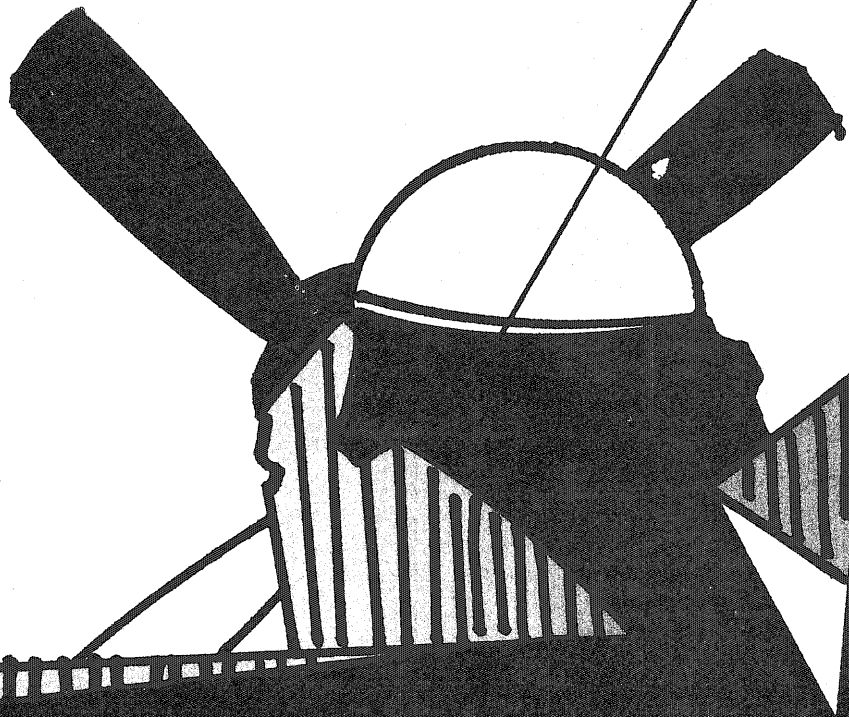
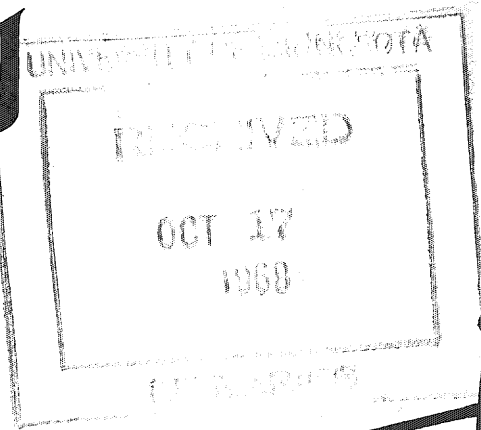




technolog

P-51 Mustang

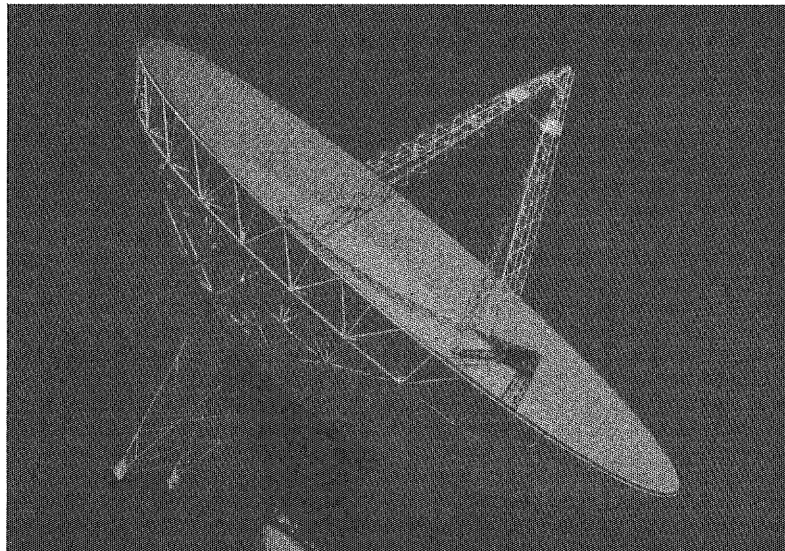


APD
OCTOBER, 1968

Westinghouse needs engineers with light experience



**unless they prefer
to work in the dark.**



Ever since George Westinghouse lit up the 1893 Chicago Exposition with alternating current (a first), we've been shedding a lot of light on America. Today, our nuclear power plants light many of the world's brightest cities. We're working on an advanced breeder reactor. Our new spherical laser is the most efficient of its kind.

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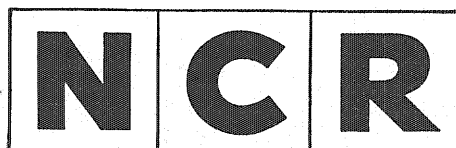
Right now, hundreds of engineers, chemists, and physicists are exploring their own ideas at NCR. We encourage them because we consider idea-people as the backbone of technological advancement in our field of total business system development.

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Whether you're a seasoned pro, or an ambitious self-starter, and whatever your degree, if the excitement and satisfaction of start-to-finish idea development appeal to you, you'll go far with NCR. And so will your ideas.

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Try Xerox and see



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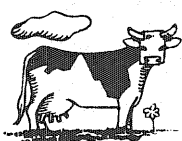
* If you need more excitement, you might find it on the 42 golf courses in the Rochester area.

XEROX

An Equal Opportunity Employer (m/f)

How to keep a cow's mind on milk. Instead of flies.

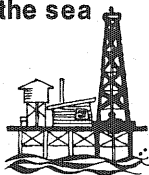
An informal report on a few current projects at Shell. Some of them might seem like offbeat work for an oil company. But this is a company that contributes broadly and significantly to society. A company of experts that brings out the best in its engineering, scientific and business people.



Shell scientists have come up with a vast improvement over even the most talented cow tail. It's called VAPONA® insecticide. A plastic strip impregnated with it will kill flies in a cow stall for up to three months. And VAPONA® insecticide combined with CIODRIN® insecticide keeps cows fly-free 24 hours a day—even out in pasture. Give you ideas for further applications?

Energy from under the sea

Shell is heading into ever-deeper water in the search for oil and natural gas. Recently we designed and installed permanent drilling/production platforms as tall as a 34-story building, with



still bigger structures in the works. And we are operating in considerably deeper water from floating platforms. We are also searching on land in 16 states to help meet burgeoning energy needs.

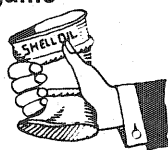
Digestible detergents



The main trouble with detergents is they don't go away. They pollute streams, make fresh water foamy. The solution: detergent compounds that organisms can consume. These "biodegradables" clean clothes just as effectively, but keep streams free of detergent foam. Elsewhere in the chemical part of our business, Shell research has resulted in a wealth of plastics for home and industry, and fertilizers to alleviate food shortages.

The name of the game

More gasoline per barrel of crude oil delights engineers, scientists and conservationists alike. Our new hydrocrackers actually produce *more* than a gal-



lon of refined product from a gallon of feed stock. And we are using sophisticated techniques to tailor-make products by reassembling hydrocarbon molecules.

The pursuit of excellence leads Shell into a variety of fields, both on and off the beaten track for an oil company. If you have a more-than-one-track mind, a desire to explore, to pit your skills against many kinds of problems, there could be a place for you in Shell.

Perhaps your training in engineering, science or business can contribute to tomorrow's new developments. For information about openings throughout Shell sign up at the placement office for an interview with our representative. Or write to Q. C. Stanberry, Recruitment Representative, Dept. E, The Shell Companies, Box 2099, Houston, Texas 77001.

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technolog

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COVER: This month's cover is an abstract of the P-51 aircraft pictured on page 31.

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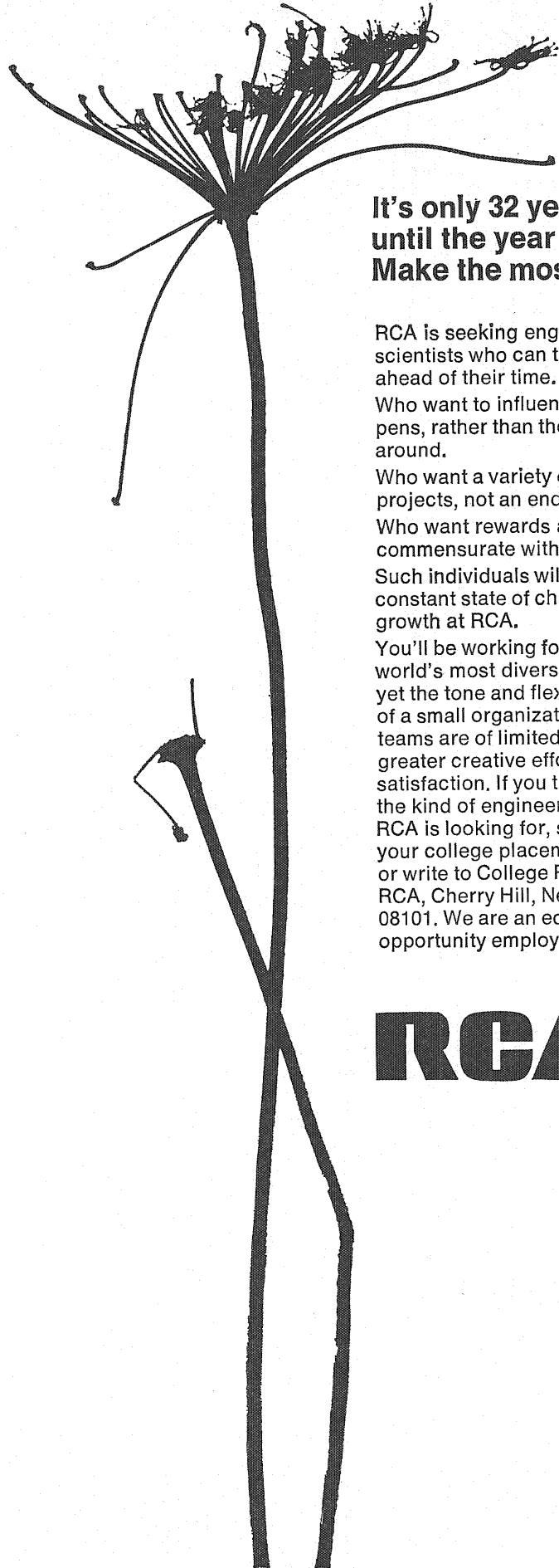
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Who want a variety of absorbing projects, not an endless routine.

Who want rewards and opportunities commensurate with their worth.

Such individuals will fit into the constant state of change and growth at RCA.

You'll be working for one of the world's most diversified companies, yet the tone and flexibility are those of a small organization. RCA project teams are of limited size—to foster greater creative effort and personal satisfaction. If you think you are the kind of engineer or scientist RCA is looking for, see your college placement director, or write to College Relations, RCA, Cherry Hill, New Jersey 08101. We are an equal opportunity employer.

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You can go forward, go fast, go far... at Hughes Field Service & Support Division. If you are seeking a stimulating assignment where you can get in on the ground floor of the rapidly-expanding aerospace/electronics field, capitalize immediately on your background and training, and progress quickly toward your career goals—Hughes Field Service & Support Division in Southern California will welcome your inquiry.

Some current fields of interest include:

DESIGN ENGINEERING

Openings exist for Electronic and Mechanical Design Engineers in the development of Trainers & Simulators and in the design of checkout and test equipment for large missile and aerospace systems. These responsible positions require interest and/or experience in such design areas as: analog circuits, digital logic, switch/relay logic, electromechanical packaging, infrared testing, inertial guidance and Command/Control systems.

Responsibilities will include all phases of design and development from concept to final fabrication and evaluation. M.S. or Bachelor's degree is required in E.E., M.E. or Physics.

FIELD ENGINEERING

The Field Engineer's job ranges from complete contractor maintenance of electronic systems to technical assistance. His primary function is to assist

the customer at operational sites. Responsibilities include: providing maintenance, operational and technical assistance; formal and informal on-the-job training; logistic assistance and the investigation and solution of equipment problems experienced in the field. Requires a Bachelor's degree in E.E. or Physics. Experience with military fire control, radar or communications systems is desirable but not mandatory.

MAINTAINABILITY ENGINEERING

During design phase, positions involve analysis of the feasibility of built-in, self-test features, application of automatic checkout equipment, standardization of circuitry design, minimization of adjustment and alignment requirements and packaging of the product. During system development, assignments will involve production of a complete set of integrated logistics support documents for use as planning guides. Requires B.S. degree in E.E. or Physics.

TECHNICAL TRAINING

Hughes Technical Training prepares both civilian and military personnel to efficiently operate and maintain advanced electronic systems. Technical Instructors conduct training classes at Hughes California sites and work directly with customers to evolve special

training devices, plan field training programs and prepare courses for use at customer bases. Requires a Bachelor's degree in E.E., or Physics. Experience in preparing and presenting technical electronics material in the classroom and laboratory is highly desirable but not mandatory.

ENGINEERING WRITING

Specialists in printed communications convert complex engineering data into simple, accurate, illustrated support publications, including technical manuals, orders, brochures, sales proposals, etc. Fields of interest include: digital/analog computers, display systems, digital and

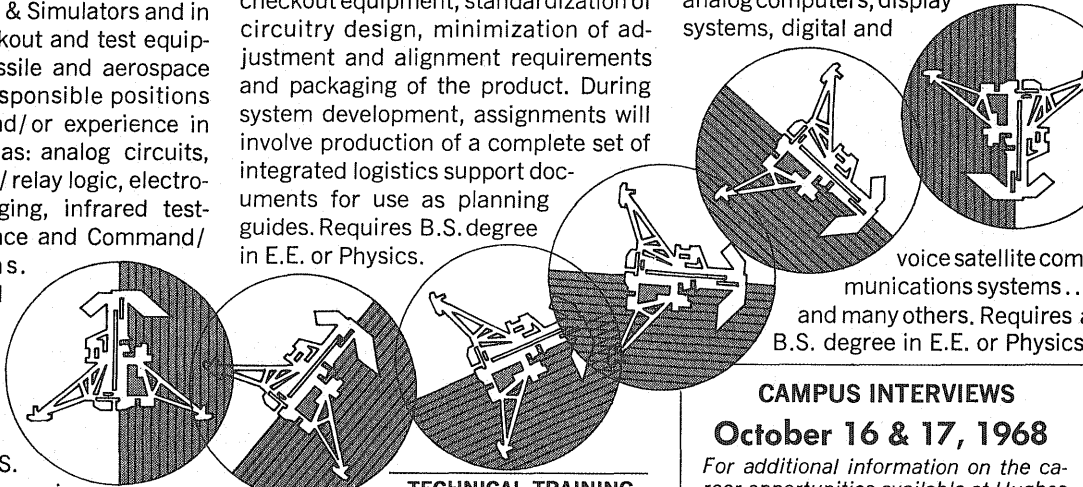
voice satellite communications systems... and many others. Requires a B.S. degree in E.E. or Physics.

CAMPUS INTERVIEWS

October 16 & 17, 1968

For additional information on the career opportunities available at Hughes Aircraft Company—and to arrange a personal interview with our Technical Staff representatives please contact your College Placement Office or write: Mr. R. J. Waldron, Hughes Aircraft Company, P.O. Box 90515, Los Angeles, Calif. 90009.

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The 5 billion dollar corporation you probably never heard of.

Funny how big you can get and still remain virtually anonymous.

Somehow we've managed to do it.

We're a group of over 60 companies, making everything from microwave integrated circuits to color television. And we rank number 9 in the top 500 corporations in the nation.

Pretty hot stuff for a nobody.

But though you may not recognize our name, maybe the name Sylvania rings a bell.

It's one of our companies.

You may even live in one of our telephone company areas. We operate in 33 states.

So here we are, 5 billion dollars strong, growing all over the place, and looking for engineers and scientists to grow with us.

Why don't you think us over with your Placement Director?

Incidentally, we are known in the communications field as General Telephone & Electronics.

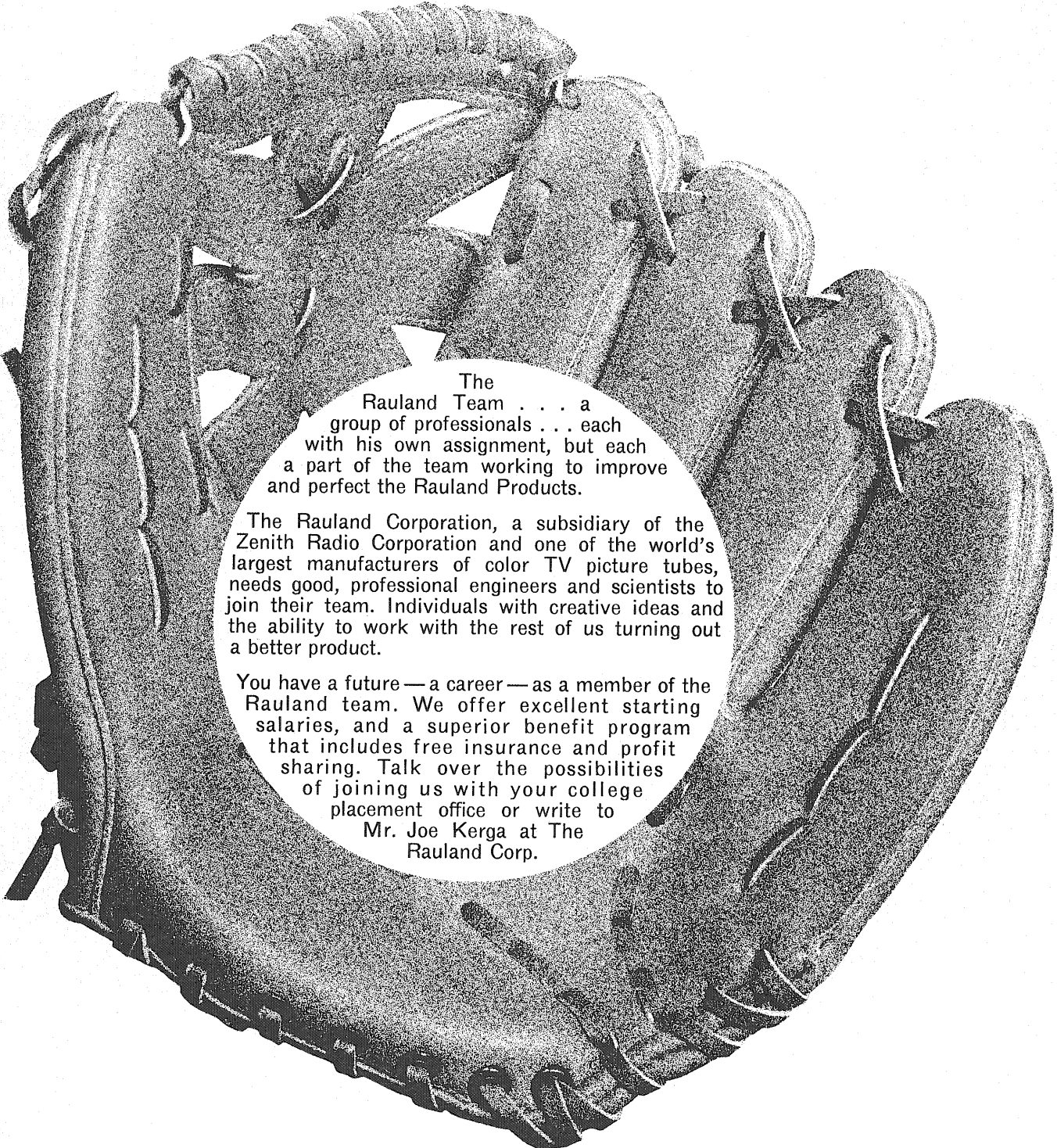
Pssst. Pass it on.



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a part of the team working to improve
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You have a future — a career — as a member of the Rauland team. We offer excellent starting salaries, and a superior benefit program that includes free insurance and profit sharing. Talk over the possibilities of joining us with your college placement office or write to Mr. Joe Kerga at The Rauland Corp.

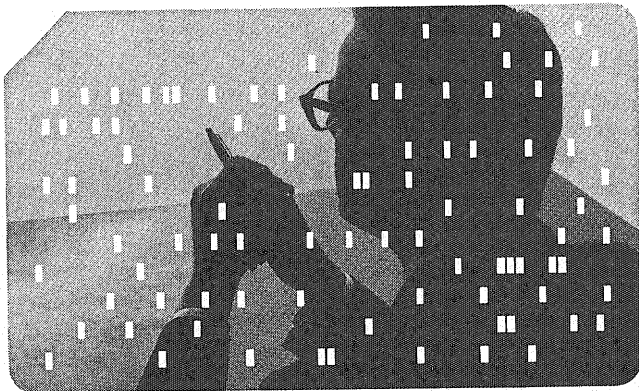
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Punchcards are for payrolls.



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Not at Phillips. Sure, we're big. And we know that a lot of companies our size run their personnel operations like a computer dating bureau. But not us. We don't even like the word "personnel." "People" is our word. And that's the way we treat you, and that's what we're looking to hire. People, not simply grades or standings in a class. People who are interested in things like engineering and chemistry and physics and

mathematics and oil exploration and production. People who see all the advantages and all the diversity in the areas of petroleum, fuel and lubricants. People who want to do things with plastics, rubber, fertilizers, LP-gas, petrochemicals, packaging, carbon black, fuel cells, and other much-needed products. People who want to solve the problems of an increasing population, an expanding world. Problems, ultimately, of helping other people. We encourage this kind of involvement, personal or technological, because we're a people type of company. The type of company where you can keep moving—upward, of course; laterally if there's some other dimension you want to explore. Our slogan is, "at Phillips 66, it's performance that counts." And that's for real. At Phillips you're never a punchcard. You're people. Like us. Why not get together? Write James P. Jones, 104 Frank Phillips Bldg., Phillips Petroleum Company, Bartlesville, Oklahoma 74003.

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Speaking with the Dean



Warren B. Cheston
Dean, Institute of Technology

For the academic community, fall is the spring season of primitive cultures. It is a period of rebirth of hopes and the regeneration of enthusiasms which have become lost in the previous year. Although many of us, faculty and students alike, look to the summer as a period of relative relaxation, the fall brings with it what for want of a better word can be called the "action." The reason why all of us are here is that the University is a center of action, a place for exploration of ways in which individuals can fulfill themselves and learn to play their proper roles in the larger society. A university is not a refuge, a wayside stop between an experience of the past and an experience of the future. Those who view the University as a convenient place to while away a few years of life will find it an exceedingly disappointing place.

The University cannot isolate itself from the societal forces which now beleaguer it and remain a vital element in society. As a consequence, it can be expected that an increasing fraction of the University's efforts will be focused on the rights and desires of those who have not benefited from the wealth generated in our technologically based society. Of particular interest this fall is the program to provide educational opportunities at the University to an increased number of economically deprived students from the ghetto areas of the Twin Cities. In addition, through the recently created Center for Urban and Regional Affairs, the University is devoting its resources to helping the urban communities solve some of their pressing problems. As the University looks more outwards into the urban community in which it is imbedded, more interaction can be expected to take place between the scientists and engineers of the Institute of Technology and the social scientists and humanists of other colleges of the University in areas of mutual concern. Social scientists are becoming increasingly aware of the methods and techniques of the technologists who in turn are becoming more cognizant of the social implications of their activity. This will ultimately reflect itself in changes in our curricula and course content.

There are changes and additions in IT planned last year which should be brought to your attention. One of these is the additional educational opportunities available in the field of computer science. For the first time, IT will offer degree opportunities in computer science in the form of options in the departments of Mathematics and Electrical Engineering. In addition to these specialized programs, new lower division offerings in computer science will be available to all students in IT. Coupled with this is the rapidly growing usage of computers as instructional tools in all curricula within the Institute. The faculty of the Institute is looking for ways to involve students in the educational planning and decision making processes. This year a number of IT students will be invited to serve on departmental and college curriculum committees. From this experience all of us hope to learn how to involve students in a meaningful way in activities of the college.

Log Line

The *Technolog*, with a 21-problem-set-salute, officially welcomes all you rugged engineers and scientists who have returned to the I.T. salt mines. We hope that you recognize many of your former acquaintances, and that you again manage to evade the draft, er shaft. The "old school shaft" takes many forms: draft, low-grades, late registration, parking tickets, dorm violations etc. Let caution be your byword.

To all you newcomers in our ranks who may be wondering just what type of mag the *Technolog* is, we can only throw up our hands and say, "Well, . . . you can expect just about anything in the mag." This non-committal statement is in keeping with our office policy of avoiding decisions. However, our attempted goal this year will be to provide you sliderule swingers with some first priority reading material. However, we cannot be held liable if your Physics Prof pitches an eraser at you for reading *Log's Log* out loud from your front row lecture seat.

1984

The sinister shadow of George Orwell's *1984* has put in a somewhat more friendly appearance here at I.T. in 1968. Although there are no posters reading "Big Brother is watching you!" a number of Freshmen may get that feeling this quarter. It seems that Dr. R. G. Taylor, a counseling psychologist, Dean Cartwright, and the

members of Tech Commission have devised a Big Brother program in an attempt to retard the phenomenal dropout rate which afflicts I.T. The implements of this program are, of course, Juniors and Seniors who have endured the Frosh-Soph slaughter house of lower division. The thinking goes something like this: Who can give better advice on how to avoid the pitfalls than those who have just completed the obstacle course? However, the most difficult task of these die-hard Big Brothers will be to keep their freshman advisees interested in I.T. Our only suggestion to you Big Brothers is to take the kid on your next Big Ten run.

LDS Program

If you're a chapter behind in calculus, got a 9 on your last Physics quiz, and you can't figure out if you want to be a E.E. or C.E., the newest student orientated program in I.T. may be worth your time to investigate. The program sponsored by Tech Commission is a seminar for lower division students. The Lower Division Seminar Program is designed to offer practical applications of the students math and physics courses and introduce him to all of the I.T. departments. What this actually means to you guys is that you can get a simplified view of the more interesting problems that you will be attempting to solve in a few years. Each I.T. department will be sponsoring one or

Nov. 20 Chem. E.

3. The Chemical Engineering seminar will show what a Chemical Engineer does and how he goes about solving problems peculiar to the Chemical Engineering field. It will also show what the future holds for the individual who enters this ever growing field.

Dec. 4 M. E.

4. Another seminar will show the Engineer's, and particularly the Mechanical Engineer's, place in industry. It will show the importance of the curriculum given in I.T. that provides an understanding of a broad range of engineering fields. The speaker will illustrate the need for effective communication on the job and the type and range of projects that can be expected on the job.

more seminars, so, in addition to prodding your technical interests, the new program may help you decide on a "major" or "technical minor".

Although the Seminar program is being offered on a no-credit no compulsory attendance basis this year, if the student response warrants a seminar on the basis of credit every consideration will be given to an undergraduate credit seminar for next year. We urge everyone to give himself a break and to take full advantage of this new opportunity which the administration has taken the trouble to organize.

Brief descriptions of each seminar:

Oct. 23 Mr. Plunkett, Aero. E.

1. The lecturers will use graphic illustrations to show how an engineer solves problems. The mathematics involved will be of a high school level. This seminar will be an introduction to the formal Engineering process. Some students may be surprised to learn that they may have been using this process for some time without even knowing it.

Nov. 6 Mr. Huber, Civil E.

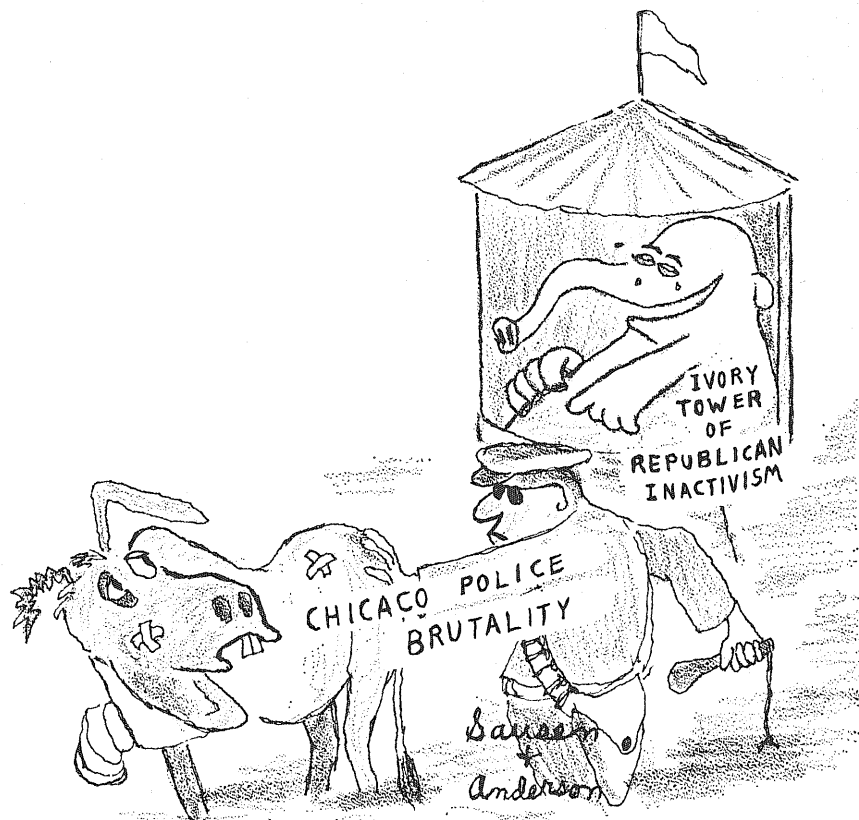
2. One seminar will be about the Traffic Engineering Section of the Civil Engineering Department. It will show the future problems and challenges of this growing field. Illustrations of some common traffic engineering problems will be given.

our case the phrase still retains some significance. Yes, we're giving everyone an equal chance to help build an All-American magazine. Now you all know that when you build something it takes at least two things, time and materials. The *Technolog* has the materials; we have adequate finances and facilities to publish an All-American. What we need more of however, is the time, or manpower. But to use a Democratic Party Cliche, we want to make it "Crystal clear" that we just don't want a large list of names for our title page. A willingness to work and to become a producing member of the staff is the only prerequisite. In contrast, business or journalistic experience is not required. But if you have had some previous experience in journalism we certainly won't hold it against you!

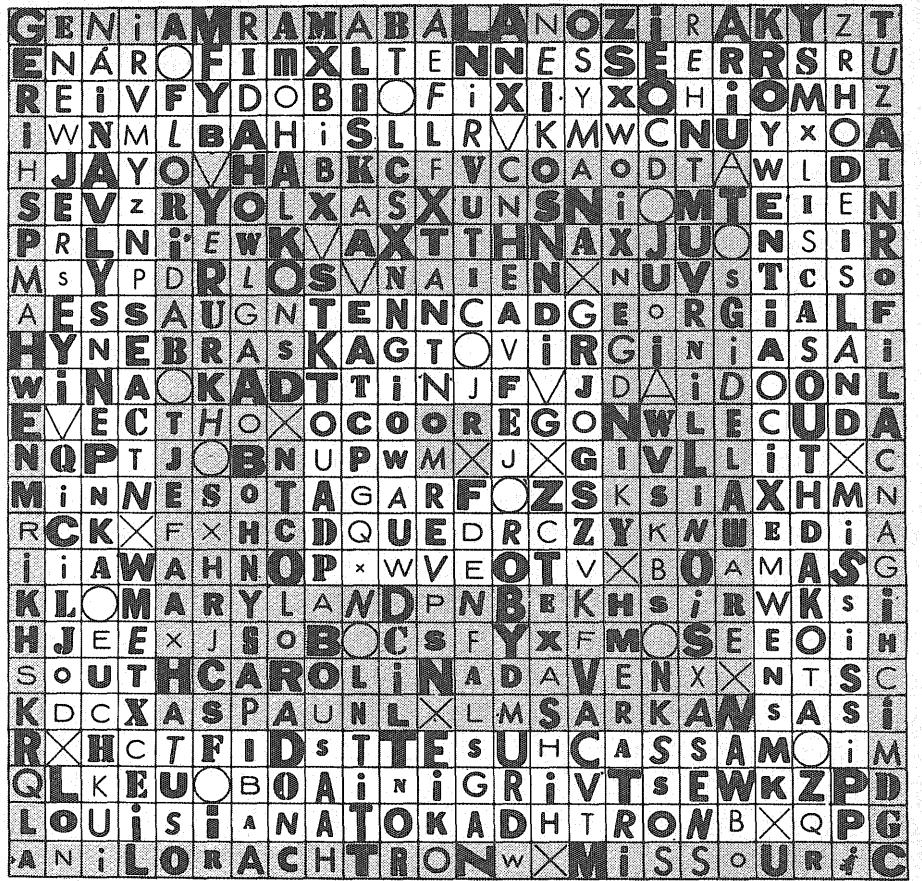
Even we accept the fact that you don't get anything for nothing, and we don't expect you to give of your time without receiving something in return. The intrinsic value of friendship and a social group to identify with far outweigh the monetary aspect. But, yet we do pay a fair amount for the work accomplished. So, why not stop by Room 2 Mechanical Engineering and knock on our door, we promise to answer.

We need help

Let it hereby be known to all Courts of Justice and to all Congressional Investigating Committees that the *Minnesota Technolog* is an "Equal opportunity employer." If perchance you are now snickering—don't. Because in



can you
find



the names of all 50 states?

(THE NAMES MAY READ UP, DOWN, FORWARD, BACKWARD OR DIAGONALLY.)

Think Maine to Hawaii.

We're located in 36 of them. In fact, every day just about every person in all 50 of them uses, or comes in contact with at least one of the 1700 different things we make.

We're in container and packaging products, for one example. In paper and plastics as well as metal. We're in consumer products (such as Dixie cups and Northern tissue) and printing (chances are our Printing Corporation of America Division printed some of your textbooks), and in chemical products.

Care to guess who's a leading producer of stannous fluoride for your toothpaste? The problems we run into range from finding a way to knit paper and glue steel, to predicting tomorrow's trends in the world of fashion ("Butterick" and "Vogue" patterns come from American Can).

All of which makes our sales more than the gross national product of some countries. Almost a billion and a half in '67. We want to do twice that by 1980.

But we won't get anywhere without talented young people like you to help us. People with the drive to succeed that matches our drive to succeed.

The opportunities are as diverse and different as North Dakota and Florida, for people in engineering, liberal arts, and business.

That's our story. Drop us a line and tell us yours.

*Harold E. Johnson
Administrator,
College Recruiting,
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Thinkers welcomed.



See us at the Institute of Technology Placement Office
October 28

We may build a bigger engine at our #2 plant.

Help wanted:

Could you engineer the changeover economically?

Situation: Complete design scheme for tools, jigs, and fixtures needed. Also need plans detailing how much time will be required, under optimum conditions, for line changeover.

Question: Is there some way we can implement this change by utilizing most of the existing machinery at the plant?

Problem: As a modest volume plant, it is imperative that we don't lose valuable time and resulting sales. Suggest you visit the Mexico City Plant where a similar changeover occurred. Would appreciate solution by Friday, next week. Thanks.

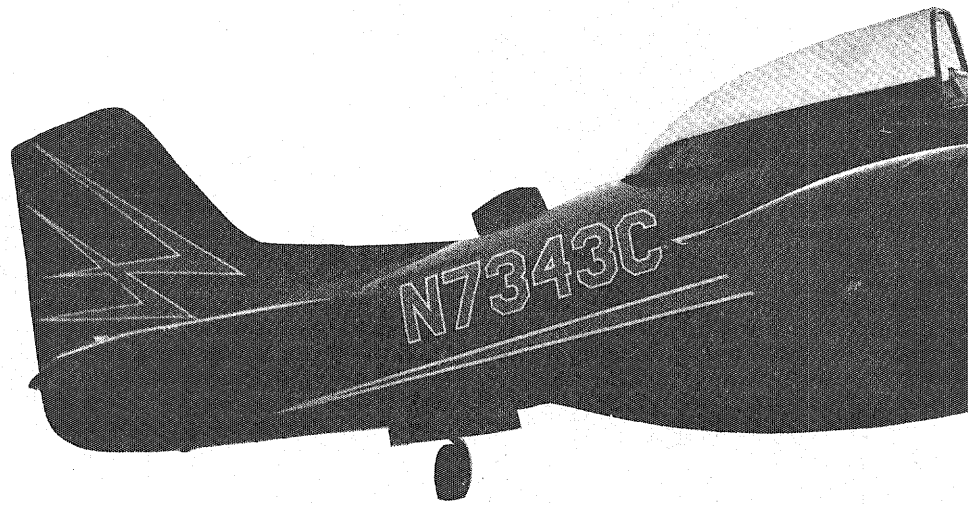
Want to work on a challenging assignment like this?

A new member of the manufacturing engineering team at Ford Motor Company does. Today his job may be establishing the manufacturing sequence of a new engine. Tomorrow, it may be determining the manufacturing feasibility of a new product idea.

To assist in solving assignments like these, our people have a giant network of computers at their service. Complete testing facilities. The funds they need to do the job right.

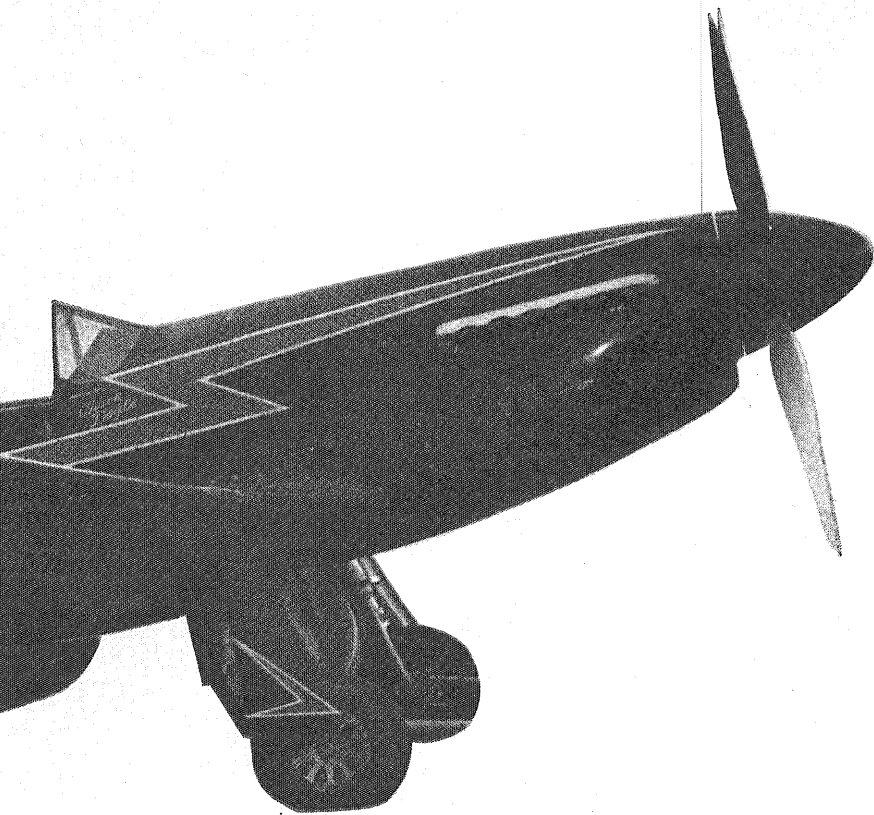
If you have better ideas to contribute, and you're looking for challenging assignments and the rewards that come from solving them, come work for the Better Idea company. See our representative when he visits your campus. Or send a resume to Ford Motor Company, College Recruiting Department, The American Road, Dearborn, Michigan 48121. An equal opportunity employer.





P-51

MUSTANG



photos by Martin Rekow

by David Buelke

World War II produced many fine aircraft built by both the Allied and Axis powers. Vickers Supermarine Spitfire, Messerschmitt Bf 109, Curtiss P-40, Fock-Wolfe 190, Chance Vought F4U Corsair and the Republic P-47 Thunderbolt contributed much to the design of aircraft in general and high-performance fighter aircraft in particular. It was for North American Aviation to produce the ultimate in propeller-driven aircraft—the P-51 Mustang.

The Mustang was conceived at North American as an alternative to filling a British order for the nearly obsolete P-40 D Warhawk fighter. James H. Kindelberger, president of North American, and his engineering staff promised to deliver an alternative design built around the same 1150 hp Allison engine within 120 days. Consequently, the first P-51 rolled from North American's Los Angeles factory four months after work on its design began. Surprisingly few bugs were found in the Mustang's original design, and for an early World War II fighter its performance figures were outstanding. Turning out 1150 hp at 11,800 feet and at 3000 rpm, the Allison powerplant pulled the Mustang around at a top speed of 382 mph, with a rate of climb just under 2000 fpm.

Mustang's excellent aerodynamic design lent it well to the low-level ground support work for which it was first used. But when the demand for a more advanced high-level fighter arose, the Mustang's Allison powerplant with its single-stage carburetor and supercharger left much to be desired. It was at this point that Major Thomas Hitchcock, along with aviation pioneer Eddie Rickenbacker, suggested cross-breeding the P-51 airframe with the famous Rolls-Royce Merlin engine found in the Vickers

Supermarine Spitfire high-altitude fighter. The performance of this engine-airframe combination proved so successful that the U.S. Merlin engine production was begun by the Packard Motor Company, producing the Packard-Merlin V-1650-3 and V-1650-7. The Packard-Merlin was a V-12 liquid cooled engine which had a displacement of 1,649 cu. in. and put out 1490 hp at 3000 rpm. It was equipped with a Stromberg 2-stage carburetor and supercharged which switched from low to high blower at 16,000 ft. This gave the Merlin much more efficiency at high altitudes. This new Mustang version, designated the P-51 B & C, had a top speed of 439 mph and cruised at 362 mph.

Up until this time, the U.S. Army Air Force had largely ignored the P-51. It was considered to be a British plane built to meet the specific needs of the Royal Air Force. The Mustang's impressive showing in Britain, however, led American military leaders to include the P-51 in their fighter inventory.

The year 1944 arrived and with it came the most famous version of the Mustang—the P-51D. Gone was the old-fashioned "window" cockpit and in its place came a modern, plastic, bubble canopy and a cut-down rear fuselage. More P-51D's were produced than any other Mustang model. Of the total Mustang production of 14,819, 7956 were P-51D's and 1337 were P-51K's, identical to the D model except for an Aero Products propeller in place of the Hamilton Standard propeller on the P-51D. The P-51D had a top speed of 437 mph, cruised at 362 mph, and had a phenomenal 3475 feet/min. climb rate. The standard Merlin V-1650-7 engine delivered 1490 hp at takeoff and 1505 at 19,000 ft.

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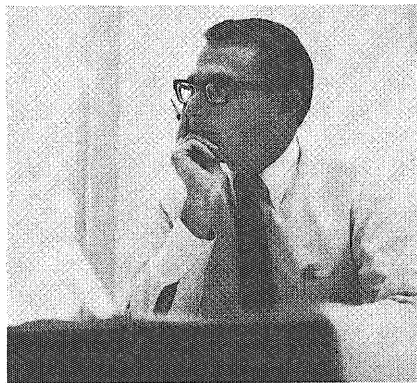
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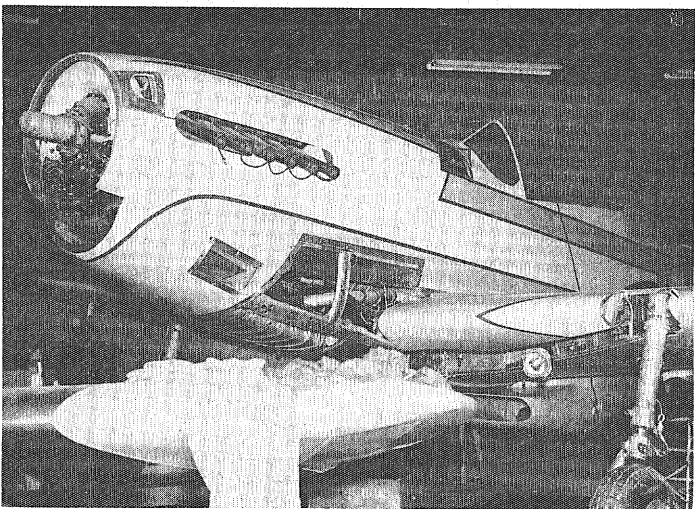
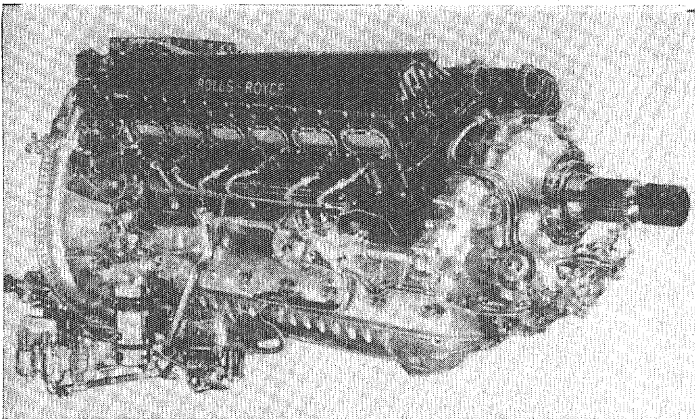
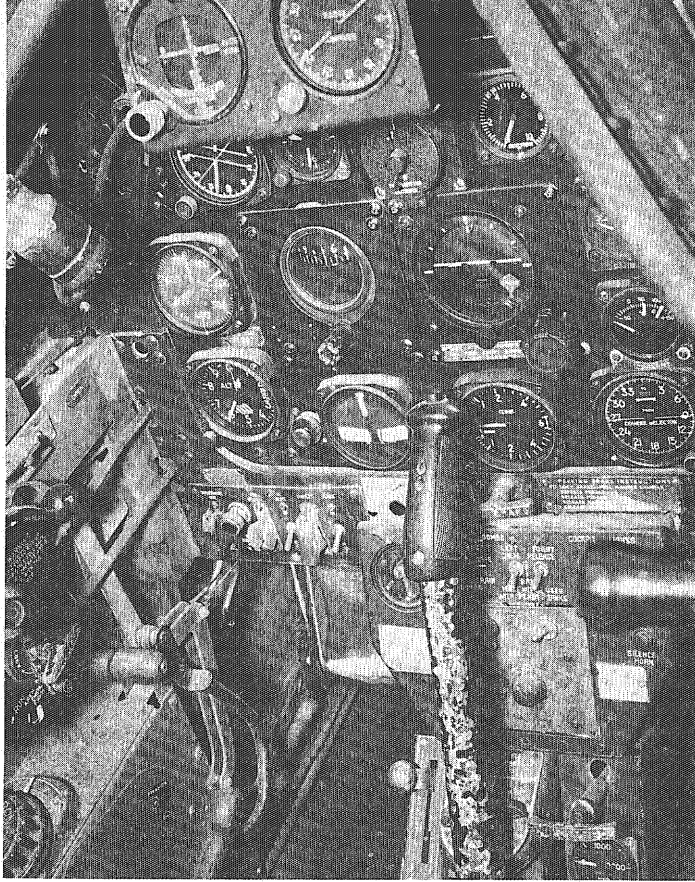
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CAMPUS INTERVIEWS

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(Top) No cockpit for the timed pilot, the P-51 boasts a 48-point preflight check. (Center) Rolls-Royce Merlin power plant. (Bottom) Chuck Doyle's latest project is this surplus RCAF P-51. After seven years in the making, this restoration is scheduled to fly late this fall.

The fastest of all the Mustangs was the P-51H. The result of an intensive effort to lighten and improve the Mustang, the P-51H saved 600 lbs. over the popular P-51D in gross weight. It had a top speed of 487 mph and a fantastic cruising range of 2400 miles. The P-51H was powered by a Merlin V-1650-9 engine which put out 1380 hp at takeoff and 2220 hp at 10,200 feet. And, like all Packard-Merlin engines, it was equipped with a two stage Stromberg injection carburetor and supercharger.

At the end of World War II most of the 5,541 Mustangs in the Air Force inventory were either sold to civilian buyers, handed out to national guard units, or sold to Canada and Latin American countries. The Korean War brought 700 Mustangs back to the battlefield, where they had the distinction of being the only propeller driven aircraft capable of battling Soviet-built MIG jet fighters. After the Korean War, Mustangs were gradually phased out of Air Force arsenals, and by 1957 the last Mustang retired from military service.

And so, like all old soldiers, the Mustang has just gradually faded away, right? Wrong. Although now nearly thirty years old, the Mustang is still agile enough to fit into the Air Force uniform. The United States Air Force has recently chosen the Mustang to meet the needs of both the U.S. and Latin American countries for counter-insurgency aircraft. Trans-Florida Aviation of Sarasota, Florida, which now owns all patents related to the P-51D Mustang has a defense contract to produce three rebuilt Mustangs per month. Modifications of the original Mustang include extending the verticle stabilizer by 14 inches, and incorporating 2.5 x 0.25 in. doublers along the lower longeron in each external side of the fuselage, allowing the Mustang to carry 5000 pounds of ordnance. Permanently mounted wingtip tanks with 110 gallon capacity each are added, and can be jettisoned within 30 seconds. The cockpit has been simplified and all arming switches have been placed at eye level instead of between the pilot's legs as in the original version of the P-51D. Also, a special rocket assist pilot escape system has been installed. Although the Mustang has been off the production lines for about 20 years, parts are not yet producing a problem for Trans-Florida. With about 100 Packard-Merlin engines in reserve and Trans-Florida's access to original dies and specs for the Mustang, almost any component for the aircraft can be obtained.

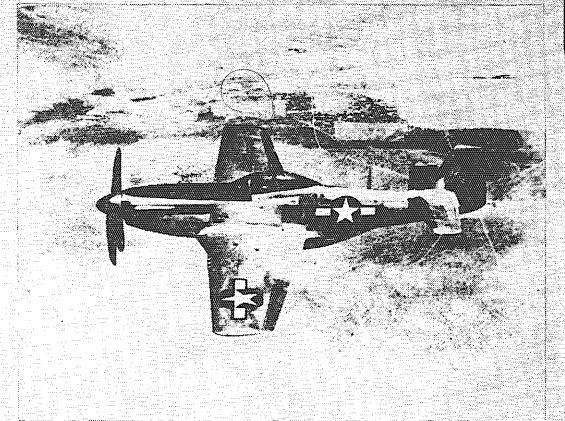
Besides being a great military aircraft, the P-51 has done a good job of invading the civilian pilot market. Trans-Florida, which now supplies the U.S.A.F. with military Mustangs, also builds a civilian version of the Mustang. Trans-Florida converts the single-seat fighter into a plush two-place executive plane for wealthy businessmen who know how to fly and want to get where they're going fast. The P-51 is ideally suited to be a businessman's airplane. It gives near Lear Jet performance but is able to land and takeoff from as little as 1700 feet of runway. Oh yes, the price: between \$40,000 and \$90,000, depending on the pilot's tastes.

Since the end of World War II, the Mustang has held a dominant position in the National Air Races in Cleveland and the Reno Air Races in Reno, Nevada. The P-51's prominence in the Unlimited Class at these races is due to its aero-dynamic design and its superb Packard-

P-51D Mustang

ANOTHER PRODUCT OF NORTH AMERICAN AVIATION, INC.

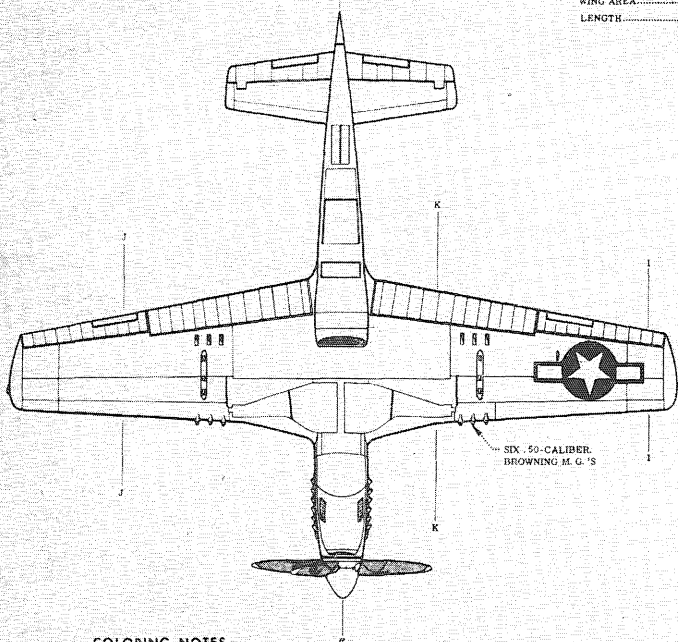
WING SPAN 37 FT 0 5/16 IN. HORIZONTAL STABILIZER SPAN 13 FT 2 1/8 IN.
 WING AREA 233 SQ FT. HEIGHT 8 FT 8 IN.
 LENGTH 32 FT 3 5/16 IN. POWER PLANT PACKARD "MERLIN" V-1650
 1455HP V-12 ENGINE



U.S. ARMY AIR FORCE P-51D "MUSTANG"
 NORTH AMERICAN AVIATION, INC.

Rated the best of the World War II fighters, the P-51 Mustangs returned to combat during the Korean War and concluded active service with National Guard and Reserve squadrons. These are the airplanes that "broke the back" of the Luftwaffe when in 1944 they began flying long-range escort missions over Berlin. Mainly a fighter, the Mustang also served as a fighter-bomber, a photo-reconnaissance plane, and a dive bomber. Originally designed for the British and accepted by the U.S. Army Air Force only after it had proved itself, the P-51 eventually was rated by a Senate investigating committee as "the most aerodynamically perfect pursuit plane in existence." The P-51D, last of the Mustangs to be used in World War II, is shown in the accompanying drawing.

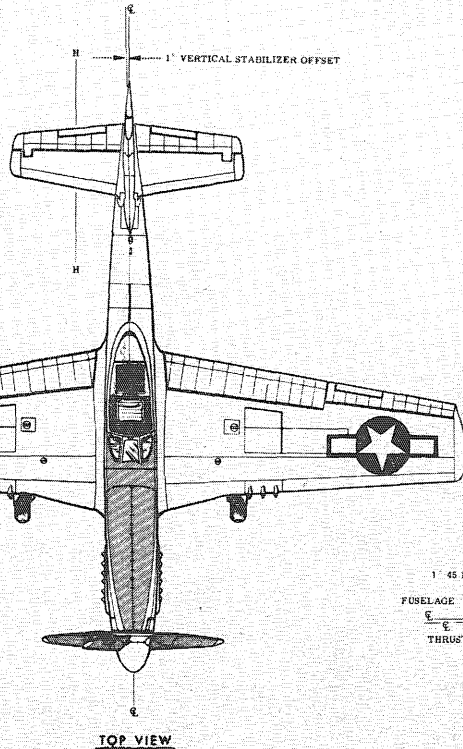
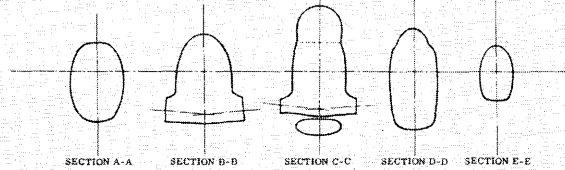
BOTTOM VIEW



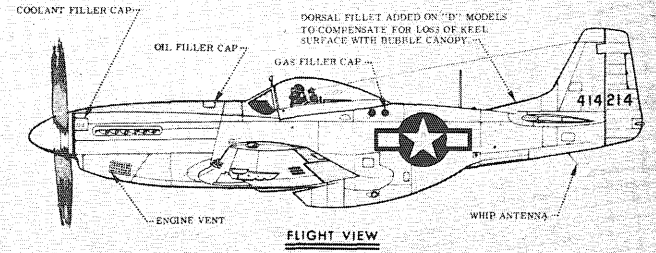
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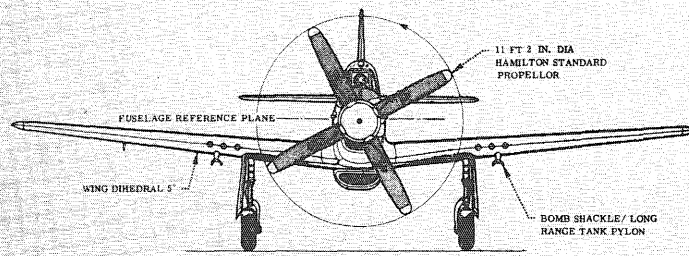
FUSELAGE CROSS SECTIONS



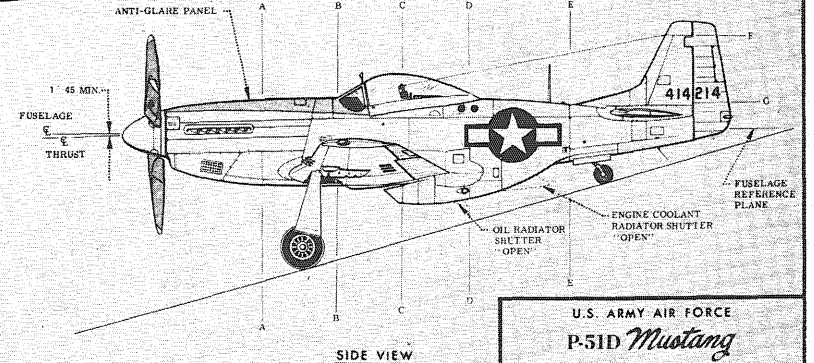
TOP VIEW



FLIGHT VIEW



FRONT VIEW



SIDE VIEW

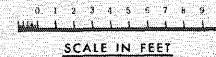


WING SECTIONS



HORIZONTAL STABILIZER SECTION

VERTICAL FIN-RUDDER SECTION



SCALE IN FEET

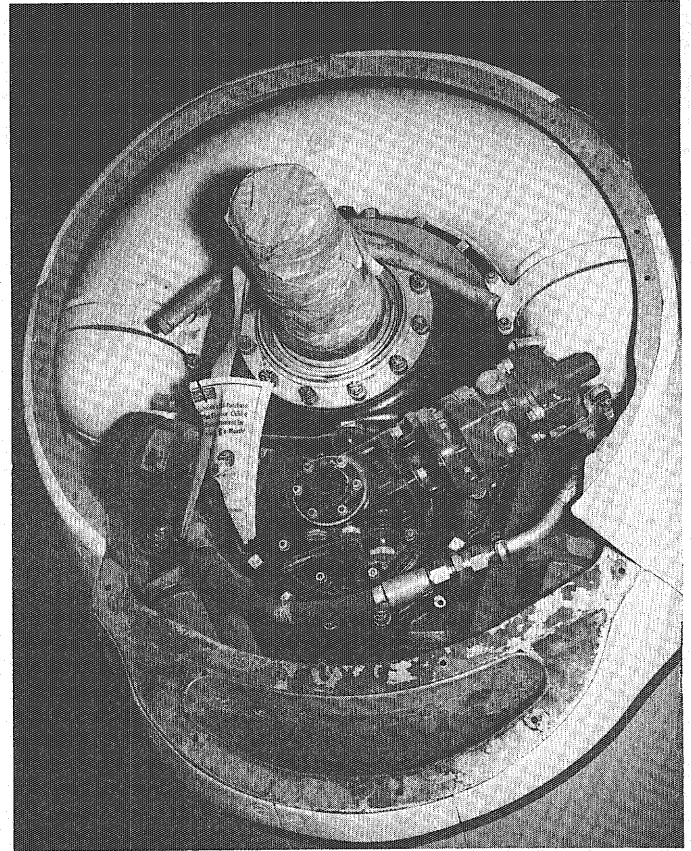
U.S. ARMY AIR FORCE
P-51D Mustang
 FIGHTER
 DESIGNED AND BUILT BY NORTH AMERICAN AVIATION, INC.
 SCALE: NOTED 1/32" TH. DATE: DECEMBER 1962
 NA-62-1494
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Merlin powerplant. The Mustang has the smallest frontal area of any other propeller-driven military aircraft due to its use of a liquid-cooled engine. The Mustang also uses the laminar flow wing (first mass production aircraft to do so) which is most efficient at speeds of 350 hp on up. The Packard-Merlin engine lends itself quite easily to modification. Competitors at the Reno Air Races have squeezed upwards of 3000 hp from an engine whose military rating is less than half that amount.

This writer has had the opportunity of interviewing Mr. Charles Doyle of Rosemount, Minnesota. An airline pilot by profession, Mr. Doyle spends his spare time seriously pursuing his hobby—restoring aircraft. Mr. Doyle is the proud owner of six airplanes, three of which are P-51's. The black Mustang shown in the photo is Mr. Doyle's only operational Mustang. He is currently restoring another P-51D in his personal hangar, while yet another Mustang (this one a P-51A, an older and much rarer Mustang) sits in a state of disassembly at his home.

Mr. Doyle purchased his present restoration from the Royal Canadian Air Force in 1961. It was the last of the Canadian Mustangs to be sold to a civilian buyer. The price of this surplus Mustang? A mere \$650.00. But this Mustang was far from being in airworthy condition. Even though it had only 800 hours on it at the time of sale, the severe Canadian weather and souvenir hunters had taken their toll on the plane. Engine instruments, and other costly aircraft components were missing from the aircraft. It took Mr. Doyle a year and a half of 400-

(Continued page 28)



The P-51 has the smallest frontal area of any propeller-driven military aircraft. Note carburetor air intake at bottom of nose.

GROWING

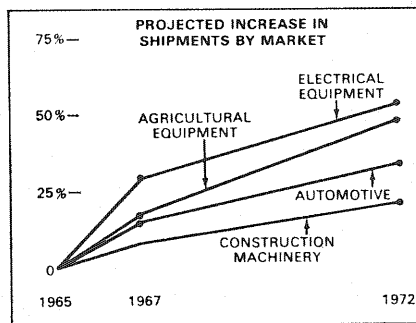
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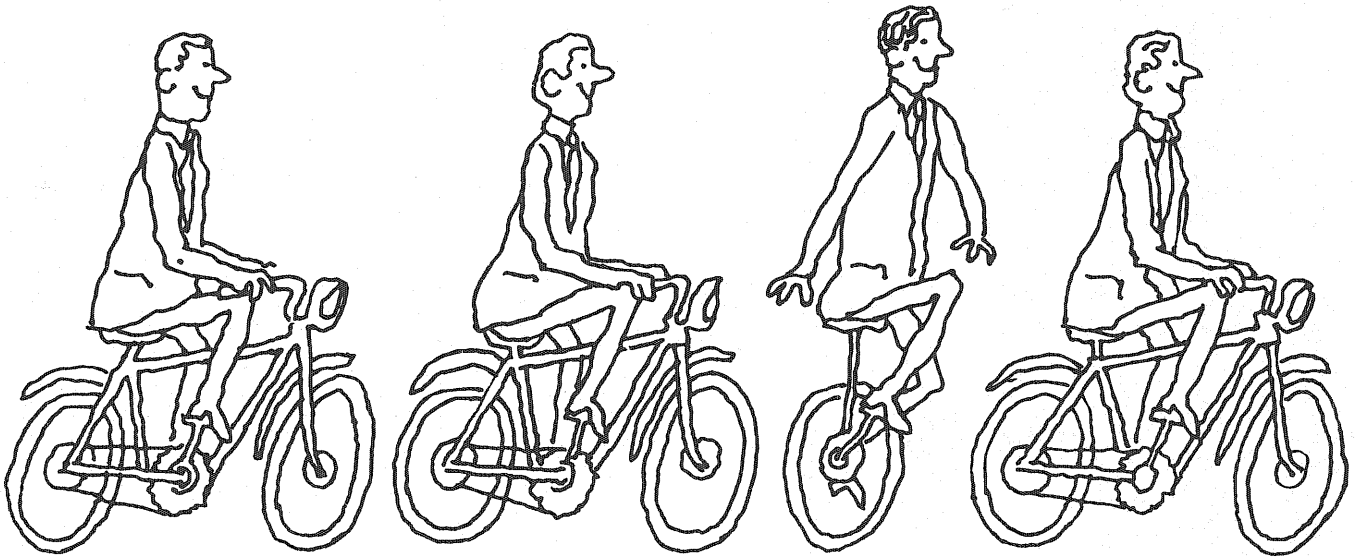
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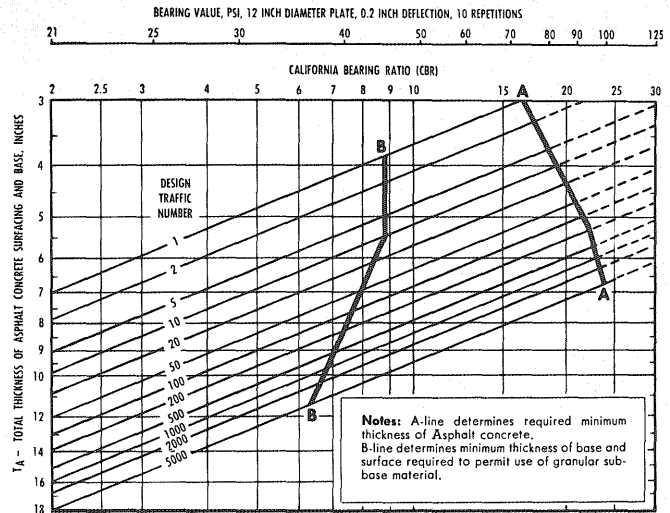
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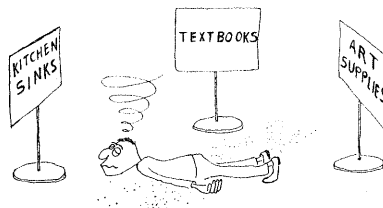
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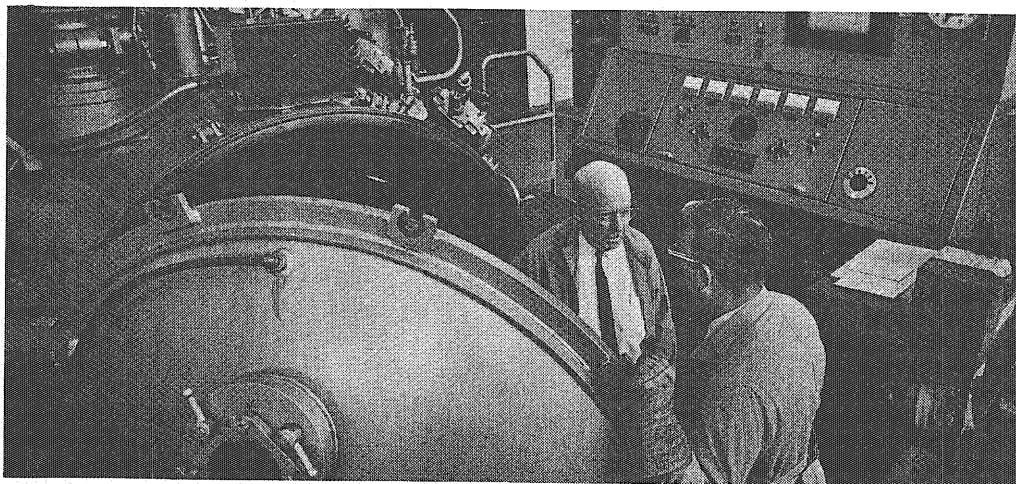
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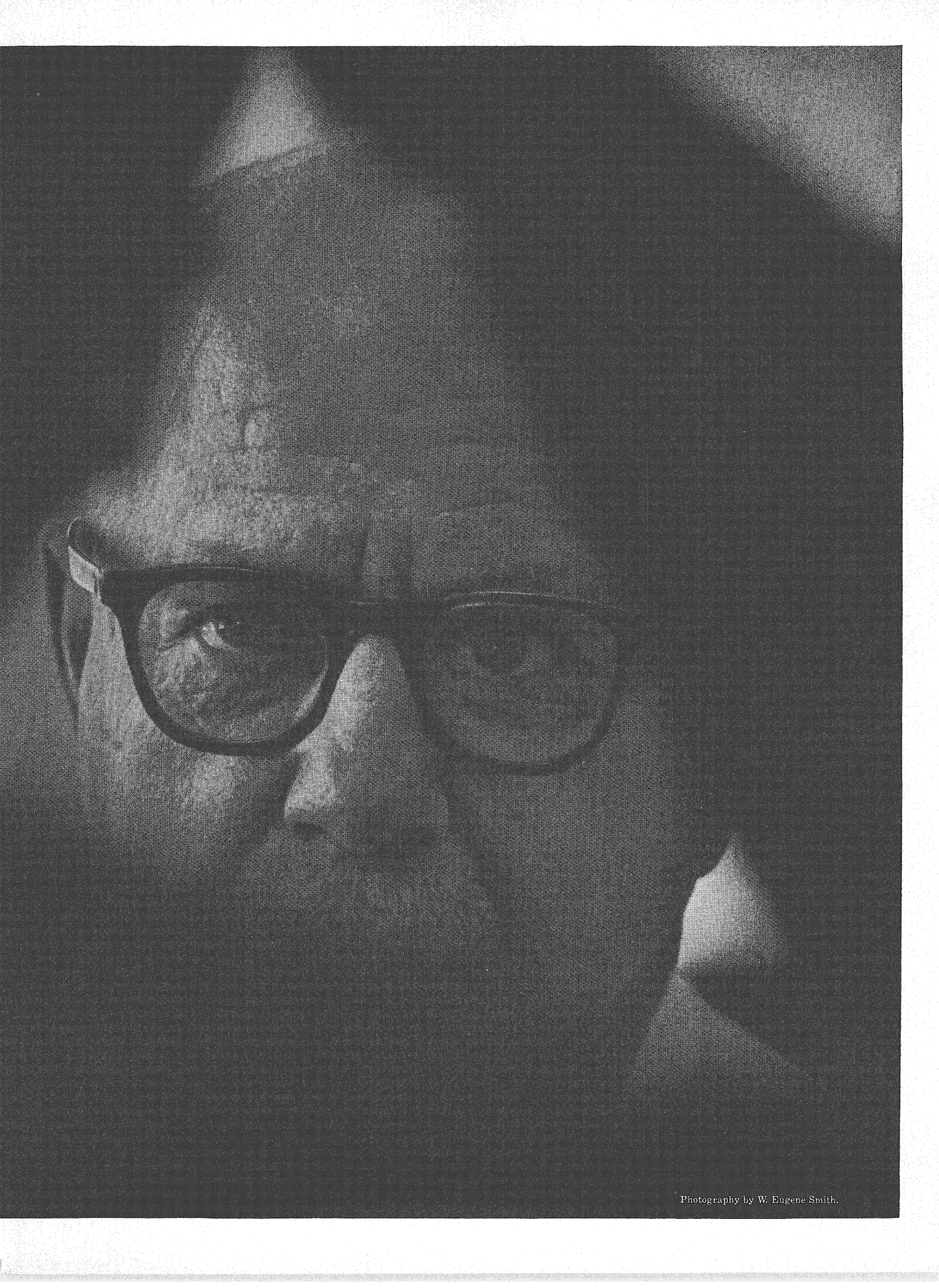
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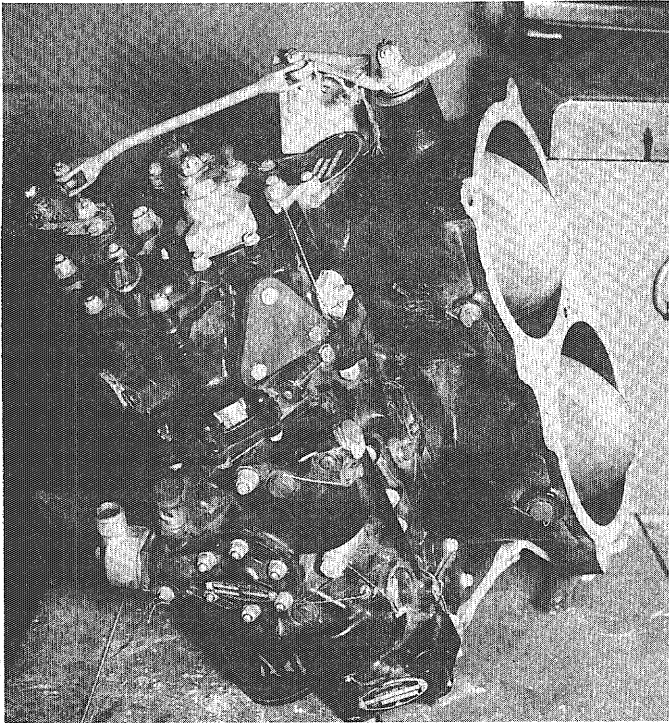
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Photography by W. Eugene Smith.



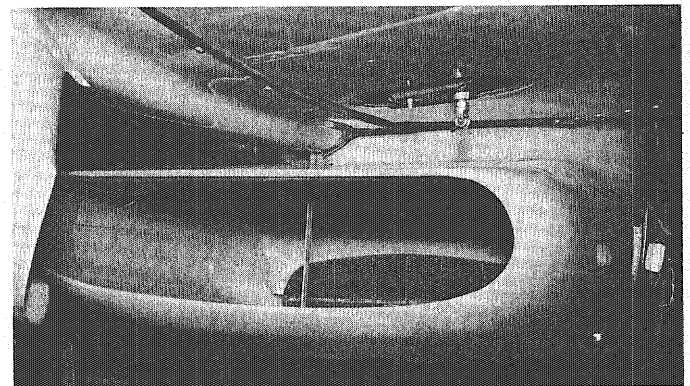
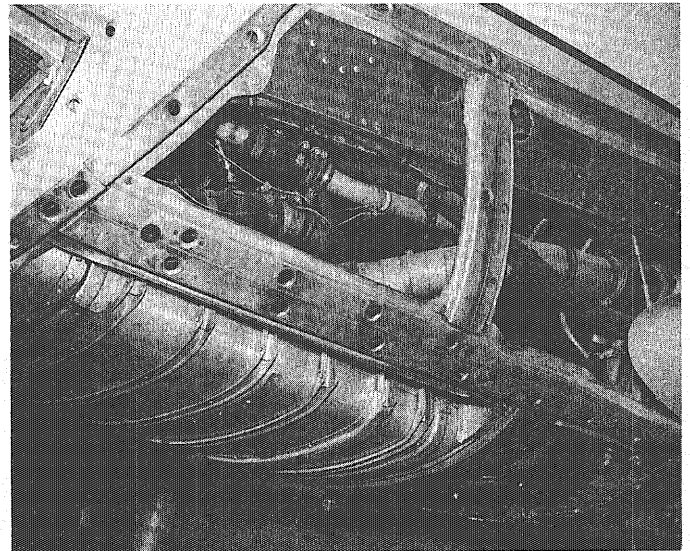
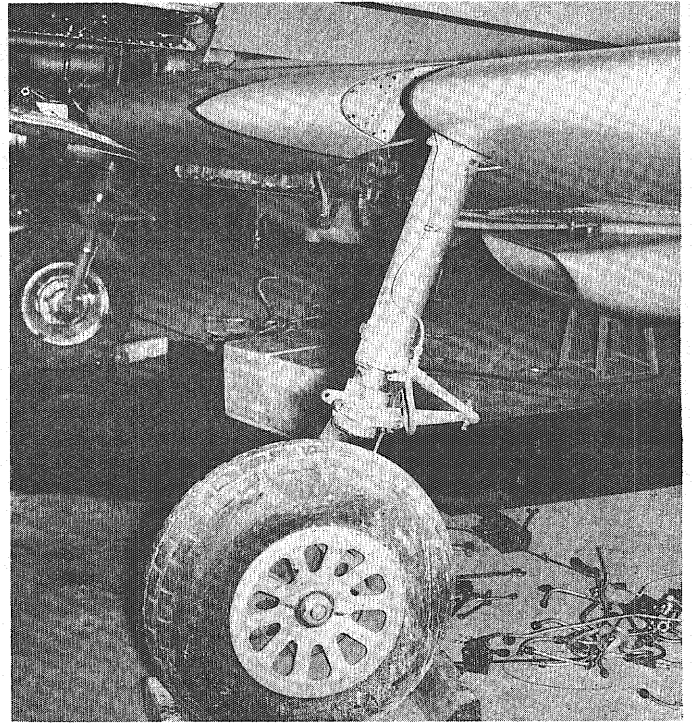
Stromberg 2-barrel injection-type updraft carburetor. Note size of glove in background.

mile trips to Canada and back with vital aircraft parts in order to put the plane in flyable condition. During the following five and one-half years he has spent countless hours and some \$3,000 in converting a salvaged military aircraft into a plush, two-place high performance airplane. One of the most costly parts to be replaced on the plane was the engine. Up until a few years ago the price of a Packard-Merlin engine was quite reasonable—about \$450.00 to \$800.00. But today, with the increased demand due both to the military and the increased civilian use of the Mustang in air racing the price has raised considerably. Today you can expect to pay between \$1500.00 and \$2000.00 for an engine in fairly good condition.

