted.

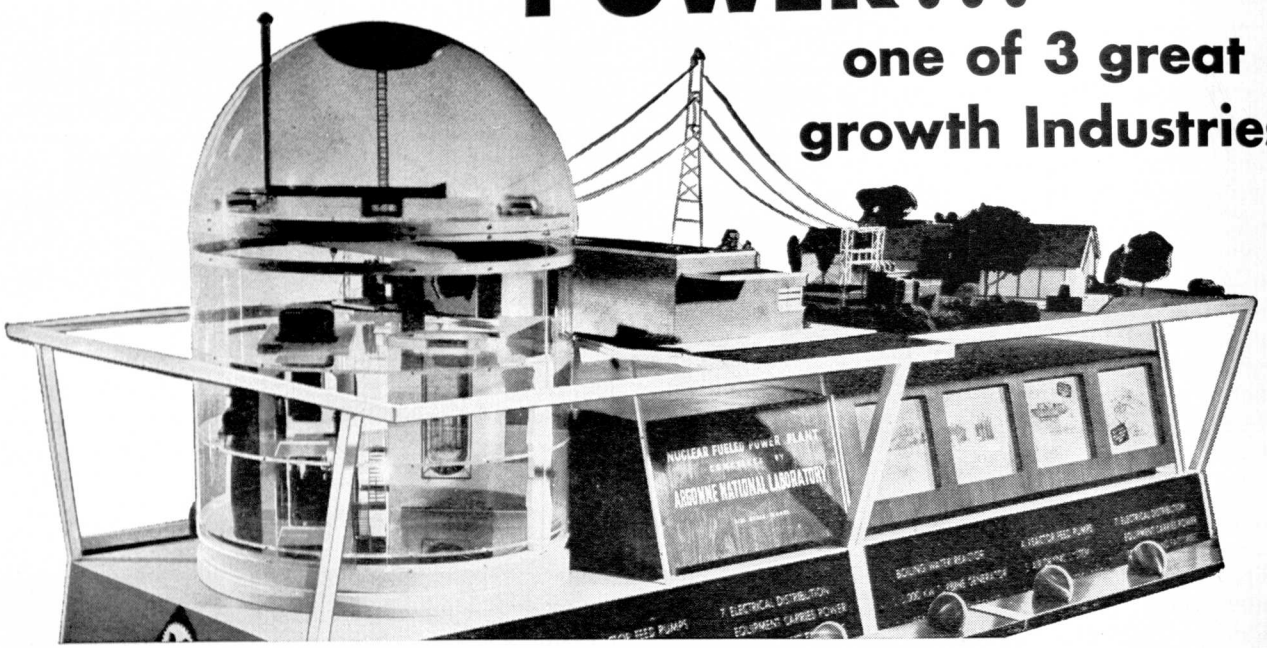
"And just what is that 'cold, calculated' figure in your mind, Honey?"

"You are the only girl in my life who did not try to marry me," Paul cracked empty words, while inside blushing from excitement.

Vivian Blackwood was a little thing. She was slender and possessed pretty dark hair and eyes. Her face was gay and eyes sparkled enough glow to light the darkest corner. She wore a red velvet dress. It shimmered as she took graceful steps down the street. Before Paul had met her, he used to blow up, "I would have no frump foisted off on me." But when he did

(Continued on page 35)

POWER...
one of 3 great growth Industries



ATOMIC POWER—Allis-Chalmers model of Argonne National Laboratory's experimental boiling water reactor power plant. Allis-Chalmers is supplying specialized equipment for the power cycle: generation, heat transfer, transmission, controls.

GO with the company that's strong in all three!

Hitch your future in engineering to the growth of the U. S. A.—and to a company that supplies the basic needs of growth!

This nation is growing at the rate of 50,000 people every *week!* To supply the needs of these people:

Electric power generation will double by 1965.

A multi-billion dollar program of new highway construction is planned within the next ten years.

Manufacturing output will have to increase by $3.5 billion by this time next year.

And Allis-Chalmers builds major equipment for all of these growth industries! Some examples are pictured here.

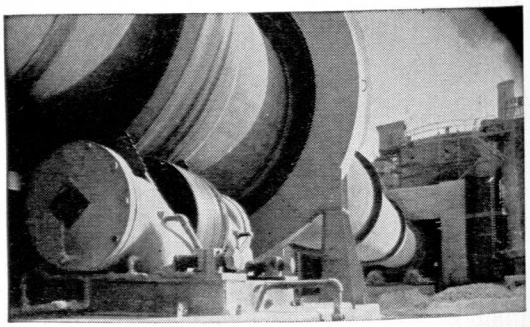
Here's what Allis-Chalmers offers to Young Engineers:

A graduate training course that has been a model for industry since 1904. You have access to many fields of engineering: electric power, hydraulics, atomic energy, ore processing.

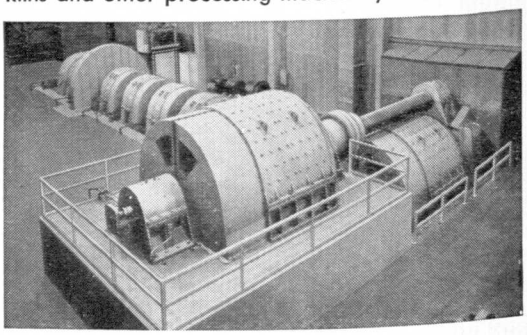
There are many *kinds* of work to try: design engineering, application, research, manufacturing, sales. Over 90 training stations are available, with expert guidance when you want it. Your future is as big as your ability can make it.

Or, if you have decided your field of interest and are well qualified, opportunities exist for direct assignments on our engineering staff.

In any case—learn more about Allis-Chalmers. Ask the A-C manager in your territory, or write direct to Allis-Chalmers, Graduate Training Section, Milwaukee 1, Wisconsin.



CONSTRUCTION demands the vast tonnages of cement produced with Allis-Chalmers rotary kilns and other processing machinery.



MANUFACTURING depends upon the reliable power of electric motors—like these 5000 hp Allis-Chalmers giants powering a rolling mill.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS 4977

(Continued from page 33)

meet her, his eyes clung to hers and hers to his as if they had a mutual confession to make. They met and went together again and again. But then one day she was introduced to another boy. The new acquaintance asked her for a date. Before accepting the offer, she called Paul up and wanted to know if it would be all right with him.

"How could it be all right, when we are supposed to go to the movies tonight? . . ."

"Just this once, please, Paul," she cooed.

"If some Meatless Tuesday interests you more than I, you are welcome to him. And you might also know that I am not going to slobber around while . . ." Then he crashed down the phone receiver, as his muscles worked in ripples in his cheeks. "I'll allow no frump to stand me up," he loudly complained to himself.

A little later Vivian called him up again, and asked for an explanation.

"You have put the whaleboat over nicely. Now let's forget about the whole thing." His soul drank fire.

Vivian did not strike an attitude, but there was hint of moist-eyed hurt about her. "All right, Paul," she said quietly and placed the receiver back in the phone cradle.

They did not have another date until they ran into each other on the street.

Vivian's black, thin brows knitted together a while then she said, "No, Paul. The only man that interests me now is the heir to Arabian Oil Wells," she poured ice water on him.

"Con . . . Congr . . .tulations," Paul uttered while his teeth clattered from fear. . . . "A man was drummed out for permitting a slight show of emotion to flit across his face. Look what I have done . . ." he chastised himself before her.

She stood there, erect, showing hopeful things behind her eyes. "On second thought, however," she spoke up warmly, "to be without faith, is like a goose without feathers. I see in the stars, you are going to be greater than the Oil Wells. I'll marry you, Paul!"

The sudden turn produced a tempest in Paul's mind. Momentarily he put up an abandonment struggle, but it was as useful to him as a prayer is to the godless. He wanted the doctor's degree of science desperately and he wanted Vivian no less. "I can't. Not just yet. I would not ask my dad to support us . . ." he tried to make the situation clear to her, and at the same time felt he was so dumb that he could not hit the ground with his hat.

"Don't wear yourself thin about nothing, dear," she sang as her gay eyes bubbled.

"How can you be so light about the marriage, Vivian? And . . ." And once again he realized that their minds met with an immediacy he had not experienced with other girls before.

"Hush, hush, you will go about your studies as you have, and I will keep on with my welcoming at the Wheel Wagon Association as I have."

"Just like that?"

"Yop."

Paul's brain quickly slipped in the gear. "If you expect to get off this one, you may just as well wait for an oyster to learn how to whistle . . . Man, your goose is cooked! . . ." He seemed to hear a voice whisper in his ear. But then and there he saw her smiling. The smile was so beautiful that it enhanced the charms of her face to the point where he could no longer stand on the street emotionless.

He understood the implications of the stocky atmosphere. She seemed to see all that was going on in his head. "We will go together," he had heard her gentle voice say and then felt her arm slip under his.

Paul was a smart chap. Therefore, he thought, he knew all the ropes. But that did not stop him from being tied down and led before the Justice of Peace where he took Vivian's hand, even as the butterflies churned in his stomach, and said, "I do."

Three days after the portentous utterance, a girl friend of Vivian's dropped in. In between their whispers, Paul heard Vivian say that she was going to continue in her work in order to help him to obtain his doctoral degree.