Mr. Doyle coated the entire aircraft with an epoxy filler in order to cover all rivet holes and give the Mustang a satin-smooth finish. This greatly reduces the drag and increases the performance of the Mustang. Lights, radio equipment, special access doors to eliminate removal of the cowlings for service, and a built-in step in the left flap to facilitate entry make this Mustang a more practical and efficient aircraft. All aluminum hydraulic lines in the landing gear doors will eventually be polished to gleam like chrome plating. The finishing touch on this plane is a superb paint job. Three coats of high-quality enamel plus countless hours of polishing give this Mustang a finish which would put most auto manufacturers to shame. After patiently working on this Mustang for seven long years, Mr. Doyle hopes to have this flying masterpiece in the air by this Fall.

Now before you would-be fighter pilots go out and buy your own personal Mustang, here are a few facts about the care and handling of this high-spirited thoroughbred. The initial cost of a Mustang, considering what you are getting, is not excessively high. You might expect to pay from \$15,000.00 on up for a Mustang in fairly good con-

(Continued page 31)



The Mustang has two radiators located in the air scoop, one for the engine and supercharger, the other for the oil. The aluminum pipes (center) lead from the engine to the air scoop (bottom). Note the oil radiator in the bottom photo.

FINAL EXAM

What company was responsible for the following engineering innovations?

The transistor _____
Radio astronomy _____
Negative feedback _____
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Synthetic crystals _____
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Magnetic tape _____
Sound motion pictures _____
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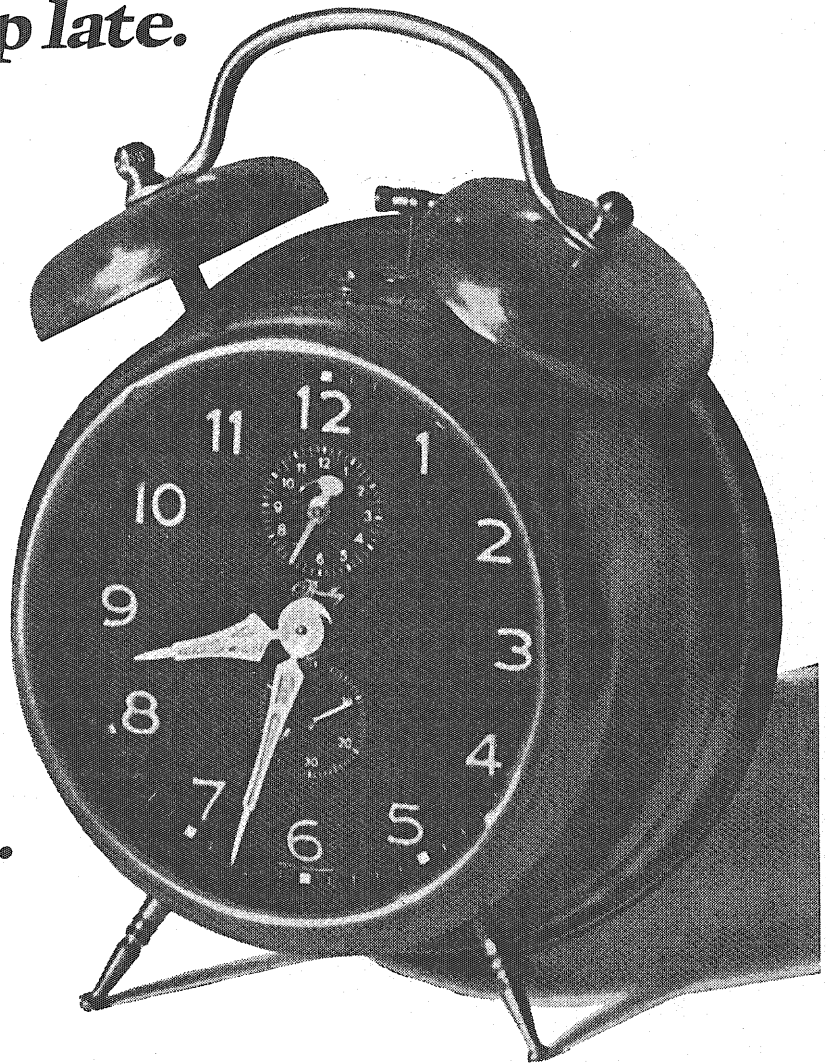
But the rest of the week you really won't want to. We hope. How come? We'll give you every chance to be so busy, so challenged, so involved that you'll look forward to each day. We'll give you every opportunity to accomplish something. And then get credit for it. That's what we really offer. In marketing, refining, planning and engineering, research and development, or administration. Is there something better? **Don't sleep on it. Talk to our representative on your campus. See our ad on the next page for the date.**

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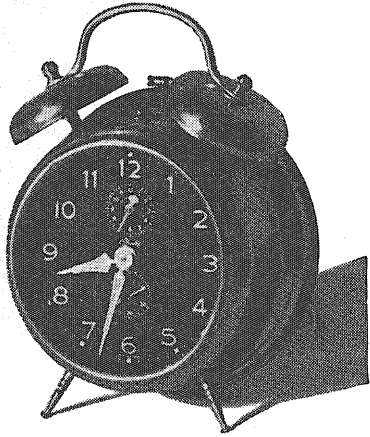


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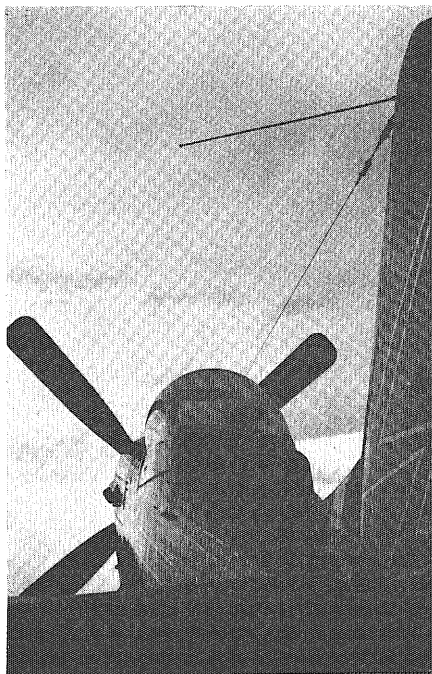
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dition. The true cost of the Mustang comes after the initial purchase. Unless you have an oil well in your back yard, the fuel costs are simply out of sight. The P-51 tank drinks about one gallon of 100/130 octane aviation gasoline per minute at cruising speed. This rate doubles at take-off power. Oil changes in the Mustang are no cinch either. The crankcase capacity of the standard V-1650-7 engine is 21.2 gallons. The cost of a major engine overhaul (required every 400 hours in the military version, every 700-800 hours in a civilian model) is a cool \$4500.00.

The P-51 is definitely not the airplane for an inexperienced pilot, not even for the average general aviation flyer. A study made by Dr. R. G. Byn-der of the FAA Accident Investigation Branch shows that twenty-five P-51 accidents occurred in a 26-month period from 1962 to 1965. Almost all were due to pilot error and inexperience. Now, twenty-five accidents may not seem like a lot, but considering that there are only about one hundred-sixty civilian Mustangs licensed in the United States, the figures speak for themselves.

So, my friend, if you have the money and the skill, the P-51 Mustang might just be your mount. Remember, you'll be flying what most experts consider to be the world's most aerodynamically perfect propeller-driven aircraft. 



WHAT DOES IT MEAN TO CONTRIBUTE ?

What does it mean to you? Is your definition flexible? Will it change next year? In five years? Chances are it will. But as an engineer with a progressive education and with a better-than-average awareness of the problems facing mankind, your definition should include these qualities: Desire to serve and ability to serve.

If your definition includes the desire and ability to serve mankind, you're the kind of engineer we want. These qualities, combined with your technical background, make you well qualified to move into industry.

You'll fit into the big picture at E-M, but you won't get lost. You'll fit into the engineering atmosphere where ideas and actions are rewarded. You'll fit in where the "engineering approach" is a reality, not just theory. You'll fit in because E-M is engineering oriented. (We have 1300 employees; 110 engineers; about 50 are U of M graduates.) But most important, you'll fit in because you want to contribute.

As a leader in the design and manufacture of electrical power apparatus, E-M is a major contributor. We serve mankind's needs in transportation, water, health and sanitation, food, and energy. (Future issues of TECHNOLOG will highlight man's basic needs and how our products help produce the goods that meet these needs.) As an employee of E-M, each engineer can see how his efforts are reflected in the overall company contribution.

Because of the industries we serve, our future is limited only by the future of man. E-M is a company where individual initiative and hard work result in the technological advances which serve the needs of man.

Join this progressive engineering team. It'll be a personal challenge with high development opportunities. If part of your goal is to serve, and to contribute, we want to talk with you. We'll be on campus on Friday, October 25, 1968.

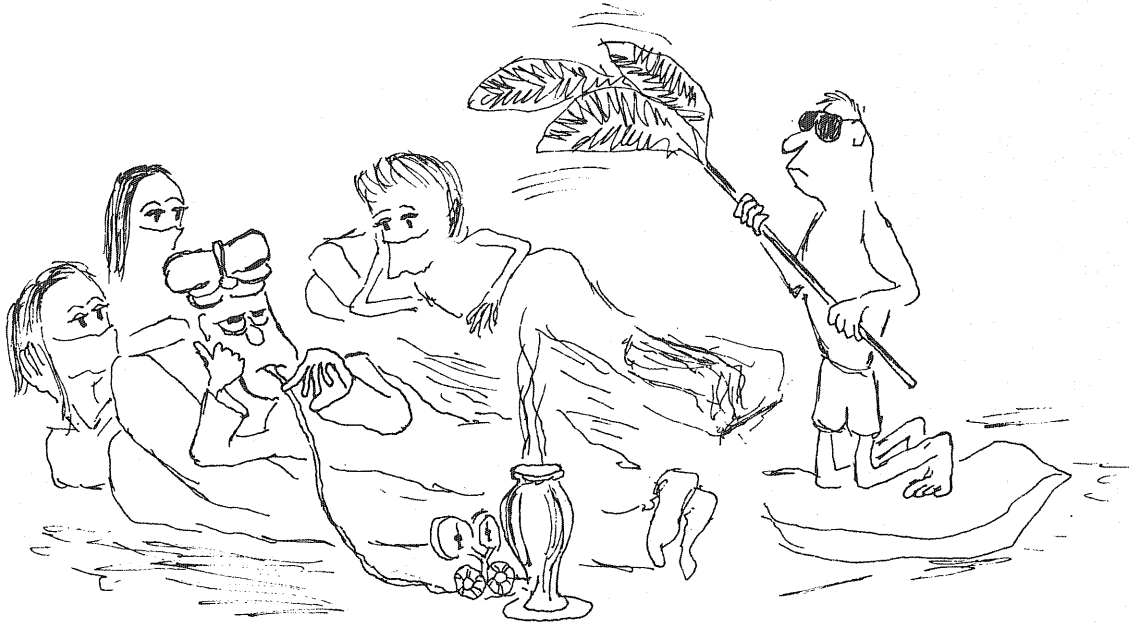
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LOG'S LOG



by jai byrd

Hello there, fellow draft-dodgers! This month you will be treated to a veritable banquet of seven courses of pasta. You should be so lucky as to have lost your tastebuds eating gut-bombs and fungus-paddies at the local MacHenry's.

First, you will thrill to the exploits of your favorite historical figure in the definitive history course of all time.

Next, for those of you who survived that dry test, a few maxims to guide you through the first troubled weeks of school, while you rationalize your non-studying to yourself.

Thirdly, you will find a story by everyone's favorite war correspondent, Ralph Groop.

Finally, you will find a summary of the high points of this next month, to help you fill those empty hours of non-study.

Parson's College Correspondence Short Course In History

Come with us now into the days of yesteryear:

As you will recall from last time, we had left Sultan Pepper clutching power by his cuticle-covered fingernails. The infamous Turk was having trouble keeping his wives from spending too much—they had not yet learned the lesson taught Marie Antoinette in France

(Revolution had just placed the "reigns" of power into the hands of a Corsican artillery officer, Napoleon Blownaparte). Even now as his wives attended the January White Sale at the slave market, a group of dissident Moslems, the Mosqued Marauders, were planning a coup led by that famous underdog Highly Slashy.

Meanwhile, Pope Gosedaveesel had succeeded Pope Orrie and was giving the ruler of Piedmont, Count Meyowt, a hard time. The Pope wished to place Baron Wayste in control.

At the same time, Kaiser Frazer ruled Germany with an "iron hand"; he felt it was time to draw the line. Unfortunately, iron hands do not make good straight-edges. His wife, the "old fossil" herself, nee Ann der Thal, was unexplainably attached to a rock group, the Munich Depressants. Another of her joys was horse racing at Pitt Downs.

World-renounced Czar Cheebloaz, ruler of all Russia, was having his troubles: his wife, Katherine the Grate, was rubbing him the wrong way; his barons hated his ecclesiastical advisor and were planning an attack upon Phelonious, the "Mad Monk".

England's Premier De But had just wiped out the "Rump Parliament" with the help of Defense Minister Lord Brandish and Admiral Bull. Cap'n Gowen had been sent out to bring the French navy to its knees (it was a very disjointed French effort). The Arch-Bishop of Cranberry wished the armada of English vessels "God speed" (estimated by contemporary mathematicians to be 20 knots).

In America, Herman Melville had just finished his novel about one Captain Ahab and his grudge-battle with a white whale (which was very one-sided . . . thus the title **Mobius Dick**).

Also President Lucius Hunkamann, famous lady-killer (nicknamed "the Destroyer Escort") and ex-Postmaster General was facing re-election after declaring the "Open Door" policy (which raised fears of a draft among college students). His opponent was Fightin' Harry La Follicle.

Down in New Lurleens, a new folk-singing style was started by Bertha de Bleuz.

QUIZ

1. Who said, "The fat is in the fire and we have gotten Greece!"?
2. Which country enhanced its position in the European power struggle by allying with the African nation of Upper Voltage?
3. What super-hero carries a utility belt of two fingers of vodka (his pinkie and second finger)?
4. Who asked for a face-to-face meeting with Count Tenants, nefarious absentee slumlord.
5. Which European ruler did all his addition and subtraction using the fingers and toes on his left hand?

Back From The Front

Ralph Groop

Ace War Correspondent for
International Enquirer

Here I am, atrocity fans, right in downtown Chicago. You may wonder what the official press organization of the International Swiss Conspiracy is doing sending me here. Apparently, the boys behind the scenes feel that Chicago's Mayor "Minnesota" Daley, is the best study in reactionary thought since Tammany Hall and "Boss" Anova.

While there can be no tales of rape and pillage to whet your sadistic appetite, there is more gore than on a Sunday in Spain. The police showed a definite disregard for anyone in their path. Innocent women, children, newsmen and pickpockets were clubbed unmercifully. Human waste was thrown at human wastes.

But, the real story was happening at the "Quadrennial Convention of Capitalist Dupes/Socialist Cop-outs" in Convention Center. Mayor Daley was cultivating the Indian and Deaf vote while he practiced his hand signals for the Charity Ball. Meanwhile, Eugene Quixote, all-around good-guy and my hero, was gallantly fighting the Daley-Johnson combine which continued to harvest delegates.

Hubert Horatio Horntweeter smiled.

When the dust and cobwebs had settled, Mayor Daley had gone into his second encore, Eugene refused to endorse any non-candidate, Hubert was Dewey-eyed, and Richard Millstream Nixon smiled.

Don't miss next month's exciting race between the hair-trigger and the turtledove.



Attention all you culture fans: Don't miss the color photos of red algae in this week's "Life".

My car has been using a lot of STP lately. I was a little worried until I discovered the engine is an "acid-head six."

• • •

Readers' Egest movie review . . . "Rosemary's Baby" starring Mia Sparrow . . . A bitter-sweet tale of a mother who must raise a child with birth defects. A mystery centers around weird dancing and chanting coming from the adjoining apartment of Mr. and Mrs. Ramone Castanet.

• • •

While many of us may not relish the idea that Death will ketchup with us one day; for others, especially the extremely downtrodden, Death heaves a "scythe of relief."

Official Daily Bull

- Oct. 15 Jeane Dixon again proves the medium is the presage.
- Oct. 19 Pied Piper trampled by lemmings.
- Oct. 21 Chicken crosses road.
- Oct. 25 Austrian ambassador expelled from Poland for spying on military installation, becomes ambassador without Fort Polio.
- Oct. 28 Road has chicken knocked off.
- Oct. 31 Halloween Great Pumpkin drives Linus out of his gourd.
- Nov. 5 Elephant and donkey fight to the death, best two out of three.
- Nov. 6 Recall petitions circulated.
- Nov. 8 Dope ring uncovered in General College.
- Nov. 11 Apply for emergency loan, told processing takes 3 weeks.
- Nov. 13 Sell blood to hospital, get hit by car when leaving.
- Nov. 14 Drafted for leaving school; Nurse consoles you.

It's not often an engineer gets to design a company.

When he does, he tends to take care of his own kind.

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launch vehicles; extra vehicular activity research and development; high mobility ground vehicles; missile systems; computer, technical and management services.

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Can you cut costs without cutting corners?

The designer of this six-wheel diesel locomotive truck frame did...that's why he chose *cast-steel*.

Using smooth fillets and fairings possible only with casting, he eliminated stress concentration caused by the corners and angles of wrought structures. To keep weight low without sacrificing strength, he varied section thickness, concentrating steel at the points of maximum stress.

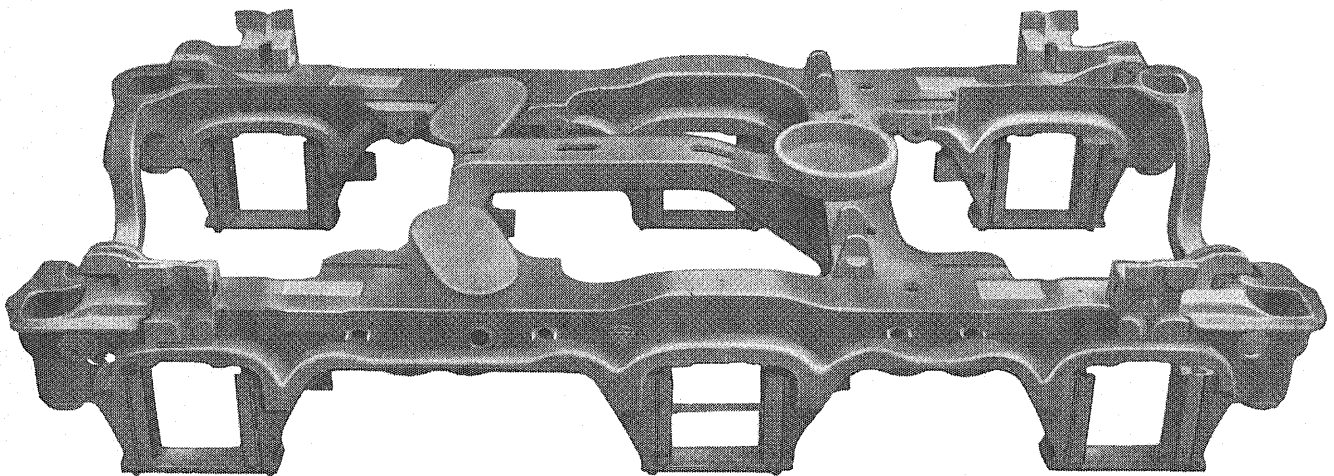
And with *cast-steel* he got substantial savings in the bargain. One-piece construction eliminated assembly costs. Holes, slots and channels were cast-in directly. With the

greater dimensional control inherent in casting, finishing costs on the 8 x 18 foot frame were cut to a minimum...Compare this with the tedious assembly, machining and finishing work that goes into a welded or bolted structure.

Want to know more about *cast-steel*? We're offering individual students free subscriptions to our quarterly publication "CASTEEL." . . . Clubs and other groups can obtain a sound film "Engineering Flexibility." Just write Steel Founders' Society of America, West-view Towers, 21010 Center Ridge Road, Rocky River, Ohio 44116.



STEEL FOUNDERS' SOCIETY OF AMERICA



***Cast-Steel
for Engineering Flexibility***

MISS OCTOBER . . .

Ann Polkinghorne



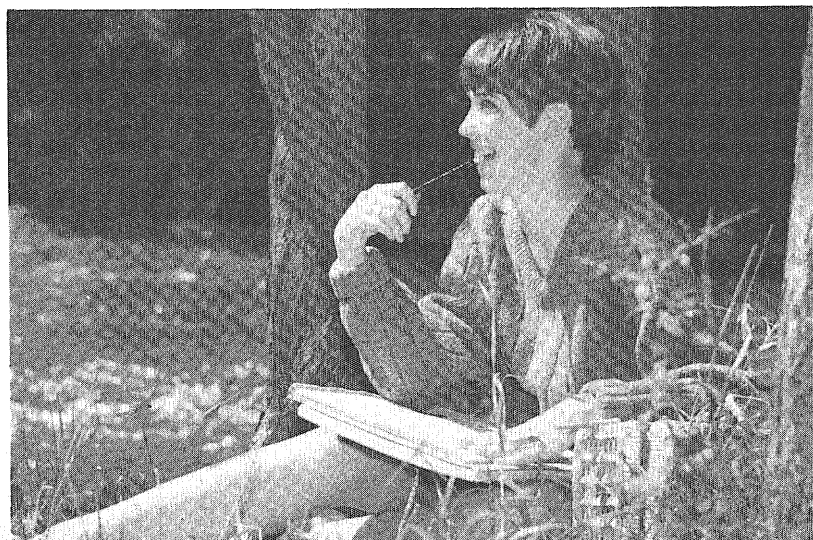
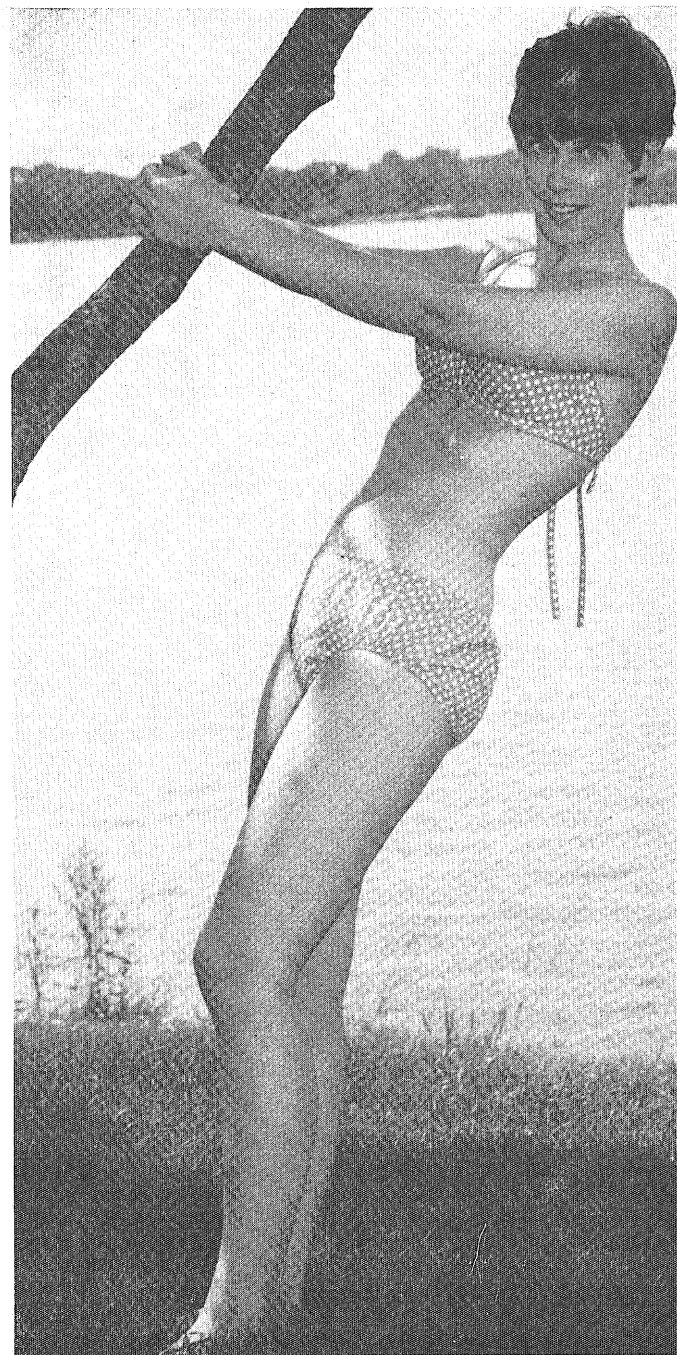


The Technolog would like you to meet one of its new recruits, Ann Polkinghorne. She will be working on the Log's Art Staff. If she looks familiar, it may be you remember her as one of the five finalists in the 1968 IT Week Queen contest.

Ann is an outdoor girl and lists biking, canoeing and camping as her favorites. She even worked at a northern Wisconsin camp. Another love of hers is poetry; she writes as well as reads it.

Twenty-one year old Ann will graduate this spring as an art education major. She starts student teaching a Jr. high art class this year.

How about it, do you think we picked a good staff member? Take a look at this month's cover; it's a sample of Ann's work.





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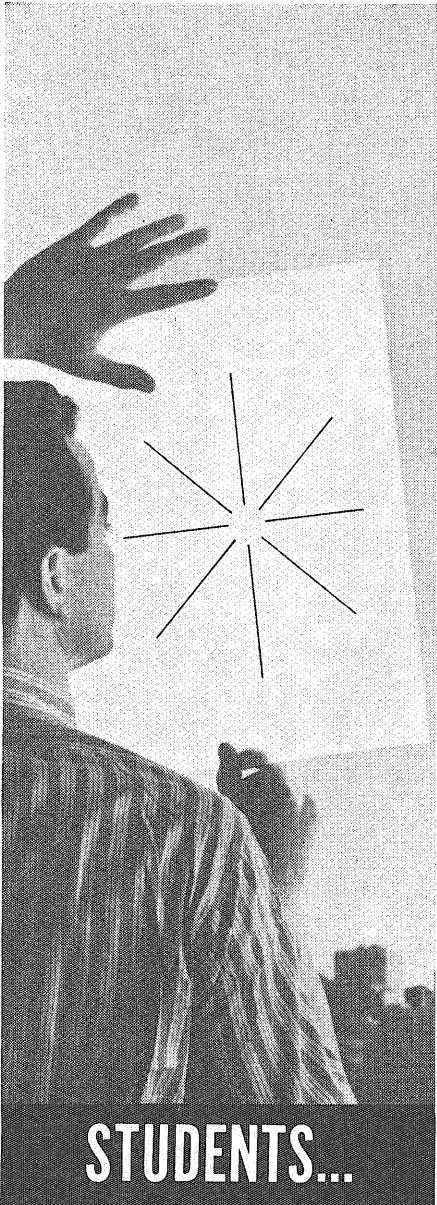
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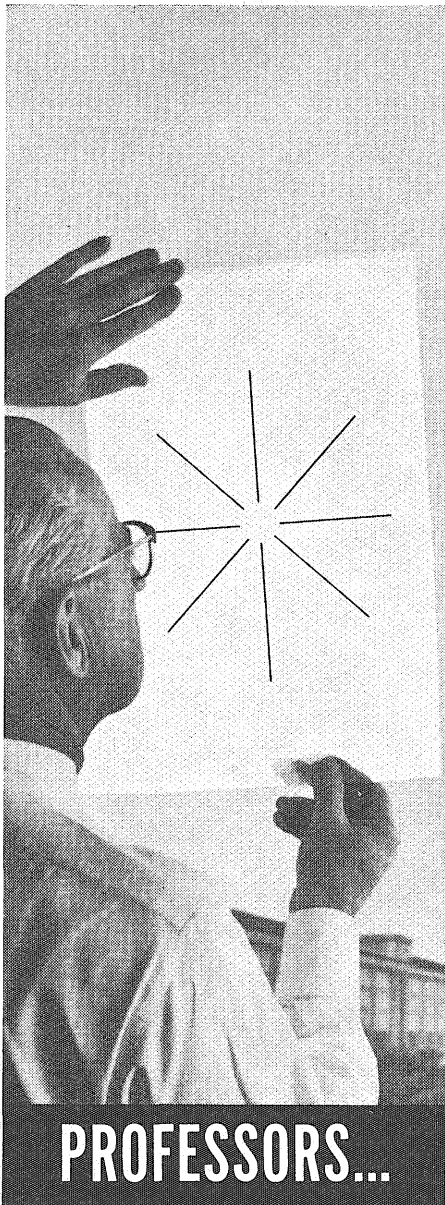
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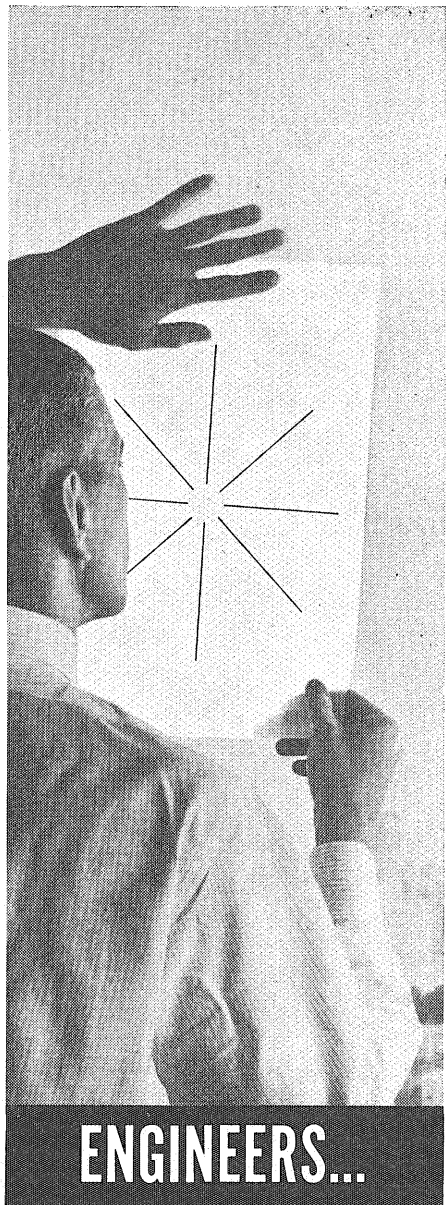
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WHAT'S NEW

in science and engineering

Edited by Pat Lamey

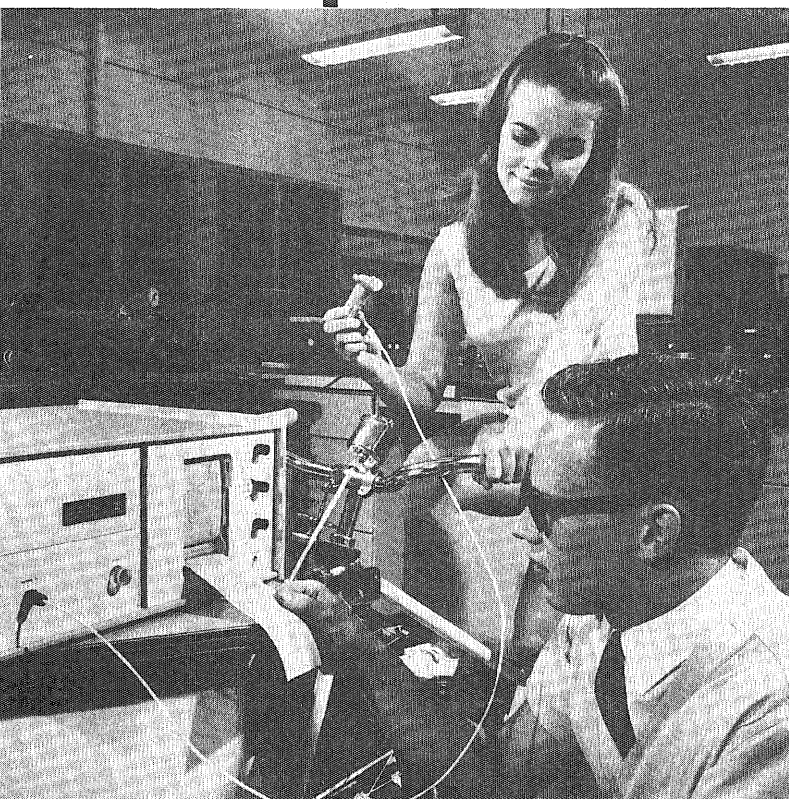
How's Your O₂ Content?

A medical oxygen monitor, so sensitive and fast acting that it can pinpoint precisely the changing oxygen content of every breath that a person takes, has been developed by Westinghouse Electric Corporation.

The instrument monitors the oxygen content of the air that has been in direct exchange with the blood in the air cells (alveolar space) of the lung. Until now, expensive and complicated instrumentation was required for such measurements.

Essentially, the monitor is an electrochemical cell consisting of a ceramic (zirconium oxide, ZrO) tube with a porous metal electrode on each side. At high temperatures, the cell generates a voltage when the quantity of oxygen at one electrode differs from that at the other. The voltage comes from the movement of oxygen ions across the solid ceramic electrolyte.

In use, room air is introduced to the outside of the cell, where it acts as the reference gas for the instrument. Then, when a person breathes through a tube into the inside of the cell, the voltage generated by the device is a measure of the different amount of oxygen present. Since the response time of the cell is extremely fast—about 10 one-thousandths of a second—the instrument gives a continuous reading of the oxygen content in the breath as a patient inhales and exhales. The information is continuously recorded on a moving strip chart. The monitor is so sensitive that, during expiration, small squiggles in the tracing indicate variations that are introduced by the beat of the heart. The accuracy of the instrument is within one-fourth of one percent of the exact value of the oxygen concentration under measurement.



Television in the Dark

"See-in-the-dark" television may soon be keeping an eye on your neighborhood school, local supermarket or nearby parking garage. Until now, such ultrasensitive, low-light-level TV systems have been used almost exclusively for looking at the "invisible" in military and space applications.

Heart of the system is a compact, one-piece, low-light-level TV camera, which uses an advanced principle of light amplification—originated by Westinghouse scientists—called secondary electron conduction (SEC).

The unique performance of the new television camera is achieved through the use of a SEC camera tube. The tube has been developed by the company's electronic tube division, Elmira, N. Y.

Basically, the tube strengthens weak incoming light by changing the light energy into electrons, increasing them in number and "strength," and using them to create a greatly brightened visible image.

The incoming light image is focused onto a photocathode, which emits a duplicate pattern of electrons. Electrical voltages accelerate these electrons and guide them onto a target that has, as part of its structure, a thin porous layer of a material resembling common table salt. The layer is so light and fluffy that 98 to 99 per cent of it is a vacuum.

Within this layer, each incident electron generates as many as 200 to 300 additional electrons by a process called secondary electron emission. These are conducted through the porous layer and are "read" out from the rear surface of the target as electrical (video) signals that form the brightened television picture.

This new camera is as simple and compact as a standard vidicon television camera, but has faster response and is 100 times more sensitive.

In fact, its sensitivity approaches that of an image orthicon camera. But it is smaller and less complicated, has much greater range in its response to light, needs less than one-tenth of the power input and is considerably less expensive. These capabilities make the camera ideal for closed-circuit television surveillance, for the monitoring of critical industrial processes, for traffic control and for other low-light-level applications.



WHAT'S NEW

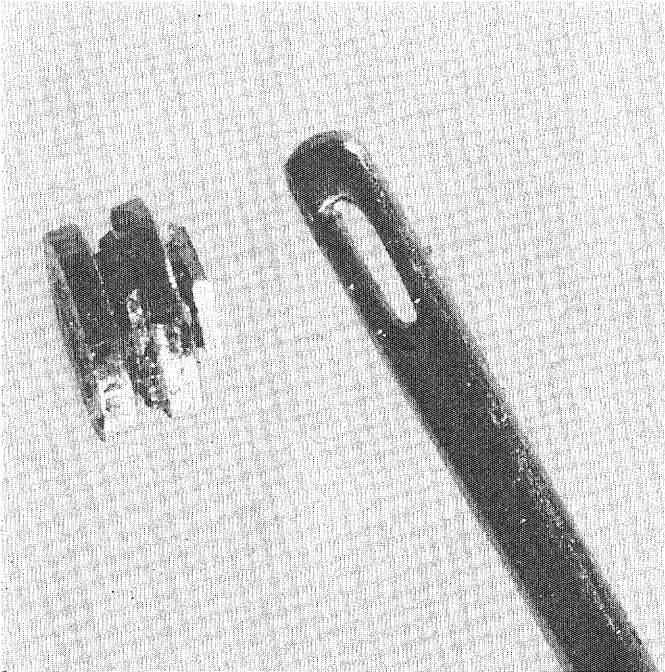
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Solid-State Diodes for Microwave Power

The series operation of directly-connected Gunn-effect diodes, an electronic feat previously believed impossible, has been demonstrated for the first time by scientists at the General Electric Research and Development Center.

Single Gunn-effect diodes—semiconducting solid-state devices, usually made of gallium arsenide—can generate low levels of microwave power under certain conditions. In addition, these diodes are easily operated in parallel, but it has generally been thought that the more useful series operation could never be attained.

In previous tests of the diodes in series operation, it was found that one member of the series chain would "capture" most of the applied voltage, rendering the rest of the diodes inoperative. A complicated form of series operation of Gunn-effect diodes, demonstrated last year, required that the devices be connected one-half wavelength apart—a distance in the microwave frequency spectrum that could range from a fraction of an inch to a few inches.



The successful series operation of Gunn diodes may make possible the development of a high average power solid-state microwave source which could produce many watts in the 10 gigahertz range with the efficiency of a single diode. Such devices could be used to power phased-array radar systems, hand-held radar equipment, and microwave relay communication networks.

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After years preparing for the "right" job . . . take time to select the "right" company. For a copy of Raytheon's latest brochure, or to arrange an on-campus interview, contact your placement director or write: Manager of College Relations, Raytheon Company, Lexington, Mass. 02173.

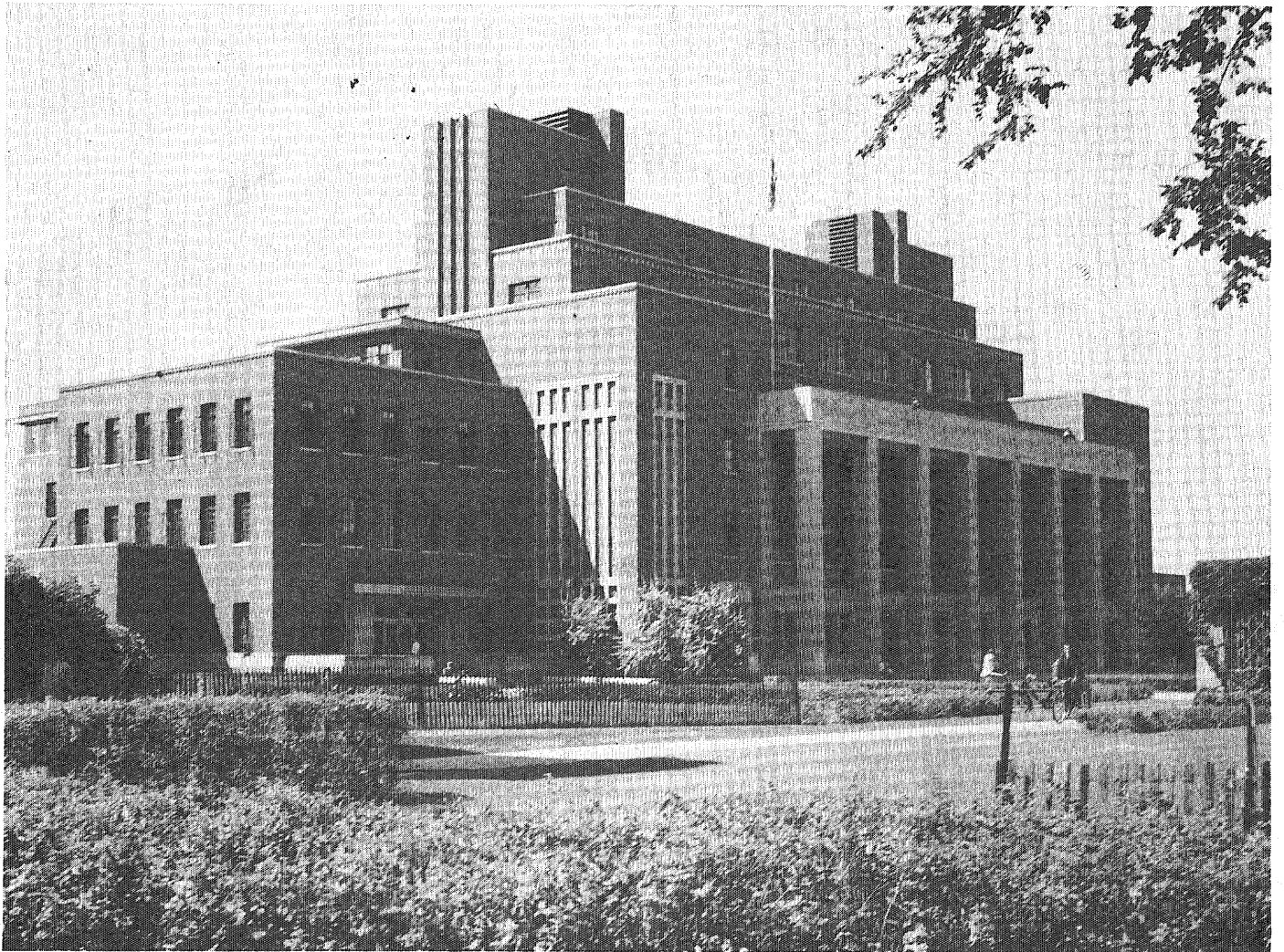


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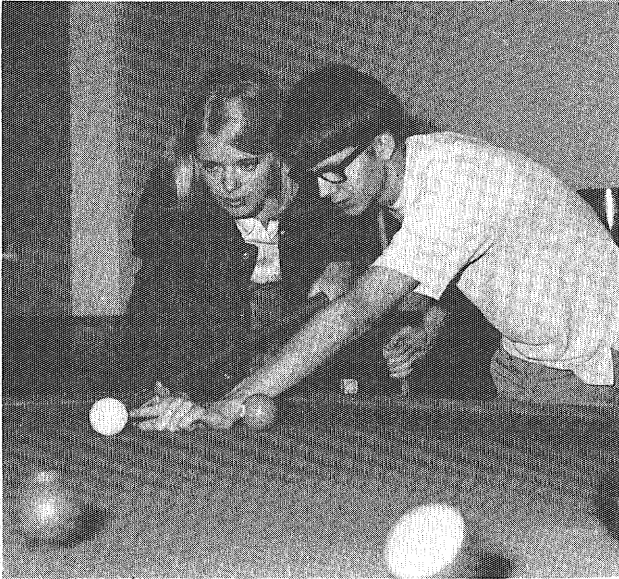
Introducing...

Coffman Memorial Union

photos by Pat Lamey



Coffman Memorial Union



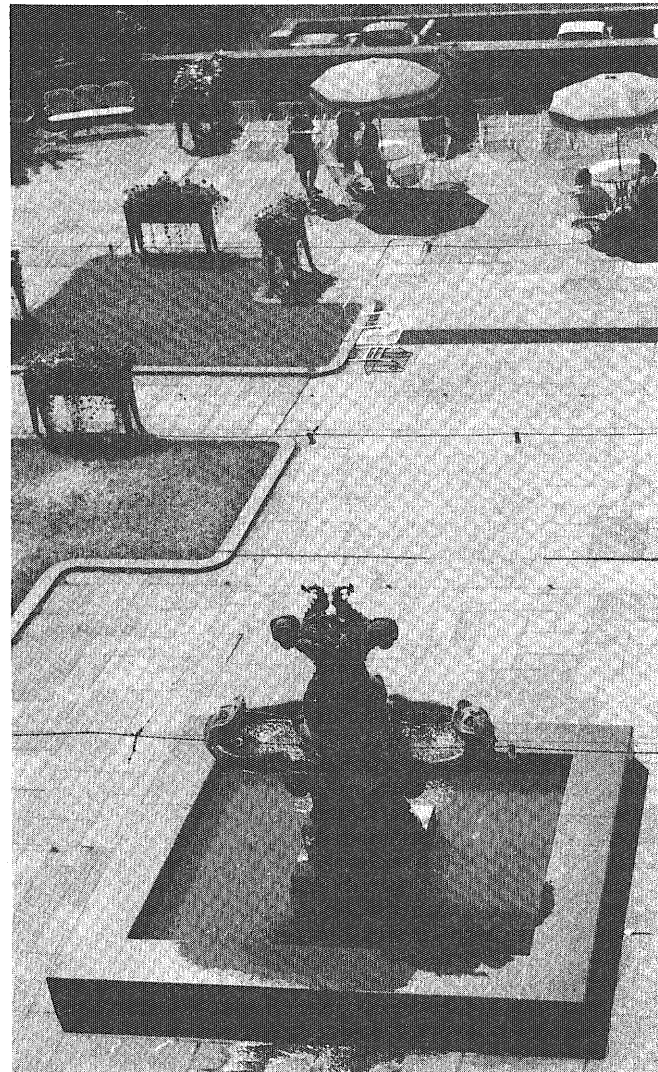
The Billiards Room on the main floor offers many forms of recreation.

Coffman Memorial Union, as the center of campus social activities provides many varied services for both students and faculty members. Everything from food to bowling can be found among the many activities at Coffman.

In the sub-basement of the union a student can make posters or work on just about any kind of art or publicity project in the Art Crafts Studio. Both tools and expert advice are there for the asking. A short distance down the hall the union bowling lanes provide facilities for classes and recreational bowling.

Up one flight of stairs the bill of fare features food. Four eating areas that range from a cafeteria to vending machines are provided to satisfy just about any student's taste. Also located in this area are the Post Office, the Bookstore and the main ballroom. They offer students a convenient place to mail a letter home, buy a book or watch Road Runner cartoons.

Relaxation and recreation dominate the first floor with a comfortable lounge where you can sit and gab with friends and a game room that includes billiards and ping pong tables. The Union information center is also located on this floor. The receptionist will be able to provide you with information about activities and meetings of such organizations as the Minnesota Student Association, Union Board of Governors, Rovers and Ski club which are headquartered in various parts of Coffman Union.



The terrace, open spring through fall is accessible from the first floor lounge.



We anticipate some squawks about our new sodium cable.

But we're glad to lend the utilities a hand in getting their electrical systems underground.

What we've done is invent a new kind of cable. We call it Nacon cable.

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Sodium's a light, excellent conductor. The only problem:
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But we've found a way to enclose it in an extruded polyethylene tube. This plastic protects the sodium from moisture. And provides the insulation.

Result: a flexible, less expensive cable.

It's something we could do because we're so involved in both metals and plastics. And it's something that's helping make it feasible to put more and more electrical systems underground—so there's less and less clutter on the landscape.

Nacon cable is a discovery that ought to make everyone happy. Except the birds.

For additional information on our activities, write to Union Carbide Corporation, 270 Park Avenue, New York, New York 10017. An equal opportunity employer.

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You'll be where all the exciting Space Age breakthroughs are. Where it's happening. Now. Today. Right now. This minute. The Air Force is the "now" place to be.

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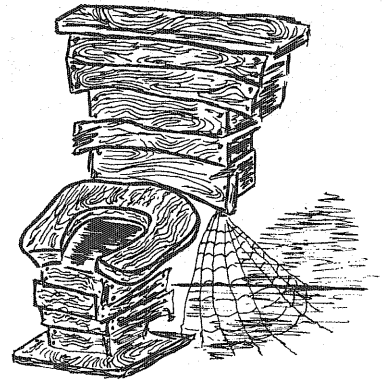
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SPLINTERS

by Paddy Hooligan

From the Log



GEOGRAPHIC AGES OF A WOMAN

Before 18, a woman is like Antarctica,
There is nothing there.
From 18 to 25, she is like Africa,
Half virgin, half explored.
From 25 to 35, she is like Asia
Hot, torid, mysterious.
From 35 to 45, she is like America,
Streamlined, efficient, cooperative.
From 45 to 55, she is like Europe,
Devastated, but still good.
After 55, she is like Australia
Everyone knows where it is, but
no one wants to go there.

C.E.: "Who's that?"

E.E.: "Oh, a girl I used to sleep with."

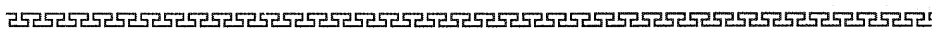
C.E.: "No kidding, where?"

E.E.: "MM 36 lectures."

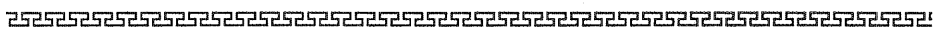
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"We got a case of beriberi up here. What'll we do with it?"

"Give it to the Engineers. They'll drink anything."



—vilitas et crudus semper eternam



The Tech Commission is providing a new service: Engineers Anonymous. If you get a strong desire to study, call them, and they'll send an IT Boy over to drink with you.

"Will you be free tonight," asked the M. E.

"No, but I'm reasonable," she replied.

• • •

Through the smoke and ozone fumes The student slowly rises.

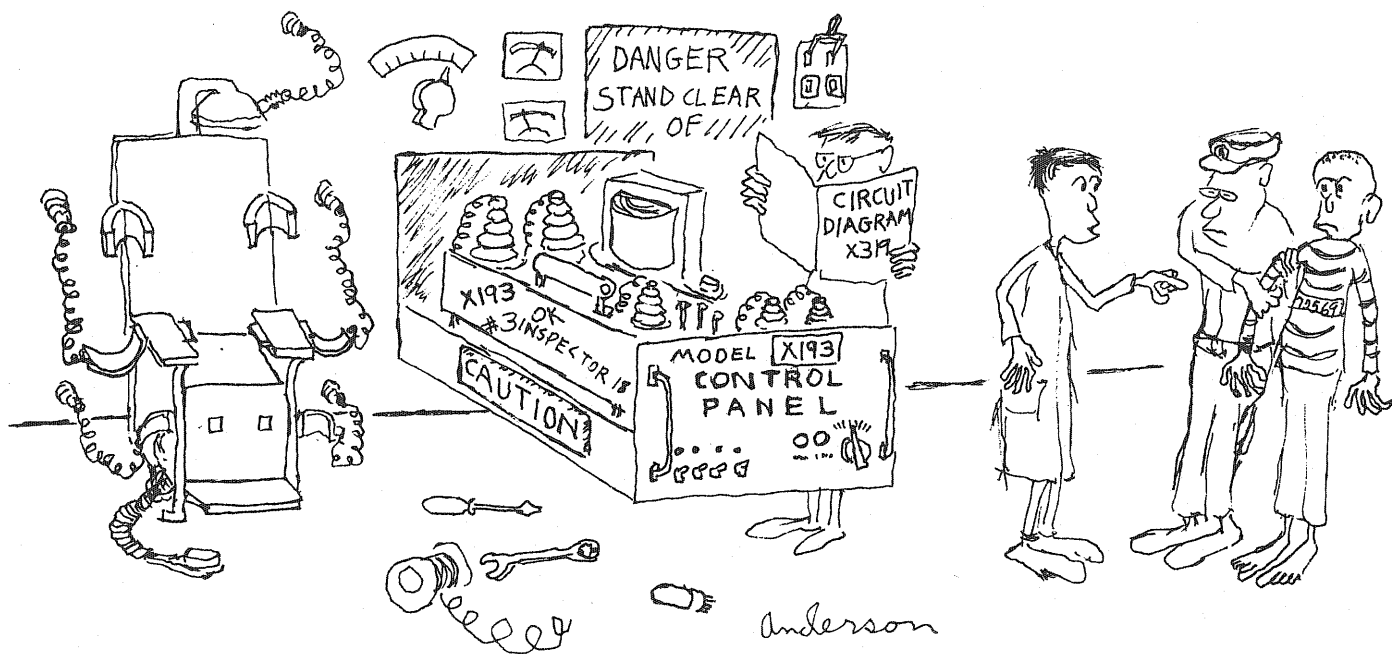
His hair is singed, his face is black, His partner he despises.

He shakes his head and says to him In words so softly spoken,

"The last thing you said to me Was 'sure the switch is open.'"

An I.E. was discovered by his wife one night standing over his baby's crib. Silently, she watched him. As he stood looking down at the sleeping infant, she saw in his face a mixture of emotions that she had never seen before—rapture, admiration, doubt, despair, ecstasy, incredulity. Touched and wondering alike at his unusual parental attitude and the conflicting emotions, his wife, with her eyes glistening, arose and slipped her arm around him. "A penny for your thoughts," she said in a tremulous voice.

He blurted them out: "For the life of me, I don't see how anybody can make a crib like that for \$3.49."



Say, you're a EE, aren't you?

The girl on the bus was reading about birth and death statistics. Suddenly, she turned to the Engineer seated beside her and said, "Do you know that every time I breathe a man dies?"

"Very interesting," he replied, "Why don't you try Clorets?"

• • •

"Hi, Charlie. How is your wife?"
"Compared to what?"

• • •

Once upon a time, a ME was stranded on a remote desert island in the middle of the South Pacific. After he had been there a long time, a barrel floated to shore one day with a beautiful girl clinging desperately to it. The knightly ME rushed into the water and helped her ashore. After she had caught her breath she inquired,

"How long have you been marooned here?"

"Fifteen years and I've been all alone, too."

"Why you poor thing," exclaimed the honey, "but now you can have something you've longed for and had to do without all these years."

"What?!" said the ME, his eyes getting bigger. "You mean there's beer in the barrel?"

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A Senior E.E. was explaining his lab technique to an Aero buddy:

"It's really quite a simple experiment. You just fasten the lead to the terminals of this motor and pull the switch. If it runs we take your readings. If it smokes we take it back and get another one."

• • •

He who only drinks to calm himself,
His steadiness to improve.
Last night he got so steady,
He couldn't even move.

• • •

Her lips quivered as they approached him. His whole frame trembled as he looked into her eyes. Her chin vibrated and his body shuddered as he held her close to him.

The moral of this is: Never kiss a girl in a jeep with the engine running.

• • •

The stunning co-ed was stunned herself when the biology prof asked her, "What part of the human anatomy enlarges to about 10 times its normal size during period of emotion or excitement?"

"I—I refuse to answer that question," the girl stammered, as she shyly avoided looking at her male classmates. One of them was called on next and he answered correctly, "The pupil of the eye."

"Miss Smith," said the prof, "your refusal to answer my question makes three things evident. First, you didn't study last night's assignment. Second, you have a dirty mind. And third," he concluded, "I'm afraid marriage is going to be a tremendous disappointment to you."



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An ocean liner captain was trying to find a coat to keep two ladies warm. He shouted down to the crew's quarters, "Is there a mackintosh down there big enough to keep two ladies warm?"

"No," came the reply from below, "but there's a McPherson who is willing to try."

• • •

I. T. is a fountain of knowledge where students gather to drink.

The Southern farmer was introducing his family of boys to a visiting governor. "Seventeen boys," exclaimed the father, "and all Democrats—except John, the little rascal. He got to reading."

• • •

"Beg your pardon, but aren't you an engineering student?" "No, it's just that I lost my belt, my razor blades are dull, a bus ran over my hat, and I have a terrific hangover."

An automobile which does not enjoy a good reputation advertised that they would give away a blonde with each car. A delighted young Aero bought a car and rode into the country and parked. He kissed her, and then whispered in her ear. "No," came the reply, "you got that when you bought the car."

• • •

Nine out of ten engineers who tried Camels preferred women.

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She was a gorgeous girl,
And he was a loving male
He praised her shape in English
French, Italian, and Braille.

• • •
"If I'm still studying when you come
back, wake me up."

• • •
An IT coed saw an elephant in her
yard and immediately called the po-
lice. "Chief," she cried "there's a
queer looking animal out here in my
back yard. He's picking flowers with
his tail."

"Yes," said the sergeant, "and what
does he do with them after he's
picked 'em."

"Never mind," was the reply, "you
wouldn't believe me if I told you."

• • •
Chem E.: "Aren't you afraid of the
big bad wolf?"

Female: "No, why?"

Chem E.: "That's funny, the other
two pigs were."

• • •
Two engineers were sitting in the
library when a young coed walked by.
"Her neck's dirty," said one.
"Her do?"

• • •
A Met. E. is a person who can look
into the steel grey eyes of a platinum
blond and determine whether she is
a precious metal or a common ore.

• • •
"Halt! Who goes there?"
"American"
"Advance and recite the 'Star
Spangled Banner'."
"Er . . . Ugh . . . Let's see now . . ."
"Proceed."

• • •
An Ag. E. phoned a veterinarian.
"Say, Doc," he said, "I've got a sick
cat. He just lies around and licks his
paws. He has no appetite. What shall
I do for him?"

"Give him a pint of castor oil," was
the reply.

Somewhat dubious the Ag. E. forced
the cat to take the pint of castor oil.
A couple days later he met the vet in
town.

"How's your sick calf?" asked the
vet.

"Sick calf! That was a sick cat I
had."

"You didn't give him the castor oil,
did you?"

"Sure did," said the Ag.E. "Last
time I saw him he was going over the
hill with five other cats. Two were
digging, two were covering up, and
one was scouting for new territory."

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Oct. 16, 1968

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"So you had a date with an engineer?"

"No, I tore my dress on a nail."

If it's funny enough to tell, it's been told; if it hasn't been told, it's too clean; and if it's dirty enough to interest an engineer, the editor gets kicked out of school.

Some people sow their wild oats on Saturday night, and then go to church on Sunday and pray for a crop failure.

The fussy prof strolled down the aisle among the desks. Spying a cigarette butt on the floor, he growled at the engineer nearest him, "Is this yours?"

"No, sir, you can have it . . . you saw it first."

Two engineers had been drinking when one lost his grip on the bar and fell on his face.

The one remaining muttered, "That's what I like about O'Riley, he always knows when to quit."

Thermometers aren't the only things that are graduated and have many degrees without having any brains.

This is my slide rule. There are many like it but this one is mine. My slide rule is my friend, I will obey my slide rule, and I shall learn to love it as a friend. When it tells me that five times five is twenty-three point eight, then, by damn, five times five is twenty-three point eight. I will learn the anatomy of my slide rule. Though I die in the struggle, I will faithfully use every scale: the black scale and the red; the inverted C and the inside out LOG; the reversed A and the mutilated D. I will master them all, and they will serve me well, they will! I will cherish my slipstick and will treat it kindly; I will call it my baby, and never shall profanity sear its long graceful mahogany limbs. My slide rule shall be my brother in suffering. Through the long hours of midnight toil we will work together, my slide rule and I. And on the great day when my slide rule and I have finished our appointed task, and the problem is done, and the answers are right, I will take that damn stick and have one hell of a fire, I will.

Then there was the M. E. who saw a sign: 'Drink Canada Dry' and died trying.



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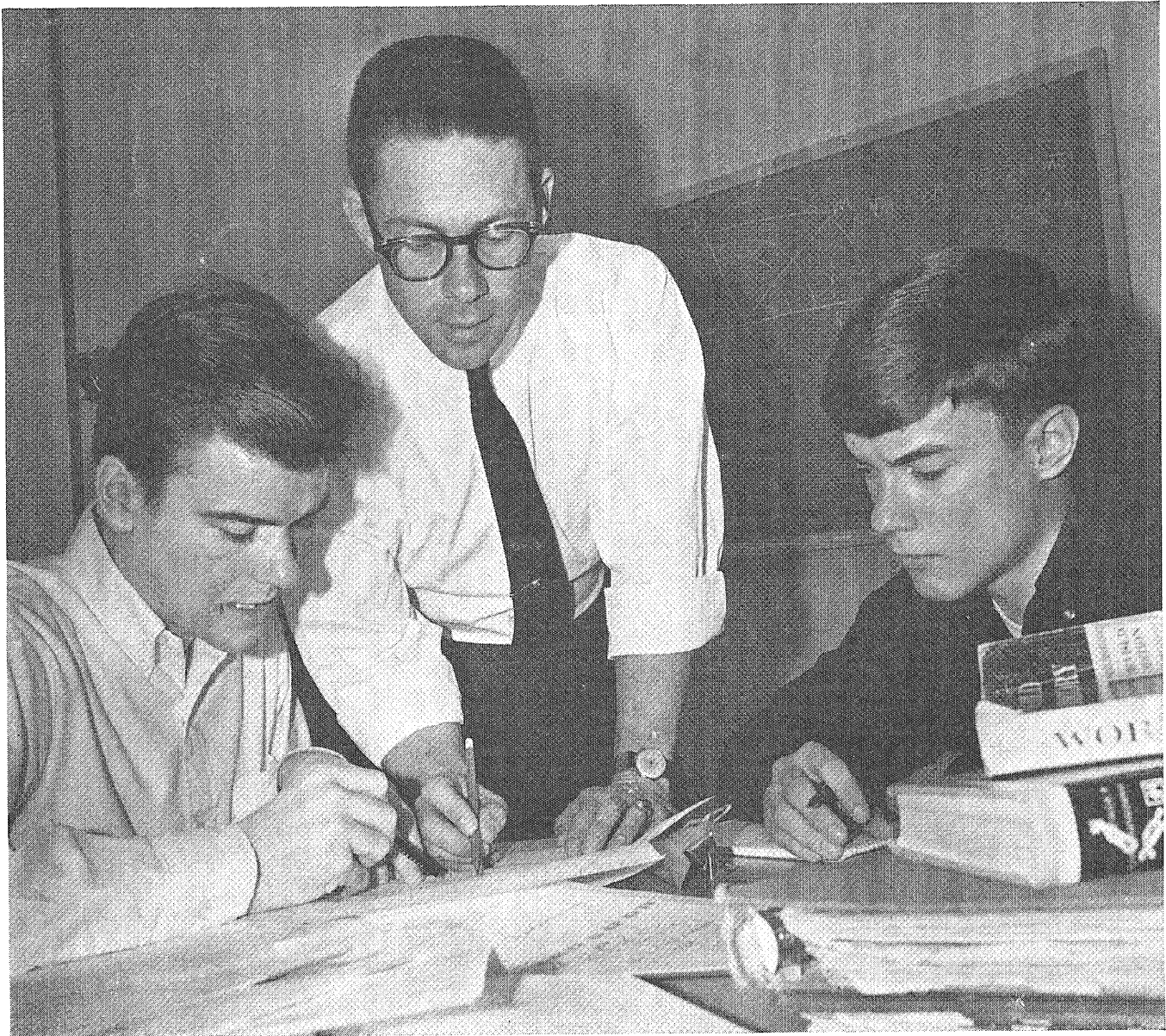
Many start in product development or process design and improvement. Some prefer on-line manufacturing problems. Others get into liaison work with our customers and become professionals in marketing.

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Like Pete Drobach, you'll find opportunities at General Electric in R&D, design, production or marketing that match your qualifications and interests. Talk to our man when he visits your campus. Or write for career information to: General Electric Company, Room 801A, 570 Lexington Avenue, New York, N.Y. 10022.

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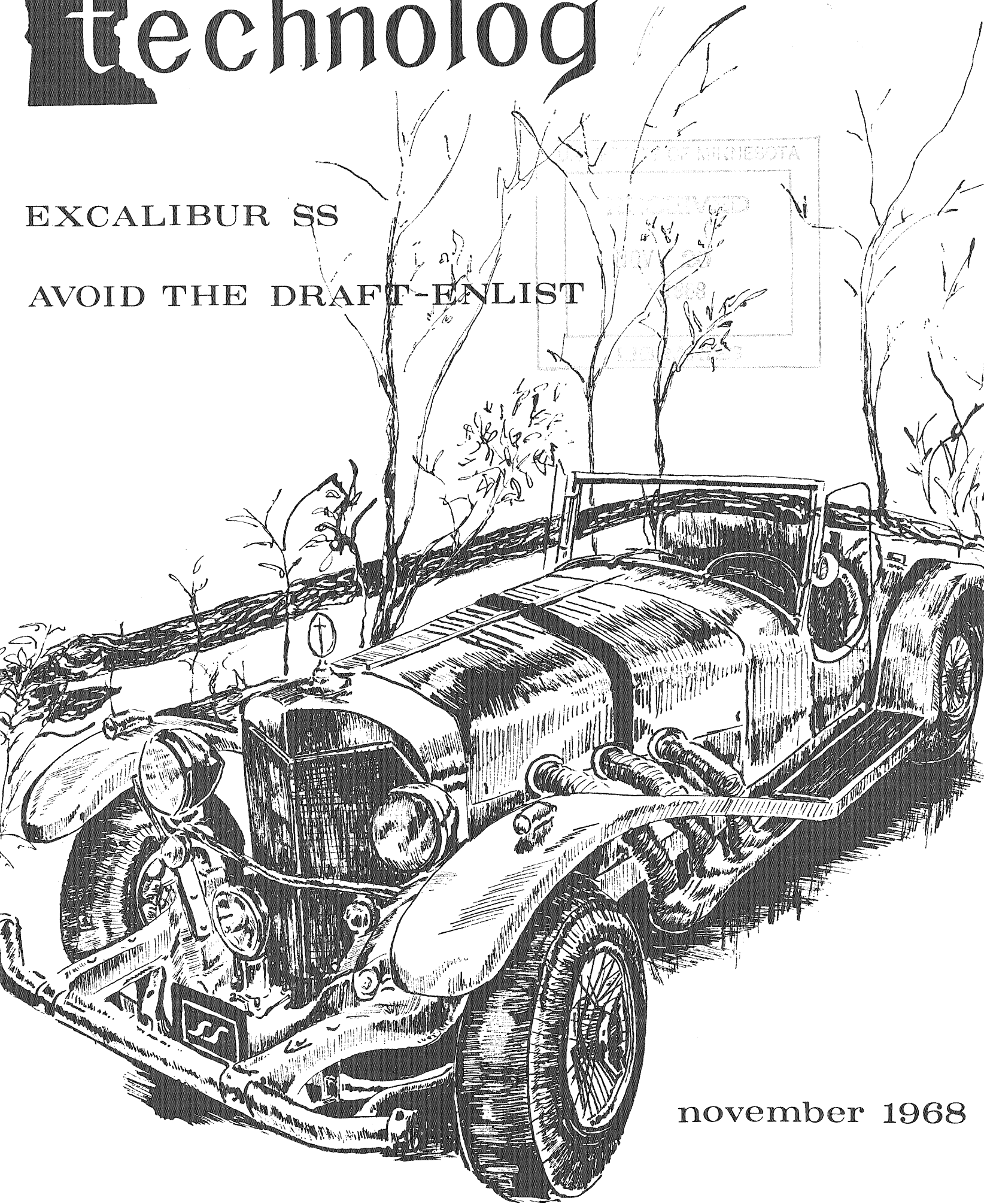
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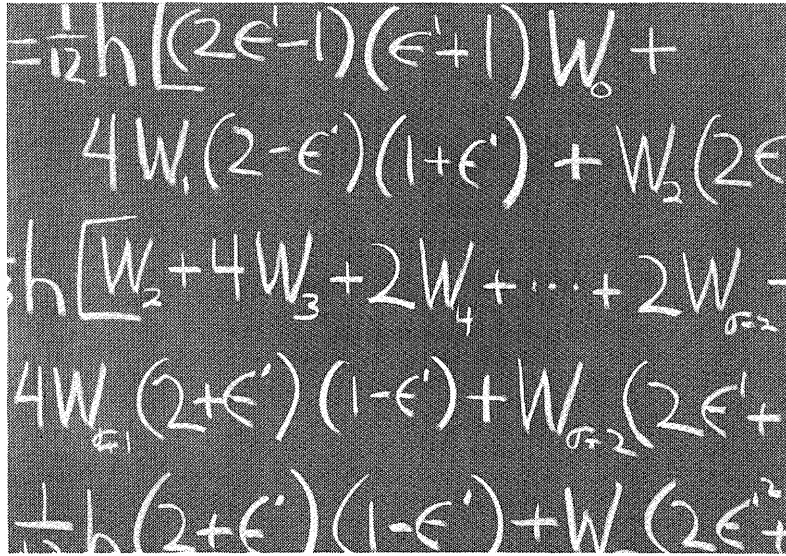
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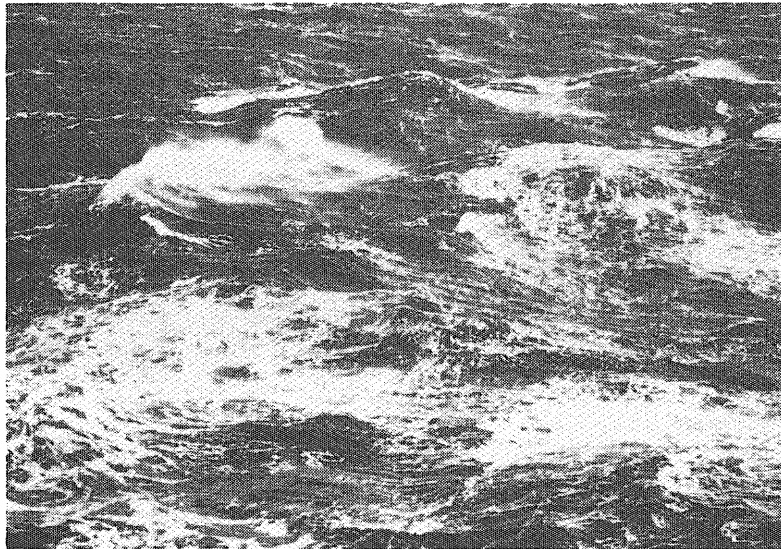


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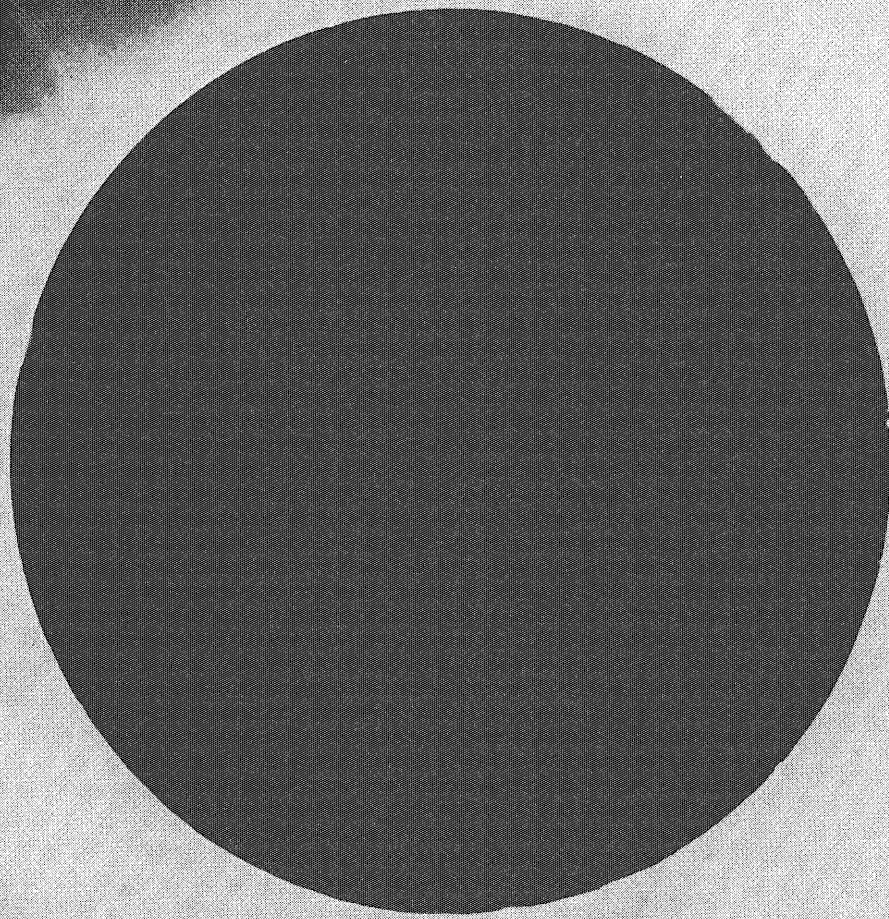
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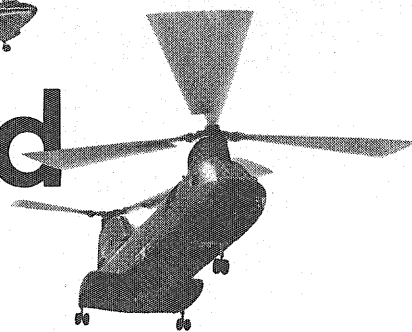
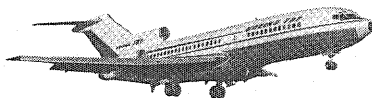
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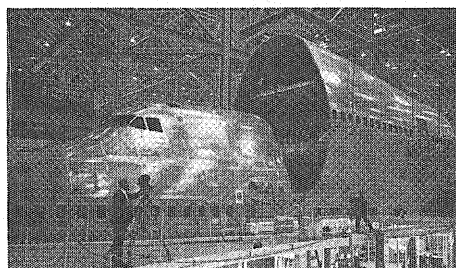
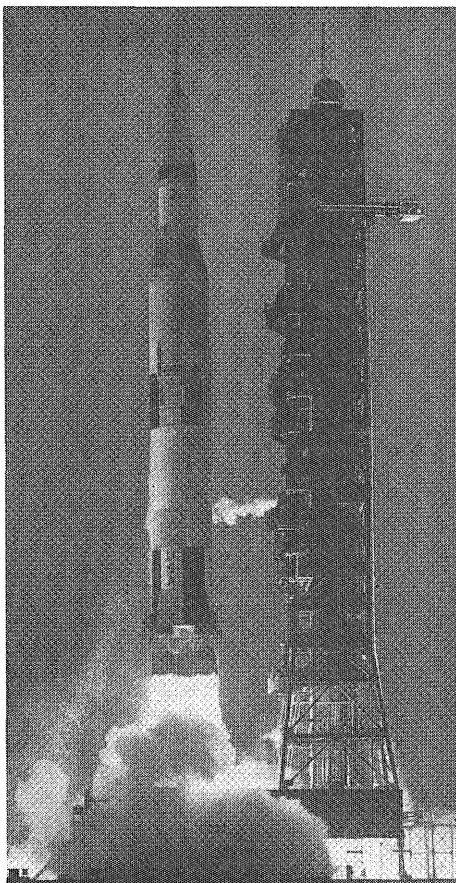
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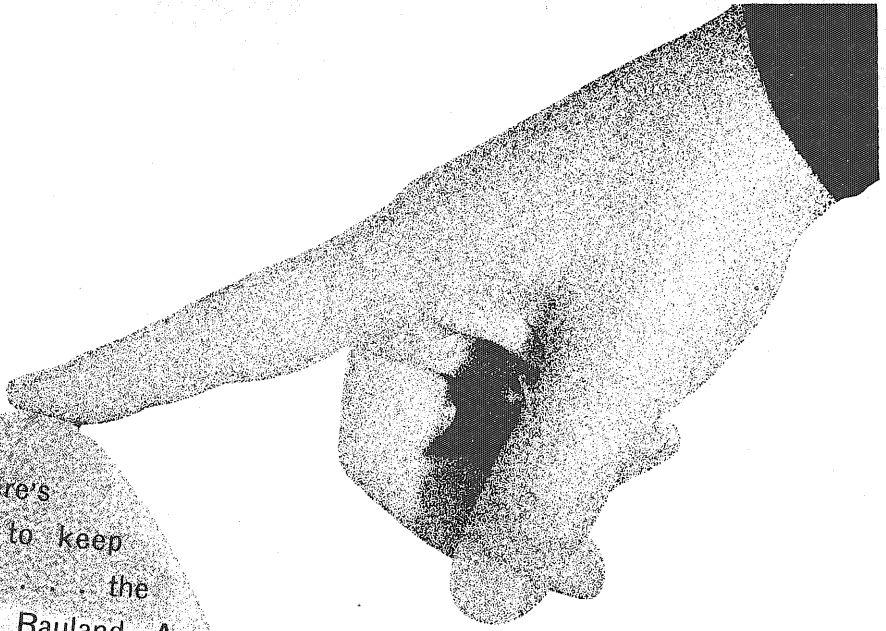
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Can you design a door that eliminates this problem?

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Question: Can you design a door that uses minimum out-swing space when opening?

Disciplines: It can go over the car, under it, slide into the frame, swing parallel to the body . . . AS LONG AS IT'S NOT TOO EXPENSIVE TO MASS PRODUCE. Door must also provide an electrical channel to the chassis to provide for power operated windows. Need your ideas in time for meeting next month. Thanks.

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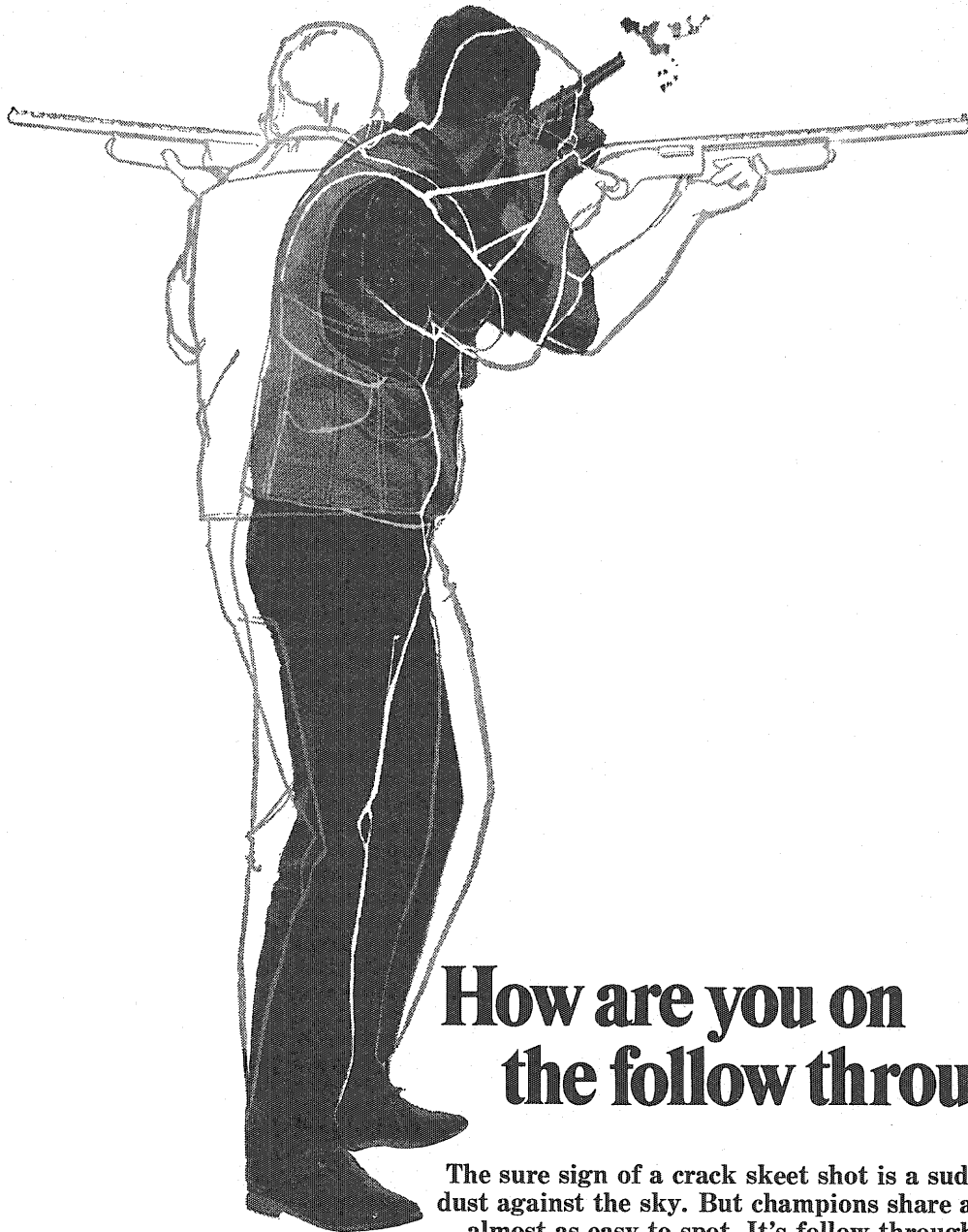
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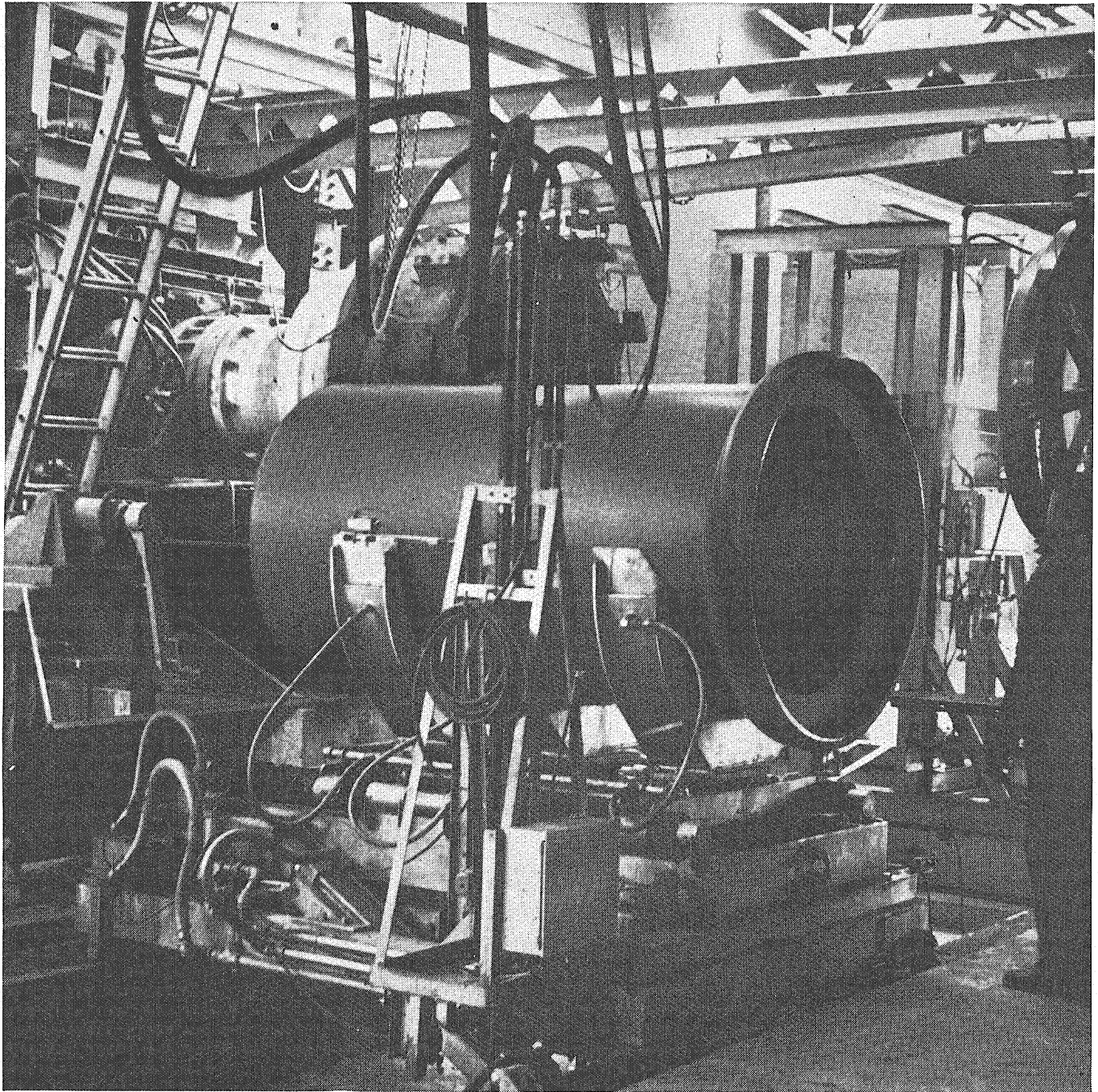
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For more information about this new break-through in manufacturing techniques, contact your Dickey salesman or any of these Dickey offices. Birmingham, Alabama; Ft. Dodge, Iowa; Kansas City, Missouri; Meridian, Mississippi; St. Louis, Missouri; San Antonio, Texas; Texarkana, Texas-Arkansas.

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Log Line

A happy mid-quarters to you and welcome to this month's circus. Taking our cue from the greatest show on earth, the Presidential elections, sweet November has two center rings and a number of side shows. But before we introduce the first act, Gentlemen, a nose count is in order. Perhaps a better measure of the number of frosh who washed out in the October monsoons would be the count of the used, warped sliderules for sale in the bookstore. And if you are as yet counted among the zealous I.T. boys we heartily congratulate you. However, there is one thing we do recommend to you. Don't show your naivete by hanging your brand new, bamboo, plasticized, 17 scale, 30 dollar slide rule from your belt. In spite of what you may think, it isn't the vogue thing to do, and besides, I.T. doesn't need that type of advertising. Furthermore, there are practical reasons such as the rule will get out of adjustment from banging around on your hip. When sitting in a narrow lecture seat, the scabbard also becomes very annoying. So, learn some couth, and give up this practice. And now gentlemen back to the show.

First of all please turn back and re-examine the roadster on the cover. It really awakens the Sterling Moss in you doesn't it? This lion is manufactured in Milwaukee, Wisconsin, by SS Automobiles, Inc. The Excalibur SS is featured in the front center ring, and in the article you can read about the engineering of such an impressive set of wheels. Just the thing to help a slumping ego or to build a pseudo-playboy image! The Excalibur (should you decide to buy one) will draw the coeds just like the Pied Piper of Hamelin.

For our second main attraction please notice Let's Enlist, a research article by a new staff member. If you're being hounded by the draft, and are cursed with spending 25 hours in class for 18 credits, and don't have

time between beers to investigate the opportunities of enlisting, this article may shed some light on the fear of enlisting. However, if the idea of being a professional engineer with the rank of private doesn't appeal to you, write to your Congressman and Senator telling them how you feel about the situation. If you're bold, you might even suggest changes in the draft policy.

Paging through the sideshows of this issue will again bring you a variety of acts. The continuing feature Speaking with the Dean is written by Dean Cheston. If you want to learn how to feed 4000 people without a Betty Crocker Cook Book, be sure to read these comments by our Dean.

In a continuing attempt to improve your orientation on campus we sent out this quarter's surveying class with a hand compass to get a bearing on the new Wilson library. But when they returned with an answer of $N92^\circ W \pm 45^\circ$, we gave up on them and sent our Introducing staff out to locate the place. They returned with many pictures, and the ridiculous idea of having the I.T. boys stage a read-in to initiate the building. In the truly democratic way we loudly shouted down their idea, but we preserved the pictures to save you the trouble of investigating the building for yourself.

As for the other features this month you can find the 'Log's solution to the parking problem and the usual trivial humor in Log's Log. Also our new pin-up staff has uncovered another gem, Jan Rosenthal. By this time however, you've probably already met her. But let us make our apologies now for the out of focus pictures. It must have been a foggy lens. And lastly, being aware that the Splinters jokes may not be new, we have at least made a game out of finding all of them among the local ads. Your old joke club can get together to compare totals.

Four Letter Words And Other Precise Accounts

The accuracy of the *Minnesota Daily* in reporting news-worthy events has risen to a precarious degree in recent weeks. The case in point being the October 1st issue. Did Editor Gruchow have the right to run the so called obscene picture which appeared on the front page. We say "yes". And we defend this position against the out-crys of the moralists by stating that the news media is charged with reporting an unbiased, precise account of what has happened. The business of sanding off the rough edges, and candy-coating a news story is not the obligation of an editor. The fact that most news media do not report all the details or that they conveniently misquote is irrelevant. A newspaper has the right to present the facts regardless of whom it offends.

Left-overs

Good evening ladies and gentlemen. We welcome you to another exciting episode of **E-day comments** or **What ever happened to a good 5c orgy**. As you might remember from May's stupendous episode, E-Day, or IT week if you prefer, which we don't, was a relatively good-sized flop as compared with the colossal flop of the year before that. We hate to say, "we told you so," but we told you so. For those of you who might be new to our audience, here is a brief description of the dilemma that faces our hero Stu Nemo, typical IT student:

Either Stu can sign up for one of the many committees at the urging of his organization president and work many long and frustrating hours to earn a few points toward "happiness" and the all-par trophy, or Stu can reject the whole thing, get the jump on his spirited classmates slaving away for IT week, plus have a three day weekend in early May.

Will Tech Commission and the E-Day Committee provide a **deus ex machina** for Stu, or will they let him get thrown out of school for bad grades or let him drown in the "maelstrom of apathy." For an exciting answer to this question make sure you get next month's 'Log.

"We'll Bury You"

Friday, October 25, Bob Plumb and his associates put in their first appearance of the year. Displaying a sense of creativity usually reserved to their opponents, the IT representatives to the Big Ten lampooned the "Spirit of CLA."

The real pity is not the apathy of CLA, however. Rather, it is the lack of interest shown by the students in IT. Instead of looking for a bigger opponent, Plumb Bob should spend its time goosing IT out of its lethargy.

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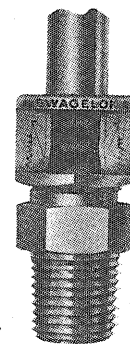
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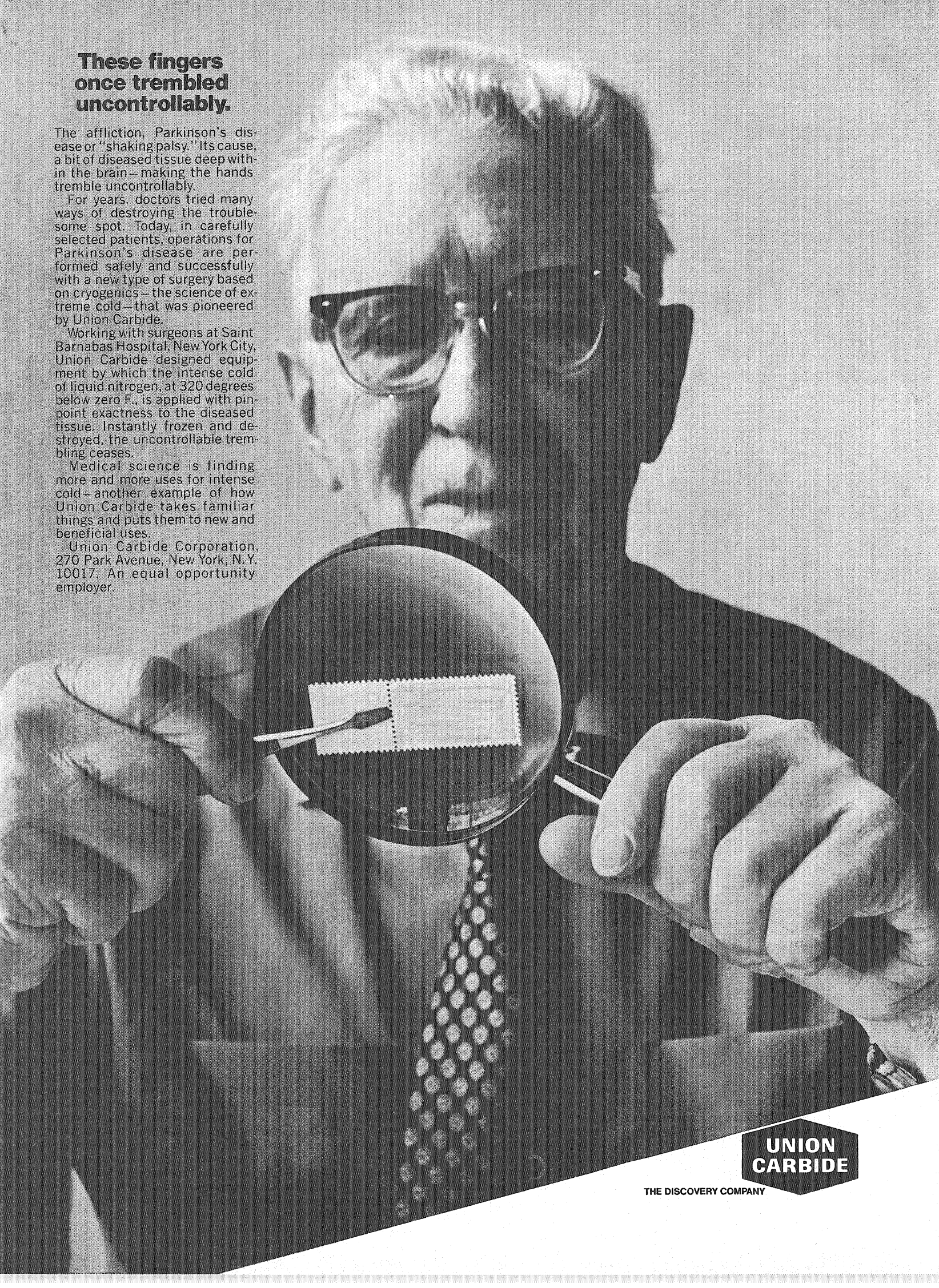
The affliction, Parkinson's disease or "shaking palsy." Its cause, a bit of diseased tissue deep within the brain—making the hands tremble uncontrollably.

For years, doctors tried many ways of destroying the troublesome spot. Today, in carefully selected patients, operations for Parkinson's disease are performed safely and successfully with a new type of surgery based on cryogenics—the science of extreme cold—that was pioneered by Union Carbide.

Working with surgeons at Saint Barnabas Hospital, New York City, Union Carbide designed equipment by which the intense cold of liquid nitrogen, at 320 degrees below zero F., is applied with pinpoint exactness to the diseased tissue. Instantly frozen and destroyed, the uncontrollable trembling ceases.

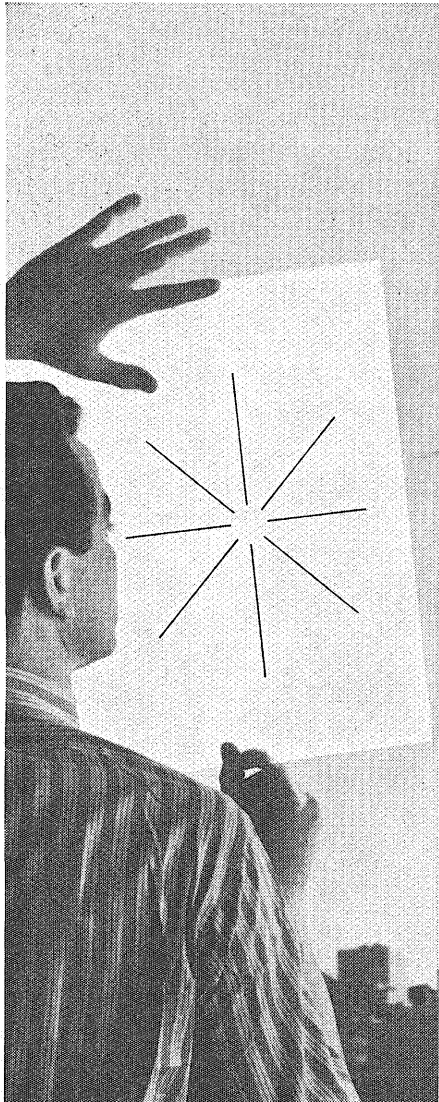
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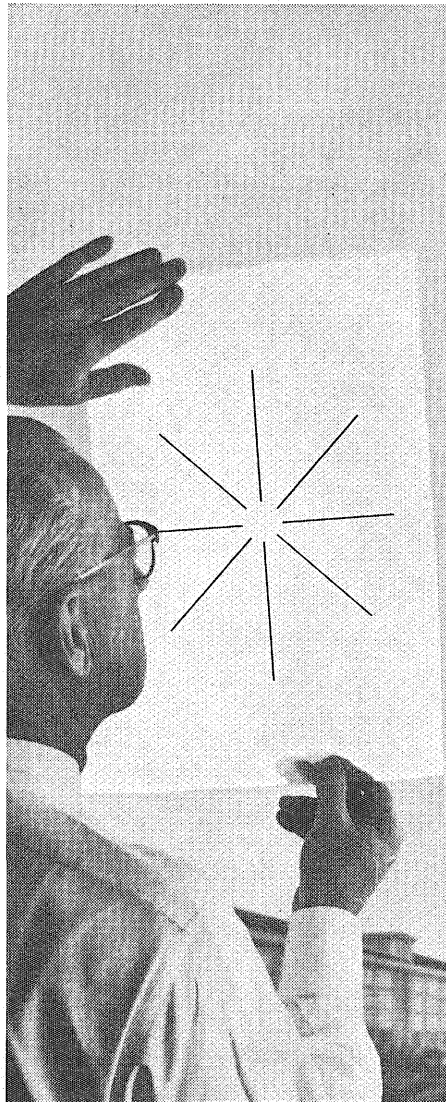


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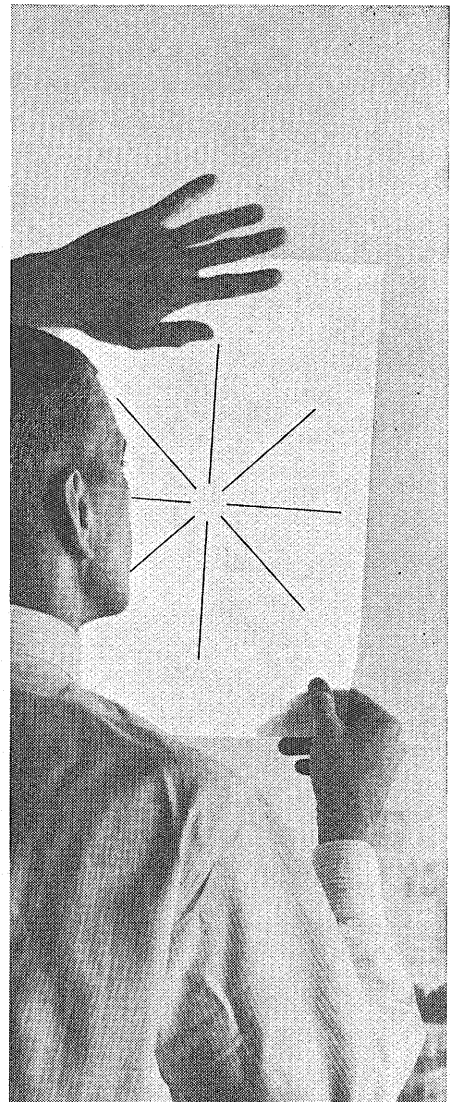
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speaking with the dean

MUCH OF THE FOOD served in homes and restaurants is precooked, quick-frozen, attractively packaged, and reheated shortly before serving. The economic success of such an approach to satisfying one of our fundamental needs certainly is evidence that we are living in an era in which Betty Crocker has more relevance than Escoffier. Once the basic technological problems have been solved, this approach to marketing and consumption has certain decided advantages even though the sensibilities of those of us raised in an earlier era are somewhat offended and, on occasion, outraged.

Betty Crocker has been invading more areas of our culture and civilization than food technology alone and certain analogies exist with the world of high education. Some of our severest critics have compared a modern university with a large hotel restaurant. The analogies are obvious enough. Pre-packaged curricula, our instructor-chefs manning the reheat ovens, etc.

How much truth is there in the charges of our critics? How much is overstatement? Since the University of Minnesota is a public institution, we have the responsibility of offering the best possible educational opportunities to those who come to us with the prerequisite educational background and aptitude. For engineering students, we are so-to-speak the only game in town. This means that we must serve a very large number of students and a certain amount of prepackaging is necessary. Even if the best possible approach to education consisted in a continuing dialogue between professors and a small number of students, we do not possess the resources to operate in this manner at all times although we do provide this kind of educational experience far more often than our critics are willing to admit.

If we must succumb to the Betty Crocker influence in education, our concern should be with quality with the quantity. However, the responsibility for the success of our system does not rest solely with the faculty since the student has an amazing variety and freedom of choice in his educational career at the University. There are pages in the IT catalogue other than those which describe the curriculum of the department in which the student is enrolled. In fact, there are other catalogues through which the student might peruse with profit. To return to the food analogy, whether a student leaves IT after four years nourished rather than merely fed is to a major degree the choice of the student. We are actively interested in providing a pleasing menu and are careful to take all steps necessary to minimize the number of cases of ptomaine poisoning.

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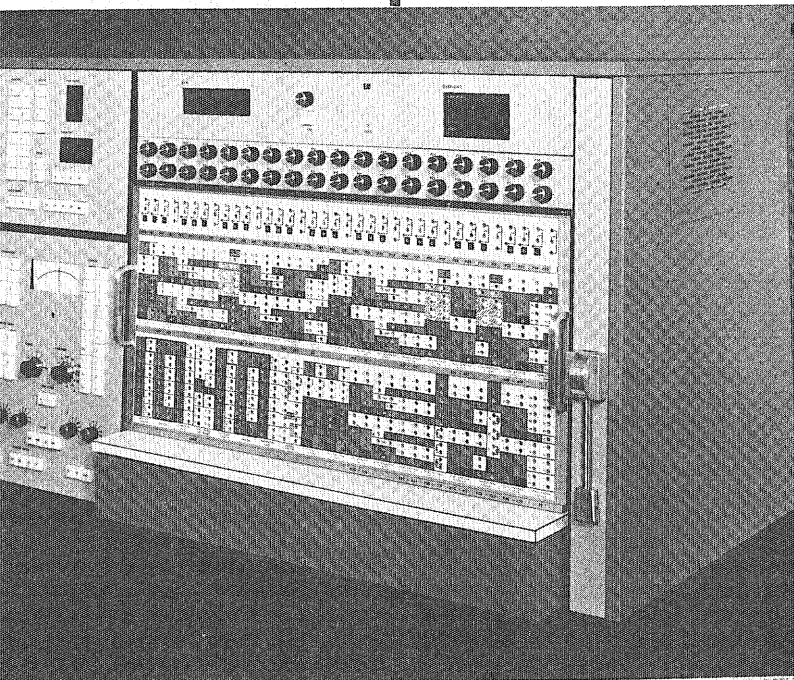
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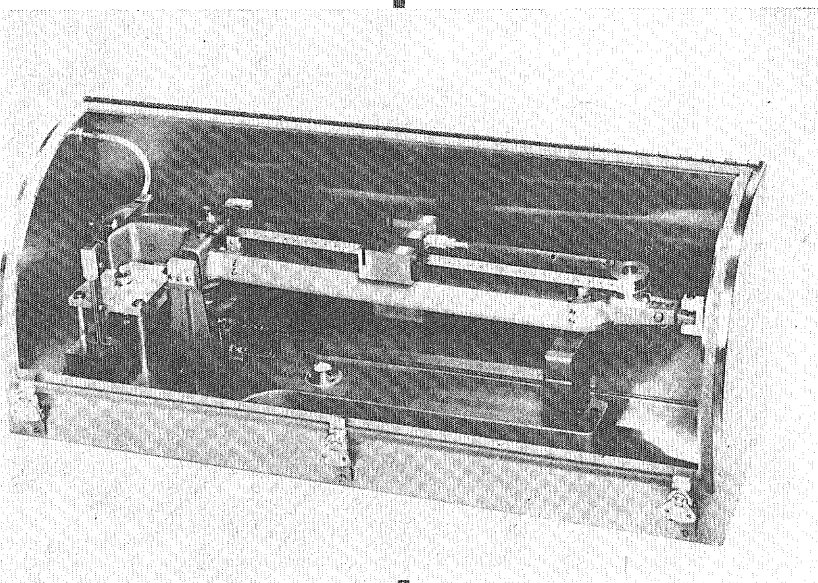


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what's new in science and engineering

Edited by Mike Voegele



Desk Top Computer

Electronics Associates, Inc., Long Branch, New Jersey, manufacturers of analog/hybrid computers and related instrumentation, has introduced a new low-cost analog/hybrid computer, the 380, a 10-volt desk-top system, for use in education, research and development work, and in industrial applications.

The basic 380 computer is an analog machine with expandable control logic for hybrid interface. In its basic analog configuration it is ideally suited to undergraduate instruction, while in expanded format, the 380, within the same main frame, can be used to teach advanced students, (or in the R & D laboratory, in modern hybrid techniques involving the study of the dynamics of physical systems too complex for simplified analytical models). Very importantly the 380 offers the advantage of direct interaction between the investigator and the system.

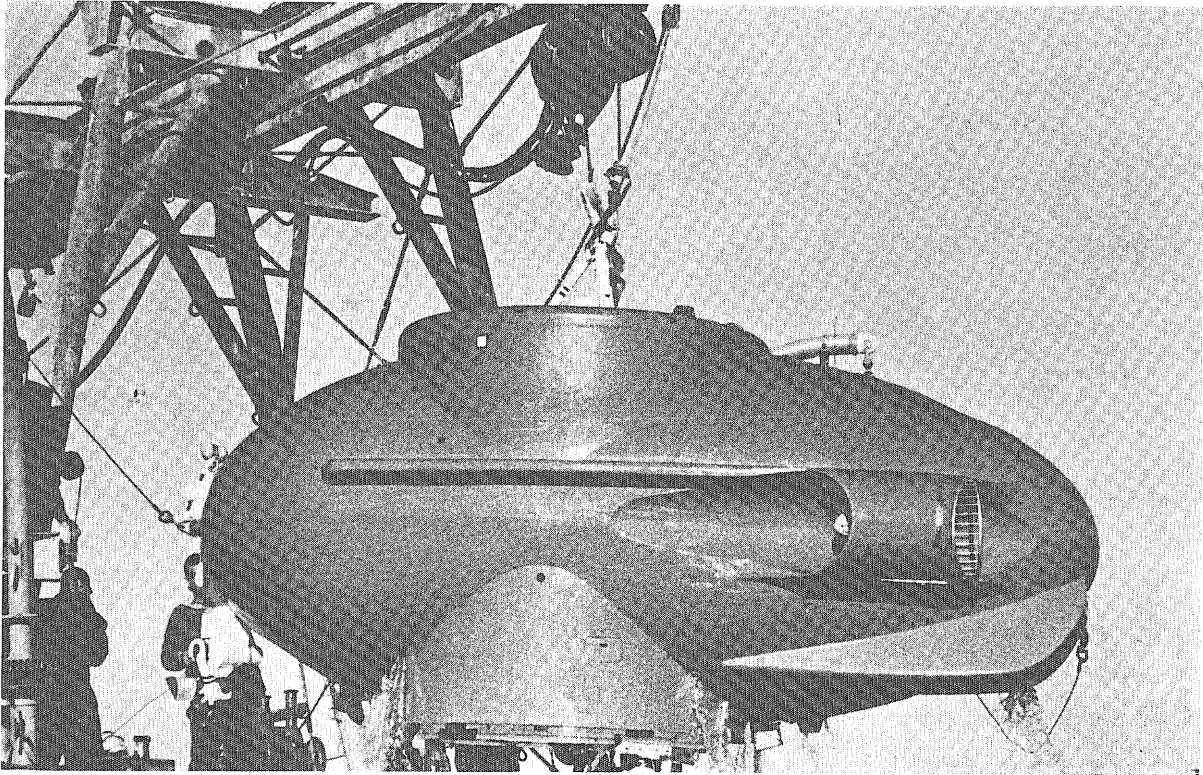
The 380 both in component interchangeability and in slaving in multi-console operations, is compatible with the thoroughly-proven EAI family of 10-V computers. Thus the 380 provides a high confidence level of quality as well as significant economies in expansion and/or combined operation. In fact, the new computer is the smallest, most economical EAI analog system offering control logic for hybrid operation.

Measuring Liquid Levels

A recent development of the Exactel Instrument Company, a Division of Statham Instruments, Inc., is the Hydrogauge, a beam-balance instrument designed to measure accurately liquid levels or depths. The Hydrogauge provides a reliable and economical method for determining the depths of rivers, water reservoirs, precipitation standpipes, underground water tables, and snow pillow standpipes. It is equally suited to a variety of tank-gauging installations.

The Hydrogauge is analogous to a beam balance. On one side of the frictionless pivot a bellows is employed as the force-summing member. Pneumatic pressure is converted to a force which acts on the weighing pan at a fixed distance from the pivot to create an initial unbalancing moment. On the opposite side of the frictionless pivot is a traveling poise weight which is positioned by a motor to create an equal and opposite balancing moment. The Hydrogauge operates in combination with the purge bubble principle to supply a pneumatic pressure to the bellows.

An especially useful feature of the Hydrogauge is its suitability for field use in remote, unpopulated areas. It is operable from batteries or from 115/230, 50/60 Hz sources. Power consumption is kept at a minimum.



Submersible Optical Lab

The first manned submersible vehicle to place complete reliance upon optical systems and electronics for underwater visibility recently completed its final pre-operational test by descending 6,420 feet to the floor of the Santa Cruz Basin in the Pacific Ocean for a look around.

Designed without view ports, the Deep Ocean Work Boat (DOWB) of General Motors AC Electronics-Defense Research Laboratories provided a new optical viewing capability with 360-degree visibility for its two-man crew, a "first" among submersibles developed to perform useful undersea work.

As the 17-foot-long orange-hued DOWB descended in its final sea test its pilot and co-pilot became the first in a submersible to observe both their forward movement, the surrounding sea and ocean floor without restrictive or isolated view ports and crew discomfort. This was accomplished by wide-angle "fish-eye" objective domes above and below the hull, sufficient illumination and the use of closed circuit television. Each of the domes provided complete 180-degree viewing capability through a centrally located optical console. This allowed complete viewing capability by the two crew members simultaneously while in a normal seated position.

A sonar system with vertical fan and conical beams permits search, terrain avoidance and beacon homing when required. Upward and downward beaming depth sounding devices, underwater telephone, and a free-

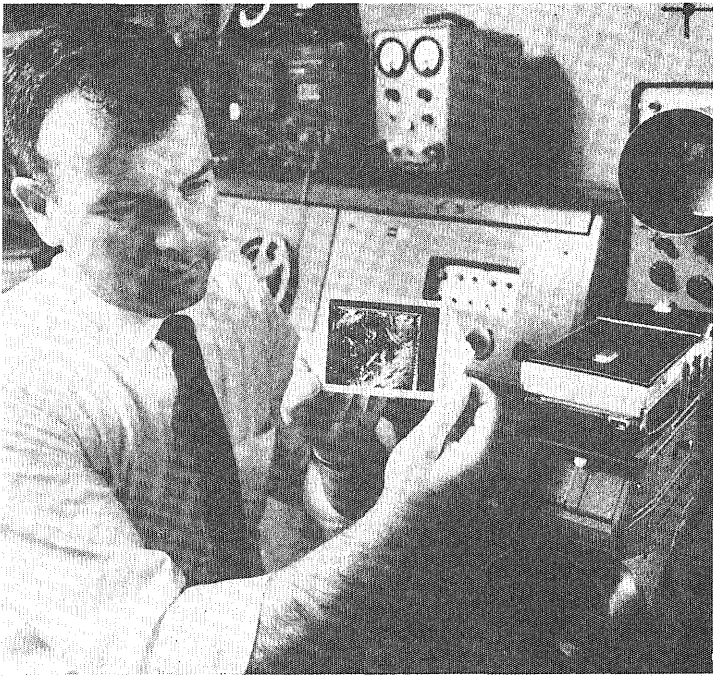
running sonic beacon allowing the submersible to be tracked continuously by the mother ship hovering above, are provided. An electro-mechanical manipulator has six degrees of freedom, which can be compared to the movements possible with the human arm from the shoulder to the finger tips. It has a reach of 49 inches. With a pincer at the end of the manipulator DOWB can implant and retrieve 50-lb objects or perform other delicate operations.

DOWB's propulsion is provided by four propellers, two of which for horizontal movement are shroud-mounted with their motors on the outside of the fairing. Mounted in vertical ducts near the bow and stern are propellers and motors providing vertical movement and a hovering capability. Lead acid batteries, sealed and pressure compensated, are mounted external to the pressure hull within the fiberglass fairing in sea water. The DC current from the batteries is converted to AC to gain a weight and reliability advantage.

DOWB, which has an operational design depth of 6,500 feet, was developed by GM's AC Electronics-Defense Research Laboratories to provide support for the laboratories' work in its Santa Cruz Acoustic Research Facility, industry's only deep-ocean acoustic tracking and submarine noise measurement range.

Continued next page

Weather At Home



Deciphering the weather pictures transmitted to earth from satellites far out in space is usually a costly, sophisticated and full-time business, but Rex L. Smith, a senior technician at the Westinghouse electronic tube division here, has a different approach: he gets the whole job done in his spare time with a handful of used and borrowed electronic equipment located in a corner of his basement.

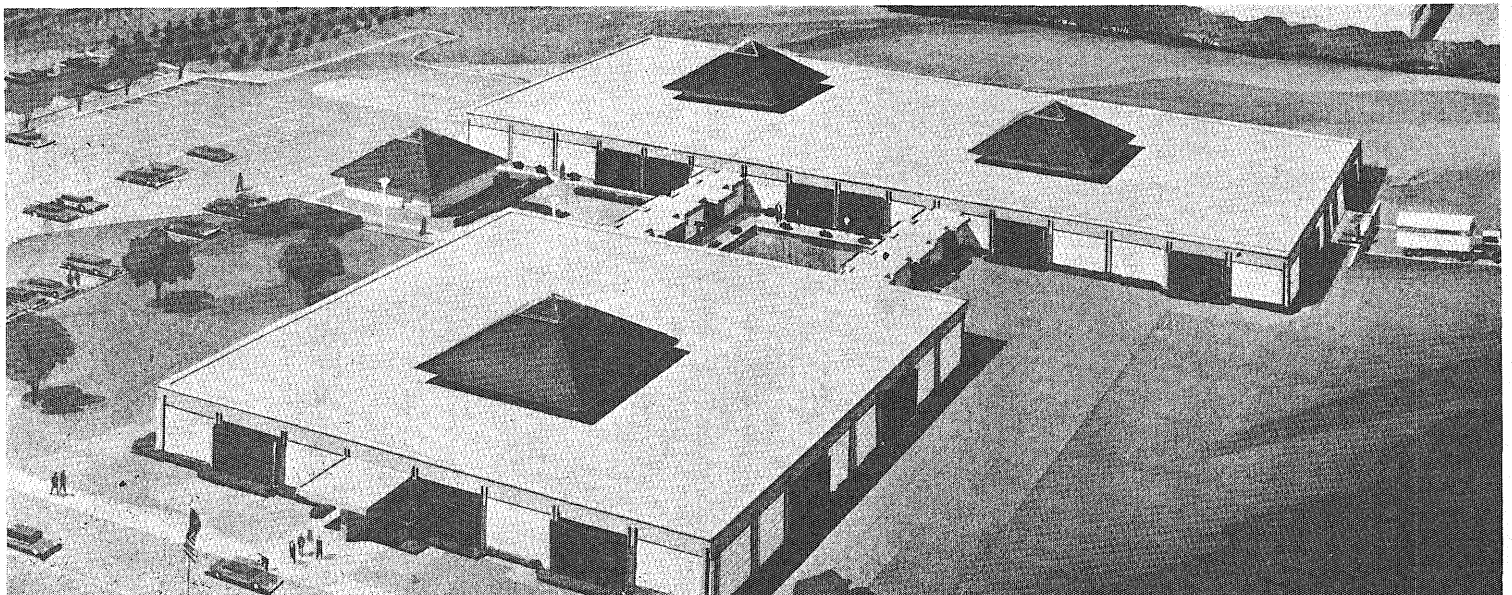
Key elements of his apparatus are an \$18 surplus military FM radio receiver, a homemade transistorized amplifier to make the receiver more sensitive to the satellite's weak signals, an ordinary home tape recorder, and a Westinghouse electronic storage tube that resembles a television picture tube, but holds its glowing pictures for a half-hour at a time.

Smith tunes in the satellite's beeping picture signals, decodes them, records them on tape and watches them build up, line by line, on the storage tube. Then, with a simple Polaroid snapshot, he records the pictures permanently.

His photographs, coming from a Nimbus weather satellite passing overhead some 625 miles in space, show areas of the United States about 1200 miles square.

A Nimbus satellite moves in a north-south direction as the earth rotates from west to east beneath it. Therefore, it comes within range of Rex's amateur ground station about two or three times every day.

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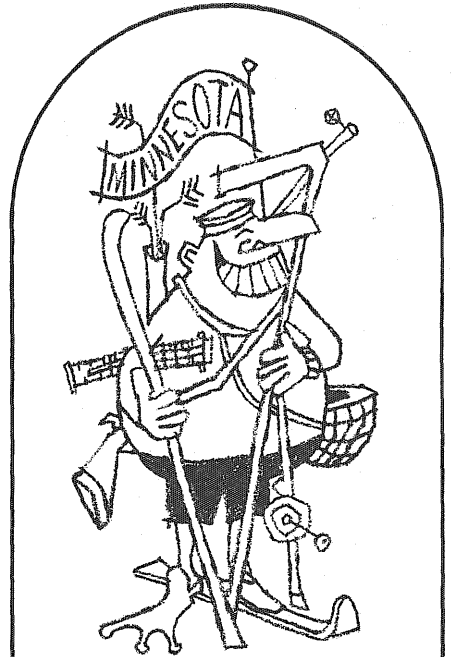
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EXCALIBUR

BILLED AS THE "CONTEMPORARY CLASSIC" by SS Automobiles, Inc., the Excalibur SS is a very close approximation to the 1927-30 Mercedes Benz SSK doorless roadster. Inasmuch as Mercedes built only 26 SSK sports cars which were for the most part different from one another, the Excalibur represents the average approach in design so as to have the most outstanding general characteristics of the original. The long hood, doorless drop sides (doors are now available upon request) folding windshield, and turtle mounted spare, coupled with cycle fenders, give the general feeling of these famous cars. Chrome wire wheels and shower top with zip-on curtains complete the general illusion of the original vehicle. In fact, the top arrangement parallels the original car even as to function. A final touch, nostalgically speaking, the "accent chic," is found in the traditional leather hood strap, a real insurance policy against an opening bonnet. However the real feature which distinguishes the Excalibur from the authentic is the fact that modern standard components, and contemporary engineering go into each automobile. This makes the Excalibur a truly "two way Classic," in contrast to your old MG TD which on occasion makes it only one way on a rally.

SS Automobiles, Inc., Milwaukee, Wisconsin, manufactures the Excalibur on a limited production basis utilizing Studebaker frames, and General Motors components. The Studebaker Daytona chassis (109" with disk brakes) was chosen over the more modern torque box frame, because the rails of the torque box frame offset and project outward to the body sills of contemporary cars. Thus, in using the Daytona chassis the Excalibur is given a narrow plan configuration which simulates the cars of the late 20's.

The Chevrolet Corvette 327 engine and 4 speed close ratio transmission, coupled with limited slip differential gives a modest acceleration of 0-60 mph in under 5 seconds and an approximate 160 mph top speed. However, if this isn't enough performance you can have your SS fitted with a Paxton supercharger which boosts your horsepower to about 450. As one can well imagine, some changes in suspension, steering geometry, and weight ratios were necessary in order to make a car with as much horsepower as a Stingray but weighing 1,000 pounds less handle properly. Some relatively simple changes such as lessening spring rates, and altering caster and camber corrected much of the problem, and indeed braking and handling characteristics are claimed to be near competition standards.

A more complex change was that of shifting the powerplant back 28½ inches in the frame. This major revision required that the additional X-member in the chassis be cut out to allow room for the transmission, and also that new engine mounts be fabricated. The apparent disregard for strength and torsional twist in the frame was justified by considering the planned weight of the car, only 2,500 pounds.

The new engine mounts and engine relocation put the custom designed bucket seats practically in the rear seat location on a standard car. This set of conditions paved the way for the long hood and deep cowl, contributing to the illusion of the real SSK. Further simulation of the Mercedes is brought about by moving the radiator back in the frame exposing the front cross member and unequal "A" frame suspension members. Also, the unshrouded appearance of these front end functional elements, in a way, contribute to the mechanical look of the original Classic.



Another problem in adjusting the engineering to fit the styling was the three stainless steel flexible header pipes which strike out from high on the hood sides. The original headers on the 327 engine bend down and hug the side of the engine block. The solution to the problem is an under the hood collector box or expansion

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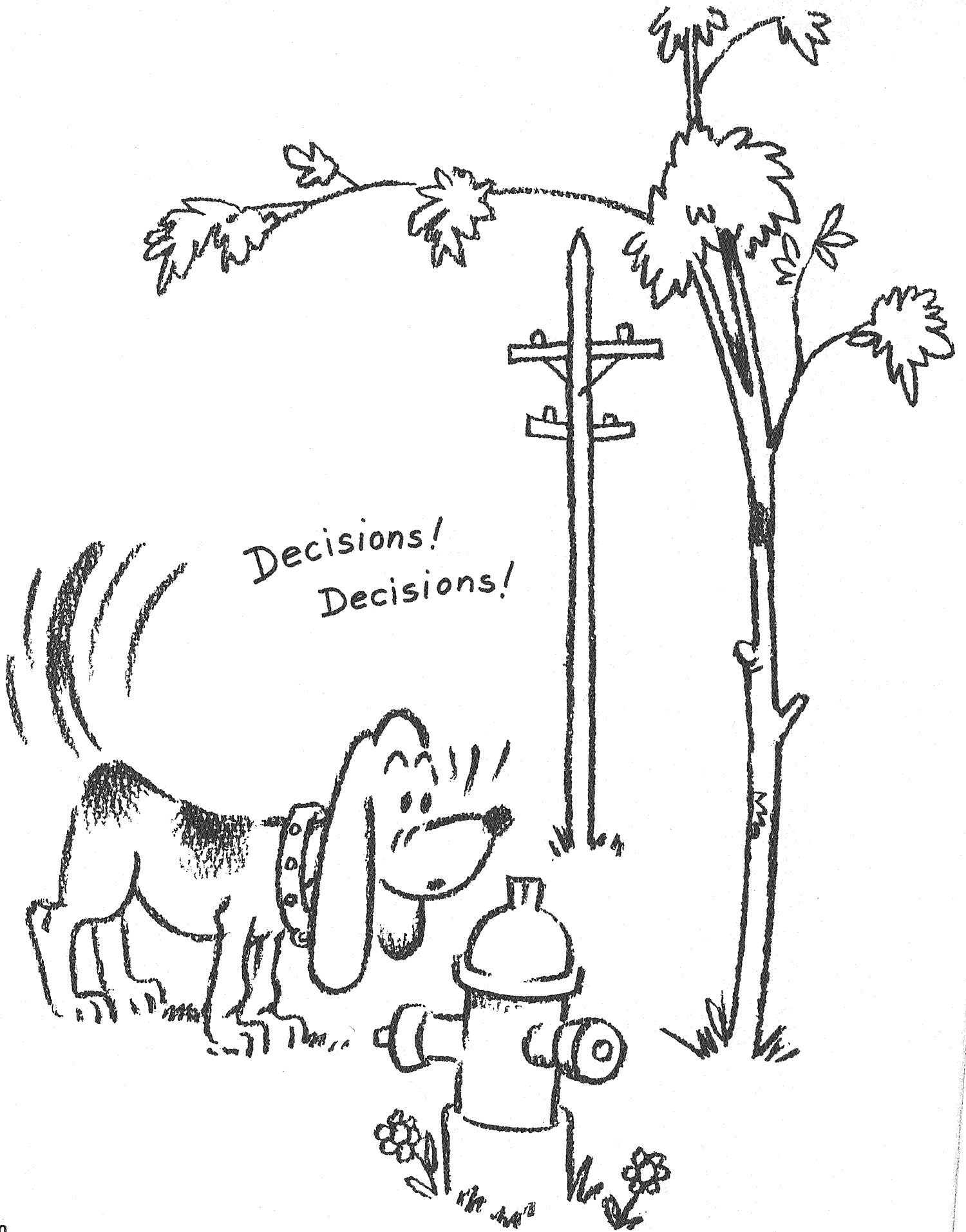


chamber which bolts on in place of the original header. Three outlets are spaced evenly on the top of this chamber thus allowing the plumbing to curve gently upward and outward through the hood side. The long horizontal collector pipes which run along the side of the car are fitted with modular Walker sausage muffler

inserts.

The bodies of the first few Excaliburs and prototype models were hand formed from aluminum sheeting. Steel tubing served to support the structure. When serious production was contemplated, SS Automobiles began making the body and fenders in fiber-

(Continued on page 30)



Decisions!
Decisions!

Some decisions are relatively unimportant. Where you put your engineering talent to work is not.

As you contemplate one of the most important decisions of your life, we invite you to consider a career at Pratt & Whitney Aircraft. Here, you will find wide-open opportunities for professional growth with a company that enjoys an enviable record of stability in the dynamic atmosphere of aerospace technology.

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And your decision is made easier, thanks to the wide range of talents required. Your degree can be a B.S., M.S., or Ph.D. in: **MECHANICAL**

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Consult your college placement officer—or write Mr. William L. Stoner, Engineering Department, Pratt & Whitney Aircraft, East Hartford, Connecticut 06108.



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avoid the draft —

enlist

by Judy Burmeister

THERE COMES a time in every man's life when he has to consider entering the armed forces. To determine which branch of service to enter: the Army, Navy, Marines, Coast Guard, or the Air Force, he should make a visit to the recruiting stations. He will first be told that there are certain qualifications he must fulfill before he becomes eligible.

The first requirement is he must be between the ages of seventeen and thirty. (This depends on the branch he wishes to enter.) Next, he must be a U. S. citizen or have filed a declaration of intent. He must be in good physical and mental condition, which will be determined by a thorough examination. Also, he must be of good moral character without a criminal record. It is preferable that he have at least a high school education although this is not mandatory.

If he can qualify and pass the above requirements, he is told what he can expect and what is expected of him.

A man must give a minimum of four years to the service, and in return he is given fringe benefits, an education, and a skill which he can pursue after he has served.

The service does not pay well. A man receives a base pay of \$102.00 a month. After graduation from boot camp the pay increases to \$137.70 a month. With each promotion and rank that he receives there is an increase in pay. In addition, there are extra allowances for clothing, and miscellaneous items.

Thirty days paid vacation a year is granted. If he is serving overseas and wants to spend his leave in the place where he is stationed he may be permitted to do so as long as he has the permission of his commanding officer.

Medical and dental care is free. You will never have to worry about health bills.

Whatever your favorite sport or hobby, you will find the facilities to enjoy it—golf, swimming, tennis, sailing, fishing, bowling, track, theaters, clubs, and libraries. Name it—the armed services have it. There is organized team competition between all branches of the service and with college teams in all major sports. And the cost—if any—is low.

If you like the service and stay in, after twenty years you will be eligible for the retirement plan. With retirement you have rank, prestige, and a chance to build a second career.

Chances of promotion and advancement depend on the individual job, and location. There are annual com-

petitive examinations for promotion to higher ratings.

Each branch of the service has its own educational program. Every man is given an Armed Forces Qualification Test. This will determine where his interest and ability lies. From these tests you will be given a choice of the field you wish to enter. Many things are taken into consideration, for example, if you are a college student or a graduate student you may be qualified to enter into an officer training program.

Basically there are 5 ways to obtain a commission:

SERVICE ACADEMY . . . All branches have academies offering a full college education and required military courses. General requirements for admission are:

1. Excellent physical condition.
2. Be between the ages of 17 and 32.
3. Show participation and leadership in sports and social activities.
4. Obtain recommendation for appointment by senator or congressman.

ROTC . . . Many universities and colleges participate in the Reserve Officer Training Program. Courses in military or naval science are taken concurrently with regular college courses. Enrollment in this program is preferably the time of registration as college freshman; however, exceptions can be made with acceptance as late as the second term of the sophomore year. The "Regular" ROTC program consists of one class per term plus 6 weeks of training per summer, and you get paid for it, \$50.00 per month during the school year and \$151.95 per month during the summer training. Total service obligation is 2 years active duty and 4 years reserve duty. In the "Scholarship" program, training requirements are the same as for the regular program, but in addition to pay for the regular program, books, tuition, and lab fees are paid. Your active duty obligation is 4 years for the scholarship program.

OFFICER CANDIDATE SCHOOL FOR THE COLLEGE GRADUATE A college senior or graduate may apply for Officer Candidate School prior to enlistment in the service. He will go through basic training like any other recruit and then go to school. A caution here, if the candidate fails to pass the examination, or fails to make it through OCS, he will serve his remaining years as any other enlisted man. Upon graduation, he will obtain a commission. The active military obligation is 3 years and the length of OCS is usually 18 weeks.

OFFICER CANDIDATE SCHOOL FOR THE ENLISTED MAN . . . An enlisted man must be accepted

providing he completes preliminary requirements. These requirements may be tough to meet because the men are put on a nationwide competitive scale, and must have served at least one year active duty. They also must take some outside college courses, correspondence courses, and self-development courses. Once accepted however, this candidate follows the same program in OCS as the college graduate.

DIRECT COMMISSION . . . Direct commission is for the men who have had professional training and may receive a direct commission in critical areas, depending on the needs of the armed forces, and right now, except for an MD or DDS, the needs are not great. Certain warrant officers and enlisted men are also eligible for direct commissions. There are three categories: Professional, college graduate, and the college student.

If you fall into the category of Doctor, Dentist, Lawyer, Engineer, or Clergyman, you can qualify for a direct commission instead of enlisting. You will then be assigned to places where your skills are needed.

If you are a college senior or graduate working toward your degree you may also apply for a direct commission in which case you would be required to take Armed Forces Examination. If you pass, there will be a basic training course and then you will be sent to Officer Candidate school. Upon graduation from OCS you will become a commissioned officer and be given the pay rate of a commissioned officer.

If you are a college student working toward a degree at a recognized college or university you may apply for a Platoon Leaders class. If accepted you will go through a basic 2 year training period which requires a 6 weeks session each year on the East Coast. Upon graduation you will be commissioned as a 2nd lieutenant. While in college you will obtain a draft deferment and be classified 1-d. There will be no other classes or uniforms to wear except during the 2 years of 6 weeks summer sessions. This should not be confused with ROTC.

If you do not qualify for any of the above, each service branch offers educational programs for which you may be qualified.

The Army conducts over 300 courses in service schools. These cover every phase of every job. If you qualify the Army will GUARANTEE in writing the job of your choice before you enlist. The Army falls into three categories: Graduate Specialists school, The Vocational Training System, and the Combat Arms Program.

VOCATIONAL TRAINING SYSTEM is different from the Graduate Specialists Program in two respects, 1) There are no educational qualifications for this option, 2) instead of choosing a specific classroom training course, you select your training from categories called Career Fields. If you qualify you will receive basic technical course instruction and/or receive on-the-spot training in the vocation you have selected. While the Graduate Specialists Program lets you choose intensified classes you want, the Vocational System offers you a chance to select the career field you want, and you receive all the training necessary to make you proficient in your job. Enrollment procedures will let you select vocational training from the categories currently available—take aptitude tests—and receive a physical examination. If you qualify you will receive the training

you want. In fact, it's written in the future Army record on-the-spot—a GUARANTEE, before you enlist.

COMBAT ARMS PROGRAM . . . you can take your pick of fighting branches . . . infantry, armor, or artillery.

Airborne—A man must volunteer to be a part of this outfit. Extra pay is the reward for volunteering, and those paratroopers that are gung-ho about their work can volunteer for Special Forces training.

Army Air Defense Command . . . The U.S. Air Defense Command is a combat-operational command with headquarters in the continental United States. At the time you enlist, you receive a written guarantee that you'll be assigned to the metropolitan or strategic defense area you want after basic training. Moreover you will remain in that area for a minimum of 14 months. You can choose your assignment from any of the metropolitan areas in which openings are available at the time of your enlistment.

Army Security Agency . . . This organization plays a distinctive role in our national defense. Young men enlisting for ASA will have the chance for special training in languages, mathematics, physics, electronics, and associated subjects.

U. S. Army Intelligence . . . Intelligence personnel are charged with detecting treason, sedition, subversion, and disloyalty, and with preventing espionage and sabotage.

Army Band . . . If you're interested in music, and play an instrument, you can enlist for assignment as an army bandsman. If qualified, your choice is guaranteed before enlistment.

Warrant Officer, Army Aviation Program . . . If you meet the mental and physical requirements, you'll attend Regular Army basic training before enrolling in flight training (either fixed wing aircraft or helicopter). At the successful completion of training, you will be appointed a Warrant Officer, USAR. Your tour of duty will be 3 years from the completion of flight training.

NAVY . . . The Navy has five fields for which you may qualify. These are Advanced Electronics Field, Nuclear Field, Aviation Field, Hospital-Care Field, and the General Field. If you should train for the Advanced Electronics Field or the Nuclear Field, you must enlist one year more than the minimum 4 years required.

The Advanced Electronics Field . . . offers the chance to qualify for a tour of duty in one of the many phases of electronics, including sonar, communications, and guided missiles. This program is for the individual who possesses the mathematical and mechanical capabilities.

The Nuclear Field . . . is available to the student who has education in a junior college, community college, or university. Enlisted men attend one of the class "A" source schools of the nuclear field program. Upon successful completion of class "A" school, training is received in the operation and maintenance of nuclear propulsion plants.

The Aviation Program is available to the individual who otherwise would not qualify for the programs mentioned earlier or who has no desire to apply for such programs and who wishes to associate himself with Naval Aviation. There are more than 17 ratings open through this program. After recruit training the individual is assigned to duty at naval aviation activity,

either afloat or ashore where he performs "on-the-job" training and studies Navy training courses. Later in his Navy career, if he shows aptitude for further training he may be sent to Naval School.

Hospital-Care Field . . . selectees for the Hospitalman category become expert medical or dental technicians.

General School . . . There are more than 60 different schools open to young men who do not qualify for any of the above. After recruit training they are assigned to duty aboard the ship or at a shore station on the United States or overseas.

COAST GUARD . . . There are 35 special career fields and advancement in each of them. After recruit training, qualified men will be offered training in a variety of specialties, from aviation and electronics to oceanography. There is a 6 month waiting period before they will take you so if you are considering this branch of service you must plan in advance.

MARINES . . . Marines may become skilled technicians in nearly 40 occupational fields. Education falls into two categories . . . Formal or Technical School, and Off Duty Education.

Formal or Technical School . . . In general recruits will be assigned initially to either formal school training followed by a Fleet Marine Force assignment, or directly to a Fleet Marine Force unit. Marines must be continually trained and available for combat units. Also security force and support establishments are ready sources for experienced combat-trained Marines. The technical skill required to operate and support complex Marine Corps aircraft, ground vehicles, missiles, and electronic equipment is provided by attending the Ma-

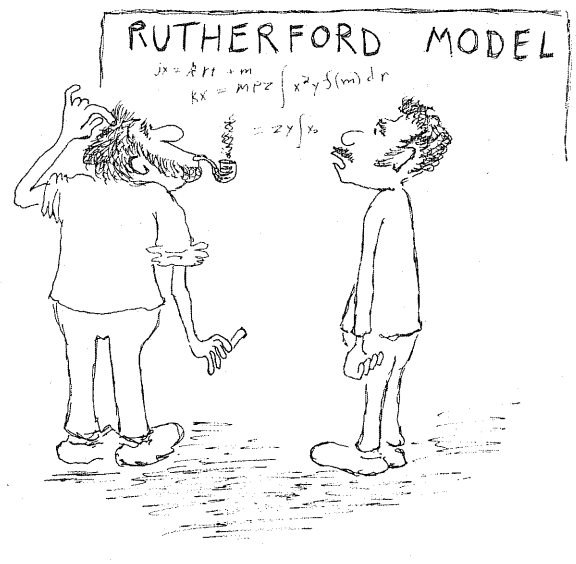
rine Corps and other service schools.

Off Duty Education . . . The Marine Corps encourages all marines to improve their education. For this purpose the Marine Corps makes available a variety of off duty study programs. High school and college level courses (more than 6,200) may be taken through the United States Forces Institute (USAFI). Or you may enroll in evening classes in a civilian high school or college near the base where you are stationed. In this case, a large part of the tuition is paid by the Marine Corps. If you desire to improve your technical and military skill, you can, at no cost, apply for correspondence courses from the Marine Corps Institute (MCI).

AIR FORCE . . . The Air Force has four job specialties . . . General, Administrative, Mechanical, and Electronic. You must take the Airman Qualifying Examination. There are some 46 career fields and 230 career ladders in their classification system.

The Airman Education and Commissioning Program requires . . . that you have one year active duty and that you be selected as qualified. Then you will be assigned to a civilian college or university to complete your undergraduate work. Of course this program is highly competitive and there is no guarantee of selection before enlistment.

You have a military obligation. Chances are nearly 9 in 10 that you will fulfill it, one way or another. The secret of getting through in the least amount of time with the least amount of risk is to look around and think about the propaganda you are getting from the recruiter. Look for loopholes and always be conscious of the risk factor. \square



RUTHERFORD MODEL

$$dx = A dt + m$$

$$Kx = MPZ \int x^2 y^5(m) dt$$

$$= zy^5$$

THE COMPLEAT BOOKSTORE

I say, old boy, you'll never solve the bloody thing without a table of integrals from the

Engineer's Bookstore

We developed TV transmission. But a lot of engineers still don't get the picture.

Like, we'll ask a graduating engineer:
"What opportunities do you think an engineer has
if he works for the telephone company?"

And, zap—we get a blackout!

Well, we think the company responsible for
engineering innovations such as the transistor, radio
astronomy, high fidelity and stereo recording,
magnetic tape, synthetic crystals, negative feedback,
sound motion pictures, microwave relay, electronic
switching, the solar battery and telstar deserves a
consideration that's strong and clear.

When the Bell System recruiting team comes
to your campus, be sure to talk to them. Or ask your
Placement Director for the name of the Bell System
recruiter at the local Bell Telephone Company.

We'll turn you on.



miss november...

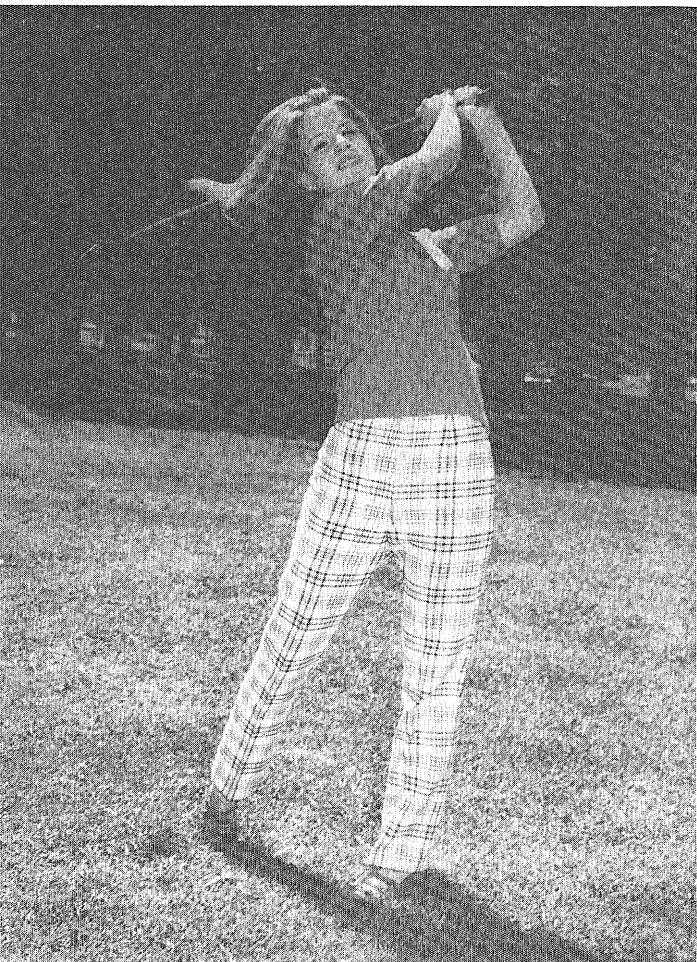
Jan Rosenthal

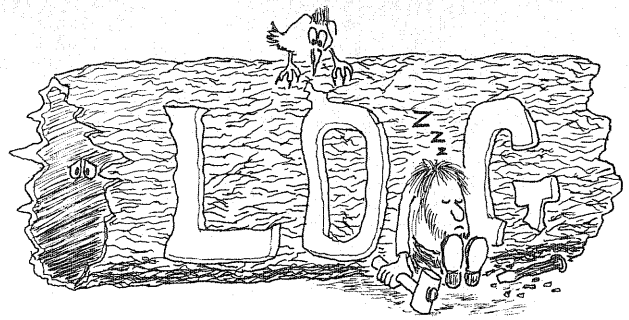
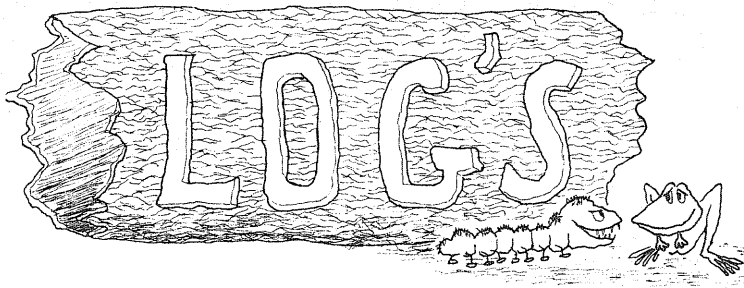


Jan's quite a golf enthusiast; she once played 45 holes in one day. Also listed as her favorite hobbies are boating, iceskating, reading, listening to both jazz and classical music, and watching football. This winter she hopes to add skiing to the list.

Jan is a CLA freshman this year. She plans to major in English and then hopes to get her masters in library science. She has been working at a library since this summer. Generally she helps people find the books they want and during the summer helps in the children's programs.

Besides being a whiz in a library, she has a brother in IT and wants to join the Technolog staff. What could be better?!!





jai byrd

Here we go again, onward and upward. Canons to the right of us, canons to the left of us; obviously we've strayed into the Vatican archives.

Fellow students, we have too long endured the oppression of the faculty. Witness another affront to our desires and dreams. I have intercepted the following evidence of the International Faculty Conspiracy. This stuff is hot off the desk of Elmer Learn.

And of course, Ralph Groop makes his appearance. What an exhibitionist!

Last of all, you will find this month's calendar of activities along with glimpses into the historical past.

catch as catch can

To: All Staff Members

From: The Committee On Parking and Movement

Re: Rest Room Permits

Since the Committee has effectively solved the automobile parking problem, it has assumed the responsibility for a workable solution to the overcrowded rest room problem. Since state funds are not appropriated for rest room construction, some other means of raising the necessary funds must be sought.

Several experts on the faculty and administrative staffs were consulted. Twelve graduate students made an extensive study of all University Rest Rooms (see University Press Publication "Graffiti and 'U'"). Some areas on campus show a use rate of 90% to 105% during peak periods. Other areas show as little as 5% occupancy. The peak periods are during the fifteen minutes between classes. The lowest use periods are from 1:00 to 6:00 in the morning.

Comparison of per capita rest room spaces at Minnesota with the rest of the Big Ten schools shows that only Indiana has fewer spaces. It has been reported that several members of the faculty have left for positions with better rest room facilities. Unless something is done to relieve the situation, Minnesota will have difficulty in recruiting and keeping top notch people.

The next step will be the implementation of a rest room permit system. The basic policies of this program are as follows:

1. There will be no student rest room use allowed on campus.
2. Rest room permits will be issued to staff members at an annual fee of \$25 for "B" permits and \$60 for "A" permits.

3. Reserved permits will be issued at a cost of \$100 to persons designated by the President.
4. Metered rest room spaces will be provided for visitors only.
5. Latrines along the Mississippi River will be free. A shuttle bus system from various points on the campus to the river flats will be provided at no cost if there is sufficient interest.
6. New rest room spaces will be erected with the funds from the rest room permits. (Some suggested locations are Temporary North of Clay School, Temporary Southwest of Heating Plant, Temporary West of Comstock and Temporary East of KSTP.)

A more detailed discussion of some of the above points follows:

Rest Room Permits. Class "A" permit holders will be permitted to use either "A" or "B" spaces in any University rest room. Class "B" permit holders will be permitted to use only class "B" spaces. Class "A" spaces will be identified by yellow seats; class "B" spaces will be identified by blue seats. P & S has been authorized to hire seventeen extra patrolmen and purchase twelve additional Cushmans to patrol all University rest rooms. Any infraction of rest room rules subjects the violator to possible revocation of all rest room privileges. Student husbands of staff wives may not use their wives' permits. The permits must be displayed on the upper left chest of the permit holder. Staff members not desiring to purchase rest room permits are encouraged to obtain staff rest room identification cards so that they will not be maced by the patrolmen as they walk near University rest rooms.

Reserved Rest Room Spaces. Reserved rest room spaces will be available to a limited number of staff members as designated by the President at an annual cost of \$100. Reserved spaces will be identified by their white mink lining.

Metered Visitor Rest Room Spaces. A limited number of metered visitor spaces will be provided in central locations. Charges will be 10 cents per 5 minutes with a maximum of fifteen minutes. All-day visitor permits will be sold at a rate of 25 cents per day. Meters will be emptied at the close of each day. Staff members may not use visitors' spaces.

Shuttle Bus to River Flats. For those staff members not desiring to buy staff rest room permits, the University will provide free shuttle bus service to the Mississippi River Flats (if there is sufficient demand). The

bus will stop at specific locations on campus at fifteen minute intervals. Staff members living close to campus are also encouraged to use their own home rest room spaces. Negotiations are under way between the Minnesota Research Foundation and a large corporation for the installation of a monorail system linking the campus with Powderhorn Park. Portable comfort stations for the monorail system would allow staff members to return to their offices within ten minutes.

General Information. A committee of staff members is being appointed to handle all appeals of rest room permit violations. Any person accused of such violations may appear before the committee and present his case. Any suggestions regarding the new rest room permit policies would be appreciated. It is hoped that the program represents a step forward in the solution of this serious problem that is facing higher education today. Remember those famous words. "In its chosen field, Minnesota must lead, not follow."

Respectfully submitted

THE COMMITTEE ON PARKING AND
MOVEMENT

back from the front

Ralph Groop

Ace War Correspondent for the International Enquirer

While for Knute Rockne it was "When in doubt, punt," Tom Lehrer would agree with ex-President Johnson in saying, "When in doubt, send the Marines."

No sooner said than done.

Well, here we are in the "Wonderful World of War" alias South Vietnam, land of President Thieu and his spy brother, U Thieu.

Some people think that the Viet Cong are puppets of the North Vietnamese, hypnotized, as it were, to do

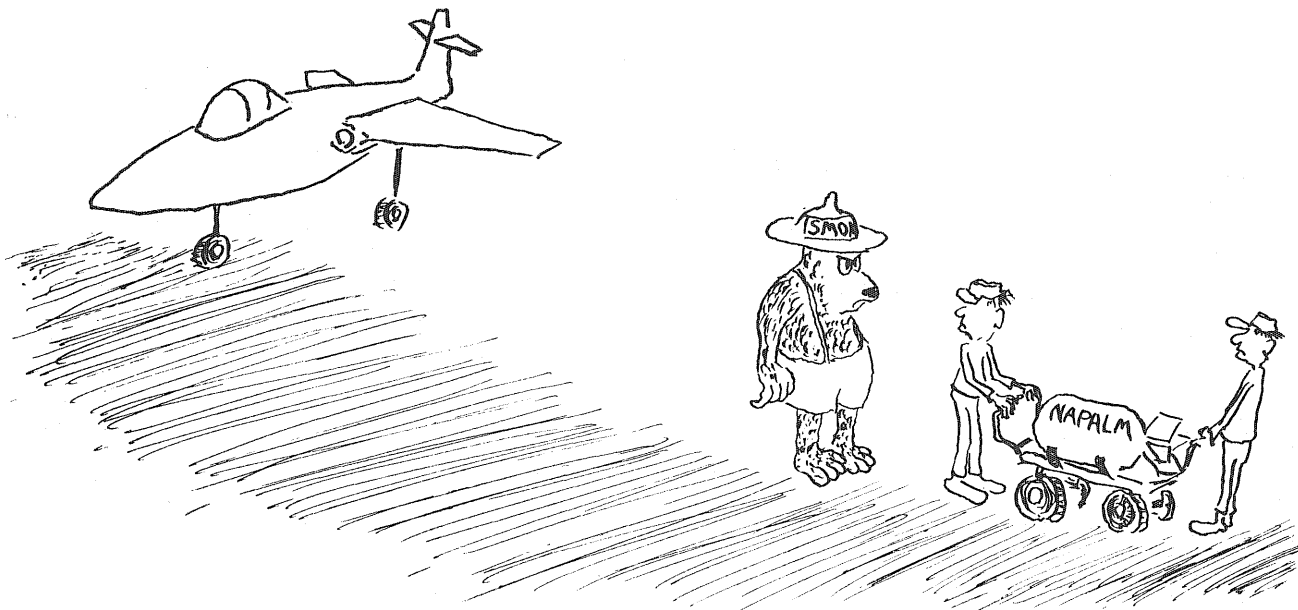
their bidding—yet the casinos in Saigon still haven't caught on to the system. One wonders how low these nefarious plotters will sink to secure their precious success. (Special contest: What is the specific gravity of the plotters?)