It was kind of her, of course, he thought, but she did not know that he was a proud young man. He had always worked out his own problems, all by himself. He had been doing that ever since he crawled from under the table. Moreover, he already had earned his B.S. and therefore, he did not like the idea of having others claim credit for his personal accomplishments. He did not allow his parents to help him even in his younger years, so, naturally he was not going to let his wife help him, either. That very moment he decided to forego the Kidney Bean Project and with it the doctoral degree. On the same day Paul sneaked in on an aircraft interviewer. A position was offered to him and he accepted. Vivian swore she did not understand him after he had told her of the acceptance. But he revealed not his reasons for the action.

Paul's first assignment was to study causes leading to airplane wing failures in the flight. His penetrating look into the problem at once uncovered radii forming as the chief culprit of the trouble. Forthwith and as a remedy he recommended strict relationships between the metals, the thicknesses and their subsequent radii formations. After his recommendation had been accepted there appeared no more incidents of wings coming down ahead of their pilots. For that Paul received a hearty hand shake and a boost up the ladder toward his future undreamed of success.

Then another task came to his desk. Washington begged for quick delivery of combat planes. At the same time some one in the Defense Department decided to redesign a small item in the leading edge. As a result of the redesign, production, instead of going up, went down like overalls at the quitting whistle.

(Continued on page 57)

to the well too often

There are easier ways to get a drink.

And engineering graduates will be called upon to develop them. They'll have to help supply and distribute the billions of gallons of water needed daily by homes and industry. Water that will be increasingly hard to find.

But when they find it, they can rely on cast iron pipe to carry it. Practically every city in America—large or small—uses it for water and gas mains. In over 70 public utilities cast iron pipe has served for a century or more. No other pipe can point to such a long and useful record of service to the nation.

CAST IRON PIPE RESEARCH ASSOCIATION

Thos. F. Wolfe, Managing Director, 122 So. Michigan Avenue, Chicago 3, Ill.

CAST IRON

CAST IRON PIPE SERVES FOR CENTURIES

EXPANSION

(Continued from page 13)

The Mechanical Engineering laboratory unit will house automotive laboratories, power laboratories, heat transfer laboratories, and gas dynamics laboratories as well as some staff offices and department shop facilities. This will be largely a one floor plan building, with a second floor only over a portion to house classrooms and offices. This permits lower cost construction than is possible in a building of multiple stories. Of particular interest in this building will be several test cells for experimental work with such modern devices as jet engines, and fundamental studies in heat flow and combustion of fuels.

The Duty of Engineering Education

Engineering education began in this country in 1802 with the founding of West Point and its training of what were then known as military engineers. Engineering education in other schools began about 1850 and in 1859 at M.S.U.; the Department of Mechanical Engineering was established in 1885. Early engineers were very largely concerned with building of things; the development of abstract ideas with which others could build was not their concern. These early engineers were in fact largely concerned with the development and utilization of the raw materials of their economy. Constantly there has been a trend to improve engineering and the engineer's works, and with the expansion of United States industry and civilization into a more mechanized type of living in the last twenty years, and particularly since World War II, the engineer has found himself faced with many problems unknown to the early engineer and to which the early engineer's training was unsuited. As a result, engineering education has been moving continually since its inception toward a more fundamental approach, and this has been very much accelerated during and since World War II. It has been fully realized that with the breadth of our modern industry, it is no longer possible to prepare an engineering graduate for a job in applying a specific type of knowledge to a specific project. We have now to prepare a man for work in rather broad general areas and must center our attention on the fundamentals of engineering and science, and leave to the man the acquisition of the more practical knowledge after he steps into his job.

This means that our training should be pointed more towards the creative activities which are actually the interest of most of our students, and away from technician and so-called "practical" training. At the same time, it should be realized that we are not overlooking other less creative activities into which many of our graduates ultimately step. We feel, however, that in making our objective the highest level of scientific attainment, we are in nowise harming our graduates, but are actually preparing them for the really fine creative and managerial jobs which should be theirs twenty years after graduation. Such training does no harm to men who are oriented towards job in the field of production, sales, manufacturing, and the like, since past training in the purely practical was usually considerably out-of-date by the time the man received his bachelor's degree, and was therefore of little use and had to be relearned after entering industry.

The planned expansion of the Engineering College at Michigan State University will give us an opportunity to offer to our graduates and to boys in the State of Michigan an education directed towards the modern science of engineering and will prepare them to plan, design, and create the machines and the structures of tomorrow, and to discover and create the new knowledge and methods by which engineering science will advance.

NEW DEVELOPMENTS

(Continued from page 24)

tinuous path which is normally present for the electric arc to travel.

In addition to good arc resistance, molded electrical insulation should be inexpensive, easily shaped and mechanically strong enough to withstand normal "wear and tear." Among the few molding compounds which meet the requirements of low cost and basically good electrical and mechanical properties are those made from what we call phenolic resins. These resins have been used as molded insulation for many years, and they do an excellent job in most respects. However, one factor has limited their even greater use. This has been their comparatively low arc resistance.

Standardized test procedures show that the new laboratory method of preparing phenolic-type insulation gives it an arc resistance as good as that of more costly materials, without sacrificing any of the other superior properties it possesses.

The study of the nature of phenolic insulating materials shows them to be susceptible to arcing because of their chemical structure. Their molecules contain "chains" of carbon atoms which tend to "unlink" under heat or strong electrical discharge, forming simpler chemical substances which conduct electricity. Once formed, these substances act as a path, or roadway, for an electric arc.

What has been done is to insert small, non-conducting particles of an inert material between the molecules of the molding compound. It is these inert particles which "block" the path of the electric arc.

Photosensitive Paper Developed for New Dry Photo Process

A low-cost, coated paper that is so photosensitive that it can make contact prints at exposures of a fraction of a second has been developed by scientists for use in a new, simplified dry photographic process known as Electrofax. At exposures of one-half a second in outdoor light, it has produced positive prints in a few seconds, with no chemical processing.

The speed with which images can be photographed and printed with the new paper and the Electrofax technique has permitted experimental development of a mechanized system of continuous-strip reproduc-

(Continued on page 59)

an enthusiastic OK

for Collins New Integrated Flight System

Capital Airlines wires: "Enthusiastic in approval of Collins Integrated Flight System—basic flight instrumentation for our entire Viscount aircraft fleet."

There's good reason for this enthusiasm. The Collins Integrated Flight System is the greatest advancement in all-weather flying aids. It presents to the pilot a continuous picture of his aircraft's attitude and position, on two easy-to-read instruments. It takes the strain out of instrument landings, assuring the most precise descent possible. It makes cross country navigation easier and more accurate.

The Integrated Flight System —another leading achievement by Collins in aviation electronic development.

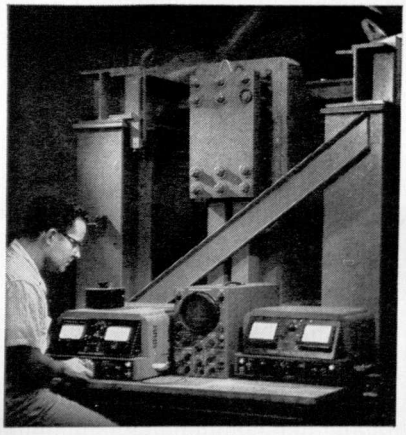
COLLINS RADIO COMPANY

CEDAR RAPIDS, IOWA • 1930 Hi-Line Drive, DALLAS 2, TEXAS
2700 W. Olive Avenue, BURBANK, CALIFORNIA

COLLINS

Electronics Research Engineer Irving Aine records radiation antenna patterns on Lockheed's Radar Range. Twenty-two foot plastic tower in background minimizes ground reflections, approximates free space. Pattern integrator, high gain amplifier, square root amplifier and logarithmic amplifier shown in picture are of Lockheed design.

Mechanical Research Engineer W. M. Watkins (left) directs Research Mechanic Earl Rollo in operating Lockheed's new Hailstone Gun during a test on the effect of hailstones on new types of plastic radome "skin." The gun, which was designed by Watkins and Mechanisms Group Engineer G. W. Louthan, fires up to five hailstones spaced 25 feet apart at speeds ranging from 270 to 500 mph. The hailstones, which are made in the gun, can be varied in size from $\frac{3}{8}$" in diameter.



Research Engineer Russell Lowe measures dynamic strain applied by Lockheed's 500,000 lb. Force Fatigue Machine on test specimen of integrally-stiffened Super Constellation skin. The Fatigue Machine gives Structures Department engineers a significant advantage in simulating effect of flight loads on a structure. Among other Lockheed structures facilities are the only shimmy tower in private industry and largest drop test tower in the nation.

C. H. Fish, design engineer assigned to Lockheed's Icing Research Tunnel, measures impingement limits of ice on C-130 wing section. The tunnel has a temperature range of −40°F. to +150°F. and maximum speed of more than 270 mph. It is the only icing research tunnel in private industry.

Advanced facilities speed Lockheed engineering progress

Lockheed's unmatched research and production facilities help make possible *diversified* activities in virtually all phases of aviation, military and commercial.

They enable engineers to test advanced ideas which would remain only a conversation topic in firms lacking Lockheed's facilities. They help give designers full rein to their imagination. They make better planes — and better careers.

Engineering students interested in more information on Lockheed's advanced facilities are invited to write E. W. Des Lauriers, Lockheed Student Information Service, Burbank, California.

Lockheed

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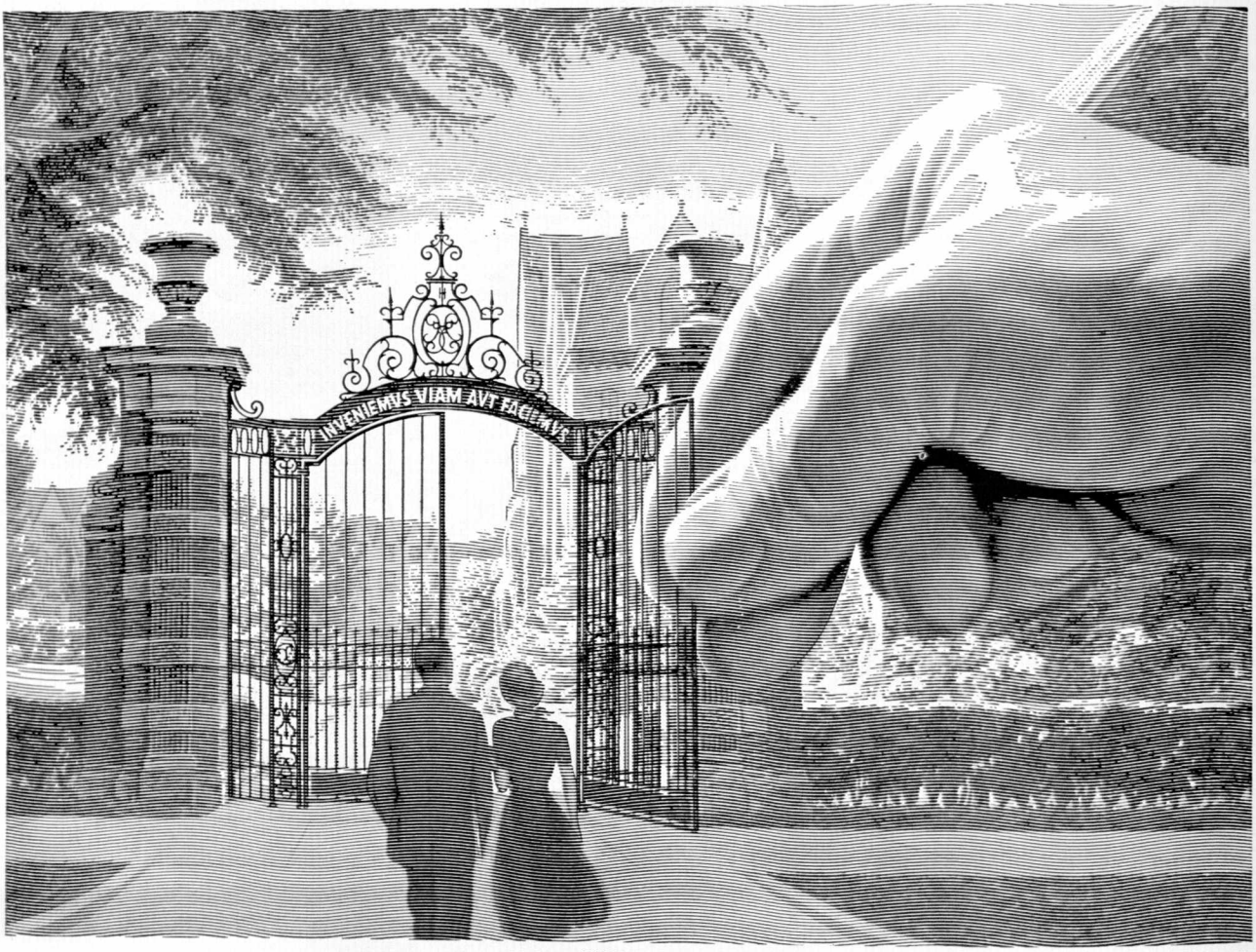

INVENIEMUS VIAM AUT FACIEMUS: "We shall find a way or we shall make one."
—Memorial Gate, University of Pennsylvania

Investing in young America . . . a progress report

"To HELP deserving young men and women obtain a college education . . . to give financial support to a cross-section of American colleges . . ."

FOUR YEARS AGO, the Union Carbide Scholarship Plan was established with those objectives.

Today, the plan provides the complete cost of tuition and fees for 400 four-year scholarships at colleges and universities throughout the country. As an important part of their education, the scholars are encouraged to gain valuable experience in their chosen fields by obtaining jobs in industry during summer vacation.

50 TECHNICAL SCHOLARSHIPS are also available in specific fields of study. They cover the student's tuition and fees for the senior year. In addition, to assist graduate students and to support academic research, Union Carbide offers 66 fellowships and grants-in-aid to universities.

THE PEOPLE OF UNION CARBIDE regard these scholarships as an important contribution to the future and to two of America's priceless assets—its educational system . . . and its youth.

TO LEARN MORE *about the Union Carbide undergraduate scholarships and the colleges and universities in which they have been established, write for Scholarship Plan booklet X.*

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CLUBS AND SOCIETIES

Engineering Council

From all indications, the eighth annual Engineering exposition will be a huge success. Last fall, the Engineering Council, which sponsors the exposition, received a much needed shot in the arm. A new constitution was drawn up under the direction of Dean Ryder. One of the best features of the new constitution is the requirments for membership. The Vice President of the Engineering clubs, Fraternities, and societies will also be an Engineering Council representative. Now, whole organizations are getting behind their representatives' project and getting the job done right. Our hats are off to Dean Ryder, the Engineering Council and the Engineering Clubs, fraternities and Societies for greater co-operation and accomplishment in this year's exhibition.

AIEE-IRE

The Student Branch of AIEE-IRE is an organization which has the purpose of acquainting Electrical Engineering Students with the activities and advantages of membership in their two professional societies, the American Institute of Electrical Engineers and the Institute of Radio Engineers.

The Student Branch was originally organized during the late 1920's. From this period until 1947 the student branch consisted of members of the AIEE. In 1947 a joint student branch was formed to incorporate AIEE and IRE. At the present time there are approximately 90 members of the national organizations in the student branch. The majority of these members are juniors and seniors and represent about 60% of the enrollment of these classes.

Any student who is registered in a regular course of study in engineering is eligible for membership in the Student Branch AIEE-IRE and in the National Organizations. We would like to point out that membership is in no way restricted to Electrical Engineering students.

Our meetings are held twice monthly on Tuesday nights and consist of short business meetings followed by speakers, movies and programs with topics of current interest to Electrical Engineers. Meetings we have had since publication of the January Spartan Engineer are:

February 7—A business meeting was held to plan the activities of the group in preparation for the Student Papers Contest and The Engineering Exposition. Exposition topics discussed were "the micro-midget car race" and "Student Exhibits." A committee was set up to take charge of student and industrial exhibits. This committee was charged with the responsibility of reviewing last year's exhibits, suggesting improvements and additions, and coordinating work on exhibits. Refreshments were served after the meeting.

February 21—A joint meeting with the Detroit Area Branch of AIEE-IRE was held with a program consisting of the reading of student papers. Ralph Powell, Royal Oak Senior, was chosen to enter the district competition at Purdue University.

March 6—A tapescript from the Bell Laboratories, "The Bell Solar Battery," was shown during the daytime the week of March 6 for anyone interested.

April 10—The Michigan Section of the AIEE presented "Industry and Education in Russia," a program held in the Union Building, to which all Engineering Students were invited.

April 24—"Computers Applied to Power Systems," presented by speakers from the Detroit Edison Company.

Meetings planned for the future are:

May 22—"A Is for Atom," presented by a speaker from the Detroit Edison Company.

Near June 1—Our annual picnic will be held which highlights the Junior-Senior Softball Game the winner of which plays the Faculty Team.

At the present time our members are hard at work preparing exhibits and serving on committees for the Engineering Exposition. Also we are in the feverish race to be sure that our Midget Racer is in winning shape. Our racing record in the past has been an "also ran" the first year of competition and second place winner last year. This year we are working on the racer harder than ever before and are confident that the next step in our racing record will be "the winner."

A. I. Ch. E.

"When the A. I. Ch. E. was formed almost 50 years ago, chemical engineering had just started to become a new branch of engineering. Its literature was almost non-existent and the few who could call themselves chemical engineers were widely scattered. The founders of the society knew that they were starting with a clean slate, and in the original constitution stated as general objectives the advancement of chemical engineering in theory and practice, and the maintenance of high professional standards amoung its members. Wisely, they left the ways and means to their successors.

Since the time of formation the institute has grown in vast proportions. In size, the expected 1970 membership is 70,000. In function, there are publications, conventions, lecture series, and awards to outstanding men.

The major portion of members of the Institute are professional engineers. The successors, however, will come from the body of students enrolled in chemical engineering in the colleges and universities throughout the country.