Vietnam is a land where one can buy anything on the Black Market—from a jet helicopter to Twiggy Flatwear.®

The war goes on. Yet, in spite of all the disturbance, you can still see little children running down the streets and trickling into the storm sewers.

official daily bull

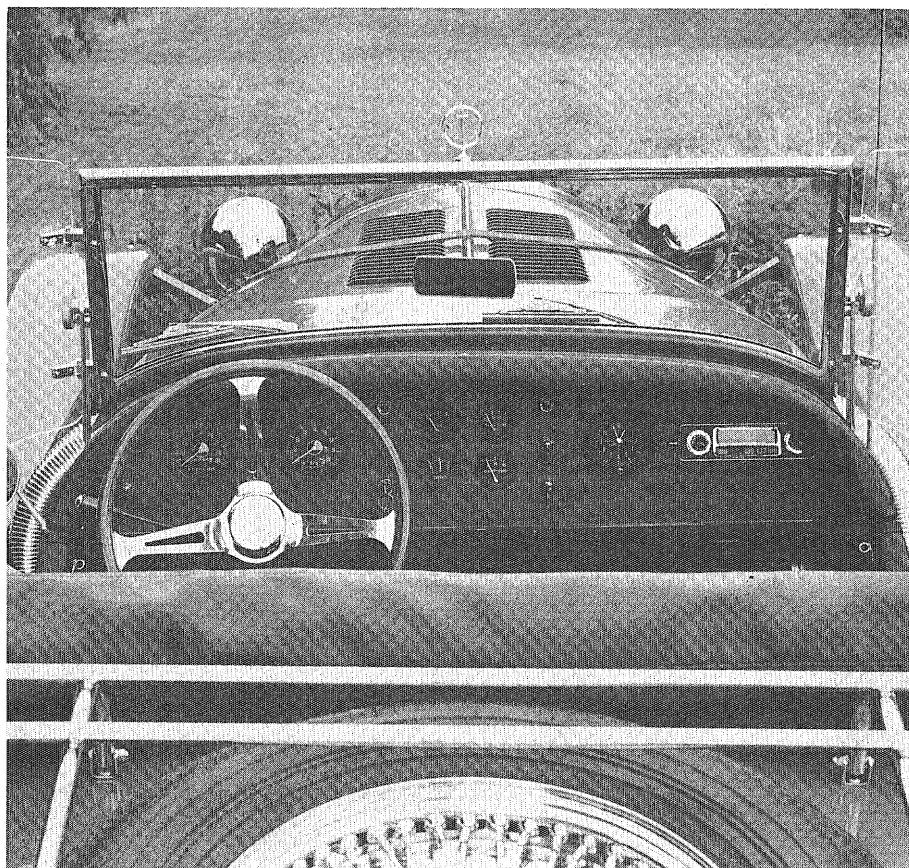
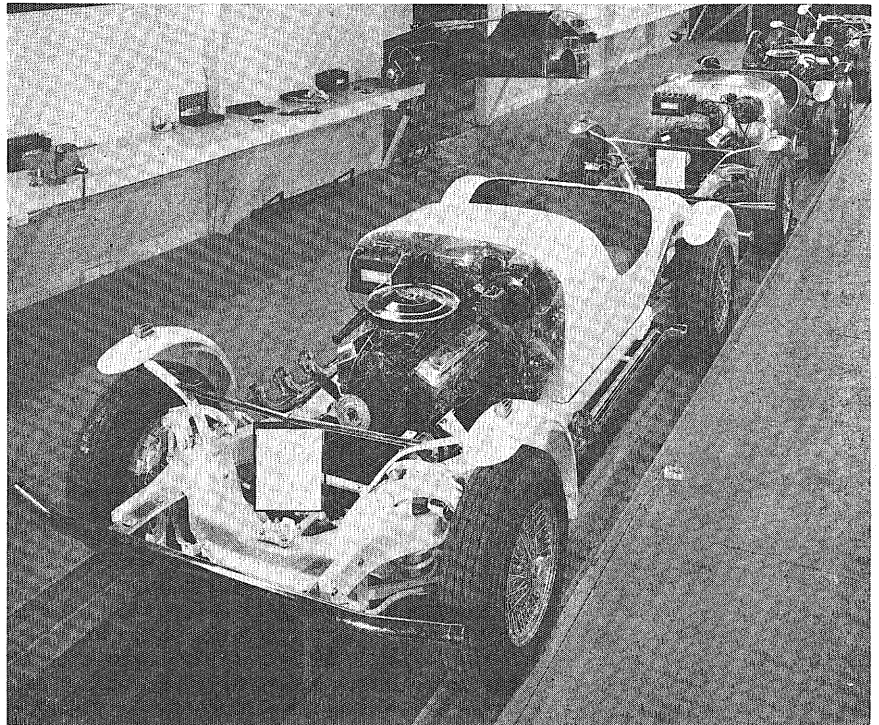
- Nov. 16—Memorial Stadium to get new turf; contract goes to Marquis de Sade.
- Nov. 18—On this date, 100 years ago, Karl Marx bought controlling interest in Standard Oil.
- Nov. 19—He sells out Howard Hughes.
- Nov. 22—Commissar of Vladivostok dies mysteriously, buried in Communist plot.
- Nov. 24—Chinese television announces new Saturday morning show: The Amazing Adventures of Super-Mao.
- Nov. 28—Thanksgiving: Pilgrims land at Plymouth; New York smog halts air travel.
- Dec. 1—Priest commits Adultery; asylum director optimistic.
- Dec. 5—1908, Pres. Andy Countedphor joked "In sixty years autos will clog our streets and poison our air, fulfilling the American Dream of 'huddled' masses yearning to breathe free."
- Dec. 7—1941, Japanese Advertising Man proposes bombing Pearl Harbor as a publicity stunt.
- Dec. 10—Only 12 more shoplifting days 'til Xmas.
- Dec. 13—Get mugged by IT co-ed.




“What you’ve got to understand is that this is a car that captures the functional honesty of the past. The days when men, morals, and radiators stood four-square and upright. When old-world craftsmen toiled lovingly over every tiny niche and facet of automotive embellishment. Honesty! None of this knuckling under to minions of the styling and sales departments. No compromise in the face of secondary considerations like aerodynamics and creature comforts. An automobile that is all automobile.”

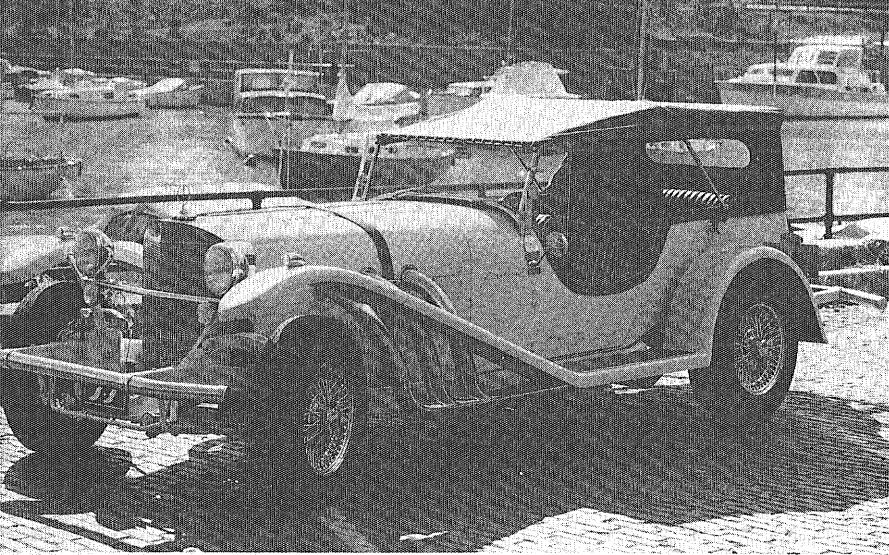
EXCALIBUR

continued
from page 19



glass. The only portion to remain of aluminum was the louvered hood panels for functional and appearance reasons. The floor pan was also redesigned on subsequent models, and is now contoured for seat locations, drive shaft tunnel, and driver's foot recess.

The Excalibur is essentially a hand-made piece of precision. The car is completely custom built to order, and to submitted owner's specifications. This includes anything you want, from luggage carrier with suitcases designed and built for the Excalibur, to leather seats and walnut instrument panel. However, there is only one catch to the whole business, and that logically enough is the cost. With a base price of \$9,000 not too many gold plated shift lever knobs are requested. As a parting comment, we can only agree with Brooks Stevens, the Chairman of the Board of SS Automobiles Inc., who admits that "all Excalibur SS cars to date have been designed for the youth of the nation beginning at age 54," or for those who can afford it! 



EXCALIBUR SS PHAETON

MODELS

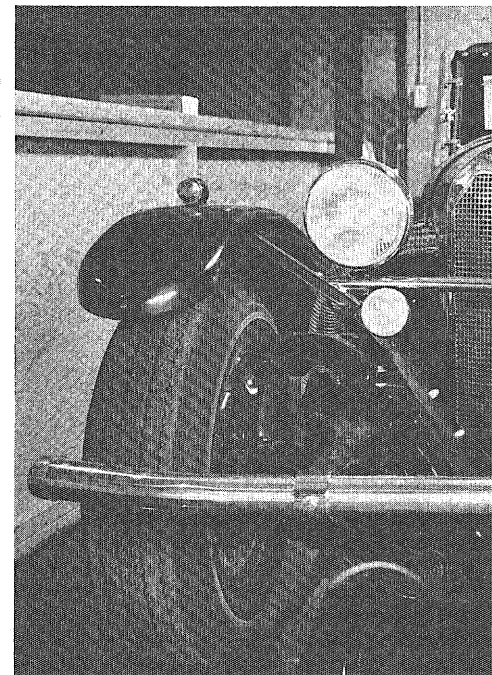
Excalibur SSK—Suggested Retail	\$9,000.00
Excalibur SS Roadster—Suggested Retail	9,000.00
Excalibur SS Phaeton—Suggested Retail	10,000.00

COLOR SELECTIONS

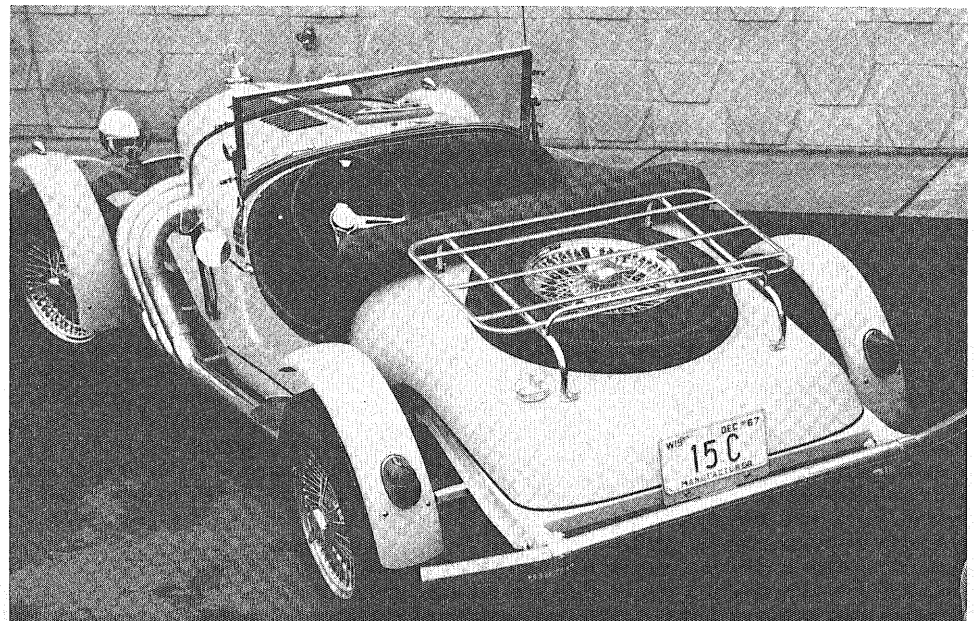
Maroon	Green	Black	Blue
Red	White	Yellow	Silver
Interior: Black or Red		Tops & Curtains: Black	

ACCESSORY OPTIONS

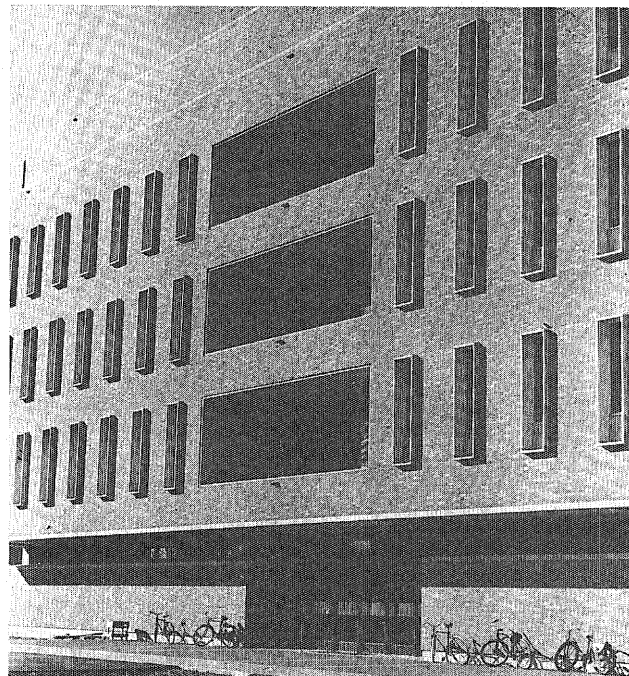
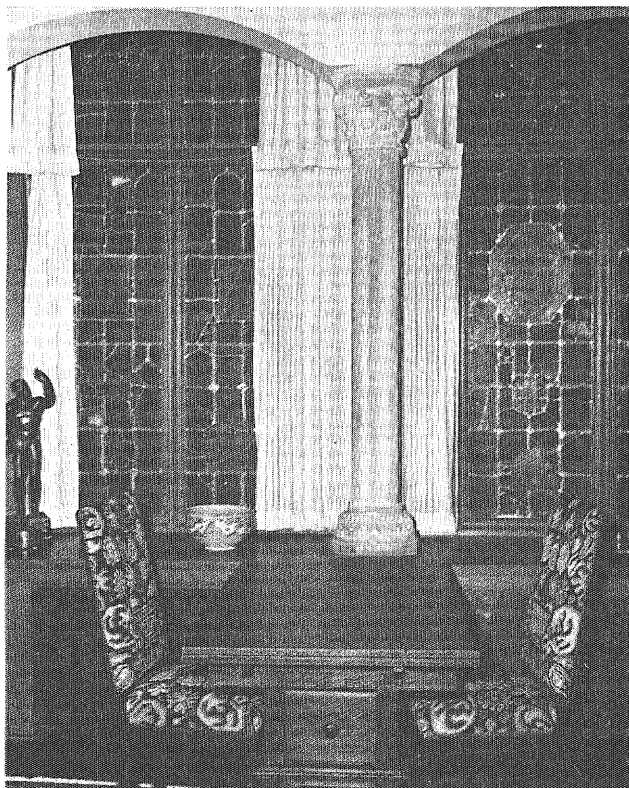
Automatic Transmission	\$200.00	Step Plates	\$ 50.00
Heater	100.00	Tonneau Cover—SSK and SSR	60.00
Luggage Rack—SSK and SSR	60.00	Tonneau Cover—Phaeton	100.00
Luggage Rack—Phaeton	125.00	AM-FM Radio	200.00
Wind Wings	30.00	Tire Cover—Red or Black	25.00
Center Driving Light	75.00	Stereo Tape Player	200.00



EXCALIBUR SSK



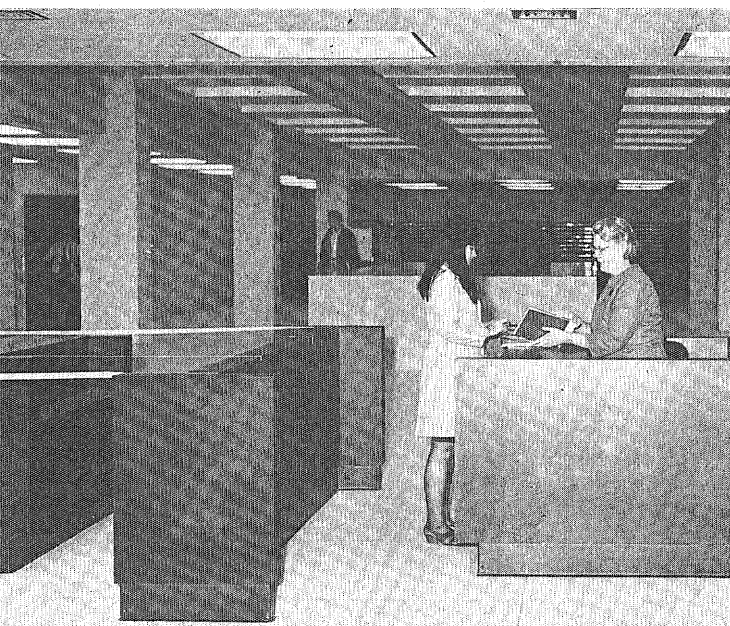
introducing . . . wilson library

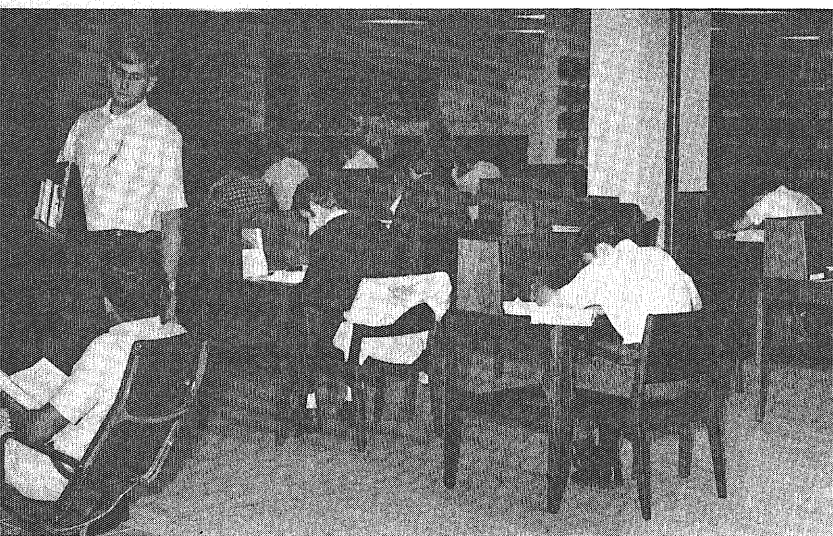
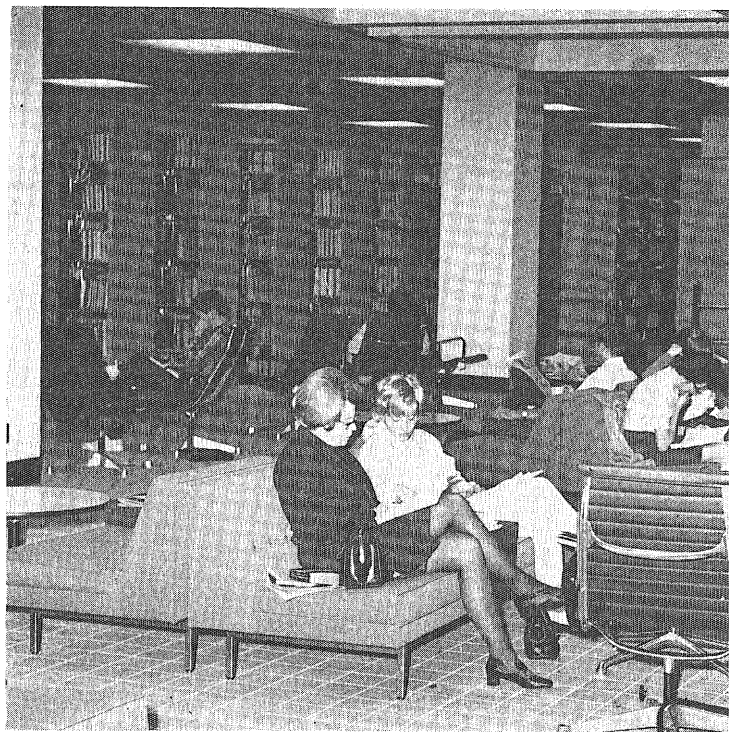
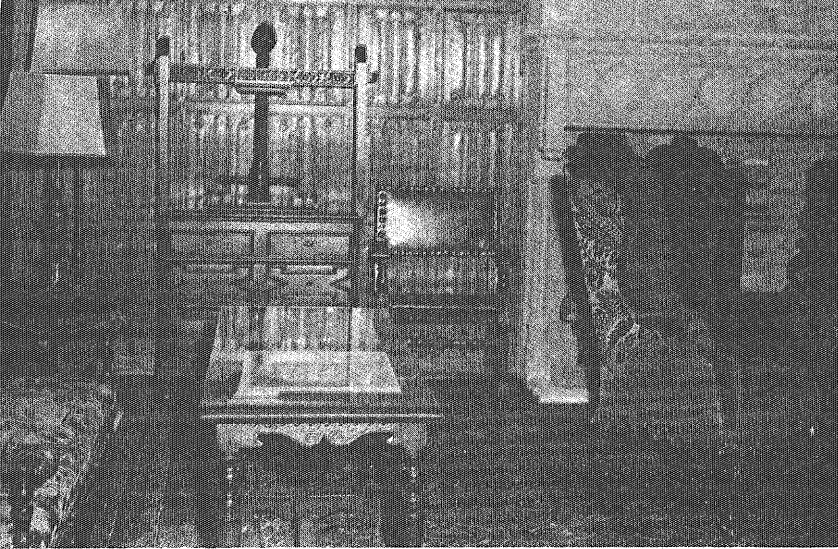


ON SEPTEMBER 23, 1968, the newest building on the West Bank, the O. Meredith Wilson Library, opened its doors to the public. As the West Bank Campus plan is completed the Wilson Library will be in the center of the complex, serving as the hub for the educational enterprise in that area.

It has been 44 years since the University built its last major library building, the Walter Library, opened in 1924. In the interval between the time that Walter Library was new and the opening of the Wilson Library, significant changes have taken place in the educational use of libraries. The differences in the design of the two buildings makes this apparent. The Wilson Library emphasizes accessibility to books and periodicals by the patrons. Indeed, tables and chairs are in the midst of library materials and the student or library user can help himself to his books and sit right down and study them. This is unlike service heretofore provided in Walter Library where essentially the books were housed in the 12-story stack area which was surrounded on three sides by reading rooms.

The new library is named for Dr. O. Meredith Wilson, President of the University, 1960-67. It was during his administration that funds for the building were ob-





tained, two-thirds state legislative monies and one-third federal. Total project costs for the building was ten million dollars.

The Wilson Library is basically a Humanities and Social Sciences library. However, it also now becomes the "main" building of the University Libraries system. As such it contains the library's administrative and processing offices, and is the headquarters for reference service, circulation of books and periodicals, and government documents. It houses also such specialized libraries as the Ames library of South Asia, the East Asian Library, the Middle East Library, and the James Ford Bell Library. Most of the Department of Special Collections' books are in the Wilson Library as is the Map Division, the Newspaper and Microfilm Division, the Periodicals Division, and the central card catalog. Among the services provided in Wilson Library are Interlibrary Loan, photocopying, and reserve book service.

Among the special features of the new library are the two entrances, one on the plaza level which enters from the West Bank plaza area; the other entrance is from the wide underground concourse that connects the library with the other classroom and office buildings on the West Bank. The library has automatic door

openers and a one way escalator that moves people from the basement level to the plaza or main level. It is the first completely air-conditioned building on the University campus.

In size the Wilson Library is larger than the Walter Library, and provides seating for 2,200 patrons at one time. It has a book capacity of 1,500,000 volumes, and has 40 miles of shelving. Among the seven floors of the building four, plus the penthouse, are above the ground and two are below grade. The lower levels are larger, however, so that nearly half of the space in the building is below ground level.

The O. Meredith Wilson Library is an inviting building, beautifully furnished, comfortable, and spacious. Its collections will meet the reading interests ranging from the light recreational type of literature to the esoteric, unique, the scholarly items which appear in more than 50 foreign languages. With a total collection of about 2,750,000 volumes in the University's libraries, all of which are indexed in the Wilson Library card catalog, the library's staff can confidently respond to nearly any request for information of published material. It is, indeed, worth a visit to this outstanding addition to the University's buildings.



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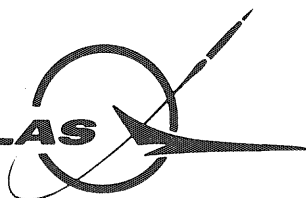
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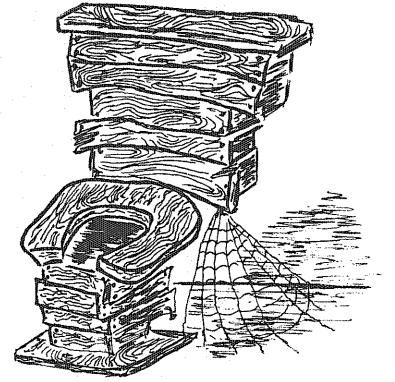


splinters

from
the

log

by Paddy Hooligan



The boys in IEEE have come up with a new whisky test:

Connect 10,000 volts D.C. across a pint of fluid. If the current jumps it the product is poor.

If the current causes a precipitation of lye, tin, iron slag, and alum, the whisky is fair.

If the liquor chases the current back into the generator, it's darn good stuff.

Two patients in a hospital were exceedingly bored one day, so they found a stack of diagnosis cards on a table and began to play poker. One shuffled the cards and dealt. They picked up their cards and examined them. One bet, and the other raised, they raised and raised again, until finally one of them called.

"Looks like I win. I've got three pneumonias and two gallstones."

"Not so fast. Not so fast! I've got four enemas."

"Well, I guess you take the pot."

Then there was the I.E. who saved for years and years to buy his mother a house, only to find that the police department wouldn't let her run it.

Prof: "I won't begin today's lecture until the room settles down."

Voice from rear: "Why don't you go home and sleep it off?"

A woman got on the train with three sets of twins. When the conductor came by for the tickets he looked in astonishment. "Do you mean to say you get twins every time?" he asked.

"Oh, no," she replied. "Hundreds of times we don't get anything."

As the high school teacher was distributing the first grades of the year, she noticed one blond teenager, a future IT coed, scowling. "What's the matter, aren't you satisfied with your grades?" she asked.

"I certainly am not," replied the girl. You gave me an "F" in SEX, and I didn't even know I was taking it."

~~~~~

*-vilitas et crudus semper eternam*

~~~~~

These days the necessities of life cost about three times what they used to, and half the time they aren't even fit to drink.

A few years ago Uranium cost two dollars a ton. Then, someone found out you could kill people with it.

An instructor asked the E.E. the purpose of a bolt with a left hand thread and got this reply:

"A bolt with a left hand thread is a bolt which the tighter it's screwed the looser it gets."

ENGINEER'S CHANT

Keep on studying, get no sleep,
soon you're looking like a creep,
Coffee flows, aspirin too,
seems your eyes are full of glue.
Stress and strain, calculus,
find unknowns, must not fuss.
Temper short, walk with droop,
keep on feeling like a stupe.
Paper spread on the floor
"Quiet Please" pinned on the door,
Books are stacked in towering pile,
wonder if it's all worthwhile.
Toss a coin, decide the crams,
heads, the Army, tails, exams.

An attractive young lady lay on a bed in the receiving ward of the hospital, covered only with a large sheet. Two young men entered the room, drew back the sheet and examined her carefully from head to foot.

"Do you think you'll have to operate?" the girl asked anxiously after a few minutes.

"Oh, you'll have to ask the doctor," said one of the men cheerily, "We're engineers."

In a Paris apartment, a French wife called her husband, Pierre, into the bedroom and said to him:

"Pierre, our son, Armand, has now reached the age where I think he is interested in girls. I want you to speak to him."

"About what?" asked Pierre.

"Tell him about the birds and the bees," she said.

Pierre protested and protested, but his wife was adamant, so he reluctantly walked into Armand's room.

"Armand," Pierre said, "you remember last summer when we took a trip to Marseilles?"

"Yes, papa," Armand answered.

"You remember we went to that house with the lovely ladies and the music and the wine?"

"Yes, papa," said Armand, his eyes lighting up.

"You remember that beautiful brunette with the transparent dress who sat on your lap and ran her hands through your hair?"

"Yes, papa!" Armand cried, excitedly.

"Then you remember her taking your hand and leading you up the stairs?"

"YES, PAPA!!!" Armand fairly cried with glee.

"And you remember what you did?"

"YES-YES PAPA!!!!" Armand cried.

"Well," Pierre said, "it's the same with the birds and the bees."

C.E.: "I just bought a skunk."

E.E.: "Where you going to keep 'im?"

C.E.: "Under my bed in Bailey Hall."

E.E.: "What about the awful smell?"

C.E.: "He'll just have to get used to it like I did."

Two engineers, upon graduating from IT, purchased a small saloon in a country town. They immediately closed the place down and painted it inside and out.

The villagers, after a few days, gathered outside the place, and one of them knocked on the door. A window opened, and one of the engineers inquired as to the reason for the gathering.

"We want to know when you are going to open up," was the reply.

"Open up," retorted the man at the window, "we bought this place for ourselves."

• • •

Before he went off to the wars, King Arthur locked his wife, Guinevere, in a chastity belt. Then he summoned his loyal friend and subject, Sir Lancelot.

"Lancelot, loyal knight," said Arthur, "within this sturdy belt is imprisoned the virtue of my wife. The key to this chaste treasure I will trust to only one man in the world. To you."

Humbled before this great honor, Lancelot knelt, received the King's blessing, and took charge of the key. Arthur mounted his steed and rode off.

Not a mile from the castle, he heard hoofbeats behind him and turned to see Sir Lancelot riding hard to catch up with him. "What is amiss, my friend?" asked the King.

"My Lord," gasped Lancelot, "you have given me the wrong key!"

• • •

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The results of the exam were exceedingly poor. Making inquiry, the Prof asked, "Mr. Jones, why didn't you study for this examination?"

"I was holding hands with Lucy, sir."

"You are suspended for two days," snapped the angry prof.

"You, Mr. Adams, why weren't you prepared for the exam?"

"I was playing post office all night."

"You are suspended for a week," roared the prof.

"Thomes—where are you going?"

"I'll see you next semester."

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The admiral had made himself very unpopular and when he fell ill and had to go to the base hospital, everyone breathed a sigh of relief. The hospital, however, did not improve his temper, and he made life miserable for the staff. One day, one of the orderlies put on a surgeon's mask, went into the admiral's room, picked up his chart and examined it very

professionally. Then, he advised the admiral that he would have to take his temperature and told him to roll over on his stomach. On no account was the admiral to turn over, and he promised to return and read the thermometer as soon as possible. The admiral harumphed but did as he was told. About an hour later the floor nurse looked in to check the admiral

and found him still on his stomach. "What on earth are you doing, sir?" she inquired.

"What is the matter with you?" growled the admiral, "haven't you seen people having their temperature taken before?"

"Yes," she cried, "but with a daffodil?"

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Don earned a B.S.E.E. in 1965. Today, he’s an Associate Engineer in systems design and evaluation at IBM.

Most of his work consists of determining modifications needed to make complex data processing systems fit the specialized requirements of IBM customers.

Small teams

Depending on the size of the project, Don works individually or in a small team. He’s now working with three other engineers on part of an air traffic control system that will process radar information by computer.

Says Don: “There are only general guidelines. The assignment is simply to come up with the optimum system.”

This informal working environment is typical of engineering and science at IBM

Don sees a lot of possibilities for the future. He says, “My job requires that I keep up to date with all the latest IBM equipment and systems programs. With that broad an outlook, I can move into almost any technical area at IBM.”

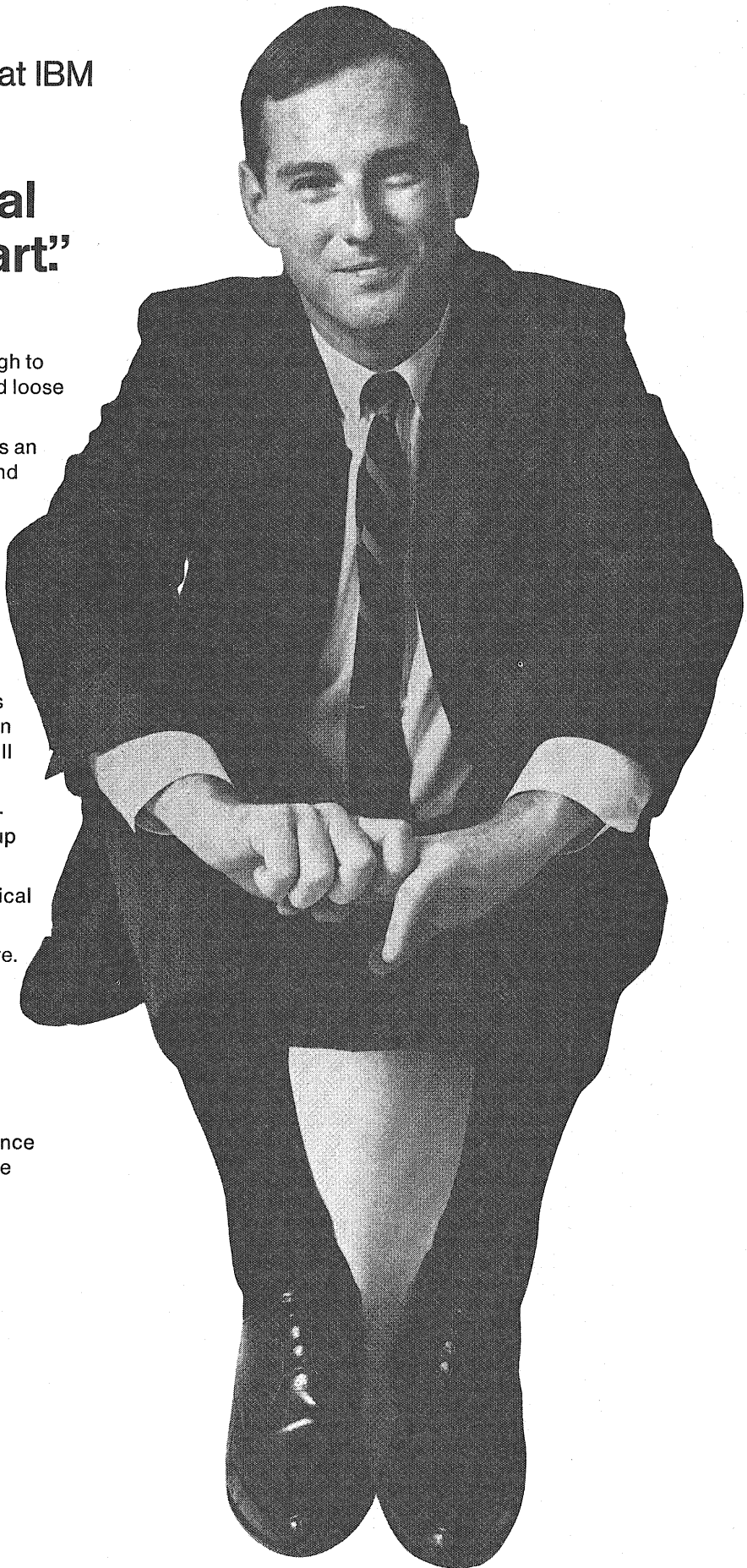
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At the end of the first session the psychologist was explaining to the women what caused their problems.

"You," he explained to the obese one, "think of nothing but food. It even shows in the naming of your child—Candy."

Turning to the penurious looking one, he said, "You think of nothing but money, that's why you named your child Penny."

The third woman arose abruptly and exclaimed, "Why I never heard of such crazy stuff in all my life." And grabbing her young son's hand she said, "Come on, Dick."

If a girl doesn't like her figure, she can always lump it.

Math Prof.: "Give me an example of an imaginary spheroid."

M.E.: "A rooster's egg."

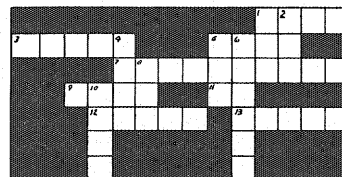
The difference between amnesia and magnesia is that a person with amnesia doesn't know where he is going.

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First Voice: "Do you have five one's for a five?"

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Driver: "Yeah, and if you can do the same thing with your dog, you can ride the bus."

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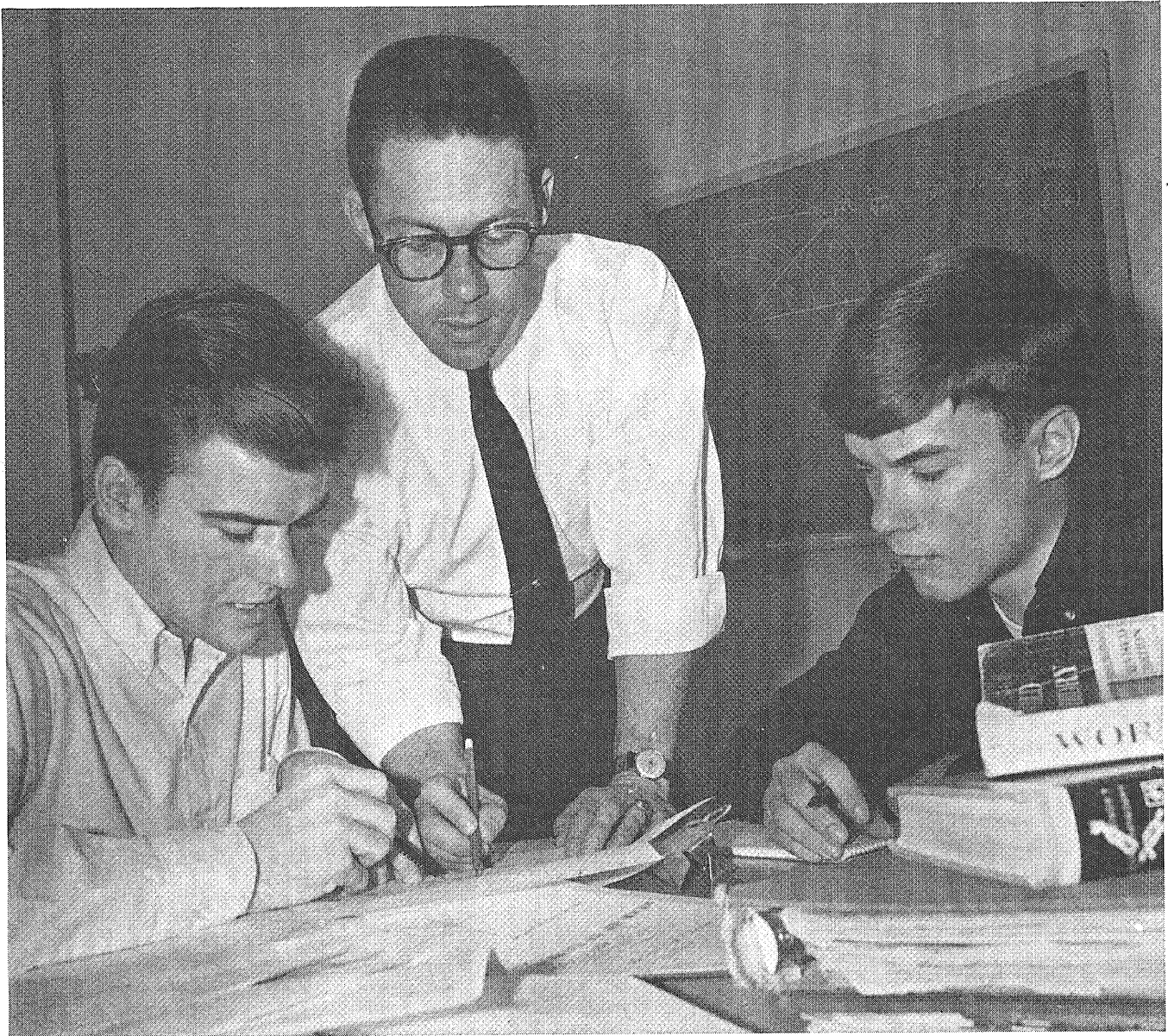
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But when Pete graduated from Rutgers in 1964, it wasn't these youngsters with their homework problems that brought him to General Electric. It was the chance to help people in industry solve tough technical problems. A career in technical marketing at General Electric gave him the opportunity.

Today, Pete's an application engineer in steel mill

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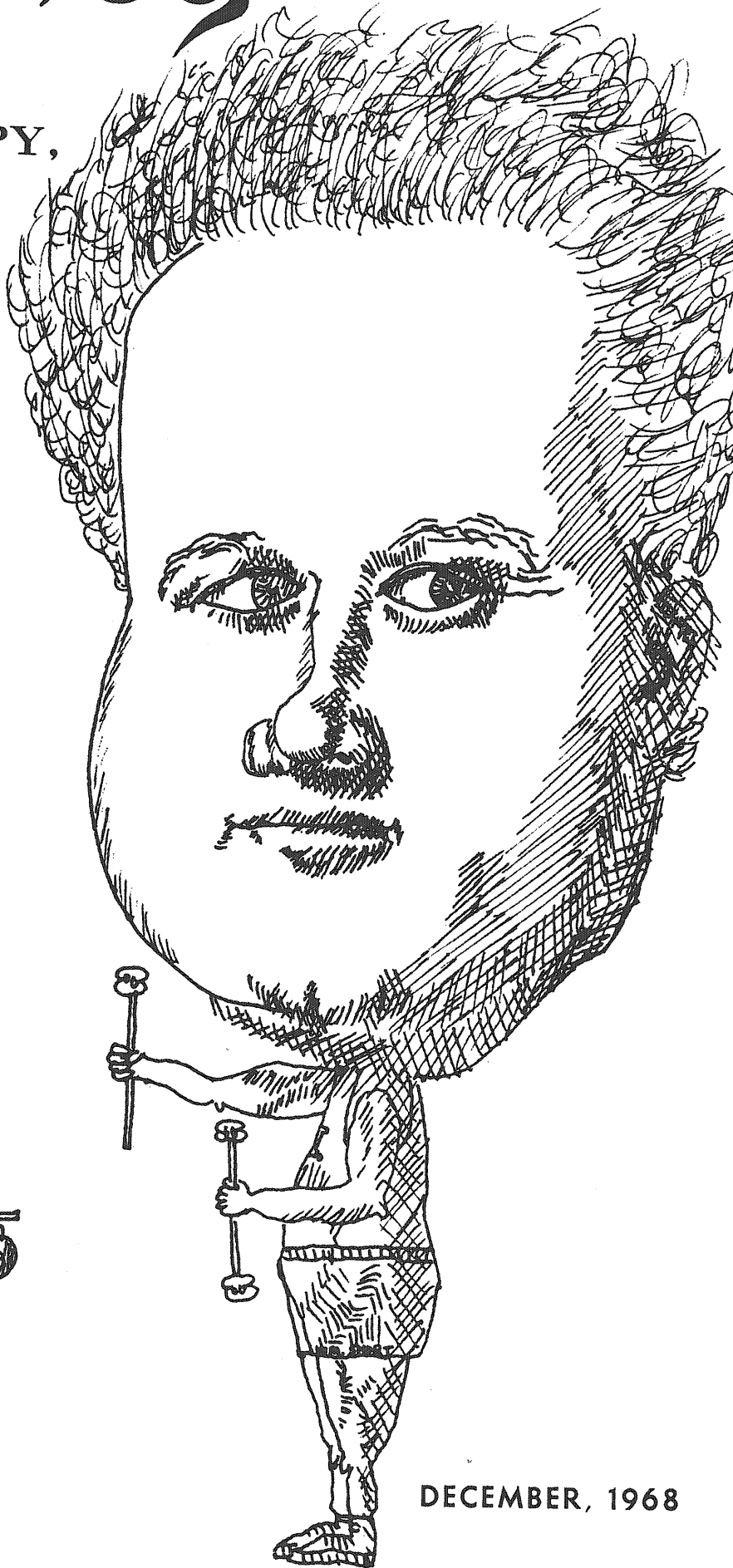
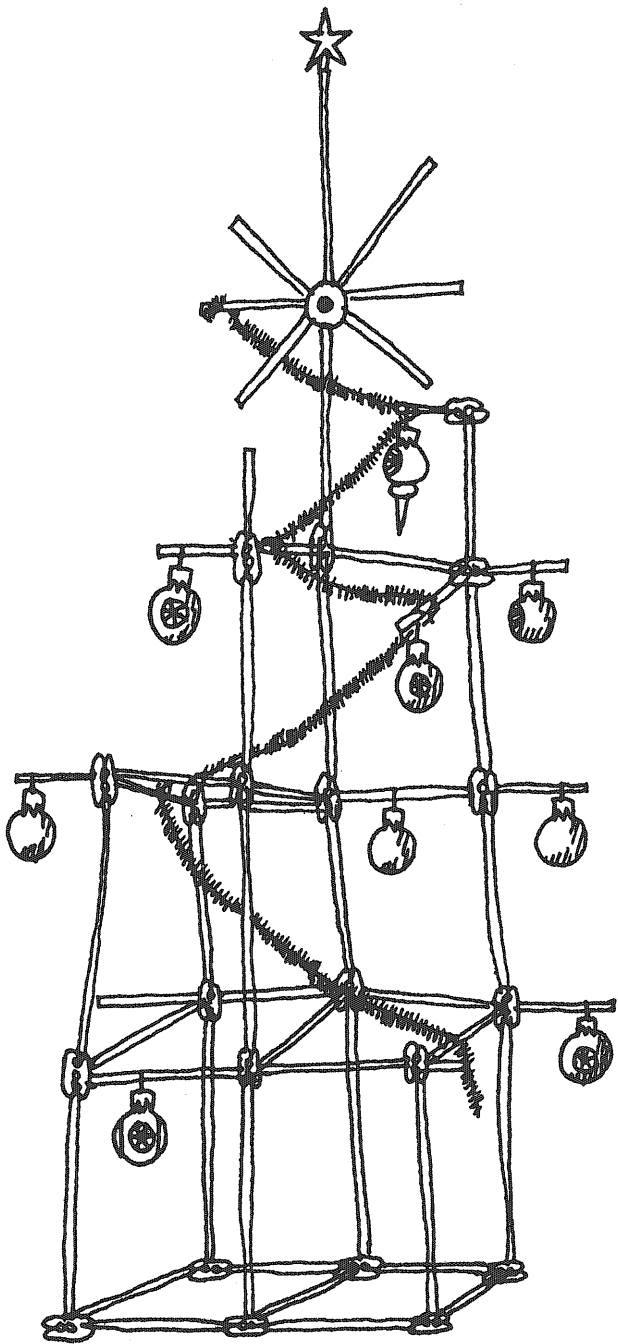
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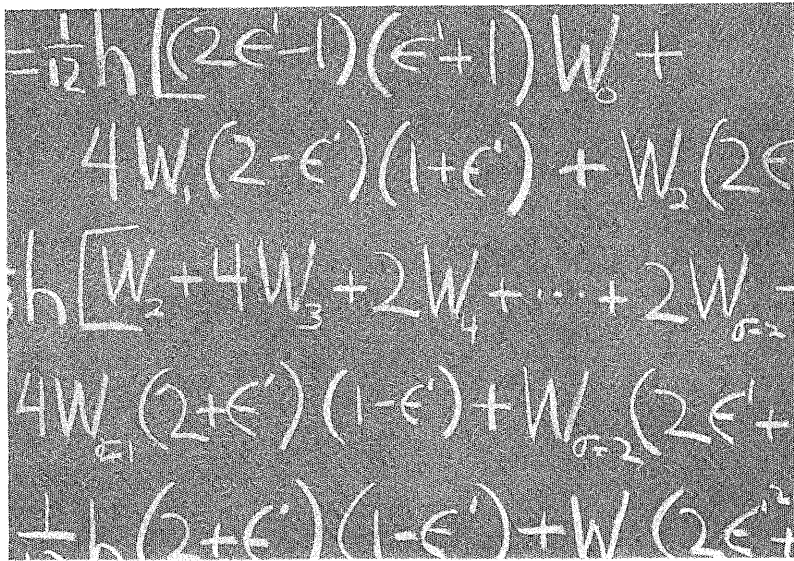
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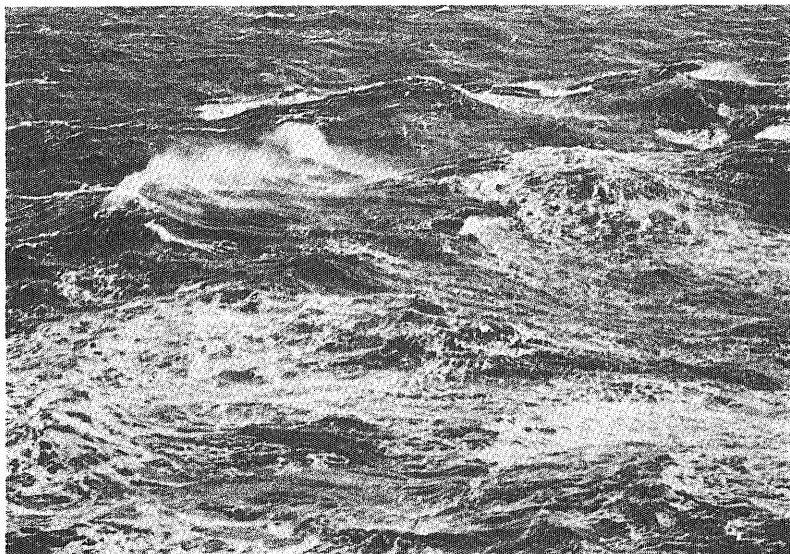


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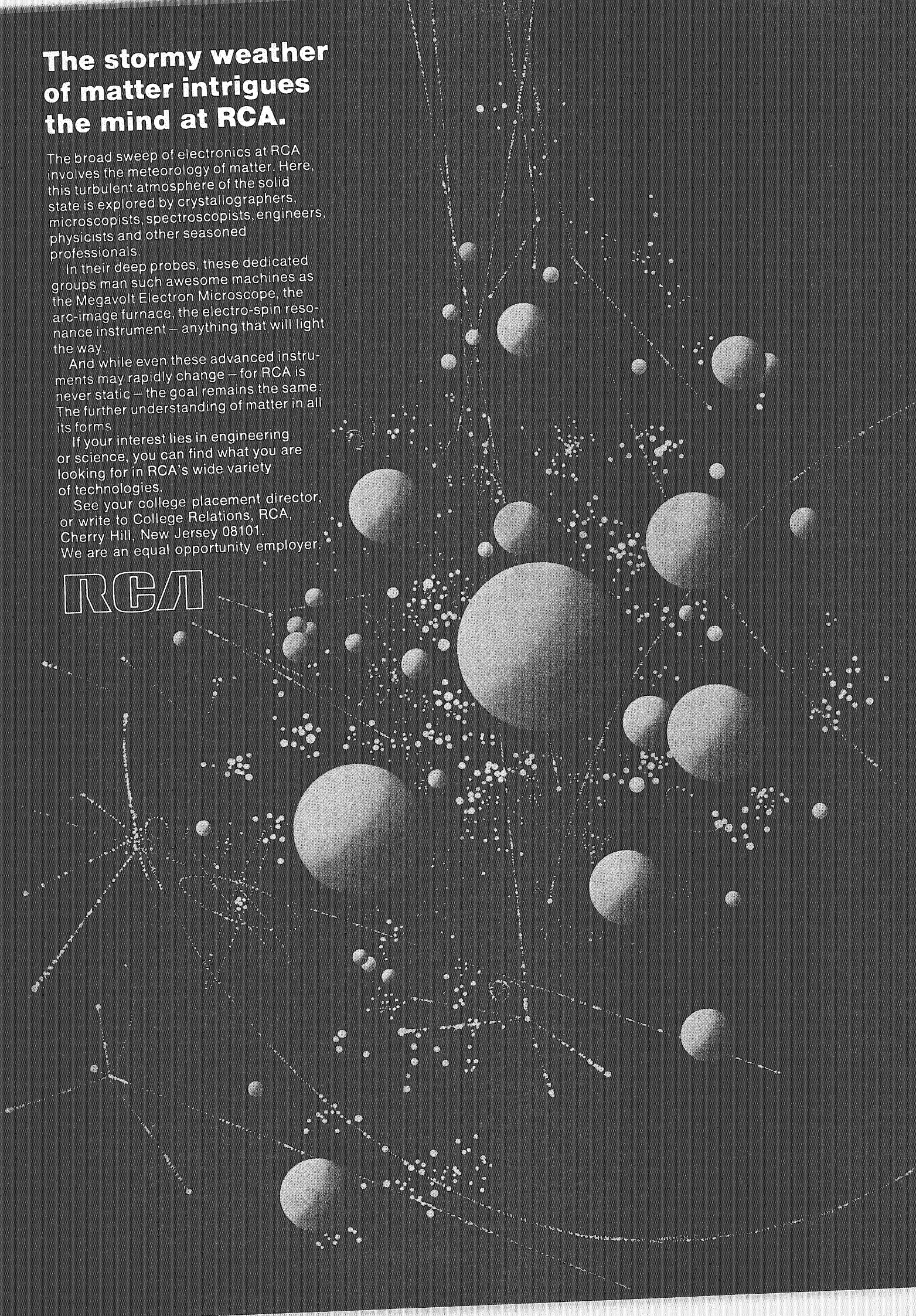
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technolog

Official Student Publication of the Institute of Technology, University of Minnesota

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COVER: All I want for Christmas is a \$10.5 million expansion program and a huge set of Tinker Toys says Dean Cheston. Art work by Bill Short.

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Vic Taylor is a corrosion specialist for International Nickel at its testing lab in North Carolina.

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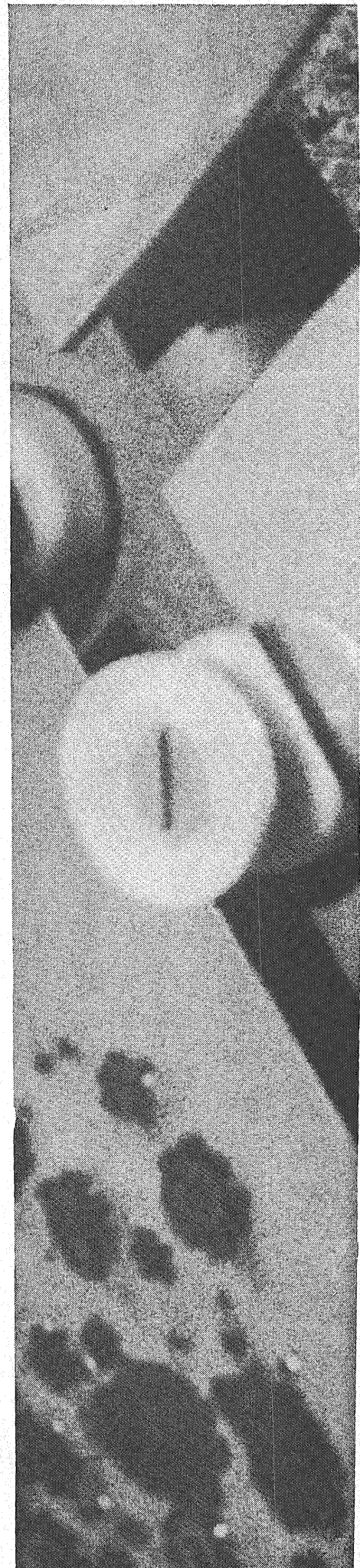
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Vic holds a nickel-chrome plated automobile bumper which was tested in the corrosive seaside atmosphere.





Photography by W. Eugene Smith.

Log Line

In between a quick chorus of "How Quickly the Fall Quarter Goes" allow us to wish you all the right answers on your final exams. In fact the bill of fare for December includes Charlie Brown's quick course in Thermodynamics. "It's Your Entropy Charlie Brown" is a successful M.E. 30A review which relates the concepts of thermodynamics, especially entropy to the tangible things around us, from sand castles on the beach to Shakespeare's English. Our many thanks to the *Louisiana Tech Engineer* and Dr. Randall F. Barron for allowing us to reprint this article.

A budget request of 10.5 million for expansion of the Institute of Technology triggered a staff interview with Dean Cheston. The results or answers to our main question, "Where is all the money going" disclosed a plot by the I.T. faculty to take over nearly all of the east bank by 1971. For further details see page 14.

Also on this month's menu is an unheard of phenomenon, a contribution to the *Log* by someone not on the staff. The untitled poem is a reflection on our actions and our effect on the world as engineers. Although possibly not an original idea, the poem surely warrants its publication by virtue of the fact that it is an unsolicited expression of feeling by an I.T. student. And as you all know, Sliderule Sam, typical I.T. student is usually very short of feelings of any kind.

Wrapping up this month's Christmas package is the usual red tape and ribbons and bows. Happy Holidays!

A Fairy True Tale

Once upon a time there was a young man who lived in a land

where many people were unhappy. He was moved by their unhappiness, and wanted to help them, so he went to the wise men to learn how to be an engineer.

Now in that land, the wise men lived apart from the people in great high towers. The young man went to the towers and struggled and climbed up them to the wise men. The wise men saw he was a young man of pure heart and good purposes, so they taught him all they knew about mathematics and engineering.

After many years, the wise men told the young man that he knew all there was to know about the theories of engineering and he was ready to leave the towers and go back to the people.

So the young man went back to the people, and he worked for two years trying to make the people happy. But the people were ignorant, the theories did not always work in practice, and the young man became frustrated. Then he remembered his years of work with the wise men, and how learned they were.

The young man went back to where the wise men dwelt in their towers. There he used his knowledge to build a great, high tower for himself, where he could be very wise, and enjoy the companionship of his wise teachers.

But the people were so unhappy that they decided to go to the wise men for help. So they went to the place where the wise men dwelt, and called up, "Oh great and noble wise men, will you help us?" But the wise men were too busy being wise, and they did not hear the people. So the people in their ignorance thought they could bring the wise men to the people by destroying the towers. Alas, they did not know they would kill the wise men. So the young man, with the rest of the wise men, died and the people were still unhappy.

The opinions expressed here, unless otherwise signed, are those of the editors and do not necessarily represent the views of the Institute of Technology, its faculty or students, or any other organization.

Baby Spits Up

Knowing full well that by the time this is published, the Saigon situation may have changed, it is still our belief that we should cry out at the indignation suffered by the United States as a result of being associated with and committed to the defense of a Vietnamese government which demands a military victory in their civil war. And not only do Thieu and his associates have the audacity to demand that we fight to give them a military victory, but also the United States has the stupidity to kiss his ass and try gentle persuasion to get S. Vietnam to the peace table. Since when does the puppet government pull the strings? If you would please remember, the expanded peace talks were to begin Wed., the day after the Presidential election. Thieu refused to send a delegation. Why didn't the United States very plainly state, "Either you be in Paris on Wednesday or on Thursday we'll start bringing the troops home!" There is no excuse for Saigon deliberately prolonging the war or embarrassing the United States, the so called peace loving nation. The point of the matter is that Thieu is not in a bargaining position with us. Or to quote an old cliché, you don't bite the hand that feeds you. Hopefully, the learned men in Washington will soon realize that the United States is spoon feeding S. Vietnam and that we certainly should not tolerate any temper tantrums from the baby.

Five Year Program

Soon, the technical commission representatives to the I.T. faculty curriculum committee will be introducing a plan for an optional five year engineering degree. This plan, formulated primarily by the Engineer's Club, has the nearly unanimous support of Tech Commission, the technical societies, and the **Technolog**.

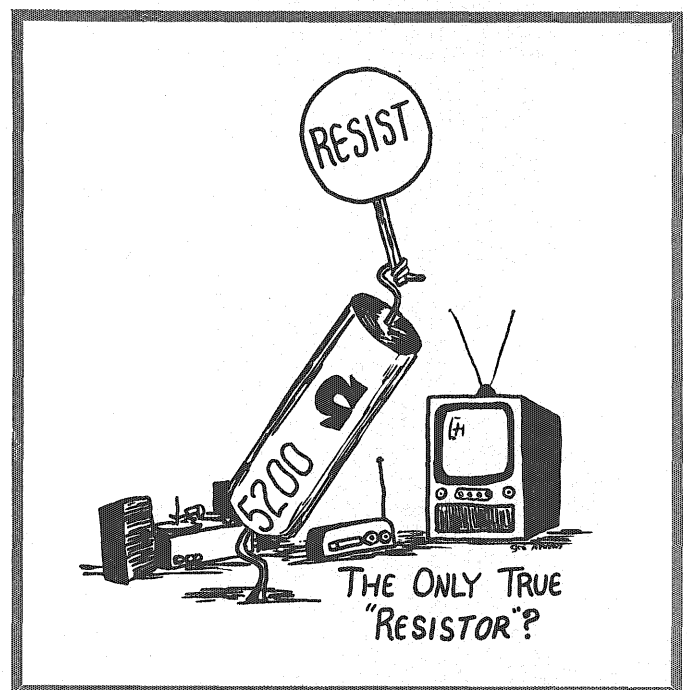
We believe an optional five year engineering degree is a necessity and must be organized as quickly as possible. The reasoning behind this proposal are these: (1) In the four year program engineers are not given enough time to develop their education in non-technical areas. In the proposed plan an increase of 15 non-tech credits will be required, which brings the required total for graduation to 218 credits; (2) The student is not capable of studying the average 17 credits per quarter and obtaining a lasting knowledge of the subjects; (3) from figures supplied by Dean Cartwright, the average B.S.

graduate of I.T. spends approximately 13.5 quarters in attendance. His figures show that the students cannot finish the required amount of work in 4 years or 12 quarters. The 203 credits for 13.5 quarters figures to about 15 credits per quarter or the suggested CLA credit load. Why then should we have a 12 quarter, 17 credits/quarter system when no one can keep up with this unobtainable theoretical pace? Why should we be required to put out more work in less time than the CLA people?

Our argument is not against the total amount of work required, but the amount of "draft-free" time in which to complete it. Why should we be forced to attend summer sessions so that we can barely receive our degree before being drafted? We would like more Institute of Technology approved time; we would like the Institute of Technology to recognize and endorse the five year program which we already in effect have.

Below is printed the proposal for the optional five year program. Having read this far, read the proposal, and if you see the validity of the program and support our suggestions, do something! The Deans and curriculum faculty members will assume your non-support if you don't make them aware of your attitudes. The Deans and faculty members continually claim they are willing

(Continued on page 11)

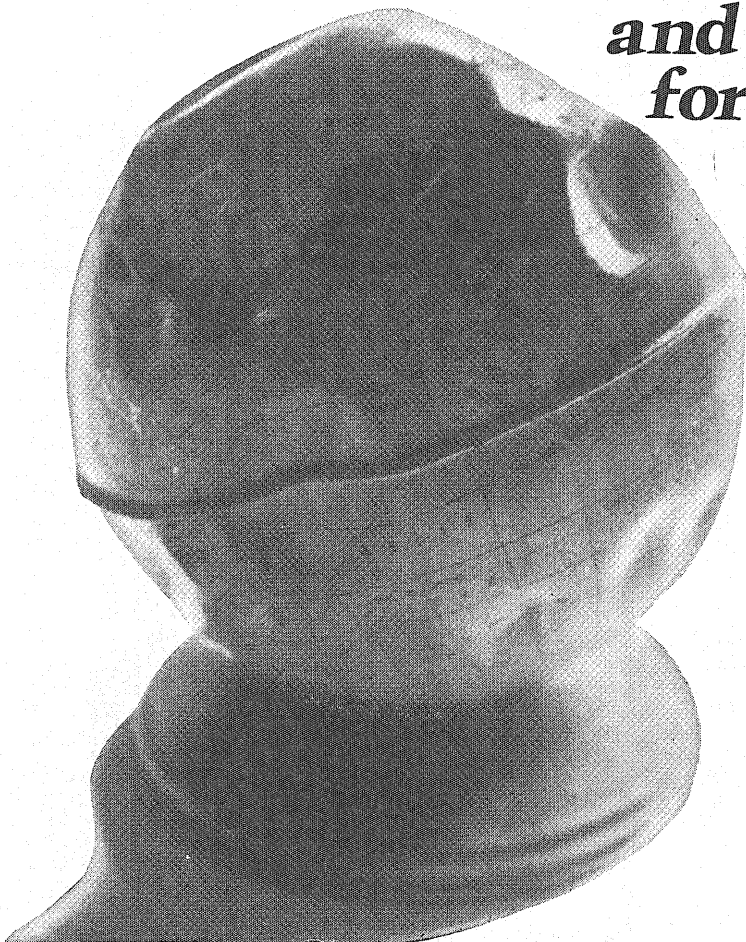


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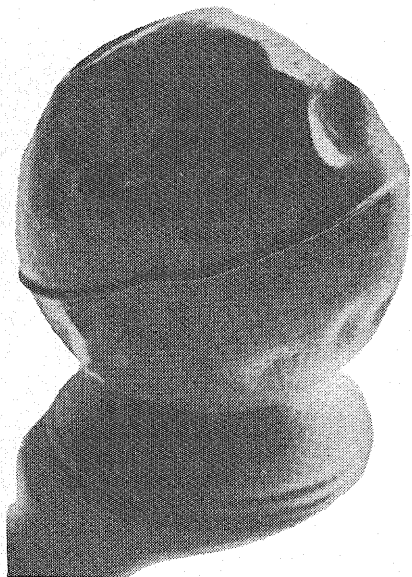
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Log Line


to listen and consider the voice of the students. Talk to your advisors, get together a group of guys and write a petition to the Dean telling him of your support for this program. We need your support. We need your push to overcome the inertia of the faculty. The faculty is a practical example of Newton's First Law, a body at rest tends to stay at rest. And likewise, the system will remain in the same pattern until some force acts to change the system. Let's act!

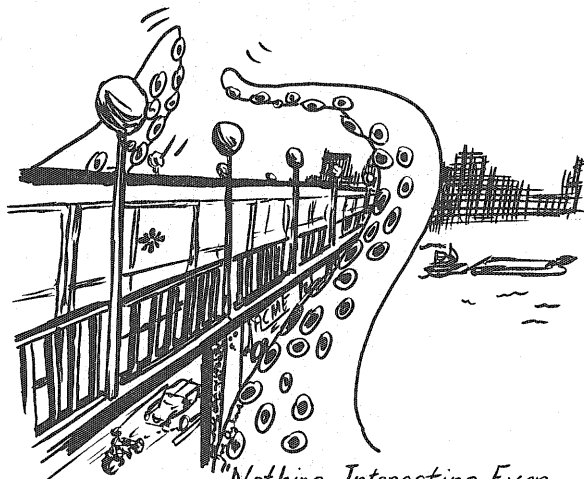
CURRICULUM PROPOSAL

The Minnesota Society of Professional Engineers', Student Chapter, recommends that the IT Curriculum Committee consider an optional expanded five year program, in addition to the present four year program. This expanded program would increase the non-technical credit requirement from the present 27 to a minimum of 42 and the free elective requirement from 9 to 21. The remainder of the curriculum would remain unchanged from the present four year curriculum.

The Engineers' Club believes that such an expansion would:

- (1) give the engineering student a more liberal education to better prepare him as a more knowledgeable and responsible addition to society.
- (2) allow the student the opportunity to take additional courses that he is unable to take under the present program because of lack of credit time.
- (3) encourage the IT student to explore other fields of interest outside his major field.
- (4) allow the student to carry a lighter credit load per quarter, thus enabling him to better learn the material presented for each course.
- (5) allow the student with a lighter credit load to more fully participate in extracurricular activities.

It is the Engineers' Club's opinion that an engineering education should provide the student with more than the basic technical tools of his trade, as is now the case, but should, in fact, produce a well rounded and liberally educated individual. We feel that an optional five year program would allow those who so desire an opportunity to achieve such goals. 



*"Nothing Interesting Ever
Happens on This Bridge!!"*



speaking with the dean

WE ARE CONSTANTLY reminded that our increasingly urban society is in trouble because of the developments of modern technology. Those that remind us of our present difficulties can justly be accused of loose terminology. A major source of our present problems is the application of old technologies to new situations. The automobile illustrates my point. It is an old technology which strangles our cities. What new technologies which have been developed to move people quickly and cheaply from one point in the city to another are blighting our physical environment?

A reminder that it is old rather than new technologies which are killing us off is the plight of Venice. (Here, at least, we cannot blame the automobile.) There is compelling evidence that one of earth's urban treasures is being rapidly destroyed by careless application of old technologies and studied neglect of new technologies. Rapid industrial development in the environs of Venice has polluted the air to such an extent that buildings which have withstood the ravages of centuries are crumbling, attacked by corrosive air-borne pollutants and sulfuric acid produced by the combination of sulfur compounds in the air and the ever-present sea spray from Venice's canals and lagoon. Italian industrialists have chosen to ignore the technologies which inhibit pollution since these are expensive to implement, preferring instead to witness the destruction of their heritage which is priceless and, therefore, not a fit parameter in the economic equation.

In addition, Venice's waterways have been dredged and channels rerouted in order to allow the passage of larger ships to serve the industrial development of the area. The effects of these alterations in the waterways were not studied or analyzed beforehand by modern techniques of the hydraulic engineer. Many believe that the disastrous floods which Venice has experienced in the past few years are attributable to ignoring the complex interaction between the tides of the Adriatic and the lagoon and waterways of Venice.

Finally, a large section of Venice has been abandoned and is decaying simply because no one has searched for ways to supply Venetians with life's necessities at prices consistent with existing incomes. For example, lack of modern methods of transportation and storage of foodstuffs has caused food prices to rise to intolerably high levels in the city.

Paris was saved at one point in its history by the application of the then modern technologies of sewage and waste disposal. Venice is provided through the action of its daily tides with a natural sewage system. What it needs to assure its survival is the application of techniques and methods of analysis and action familiar to modern engineers.

The problems of Venice are mirrored to some degree in each of our cities. The insistence on exploitation of old technologies because such exploitation is momentarily profitable should be countered by everyone of us who has the opportunity to apply our knowledge of new methods to save our environment and our culture.

Warren B. Chester

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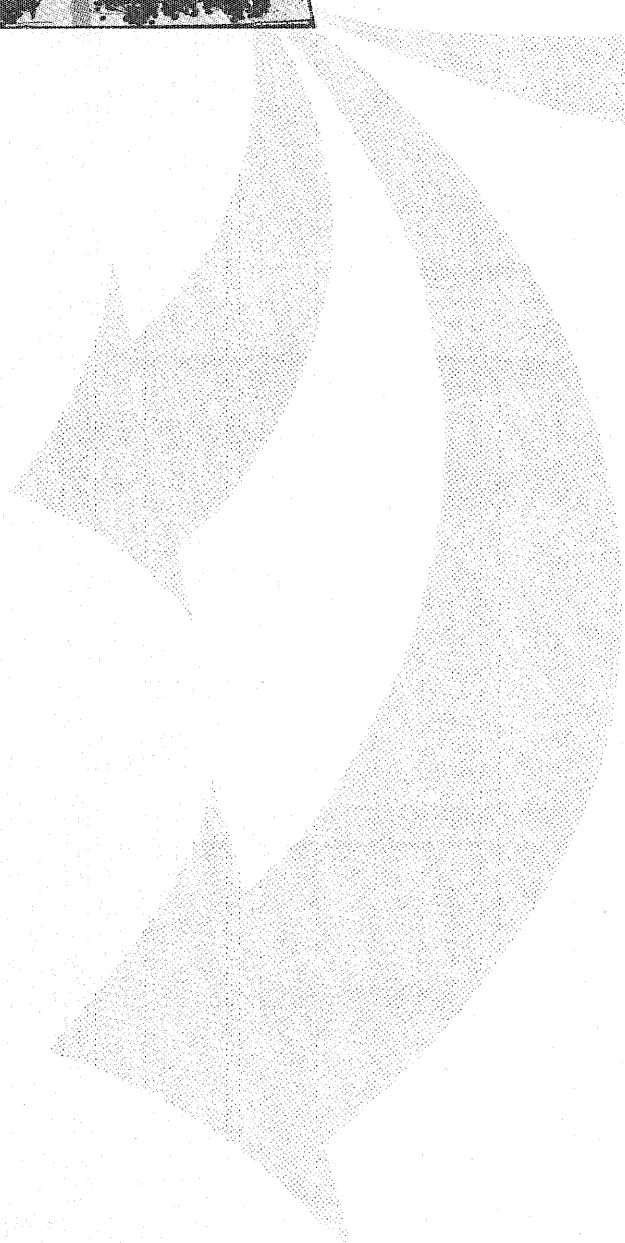
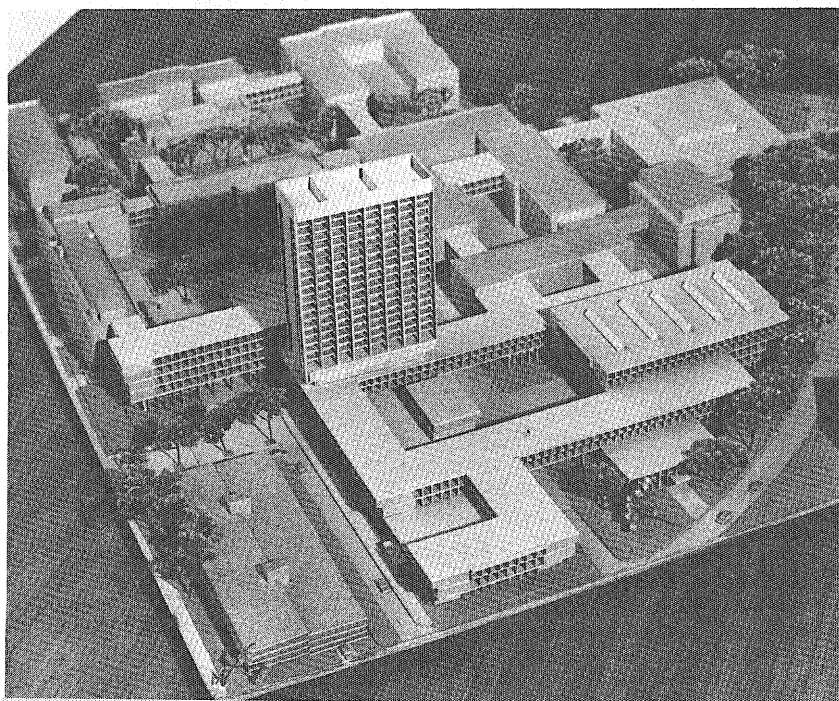
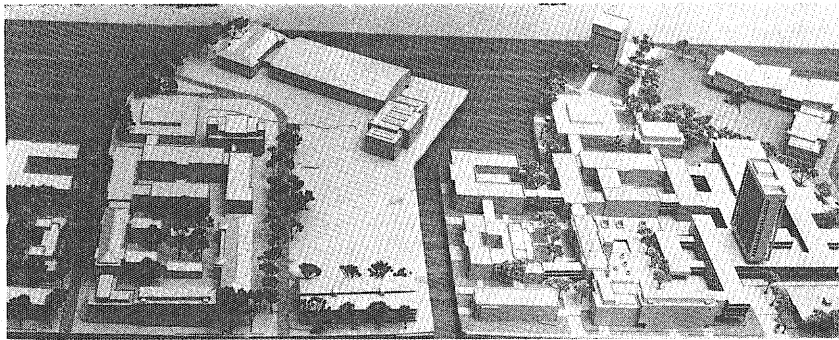
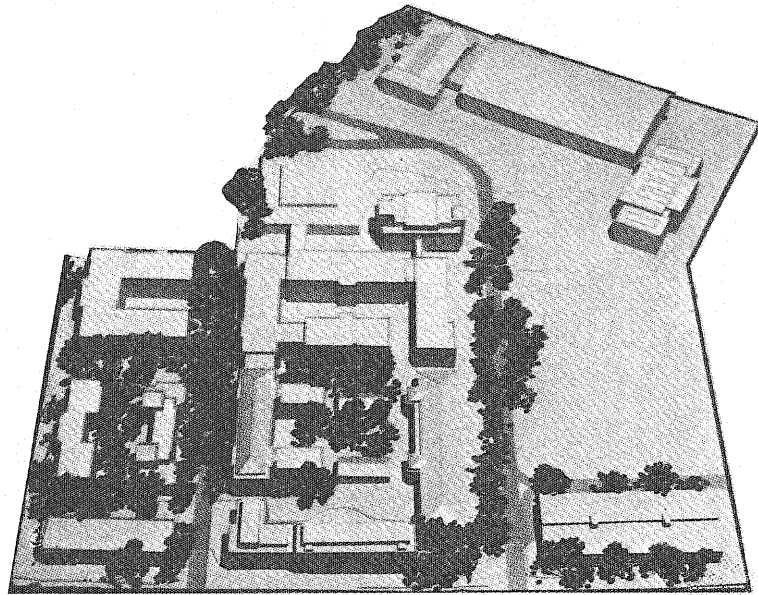
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AN INTERVIEW WITH DEAN CHESTON:



I.T. EXPANSION



Technolog: In the next legislative session, the Institute of Technology will be requesting \$10.5 million. What are the chances of getting the money?