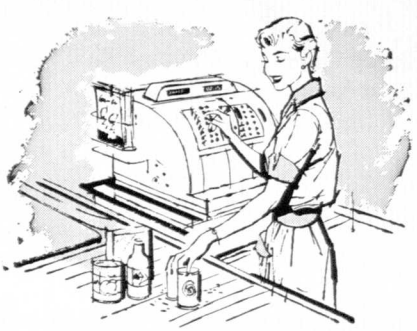
It is apparently important then to have student membership to keep up the work of the Institute, but the purpose of this article is to inform the students presently enrolled in chemical engineering at M.S.U. of the functions, and aims of the local chapter, and show the advantages of membership.

Although membership in the local chapter of the

(Continued on page 43)

NEW DEPARTURES OF TOMORROW

TOMORROW: Choose items from the monitor screen; electronic impulses select, assemble, deliver your order, total your bill and return your change.



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A week's shopping in minutes! And you haven't moved from your car. It's that simple at the Drive-In Market of tomorrow. **Just select your items from the monitor screen; electronic impulses select, assemble, deliver your order, total your bill and return your change.**

It's just a dream away! And when it takes shape, look for New Departure to provide the proper bearings to keep all moving parts functioning smoothly. New Departure ball bearings keep parts in perfect alignment, support loads from any angle and require little or no maintenance.

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NEW DEPARTURE
BALL BEARINGS

NOTHING ROLLS LIKE A BALL

(Continued from page 41)

A. I. Ch. E. is open to all students enrolled in a curriculum leading to a degree in chemical engineering, the most active group each year are the seniors. This possibly can be attributed to the crowded curriculum of the juniors and the separate departments in which freshmen and sophomores must take courses.

It is desirable, however, and an effort is made through invitation to obtain the highest possible freshman, sophomore, and junior memberships in order that the chemical engineer not so near graduation may become familiar with the actual work and problems of the field, work in coordination with his classmates, and meet the professors with whom he will be working and from whom he may get counsel in his problems whether they be academic or personal.

With this purpose in mind, the officers of the A. I. Ch. E. arrange six to eight programs during the year at which a speaker covers a phase of engineering or industry. This speaker is usually a person of some esteem working in industry. Some of the topics covered this year were Registration, Surface chemistry, ethics, and the work of the development engineer. An informal coffee hour is part of every program.

Several plant trips are arranged each year so that the student views various industries.

This year 12 members attended the national convention in Detroit.

At present a race car is being built and the chemical engineering building is being readied for the exposition.

At the end of each year an annual outing is arranged for all members who wish to attend.

Through these means the chemical engineer can find information and interest and help if he needs them.

Membership may be obtained by accepting the invitation sent to you engineers before each program and by attending. If you are interested, pay the $3.50 dues, your name will be sent into the national headquarters and you will be sent a membership card.

If further details are desired, they may be obtained by consulting Dr. Ludt, 4th floor, Olds Hall, or writing the American Institute of Chemical Engineers, 25 West 45th Street, New York 36, New York, and asking for the pamphlet, "Know Your Institute."

A.S.A.E.

The Agricultural Engineering club has been very active on the campus during the past year. The meetings are held biweekly and have been highlighted by outside speakers.

The first event last fall, other than regular scheduled meetings, was the judging of a tractor driving contest at Perry. This was done on a Saturday afternoon by five of the club members.

During the winter term, the members helped with Farmers' Week. The club ran an information booth at the entrance of the Agricultural Engineering building daily. At noon the club served lunch for exhibitors in the student room.

Another project is earning money to send representatives to the national meeting of A.S.A.E. in Virginia this June. To accomplish this, all of the club members work several hours and donate their wages to the club treasury.

Many activities will be occurring in spring term. The major project will be to remodel the club room. The first step will be laying of tile on the floor followed by the replacing of the furnishings.

The Engineering Exposition will be held later in the term. The agricultural engineers hope to equal last year's performance of winning first place in the midget auto race, and first and third in students exhibits.

The term will close with a student-faculty picnic and softball game.

A.S.M.E.

The second elimination speech contest was held March 12, 1956, at Jackson, Michigan. This meeting was held jointly with the Detroit Sub-Section and our student speaker representatives. The first place prize was a slide rule and case, which was presented to Tony Burdo, who gave his paper on "The Outlook of Titanium." Tony will represent M.S.U. in the Regional Student Conference which will be held in Kellogg Center, April 27-28. At this conference there will be an expected 250 students and faculty from 19 other colleges and universities.

To "break the ice" at the conference, the second and third place papers will be presented by Marvin Vanderploug, title, "Cobalt 60" and Leroy Louchard on "Automobile Design."

Our meeting of April 10th was attended by 75 people, who enjoyed our guest speaker, Roger Huntington. His topic was "Secrets of Stock Car Racing," followed by a very interesting movie on the subject. Some of the fellows had a chance to ride in three of the cars that were down to Daytona Beach for the races. Although they didn't go the clocked 136 m.p.h., they did have a very good ride.

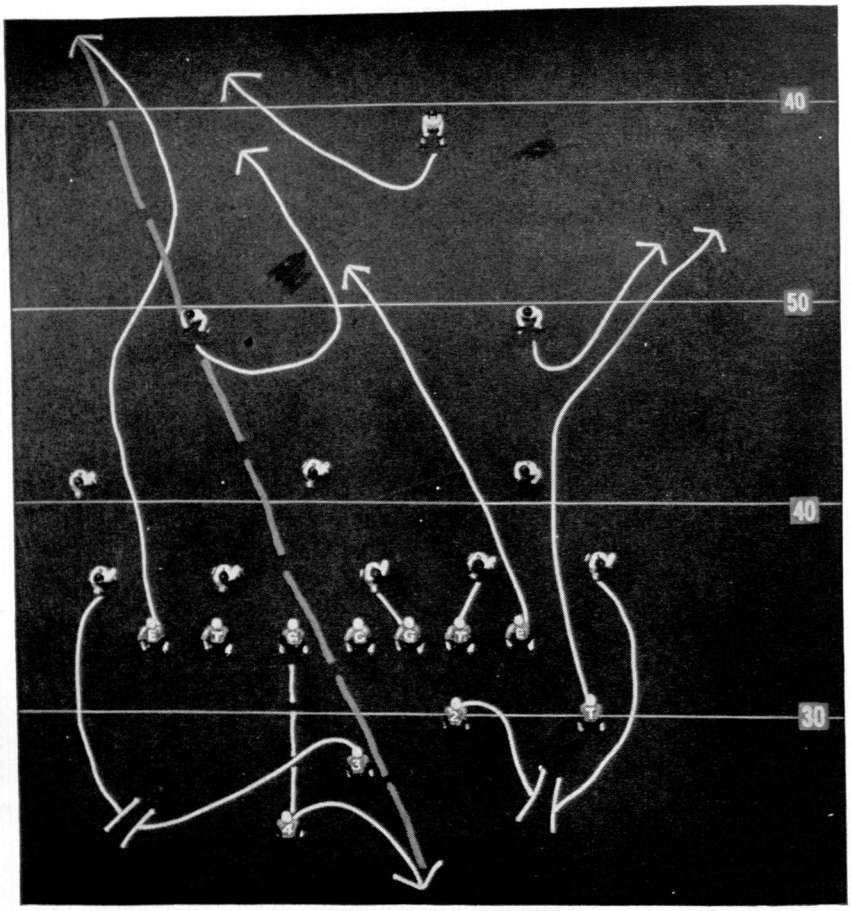
We have jobs for more engineers at both the Student Conference and for the Engineering Exposition, so if you have a few spare hours during these events, please contact Mr. Hemmye or Tony Burdo.

A.S.M.

All engineers interested in metallurgy are eligible for membership in A.S.M. Two or three meetings a term are arranged where there is a short business session followed by a technical discussion led by persons from industry. The A.S.M. tries to arrange at least one field trip a term.

During the past term the A.S.M. has co-sponsored one field trip and one meeting with A.F.S. The field trip was to the Dow Chemical Magnesium Foundry

(Continued on page 57)



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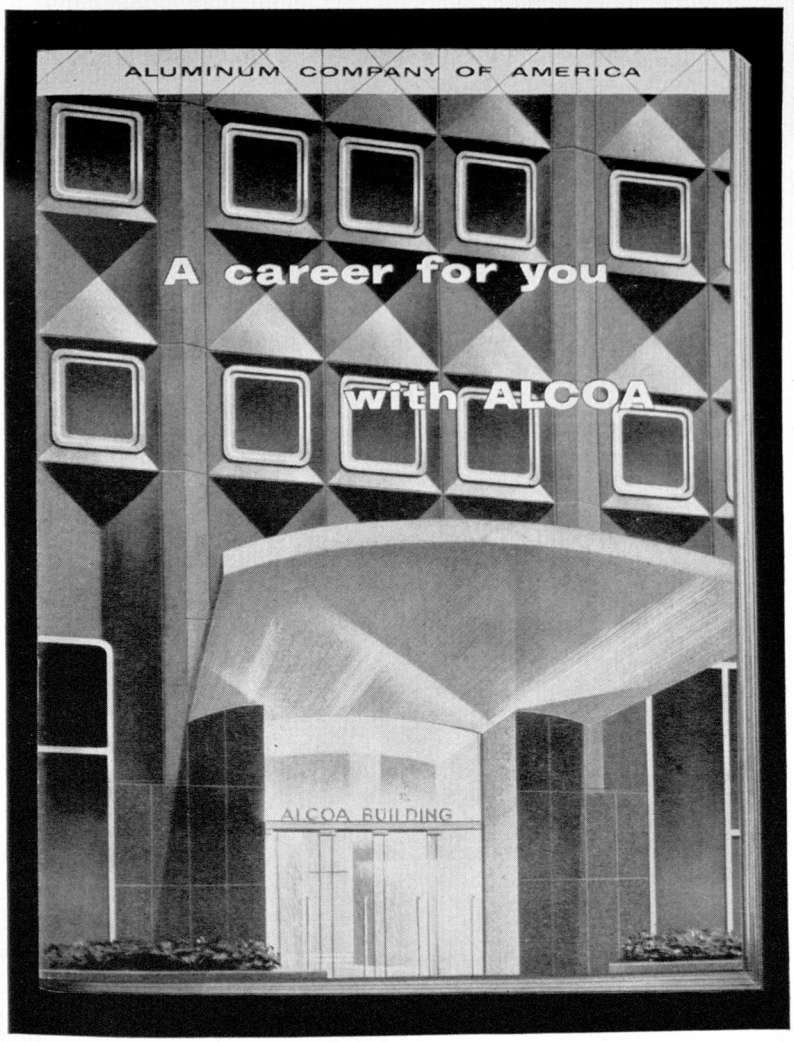

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A FEW YEARS AGO, HE WAS ON CAMPUS AT PURDUE UNIVERSITY, AND NOW . . .

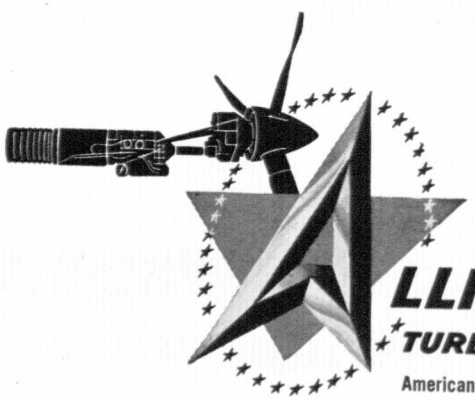
FLOYD D. (Doug) WALLACE, JR., above, is a senior project engineer at Allison.

He left Purdue in 1947 with his AE degree and came to Allison the same year. Presently, he is in charge of instrumentation and automatic process controls at Allison's new Research & Development test center.

With Allison now in the midst of a $75 million engineering expansion and building program, much of his time is spent in vendor contact work, studying and selecting equipment most adequate to do the job; observing, and helping with installation. He is shown above checking a control valve positioning amplifier on the instrument panel for controlling air pressures and temperatures of four electric motor-driven, axial flow compressors. This new facility is part of the new Research and Development test center, which—when completed—will enable testing of individual combustion components for turbo-prop and turbo-jet engines, compressor and turbine components.

Doug's work is "cut out" for him for some time to come, for only recently, Allison broke ground for the engineering building which is to be the center of expanded Research and Development facilities for advanced types of aircraft engines for commercial and military use.

With this long-range expansion program, Allison needs more engineering personnel, and opportunity for young graduate engineers is unlimited. Arrange now for an early interview with our representative on your campus, or write for information about the possibilities of YOUR engineering career at Allison: Personnel Dept., Engineering College Contact, Allison Division, General Motors Corporation, Indianapolis 6, Indiana.



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American built for the new era in air travel

PLACEMENT BUREAU

(Continued from page 17)

students are kept advised of current employment trends, manpower shortages or oversupply, as well as current starting salaries.

7. In a centralized placement operation, you have trained personnel who are always available to discuss placement problems with any student or alumnus who wishes an appointment.

To render the best possible service, the Placement Bureau has four divisions. They are:

1. Senior Placement Division.
2. Education Division (Primarily teacher placement).
3. Business and Industry Alumni Placement Division.
4. Part-time Student Employment and Summer Placement Division.

The Senior Placement Division is responsible for all senior interviews and the scheduling of company visits. It is also responsible for the scheduling of company visits for those companies who visit the Placement Bureau during spring term for interviews with Sophomores and Juniors (primarily Juniors) for summer employment. Most summer employment jobs are of 8 weeks duration. Sophomores and Juniors taking interviews for summer employment do not have to complete a placement bureau information sheet. However, most companies request that their own application form be completed prior to the interview. Publicity relative to company interviews for summer employment is carried in our weekly bulletins of company visits.

During the school year and during the summer months many of our students find it necessary to work part-time to supplement their other incomes. The Part-time Employment Division handles these students. Last year more than 12,000 jobs were filled by students working part-time. Last summer approximately 3500 students obtained summer employment in camps, resorts, summer hotels and industry because of aid from this division. Many technical business firms who employ engineers for summer work but do not come to the Placement Bureau for interviews, list their requirements with this division of the Bureau.

The Education Division deals primarily with the placement of teachers, principals, and superintendents. Also the placement of people who are qualified to teach on College and University faculties.

The Placement Bureau also maintains a small, but up-to-date, library on approximately 1000 different companies. Moody's Industrials, Business Week, Fortune and other current publications can also be found in the library.

Most senior engineers are quite interested in the average starting salaries. Rather than specific averages, I'll give average ranges. These are the current figures:

B.S.	M.S.	Ph.D.
$410-425/mo.	$450-475/mo.	$590-650/mo

Remember—the Placement Bureau is your Bureau. We are here to serve you in any way we can in our designated area. If you have a problem and you feel we can help you, come over and see us.

OVER POPULATION

(Continued from page 21)

totle preached child killing and this was practiced by the Hawaiians and Tahitians. The mass adoption of birth control could avert disaster, but it is opposed by many religious blocks. Japan and Switzerland have legal abortions. If for no other reason, the solution by a series of Atomic wars is dispelled because it would offer only temporary relief. The total populations of Russia and the United States would be replaced in 10 years.

India plans to add 15 million cultivated acres by the end of 1956 in her recent five year plan, but this will not even keep up with her five million annual increase. Pakistan boosted food production by 20%, but it was cancelled by the population increase and there now is 10% less food per person than 15 years ago. Agricultural production per head is lower in Japan, Burma, Indies and Ceylor than it was before World War II. Most countries would have to double food production to meet the United Nations Food and Agriculture Organization's minimum daily intake of 2,650 calories. The United States average is 3,200 calories per day.

A prime problem is, paradoxically, man's increasing ability to prolong life. In underdeveloped countries the death rate has been lower while the birth rate remains stationary. Fertility will remain until industrialization and urbanization come about. The present high fertility and lower death rate yield a sharp increase in population.

Medical progress must be accompanied by progress in other domains. The United Nations Population Branch prepared regional forecasts which are essential to planning all aspects of economic and social development. A Seminar was held in Bandung in November for the exchange of data and views for development. This Seminar was related to a research project of the Economic Commission for Asia and the Far East on population growth and economic development. They considered the relation between populations and manpower, employment, public health, education, housing, consumption of goods, capital formation, investment and level of living. The International Social Science Council awarded special fellowships for further study to Burma, Ceylon, India, Japan, Laos, Pakistan, Philippines and Thailand. A Seminar was also held in Rio de Janeiro in December. For an improved standard of living, vigorous programs are now operating or being formulated there. Twelve Latin and South American countries received fellowships. The many ramifications of the problem are illustrated by a list of interested organizations that

(Continued on page 57)

"A new era is beginning...

"As I review the progress in aeronautics within so short a span, and marvel at the complex aircraft of today, I call it an achievement little short of miraculous.

"Today, electronically-guided planes take off and land without human touch. Lethal sky missiles seek and destroy invisible targets with uncanny precision. And still other fantastic achievements in both man-controlled and pilotless flight are now in the offing.

"When men go to the moon and planets, electronically-controlled skycraft will take them there. Aviation maps will be studded with stars as well as with cities. New developments in aeronautics will go on and on. Success opportunities and careers will continue to develop for ambitious young men in this exciting field where a new era is beginning."*

LEE De FOREST

Appropriately qualified to speak for aeronautics and other fields in which his own scientific achievements play an important part, Dr. Lee de Forest gives helpful counsel to young graduates headed for successful, rewarding careers.

His expression, "a new era is beginning," has particular significance at Northrop, world leader in the design, development and production of all-weather and pilotless aircraft.

At Northrop, permanent positions are available that offer full play for individual talent and ambition. Here the graduate engineer will find interesting assignments for which he is best fitted. Surroundings are attractive, co-workers congenial, opportunities for advancement unceasing, the compensation good.

For detailed information regarding specific openings in your field of specialization, write Manager of Engineering Industrial Relations, Northrop Aircraft, Inc., 1001 East Broadway, Hawthorne, California.