Cheston: It is very difficult to tell. The state legislature has always been sympathetic toward IT's requests in the past, but this has been by far the largest request IT has made for a building fund.

Technolog: Will we be getting any money from the federal government in the form of research grants?

Cheston: It is rather unlikely this year or the next year that there will be very much money available from the federal government as far as matching funds for buildings are concerned. It is just one aspect of the general austerity program of the federal government.

Technolog: Of the money requested from the state legislature, will it be used largely for new buildings or for all aspects of IT?

Cheston: The \$10.5 million dollar figure covers costs of building the first structures in the new IT complex. It will house new quarters for the Civil Engineering Department, and also house some expanded activities of the Electrical Engineering Department.

Technolog: Where will the new complex or building be built?

Cheston: The new complex will be started on the football practice field; it will soon be dedicated to Institute of Technology activity rather than athletic activities.

Technolog: What will happen to the Engineering Courtyard where the temporary buildings are now?

Cheston: The temporaries in the engineering court, and also the two stubs on the Main Engineering Building will eventually disappear and the area will contain, at least we hope it will contain, an underground structure,

which will house a new science-engineering library and perhaps such things as computing facilities. But the area is dedicated to the Institute of Technology courtyard and will not have buildings above grade.

Technolog: When do you expect this work to take place?

Cheston: That's about the last phase of the building program, and if everything goes according to schedule it should take place around 1975.

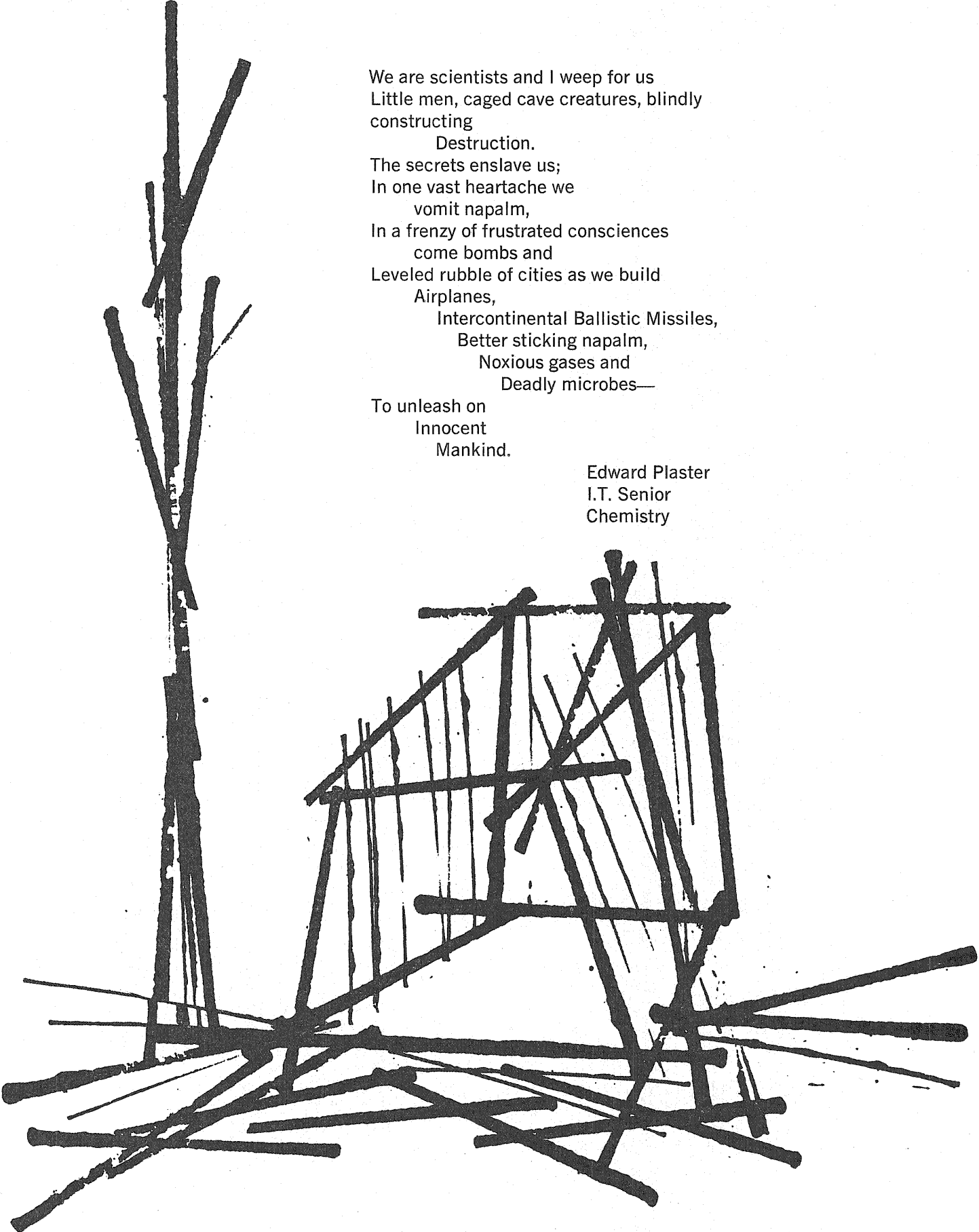
Technolog: The Civil Engineering Department of course does not have a building of its own now. What sort of facilities will be built for them and will they be complete facilities?

Cheston: The Civil Engineering Department is spread around within a number of buildings on the campus. One building, the experimental engineering building, is scheduled for demolition in about 4 to 6 years. The new building will also contain the kind of modern laboratory facilities that are necessary in a field such as civil engineering, which has changed radically in the last 40 to 50 years. The same is true, of course, of electrical engineering. None of the electrical engineering facilities that presently exist will be demolished, but the Electrical Engineering Department has expanded and has changed its orientation considerably in the last few decades, and just needs modern facilities.

Technolog: What expansion will be done across Church St. in Murphy and Vincent Halls?

Cheston: The Math Department will move in about 2 years into what we now call the Murphy-Vincent complex. The money, which is needed to modify those two buildings and to connect them is already in hand. As a matter of fact, the university will soon start construc-

(Continued on page 26)



We are scientists and I weep for us
Little men, caged cave creatures, blindly
constructing

Destruction.

The secrets enslave us;
In one vast heartache we
vomit napalm,
In a frenzy of frustrated consciences
come bombs and
Leveled rubble of cities as we build
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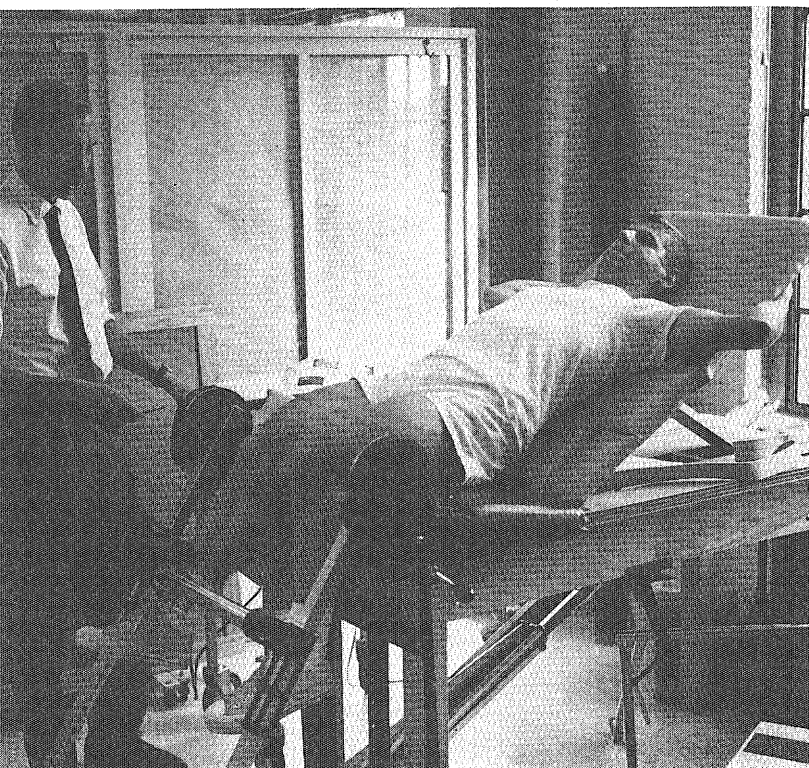
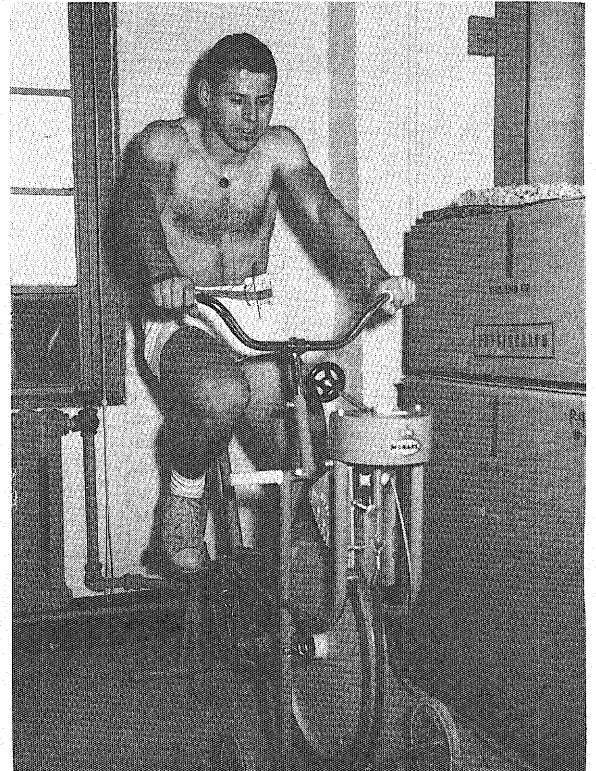
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education
research lab



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The best measurement of physical fitness is to determine the maximum rate of oxygen consumption. A motor driven tread mill is the device used to test oxygen consumption. Both the speed of the runner and the slope of the incline can be set so that the amount of work the volunteer must do at each test session can be controlled.

Electrolytic paste is used to attach two tabs on the volunteer's chest. These are connected to a transmitter, worn around the waist, from which signals are sent to a machine which converts the heartbeats to a graph

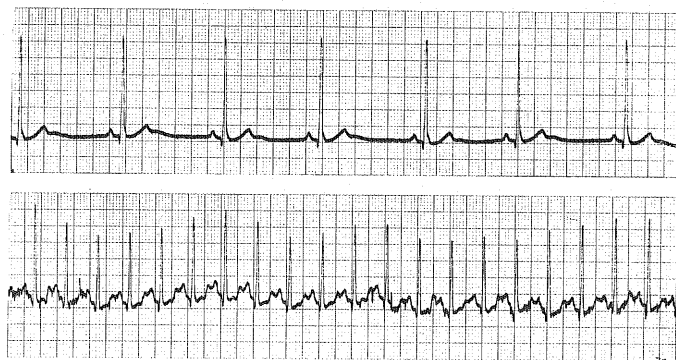
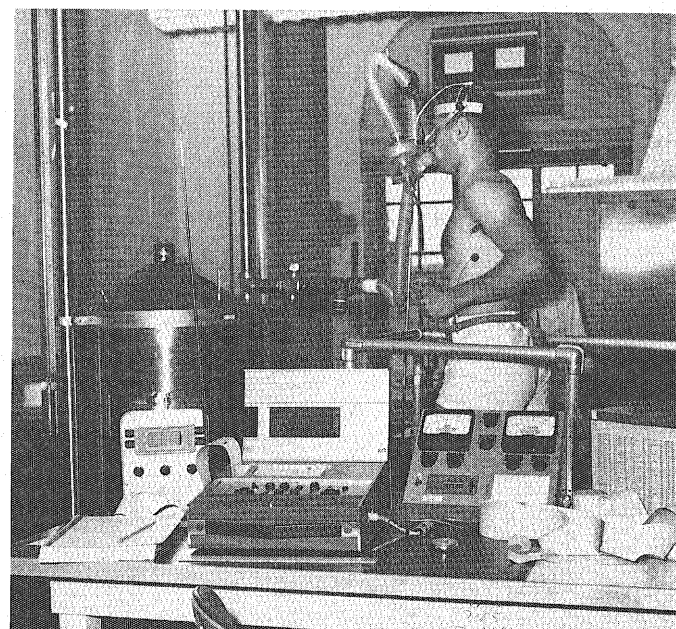


Fig. 1




on paper tape (see Fig. 1). One heartbeat is recorded by a maximum peak with one subpeak on both sides. By measuring the average distance between two peaks and by knowing the speed of the tape, the heartbeats per minute can be computed. This is not used directly but is recorded as background data on the subject.

A head gear is also worn by the runner. His nose is plugged and he is forced to breathe through a hose connected to a drum which collects his expired air. The percentages of oxygen, nitrogen, and carbon dioxide are then measured and compared to a standard mixture of the same three gases. From this, the cubic centimeters of oxygen per minute per kilogram body weight is found. As the runner exerts himself more, his oxygen consumption rises. When the difference between two successive measurements is less than 2.5 cubic centimeters of oxygen per minute per kilogram body weight, a maximum consumption of oxygen is reached. People whose maximum oxygen consumption rate is very large have more

potential to use energy and exert themselves than those with a small maximum oxygen consumption rate.

The lab also has other machines to measure fitness. A bicycle is used to make a rider exert himself, while the electrical activity of his muscles is recorded. The bicycle can be set so that the rider will do work at a specified rate. An electromograph, recording from the same transmitter that is used during the treadmill experiment, measures the muscle activity in units called ergometers.

Also used to measure electrical activity in muscles is a strength table on which the volunteer sits with a bar across his shins. When he pushes on this bar with his legs, the maximum force his leg muscles can exert is also measured.

By plotting the data for all students in a particular group, an average can be calculated for the group. Graphs are then made to compare any number of teams or individuals. 



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—Old Irish Proverb

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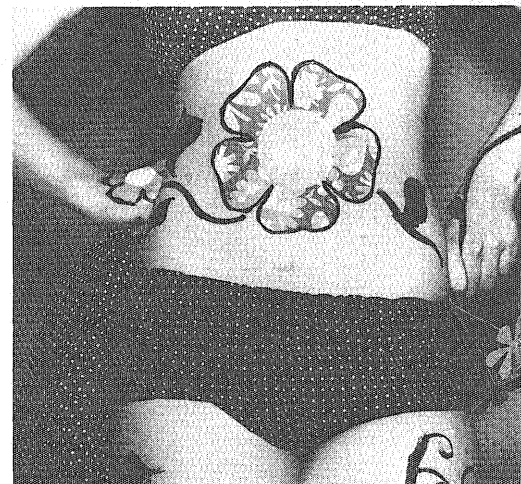
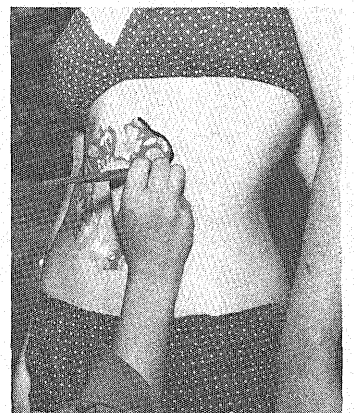
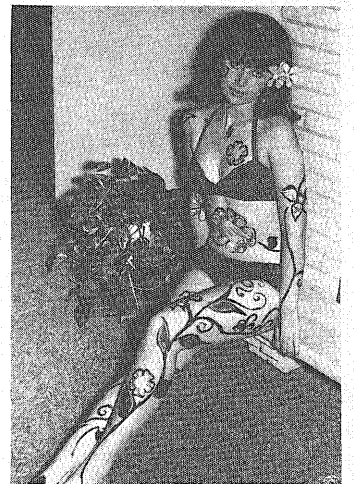
AN EQUAL OPPORTUNITY EMPLOYER

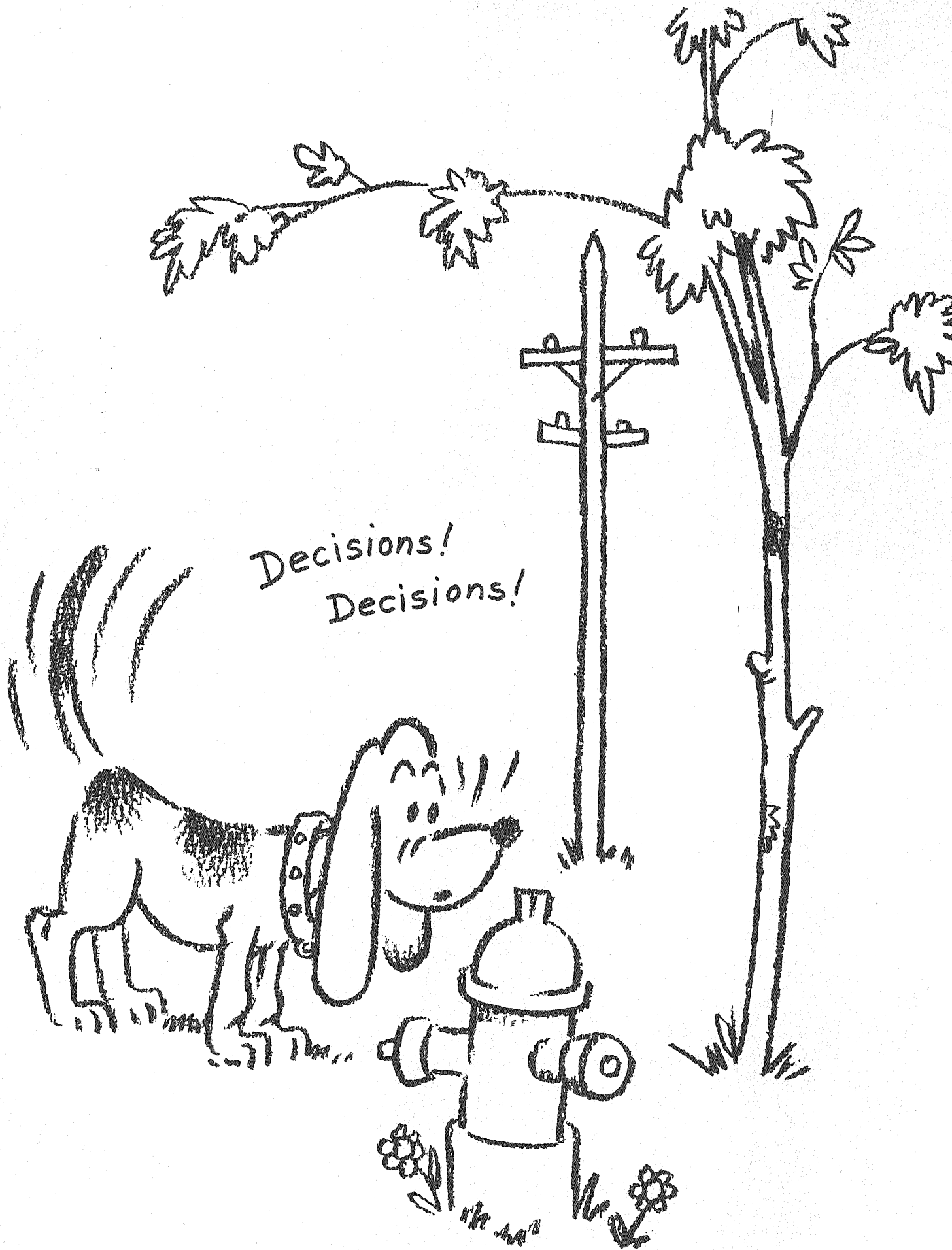
miss december . . .

Jennifer
Mortenson



These pages should come as a welcome distraction from all the joyous activities of this month (finals)? This lovely brunette is Jennifer Mortenson, an art major here at the U. She has a great variety of interests and when asked of her favorites she replied, "I go sailing. We entered a race once and came in fifth out of five, we had fun though. I ski and I love sports cars and races. You might say I really like going to races in the summer, skiing in the winter, but in the fall I like going to very old cemeteries and abandoned houses." For those who have motorcycles, she enjoys riding along on back. Jennifer has been frequently called upon to model in fashion shows. Our personable treat this merry month is also very good at doing portraits. I'll bet that's just what you had in mind as a gift to send back home.





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I. T. EXPANSION

(Continued from page 15)

tion on that.

Technolog: What about the new Chemistry addition?

Cheston: The new chemistry addition of course is part of the institute complex and we also hope to get funds to enable the chemistry building to be linked to the old Walter Library. Because Walter Library is becoming the book repository library for science and engineering, and also contains the present Chemistry Department library.

Technolog: Then most of the east bank will be devoted to IT.

Cheston: You're right except for the area which is called the Knoll Area which is on the other side of the Northrop Auditorium where the old Psychology Building is. But the main quadrangle, for example, will primarily house IT activities.

Technolog: Will you be going out into the state and setting up advanced programs in Duluth and Morris?

Cheston: The Duluth and Morris activities are independent of the Institute of Technology, however, they are not independent of the University of Minnesota. We will try to coordinate whatever expansion activities that go on in Duluth and Morris with whatever we do here.

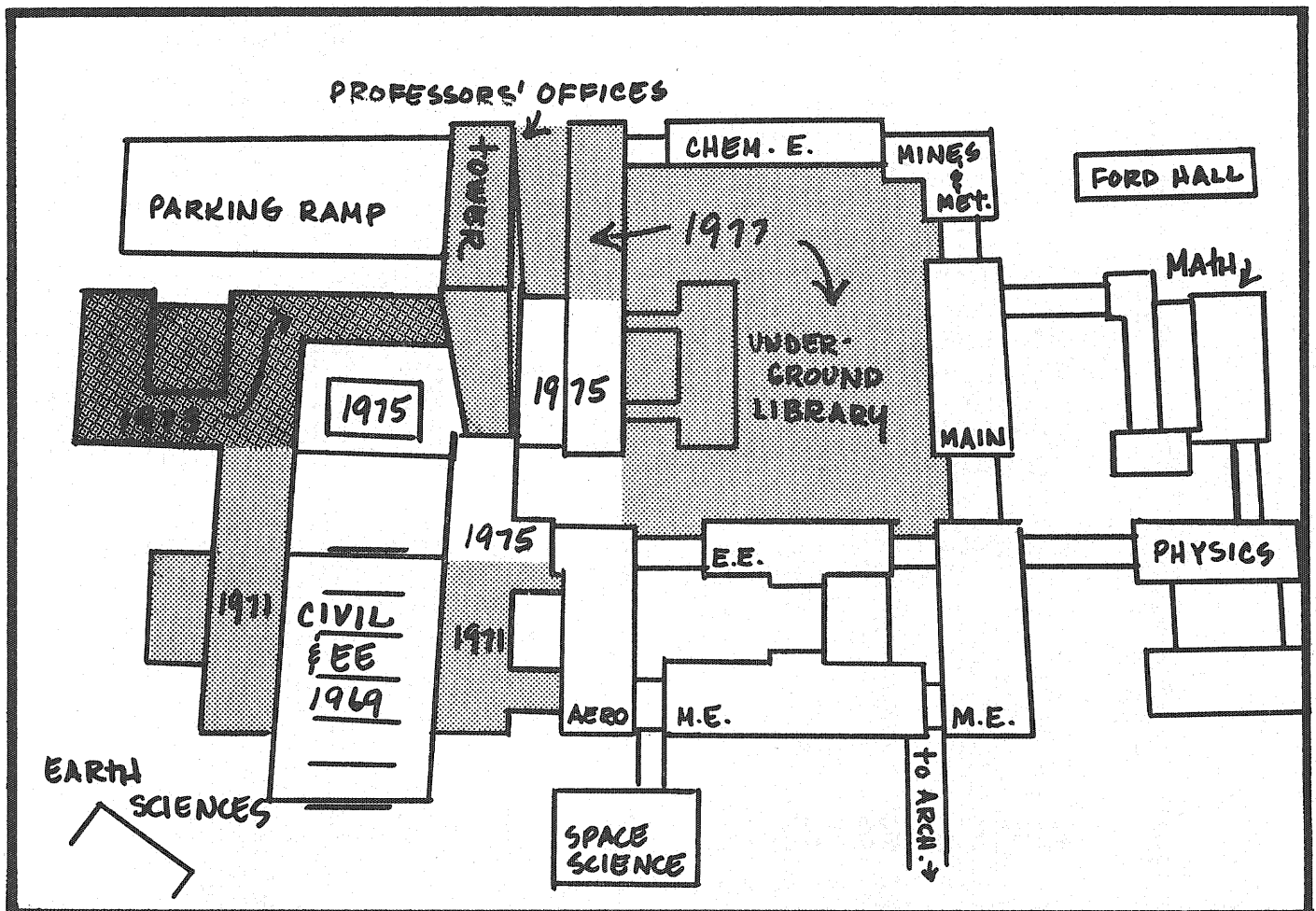
Technolog: A number of students here take their first two years at state colleges or branch campuses. How

much correlation is there between our programs and the others?

Cheston: We're getting an increasing number of transfer students into our upper division from Duluth and state colleges and state junior colleges. As a matter of fact, this year we experienced a drop in the number of incoming freshmen from high school, but that was more than made up by the increase in the number of transfers from other colleges. Right now we have more students in the upper division than in the lower division, which is a reversal of the past. We expect within 6 or 7 or 8 years to have 2 to 3 times more people in the upper division than in the lower division. That's because of the rapidly growing program of state junior colleges and state colleges, especially the five new junior colleges which we have in the metropolitan area. We expect to get a large number of transfers from them into the Institute of Technology.

Technolog: Then, will most of the building that will be going on in the next few years be for upper division and research facilities?

Cheston: Most of the building that will be going on over the next decade or so is intended to house the upper division activities and graduate activities. That's why it's expensive and takes a lot of space, simply because you need much more space to present an upper



FINAL EXAM

What company was responsible for the following engineering innovations?

The transistor _____
Radio astronomy _____
Negative feedback _____
High Fi and Stereo _____
Synthetic crystals _____
TV transmission _____
Magnetic tape _____
Sound motion pictures _____
Microwave relay _____
Electronic switching _____
The solar battery _____
Telstar _____

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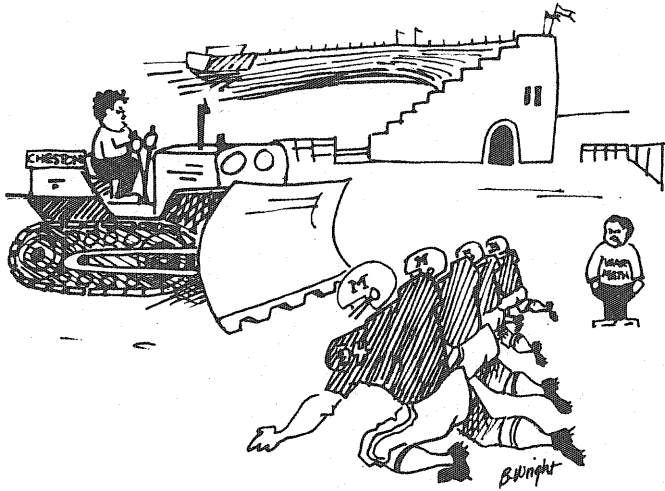
Be sure to see your Bell System recruiting team when they visit your campus. Or ask your Placement Director for the name of the Bell System recruiter at the local Bell Telephone Company.

We hope the above final can be the start of something great.



I. T. EXPANSION

division laboratory sequence in electrical engineering than you do in a lower division section of mathematics.
Technolog: What section of what is now the football practice field will be used?



Cheston: What's now called Union St. will be rerouted and will skirt over by Cook Hall and the stadium and end up somewhere around (Harvard St.). What you now

call the football practice field will indeed be given over to IT structures eventually, and so will Union St. itself. Union St. will disappear and there will be buildings smack where Union St. now exists.

Technolog: Will that whole area be devoted to civil and electrical engineering?

Cheston: No, actually plans were worked out last fall with Leonard Parker who is a member of the Architecture faculty, and a group of faculty from the institute, for the expansion of IT facilities through 1980, it is an integrated plan. What is very nice is that we're trying to get funds for carrying out this plan, requesting a certain amount of it from each state legislature every two years rather than trying to build it all at once.

Technolog: What other buildings are you planning on putting in this area?

Cheston: In addition to providing for civil engineering and for all of electrical engineering, the earth sciences, which is now located in very cramped and outdated quarters over in Pillsbury Hall will be moved into this area. We hope that the activity related to computer science and computer technology, and part of the university computer center will be over in this area. Of course, we talked about the new engineering library and things of that nature. L

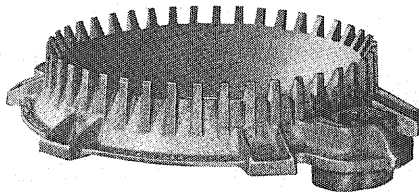
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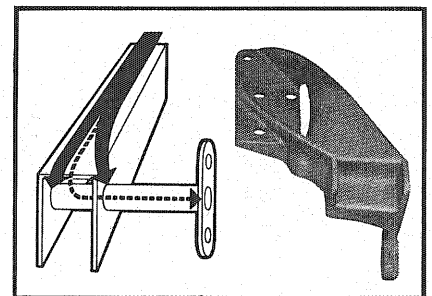


and Malleable iron for strength and ductility, these clamps combine service and value.

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The illustration shows how stresses "set up" at sharp corners. A much smoother transfer of stresses was achieved when this part was switched to a Malleable casting (shown on the right).



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It's Your Entropy,

Charlie Brown!

DR. RANDALL F. BARRON
Associate Professor
Department of Mechanical Engineering
Louisiana Polytechnic Institute

THE SCIENCE of thermodynamics involves four basic principles of nature, which have been given the highly imaginative names: Zeroth, First, Second, and Third Laws. The Zeroth Law was given its name because people did not realize that it was a "law" until the First Law had been named, and it was too late to change things. The Laws may be stated as follows:

Zeroth Law. Two systems, each in thermal equilibrium with a third system, are in thermal equilibrium with each other and therefore are at the same temperature. (Ref. 1, pg. 62)

First Law. Whenever a transfer of energy occurs, energy must be conserved. (Ref. 1, pg. 114)

Second Law. (a) Statement of Kelvin and Planck: It is impossible to construct a device that will operate in a cycle and produce no other effect than the raising of a weight (doing work) and the exchange of heat with a single reservoir. (Ref. 13, pg. 161)

(b) Statement of Clausius: It is impossible to construct a device that operates in a cycle and produces no effect other than the transfer of heat from a cooler body to a hotter one. (Ref. 13, pg. 161)

Third Law. It is impossible to reduce the temperature of any system to the absolute zero of temperature in a finite number of operations by any procedure, no matter how idealized. (Ref. 14, pg. 397)

The laws of thermodynamics have been summed up in concise form by some astute observer:

Zeroth Law: You may get into the game,

First Law: But you can't win.

Second Law: In fact, you can't break even,

Third Law: And you can't even get out of the game.

Although it sounds trite, the Zeroth Law does allow us to measure temperature and "get into the game" of energy conversion and transfer. It is not quite as transparent as the famous mathematical theorem: "A con-

tinuous function of continuous functions is continuous." (Ref. 12, pg. 152) (For example, if Jane dates Tom, and Tom dates Sue, it does not necessarily follow that Jane dates Sue.)

The First Law or Conservation of Energy Principle is fairly easy to accept, because we all like to believe that there are a few things which can be conserved in this world. From the time of Parmenides (a Greek philosopher of the fifth century B.C.) on down, the human mind has felt an irresistible urge to find an anchor that would stay put while everything else seemed to be changing. In spite of horse racing and Foreign Aid, most people accept the fact that we mortals cannot create energy—we can convert it from one form to another. Since the First Law is a bookkeeping scheme for energy, when new forms of energy are discovered, we simply open another account in the energy equation to take care of this new-found energy.

The Second Law is more difficult to accept, since it states that we cannot construct a 100% efficient machine. We can't break even in the game of converting energy from one form to another—some energy must be wasted to obtain useful work.

The Third Law is important to the chemist and cryogenic engineer. To the chemist, it gives values of properties as the temperature approaches absolute zero, and it tells the cryogenic engineer that he can get quite close, but never reach exactly absolute zero.

The Second Law is much more far-reaching than a M.E. 31A course, however. It invades all areas of our life. We would like to discuss some of these implications of the Second Law in the following material.

A more general statement of the Second Law may be given as:

Every system left to itself will, on the average, change toward a condition of maximum probability; or, every system left to itself will, on the average, change toward a condition of maximum disorder.

This trend of nature from order to disorder has been reversed only once in recorded history, and an external agent was involved in that case.

Genesis 1:1. In the beginning God created the heaven and the earth.

"The classical development of physical science offers no subject of more grace and elegance than thermodynamics."

—Cecil J. Schneer
THE SEARCH FOR ORDER

And the earth was without form, and void; and darkness was upon the face of the deep. And the Spirit of God moved upon the face of the waters.

And God said: Let there be light: and there was light.

Order was created from chaos, but the Second Law has been in operation ever since.

In keeping with the idea of the trend from order to disorder, the Second Law tells us that the stores of energy are continually becoming unavailable for use as energy is dissipated from an ordered, useful form to a disordered, unusable form.

Although the fate of our world will be fire and brimstone, the fate of the universe is supposed by most Second Law followers to be a "heat death," in which all stars burn out, and the universe finally comes to some equilibrium low temperature.

We may take heart, however; for the External Agent has said that He will save us from the Second Law.

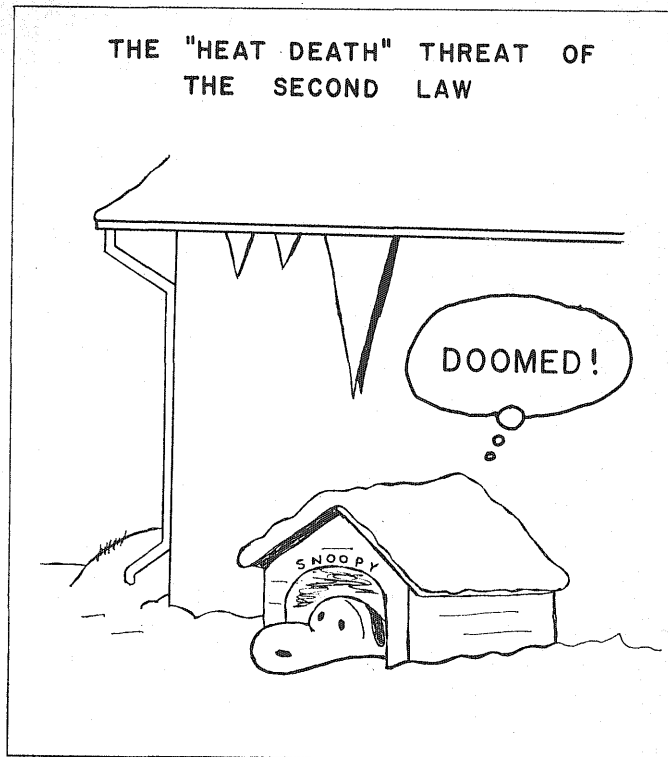
Isaiah 65:17. For, behold, I create new heavens and a new earth: and the former shall not be remembered, nor come into mind.

Parkinson and Peanuts

The Second Law is in action in business administration, if we may believe the words of C. Northcote Parkinson. (Ref. 6) He has stated several "Parkinson's Laws," which are corollaries of the Second Law, in fact. Notice the underlying thought of the natural trend of organization and order toward disorder for a system left to its own wiles:

"Work expands so as to fill the time available for its completion."

In any public administrative department, Parkinson claimed that the number of people on the staff would increase by approximately 6% per year, irrespective of any variation of the work (if any) to be done. For example, in 1914 the British Admiralty had 62 ships in commission, 146,000 officers and men in the Royal Navy, and 2000 Admiralty officials to do the paperwork. In 1928, there were 20 ships, 100,000 officers and men in the R.N., and 3569 Admiralty officials. In 1954, after



Snoopy Tells About The Second Law

England had ceased to be the dominant world power at sea, the Admiralty staff numbered 33,788.

Charles M. Schulz had some thoughts on the Second Law. (Ref. 10) What better example of a highly disordered system than Pigpen? Consider that cartoon in which Linus is building an elaborate sand-castle. As he completes the intricate and complicated structure (high order), rain begins to fall. The rain continues until the whole complex is a flat mushy mess (high disorder). A disheveled Linus looks at us and says: "There's a lesson to be learned here somewhere, but I don't know what it is . . ." Why, it's the Second Law, Linus!



The Trend From Order To Disorder

That Stuff Called Entropy

Thus far we have spoken of the Second Law in terms of order and disorder. In engineering we like to have a more concrete measure of the effects which we analyze, and as a result, the concept of *entropy* evolved. Entropy is a quantitative measure of the disorder associated with a system in any given condition. The *Webster's New Collegiate Dictionary* defines "entropy" as: "A mathematical factor which is a measure of the unavailable energy in a thermodynamic system."

We have Rudolph Clausius, a German physicist, to thank for coining the word *entropy*. He used the Greek word *trope*, which was intended to mean "transformation" to allude to the tendency of systems to transform to a state of higher disorder. The modern usage of the Greek word has changed so that it is closer to the notion of "turning one's face aside" or "shame". (Ref. 12, pg. 77) As Linus said, "There's a lesson to be learned here somewhere."

The mathematical definition of entropy (or, actually, change in entropy) used by the engineer is: $s = k \sum (p_i \ln p_i)$ where p_i = probability of the outcome of the i th specified event, and k is a constant, which depends upon the units which we use to measure entropy. The two definitions look entirely different; however, they are equivalent.

The Thermodynamics of Shooting Craps

Although the engineering definition of entropy is more convenient in problems involving macroscopic energy transfers, the statistical definition allows the concept of entropy to be applied in many other situations. For example, let us calculate the entropy associated with throwing dice. With two dice, there are 11 possible outcomes (2 through 12), and the probabilities associated with each outcome are tabulated as follows:

TABLE 1. Probabilities for "fair" dice.

Outcome, i	2	3	4	5	6	7
Probability, p_i	1/36	2/36 (1/18)	3/36 (1/12)	4/36 (1/9)	5/36	6/36 (1/6)
Outcome, i	8	9	10	11	12	
Probability, p_i	5/36	4/36 (1/9)	3/36 (1/12)	2/36 (1/18)	1/36	

Using our equation for entropy, we find:

$$S/k = - \sum_i (p_i \ln p_i) = 2.268$$

In dealing with many statistical situations, the unit called the *bit* is used, in which the constant k is taken as

$$k = \frac{1}{\ln 2} = 1.4427 \text{ bits}$$

In this system of units, the average entropy per throw is:
 $S = (2.268)(1.4427) = 3.28 \text{ bits/throw}$

Suppose we are in a slightly irregular game, in which the dice are loaded such that 6 occurs 3/12 of the time; 5, 4, 3 and 2 each occur 2/12 of the time; and 1 occurs

TABLE 2. Probabilities of Outcomes for an irregular game.

Outcome, i	2	3	4	5	6	7
Probability, p_i	1/144	4/144	8/144	12/144	16/144	22/144
Outcome, i	8	9	10	11	12	
Probability, p_i	24/144	20/144	16/144	12/144	9/144	

1/12 of the time for a single dice. The probabilities of the 11 outcomes using two dice are as follows:
 After calculating the entropy, we find

$$S/k = 2.229 \text{ and } S = 3.22 \text{ bits/throw}$$

The entropy is lower, in this case, because we have "ordered" the outcomes by loading the dice.

Now, suppose we are in a real swinging game, in which the dice are loaded so that *only* 6 may occur on a single dice. The probabilities for the various outcomes are as follows:

TABLE 3. Probabilities for a severely loaded set of dice.

Outcome, i	2, 3, 4, . . . , 10, 11	12
Probability, p_i	0	1

The entropy becomes: $S/k = 0$ and $S = 0$ bits/throw. We have a perfectly ordered game (only 12 will turn up), but we do not have a very "fair" game.

The Second Law may be used to determine if a game is "fair". Since we know all about entropy now, we may restate the Second Law in the following form:

Every system left to itself will, on the average, change toward a condition of maximum entropy, consistent with the constraints on the energy of the system.

Let us consider the problem of tossing coins. If the probability of obtaining heads in p , the probability of obtaining tails in $(1 - p)$, since we are excluding the remote possibility that the coin will land on its edge and remain. What should be the value of the probability p if the coin is fair? Using the expression for the entropy,

$$S = -k [p \ln p + (1 - p) \ln(1 - p)]$$

The Second Law tells us that the entropy must be a maximum for a fair coin. For a maximum in entropy, we must have

$$\frac{dS}{dp} = 0 = - [1 + \ln p - 1 - \ln(1 - p)] = -k \ln \frac{p}{1 - p}$$

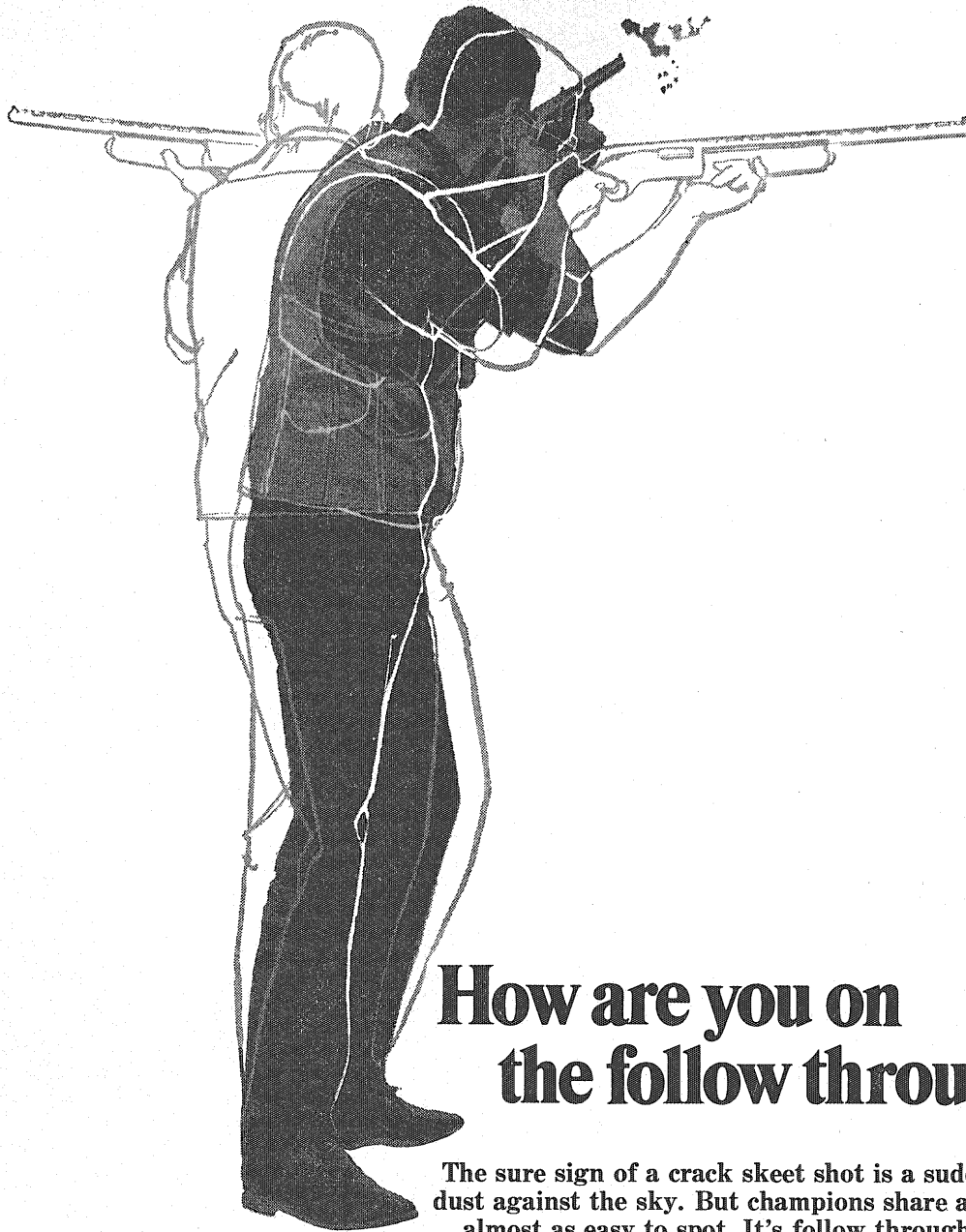
Or,

$$\frac{p}{1 - p} = 1 \quad \text{so} \quad p = 1 - p$$

The probability of obtaining heads for a fair coin is:
 $p = \frac{1}{2}$

We have found that the fair coin should have equal probabilities of obtaining heads and tails. Isn't science wonderful! Although the answer in this example was "intuitively obvious," the same principle may be applied in much more complicated situations to find the specific

(Continued on Page 37)



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what's new

in science and engineering

Edited by Mike Voegele

project celescope

CAPE KENNEDY, Fla.—A foot-long, 12-ounce television camera tube, will give man an entirely new look at his universe. The tube, called a Uvicon, is a key scientific instrument aboard the National Aeronautics and Space Administration's largest and most instrumented unmanned satellite, the Orbiting Astronomical Observatory, OAO-A2.

Developed by Westinghouse Electric Corporation, four of the Uvicon tubes will map the stars and interstellar space in a space experiment—called Project Celescope—conducted for NASA by the Smithsonian Astrophysical Observatory, Cambridge, Mass.

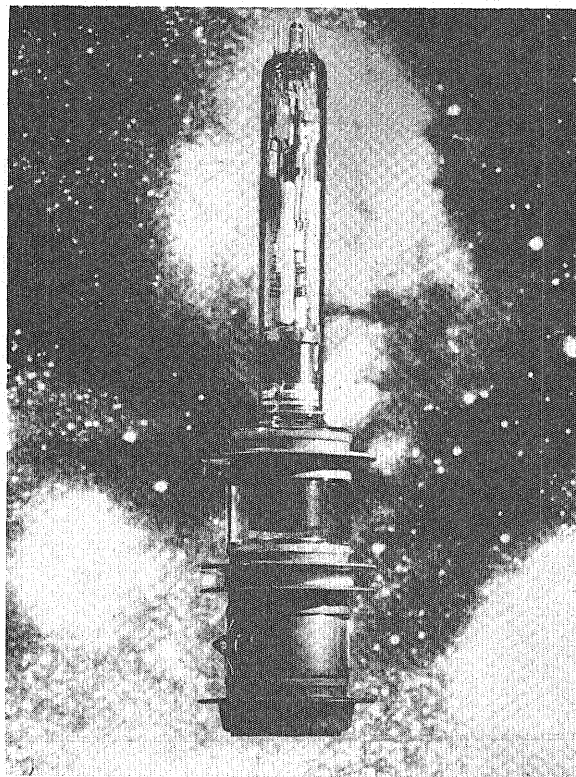
The mapping will be done by means of far ultraviolet radiation (uv). These ultraviolet rays, emitted by celestial bodies, never reach the earth's surface because they are absorbed in the atmosphere. Thus, the Uvicons will give pictures of the heavens that have previously been screened from man's earth-bound observations.

Such pictures offer promise for gaining new insight into theories concerning the atmospheres of young, extremely hot stars, including their age and their chemical composition. Such information might lead to new discoveries about the origin and evolution of the universe.

Project Celescope is a pioneering space experiment dating back to the late 1950's, when the Smithsonian proposed it to NASA and began work with Westinghouse on development of the key Uvicon tube. The project will survey some 100,000 uv stars at a rate of up to 700 per day. An ultraviolet map of the entire sky will require about a year to complete.

Basically, a Project Celescope telescope consists of three components: —an optical system (Schwarzschild telescope) to form the ultraviolet star images and focus them onto the Uvicon camera tube; - - - —the Uvicon tube, which responds to the uv images, amplifies them electronically, stores them and converts them into television-type electrical signals; and a digital television system that processes these signals for transmission back to earth, where the original uv pictures are reconstructed.

The Uvicon is an extremely sensitive camera tube. It is a member of a family of devices known as SEC image tubes, so-called for secondary electron conduction, the electronic principle used to strengthen the images they receive. SEC tubes designed to respond to visible light are used for low-light-level surveillance in military, industrial and security applications and in astronomy, since they have the inherent ability to literally "see in the dark."



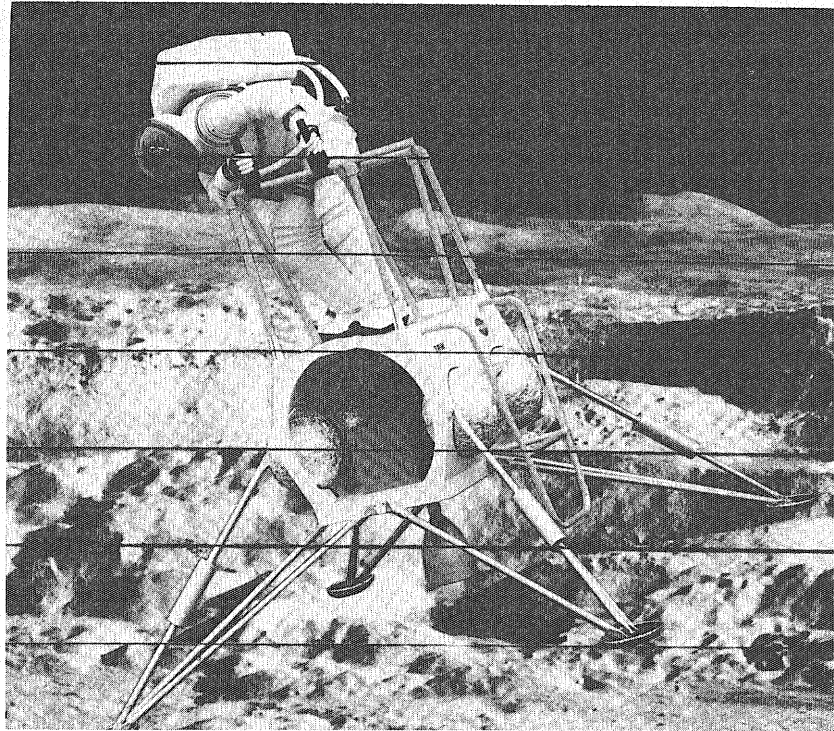
lunar transportation

A rocket-powered vehicle that could greatly expand scientific exploration of the moon has been proposed to the National Aeronautics and Space Administration by TRW Inc.

Based on requirements of the NASA Manned Spacecraft Center, TRW's Systems Group here developed detailed designs and analyses for a manned "Lunar Flyer" that could transport an astronaut from the Apollo Lunar Module to surrounding craters, surface cracks and other areas of scientific interest.

Presently, NASA envisions that two Lunar Flyers could be carried on each mission following the initial manned lunar landings. On the moon, one astronaut would be sent out on exploration missions with the Lunar Flyer, the other astronaut would remain with the Lunar Module. The Flyer would contain equipment and instruments for gathering data and samples of the moon's surface.

If the first astronaut or his Lunar Flyer had difficulty, the other Flyer could be used for rescue. On later missions, it may be possible to carry only one Flyer, using one remaining on the moon from a previous mission. The Lunar Flyer would be carried in the descent stage of the Lunar Module. A flyer would be fueled on the moon with propellants remaining in the tanks for the TRW-built Lunar Module descent engine. It would then be ready to fly to heights of several thousand feet and at speeds of 100 to 150 miles per hour. It could travel as far as eight miles from the Lunar Module. In contrast, astronauts on foot are limited to a mile from the Module. On later long duration missions it could make at least 30 round trips during each lunar landing. It would be maneuverable in any direction and could hover like a helicopter.



radio stethoscope

Westinghouse engineers have invented a kind of radio stethoscope to check the health of generators in electric power plants.

Called an electromagnetic probe, it allows examiners to detect radio noise, or static, symptomatic of abnormal sparking within coil insulation, and to locate the section where the trouble exists. Generator power is created by a rotor inducing current in hundreds of feet of these insulated coils.

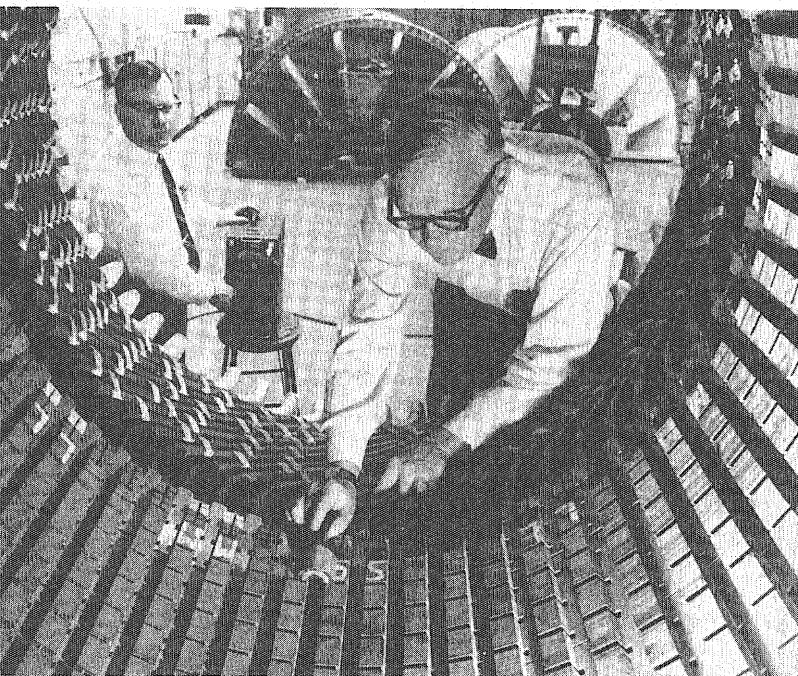
Sparking occurs in air pockets and separations in faulty insulation. It may lead to complete breakdown of the insulation, and possibly even to destruction of the generator. At stake are investments of thousands of dollars in the coils and hundreds of thousands of dollars in the generator.

A variety of tests are used in regular examinations of the hundreds of coils in a generator during their lifetime of more than 30 years, so that problems can be spotted early and remedied. Standard tests indicate existence of insulation voids, but not how many there are or where they are located.

The electromagnetic probe has a further advantage over other methods in being able to distinguish large, harmful voids from the numerous small voids that normally occur during aging without causing harm.

"Each of the standard tests will still have its place, but the electromagnetic probe will be the best we have to detect abnormal insulation voids," Dr. Dakin said.

The instrument consists of a palm sized horseshoe electromagnet that exactly bridges the gap over the generator slot in which the coil section under test is lodged.





“It never crossed my mind that IBM wanted Mechanical Engineers.”

“IBM is so involved in the electronics field, I’d always assumed they weren’t particularly interested in M.E.’s,” says Andy Simon.

Andy got his M.E. degree in 1967. He’s now a packaging engineer in memory development at IBM.

Andy found out why IBM needs good mechanical engineers when he went to his campus interview. As electronic packaging gets smaller and packaging density increases, a lot of new problems arise. And the M.E. has to solve them.

As Andy says, “When I design the hardware package for a micro-electronic memory unit, I deal with heat transfer and other thermal prob-

lems, vibration and shock analysis, and electromagnetic compatibility. The associated connector design work gets me into stress and creep analysis and Hertz contact stress and evaluation.”

Then comes production

That’s only part of Andy’s job. After his team designs, develops, and produces a prototype memory unit, he has to work closely with manufacturing engineers, advising them on machines and processes to mass-produce the unit.

“It’s tough but rewarding work,” says Andy, “because the problems change with each new assignment. So an M.E. gains a lot of experience fast.

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ENTROPY

(Continued from page 32)

heats of vibrating molecules, the equilibrium composition of a copper-brass alloy, etc.

Thermodynamics of Gossip-Information Theory

Thermodynamics becomes important in the study of transmission of information—so-called *information theory*. Writing and literature involve some degree of order and disorder, so entropy comes creeping in. Studies have been made to determine the entropy associated with great works of literature. The probability of a word having j syllables in a book of N words is:

$$p_j = \frac{n_j}{N}$$

where: n_j = number of words having j syllables. By simply counting the words and syllables, we may determine the average entropy per word in any piece of literature. Some results are shown in the following table:

TABLE 4. Entropy per word for different languages. (Ref. 4, pg. 177)

Author	Work	Average no. of syllables per word	Entropy, S bits/word
English Shakespeare Galsworthy Huxley	Othello	1.29	0.42
	Forsythe Saga	1.34	0.48
	Brave New World	1.40	0.53
German Mann Jaspers	Buddenbrook	1.74	0.74
	Der Philosophische Glaub	1.89	0.72
Greek Euripides	Orestes	2.13	0.85
Latin Sallust	Epistula II	2.48	0.92

Note that the entropy of the Shakespeare work is lowest; while the entropy is highest for the Latin work.

TABLE 5. Entropy for technical articles and children's books

	Aulds and Barron		Dr. Seuss	
	n_j	p_j	n_j	p_j
one syllable	820	0.594	331	0.869
two syllables	258	0.187	48	0.126
three syllables	165	0.120	2	0.005
four syllables	82	0.059	0	0
five syllables	55	0.040	0	0
Total no. of words	1380		381	
Average no. of syllables per word	1.763		1.137	
Average entropy, bits/word	1.692 (s/k = 1.173)		0.586 (s/k = 0.409)	

Latin is a "dead" language now—did the Second Law have anything to do with its demise? We note that the Second Law is in operation in the English language, because the entropy per word is on the increase from Shakespeare to Huxley—some 300 years.

Another interesting comparison may be made between two types of English literature: a technical paper in an engineering journal, and a children's book. In the following table, a comparison is made between a technical paper, "Three-Fluid Heat Exchanger Effectiveness," D. D. Aulds and R. F. Barron, *International Journal of Heat and Mass Transfer*, Vol. 10, No. 10, (1967), pp. 1457-1462, and a children's book, *The Cat In the Hat*, Dr. Seuss, Random House, Inc., New York, (1957).

People have said that "technical literature is Greek to them." We see that the entropy for the technical article is actually *greater* than the Greek work by Euripides in Table 4.

We may also examine the entropy per letter in the English language. If all letters and the "space" between words were equally probable (27 symbols), the entropy per letter would be

$$S = - (1.443) (27) (1/27) (\ln(1/27)) = 4.75 \text{ bits/letter}$$

The probabilities for each of the letters are *not* equal, however, as indicated in the following table. (Ref. 3, pg. 52)

TABLE 6. Probability of occurrence p_i for the letters of the English alphabet.

Symbol	Probability	Symbol	Probability
space	0.200	C	0.023
E	0.105	F,U	0.0225
T	0.072	M	0.021
O	0.0654	P	0.0175
A	0.063	Y,W	0.012
N	0.059	G	0.011
I	0.055	B	0.0105
R	0.054	V	0.008
S	0.052	K	0.003
H	0.047	X	0.002
D	0.035	J,Q,Z	0.001
L	0.029		

If we calculate the entropy from the data in the table, we find $S = 4.03$ bits/letter

The English language has even more order than this, because if a certain letter occurs, the probability that certain others will occur next is not the same as the probabilities given in the table. For example, if the letter "t" is given, the probability that "h" will follow immediately is much greater than the probability that "n" will occur next. Similarly, given the group "tio", the probability that the letter "n" will follow is extremely high. Using data on pairs of letters in the English language and recalculating the probabilities, we find the entropy

$$S = 3.32 \text{ bits/letter}$$

By using data on groups of three letters,

$$S = 3.1 \text{ bits/letter}$$

In the limit, we find: $S = 2.14 \text{ bits/letter}$

This is not the final answer, however. Given a group of letters in a complete word, the probability of finding certain other letters in the following words is different than for the case of unrelated words. From extensive tests by C. E. Shannon of the Bell Telephone Company (Ref. 9), he found that the entropy for a long message in English was between 1.4 and 1.93 bits/letter. There is quite a bit of order in the English language, since the entropy (disorder) for 27 randomly distributed symbols is 4.76 bits/letter—some 2.5 to 3.5 times that for an actual English message.

Our Struggle Against Entropy

The Second Law seems to paint a dismal picture of the far future of the universe. Although the total energy of the universe remains constant, the opportunity to transform this energy into useful work steadily declines as the entropy of the universe climbs toward its maximum value. Clausius (Ref. 2, pg. 50) summed the situation up by saying:

“Die Energie der Welt ist constant.

Die Entropie der Welt strebt einem Maximum zu.”

(The energy of the universe is constant.

The entropy of the universe tends to a maximum.)

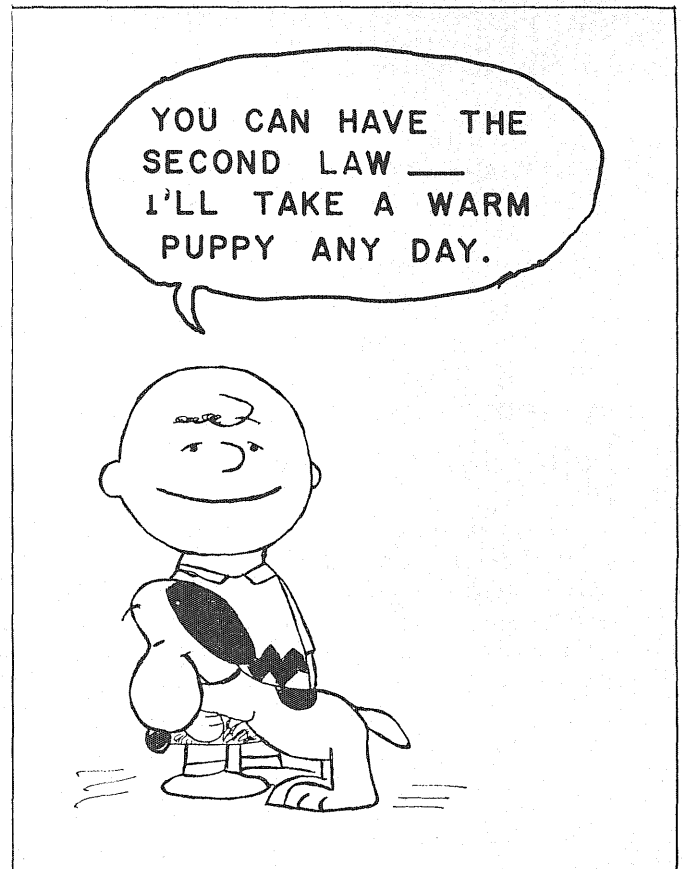
There are many examples of systems in which the entropy of the system is decreased, such as the space inside a refrigerator from which heat is removed. Useful work must be expended to cause this local decrease in entropy, and the net effect is an over-all increase in the entropy (and hence a decrease in available energy) for the universe.

The Second Law states that the entropy of a system tends toward a maximum value; however, one of the basic principles of irreversible thermodynamics states that, in steady state, the rate of increase of entropy (the “entropy production” rate) has a minimum value, consistent with the First Law constraints. (Ref. 8, pg. 75) Although the entropy of the universe must increase, we try to hold back the rate of increase as much as possible.

Living organisms are the best examples of systems which struggle against this inevitable entropy increase. The disordered elements are arranged into brain cells, bone cells, etc., to produce a system which is certainly more ordered (lower entropy) than the original elements alone. The Second Law eventually wins out, since we “return to dust,” and the ordered system returns to a state of disorder. Nevertheless, it does appear that man, with his highly-developed nervous system, acts deliberately (maybe instinctively) to decrease the entropy of his environment. Man builds dwellings instead of living in the open; man designs and uses jet planes instead of walking; man develops a language instead of howling at the moon.

This characteristic of man’s desire for order has been stated by Lindsay (Ref. 4, pg. 292) as the *Thermodynamics Imperatives*.

“All men should fight always as vigorously as possible to increase the degree of order in their environment



(i.e., decrease their entropy as much as possible) in order to combat the natural tendency for entropy to increase and for order in the universe to be transformed into disorder, in accordance with the Second Law.”

Polgar (Ref. 7) has even attempted to show how the evolution of man was prompted by this thermodynamic imperative. Man does have somewhat higher degree of order (lower entropy) than a virus.

Although we sometimes feel that our legal system may have a large entropy, most of our criminal and civil laws are basically commands to decrease our entropy rather than increase it. For example, “Thou shall not kill” means that we are encouraged to refrain from increasing the disorder or entropy of our world by destroying a human being and end his struggle for a personal entropy decrease. If we could determine a way to calculate the entropy associated with each of man’s social actions, then there would be a great demand for thermodynamicists in our judicial system. The severity of the punishment for a crime could be set in proportion to the entropy increase due to the act. Can you hear a judge saying: “I fine you \$25 for speeding and thereby increasing the entropy of the State of Louisiana by 25 Btu/°R.”

Improvement of many activities of man may be judged in the light of the decrease in local entropy brought about by the activity. J. S. Seifert (Ref. 11) has suggested that engineering educators use the Thermodynamic Imperative in improving university education. We cannot press the Thermodynamic Imperative too far without recognizing the constraints on its application, however. One could conclude that the minimization of

entropy (maximization of order) in a social system would result when the behavior of every human being was rigidly specified and controlled, similar to the positions of the atoms in a crystal at absolute zero (which does result in a high degree of order or a low entropy value). The thermodynamic imperative has the constraint that the individual must have the freedom to obey or reject it as he sees fit. Obviously, there can be no meaningful ethical code for a society of robots. Maybe the Third Law comes into play here, too.

Conclusion

We have seen that the Second Law of Thermodynamics is, in reality, a principle of nature which crops up in every walk of life. Sir Arthur Eddington has given this assessment of the Second Law:

"The law that entropy always increases—the Second Law of Thermodynamics—holds, I think, the supreme position among the laws of Nature. If someone points out to you that your pet theory of the universe is in disagreement with Maxwell's equations—then so much the worse for Maxwell's equations. If it is found to be contradicted by observations—well, these experimentalists do bungle things sometimes. But if your theory is found to be against the Second Law of Thermodynamics, I can give you no hope; there is nothing for it but to collapse in deepest humiliation."

To Charlie Brown, happiness may be a warm puppy, but to the thermodynamicist, happiness is definitely the Second Law.

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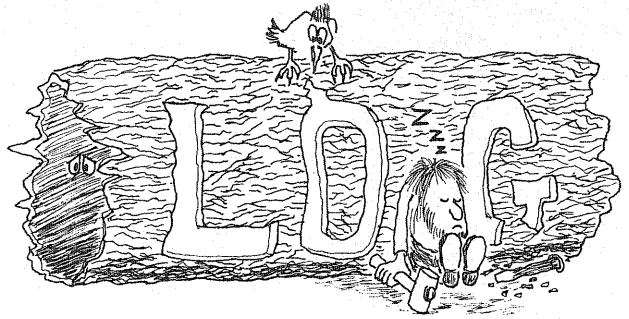
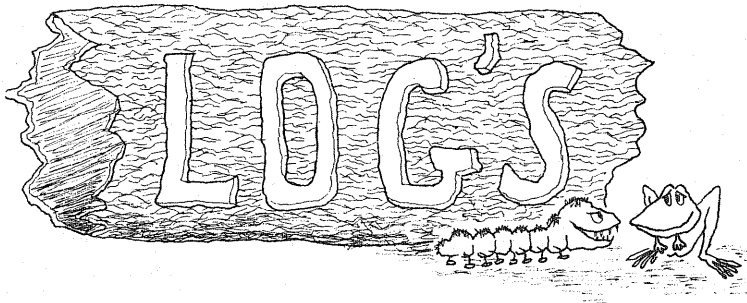
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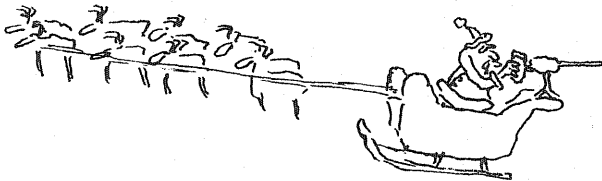
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the iceman cometh (you supply the booze)

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Very soon the above named will once again be in your midst, dehydrated and demoralized, to take his place once again in life as a human being engaged in life, liberty, and the somewhat related pursuit of happiness. In making your joyous preparations to welcome him back into society, you must make allowances to offset the rude environment to which he has been accustomed for the last few months.

Show no alarm if he cries with terror at the sound of youngsters and/or toy whistles, or if he rips menus into small pieces when they contain items such as beef stew, stewed franks, or potatoes. Be careful when he mops the floor each evening with a filthy mop or stands at attention on the front lawn at 0430 with a sour look on his face. Do not get upset when he calls the kitchen "a mess" and the bathroom "a head." His frequent references to his piece are in reality quite innocent of sexual overtones. However, for the first few times watch him in the presence of women, es-

pecially young, good looking ones. His intentions are sincere, though pressure has twisted his sense of honor.

Greet him with kindness and you will be able to rehabilitate what is now the shell of the once proud civilian known to you long ago.

Send no further mail to San Diego. Get the girls off the street, get the kids out of sight, fill the ice box with cold beer, and get the civies out of mothballs.

I'm coming home.

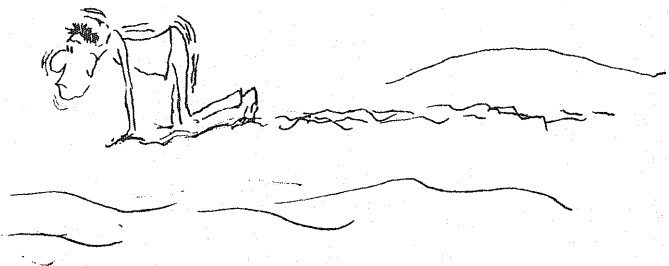
back from the front

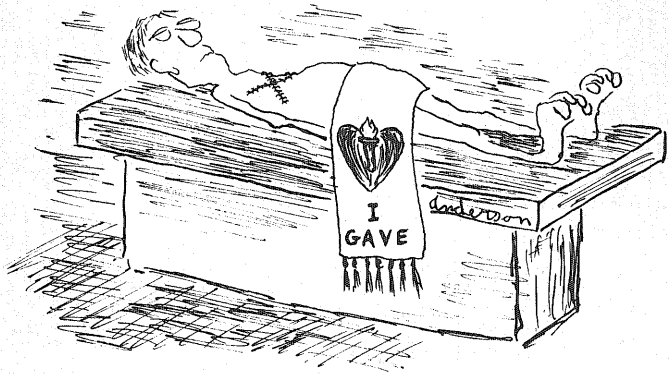
Ralph Groop—Ace War Correspondent for Log's Log

Now there's a man after my own heart, that Dr. Smock! He is not satisfied with world fame as a baby doctor and "dirty old man;" he has now expanded his operations to the "Body Politique."

One of his prime targets is General Nestle. As Smock's arch-rival, the General would prefer to let no one escape the draft—not even those with flat feet.

In the end, the Selective Service will save \$10,000 on heating this year by burning draft cards which have been turned in.





The pacifists have labeled ex-President Johnson as a "lame excuse for a President" and "pretty foul" all along, and now he's a "lame duck." They have called for us to withdraw from Vietnam, but it's after the sixth week and the scholastic committee won't let us.

Who knows? It may all go back to Dr. Smock's advocacy of lenient "toidy training." The parallel can be seen in phrases like "Hell no, we won't go!"

my gun is sick

Withrop Hammer

Crime Reporter

I had just failed to extort—er—secure a raise from our beloved editor. As I picked myself up from the floor and brushed the remains of the office typewriter from myself, Ralph Groop and Sam Borque entered the office.

"You look awful!" remarked Sam.

"Oh, I'm just keyed up," I said, dropping the "K" and "Z" into the wastebasket.

I decided that I might as well go out and look for a story—"Barney's Fun House" first came to mind. (That's a bar and grill at 4th Ave. and 15th St.) I left our offices in the basement of the Seedy Theatre. (A double-feature was showing: "Mondo Incesto"/"Good family entertainment"—Will Jones/ and "I Rolled My Own".)

When I arrived at Barney's, Lieutenant O'Shuvit of the vice squad was just being approached by a wench in a miniskirt.



She flopped a juicy T-bone down in front of O'Shuvit, asked "That was 'to go', wasn't it?", and began wrapping it.

"I see you're on another stake-out, Lieutenant," I greeted him cheerily.

"Quiet, you fool! I'm going by the alias of Officer Cupcake," he growled, picking up his steak.

"Will that be all?" asked the waitress.

"I'm on duty, Sally," O'Shuvit replied, meat in hand.

He left and I bellied up to the bar, knocking people this way and that—cutting some with my belt buckle.

I spotted a likely woman at the other end of the bar. She had a "Twinkie" in her eye (the Hostess Cupcake man had just tripped).

"Hi there, Big Boy," she rasped.

"I'll have you know that my voice changed many years ago!" I retorted, my voice cracking.

"Buy me a drink and I'm yours."

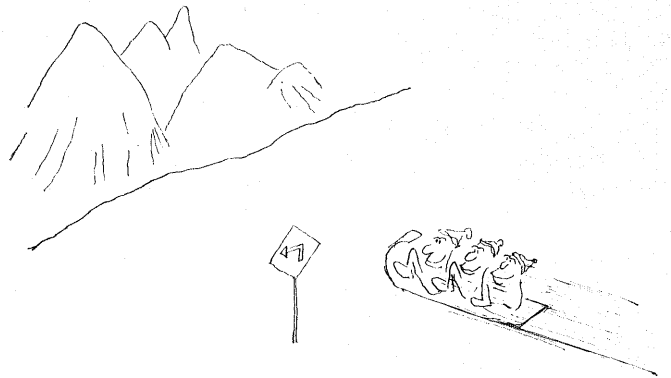
"You drive a hard bargain, Baby."

I ordered a "Log Coffin" (two parts vodka to three parts maple syrup); she had a straight Club Soda.

Just then, a little old lady screamed and burst into the bar.

"Help, I've been attacked—by a vampire!"

I dashed outside to find O'Shuvit lying in the snow with a steak in his chest. Those T-bones will get you every time.



official daily bull

- Dec. 15—Fireman wears red suspenders.
- Dec. 19— . . . Nixon finds out; begins investigation of Communists in government.
- Dec. 20—Scientist-Inventor perfects "Life Cycle;" sells bike at newsstand price.
- Dec. 24—Your girl friend tells you you're going to get a suit for Christmas.
- Dec. 25—Mr. Scrooge dies in bed.
- Dec. 28—Santa's reindeer eat President Moos.
- Jan. 1—Resolve never to drink again.
- Jan. 3—Die of thirst.