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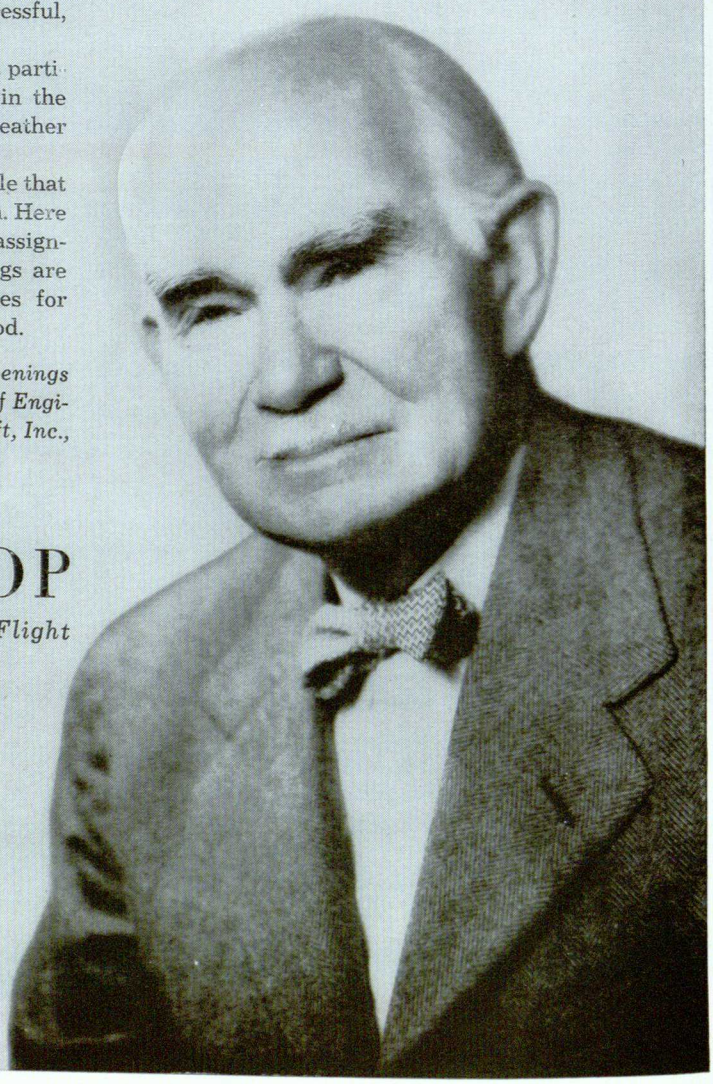


**A statement by Dr. Lee de Forest, pioneer in radio.*

Eighth Annual

ENGINEERING EXPOSITION

by ROGER PRUESS, M. E. '56
and RICHARD HERRICK, M.E. '56

Once again, State Engineering students get into the swing of the Engineering exposition. For many it will be sweat and hard work setting up displays, moving exhibits, painting and erecting signs, tuning up engines and a bustle of last minute activity. Others will be tossing their sun tans into the corner and dusting off suits and ties for guiding and demonstration activity, and of course the Engineers' ball.

The object of all this extra curricular activity is to present an appealing view of Engineering to many guests, particularly to high school students. All sorts of devices are conjured up to point out the accomplishments, challenges and opportunity of Engineering.

The Engineering Council is responsible for the organization of the exposition. Jim Koan is this year's General Chairman and has had the well organized help of all the Council representatives and their respective Clubs, Fraternities, and Societies.

Regular visitors will recognize the perennial favorites of the exposition: the magic faucet, the Corliss steam engine, the lie detecting light bulb, invisible fish, singing light and many strength tests.

Many educational and eye catching Industrial displays will show off the products of engineering skill, and of course will urge students to study engineering and fill the nations' need for engineers.

The high school students themselves will have a chance to show off, too. A $25 U. S. Savings bond and a suitable trophy is offered as first prize for the outstanding jet club exhibit. Mr. Skamser has contacted several hundred clubs, urging them to visit and participate in the exposition.

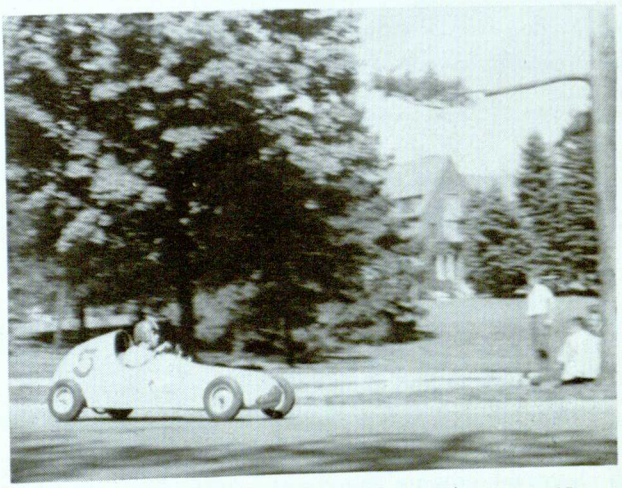
As in previous years, there will be the annual auto race, and this year there will be new cars, rules, and course. Safety will be the keynote as far as design is concerned. All cars will feature roll bars, and safety belts, and a rigorous safety inspection will be held prior to the race. A minimum of six and possibly eight cars will participate. Some of the entries being Triangle, Ag. engineers, S.A.E., and Civil engineers. The drivers will pilot their 2 H. P. racers around the Snyder-Phillips Dormatory at about 25 m.p.h. The new course is about ½ mile long and should provide more safety and better spectator facilities. It is scheduled for Saturday afternoon, about ½ hour after the time trials. Two trophies will be awarded, one for the winning car, and one for the most attractive one.

As usual, an auto show will be open both Friday and Saturday. This year you'll see everything from stock cars like the Studebaker Golden Hawk and Packard Carribean to sports cars and special numbers such as Continentals, and Thunderbirds. For variety, possibly a few antiques. The show will be in Dem Hall and the drill field.

There will be several special shows presented daily. The General Motors Preview of Progress, demonstrating such interesting possibilities as high frequency cooking. Bell telephones will present a show which concerns modern communication. Both shows are free and a look at the exposition program will tell you just when you can see them.

The exposition will be climaxed Saturday night by the "May Hop," an all-university semi-formal dance, sponsored by the engineering council. The dance will be held 9-12 in Brody Hall, with music furnished by Tiny Piper and His Aristocrats, an out-of-town outfit making its debut at State. Tickets are available from the various engineering societies and at the Union Concourse ticket window for $2.25 a couple. During the intermission, the first initiation for the Knights of St. Patrick will be held. The Knights of St. Patrick is a new organization on campus, but it originated back in 1903 at the University of Missouri. It is an activities honorary open to juniors and some seniors who have shown much interest in the various activities in the engineering school. This year's candidates will not know of their appointment until intermission time when they will be called from the audience.

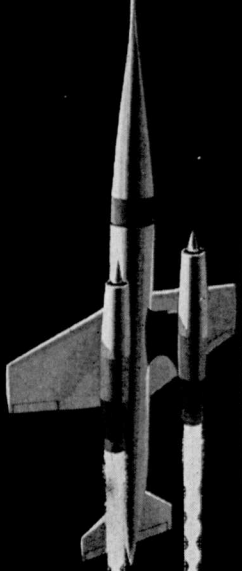
All in all, May 11 and 12 should be a great week for everyone on campus with the Engineering Exposition, International festival, and parent's weekend all at the same time.



Last year's winner of the midget auto race was the Ag. Engineers entry. Holding a commanding lead, it rounds the final curve by the Women's Gym.

marquardt *Announces*

A NEW PROGRAM OF



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I. P. D. gives our engineers a chance to advance to their maximum potential in their present fields... and those beyond... in a climate of continuing professional growth from in-plant courses and more than fifty current courses in Southern California's leading universities. New courses are constantly being added.

I. P. D. differs in its concept and objectives from ordinary company training programs in that it gives each engineer an opportunity to grow and plan his development toward his own goal and at his own pace rather than having to follow a rigid predetermined pattern.

I.P.D. is part of an overall expansion program which anticipates a two-fold increase in personnel during the current year. This increase represents many additional engineering opportunities. You can become a leader in supersonic propulsion. Write for details.

FACULTY MEMBERS' INQUIRIES FOR SUMMER EMPLOYMENT INVITED

MASTER'S DEGREE . . .

EDUCATION MADE EASIER

By Forrest H. Frantz, Sr.

Reprint from Industrial Science and Engineering

The student who decides to earn the Master's degree is confronted with the six letter word *thesis* which usually accounts for six credit hours in his graduate program. Considerable myth has grown about the creation of a Master's thesis. It is unfortunate that so much of the myth is of a pessimistic nature that leads many students to believe the creation of a thesis is a tedious undertaking beset by drudgery and unpleasantness. This is not the case at all. The thesis requirement allows you to investigate a subject that is of particular personal interest. There is no other place in your program of formal study where you may select a special subject for study and earn six hours credit. How then can the creation of a thesis be considered anything but a wonderful opportunity for a delightful experience?

In laying plans for the thesis undertaking you should keep several things in mind: (1) Your thesis will be your calling card when you go job hunting; (2) The thesis will be available for examination during and beyond your lifetime; (3) You are more likely to create a good thesis if you are intensely interested in the problem; (4) The thesis has greater stature if it makes a definite contribution to society and the fund of knowledge.

Many persons take the attitude that Master's research must not necessarily contribute to society if it yields a considerable amount of knowledge for the student and demonstrates ability to conduct individual investigation. There is no doubt, however, that the thesis which contributes to the general fund of knowledge receives more attention.

Select the subject early

The choice of a thesis problem is not a simple, straightforward matter. The student cannot blindly say, "I will do this," go to work, and come up with a thesis that is worthy of the effort. He should select his general area of endeavor and then with the helpful suggestions of his thesis advisor narrow the research range to manageable size. This does not imply that the thesis problem can be pinpointed at this time. But the thesis subject should be tentatively selected early in the graduate program. There are definite reasons why this should be done.

In the first place, it is quite possible to select a problem, do the experimental work, and then find similar work reported in the literature. If a student allows himself to do this, he tells the world that it took him months to learn what he could have learned in the library in hours.

A second reason for making an early tentative problem area choice is that in so doing you alert yourself to information pertinent to your problem which may be part of your course work, reading, or of the conversation of teachers, fellow students, or co-workers. Other reasons for getting an early start will become apparent from the procedure proposed in this article.

ment or series of experiments, if possible. This explora-

After the thesis problem area has been selected, you should conduct an initial exploratory experition will familiarize you with the practical aspects of the problem and stimulate questions and interest for guidance in your library research. The set-up should be inexpensive and rough to save time, but it should be of adequate quality to allow results of moderate accuracy.

Ready-made instruments and equipment should be used wherever possible to save time. The great researcher, Charles Kettering, once pointed out that a lab technician could lose considerable time if he didn't have quick access to a ten cent ruler when he needed it.

In the course of my Master's research, I undertook the adaptation of an old bomb-sight component as an electrode positioning device. My thesis adviser, Dr. August Raspet of Mississippi State College's Aerophysics Department, quickly pointed out that a milling machine could be used as the electrode mount. This provided the required three degrees of freedom for electrode positioning without any modification or extensive equipment building. On another occasion a research adviser commented to me that one of his students had just consumed a month in building and painting a precise and neat wooden box to hold an experimental component that could have been housed in an available shipping crate without detriment.

When you run your exploratory experiments, begin an *experimental notebook*. This notebook should be one of the large better quality spiral or journal type books. This is cheap insurance against loss in a maze of loose papers of odd sizes. Entries should be made

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THESIS WRITING

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in ink whenever possible and the date of the performance should be recorded in case a quesition of priority ever arises. The entries should contain sufficient information to allow a repetition of the experiment under similar conditions at some future time. Entries should be made on one side of the page only so that data sheets, graphs and photos may be stapled to the blank page opposite pertinent entries.

Be careful not to become so engrossed in the exploratory experimental work that you continue it for a long period of time. Complete or at least slow down the experimental work in two or three weeks, and then begin your library work in earnest.

Prior to the first journey to the library in connection with the thesis work, obtain a copy of your school's style manual for thesis writers. Use this manual as a guide for recording reference information in accumulating a tentative bibliography of published literature on the thesis subject. A *library notebook* similar to the laboratory notebook should be used for this purpose. *Electronic Engineering Master Index, Engineering Index, Science Abstracts, Chemical Abstracts* and the library card catalog should be most helpful in compiling the bibliography. In general, you will find the basic knowledge concerning the research subject in books. The specialized, most recent information on the subject which will be of greatest value will be found in periodicals, theses, and other sources of this nature.

After the bibliography has been compiled, you are ready to venture into the stacks of reading. Keep notes on your reading in your library notebook so that you can readily return to the source of a certain piece of information. This notebook will help you if you forget the author or the title of the article that contained the information. Add to your bibliography from the footnote citations as you read the sources on the original list.

To be sure that your literature search is up to date, go directly to the periodicals in the subject field and scan back from the current date for a period of one to two years. You can determine how far back to check by noting the latest dates of publication catalogued in the "Indexes" used.

At this stage you are ready to begin serious experimental work if you don't find that someone has already done the work originally planned. It is probable that your reading will have given you new ideas and that you will have redesigned your experi-

mental plan several times during the course of your reading. The experimental plan will be subject to change even during its conduct. Einstein said, "Intuition resting on sympathetic understanding of experience leads to nature's truths."

As you engage in experimental work, you gain experience. Again, keep in mind the importance of using available instruments and equipment whenever possible. Be more accurate in this portion of the undertaking than you were in the initial exploration. Qualitative treatment is inadequate at this stage.

Lord Kelvin said that when you can measure and express quantities with numbers, you have advanced to the stage of science, and if you can't, your knowledge is meager. Be sure to record identification numbers for the instruments used, and if at all possible, make quick checks of instrument accuracy.

You will find that you can continue library work through the experimental stage. You will come across new information sources, and go back and recheck your original reading. But having familiarized yourself with the literature earlier, your reading now has greater depth of meaning. You'll also find it advantageous to begin writing the thesis. What can you write before finishing the experimental work? Write the introduction, the equipment section, the procedural section, and start the discussion section. You'll probably want to make changes in them later when you settle down to the serious writing. However, early writing attempts will have been good experience when you tackle the final writing, and in most cases, you will find that the preliminary writing brings up valuable questions and ideas.

A caution is in order here. Don't allow yourself to anticipate a conclusion to be reached from the work. If you do allow yourself to anticipate a conclusion, you become unconsciously biased. Then you may work toward a preliminary conclusion and overlook important possibilities that might yield a different conclusion.

When the experimental work has been completed you are ready to begin writing in earnest. If you have followed the suggestions in this article, you will have at hand at this point: (1) A thesis writer's style manual; (2) A complete bibliography of reference material in your library notebook; (3) A partially written rough thesis; (4) A well-organized record of experimentation in the laboratory notebook. With these, you are prepared and the serious writing of the thesis will not be very difficult.

Some suggestions on the mechanics of coming up with the final copy of the thesis may be helpful. The thesis writer's guide will, of course, furnish the information concerning layout. The first serious writing of the thesis will probably require changes. Proper spacing of pages and footnoting also present a problem. Therefore, type the text of the thesis on legal size paper without footnoting on the first go-around. The footnotes should be typed together on another sheet of paper. If any paragraph must be changed enough to require rewriting, it is merely snipped out with a pair of scissors and the rewritten paragraph is pasted in its place. After all changes have been made, the legal sized text sheets may be cut to the proper length to leave the space required for the footnotes on the final thesis size pages. Thus, the thesis is pasted together, and is in the properly spaced form to allow the typist to prepare the final copy free of spacing and layout problems. This presumes that the same typewriter was used for the paste-together copy and the final copy and that the marginal and other mechanical requirements of the school have been met. Usually a check with the person in the school library responsible for the layout and form acceptance requirements on theses is advisable, if not required, prior to the final typing.

Thus far small mention has been made of one of the most important influences in thesis work. This has been intentional because this influence is present at every stage of the work and is of such importance to be deserving of special, separate mention. This influence is the thesis adviser. The thesis adviser is your personal guide, consultant, and a powerful source of inspiration.

It is important that you consult with the thesis adviser during the period of thesis selection because the adviser usually has his finger on the pulse of challenging problems in your field. He is likely to know the type of problem that will constitute an adequate thesis undertaking. It is also well to consult with him concerning the way in which the work is to be handled. He should be considered as your primary guide. This article is in no way intended to minimize his importance, but rather as a help in your thesis work, intended to save your time and his.

Before, during, and after each stage of the thesis undertaking, the adviser should be consulted. Don't report only your problems to him; let him know about your successes, too. Don't try to keep him so informed or lean upon him so heavily that you consume a disproportionate amount of his time. Present your findings in lucid form for rapid interpretation. Mississippi State's Dr. Raspet has a standard recipe for researchers who come to him with an assortment of loose data sheets. The recipe: "Plot it and bring me a graph." Depend on your adviser as a guide, but don't try to use him as a crutch!

The ideas presented here are subject to modification to fit the particular subject field, school, and other circumstances. A discussion with your adviser of the points enumerated in this article might yield a plan more tailored to individual considerations. If you approach the thesis requirement with the right attitude you will find thesis work enjoyable, and furthermore, you will find that your thesis will be a helpful friend in future time.

A Code for Interviews

This code of ethics was prepared by the National Electrical Manufacturers Association:

1. In anticipation of an interview with an organization, it must be the responsibility of the student to prepare himself properly by reading literature, attending meetings at which the story of that industry is being presented, organizing his own thoughts in order to ask and answer questions, and being as fully informed as possible on the type of business conducted by that organization.

2. He should be prompt in meeting interviewers and in handling his correspondence.

3. He should not accept interviews after he has signed up with a company.

4. After accepting an offer, he should promptly notify those companies whose offers are to be rejected.

5. He should use care in filling out various necessary forms.

6. He should recognize that failure to answer offers of employment is detrimental to his classmates, and therefore, he should be prepared to make his decision far enough in advance of his graduation so that industry can make its plans.

7. He should keep the placement office or faculty members intimately advised concerning his negotiations.

8. He should recognize that regardless of the number of interviews he takes he should conduct himself in a business-like manner and not expect individual or unusual consideration or entertainment.

9. He must recognize that he must sell himself and that industry can advance him only on the basis of his performance.

KIDNEY BEAN

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The government was setting to cancel the billion dollar contract and the manufacturers readied themselves for high-diving into a dry concrete pool. An insignificant piece of metal, "size of a lady's shoe heel," generally known as a spar, held the production to a crab in the sand speed. It took six hours truncheon beating to put the piece into proper shape. A total of twelve hundred hours required for one plane.