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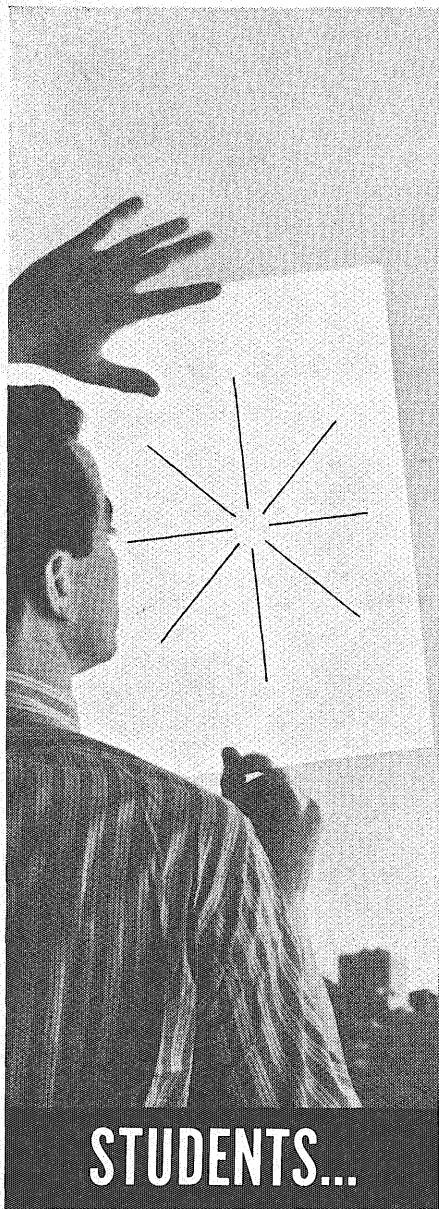
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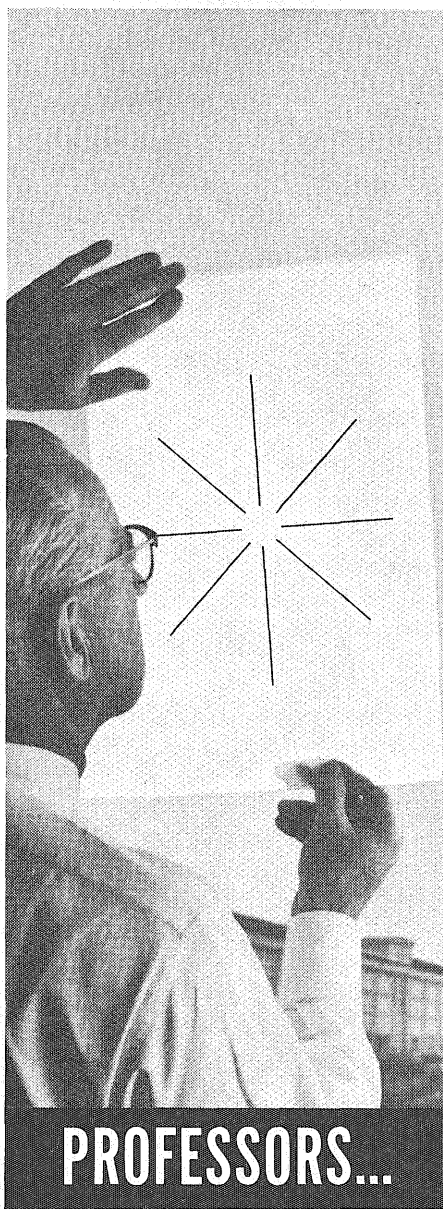
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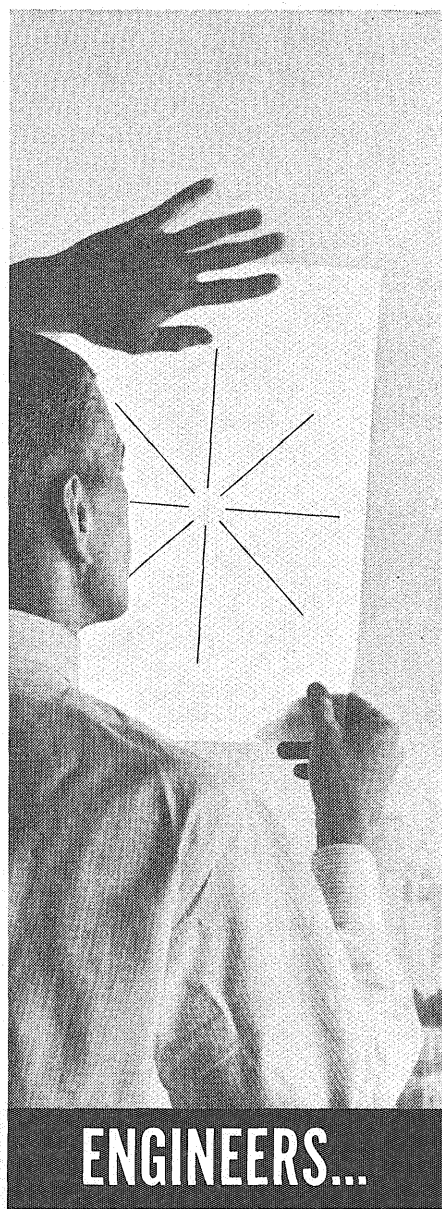
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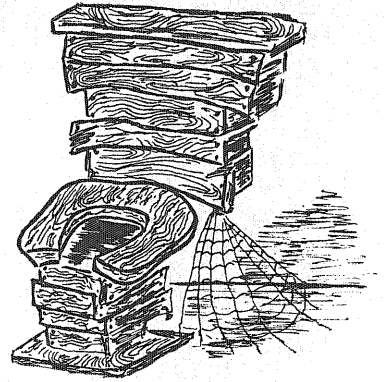
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Entropy is a Commie plot.

“Don’t any of your children have the same father?” asked the social worker of the woman applying for relief.

“I think the twins might,” she answered.

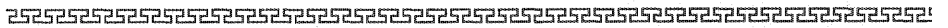
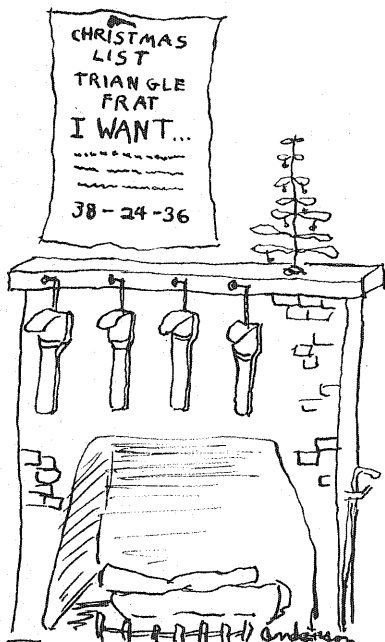
Once upon a time, as the story goes, the fence broke down between Heaven and Hell. Satan appeared at his side of the broken fence and called to Saint Peter: “Hey, St. Peter, since all of the engineers are over on your side, how about sending a few to help fix the fence?”

“Sorry,” replied St. Peter, “my men are too busy to fix fences.”

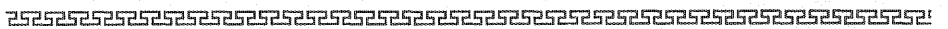
“Well, in that case,” said Satan, “We’ll sue.”

St. Peter: “Guess you win: you’ve got all the lawyers on your side.”

The U. S. Post Office is an entropy source.



—vilitas et crudus semper eternam



A doctor can bury his mistakes; a lawyer’s mistakes are hung; but an engineer has lasting monuments built to his mistakes.

“How about joining me for a cozy weekend in a quiet suburban hotel?” he whispered in the curvaceous lass’s ear.

“I’m afraid,” she said, “that my awareness of your proclivities in the esoteric aspects of sexual behavior precludes you from such erotic confrontation.”

“I don’t get it,” he said.

“Exactly,” she smiled.

“Gentlemen of the jury,” said the defense attorney, beginning his summation, “the real question before you is, shall this beautiful young woman be forced to languish away her most lovely years in a dark prison cell? Or shall she be set free to return to her cozy little apartment at 4134 Seaside Street—there to spend her loveless hours in her boudoir, lying beside her little princess phone, 962-7873?”

We know an I.T. Coed who thinks she’s a robot just because she was made by a scientists.

Divorce on the grounds of incompatibility usually means either that he has lost his income, or she her patability.

Smoke entropy 100’s.

Two budding young engineers were sitting in a bar. One noticed a young lady sitting at the other end of the bar and turned to his companion.

“Say, isn’t that Hortense?”

“I don’t know,” shrugged his friend, “she looks relaxed to me.”

Confucius say: With woman putting on false front, man never know what he is up against.

A man in an insane asylum sat fishing over a flower bed, a visitor approached and asked, “How many have you caught?”

“You’re the ninth,” was the reply.

“Who was the lady I saw you outwit last night?”

Entropy is good for you.

Our editor went into one of the better restaurants in town last week and ordered a Strausberg goose. Last thing he remembers hearing is the waiter shouting, “Hey, Strausberg, come here.”

The only time an IT coed says NO! is when they ask her if she’s had enough.

ME: “Do you neck?”

She: “That’s my business!”

ME: “Ah! At last, a professional!”

No one can climb the ladder of success with his hands in his pockets.

A B C D L F N

M N O L F N

O S A R

Peter picked a peck of pickled entropy.

An M.E. on the Log staff broke his arm fighting for a woman’s honor. It seemed that she wanted to keep it.

Wisdom: Knowing what to do.

Skill: Knowing how to do it.

Virtue: Not doing it.

"How'd you get that flat tire?"
 "Ran over a bottle of milk."
 "Didn't see it, huh?"
 "Naw, the kid had it under his coat."

Raquel Welch is an entropy sink.

Under the spreading mistletoe
 The IT coed stands,
 And stands, and stands,
 And stands, . . .

Work in a Growing Minnesota

Two elderly gentlemen, whose active days were behind them but whose wild-oats memories were not forgotten, were amusing themselves at the bar of a cocktail lounge by watching two young men ply their dates with martinis and lengthy conversation.

"These young bucks today just don't know how it's done," said one. "Why, in our day we would have had those girls in the buggy and out in the moonlight by this time."

"Yes," agreed his companion. "They sure don't make 'em like they used to."

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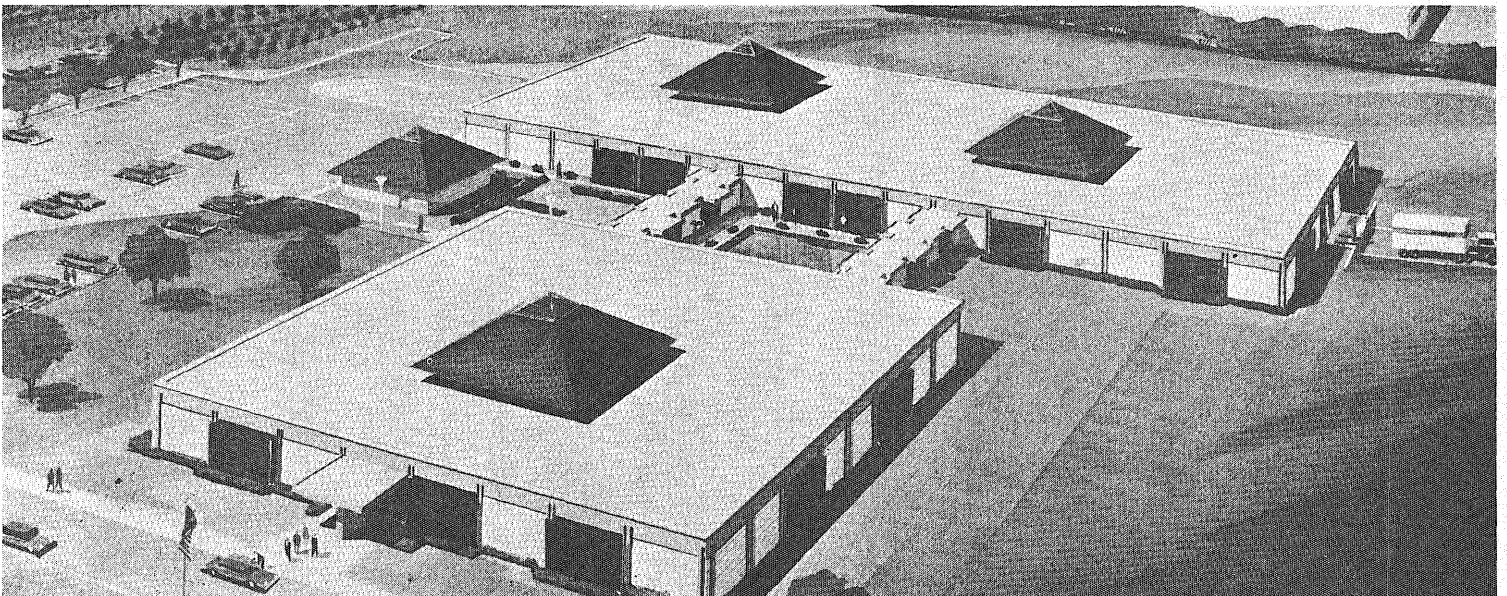
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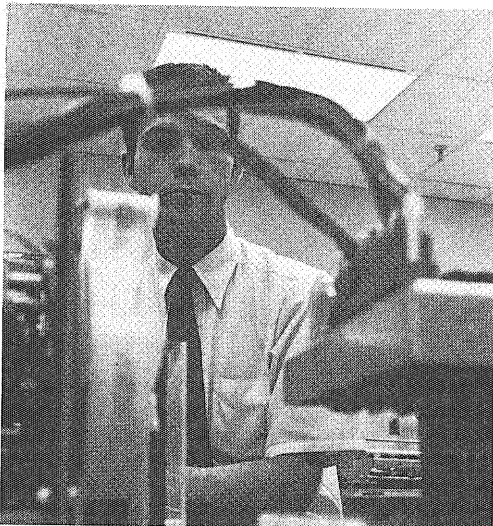


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Can there be this kind of excitement in engineering?

You've forgotten the rising long before dawn and the drive along deserted roads. Now the morning is still and crisp; the waist-high weeds are perfect cover. You work through them carefully, quietly, expectantly. Then—the multi-colored explosion of a flushed bird*, beating up in a blur of speed and sound. The over-and-under is at your shoulder by pure reflex... you lead and squeeze...

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An engineer checks out a data collection machine using punched tape to record number and type of operations performed.

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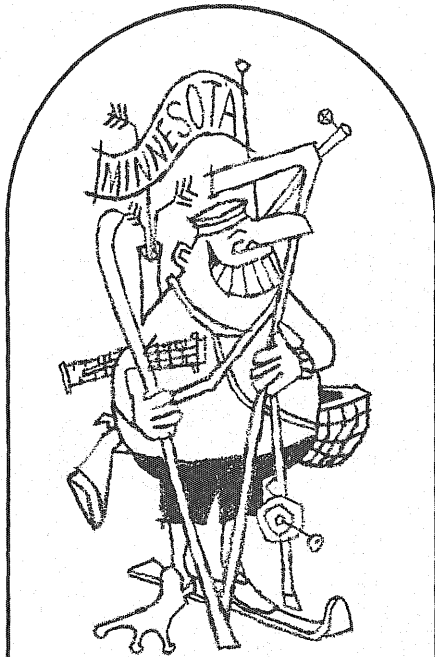
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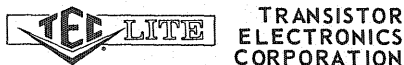


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E-M is a company that has contributed to transportation in many ways. We have designed and built electrical equipment for railroad power, power supplies for ocean going vessels, and ground support equipment for missiles and aircraft.

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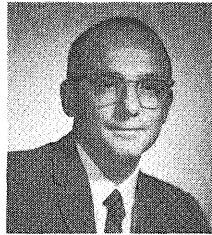
What MECHANICAL ENGINEERS do at Kodak

They design new products and better performance into existing ones, figure out the best possible ways to manufacture the products; apply pure reason through mathematical tools to make physics serve—not oppose—human needs; create the right physical tools, the plants to house them, and the services to keep them functioning; get out into the field, showing customers how to get their money's worth, and bring back word on how to do better in the

future. Some typical assignments are in development of automatic and semi-automatic manufacturing equipment; production-line layout, precision tooling, and materials handling; design and development of control units and instrumentation devices; creative design of scientific, industrial, business, professional, and amateur photographic apparatus; economic engineering, cost analysis, and methods engineering; utilities and facilities engineering.

—and chemical, industrial, and electrical engineering assignments can sound equally impersonal

Yes, it is possible to draw a lifetime's pay without much excitement or satisfaction. If you don't mind it that way you'll be easier for the boss to handle. Just await instructions and carry them out to the letter, docilely.



This docile-looking Kodak engineer did not operate that way. That's why we brag about him below. There are others who would have made equally good examples.

Tell us about yourself with a note to

EASTMAN KODAK COMPANY

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Kodak

Van Putte is the name—Douglas—and plastics* is the game. While other Kodak engineers find strong interest in parts of the plastics market where a one-cent change in price can turn failure into success, or vice versa, Van Putte's work is having the effect of upgrading acrylic polymers into better optical materials than the great European lens makers of yore had for fabricating their precious jewels—and a good risk for upholding the public's confidence of reasonable success in picture-taking. Our engineers in the South, who work with plastics we make, spread themselves very widely into marketing activities; Van Putte, working with plastics we buy, has done himself equal credit by digging deeper into one circumscribed but important engineering topic than we think has ever been dug before. Van Putte, born (31 years ago), brought up,

*This word has taken on a broader, more diffuse meaning in certain non-technical circles of contemporary society. Actually, we do have other concerns than plastics, whether broadly or narrowly defined.

and educated in the North, likes working in Rochester just as much as the Southerners prefer their part of the country.

How it went: Always enjoyed math, of course. Master's in heat transfer and fluid flow. First Kodak assignment doing, logically enough, heat-transfer calculations. Bountiful supply of scratch pads, easy access to pencil sharpener and computer, no extra information on big picture into which calculations fit. Proves patience for eight months. Then manufacturing technology department on consumer-goods side of house decides it too could profit from a little campus-fresh sophistication in heat-transfer analysis. Van Putte overjoyed to accept challenge.

New single-minded assignment to learn all he can about injection-molding process. At least that's how the boss's boss now remembers the assignment. Van Putte remembers it a little differently. More like "Is it the temperature that's wrong in those lens-molding machines? The pressure? Or is it the flow rate?" On a certain lucky day,

after a year or so of continuing to scratch away for data on first one of these parameters and then another, Van Putte sells a program of fundamental studies with sensors for all the injection-molding parameters and on their relation to the parameters of optical performance in the photographic lenses produced. Thixotropic nature of polymer melt properly allowed for. Feels now in retrospect it took him too long to make his program pay off. Others take kinder view, drink toasts to Van Putte's health, look forward to next phase of his work wherein he educates injection-molding machines to know about the optical performance of the lenses they turn out.

Well known fact in industry that when a program turns out well, it was the big boss's idea. Van Putte crafty enough to understand that fact. Boss also crafty. Knows better than to call in a green young engineer and tell him to make a quantum jump in technology. Even if that's what he wants done.



Bob Nerad seeks recognition

But not just for himself.

Bob was Chairman of a special Jaycee project to select the "Outstanding Young Educator" in Schenectady, New York.

He began by rediscovering firsthand some of the vibrant situations that confront young teachers. With that background he was ready to coordinate the nominating and judging.

Planning and coordinating come naturally to Bob. As a Production Control Specialist with General Electric's Medium AC Motor and Generator Department, he keeps production lines running smoothly. Coordinating machinery, raw materials and labor is crucial to any efficiently run business.

With a mechanical engineering degree from Cornell, in 1962, and an MBA in personnel administration from George Washington, in 1963, Bob sought to plunge

directly into meaningful work. He'd had enough theory and simulations to last him for awhile.

At General Electric he found people that agreed with his thinking, and what's more, GE offered him immediate responsibility via the Manufacturing Management Program.

Like Bob Nerad, you can get a fast start at General Electric, in R&D, design, production or technical marketing. Talk to our man when he visits your campus. Or write for career information to: General Electric Company, Room 801B, 570 Lexington Avenue, New York, N. Y. 10022

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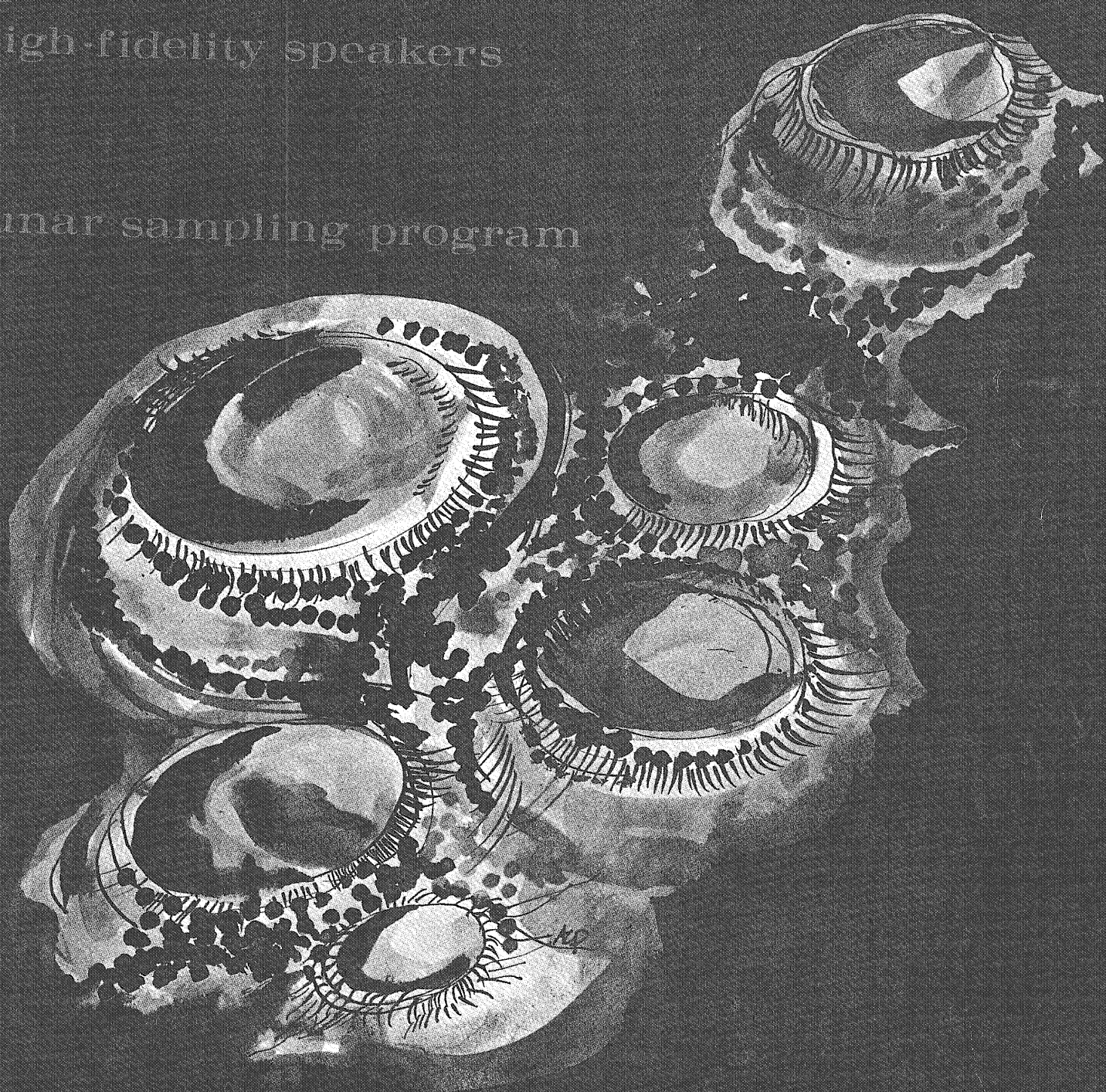
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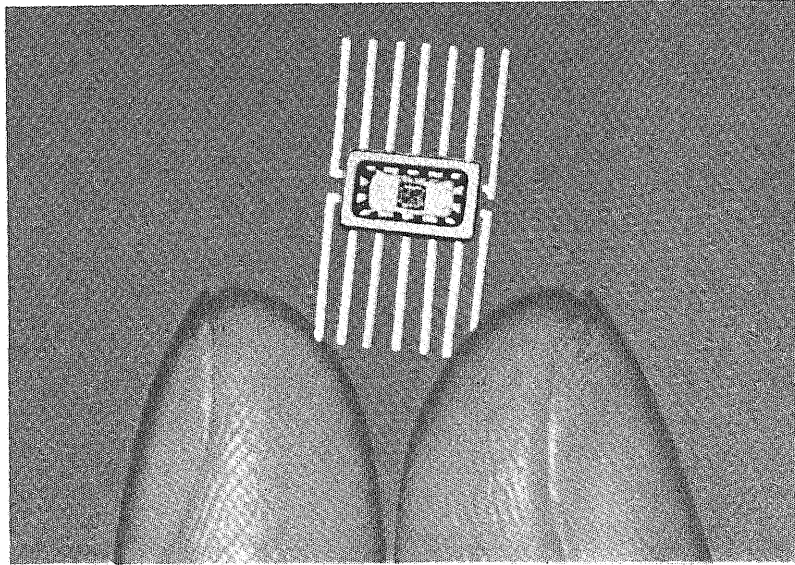
fundamentals
of
high-fidelity speakers

lunar sampling program



january 1969

Westinghouse needs engineers to solve little problems



or big ones.



Microcircuitry actually began at Westinghouse in 1958, when we developed the first integrated circuit for the Air Force. Today, we're the largest producer of very-high-reliability microcircuitry for the aerospace industry.

And there's no end in sight. As space vehicles get more complicated, electronics have to get

smaller and better. We're deep into R&D on the next generation.

Westinghouse is also grappling with some down-to-earth problems. Big-city problems. We make more products for construction than any other company. So, quite naturally, we're deep in urban renewal and city planning.

Which doesn't even start to de-

scribe Westinghouse. We're also in computers, transportation, medical science, oceanography, and more. Is that any way to run an electrical company? We think so. If you think so, talk with our campus recruiter, or write Luke Noggle, Westinghouse Education Center, Pittsburgh, Pa. 15221. An equal opportunity employer.

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Westinghouse



We may build a bigger engine at our #2 plant.

Help wanted:

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Situation: Complete design scheme for tools, jigs, and fixtures needed. Also need plans detailing how much time will be required, under optimum conditions, for line changeover.

Question: Is there some way we can implement this change by utilizing most of the existing machinery at the plant?

Problem: As a modest volume plant, it is imperative that we don't lose valuable time and resulting sales. Suggest you visit the Mexico City Plant where a similar changeover occurred. Would appreciate solution by Friday, next week. Thanks.

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A new member of the manufacturing engineering team at Ford Motor Company does. Today his job may be establishing the manufacturing sequence of a new engine. Tomorrow, it may be determining the manufacturing feasibility of a new product idea.

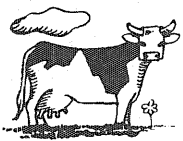
To assist in solving assignments like these, our people have a giant network of computers at their service. Complete testing facilities. The funds they need to do the job right.

If you have better ideas to contribute, and you're looking for challenging assignments and the rewards that come from solving them, come work for the Better Idea company. See our representative when he visits your campus. Or send a resume to Ford Motor Company, College Recruiting Department, The American Road, Dearborn, Michigan 48121. An equal opportunity employer.



How to keep a cow's mind on milk. Instead of flies.

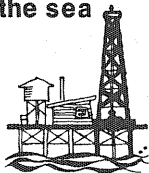
An informal report on a few current projects at Shell. Some of them might seem like offbeat work for an oil company. But this is a company that contributes broadly and significantly to society. A company of experts that brings out the best in its engineering, scientific and business people.



Shell scientists have come up with a vast improvement over even the most talented cow tail. It's called VAPONA® insecticide. A plastic strip impregnated with it will kill flies in a cow stall for up to three months. And VAPONA® insecticide combined with CIODRIN® insecticide keeps cows fly-free 24 hours a day—even out in pasture. Give you ideas for further applications?

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The main trouble with detergents is they don't go away. They pollute streams, make fresh water foamy. The solution: detergent compounds that organisms can consume. These "biodegradables" clean clothes just as effectively, but keep streams free of detergent foam. Elsewhere in the chemical part of our business, Shell research has resulted in a wealth of plastics for home and industry, and fertilizers to alleviate food shortages.

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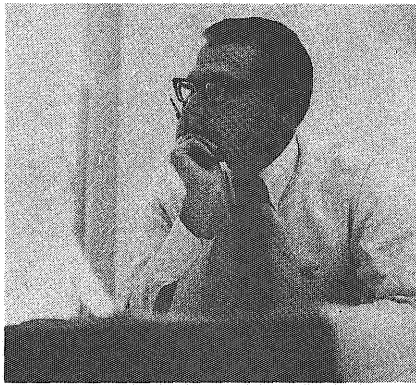
Do you think a bright young engineer should spend his most imaginative years on the same assignment?

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Product Design Engineers

For additional information, please contact your College Placement Director or write:

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CAMPUS INTERVIEWS

February 17

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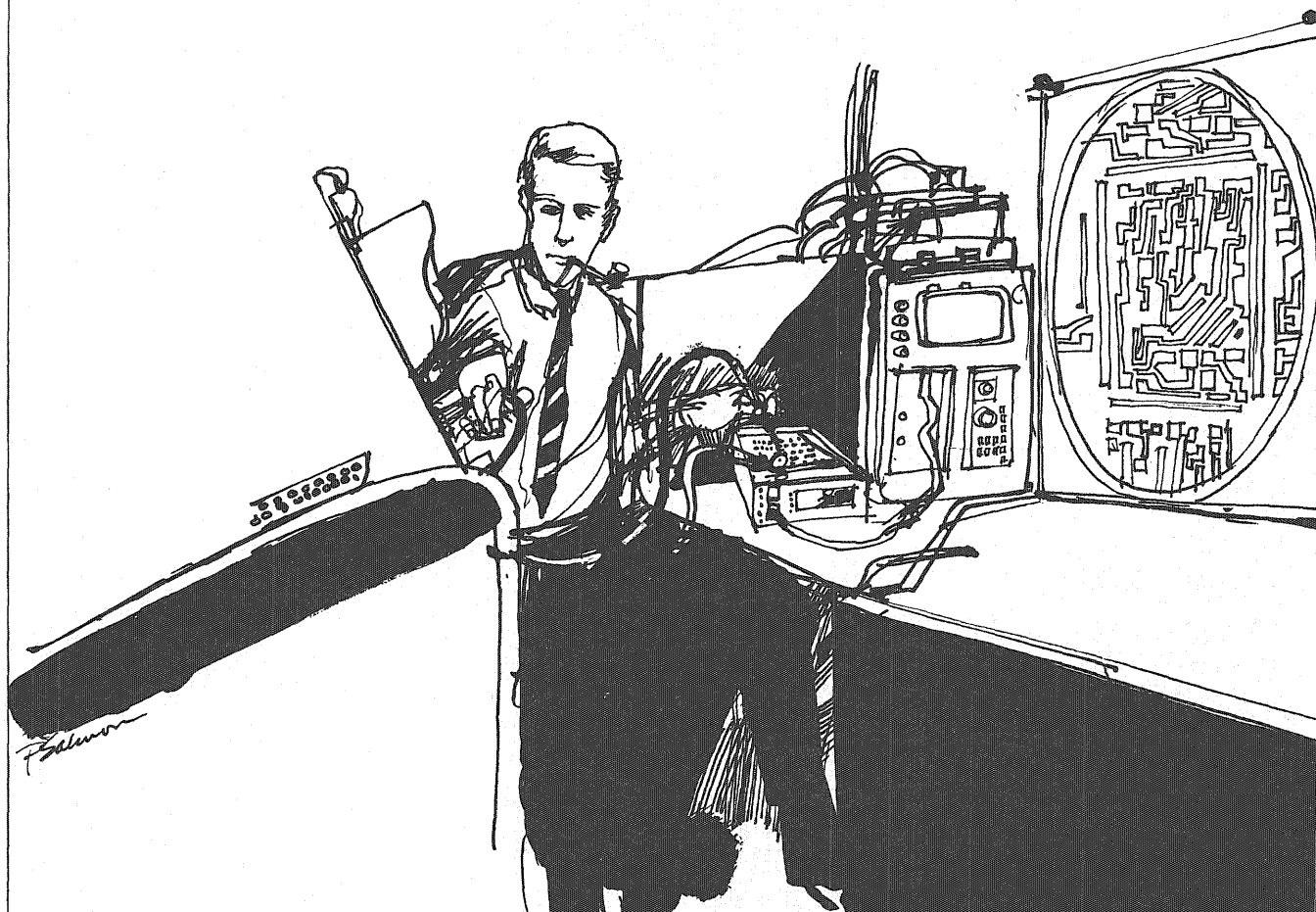
Check with your Placement Office for further information about NSA, or write to: Chief, College Relations Branch, National Security Agency, Ft. George G. Meade, Md. 20755, Att: M321. An equal opportunity employer, M&F.

Campus Interview Dates:

February 17



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... where imagination is the essential qualification



technolog

Official Student Publication of the Institute of Technology, University of Minnesota

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COVER: Even though the astronauts claim that the moon is "plaster of paris grey," it will always be a blue moon to us earthlings. Art work by Ann Polkinghorne.

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Log Line

Fellow engineers and scientists, welcome back to the land of the dying, to the red brick igloos, and the frozen co-eds. We trust that you have already broken your New Years Day resolution never to drink to excess again. If you haven't you aren't fully recovered from that New Years Eve party yet. At any rate a new quarter has begun and nothing's changed since you left.

The slate of required reading for January contains an unusual variety of informative articles. At the top of the list is "Fundamentals of High Fidelity Speakers", a research article written by staff members. This article is not a treatise on the theory of sound transmission, but rather an informal explanation of what high fidelity speakers are all about. If you are planning to purchase some hi-fi equipment, or if you already are an audiophile you should be able to pick up some helpful information.

Our second offering is an explanation of the analysis program which will be run on the samples of the moon which Apollo 9 will bring back. Dr. Robert Pepin, project chief at the University, takes an optimistic, yet cautious view, of the national space program, while explaining the goals of the lunar sampling program. Concerned with the same topic, that of the space program is Dean Cheston's column, "Speaking with the Dean." Opinions on the Apollo program by other Deans and administration officials are expressed in "The Apollo Program—An Evaluation." The latter two articles may cool your hero worship of our great new national heroes, and start you thinking in a rationalistic manner once again. Be sure you read them, if nothing else they might amuse you.

Finally, our last article this month is in the realm of student power. Do

you have any student power? Do you have any ability to change the conditions around here? You should, and if you would like to flex your "muscles" we have found a new cause for you to rally for—Student Lounges for I.T. In case you haven't noticed I.T. doesn't have any. No place to sit, no place to meet friends, no place to rest after a hard exam—nothing! We have a legitimate gripe. The West Bank is filled with areas designated for student study or recreation. It seems to us that I.T. won't be able to change its "cold and cut-throat" image until it finds a place where its students can enjoy a warm and friendly atmosphere.

An Unsolicited Contribution

To the Editor:

Intrigued by the possibility of becoming an "unheard of phenomenon" (Dec. issue of *Technolog*, p. 8), I am writing as an expression of observations after 2½ academic years here at M.I.T.

I was recently very heartened to read the enclosed article in the October issue of *Professional Engineer*. This article was fascinating for it seemed to tell it like it most assuredly is. Obviously the discovery of an excessive work load for engineering students is no discovery to engineering students. It is pleasant though, to see in this article a member of the oft referred to Establishment discuss the problem and its possible solutions.

I recall how, as a freshman, I read the letters to the *Technolog* editor which soundly denounced all I.T. stu-

dents for not participating. At that time I swore that I would definitely participate in the many activities which lay before me. I am still swearing.

Carrying 14 credits (requiring 21 hours of class time), working 20 hours a week and receiving threatening telephone calls from the draft board ("If you *are* a full time student, could you tell me again why you would like more time . . ."), I often wander about these slide rule encrusted halls with a definite envy of those who do participate. And it certainly is true: you put in your time at the place, but without participating you feel like an outsider looking in.

It would seem that most I.T. students become so accustomed to not being able to participate that when they occasionally do find the opportunity, they are either disinterested by habit or they simply don't know how. The often stated cause (or excuse) of this situation is, once again, the work load.

I consider the proposed five year program a welcome alternative. Hopefully this will alleviate many of the irritating aspects of the present arrangement, such as instructors informing you that the three course sequence you are required to take for four credits a quarter used to be four, three credit courses (eg., MM 35, 36, 37), and they are sorry that you have to cram so much into a shorter time. One question why a four year program was adopted in the first place.

I want to state that I do not necessarily hold my views to be typical. But as it was once stated to me, under the present system it seems that the name of the game is "screw the student."

Tom Crane
M.E. Junior

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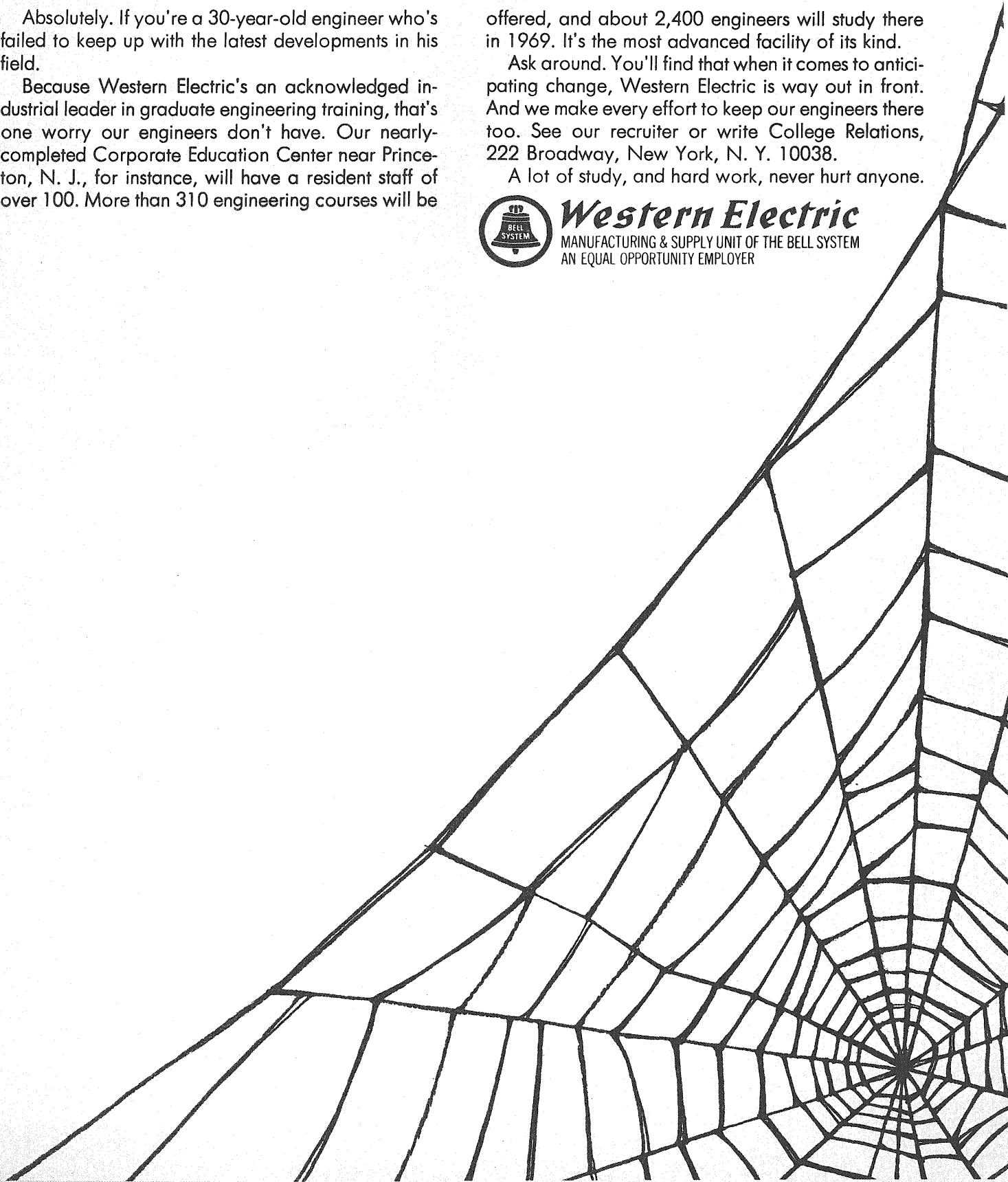
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speaking with the dean

THE END OF 1968 witnessed two rather striking technological achievements: the successful Apollo 8 mission and the first flight of a prototype of the Russian supersonic transport (SST). Without attempting to detract one iota from the consummate skill of all of those who contributed to these two technological events, I am still compelled to assert that both are prime examples of how nations should not employ their skills and resources. The "man in space" program has always been one of doubtful scientific validity. The successful landing of a man on the moon by 1970 was enunciated by President Kennedy as national policy and, since that time, the absence of any well considered scientific goals has been irrelevant. From the beginning, there were sporadic attempts by the scientific community to question the "man in space" program; but unfortunately, those in the scientific community with influence in Washington meekly accepted the political goals of the program as overriding any scientific consideration. The Russians seem to have adopted a similar attitude towards their space program. Naturally, both the U.S. and the U.S.S.R. issue statements denying that their space programs are politically motivated but events belie their assertions.

In a certain sense, the case of the SST is an even more striking example of non-scientific overriding scientific considerations. The SST has been called an "unwanted technology" yet vested interests, some scientists and engineers undoubtedly among them, have not only seduced the U.S. and the U.S.S.R. but also a consortium of Great Britain and France into the rapid development of such an unwanted technology. Certainly we have our priorities all wrong investing our resources in the development of the SST when our air traffic control systems at major airports are not able to cope adequately with the volume of normal air traffic. In a very short period the giant jet air busses will be operating out of major air terminals which cannot even cope with the passenger volume associated with normal jet aircraft. Those who live under approach patterns to a major airport know how serious the jet noise problem can be. Noise pollution has grave consequences, yet the amount of technological genius applied by NASA and other federal agencies to jet noise abatement is very small indeed. Yet major federal subsidies have been granted for SST development, and the airlines have dedicated huge resources for the purchase of SST fleets. Get a man on the moon and develop the SST—neither with scientific or human relevance—these are the important goals of our technological society which appears to have more muscle than brain.

I am not so naive as to believe that money not spent on the man-in-space program and the development of the SST would be spent instead on worthwhile social projects such as low-cost housing. However, there are many aspects of the space program with legitimate scientific goals to which our resources and technological skills could be applied; and I am naive enough to believe that Congress could be persuaded to allocate the funds for these worthwhile aspects of space research as well as for desperately needed research and development on our air transportation program.

Well, cheers for 1969! May it give us an administration and a Congress sensitive to the priorities which should prevail in the scientific and technological aspects of our lives!

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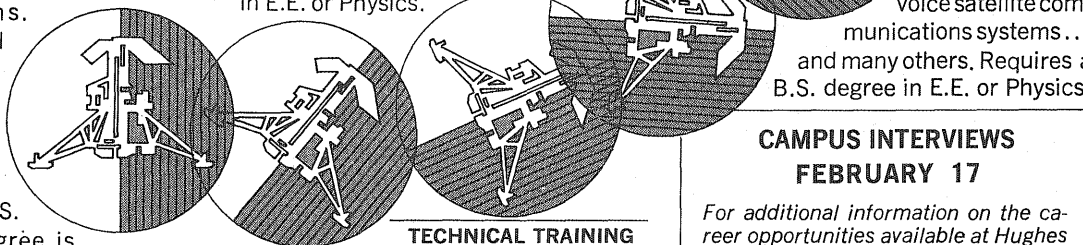
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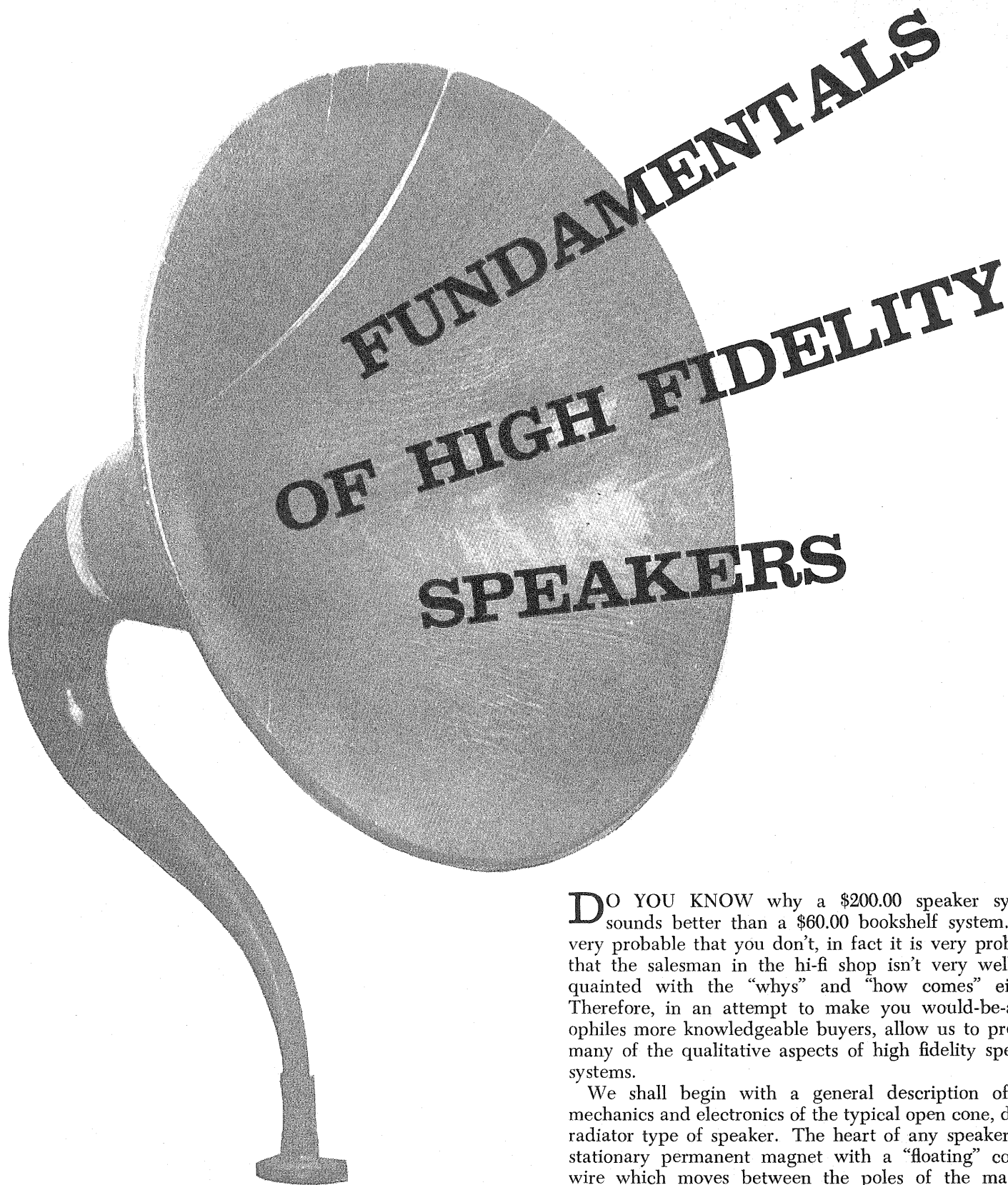
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CAMPUS INTERVIEWS FEBRUARY 17

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DO YOU KNOW why a \$200.00 speaker system sounds better than a \$60.00 bookshelf system. It's very probable that you don't, in fact it is very probable that the salesman in the hi-fi shop isn't very well acquainted with the "whys" and "how comes" either. Therefore, in an attempt to make you would-be-audiophiles more knowledgeable buyers, allow us to present many of the qualitative aspects of high fidelity speaker systems.

We shall begin with a general description of the mechanics and electronics of the typical open cone, direct radiator type of speaker. The heart of any speaker is a stationary permanent magnet with a "floating" coil of wire which moves between the poles of the magnet. (Fig. 1). The magnet is built in such a manner as to maximize the amount of magnetic flux flowing across the gap (voice coil gap) through which the coil (voice coil) must move. Thinking back to Physics 23 recall that a coil carrying a current in a magnetic field tends to move in the direction indicated by the right hand rule. Therefore, depending upon the direction of the current in the voice coil, the coil moves and causes the paper cone to which the coil is attached to move. This displacement causes a pressure gradient along the surface of the cone

by PAT LAMEY
MIKE KANTAR
KEN GREER

and this gradient or pressure disturbance is sensed by your ear and interpreted as a tone.

The frequency of the tone your ear hears is the same frequency at which pressure gradients are being formed on the surface of the paper cone. This implies also, that the alternating current flowing in the voice coil is changing direction at this same frequency. The last consideration in the qualitative aspect of speakers is that the loudness of the tone generated is dependent on the amplitude or the distance which the voice coil moves. This distance, which is termed the excursion, is a function of the magnitude of the current in the coil. So finally as an analogy to the workings of a speaker one can think of it as an air pump. The voice coil is the diaphragm/piston of the pump. As the piston travels back and forth it pushes and pulls air in and out of the volume created by the paper cone. The paper cone acts like the cylinder of the pump. In the cylinder the air is alternately compressed and rarefied. The pulses of air radiating from the mouth of the cone are actually pressure disturbances which your ear can then interpret as sound.

In high fidelity speakers we have a higher goal than that of just reproducing sound. We are attempting to reproduce the whole audible sound spectrum. Furthermore, reproduction of this range of frequencies, from 20 to 20,000 Hz, should be done with the least amount of distortion and with the greatest possible efficiency. These two areas of design, those of decreasing distortion and increasing efficiency, are the next topics which we shall consider.

First of all, when we speak of minimizing the distortion we are speaking of the distortion which creeps into the reproduction in the process of changing electrical energy into mechanical energy, and then into a radiated sound wave. By looking at the formula for radiated sound energy we can pinpoint one possible source of distortion.

$$P = A E^2 F^2 K^2$$

where

- P = radiated power in watts
- A = effective area of speaker cone
- E = electrical energy
- F = frequency in Hz
- K = a lumped constant

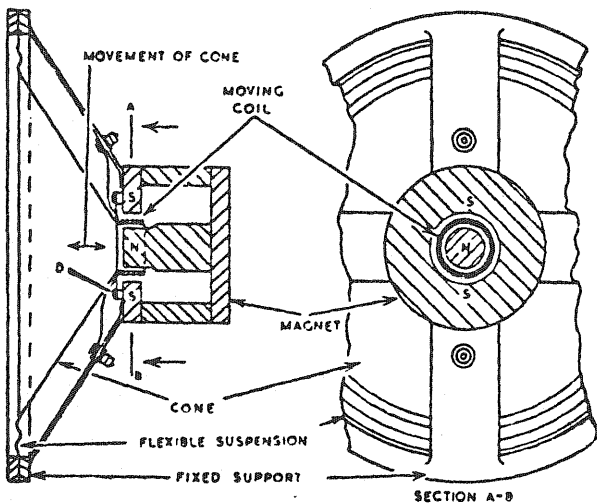


Fig. 1

From this one can see that by increasing the area, the frequency that can be produced decreases by the square. If the area is halved the frequency is decreased by $\frac{1}{4}$. However, there is a practical size limit to a speaker, approximately 15 in. diameter. Above diameters of 15 in. the mass of the speaker and coil which must be vibrated becomes much too great and its efficiency much too small. Thus, we now have in effect a constant area in the formula. The excursion term then is the only variable if we are to hold the power constant, and vary the frequency. For a 15 in. speaker the excursion necessary for a 30 Hz frequency at 1 watt of radiated power is about 0.5 in. But what has this to do with distortion? The distortion is introduced by the fact that the excursion is not a linear function of the electrical power. The compliance (somewhat like a spring constant) of the material

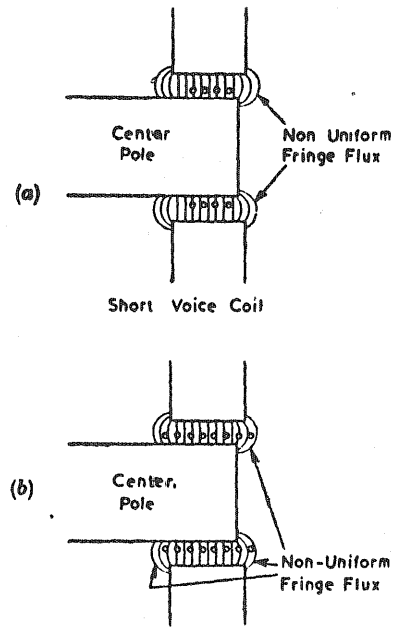


Fig. 2

which connects the voice coil to the speaker cone should be as close to linear with excursion as possible. The use of metal as a connecting material is ruled out because of its high mass. In good speakers a slightly stiff cloth material is used.

Another source of distortion directly related to the excursion of the voice coil is that the magnetic field in which the voice coil moves must be uniform over the whole distance of travel. This uniformity is hard to achieve because it demands a considerable increase in the size of the magnet to provide the same flux density over an extra long gap. This is one solution, to increase the volume over which the flux density is the same so that the voice coil never moves into the fringe flux region. (See Fig. 2). A second solution is to extend the length of the voice coil so that the product of the number of turns and the total flux cut is the same, i.e., the voice coil is always cutting the fringe flux. This however, is not really a practical solution because the mass of the voice coil becomes too large and a great amount of energy is needed just to overcome its inertia.

A third source of distortion is frequency modulation, of the Doppler effect. A speaker which is emitting the whole frequency range must radiate both the low frequencies and the high frequencies. By the Doppler effect the radiated waves add and subtract from one another. The high frequencies are more noticeably affected than the low. Harsh, non-harmonic tones are the product of such distortion, and this type of distortion is very annoying. A means of partially solving this distortion is to mount a smaller cone inside the large cone but connected to the same voice coil. This smaller cone has a greater tendency to vibrate at a high frequency than that of the larger low frequency cone. A better system is to design special speakers each with a certain range of frequencies.

Transient response is a fourth source of distortion in high fidelity speakers. Transient response is a measure of how accurately a speaker can follow a square wave input. The ability of a speaker to produce a short burst of sound without producing an added tail noise or hang-over resonance is a highly desirable characteristic. What happens in most speakers is that after the electrical impulse passes through the voice coil, and the coil moves correspondingly the voice coil continues to vibrate. (See Fig. 3). This unwanted resonance of the voice coil and cone after the electrical pulse has passed is often noticed

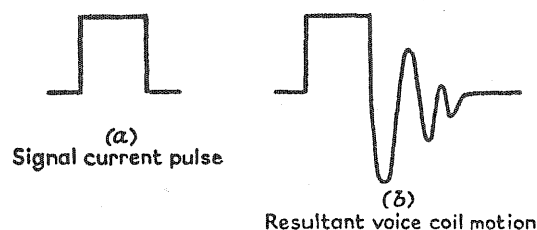


Fig. 3

in old speakers. The compliance of the material connecting the coil to the cone becomes loose, and the coil and cone is free to vibrate at will. There is one engineering solution to eliminate this unwanted tail resonance, and that is to increase the damping force. There are two effective ways of increasing the damping force, both are an electrical damping. In the first, two or more identical speakers are connected in parallel. When the voice coils tend to resonate at the end of the electrical impulse they generate a small voltage because the coil of wire is cutting magnetic flux lines. But as the coils are in the same circuit they interact with each other and the net result is an energy loss which halts the movement of the voice coils. The second method of improving the transient response is to increase the flux density in the gap in which the coil is moving. The voltage which the coil develops is directly proportional to the density of the flux. If a higher voltage is being generated the kinetic energy of the freely oscillating system is being changed more quickly to electrical energy. This electrical energy is dispersed by the internal resistance of the line and the output resistance of the amplifier. As was mentioned before, increasing the flux density is a rather expensive solution. This is one reason why high quality speakers cost a great deal. Increasing the flux density also has other beneficial results such as increasing the efficiency. The efficiency of the system is the next topic which we

shall discuss.

Efficiency, by definition is

$$N = \frac{\text{Power Output}}{\text{Power Input}} = \frac{\text{Acoustical Power}}{\text{Electrical Power}}$$

To give you some feel for the order of magnitudes involved, a \$6.95 transistor radio has a speaker with an efficiency of less than 1%. When you move to high quality stereo speaker systems, your efficiency may move to the 15 to 30% range. Consistently, the cost has also increased by an even larger factor. The efficiency is proportional to the product of the volume of the voice coil and the square of the gap flux density.

$$N \sim V_c B^2$$

Where,

- N = efficiency
- V_c = volume of voice coil
- B = gap flux density

In a magnet the magnetic flux is directly proportional to the magnet's weight/volume up to a limit of 20,000 gauss. Thus to increase efficiency the logical thing to do is increase the size of the magnet or increase its gauss rating. Bass speakers in very high quality speakers may have magnets weighing in the vicinity of 10 to 15 pounds, with a flux density of at least 12,000 gauss.

The ideal efficiency would be constant over the entire audio range. But we can see that a 15 in. speaker is limited in the 19,000 Hz range. The voice coil and cone is just too massive to vibrate at that frequency. In the same manner a 3 in. speaker cannot radiate in the 30 Hz range because it cannot sustain enough air in motion. However, speaker manufacturers have devised filtering circuits known as crossovers to try and make N a constant over the entire range of frequencies. In any three range speaker system, three speakers can be found, the woofer, 15 to 1,000 Hz, the mid-range 500 to 12,000, and the tweeter, 10,000 to 20,000 Hz. (Notice: The speakers "overlap" or "crossover" each other's frequencies.) The filtering is done in the circuitry, and the effect is to channel the different frequencies to the most efficient speaker for that particular frequency. In this way N tends to become a constant over the entire frequency range. A constant N for the middle and high frequency ranges is quite easily achieved. However, due to the physics of the low frequencies the efficiency of the woofer for especially low frequencies is still very poor.

The efficiency of the speaker in producing low frequency tones can be increased by placing the speaker in an enclosure or a baffle. A speaker hanging in free air is radiating sound in two principle directions, both from the front as one normally expects, and also from the back. The waves generated are mirror images of each other and are out of phase by $\lambda/2$ or 180 degrees. In free space the low frequency waves radiate spherically and thus the wave from the back of the speaker tends to cancel out the wave from the front of the speaker. To eliminate this problem many types of baffles and enclosures have been designed with varying degrees of practicality.

(Continued page 41)

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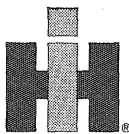
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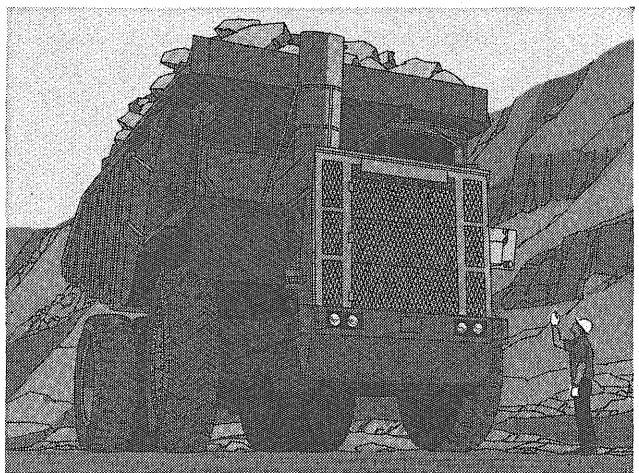
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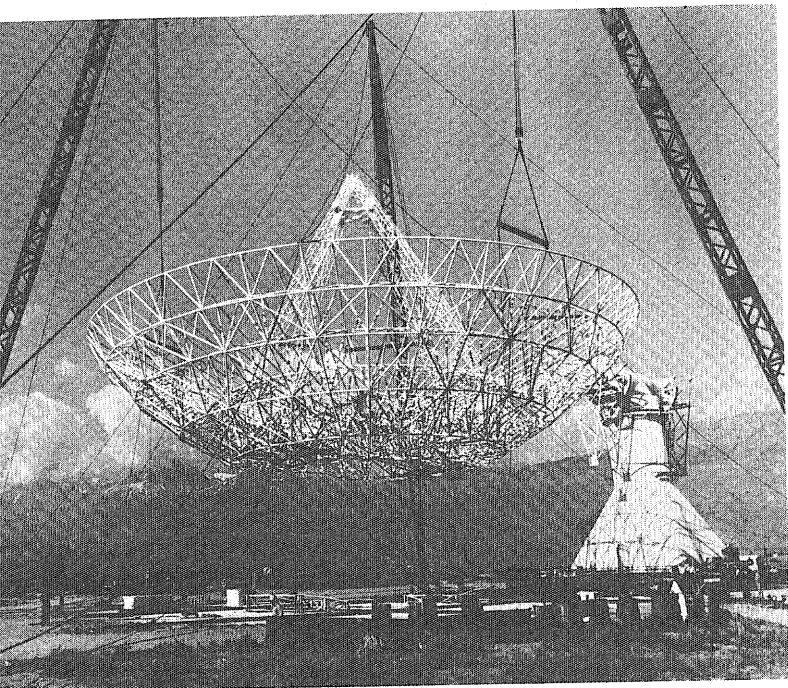
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what's new

in science and engineering

Edited by Mike Voegele

radio telescope

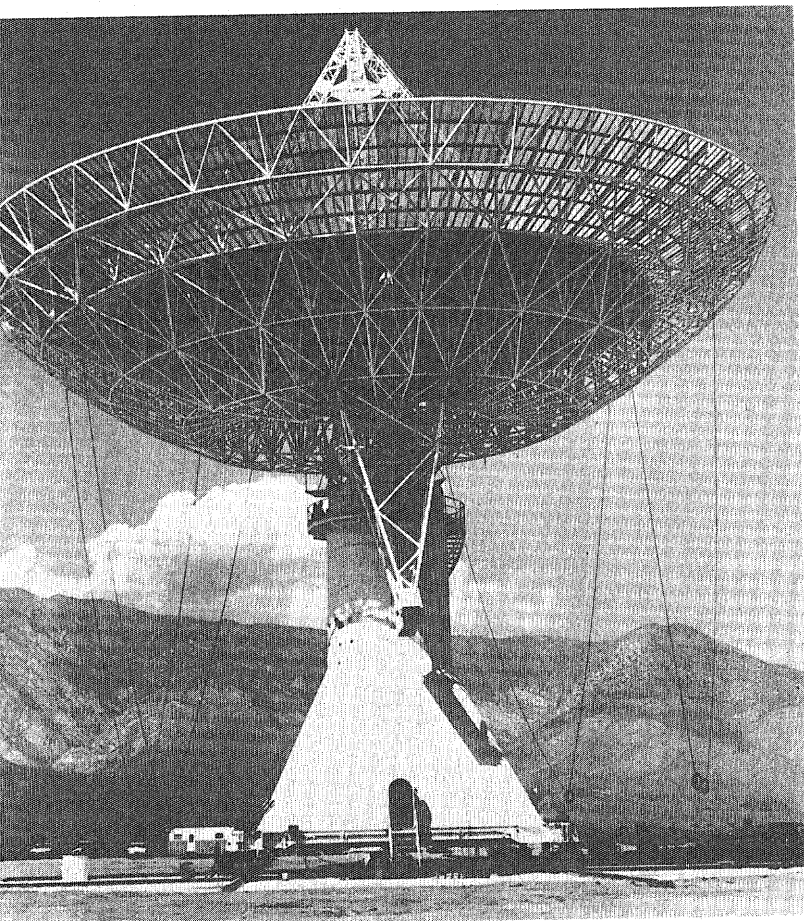
Dedication of the 130-foot radio telescope at California Institute of Technology's Owens Valley Radio Observatory on October 18 completed the first stage of a major expansion program. The proposed system recommended by the National Academy of Sciences consists of an interferometer array composed of seven more of the giant antennas.

The system would make this the world's most powerful and flexible radio observatory for the study of radio sources in and beyond our galaxy. It would be able to detect objects with radio strengths only 1/20 of those presently detected.

The new antenna is being used with twin 90-foot dishes. To overcome the severe limitation in resolving power of individual radio telescopes, two or more steerable antennas can be used in an interferometer array. Many of the techniques used in radio telescopes are similar to those used with optical telescopes. Radio waves are caught in a huge aluminum reflector and focused on a radio receiver positioned at the focal point of the reflector.

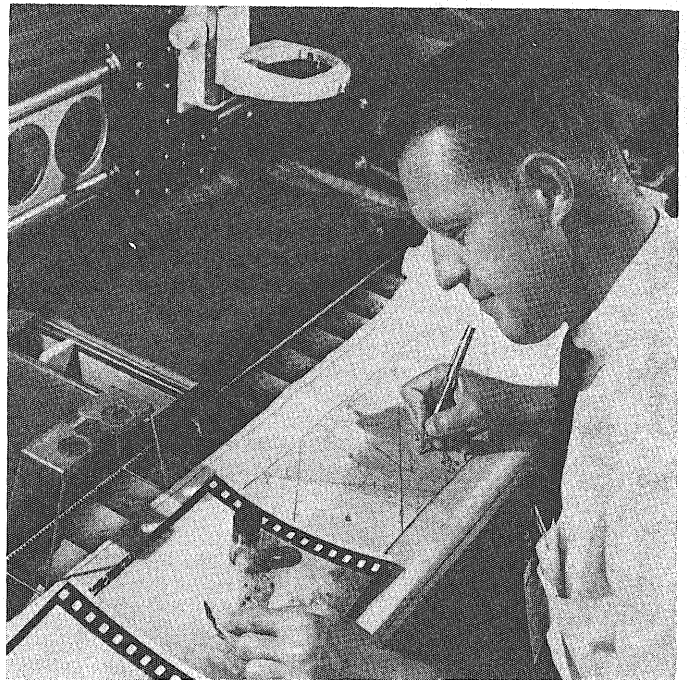
The basic design of the new 130-foot antenna was done at CalTech. The detail design, manufacture, partial assembly and test were done by the Westinghouse Marine Division at Sunnyvale, where the gears and drives for turning the dish, and the trucks and motors to move it along rails on wheels, were also built.

Now that the new telescope has been completed and aligned, it will provide radio astronomers with a much more sensitive tool for detecting and measuring minute celestial signals than they have had previously. Astronomers hope to obtain many answers to questions that have arisen from previous observations with less sensitive telescopes—and will undoubtedly come up with new questions in the process.



space geologist

In an aerospace firm whose engineers and scientists traditionally are identified with space-age skills, one might not expect to find a ground-bound geologist. But then, one could be surprised—particularly if the company was Lockheed. Jim Clinton, a geologist at Lockheed Electronics Company's Houston Aerospace Systems Division, is shown interpreting and indexing Apollo mission photographs of the earth. Stereoscopic and monoscopic viewing of film positives is conducted on a two-channel light table with a mechanized film drive. Images then are compared to published maps. Analysis reveals details of the earth's resources, including its geological structure. (Photo supplied by NASA)



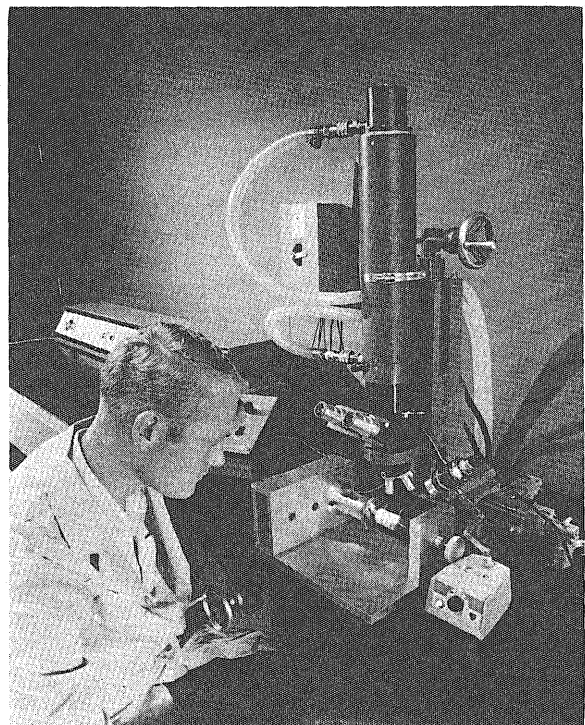
rent-a-laser

Lasers, electron beams, electric arcs—Westinghouse Electric Corporation recently announced it has consolidated all of the commercial activities involving these welding and cutting techniques.

Westinghouse established its "rent-a-laser laboratory" last year and offered manufacturers—on a rental basis—not just a laser but a whole laboratory and its highly skilled engineers.

Now, anyone who wants to try out new techniques doesn't have to buy a laser machine tool and install it in his production line. Instead, he rents the laser facility and gets a complete manufacturing cost and feasibility study of his new production-line technique without having to invest in the equipment to do it.

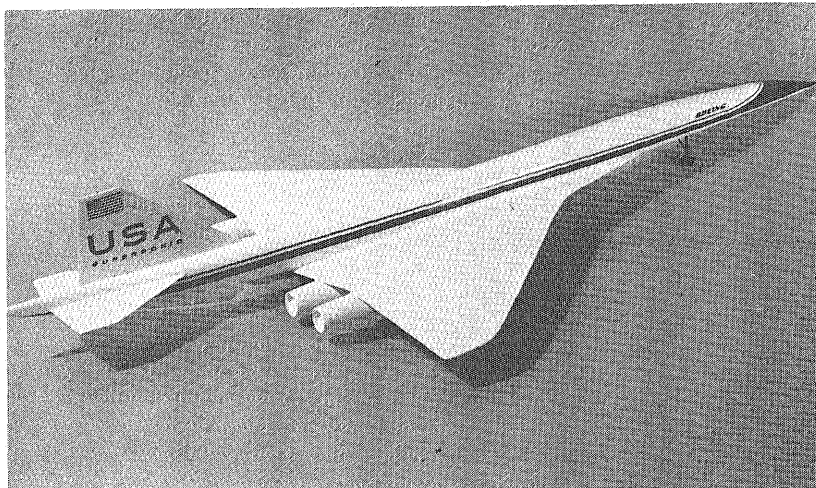
Costs vary according to the complexity of the job, but the typical rent-a-laser charge of about \$350.00 is a fraction of the cost of creating an in-house laser capability. It is also a fraction of the savings that can usually be realized by applying laser technology to many welding and cutting problems.



what's new

(continued)

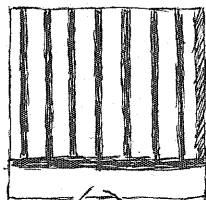
supersonic transport



Early this year The Boeing Company will recommend that the United States build two prototypes of the supersonic transport pictured here for the first time. Striking through the sky at 1,800 miles an hour, the U. S. SST will reduce travel times on key overwater air routes by more than half. No two major cities will be more than half a day apart. New York will be 2 hours and 40 minutes from Paris, Los Angeles 2 hours and 5 minutes from Honolulu, Tokyo 2 hours and 50 minutes from Honolulu. The U. S. SST will have a fixed-sweep wing and conventional tail similar to current jetliners. Built of titanium, it will be 280 feet long, 50 feet high and have a 142 foot wing span, with leading edge sweep of 50 degrees.

Powered by four General Electric GE4 jet engines of more than 60,000 pounds thrust each, the supersonic transport will cruise at altitudes above 60,000 feet. Carrying up to 280 passengers, production model SSTs will operate from international airports of the mid-1970s, taking off and landing at speeds comparable to current jets. To date 26 airlines have reserved 122 U. S. SST delivery positions. Two prototypes are being developed by Boeing in Seattle, Washington, under contracts administered by the Federal Aviation Administration. The government will recover its development program investment plus \$1 billion through royalties on the minimum expected sale of 500 aircraft. First flight is scheduled for 1972.

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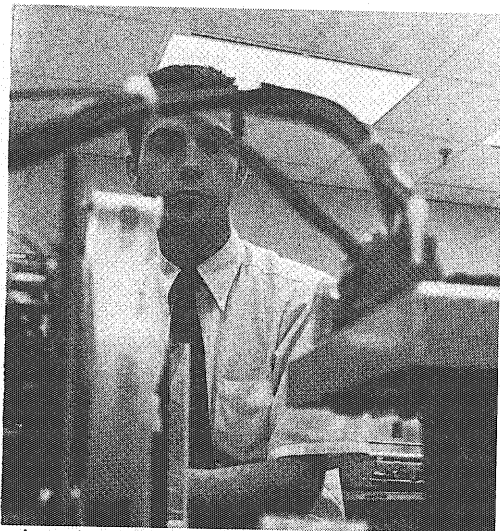


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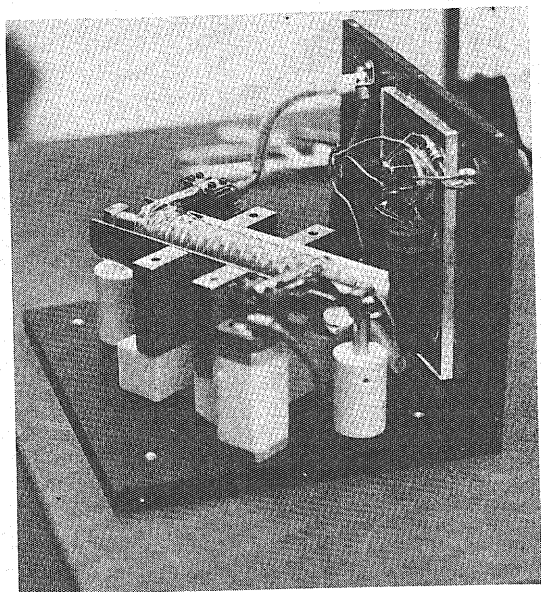
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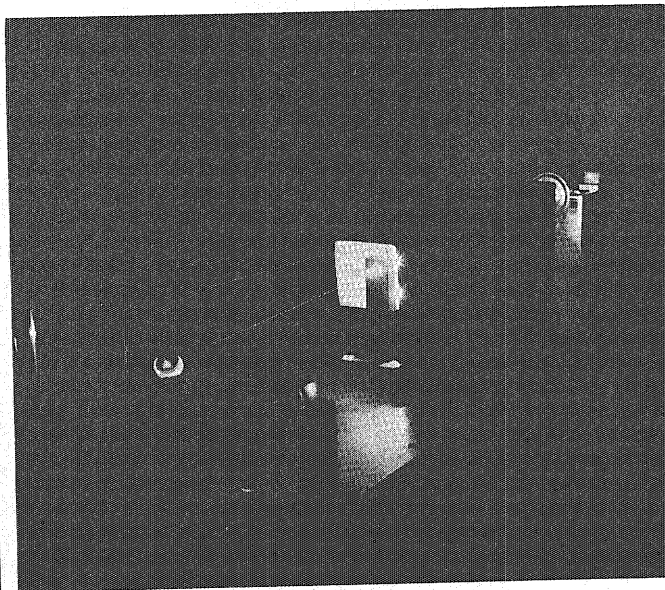
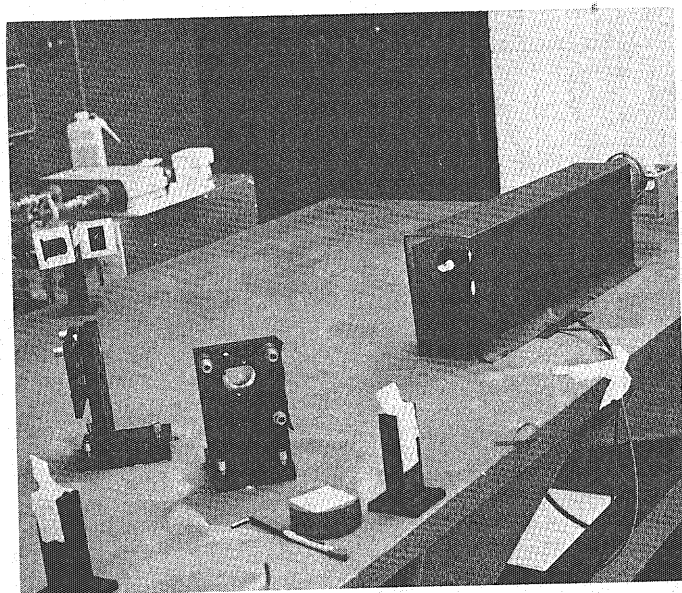


LASERS AND THEIR APPLICATIONS are presently under study on the third floor of the Space Science Center under the auspices of the Electrical Engineering Department. Four types of lasers or laser applications are presently under study; they are the ring laser application, the optical bridge application, the carbon dioxide laser, and the Ruby laser.

The term laser is derived by using the first letter of each word in the descriptive name, Light Amplification by Stimulated Emission of Radiation. The methods of atomic stimulation vary between the Ruby laser and gas discharge lasers, but the principles of operation are the same. The material of the laser, be it a long cylindrical ruby crystal, or a quartz tube containing special gases (Helium-Neon or Carbon Dioxide), is excited by some means, either light (for Ruby) or a radio frequency generator (for gas). This input of energy excites the material of the laser on an atomic scale to a higher energy level, somewhere above the atoms ground state. When these excited atoms drop to their ground states, a photon of light is emitted. Of all the photons emitted, only those initially traveling along the direction of the center axis of the crystal or tube will eventually emerge in a laser beam. The other photons are passed out through the side walls of the laser, causing the laser tube to glow while in operation. Those photons traveling along the direction of the center axis are then reflected back and forth through the laser material by use of mirrors at each end of the material. This light continues to travel back and forth increasing in intensity all the while, until the light intensity is great enough to allow some of the light to pass through one of the end mirrors. This mirror is usually designed to allow the light to pass through once a certain intensity is reached. Only a small quantity of light is emitted, and this is considered a pulse of coherent light. Enough of these pulses are generated so that to the eye these pulses appear as a single beam of light.

The ring laser under study is an application of the Hel-

ABOVE: Electronic flash lamp coiled around ruby crystal. Mirrors are not in place. BELOW: Ring laser. BELOW RIGHT: Ring laser under operating conditions. Laser beams meet at extreme left side.



ium-Neon red, gas discharge laser where the emitted beam is directed into a ring of mirrors (hence the name). The laser is unusual due to the fact that the beam is emitted through both ends of the Helium-Neon tube. The mirrors at each end of the laser reflect 99.7% of the light incident upon them, which means that the laser beam pulse is only 0.3% of the light generated within the tube. To watch the laser operate, it appears that a continuous beam of light constitutes the ring. However, the pulse that is emitted from the laser takes only 7 billionths of a second to complete its excursion around the ring, and in fact, this pulse is only 1/10th the length of the ring itself.

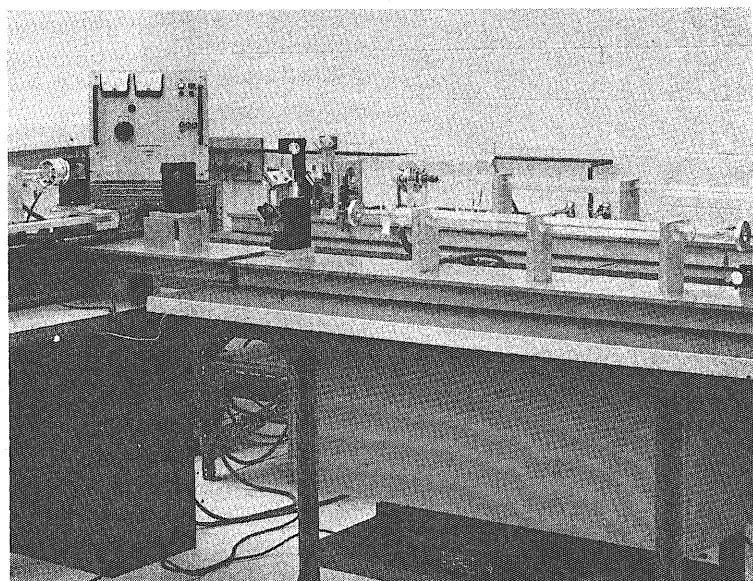
The purpose of the ring configuration is to determine the relationship between two pulses traveling in opposite directions. The ring laser is so constructed that the two beams meet, one from each end of the laser tube, and it is at this junction that the study of the relationship occurs.

The Optional Frequency Bridge, incorporating a Helium-Neon red laser and using a Mach-Zender interferometer as the optical bridge, is being used to study small amplitude changes (about one part in a million) and small wavelength changes (about 1/100th wavelength in magnitude) in the laser beam due to internal atomic excitations. The effect of the Helium-Neon atoms on the velocity of light as it is produced by the laser can be determined by use of the optic bridge. The laser beam is directed into the interferometer, and the beam split. One beam traveling without any external changes affecting it, the other beam subjected to a change in amplitude and/or wavelength. When the two beams are reunited, the effects of the excited atoms can be obtained.

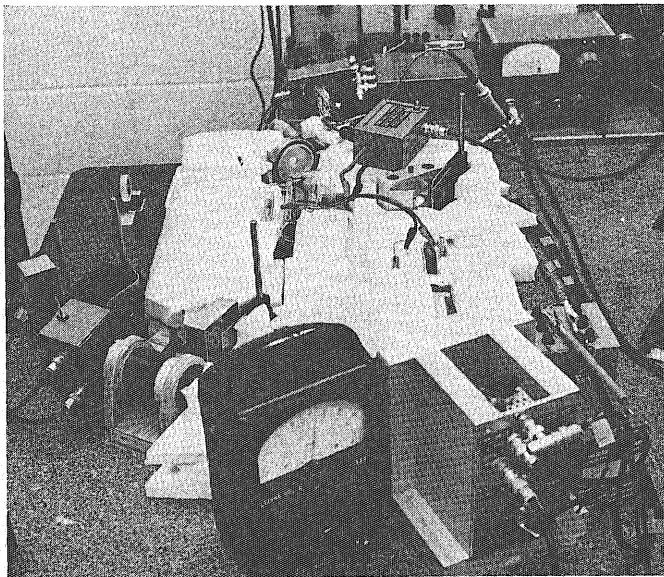
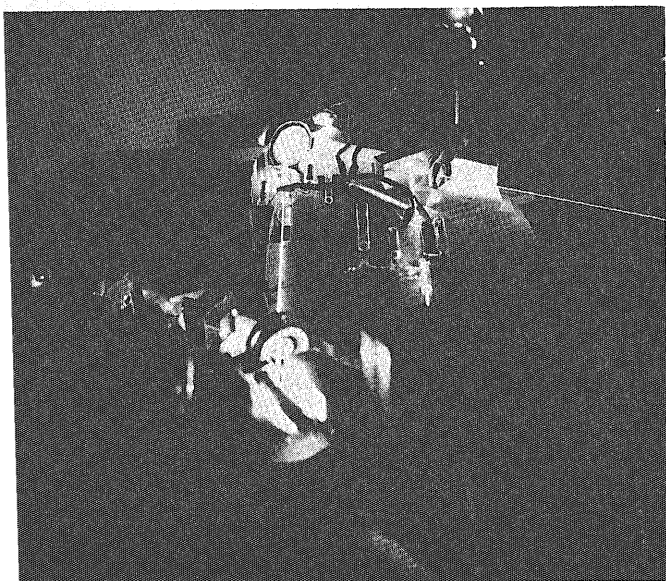
The Carbon Dioxide laser is physically the largest of the laser in the Space Science Center. It is a high energy, long term application laser, and the laser which seems to have the greatest possible application in the field of television communications. None of the other lasers seem to have the ready adaptability to the com-

munications problem, such as the high power output, or the capability to produce this power for a long period of time. In communications, it will be necessary for the laser to have these two basic attributes.

The Ruby laser is a short pulse, high energy laser. The applications of the Ruby laser seem to be in those areas where a lot of power would be necessary for a very short period of time. Applications of this type are already found in medicine, and soon will come in other such fields where the short term power of the laser can increase the capability of man at work.



ABOVE: CO_2 gas discharge laser. BELOW: Optical frequency bridge. BELOW LEFT: Optical frequency bridge under operating conditions. Laser enters from right side.





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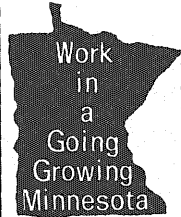
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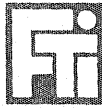
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splinters

Scene: Parked car . . . moonlight.
 "Goodness!" she exclaimed. "It's three o'clock. I should have been in hours ago."

"So should I," he murmured disgustedly.

• • •

The fire engine went screeching down the street, past a small bar. A very woozy character stumbled out of the bar and started to chase the fire engine. He ran for five blocks, but simply wasn't able to catch up with it, and finally he collapsed against a handy lamp post and shook his fist at the departing engine.

"Okay," he screamed, "keep your damn peanuts!"

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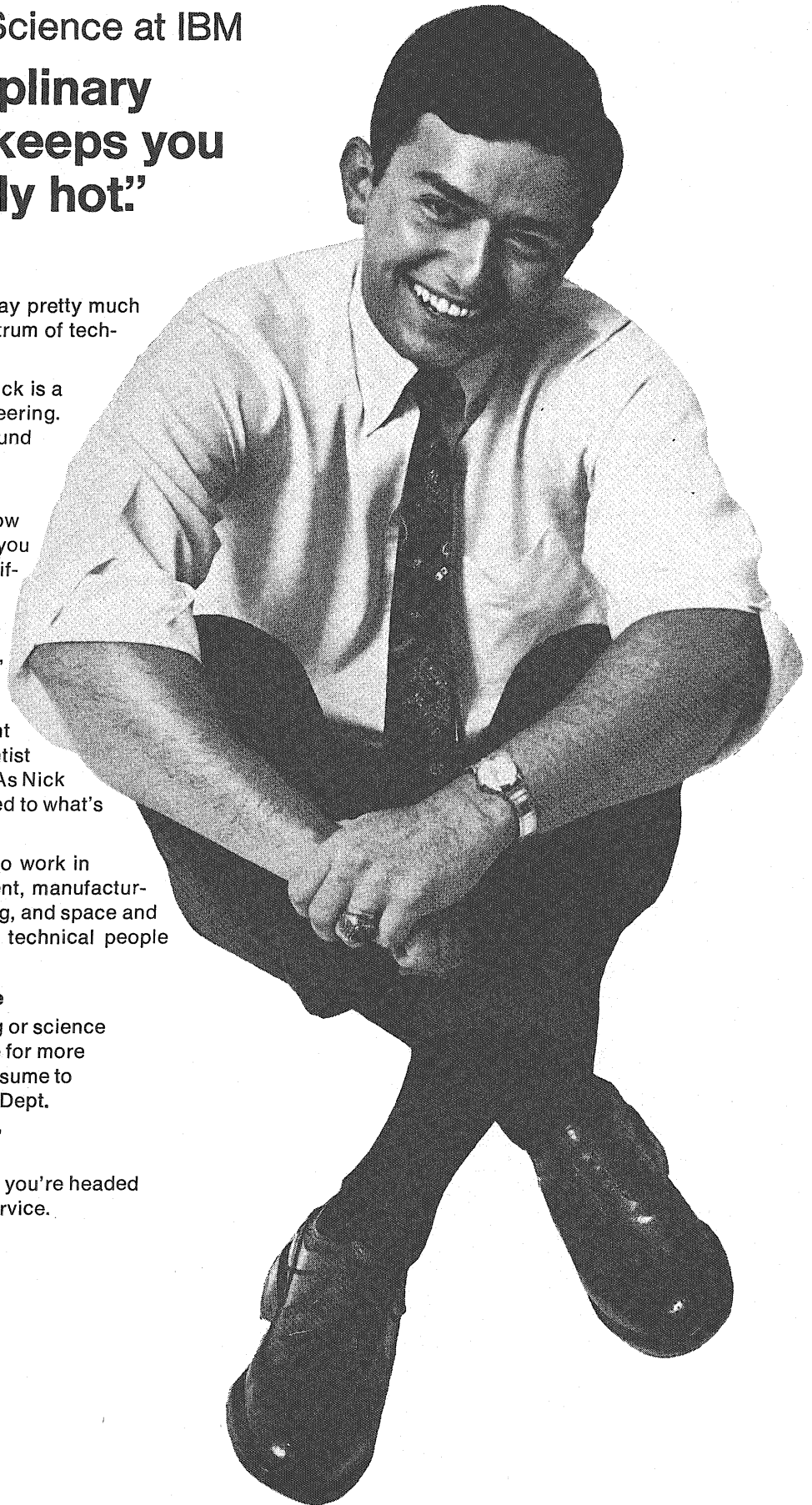
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more splinters . . .

The difference between "Stickup" and "holdup" is age.

Then there was the one about the guy who took his girl into the night and mist. . . .

Love is blind . . . so a fella has to feel his way around.

Love is one game that most girls like to see end in a tie.

She was only a brick-layer's daughter, but that didn't keep her from getting plastered.

Two golf players, Bob and John, were getting a little impatient because the men just ahead of them were quite old, and couldn't play the game very fast.

Bob: "Why don't we just play through? Hit your ball and yell fore!"

John: "But what if my ball hits one of them? Can't we wait a little longer?"

Bob: "Go on! Just hit it. We can't wait all day."

John: "Well, okay . . . fore!"
The ball sailed in a beautiful arc and, alas hit one of the old men in

the head. Bob and John walked up to the scene. The poor old man lay dead, the ball well embedded in his forehead.

John: "Well, now I've done it? What should I do now?"

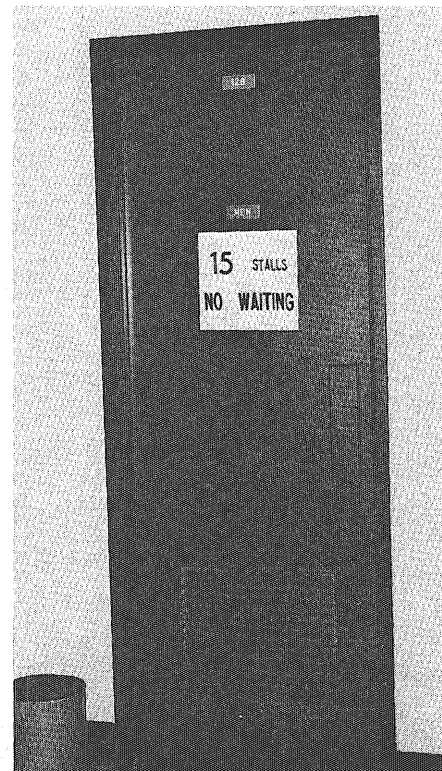
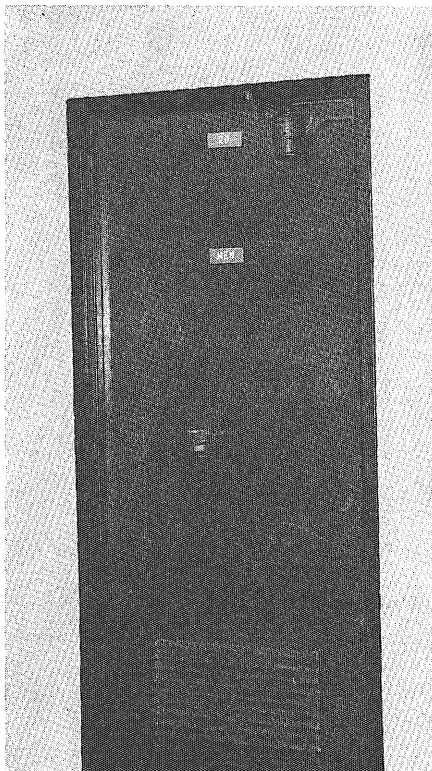
Bob: "Hmm . . . I think you should try using your wedge."

"She was only the optician's daughter—two glasses and she made a spectacle of herself."

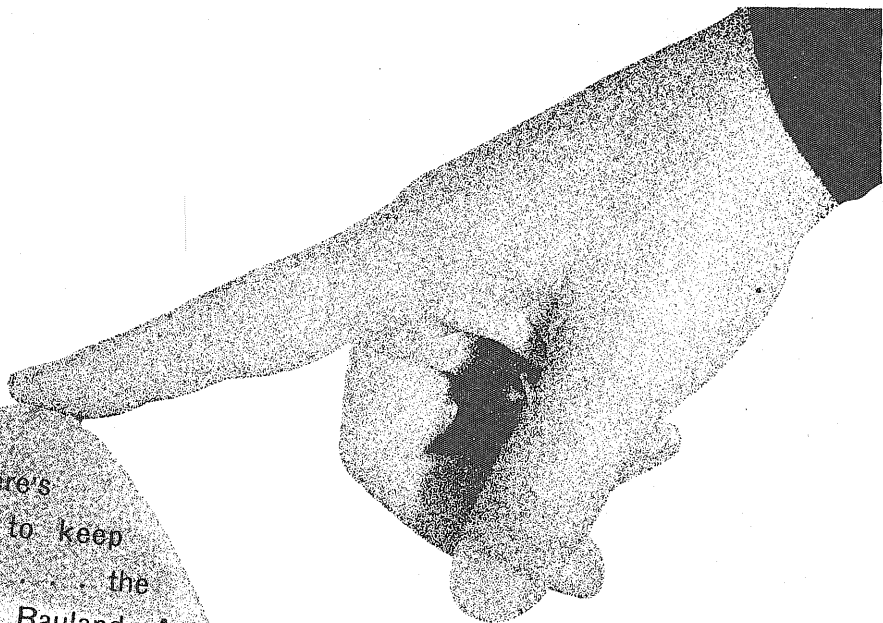
At a service station: "Treat your car as you would yourself—have it tanked up."



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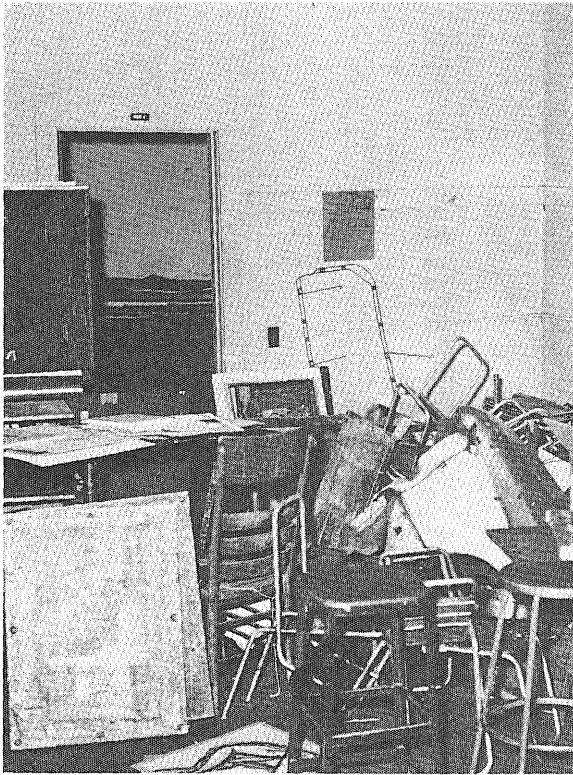
I T STUDENT LOUNGES

AS REPORTED in the December issue, I.T. will shortly begin expanding its facilities. When this expansion is completed, hopefully in the middle 70's, I.T. will have classrooms, offices, and labs, second to none.

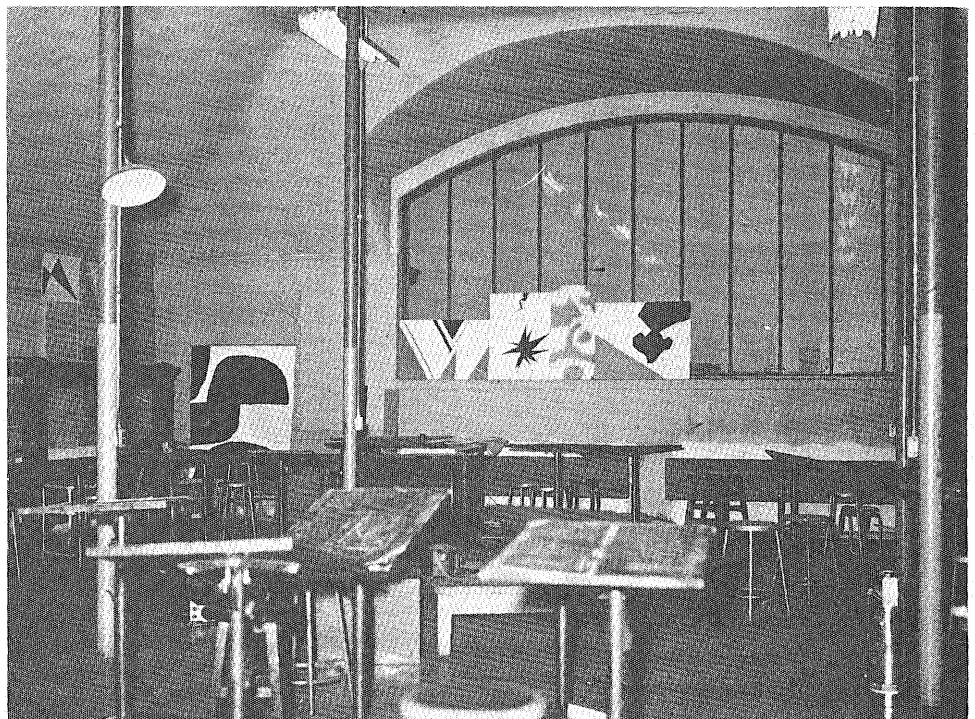
But in all the plans, no mention has been made of student lounges. You may very well ask what a student lounge is. For, unless you are accustomed to hiking to CMU or migrating to the West Bank, you have probably never seen a student lounge.

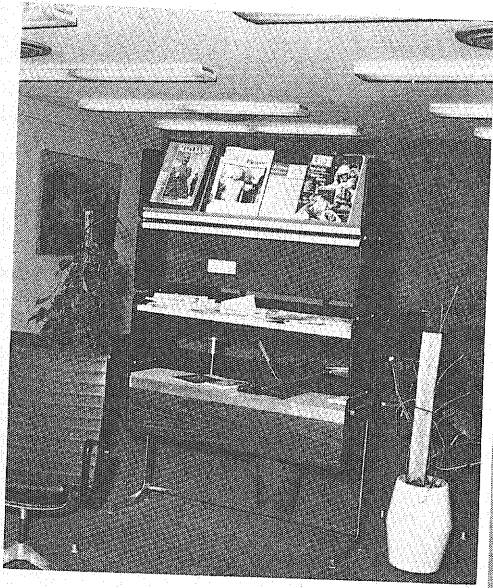
The purpose of this article is to show you what you are missing, and to show those in authority what can be done with a little space and money. The accompanying pictures show two lounges on the West Bank. They typify what we would like to see in I.T. as the expansion program gets into gear. There is a problem here, though. Most of us hope not to be here in the middle 70's. (At least not in lower division!) What can be done in the meantime?

Conveniently enough, there already exists a room which could be made into a lounge *right now*. On the fourth floor of Main Engineering, there is a room, presently used only as an art studio for architecture students. This room is used only approximately 10 hours per week. It would be no great



BEFORE





WEST BANK LOUNGES

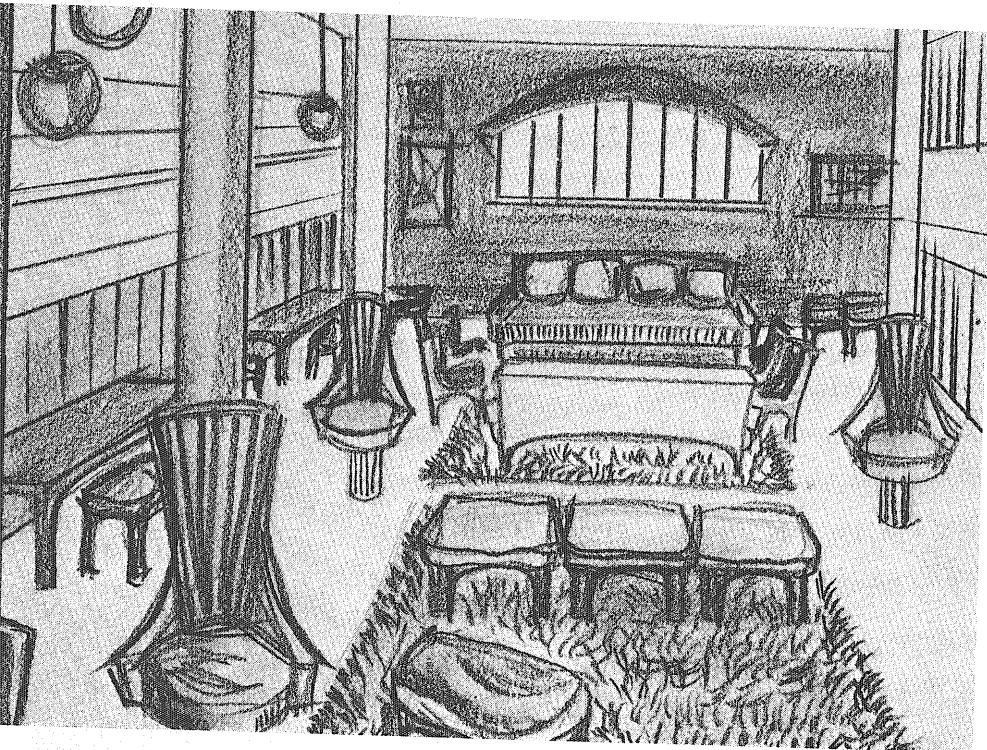
... what our liberal friends have.

task to shift these few classes to a drawing lab in the Architecture Building. Then the room, currently looking like a child's playpen, could become a warm friendly haven for engineers looking for a place to study or rest between classes. If you've ever laid your tired body down in a second floor hallway for lack of a better place to rest/study, you certainly can appreciate the necessity of this project.

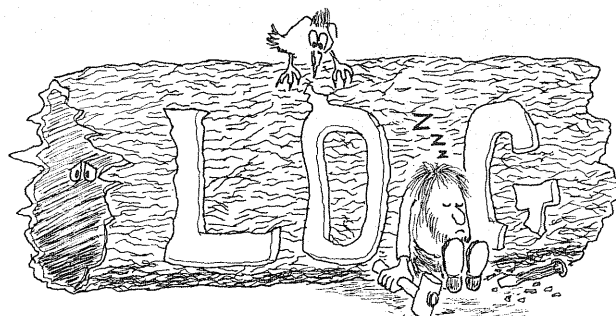
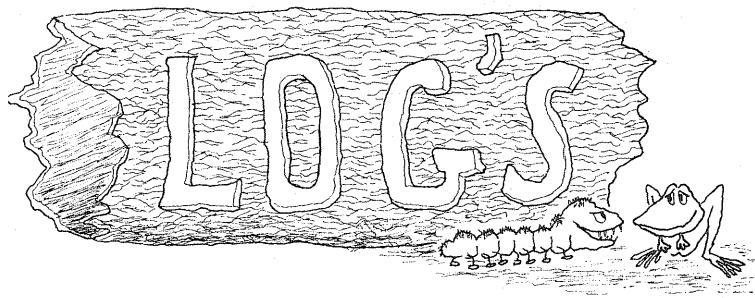
The question now is, "Can we get this kind of thing for I.T.?" We sincerely hope so. We believe that I.T. definitely has something of which to be jealous. It would be a shame if I.T. could boast new buildings, but,



with the attitude "who gives a damn about the students", offer only the study room (pigsty) near the bookstore as a lounge.



AFTER
(HOPEFULLY)



jai byrd

And here he is, folks, direct from another masochistic weekend in that mythical land where the streets are paved with empty whiskey bottles—the Iron Range. Say a few words, jai.

"?,:(!;' I think that whole area stinks! What it needs is a Right Guard can the size of the Empire State Building. All you see up there are open pits. Of course, I'm prejudiced because I was born up there."

Actually, jai has just had his ideals shattered; someone told him about Santa. She's a transvestite, you know.

First on the agenda is a backward glance at 1968. Then, Ralph Groop comments on the "Peace de Resistance" student movement, followed by a short plug on the extension of non-secret research. Lastly, this month's social calendar is posted.

1968 in rectalspect (a heads-up analysis)

Yes, 1968 will be remembered as the "Year of the Assassination." Who can forget the day promising Negro comedian, Bill Cosby, was eaten by a trained chicken heart.

Then, of course, Mandrake the Magician succeeded in hypnotizing every known member of the "vegetable world" except the carrot—now known as a "hard-trance plant."

This year, rumors circulated that all NATO members would be given control of some of our nuclear forces. One counter-proposal was that we give only certain countries this power, while giving the impression to Russia that all of them have it. You might call it contemporary "Button, button, who's got the button?"

This year brought the arrival of P-N grading. Here's the lowdown from "P-N Grading for EE Majors":

P-N grades are great unless you want to go to grad school, to get a scholarship, to graduate with honors, or to go to work after graduation.

We all enjoyed the flight of Apollo 8 around the moon. Remember the trouble they had getting pictures of the Earth at first? Well, RCA technicians solved it by using a special screening-filtering device which blocked out interference—especially low monotonous bovine sounds.

All in all, it was a good year, except for one or two things. See you at Dayton's "exchange department."

back from the front

Ralph Groop—Ace War Correspondent

Cymbalism has entered into the clash between students and administration police on free world campuses. "Ω", the sign of resistance, was designed to reduce the effects of police charges into the student lines.

Simon Sez, leader of dissident English students, compares the Cambridge University administration to the despotic rule of Sultan Battery. Mr. Sez would prefer a more flexible rule (such as General El Boe's representative democracy in the joint provinces of Aden and Abbetting south of Saudi Arabia). According to Mr. Sez, such a change would be a giant step forward.

In Mean Time, Greenwich's resident British historian, Sir Malcolm Corpuscle declares that all this is just a "red-blooded" male attempt of the students to assert their masculinity. Note the slogan they have borrowed . . . "We shall over-come!"

And what is Parliament doing about the problem? Some say it has crawled into a hole to hide. In actuality it is in recess.

secret[®] research stinks

Secret research at the University of Minnesota must stop! Only last week, another tragedy of warped scientific methods became public. It seems that U researchers crossed a mermaid with a Slobbovian and got a retarded carp.

Who can forget the terror unleashed upon the campus when a 6-foot experimental rat ("Mervin the Rat", as he is called) escaped from the Psychology Dept. to forever prowl the steam tunnels in search of food? That was two years and six Great Northern grain-filled boxcars ago. Minneapolis has hired famed animal tamers and the star of True-Life Adventure Film, "Tiger's Revenge", Claude Crotch, to track down the wanton beast.

On the other hand, observe the benefits of non-secret research. Was it not the University that invented the "accordion front-end" for cars? The new invention plays the "Funeral March" after every accident. Truly, secret research must be curtailed, while more non-secret research instigated.

spirits of '69

At one of the innumerable parties we attended on New Year's Eve, we stumbled upon our old friends, Charlie Boorman and Stu Nemo, who, in the manner of Greek oracles on their lunch break, were mystically swapping predictions for the new year. "I think it's going to be another rotten year," said Charlie. "If I get another 1.8, I'll be drafted." We all agreed with that prediction.

What do you see for I.T. in 1969, we asked Stu.

"Raquel Welch will register for Fall 1969 as a Freshwoman in Civil."

"Dean Cheston will open his mail on May 2 and find a bottle of Dippity-Do sent anonymously by the more conservative members of the faculty."

"Joshua Wellknownfact, M.E. sophomore and ex-band member will march around TNCE and TSCE playing his trumpet, and after seven times the walls will come tumbling down."

"An I.T. faculty-student beautification committee will be formed to find sculpture for the lawn between the Space Science Center and the Architecture building. The sculpture will be entitled **'63 VW Demolished by '56 Chevy while Fighting for Parking before Second Hour Class.**"

Those are good predictions we said, turning to see what Charley would add.

"I need another drink," he mumbled.

We asked Stu what his predictions were for the rest of the campus.

"In 1969, Aero. E. junior Barry Mayer will design an air attack that will introduce sophomore sensations Jerry Messerschmitt and Joe Peefiftyone to the football fans. This offense will lead the Gopher football team to Pasadena, California, for the New Year's Day Air Races."

"The Technolog staff football games on the engineering courtyard will be discontinued when Dean Cartwright finds evidence of recruiting violations and red-shirting."

Stu paused to take another drink. We asked him what he was drinking.

"This is a 'Moon on Xmas Eve'—one swig and you're looped."

Stu pulled the hors d'oeuvre toothpicks out of his face as he predicted the future for the real world.

"Sometime in July, Apollo 11 crewmen will step on to the surface of the moon and find astronaut Borman

was right and the moon is American cheese—made in Wausau, Wisconsin, by a funny little German with a Charlie Chaplin mustache."

"The Minneapolis and St. Paul Sanitation Departments will, for the first time in history, have all the streets plowed by summer 'which will be on July 23rd this year.' 'between noon and 3 p.m.'"

"The Minnesota Twins will win the American League championship and go on to win the World Series in four straight, beating the Nagasaki Giants."

"The Minneapolis Downtown Council will finally get rid of those diesel buses on the mall—replacing them with electric trollies—vintage 1898."

"Spiro T. Agnew will go into Hughes-like seclusion to avoid his admirers."

"Apollo 10 will be hijacked to Cuba."

Stu started to mumble another prediction but apparently thought that it was not worth while, because he did not complete it. He was passed out on the floor. We turned to Charley who had been strangely silent, as if meditating. We wondered if he had a final prediction for the year.

"Christ, I think I'm going to puke," he gurgled as he ran toward the bathroom.

We nodded understandingly.

official daily bull

- Jan. 10—1869, Phyllis Upp begins brilliant stage career, later elected "Most Valuable Shotgun Rider."
- Jan. 13—U of M M.E. first to get Hong Kong Flu; but you too can get this handy furnace accessory for only \$5.95 plus 50c postage. Unlimited supply!
- Jan. 20—Architecture students given project of making 3-dimensional representation of the "lay of the land" around Minneapolis. Philbert Noxema objects, "My girl is in CLA!"
- Jan. 24—Dean Martin's skin-diving partner injured off Bahamas. Dean tries to warn him: "That's a moray!"
- Jan. 26—100th successful sex change at U of Minnesota: IT coed now female.
- Jan. 30—8 months after his successful sex change operation, Gertrude Snickefritz (formerly Bill Johnson) has been informed she is about to have a son. The paternity suit was served on her this morning.
- Feb. 2—IT Coed sees her shadow.
- Feb. 4—Landscape engineer arrested for sexual perversion—accused of "sod"omy.
- Feb. 7—Roy G. Biv, UN Ambassador from the Congo, is declared most colorful personality of the year.

THE APOLLO PROGRAM:

AN EVALUATION

by RODGER WHIPPLE

S ometime this year a man-made craft will settle down on a barren land surface, a hatch will open, and a human, for the first time, will step onto the surface of the moon.

That spaceman's step will be the result of a crash program and \$22 billion. What is its worth?

In 1961, President Kennedy set, as a national goal, a manned moon landing before 1970. Also in 1961, the Russians were painfully far ahead of the Americans in space firsts. The result was a crash program, which fed on large amounts of money and people. But in seven years, the Americans have caught the Russians, and, with the failure of the cosmonauts to circle the moon, have passed them.

However, in the same years, the words "Vietnam" and "race riots" have taken over the news, and while huge programs were begun to solve these problems, critics of the space effort argued that the best management and scientific brains were being wasted on a useless project.

Critics of the space program have not always limited themselves to questioning the expenditure of men and money, but they also question safety and timetables. Critics claim the engineers are not prepared for space rescue, and the moon program is too rushed.

These critics are usually the severest, because they are scientists or engineers, and know what they are talking about. Probably the most famous of the critics, is British Astronomer Sir Bernard Lovell who said, "On a scientific basis, this project is wasteful and silly. We've reached the stage with automatic landings when it's not necessary to risk human life to get information about the moon."

While not as well known as Lovell, Dean of the University of Minnesota's Institute of Technology Warren B. Cheston is just as severe. He said more money should be put into the unmanned programs, like weather, communications, navigation, and other practical and research satellites. The Apollo program, he explained, is too much of a crash program, with too little being gained from it except the moon landing. He calls the program "politically motivated."

But the funds for the space program in general, added Cheston, should not be given to poverty or war programs unless they "could be diverted with a guarantee (they) would be used for specific programs. But there is no guarantee."

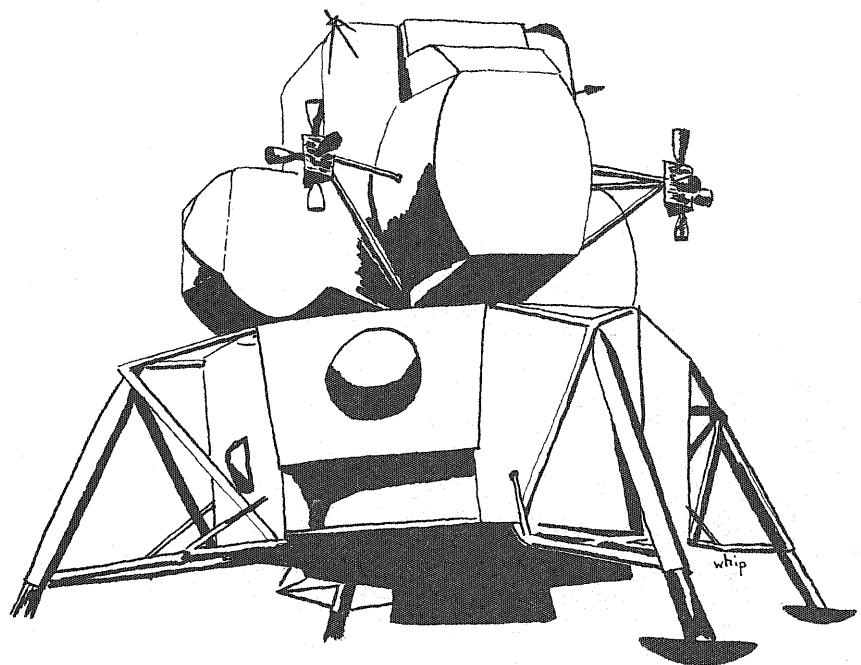
Associate Professor of Aeronautical Engineering at the university, Dr. Eugene Stolarik, while not as severe

as Lovell and Cheston, says "It would be foolish to cut off the moon program now, when we are so close to the conclusion. But I think from the beginning of the program, there should have been less funds and the program should have been more even."

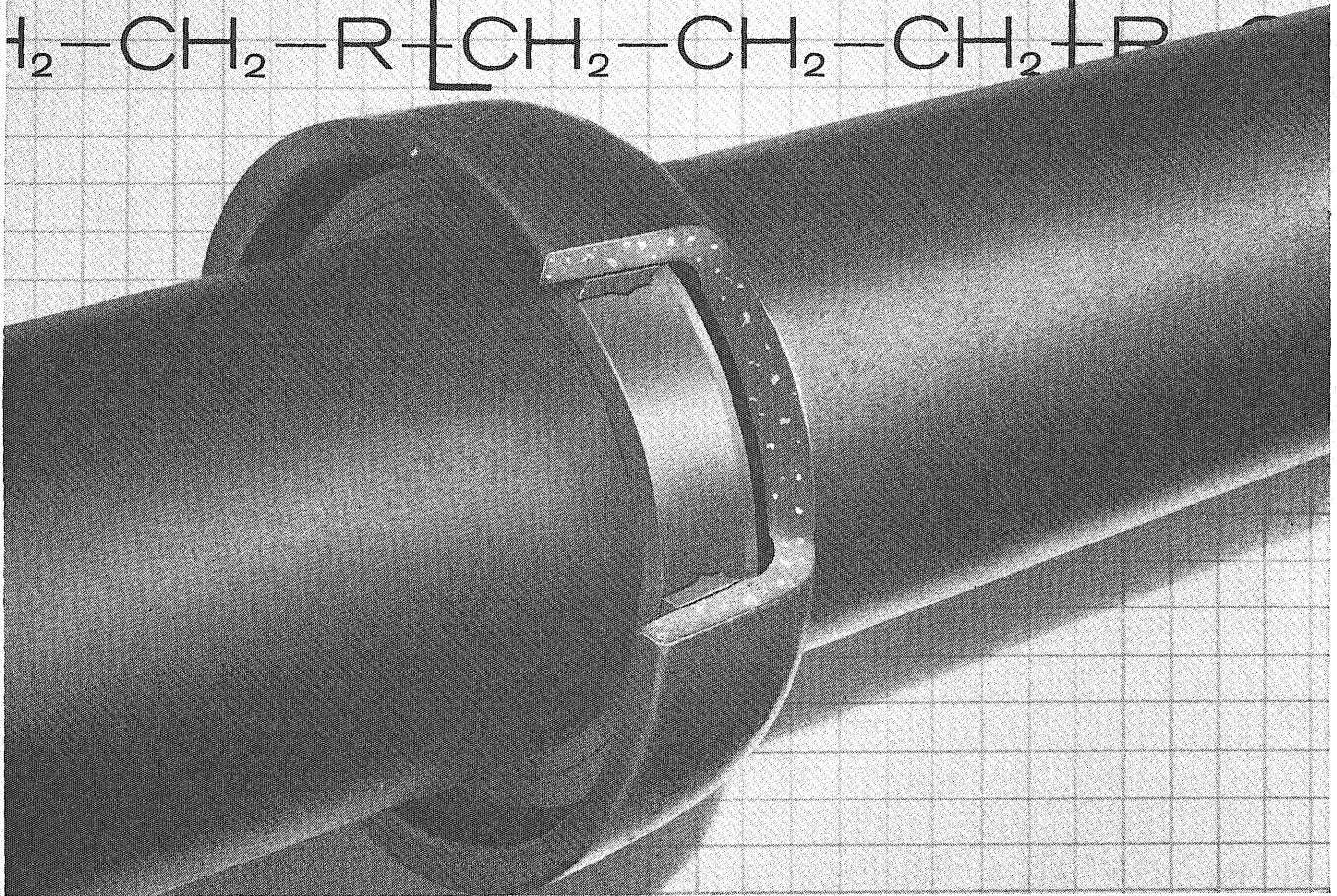
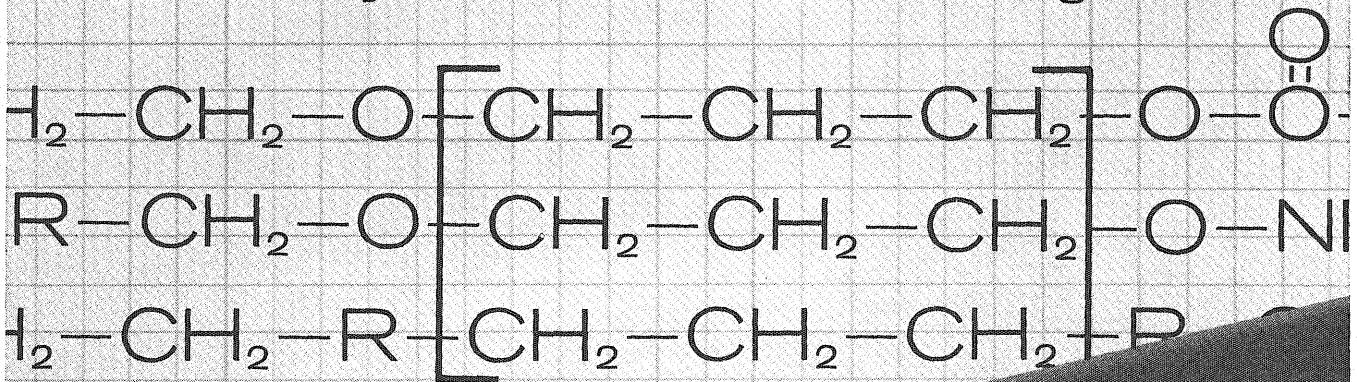
Stolarik also says, "I am very much aware of current needs in other areas." Other space projects are important though and have done a great deal for society, especially in the area of miniaturization, and computerization."

Of course, the critics are not always engineers. William L. Zwerman, Assistant Professor in Sociology at the university calls Apollo "a dead-end project," and "a hell of a waste of money." He explained, "It is a fantastic investment that will just get a man to the moon and back. If the

(Continued on page 43)



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Dickey urethane is unique, and it assures the finest possible factory-made pipe joint. Here's why. First, we make our own urethane . . . because it gives us positive control of quality and uniformity. This urethane is the most resilient material available. Nothing compares with its ability to "bounce back"—a requirement for a tight joint.

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W. S. DICKEY



CLAY MFG. CO.

LUNAR SAMPLING PROGRAM

Even though we can't all go to the moon yet, consider a university scientific program that will make the trip worthwhile.

by DR. ROBERT PEPIN

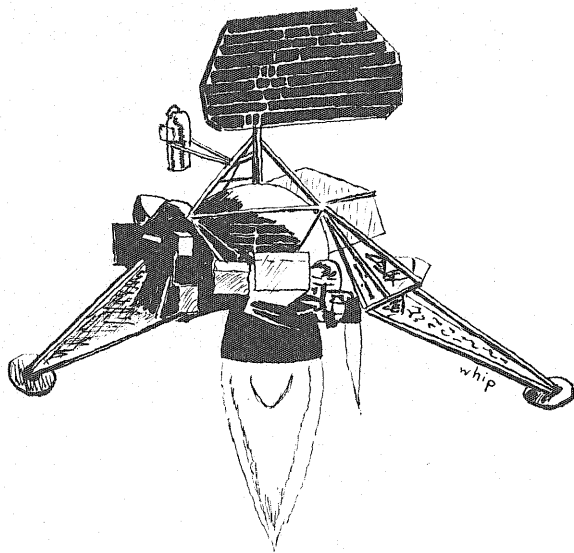
IF NASA can stick to its current schedule—and there's clearly no cause for pessimism on this score in the flights of Apollo 7 and 8—then sometime this summer Apollo 11, carrying three astronauts, a vacuum-sealed metal box loaded with moonrock, and (in a spirit of proper caution) perhaps a colony or two of hitchhiking lunar microorganisms, will splash down in the Pacific. While there's been much questioning, some of it thoughtful, of the priorities which have driven the Apollo Program, it cannot minimize either the grand adventure itself or its scientific return. Part of that return—to many, in many ways, the most interesting and valuable part—will be Apollo 11's box of lunar samples: the first direct collection of material from a planetary neighbor.

The astronauts and the Apollo 11 command module, with the lunar samples still inside, will be transferred behind biological barriers from the recovery ship to NASA's Lunar Receiving Laboratory (LRL) in Houston, where everything exposed on the moon's surface will be held in strict quarantine, nominally for 30 days or so. Although chances are pretty slim that life in any form can exist in the hard vacuum, ambient temperature swings of 250°C, and massive doses of radiation from solar flares which make up the climate of the lunar surface, a healthy respect for the stub-

born survival of forms of terrestrial life under harsh conditions dictates that tests for viable organisms will have to precede the release of the samples (and the astronauts) into the terrestrial environment. If (a very big if) the tests are positive, and most certainly if they reveal any suspicion of unfriendliness to the terrestrial biosphere, it's realistic to assume that the lunar material will not be released from LRL for study by outside laboratories. In this event the situation of the astronauts will be somewhat delicate. (There was a diverting exchange on the possible "contamination" of the lunar samples by resident microorganisms, during a general meeting in Houston last year of the scientists who will carry out a wide range of studies of the samples in many laboratories around the world. It was of course very clear that a discovery of native life in the samples would immeasurably complicate plans to distribute them to the laboratories. There was a natural tendency to develop a kind of tunnel vision in this situation, whereby one's own experiments on the samples assumed dominant importance and others faded, at least momentarily, into the periphery. When one speaker characterized the presence of lunar microorganisms as an "unfortunate possibility" that required multiple biological barriers around the sample at LRL, and moreover would foul up the whole distribution schedule, many heads nodded. It took an acid comment from the back of the room—not, curiously enough, from a biologist—suggesting that the dis-

covery of alien life in the universe might possibly outweigh the inconvenience it would cause, to restore a certain perspective.)

Exciting as the prospect may be, nobody really expects to find life in the moon samples, except perhaps a wandering pollen grain which has managed to sneak past a second rank of biological screens erected to guard the material from terrestrial contamination. During the quarantine period, while biological tests are being carried out, parts of the sample will be used in a battery of preliminary "in-house" examinations at LRL, ranging from determination of its chemical composition and mineralogy to tests for trapped gases, short-lived radioactivities, and magnetic monopoles; in this phase, all personnel at LRL whose experiments require exposure to the sample are also quarantined for the duration. Then, if the material is cleared, and if there's enough of it, samples will be sent to a large number of university and government laboratories for detailed examination. Distribution plans clearly hinge on how much the astronauts are able to bring back. NASA hopes for a return of something like 50 pounds (*earth-pounds*) of surface and near-surface material, but the amount will depend on how easily and quickly the astronauts can work on the lunar surface, carrying out a fairly complex sequence of mapping, photographing, collecting and packaging representative samples of rock and dust from as wide a variety of sites as they can reach, under one-sixth earth-normal gravity and in



thick-handed, stiff-bodied spacesuits.

Studies of the mineralogy, physical properties, elemental and isotopic composition, and biological aspects of the lunar samples now planned for outside laboratories will be comprehensive, to say the least. One hundred and thirty-three scientists representing research laboratories in forty universities and twenty government and industrial research centers in the United States and eight other countries have been named as Principal Investigators in the Lunar Sample Analysis program. Two separate series of experiments on lunar material, both involving mass spectrometry, will—if all goes well—be carried out under this program at the University of Minnesota, one under the direction of V. R. Murthy in the Department of Geology and Geophysics and the other in the Meteorite Laboratory in the School of Physics and Astronomy. Much of the experimental work in both projects will be done in laboratories in the Space Science Center.

The enormous scientific interest in the lunar samples is not something that has been generated by the space program itself. For the most part, it is not due to the dramatic way in which the material will be obtained. Many of the investigators in the Lunar Sample Program have been active in a growing, highly interdisciplinary effort to decipher the origin and evolutionary history of the solar system from fragmentary and uncertain clues in meteorites, in material from the earth's surface, and in observations of physical processes in the present-day solar

system and in stars. The lunar samples could provide a bonanza of new information.

The earth-moon pair is a puzzling curiosity among the planets and satellites of the solar system. The earth is the only inner planet to own a satellite of any consequence, and it's quite a satellite: about 25% as massive as Mercury, it's really close to planetary size. How, and where, did it form? Perhaps both earth and moon condensed at the same time, as a double planet, from primordial matter in the solar nebula. A possible difficulty with this lies in the rather low density of the moon, suggesting that the relative abundance of iron may be lower in the moon than in the earth and implying that both did not form initially from the same batch of material. Another view goes back to Darwin's suggestion that the moon was ejected from the earth through instability induced by tidal resonance. After a long hiatus this idea is popular again (in certain quarters), though now the physical mechanism involves rotational spin-off of material from a partially differentiated primitive earth, followed by accretion of the moon from the orbiting debris. A third possibility is that the moon was a wanderer in the solar system until its eventual capture by the earth. Such a capture is spectacularly improbable, but one can't take this as an intrinsically fatal objection. Harold Urey has pointed out that on the basis of the information we have available now the composition of the moon appears more nearly like that of nonvolatile matter

in the sun than that of the earth, meteorites, and terrestrial planets; if so, this certainly suggests that the origin of the moon may have been well removed, in space and perhaps in time, from the origin of the earth.

The age and chemical composition of the lunar samples should offer powerful clues as to which—if any—of these hypotheses may be correct, if the lunar surface material is representative of the moon as a whole. But that's the rub. Very little of the very early history of the earth is preserved in samples of the terrestrial surface. The interior of the earth is hot and plastic, and material down to great depths is apparently in slow convective motion. The terrestrial surface is undergoing local renewal through volcanic upwelling, so that ages and chemical compositions of crustal material reflect episodes of surface activity and processes of chemical fractionation rather than the primitive state of the planet. In a sense, the earth is alive. In the same sense, the moon may be dead: a quiescent, undifferentiated body, rigid and cool, untroubled by extensive volcanic activity. But this is not certain, by any means. To many people the lunar maria look like gigantic lava flows. Experiments carried out aboard Surveyor spacecraft at sites on the moon gave rough chemical compositions for lunar surface material which are interestingly close to those of terrestrial basalts. On the other hand, the very recent discovery of the so-called lunar mascons—large mass concentrations buried under the circular lunar maria—demonstrates a condition of isostatic disequilibrium of the moon's surface, and leads to the suspicion that its interior must be cool and rigid in order to support the huge submerged masses. Since there's a pronounced lack of unanimity in all these interpretations, it appears that the question of the state of the moon, and the age of the lunar surface, is effectively open, and will remain so at least until the samples are analyzed.

The experiments we are planning in the Meteorite Laboratory for the lunar samples are similar to those we have carried out on many types of meteoritic and terrestrial samples over the past several years. (Since it's by no means impossible that at least some varieties of stone meteorites come from the moon, spalled off in

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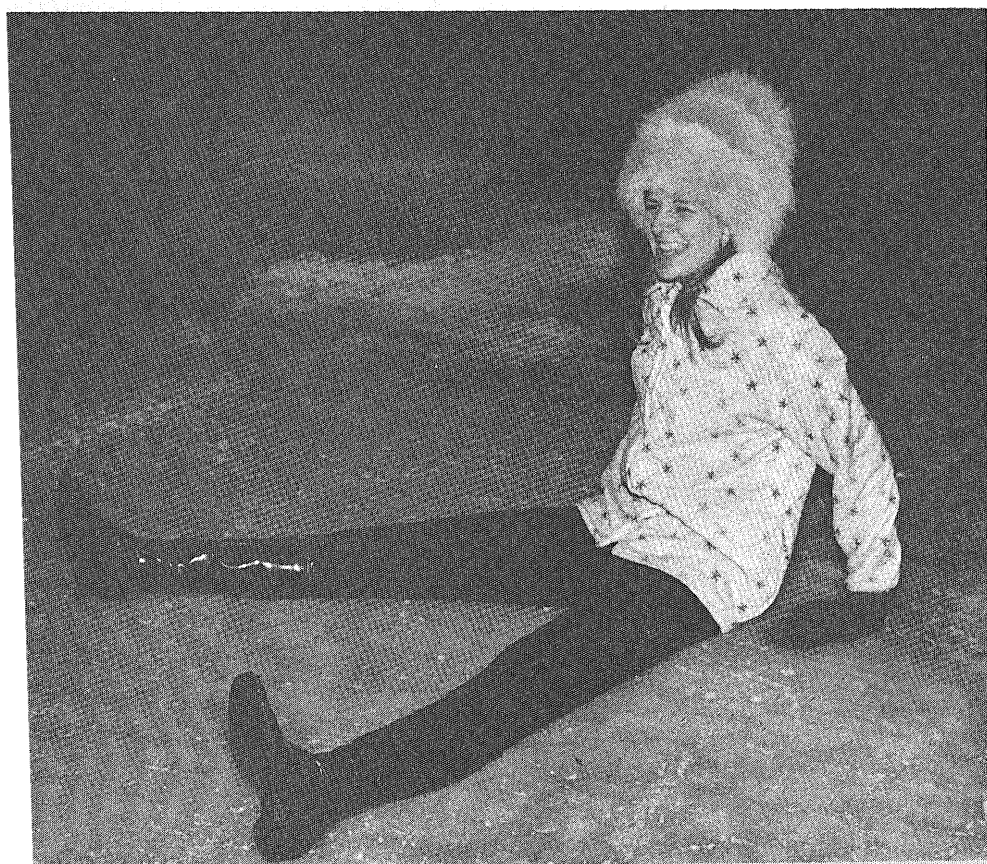
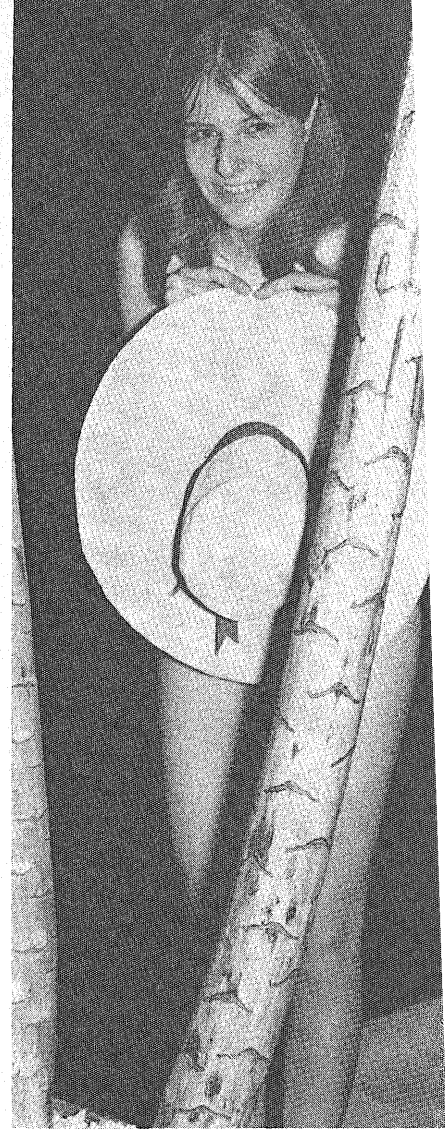
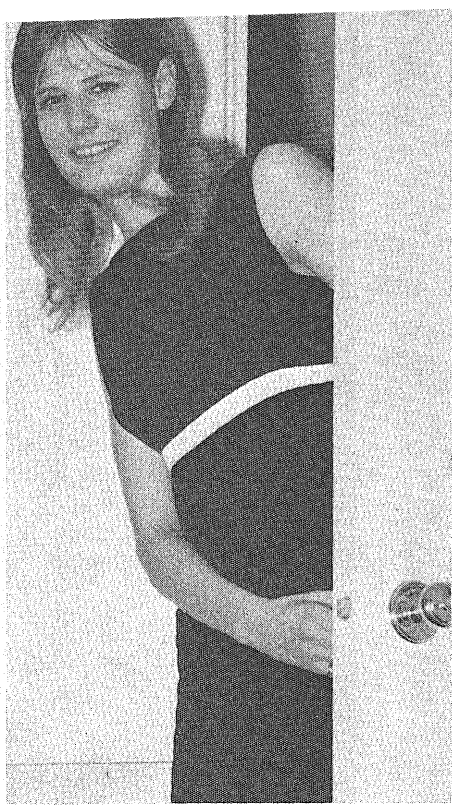
miss january

Jan

Thornsjo



BRING out the whistles, horns and streamers to announce the girl we decided to bring in the New Year with, Jan Thornsjo. Jan is a five-foot eight-inch blond majoring in Art History and minoring in History, but all of her thoughts are not in the past. When she takes time from school, she drives her father's McLaren Chevy. Off the race track, Jan's cultural interests are centered at the Tyrone Guthrie Theater where she works during the companies' season. At home Jan's musical interests include listening to Tchaikovsky and playing both the piano and the organ. Jan also creates and sews her fashionable wardrobe. It is pleasant to start off the New Year with such a photogenic and urbane girl as Miss Thornsjo.



CROSSOVER

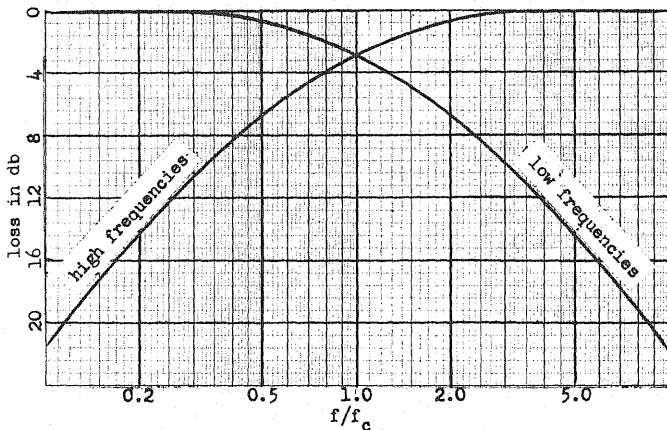


Fig. 5a

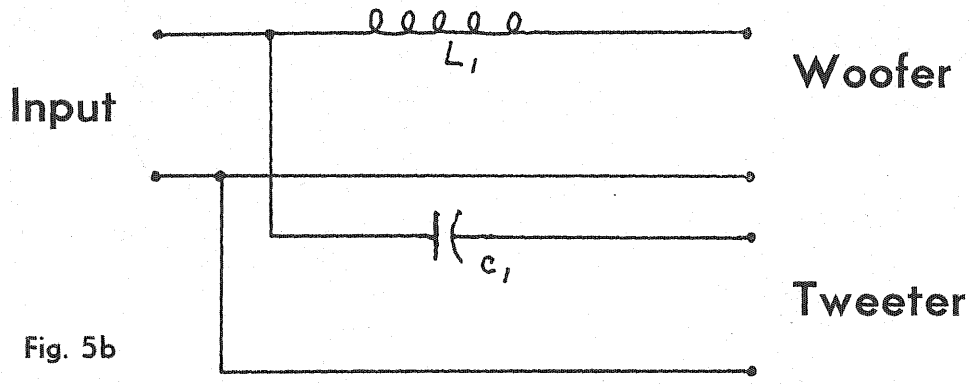


Fig. 5b

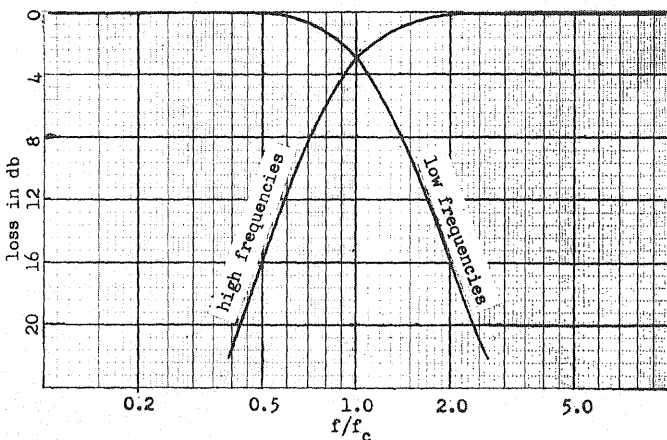


Fig. 6a

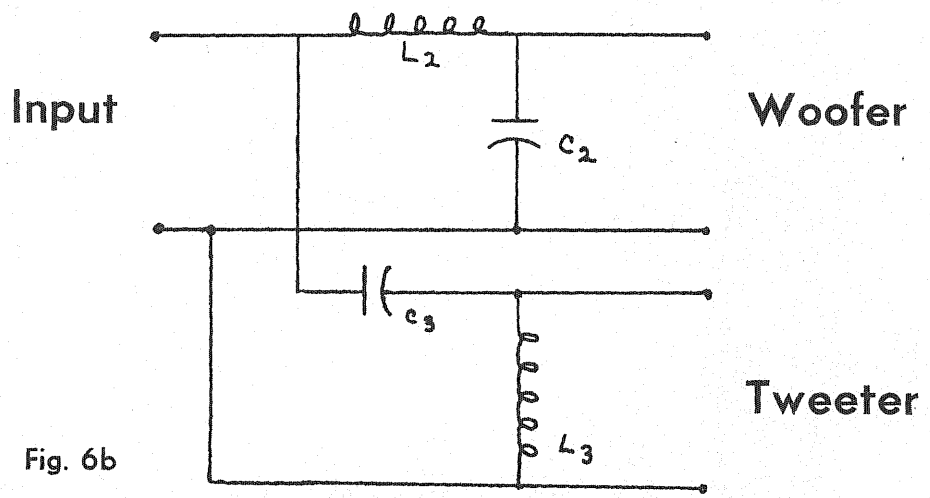


Fig. 6b

The ability of manufacturers to design specialized speakers for limited ranges has brought about the wider range hi-fidelity speaker system. The components of this system, each capable of faithful reproduction in its frequency range, are linked together by a crossover or

dividing network. The crossover serves to direct the audio signal to the speaker which is designed to reproduce it best, while preventing this signal from reaching any of the other speakers. High amplitude low frequency audio, which is necessary to drive the inefficient woofer, can overdrive and ruin an efficient tweeter. Any high frequency audio not delivered to the tweeter is a waste of output power and may cause distortion if radiated by the woofer.

An ideal crossover would permit only those signals above the crossover frequency C_c to reach the tweeter and only those below to drive the woofer. It would offer no attenuation (reduction in volume) or distortion throughout the range of the system. Practical crossovers are composed of inductors and capacitors and do

CIRCUITS

not provide an abrupt crossover frequency. Instead C_f is arbitrarily defined as the frequency where the high and low frequency response is down to half power or a drop of 3 db. Above and below the C_f the low and high frequency response will continue to drop respectively with greater deviations from the C_f . The drop or attenuation is determined by the crossover design. A basic crossover (Fig. 5) will produce a 6 db/octave attenuation slope, while the more complex circuit (Fig. 6) will produce a sharper 12 db/octave attenuation. Since these crossovers will cause some overlap of the signals near C_f , both the tweeter and woofer may be producing the same signal causing interference.

If the crossover frequency is selected at 500 Hz, it will divide orchestral music evenly between tweeter and woofer. Practical considerations sometimes require a change in this preferred frequency. It is desirable in home systems to mount the tweeter coaxially with the woofer to save space and avoid spacial separation of sounds. This greatly limits the size of the tweeter and the C_f must be raised to as high as 1.5 K Hz to 3 K Hz.

In Figure 5 any high frequencies present at the input will find difficulty traveling through the inductor, L_1 . They will be conducted along the path of least resistance through the capacitor C_1 to the tweeter. Low frequency signals at the input will find great resistance to their flow at C_1 and will travel the path of least opposition through L_1 to the woofer.

The voltage induced across L_1 is proportional to the time rate of change of the current passing through it, which increases with frequency. As the input frequency is increased, a greater portion of the total input signal voltage appears across the inductor and less goes to the woofer. The current passing through a capacitor is proportional to the time rate of change of the voltage across it. As the frequency increases, the time rate of the voltage change also increases. The capacitor will transmit more current at higher frequencies, thus passing more signal to the tweeter.

The more complex crossover (Figure 6) requires more elements but gives a sharper attenuation slope. High frequency signals see a great resistance at L_2 and any signals which are passed are shorted away from the woofer by C_2 . They readily pass through C_3 , find great opposition at L_3 , and thus pass to the tweeter. Low frequency signals find great opposition to passing through C_3 , any that are passed are shorted away from the tweeter by L_3 . These signals easily pass through L_2 , find great opposition at C_2 and drive the woofer.

Examples have been given using a crossover with woofer and tweeter. More complex units will select only the center of the audio band to drive a midrange speaker, while leaving the woofer and tweeter to reproduce the extremes. □

Hi-Fi Speakers (Cont.)

The simplest and most direct way of solving this problem is to mount the speaker in the center of a large rectangular (ideally circular) board. This forces the back radiation from the cone to travel a longer path to reach the front side and thus become in phase with the front radiations. The larger the board used, the lower the cutoff frequency, or the frequency at which cancellation begins to occur. If the rear radiation is to be brought completely in phase the total distance which the back radiation must travel before meeting the front radiation must be $\lambda/2$ or an even multiple of $\lambda/2$. From the formula

$$\lambda = V/F$$

Where,

λ = wave length in feet

V = velocity of sound in feet (about 1140 ft./sec.)

F = frequency of sound in cycles per sec. (Hz)

one can calculate that for a low frequency cutoff of 30 Hz a baffle board 38 feet square would be needed. As one can see the dimensions of this solution are very impractical if you want to attain very low frequencies.

The next approximate solution to the problem of increasing the ability of the speaker to produce the low frequencies efficiently is to completely separate the rear radiation from the front radiation. Although this doesn't add any acoustical power to the radiation from the front of the cone, it doesn't subtract any either. The infinite baffle as this solution is called is accomplished by placing the speaker directly in the wall of a room, and in this manner the out of phase radiations never meet. The effect gained by putting the speaker in a closed box (closed except for the speaker opening) is the same as mounting the speaker in a wall. If the speakers are mounted in an enclosed box, the minimum box volume should be about 15 to 20 cubic feet. In enclosures smaller than this the work done by the cone compressing and rarefying the trapped air in the box becomes appreciable. In large enclosures the volume acts as a capacitance which "stores" some of the energy but this energy is continually being absorbed by the great quantities of sound deadening materials such as fiberglass in the enclosure. This trapped air, acting like a spring, resists large excursions of the cone and when this impedance is added to the mechanical compliance (spring action) designed into the support structure for the voice coil, the cutoff frequency of the speaker raises, sometimes as much as an octave. Many of the bookshelf systems on the market today are of this acoustically loaded, i.e., (the trapped air acts like a spring) type however, the speaker cones and voice coil are designed with a loose mechanical suspension so that when they are placed inside the closed cabinet the spring effect of the air brings the compliance up to a normal level. The chief advantages of the acoustically loaded speaker is a good base response considering the size of the cabinet, and somewhat less distortion due to the more linear compliance of the air which makes up part of the total compliance of the cone. Among the disadvantages of

this type of system are the facts that the voice coil is difficult to keep centered in the voice gap because of the weak mechanical suspension, and secondly because in general it is a very inefficient system.

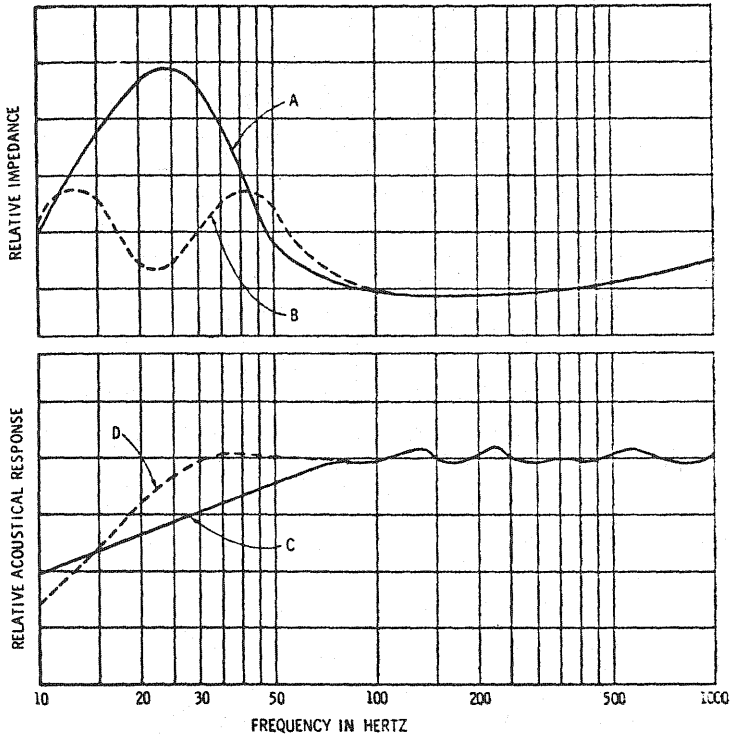

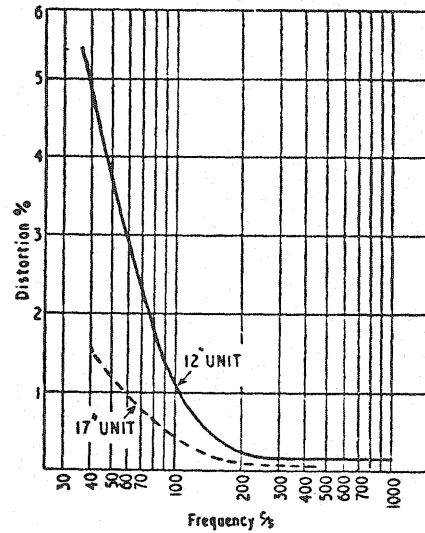


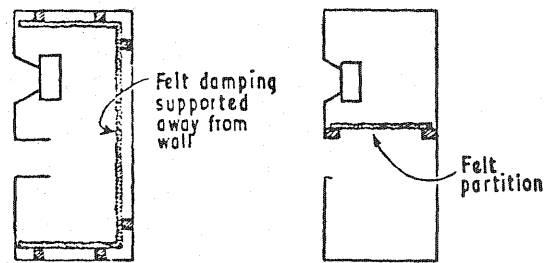
Fig. 4 Efficiency is proportional to relative impedance.

The optimum solution to the problem of increasing the efficiency in the low frequency range would be if it were possible to invert the radiations from the back of the cone and add them to the radiations from the front of the cone. In a base-reflex or phase inversion enclosure this is what is attempted. The physics of this type of enclosure is relatively simple. An extra port is put in the enclosure. The area of this port should be approximately equal to the area of the speaker cone. What happens is the air in the port is connected to the back of the speaker cone by the volume of air in the enclosure. This volume of air acts like a spring and in the process of transmitting a pulse to the port, this "spring" has the effect of delaying the transfer of the cone movement to the volume of air trapped in the port area. This time delay brings the two radiations (one from the cone and one from the port) into an in-phase condition. A specified time delay can be achieved by adding a specified amount of acoustical resistance in the form of damping material. The amount of material which is put in the enclosure is determined by empirical means. Because of the absorbing material put in the enclosure, the efficiency of the speaker is not quite doubled. (See Fig. 4). Therefore, the use of this type of enclosure is the most practical for component systems in home use. 

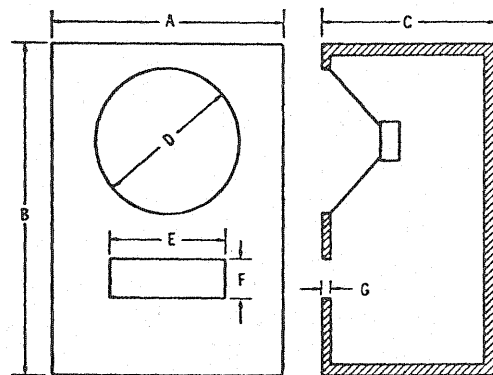
more . . .



A typical distortion curve for good quality speakers.



Damping material in the enclosure decreases resonate peaks, and adds acoustical resistance to the path of sound waves.



In the design of ported enclosures the area $\Pi(\frac{D}{2})^2$ should be equal to area E.F. Also, any one dimension of the enclosure, should not be less than $\frac{1}{3}$ of any other dimension.

LUNAR SAMPLING

(continued from page 37)

collisions of iron meteorites—or perhaps comets—with the lunar surface, it's amusing to speculate that we may already have analyzed lunar surface samples, neatly and inexpensively delivered, without knowing it.) The work will primarily involve study of the elemental and isotopic abundances of the rare gases helium, neon, argon, krypton and xenon in the samples by mass spectrometry. These gases occur in extremely low abundances in meteoritic and terrestrial materials—and almost certainly in lunar material as well. For this reason they are very sensitive indicators for physical or nuclear processes which tend to alter these abundances, such as diffusive mass-fractionation, nuclear fission, and decay of certain radionuclides, and spallation and capture reactions produced by particle bombardment. There are a number of ways in which rare gas data may yield clues to the history of the lunar samples. Four long-lived radionuclides (K^{40} , Th^{232} , U^{235} and U^{238}) produce rare gases in decaying; measurements of radiogenic Ar^{40} and He^4 abundances in the samples, combined with K, Th, and U measurements by other investigators, will give us the K-Ar and U,Th-He gas retention ages of the material. These ages are primary data in examining the question of concordant and co-genetic origins of the earth, moon, and meteorites. In addition, two other radionuclides, I^{129} and Pu^{244} , both short-lived and now extinct in nature, decay wholly or in part to isotopes of xenon. Daughter isotopes of these nuclides have been detected in meteorites: excess Xe^{129} , from the decay of I^{129} , and fission xenon, probably from the spontaneous fission of Pu^{244} . From abundances of these daughter products it's been possible to establish, at least roughly, a time-scale of about 50 to 200 million years for the evolution of the primitive solar system from the gravitational collapse of the dust and gas cloud from which the solar system formed to the formation of large solid bodies in the solar nebula. It's clear that the extinct radioactivity chronology of the lunar

samples will be illuminating. If the moon formed at about the same time as the meteorites, then evidence for this should exist as characteristic excesses of Xe^{129} and fission xenon; but if it had a significantly later origin, as might have been the case if it formed from material which separated from the earth, the abundances of these radiogenic xenon isotopes will be sharply reduced.