In this case, as in the first, Paul went through the necessary steps of reasoning. They were many, but in the end he came up with a device which reduced time from the twelve hundred hours to less than five minutes. One operation saved untold number of precious hours, hundreds of millions of dollars in production and space.

From that point on Paul's judgment was at a premium. He was loaned and he was borrowed. He was asked to travel and called in on solutions of possible and impossible riddles. His views were considered and accepted on such projects as moving sidewalks, harnessing ocean waves, piping polar and tropical air in opposite directions, rocket motive powers and electronic frequency receivers to control and guide autos, trains, and ships.

Paul's two fingers again reached for the watch in his vest pocket as he stood up.

"I just imagine the potentials of unlocking nature's mysteries, the wealth, and the fame you would have acquired, sir, had you secured the doctoral degree. Might even have discovered a way leading from here to the hereafter. With no fear or pain people would walk across thereto and back, like they do across the border to Mexico and back," Mr. Hagenbush uttered his sentiments obsequiously.

"That would have been quite something, Mr. Hagenbush. Only I begin to think that that field was not meant for me."

"I do not see why, sir. You are always full of ideas."

"Mr. Hagenbush, ta, ta. You are laying it a bit too rich." Paul deliberately interrupted his loyal accountant. And then, for a diversion, added, "If you were to say that it was meant for me to discover a way for moving Venus and Mars from their present respective orbits into their new paths, where they were to receive a moderate amount of sun's warmth and to develop an environment suitable to the earth's people, perhaps in that I might agree with you more readily."

"Oh, ho-ho! In either case, sir, you would come to a wealth that has never been known to man since the beginning of times!"

"Should I really be able to find the 'Boundary Invisible', Mr. Hagenbush, what would I do with the possession? I could not take it along with me, you know. Besides, I was never too hungry for it. Instead, I have always preferred people. I like to prattle and laugh with them. The money is so obviously sordid. Only gamblers can not resist it. And then, again, having doctoral honors does not necessarily follow that one could do better than well in the wrong field. Take me, for an example, I might still be jabbing kidney beans for a modest five thousand dollars a year."

As is known, life denies nothing to him who knows how to work with nature. And it can not be said that Paul was the one who peered at her through the bars of a trundle bed.

CLUBS AND SOCIETIES

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in Bay City. The meeting featured Mr. Karpicke, Chief Metallurgist of the Saginaw Malleable Iron Plant, as speaker. Another meeting of A.S.M. featured Mr. F. C. Bennett from the Dow Chemical Company. Mr. Bennett gave a very interesting description of the importance of magnesium die-casting in industry today. The A.S.M. annual picnic, now in the planning stage, is to be held this term.

The principal object of A.S.M. is to furnish students with industrial contacts and to give them first hand knowledge of the types of problems they will be expected to cope with upon graduation. Another objective is to promote greater interest in, and better understanding of, the field of metallurgy.

OVER POPULATION

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attended this Seminar. They are the U. N. Economic Commission for Latin America, U. N. Educational, Scientific and Cultural Organization, World Health Organization, International Labor Organization and the International Bank for Reconstruction and Development.

It is evident that the solution to this problem lies in intense and carefully planned measures. Six per cent of our nation's revenue is now needed to maintain our present standard of living with a 1% increase. Most countries can not maintain this expenditure. If the problem is to be solved on a world wide basis, then the industrialized countries must assist those not capable. The aid in the amounts now given is insufficient. Programs must be initiated to eliminate irresponsibility in wasting natural resources. Modernization is to include control of animal and vegetable disease, which takes a heavy toll each year, rational cultivation of good stocks, mechanization and soil improvements. New miracle sources for foods and energy offer possible solutions. The Algea and Plankton (animal) of the sea remains as a seemingly unlimited supply of food. An international gathering at the University of Arizona was told solar energy, water and common minerals produce synthetic Algae with protein value equal to that of milk and eggs. Nuclear energy and space conquest offer other real solutions.

The final solution or partial solution will depend on financial and economic steps, credit facilities, agrarian reforms, efficient marketing, communication and transportation. Such a complex problem demands immediate attention. Only long term planning of social, cultural, technical and economic factors will produce a rational solution. Men in such creative fields as engineering and science may be called upon to attack the problem with a zealousness analogous to the soldier fighting for immediate survival.

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tion that may be adapted for use with electronic computers or other devices which produce a flow of visual information.

The sensitivity of the new paper has been achieved by applying a thin layer of a special zinc oxide in a resin binder. Both are inexpensive materials and readily available. The coating may be applied to a wide range of papers, from those of low-cost wood pulp base to high strength bond, according to the requirements. When the paper has been coated, it remains insensitive to light, and hence may be handled without fear of inadvertent exposure, until the coating is given a negative electrostatic charge.

The charge is applied in the dark by transfer of ions as a charged wire is moved across the coated surface. Once the charge has been placed on the layer, the paper is sensitized and must be shielded from light in the manner of ordinary photographic film. The uncharged coated paper, however, will keep indefinitely without deterioration.

In the Electrofax process, the charged paper is exposed by any of the conventional photographic procedures. The electrostatic charge is reduced in the areas exposed to light, depending upon the intensity of the light, leaving a latent electrostatic image on the coated surfaces.

The latent image on the paper is developed by applying a pigmented resin powder carrying a positive electrostatic charge which causes the powder to stick to the negatively charged areas on the coated surface. To accomplish this, the research team developed a magnetic "brush" consisting of a mass of iron filings mixed with the powder and picked up on the end of a permamagnet. The iron particles take on negative charges, while the particles of powder become positive. When the "brush" is swept across the paper, the image is revealed immediately as the particles cling to the areas of lesser light intensity.

When the "brush" has been swept over the entire surface of the paper, the resulting powder image is fixed permanently by baking the sheet for a few seconds at a temperature which will cause the resin powder to melt and fuse to the coated surface, creating a durable, light-fast picture. If for any reason the image should be unsatisfactory, it may simply be brushed off before the baking process takes place, and the paper used again. After baking, the image is as rugged and permanent as any ink-printed image.

X-Rays Measure Aluminum Foil

Housewives can thank X-rays to a great extent for that multi-purpose aluminum foil which they use for everything from wrapping food to making Christmas tree ornaments. Although only one-half the thickness of a newspaper page, it is strong and will not tear easily.

This thickness is gauged by an X-ray measuring device. Sheets of foil, traveling at a speed of 40 miles per hour, are measured to two-thousandths of an inch, or one-fourth the thickness of a human hair, as they pass down the production line in aluminum foil plants.

An X-ray beam passes through the sheets of foil at a known intensity. Should the thickness of the foil be other than specified, the beam will travel through the metal at an irregular flow. This is recorded on a control panel to notify manufacturers of the undesirable thickness.

Plastic Strips Eliminate Painted Lines

Repainting of faded traffic lines is completely eliminated by cities using a new marking system of sturdy, flexible Geon vinyl plastic strips and markers called Nefslabs. Manufactured in a variety of colors, they are applied to pavement with a special cold adhesive. They have been tested in a number of cities for several years without needing replacement.

The plastic Nefslabs are compounded to be tough, yet flexible so that they do not become too brittle even at sub-zero temperatures nor too soft in the hottest weather. They do not crack or chip from the constant pounding of traffic and the rigors of weathering. Nefslabs also resist the effects of water, gasoline, oil and salts. The plastic is colored throughout, always presenting a bright surface.

Nefglu adhesive, supplied with every order, eliminates the need for any metal fasteners which are frequently recommended for other markers. The road surface is cleaned, adhesive applied and the vinyl markers put down. Foot pressure or a hand roller on the Nefslabs securely fasten them to the pavement. The glue is quick setting, keeping traffic interruptions to a minimum.

Finds Leaks That Almost Aren't There

Manufacturers of electronic tubes and other products involving vacuum or pressure systems can now find leaks so small that it would take 120 years for a thimblefull of air to get through. A new mass spectrometer leak detector is not only that sensitive, but also can find a specific leak in the presence of other leaks.

Here's how the equipment works: Helium gas is used as an indicator and is pumped into a vacuum or pressure system. If there is a leak present, the gas will pass through and be picked up by the leak detector. In the device, the helium is drawn into a mass spectrometer tube, and electrons are knocked off of some of the helium molecules in a process called ionization. The ions are focused into a narrow beam by magnetism and an electrostatic field sends them traveling at high speed between the poles of an "analyzing" magnet. This deflects them 90 degrees through a collector split. Then the helium ions are hurled against a collector plate and give up their electric charge, which is amplified to register the leak rate.

Radio announcer to clergyman: "You're on, Bishop, and please remember about those quotations from the Bible that we censored."

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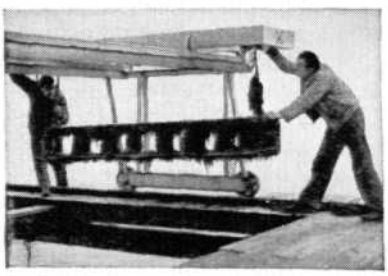

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To help you plan Inco Nickel into your future, International Nickel Company has collected data from almost a quarter of a million individual tests on the behavior of metals and various other materials under all sorts of corrosive conditions.

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