Of all the rare gas distributions found in meteorites, perhaps the most challenging to interpret are the primordial gases, which seem to be modified residues of the rare gases present in the solar nebula very clearly in the history of the solar system. Primordial xenon (the heaviest and rarest of the gases) in stone meteorites is consistently and significantly different in isotopic composition from xenon in the terrestrial atmosphere; recent evidence indicates that this is also true for krypton. The reason is not understood, except that a strong mass fractionation of either terrestrial or meteoritic xenon is clearly involved. However, in the context of the lunar samples, an isotopic composition of lunar xenon similar to either the terrestrial or meteoritic pattern would suggest a basic moon-earth or moon-meteorite relationship.

Study of the lunar samples may be very profitable in ways which may not bear directly on the primitive history of the moon. About thirty meteorites contain rare gases which apparently have been implanted directly into mineral grains by an ancient solar wind irradiation. Dust on the lunar surface, open to direct solar wind bombardment because of the virtual absence of a lunar atmosphere and magnetosphere, should contain large amounts of solar-wind gases on exposed surfaces. The distribution and composition of the rare gases in these samples would provide a direct check on the theory of solar wind implantation in meteoritic material, as well as the first direct measurement of elemental abundances in the solar wind for elements heavier than helium and perhaps an answer to the key question

of whether the wind is mass-fractionated in its expansion outward from the solar corona.

All in all, the lunar samples are an exciting prospect, especially if the moon's surface does turn out to be primitive and a readable record of its history is impressed in their structure and composition. There was a comment from Apollo 8 that the moon's surface looked like dirty gray beach sand, with footprints. Mission control replied that they were mainly concerned with the footprints. So are we. □

APOLLO

(continued from page 34)

moon project involved development beyond just going to the moon, it would be different. We are obsessed with getting a man on the moon."

In spite of the critics, the program is moving on, and as Professor Stolarik said, it would be foolish to cut off the program now when we are so close to the end. A man who is directly involved with Apollo is Walter N. Lundahl, director of Apollo operations for Honeywell. Honeywell has done much of the electronic work for the Apollo ship, and Lundahl is very much aware of the criticisms of the program.

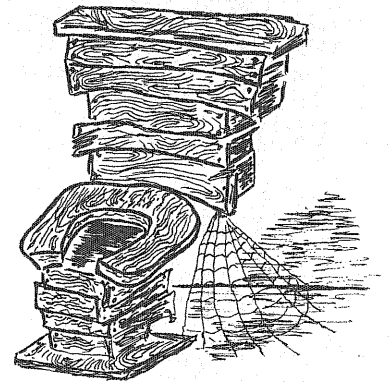
The topic is controversial since there are so many things on earth that need expenditures. But Lundahl says the program is not a waste, unless talking in monetary investment returns. \$22 billion was invested in Apollo, but we will not get \$22 billion plus in return. The investment, he says, must be measured in terms of scientific and social worth.

Man has an insatiable curiosity, Lundahl says, to find out more about his environment. This curiosity does not restrict man to learning about the forests or the sea, but extends all space to us.

In answering the criticisms of crash planning and spending, Lundahl says the effort, for being so massive, was carefully planned and managed. At the conception of the program in 1961, everyone thought the timetables were too optimistic, but through planning and management, we're going to make the grade. □

splinters from the log

by Paddy Hooligan



—vilitas et crudus semper eternam

If by chance any of the readers feel that the quality of the joke is not as high (or, possibly, as low) as you would like, I, Paddy Hooligan, Commander in Chief of the E-Day Commandos and Supreme Potentate of I.T., do hereby challenge you to submit a joke of the quality you feel is necessary to the TECHNOLOG office or Rm. 31 E.E. from where they will be collected regularly.

A Little Rock society matron broke out with a patriotic rash recently, and decided she should do something for the poor soldiers at the nearby camp in return for the sacrifice they were making for their country. She called the Post Adjutant.

"Hello, this is Mrs. Gottrox. I feel that I should be doing something for our dear soldiers, so I am having a dinner party tomorrow night at seven. I wonder if you'd send four of the dear fellows to attend? We'd simply love to have them."

"Yes," said the Adjutant. "I think we can arrange that. Any particular age or kind of boy you'd like to entertain?"

"No," replied Mrs. Gottrox. "No particular requirements, except please do make sure they're real nice boys." And then as an afterthought—"and be sure they're not Jewish."

"Fine," said the Adjutant. "The boys will be at your home promptly at seven tomorrow evening."

And promptly at seven there came a knock on the door. Mrs. Gottrox, herself, answered the door, and there on the porch stood four big, strapping Negroes, polished until their ebony elbows fairly shown.

"Is you Mrs. Gottrox?" asked one.

"Yes, and what did you wish, please?"

"Well, we is the sojers you asked to come and eat wif you tonight."

"Oh, there must be some mistake!"

"No, Mam. I am shore dey ain't no mistake. Lieutenant Goldberg jes don't make no mistakes, Mrs. Gottrox."

"I just got a bottle of scotch for my wife."

"Well, that sounds like a fair swap."

Professor: Students, what is an engineer?

Student: A person who passes as an exacting expert on the basis of being able to turn out with prolific fortitude innate string of incomprehensible formulae calculated with micromatic precision from vague assumptions which are based on debatable figures taken from inconclusive experiments of problematical accuracy by persons of doubtful reliability and questionable mentality for the avowed purpose of annoying and confounding a hopeless commercial group of fanatics referred to all too frequently as ENGINEERS.

An item picked up in an engineering economics class: A girl without principle can draw considerable interest.

A boy of ten walked into a bar and sat down at a table. A young barmaid walked over and asked him what he wanted.

"Give me a shot of whisky!" he ordered.

"Do you want to get me in trouble?" she asked.

"Maybe later, right now all I want is a shot of whisky."

Coed: "Don't you dare kiss me again. Why I hardly know you."

EE: "I won't. I'm just trying to find out who has the gin at this party."

Think of all the parents 20 years ago who had their daughters vaccinated where they thought it would not show.

A E.E., after looking over a selection of thermometers, told the clerk, "I'll take this Fahrenheit one. I know that's a good brand."



Biomedical Engineering

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The Forester took a blind date to the amusement park. They went for a ride on the ferris wheel, but after the ride she seemed rather bored.

"What would you like to do next?" he asked.

"I wanna be weighed," she said.

So the Forester took her over to the weight guesser.

"112," said the man at the scale. He was absolutely right.

Next they rode the roller coaster. After that he bought her some popcorn and cotton candy, then he asked her what else she'd like to do.

"I wanna be weighed," she said.

"I really latched onto a square one tonight," thought the young Forester, and using the excuse that he had developed a headache, he took the girl home.

The girl's mother was surprised to see her home so early, and asked, "What's wrong, dear, didn't you have a nice time?"

"Wousy," replied the girl.

• • •

Aero: "How come you know so many women?"

Chem. E.: "I used to be a purse snatcher."

The High School of Science in the Bronx has a cheer that goes:
E to the X to the X to the X
E to the X to the X

Sine, cosine, cosine, sine
Three point one four one five nine
Log, exponent, square root, pi
Science, Science, Science High !!!

• • •

An optimist is an Engineer who hurries because he thinks his date is waiting for him.

• • •

The right angle to approach a problem is the TRY angle.

• • •

Modesty has ruined more kidneys than bad liquor.



Mary was in a bar having a beer when a friend from England walked in.

"Aye say, Mary, are you 'aving one?"

"No, it's just the cut of my coat."

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M.E.: "Is that girl's dress torn, or am I seeing things?"

Arch.: "Both"

The dear Vicar's wife had just died and, wishing to be relieved of his duties for the weekend, he sent the following message to his bishop:

"I regret to inform you that my wife has just died; I should be obliged if you could send me a substitute for the weekend."

A Kansas revival service was being held, according to authentic reports, and one of the partners in a coal concern had joined the Church. He tried to get his partner to do likewise. "I can't do it, John," replied the partner. And when the insistence became irksome, he added, "Who'll do the weighin' if I join?"

First Bride: "Does your husband snore in his sleep?"

Second Bride: "I don't know yet; we've only been married three days."

Then there was the Sophomore Math student who handed his program to the computer operator and asked her what the chances were of running a quickie through.

Several engineers who were spending the summer in a nudist colony were giving the eye to a shapely new entrant. A C.E. turned to his friend and said, "Saaayyy! I bet she'd look great in a sweater."

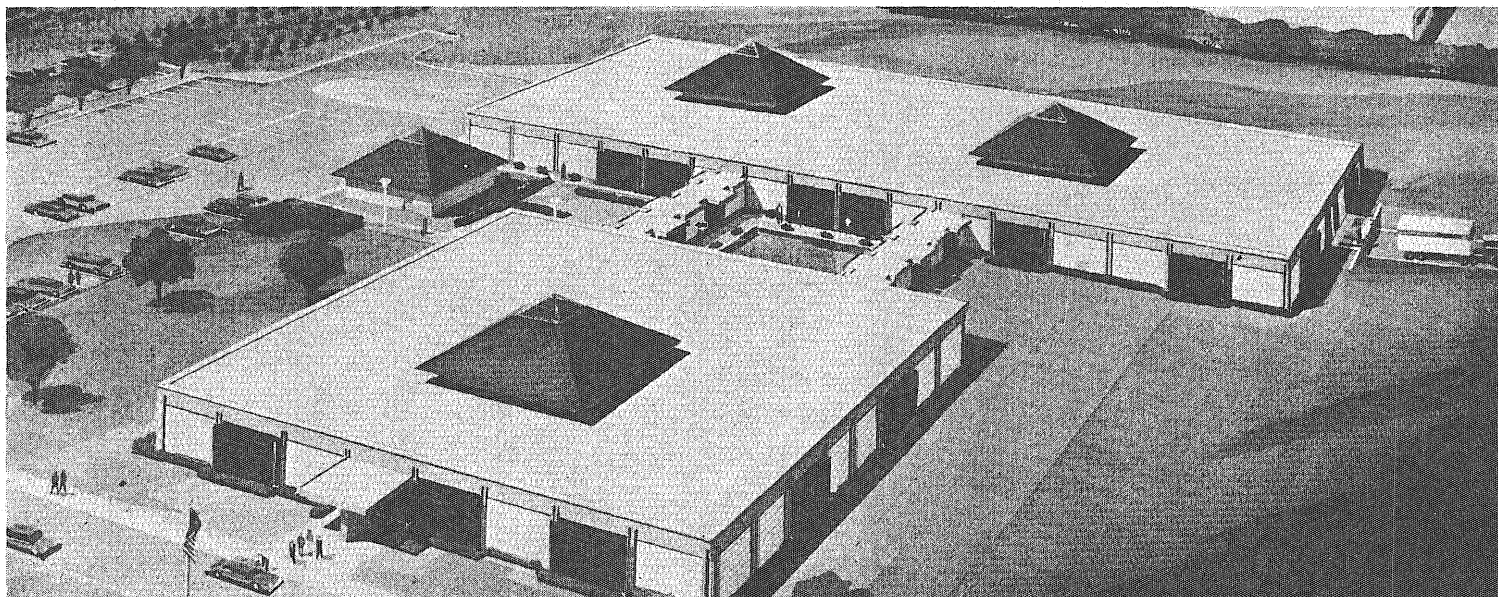
Two Physics Professors had been working all day making long calculations with their slide rules when a smart alec student came in and asked, "What's two times two?" So one Prof. took his slide rule, set it up, and started to read off the answer, "Three point nine, nine—oh hell, call it four."

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- B) Don't sign anything.
- C) Don't volunteer for anything.
- D) Vote NO
- E) Leave as soon as possible.

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Three tourists were standing on a street corner in North Africa. They were an Arabian, an Englishman, and an American. Just then a beautiful woman walked by. The Englishman said, "By jove!" The Arabian said, "By the prophet!" The American just shifted his chewing gum and said, "By midnight!"

• • •

One of the girls we know is like a coffee bean; she can be made instantly, but prefers the regular grind.

• • •

Then there was the Indian Chief who installed electric lights in the tribal latrine, thus becoming the first Indian to wire a head for a reservation.

• • •

The brush salesman was talking: "I'll never forget the time this woman opened the door in her negligee . . . which was kind of an odd place to have a door."

• • •

Unzipped mail is immoral.

I never met a nympho I didn't love.

• • •

A Chicago salesman on a business trip to Boston had a few hours to kill before catching a plane home. Remembering an old friend's advice to try some broiled scrod, a favorite fish in Boston, he hopped into a cab and asked the driver: "Say, do you know where I could get scrod around here?"

"Pal," replied the cabby, "I've heard that question a thousand times, but this is the first time in the pluperfect subjunctive."

• • •

Would you boys like to play house with us?" asked the bravest of several little girls.

"Sure," replied one lad. "Which one of you is going to be the madam?"

• • •

The sorority girl ran into the house yelling, "I've been raped; I've been raped!" The house mother calmly told her to go into the kitchen and eat a whole lemon. "Why," asked the girl. "Will that make it better?" And the house mother said, "No, but at least it will take that smirk off your face."

Half of these jokes I've seen before, and the other half I don't see yet.

PLH

• • •

He asked for burning kisses.
She replied in accent cruel!
"I may be a red hot mama,
But I ain't nobody's fuel!"

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Population, people, man,
 Trash, ash, carton, can.
 Wheels, gears, rubber, smoke,
 sack nature, go for broke.
 Tear, cut, bulldoze, rip,
 Slash, clear, butcher, strip.
 Pave, smother, cover over,
 Blacktop, concrete, puzzle rover.
 The earth becomes a porcupine,
 Its quills of steel and plastic shine.
 Someday . . . someone . . . shall never
 see
 A thing as lovely as a tree.

When a man sits with a pretty girl
 for an hour, it seems like a minute.
 But let him sit on a hot stove for a
 minute—and it's longer than an hour.
 —Albert Einstein



Did you hear about the toast to the
 German Virgin: "Guzintitel!"

Then there was the engineer who
 called his girl a discontinuous integral
 because she had no limit.

DOES PROVIDING WATER FOR MANKIND'S USE REQUIRE ENGINEERS?

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 2000, the world's demand for water will
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 available as fresh water on land and in
 the air. All the rest (99.35%) is either
 frozen or salty which means it's un-
 usable in present form.

Here's why engineers are needed: To
 keep the 0.65% clean, pollution control
 systems and treatment facilities are
 required; more economical desalination
 systems must be developed; better ways
 must be found to transport fresh water
 to thirsty people; new methods of irriga-
 tion are needed so desert lands can
 produce food for expanding population.

These are engineering challenges, these
 are the reasons why engineers are needed
 - engineers of every discipline.

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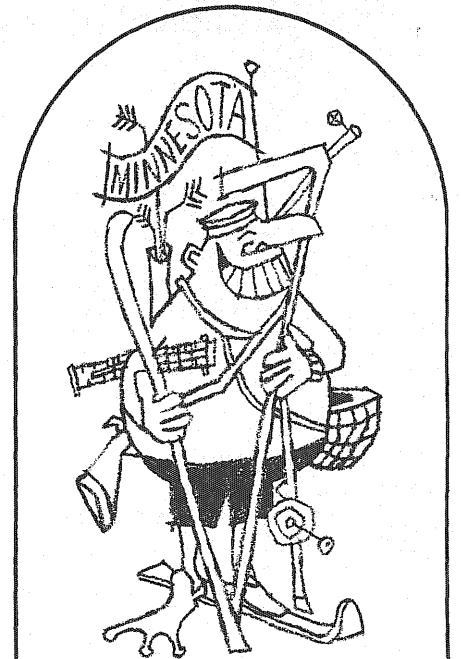
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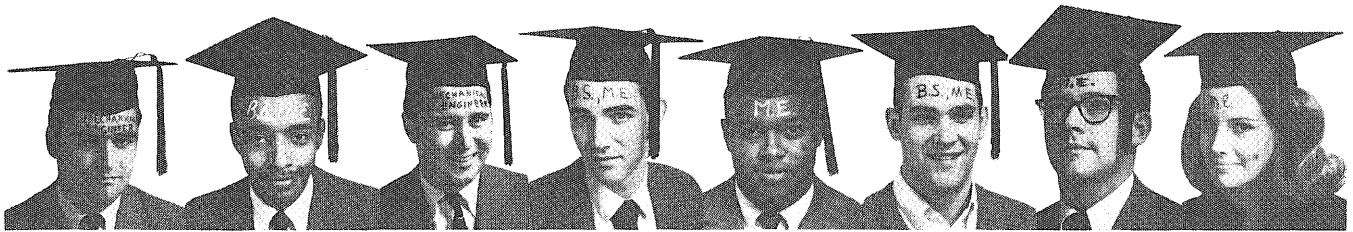
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In general, however, the label does not guarantee a uniform product. That's good.

It is worn by some who have never dipped below the five percentile academically, who enjoyed doing a paper on the psychodynamic roots of Buddhist theology almost as much as they enjoyed constructing five different thermodynamic models of the pulsar phenomenon. That kind of mind can find comparable fulfillment in some problems ultimately in-

volving our photographic systems, plastics, or fibers. Hard to believe but true.

The label is also worn by some who had to struggle for it because their minds don't work the way a professor's mind works. They are not unhorsed, however, to learn that sometimes a remark passed casually in a washroom can accomplish more than a 117-page technical report with 50 references in the bibliography.

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With a mechanical engineering degree from Cornell, in 1962, and an MBA in personnel administration from George Washington, in 1963, Bob sought to plunge

directly into meaningful work. He'd had enough theory and simulations to last him for awhile.

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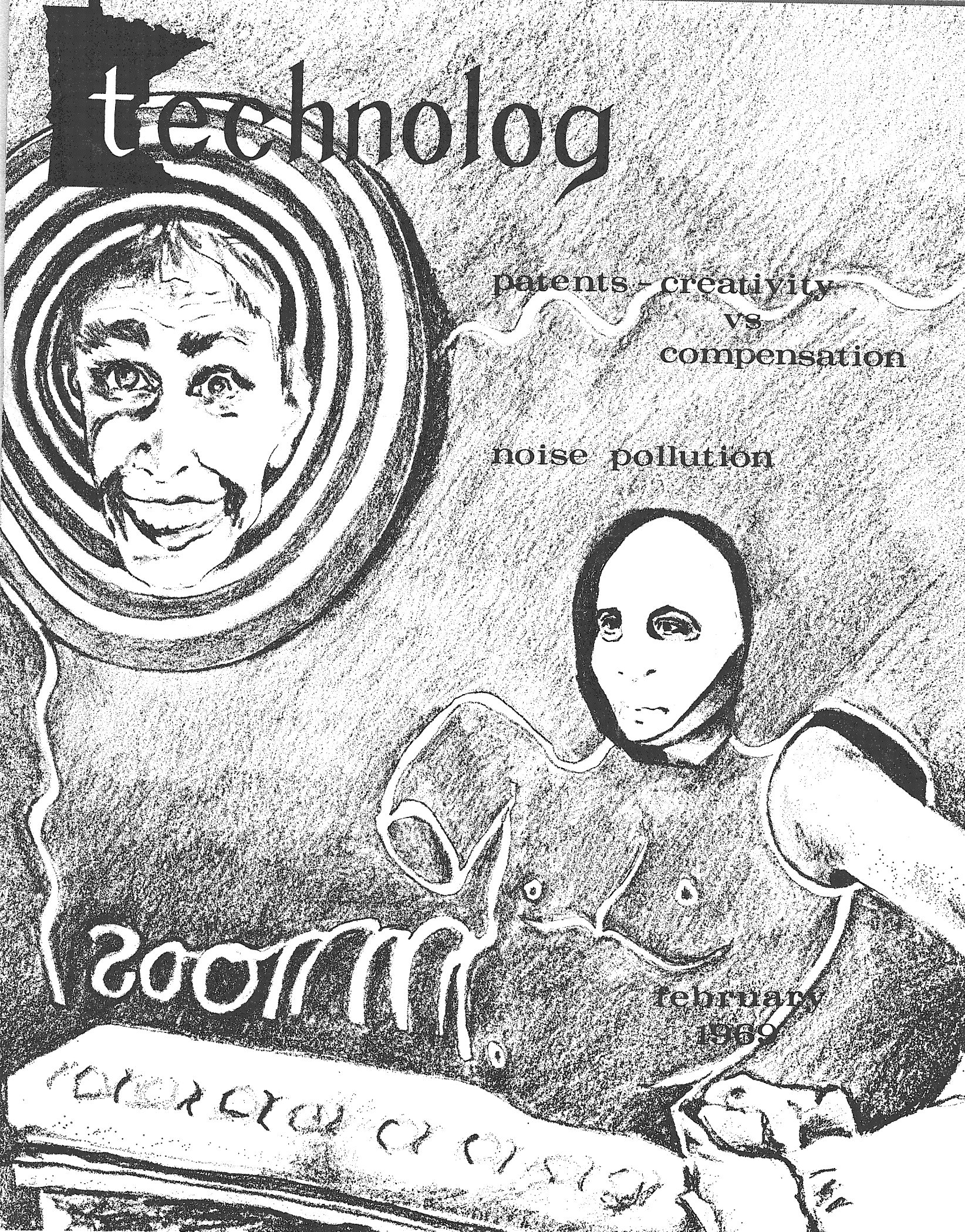
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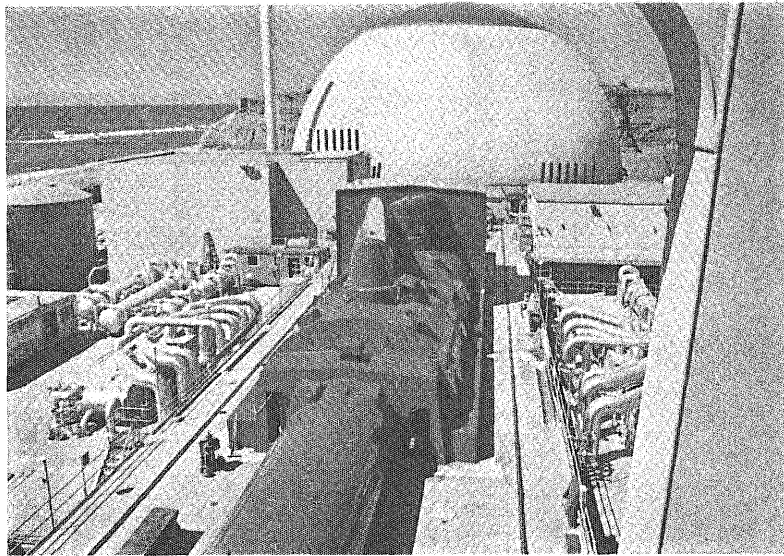


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1969

ugly art – ugly issues, see p. 8

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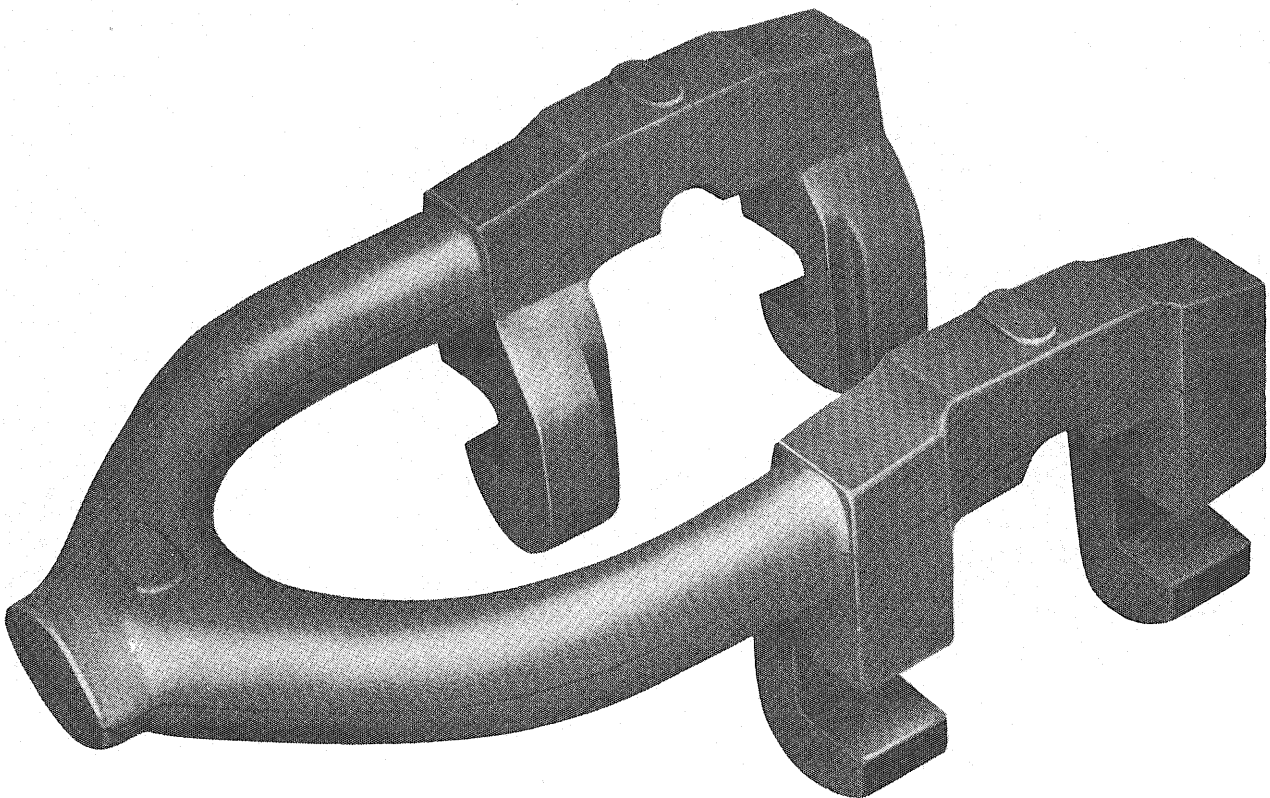
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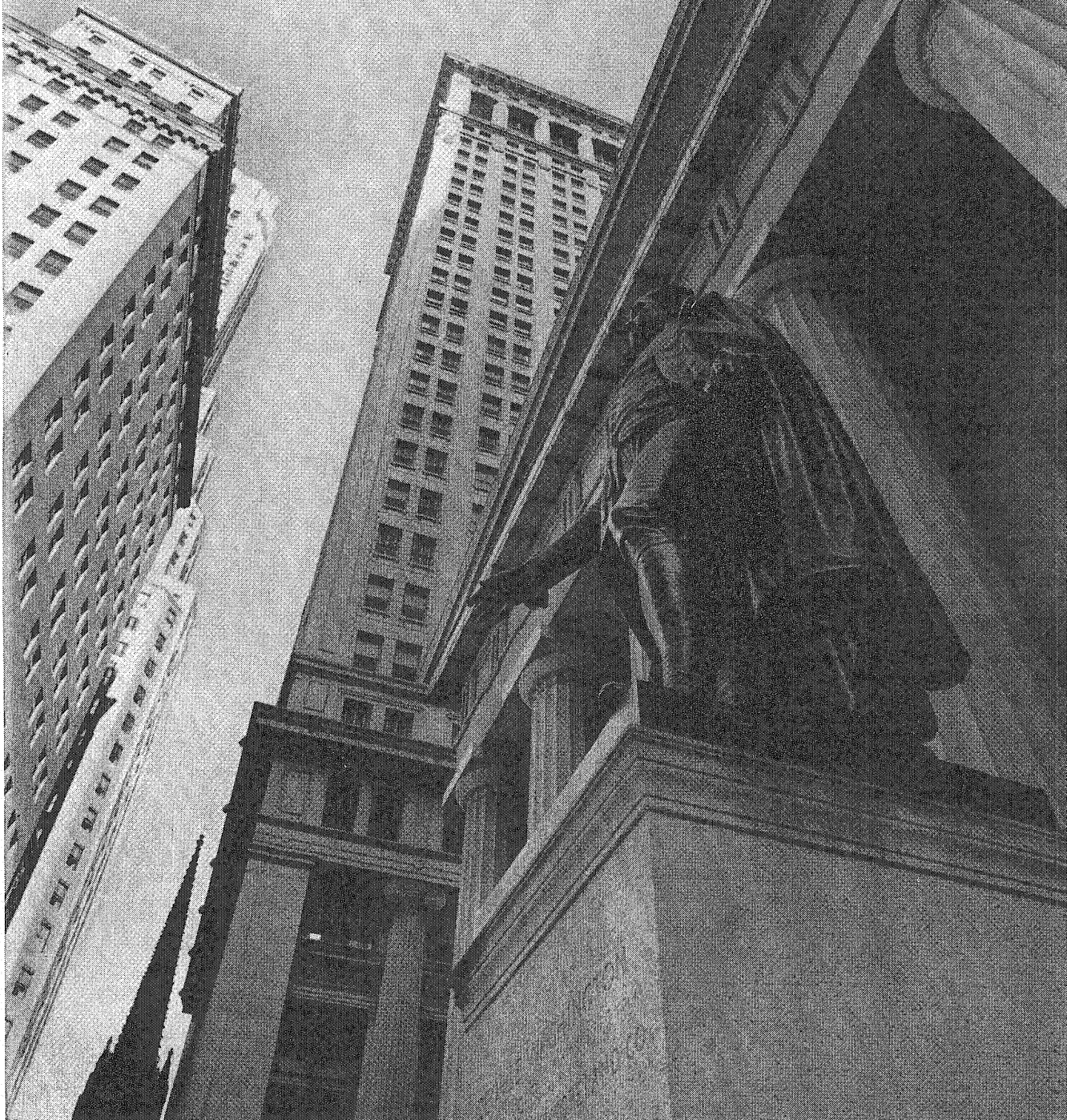
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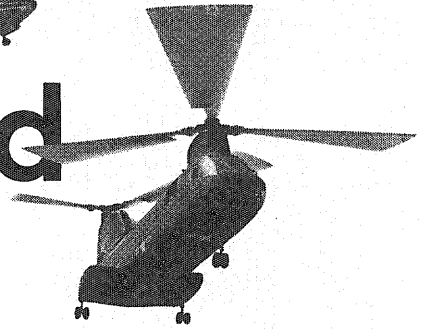
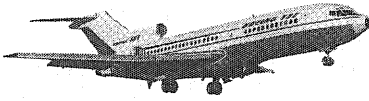
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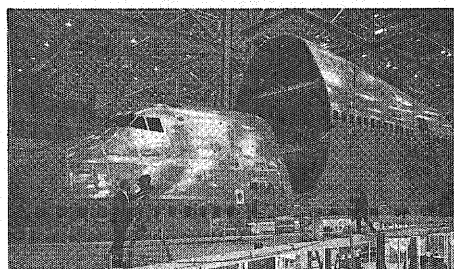
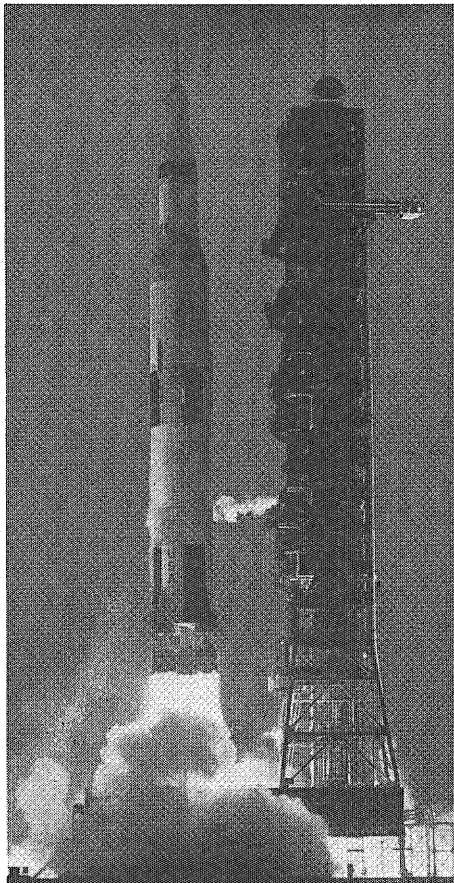
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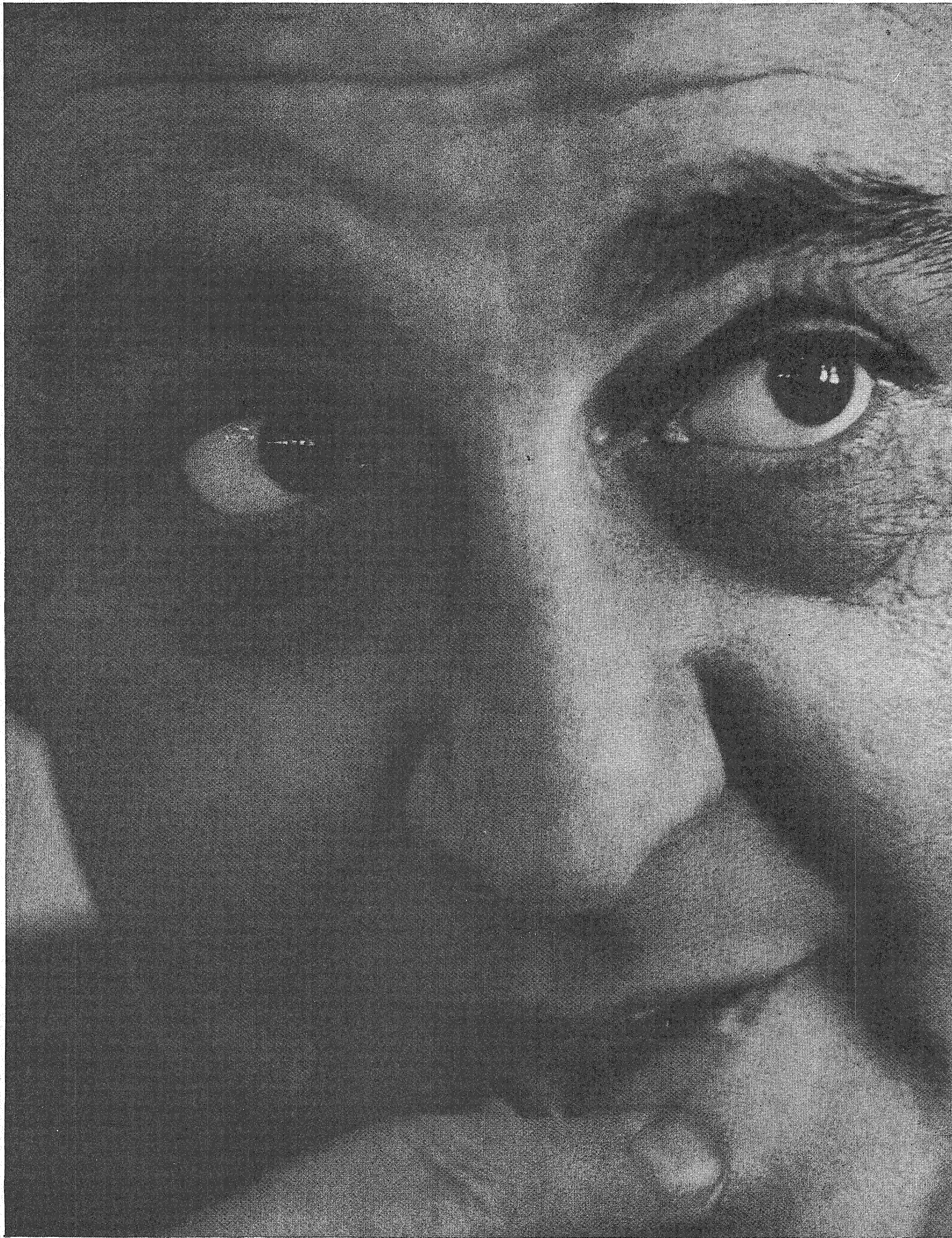
COVER: Student disturbances at Morrill Hall are the subject of this month's cover. Further explanation on page 8. Art work by Cheri Grotewold.


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“Tell me something won't work and you've made my day..”

Cordovi, Marcel. Educated Prague, Ann Arbor, Pittsburgh, Brooklyn. Authority on materials for high temperature, nuclear and corrosive environments. VIP in market development for International Nickel.

“I mind everyone's business. Say you're building a condenser for a power plant. I want to know what metals you're considering. No! I don't think you want to use that one. Our tests show it won't stand up to those conditions. And experience tells us that the long-term economics aren't right for you either. Now, how about these?”

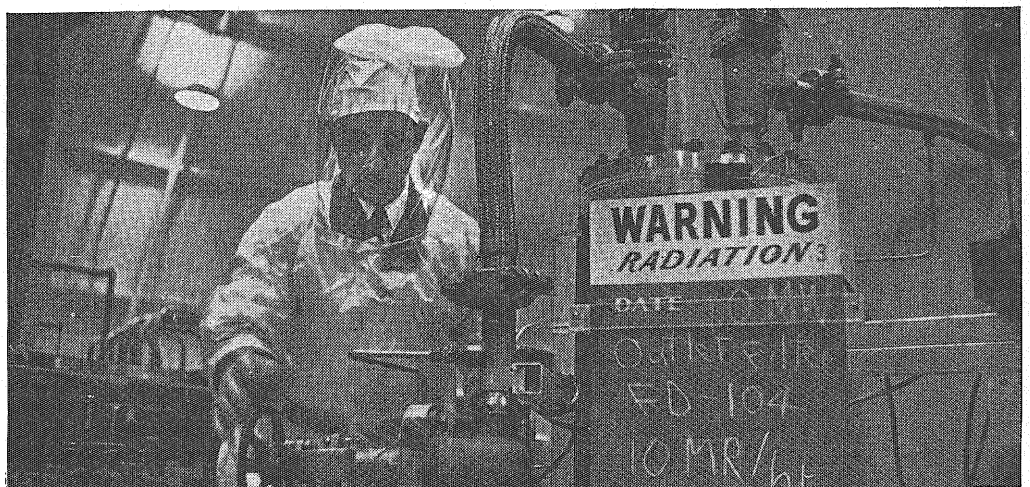
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Cordovi on an inspection tour of a nuclear reactor at Brookhaven National Laboratory. He spent 10 years there as a consultant on materials for various nuclear projects.

Photography by
Ted Russell.

Log Line

FEBRUARY is National Love Month. It is also the shortest, coldest month of the year. We cannot explain this apparent paradox, but perhaps if everyone would make an effort to extend "faith, hope, and charity" to his neighbor the latent heat of friendliness might warm your body.

Besides bringing St. Valentines Day, February has also brought another issue of the *Technolog*. In introducing this month's issue, a cover explanation is required. In the true engineering tradition of "Let's try something new" we have come up with something different. The shocking ugliness is an editorial comment on last month's racial disturbance on campus. President Moos, the joker in the upper corner is the target of attack by black power wearing a white mask. And that sirs, is your ratio of art culture for the month.

Inside this issue we present, along with the regular features, a problem facing all engineers both present and future, that of patent rights and patent agreements. Do you have the right to design and patent an invention that is totally unrelated to your employers product line? After you sign the "employee agreement" you probably won't have any "rights" to speak of. See "Patents—Creativity vs. Compensation" (page 14) for further information.

"Noise Pollution" (page 30) poses some problems and solutions in a field of engineering which is commonly overlooked. Even though the field of acoustical engineering is rather young, the acoustical engineer will soon be playing an important role in the design of modern equipment, housing, and transportation. The acoustical research facilities at Minnesota Mining and Manufacturing were recently inspected by a *Technolog* reporter. We wish to thank Mr. Henry Knoll, the chief engineer at the re-

search facility who discussed the field of acoustical engineering and some of the problems which he and his staff have been working on.

And in the true spirit of *Robert's Rules of Order* we shall soon adjourn this introduction. But first we would like to bring to your attention the fact that the editors and staff of the *Technolog* always welcome any comments or criticisms which any student or faculty member might have. If you don't have the time to write us a letter, stop by and see us. It's rather difficult to give you what you want, if you don't tell us. Meeting adjourned.

Reaction

And the white establishment reeled back in wonder at the audacity of these young upstarts. "How dare they take over a public building and demand something of me in return for its return. I pay taxes, and my father pays taxes and besides that I'm in the majority and I have rights too. Furthermore, no one was bothering them, we show no racial prejudice to speak of here in the north, and besides, these people are here to go to school, not cause trouble." If your reactions were similar to these, don't feel bad, you have a lot of company. But you should stop and think. Force yourself to look at the other side of the picture, and try to analyze what has happened. At time t_0 , three requests were made to the University by a certain group of people. These requests were ignored and pushed aside by more important business. At time t_1 the alienated group captured a building and held it in ransom for the granting of their original three requests. At time t_{1+24} hours the University ok's the requests but later finds out more money has been wasted in repair costs to the building than was granted for the

partial funding of a Black conference.

My comment on this sad state of affairs is this. If the requests were valid and justifiable, why weren't they granted when they were first presented? President Moos and his learned advisors surely had their heads in the sand if they figured that they could ignore the black minority. If the requests were unreasonable they should not have been ignored, but rather negotiated. The time for negotiation is not when the opposing side has you over a barrel, as the administration has well found out. By their blundering incompetence they cost the taxpayer \$7,000. However, the administration is not the only party which made mistakes.

Among the mistakes which I believe that the AAAC made is the fact that they allowed the destruction of property in their campaign. Perhaps, as the AAAC claims, the destruction of property was caused by the other militant social groups barricaded in the building. However, the AAAC was responsible for everything which happened in that building. It was not necessary to shift furniture around in order that doors could be barricaded. They had no chance of holding out against a militant reaction from the administration. Also, by showing disrespect for public property they antagonized many people who held "middle of the road" philosophys. These people under different circumstances would have been at the least apathetic if not leaning towards a liberal viewpoint. As it is now, these people are in the camp of the hawks who scream "the demonstrators should be fined, and expelled from school." The Hawks don't have the answer. I really don't think anyone does.

But the question of the time is "will the conflicting parties on campus learn anything from this encounter? Will they learn from their mistakes?" We'll

have to wait and see. But I'm sure that there's one thing most every one, including administration, on campus can agree. Governor LeVander and the rest of the farmers who play at being legislators should be seen and not heard.

We Lost the Money

Our state legislators have become members of a kangaroo court. They see an alleged crime and without a fair hearing, punish the University, and the Institute of Technology.

The Institute of Technology asked

for funds for the first stages of an ambitious and desperately needed expansion program (Dec. 1968). IT asked the legislature for \$10.5 million, and Dean Cheston expressed optimism that the money would be appropriated. Now he is pessimistic about getting any money for building.

You, the student, know how badly IT needs the money for modernizing and expanding its facilities. You know how outdated the labs are, how inadequate the library facilities are, how cramped you are for study and lounge space. You also know that Minnesota must modernize and keep pace with advances in technology and teaching or else find itself in a position of not providing adequate service for the people of the state.

Therefore, we urge you the student, and the alumni and faculty to contact your legislator and urge him to stop being a member of an immature vigilante committee. **█**

The opinions expressed here, unless otherwise signed, are those of the editors and do not necessarily represent the views of the Institute of Technology, its faculty or students, or any other organization.

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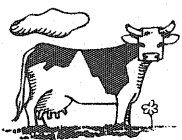
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All this and Books too!

ENGINEER'S BOOKSTORE

How to keep a cow's mind on milk. Instead of flies.

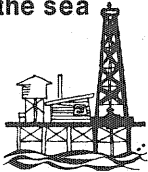
An informal report on a few current projects at Shell. Some of them might seem like offbeat work for an oil company. But this is a company that contributes broadly and significantly to society. A company of experts that brings out the best in its engineering, scientific and business people.



Shell scientists have come up with a vast improvement over even the most talented cow tail. It's called VAPONA® insecticide. A plastic strip impregnated with it will kill flies in a cow stall for up to three months. And VAPONA® insecticide combined with CIODRIN® insecticide keeps cows fly-free 24 hours a day—even out in pasture. Give you ideas for further applications?

Energy from under the sea

Shell is heading into ever-deeper water in the search for oil and natural gas. Recently we designed and installed permanent drilling/production platforms as tall as a 34-story building, with



still bigger structures in the works. And we are operating in considerably deeper water from floating platforms. We are also searching on land in 16 states to help meet burgeoning energy needs.

Digestible detergents



The main trouble with detergents is they don't go away. They pollute streams, make fresh water foamy. The solution: detergent compounds that organisms can consume. These "biodegradables" clean clothes just as effectively, but keep streams free of detergent foam. Elsewhere in the chemical part of our business, Shell research has resulted in a wealth of plastics for home and industry, and fertilizers to alleviate food shortages.

The name of the game

More gasoline per barrel of crude oil delights engineers, scientists and conservationists alike. Our new hydrocrackers actually produce *more* than a gal-



lon of refined product from a gallon of feed stock. And we are using sophisticated techniques to tailor-make products by reassembling hydrocarbon molecules.

The pursuit of excellence leads Shell into a variety of fields, both on and off the beaten track for an oil company. If you have a more-than-one-track mind, a desire to explore, to pit your skills against many kinds of problems, there could be a place for you in Shell.

Perhaps your training in engineering, science or business can contribute to tomorrow's new developments. For information about openings throughout Shell sign up at the placement office for an interview with our representative. Or write to Q. C. Stanberry, Recruitment Representative, Dept. E, The Shell Companies, Box 2099, Houston, Texas 77001.

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Parking lots are places where people bang up car doors.

Help wanted:

Can you design a door that eliminates this problem?

Situation: It is often difficult to get into and out of today's cars without bumping into the car beside you.

Question: Can you design a door that uses minimum out-swing space when opening?

*Disciplines: It can go over the car, under it, slide into the frame, swing parallel to the body . . . AS LONG AS IT'S NOT TOO EXPENSIVE TO MASS PRODUCE. Door must also provide an electrical channel to the chassis to provide for power operated windows. Need your ideas in time for meeting next month.
Thanks.*

Want to work on a challenging assignment like this? A new member of an engineering team at Ford Motor Company does. Today his job may be designing new car door hinging. Tomorrow it might be solving cab vibration in semi-trailer trucks. Or designing a different approach to vehicle controls, or even developing a new engine configuration.

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If you have better ideas to contribute, and you're looking for challenging assignments and the rewards that come from solving them, come work for the Better Idea company. See our representative when he visits your campus. Or send a resume to Ford Motor Company, College Recruiting Department, The American Road, Dearborn, Michigan 48121. An equal opportunity employer.





speaking with the dean

TO ADDRESS ONESELF to the question whether or not secret or classified research should be carried out on a university campus or under university auspices requires a very clear notion of the function of a university. The problem stated quite directly is that most people who wax eloquently on the subject of classified research have at best a very simplistic view of this function. With this preliminary remark out of the way, I am prepared to state that classified research of any sort should be barred from the university campus. Rather than suggest that there should be exceptions to this rule, it seems to me that the rule should be subject to reexamination as the external forces that impinge upon the university change. I am uneasy over the recommendation of the President's Committee on Classified Research that a review board be established to make exceptions to the rule barring classified research. Such a review board is impractical since it would not be able to examine freely the evidence for making an exception for the very reason that it is unlikely that the government agency which is sponsoring the research would accord the review board the "right to know," the essential condition necessary to examine the evidence. The President and the Board of Regents, using whatever faculty and student resources they wish to consult, should reserve for themselves the right to reexamine the rule as circumstances change rather than establish a review board empowered to make exceptions to a rule.

The Tech Commission has other views on this matter. It is my understanding that they would leave the decision on classified research to the integrity of the individual faculty member. This appears to me to be quite a distortion of the concept of academic freedom. I do not question the right of a faculty member to consult off-campus on classified research as long as that consulting activity is judged consistent with both the spirit and letter of the Regents' policy on consulting. I would certainly depend on the integrity of the faculty to come to that judgment.

There are research activities other than those sponsored by federal agencies such as the Department of Defense and the Atomic Energy Commission in which the free flow of information is impeded by restrictions imposed by the sponsor. Here I am referring to industrially sponsored research. In general, the company sponsoring the research does not wish the results to fall into the hands of its competitors before it has had a chance to evaluate these results for possible commercial exploitation. This industrially sponsored research with proprietary connotations is and should be stringently controlled at the university. A set of rules governing proprietary research separate from those formulated for classified research should be spelled out in detail but should contain sufficient flexibility to allow each instance to be judged on its own merits. Here a faculty-student review board can have access to sufficient relevant information to make intelligent decisions concerning implementation of policies restricting proprietary research.

Warren B. Chester

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Nothing helps a young engineer's career like being given a challenge. Which is another way of saying *a chance to fail* now and then. To make his own mistakes.

At Western Electric we give our newly recruited engineers responsibility almost immediately. They make their own decisions. Learn from their own errors.

Don't get us wrong. We keep our

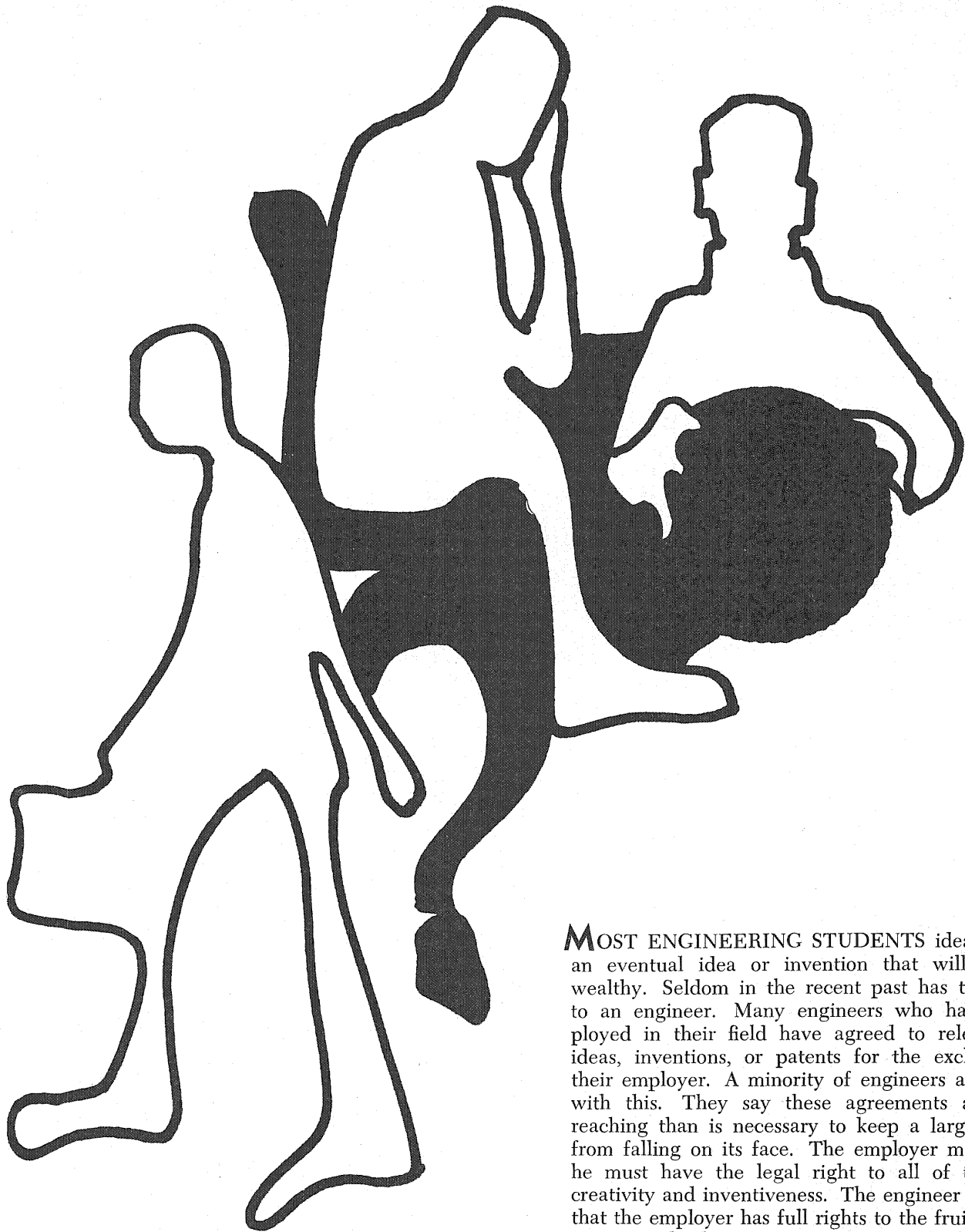
demands reasonable enough so that our recruits can make their decisions at their own pace. But our thinking is, a man feels awfully good about even a small decision when it's *his*.

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MOST ENGINEERING STUDENTS ideally dream of an eventual idea or invention that will make them wealthy. Seldom in the recent past has this happened to an engineer. Many engineers who have been employed in their field have agreed to release all their ideas, inventions, or patents for the exclusive use of their employer. A minority of engineers are dissatisfied with this. They say these agreements are more far reaching than is necessary to keep a large corporation from falling on its face. The employer may claim that he must have the legal right to all of the engineers creativity and inventiveness. The engineer will not deny that the employer has full rights to the fruits of research grown with the investment and facilities of the employer. The nature of the profession requires the engineer to exchange his talents, creativity, and skill for a salary. How much creativity and productive thought must be exchanged for this salary? "Certainly, nothing which is unrelated to the engineer's specific work assignment," claim those who are dissatisfied. An engineer should have the right to profit from his own creativeness if it is unrelated to his work experience. It is considered stealing when an engineer goes into business for himself while doing research for his company. Is

PATENTS

CREATIVITY VS

COMPENSATION

by MICHAEL KANTAR

it not stealing when an employer claims the rights to an engineer's patent if it was conceived independently of the engineer's employment?

The new engineer may expect to contribute regular working hours plus overtime when needed. In the beginning, he may believe that the salary is his compensation for the forty hour-plus work week. He may soon find that his brain is held to a twenty-four hour contract. Any marketable or profit-making idea, however unrelated to company activity or product line, may be subject to company ownership. How do these extra professional ideas become the property of a company? Most major corporations and some smaller companies require the signing of the "employee agreement" which could give the employer legal rights to every ounce of creativity the engineer may produce. New engineers are unaware of the agreement until confronted with it on their first workday. Consider the recent graduate who has rejected his first job offer for the one he has just begun. It is June 16, 1969, just nine days after graduation from the U of M. He has moved his belongings across the country, signed a lease, and moved into his new apartment. Upon reading the employee agreement, he feels tricked.

They didn't tell me this at the interview or plant tour. I'm selling my soul to these people. I don't like this agreement but what can I do? This was my favorite company. I can't back out now. It's June and I moved out here—too late for more interviews. Maybe I should have accepted that other job offer.

He would probably be more happy at his current job than his second choice, since there were reasons for making that decision. One factor unknown to him which would remain the same is the use of the employee agreement. In short he could not keep his "soul" by signing with the first company. Had he "shopped around" concerning this, he would find most agreements basically the same. Companies will pay his patent fees and give him a small bonus (\$100 to \$500) for a patent

disclosure. Some engineers may consider this a small reward for something which could net millions for the employer.

The new engineer finally signs the agreement and begins to work. During his first year, he finds that he is as creative and intelligent as he always thought he would be. An improvement in a manufacturing process is the result of his ingenuity. His original idea was crude, but after help and suggestions from his supervisor the idea is workable. Who gets credit for the ideas? In many companies the supervisor and others receive the bulk of the rewards.

Our engineer isn't discouraged—his good ideas are rewarded with promotion after promotion until he is project engineer. While on vacation, he conceives a new method for propelling his fishing boat. Recalling his patent agreement, he promptly turns the disclosure over to his company, which manufacturers semiconductors. He receives the bonus for the disclosure and observes that his patent has been shelved. The men in market research said that the company would only gross two million in sales annually. It would not be enough to justify modifications in production. An engineer with the patent rights to the device could conceivably form a small company and live very well on the sales if it were not for the agreement.

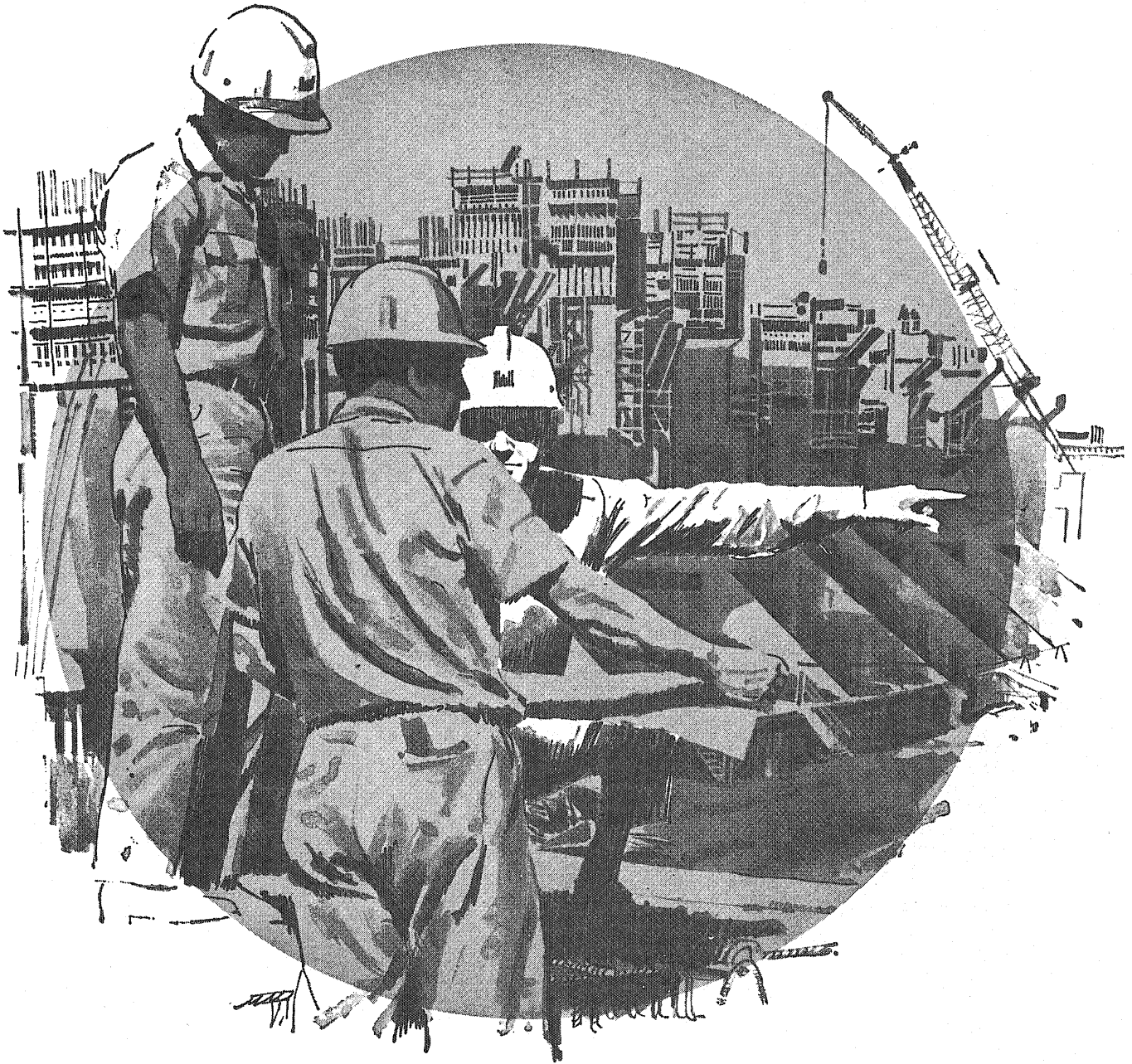
The preceding experience encountered by a graduating engineer is fictitious. However, it contains situations which the graduate may encounter. Many are the result of misunderstandings or failure to see the problem from the employer's point of view.

It is only just that an employer should have legal rights to any discovery or idea which the engineer contributes as the result of his work assignment. Some engineers have claimed they were prevented from listing prior ideas or inventions in the spaces provided on the employee agreement. They claimed these ideas were theirs. They had no legal right to them if they were not patented. The company's position would be misunderstood in some cases when pointing this out. Currently, an employer may claim rights to the patents of

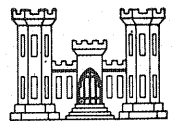
The Corps of Engineers is also the most professional, and the most active engineering/construction group. For the engineer who wants to be where the action is, the opportunities to take part in new, more advanced, extremely challenging engineering/construction projects will be virtually limitless. The Corps' activities today include the broadest sweep of professional demands — water resources development, huge

dam construction, navigation and flood control projects, construction of hospitals, family housing, manufacturing plants, missile sites—you name it! This is the organization for the engineer who wants to do things, plan things, become involved, grow—starting right now. If you're a doer, and you want to be where the action is, write to us today. We'll tell you all about the advantages of a civilian career with the Corps of Engineers.

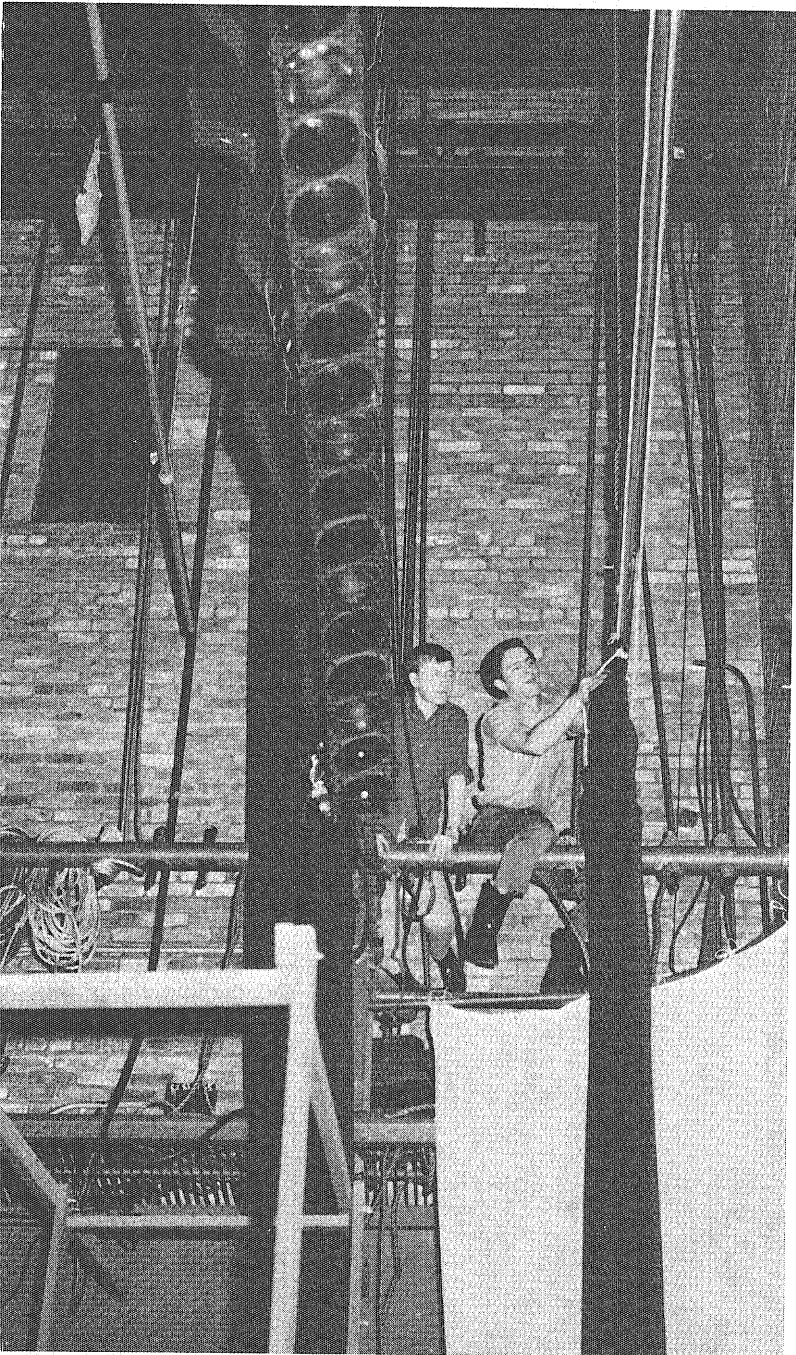
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introducing . . .

scott hall

theatre

Most of you have enjoyed a play at least once, but have you ever thought about the amount of work needed to produce a good play? This month the *Technologist* is taking a peek behind the scenes at the University of Minnesota Theatre in Scott Hall. The plays at Scott Hall, which are held from early October to May, usually run for about a week. During the summer the theatre presents plays on the Showboat and runs the Peppermint Tent, a children's theatre. The U of M Theatre is completely self-supporting, receiving its money only from tickets.

Almost a year before each season begins the permanent staff from the theatre department meets to decide which plays to present and who will direct them. Each staff member submits three plays he would like done and the theatre students also suggest a group of plays. The staff then chooses the plays and selects staff members to direct them.

After deciding the setting, the director discusses his ideas with Professor Lee Adey, the technical director, Professor Irene Pieper, the costume designer, and Professor Jean Montgomery, the lighting designer. Their suggestions are considered but the final decision is up to Professor Adey.

Most of the other people involved in the play are students, both graduates and undergraduates. The cast usually consists of theatre students, but auditions are held for anyone who wishes to try out. Theatre students who are taking required lab classes comprise the crews,



Crews setting up the stage in the Scott Hall Theatre.

which include stage, lighting, shifting, costume, sound, and publicity crews.

All costumes are made and stored on the top floor of Nicholson Hall. The costume crew sketches the costumes, buys the material, and then makes all of the costumes which are specially made for each cast member. The old costumes which are saved and stored by period are occasionally reused if they fit the requirements for a new costume.

In the scene shop, next to the Armory, the properties ("props"), backdrops, platforms and all other constructions needed on the stage are made. The shop has some wood working and metal working equipment. The basic component of set construction is the flat, used for walls and partitions, which is made by covering a wooden frame with muslin, and painting the muslin with a glue mixture causing it to shrink tight. It is then painted and re-painted for use in different plays. Backdrops are painted in the scene shop by suspending them from a huge frame. Upon completion they are transferred to Scott Hall. Platforms and stairs are constructed with a covering of ozite and canvas to keep the noise to a minimum as the cast walks around on the stage.

Throughout most plays the scenery must be shifted for different acts. There are four major methods of accomplishing this. Probably the most widely used is a shifting crew, which changes the stage while the lights are turned down. Flying scenery is another method, used mainly for light fixtures and properties which hang. Between scenes these can be lifted or lowered from the fly loft above the stage. Flat carts or wagons are a means by which the whole stage or parts of it can be rolled off on a large platform and the new section rolled in. A fourth method that is becoming more popular is the use of a revolving stage to change from one scene to another.

As the play progresses, the sound and the lighting crews are at work. A small room in the back of Scott Hall enables the crews to see the stage and run the light and sound controls. Light directed on the players, house lights, and lights on the scrim must be controlled. (The

scrim is a white cheesecloth backdrop that is hung in place of a painted backdrop. It can be lit any color depending upon the mood the director would like to create at the time.) Both the lighting and the sound crews follow special scripts which tell them what to do.

Before a play can be shown to the public there are technical and dress rehearsals. During the former, the sound, lighting, and arrangement of the stage and cast are rehearsed. During the latter, the cast becomes familiar with their costumes and make-up.

Finally, after all this preparation a great play is ready for you to enjoy. **■**

scott hall performance schedule

Beggar's Opera: Feb. 21 - Mar. 2

Camino Real: Apr. 18 - Apr. 27

Tom Thumb: Feb. 11 - Feb. 16

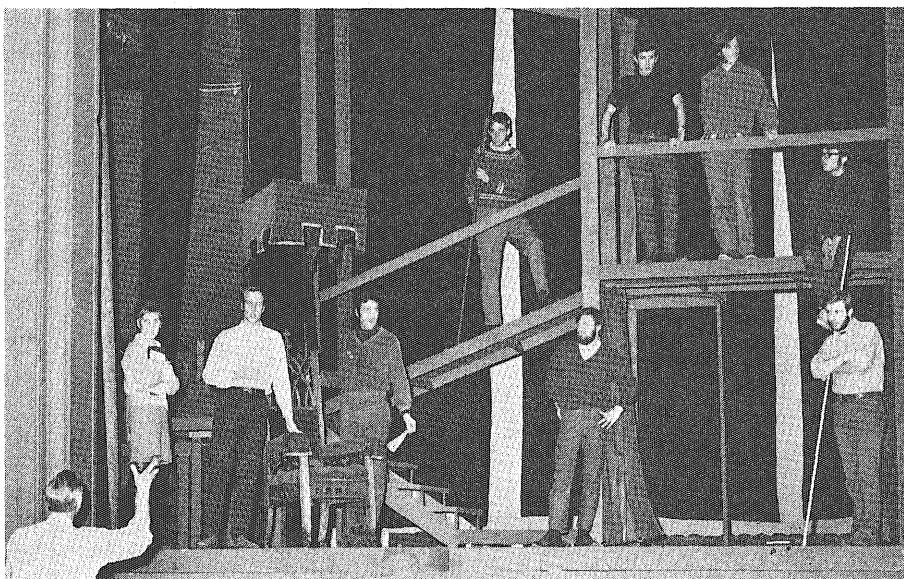
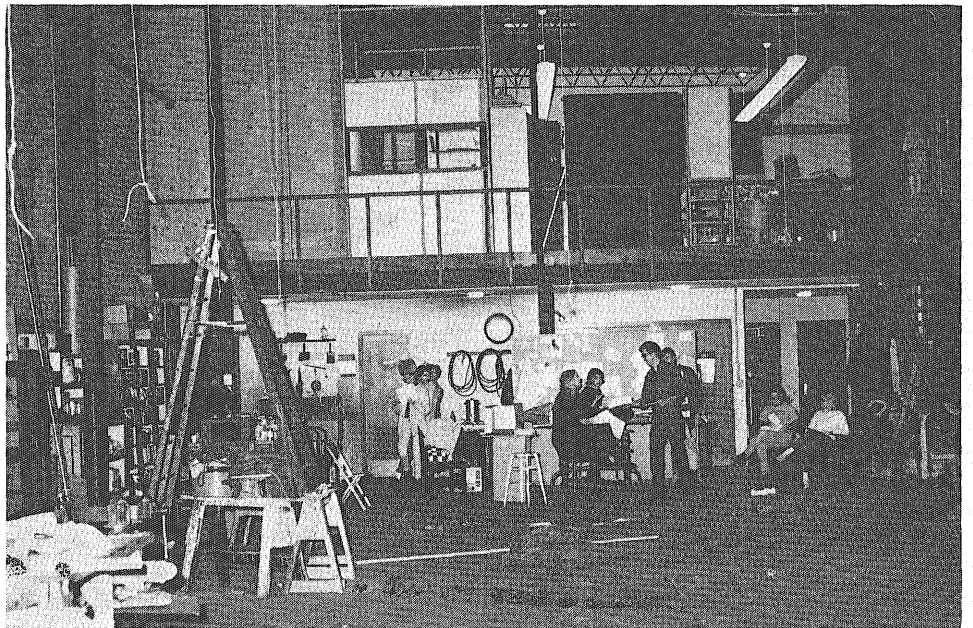
Jest, Satire, Irony, and Deeper Significance: Apr. 29-
May 4

Summertree: May 13 - May 18



Costumes are made and stored in Nicholson Hall.

Props are constructed in the scene shop, located between the Armory and the Field House.

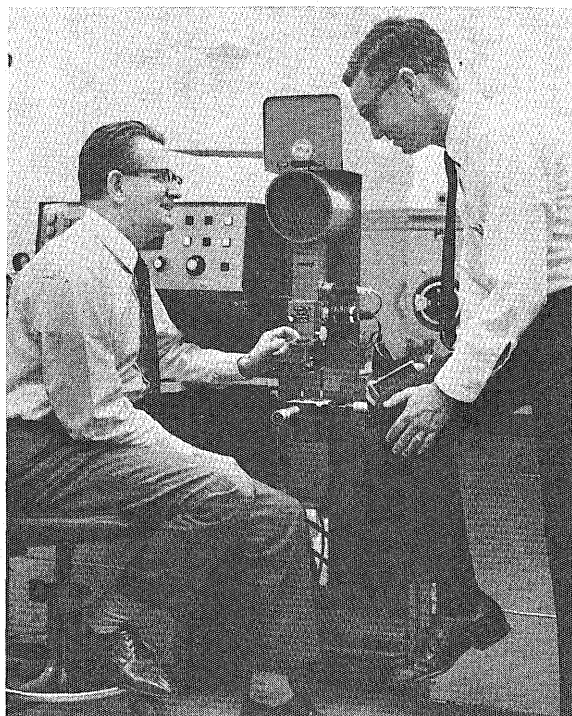


The cast of *Henry IV, Part I* rehearses under the direction of Dr. Graham.

what's new

in science and engineering

Edited by Mike Voegele



experimental diode

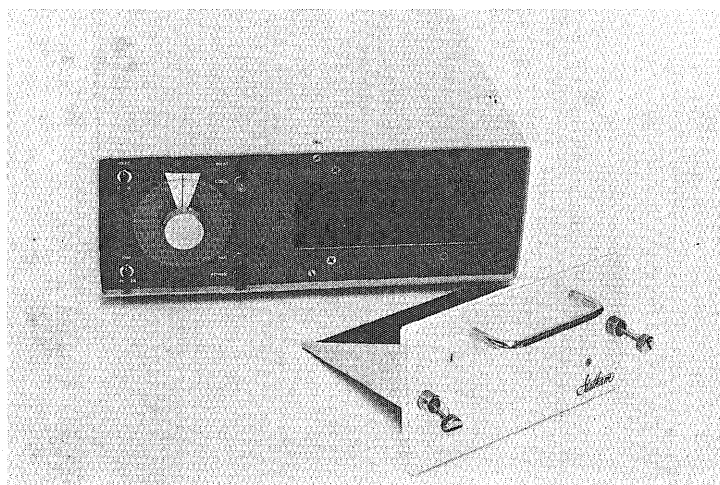
... Light from a laser was used to make a solid-state diode, two physicists from International Business Machines Corporation report in the December issue of *Solid-State Electronics*.

The quality of the experimental diode was comparable to that of devices made by conventional diffusion processes, according to John M. Fairfield and Dr. Guenter H. Schwuttke of the IBM Components Division development laboratory here.

The technique the authors used has the potential advantage of permitting a diode to be made at a specific point on a silicon wafer without disturbing the surrounding material. This capability would be useful in integrated circuit design and fabrication.

For the study, phosphorus was "painted" on the surface of chemically polished silicon wafers sliced from boron-doped single crystals. The wafers were irradiated by a focused pulse (one for each diode) from a solid-state laser for about 5 milliseconds.

No damage to the crystal was visible at low-energy levels. Crystallographic damage occurred at high-energy levels, but it was confined to the area of irradiation. Single crystallinity was maintained.



test chamber

... A low-cost temperature test chamber made especially to test small solid-state components and specimens is offered in Statham's Miniature Temperature Test Chamber.

The Model SD2 has a temperature range of -65 to $+150^{\circ}\text{C}$ with control accuracy of $\pm 1^{\circ}\text{C}$. In addition, it is equipped with a failsafe thermostat and warning light to assure dependable operation. Heating rate is $18^{\circ}\text{C}/\text{minute}$ and cooling rate is a fast $60^{\circ}\text{C}/\text{minute}$. Fiberglass insulation and small specimen area (2 in X 5 in X 5 in) promote extreme economy of operation. It is built for portability (12 lb) and easy stacking.

The SD2 is an ideal complement to the chamber line for testing a few small items or for handling overflow work when larger chambers are occupied.

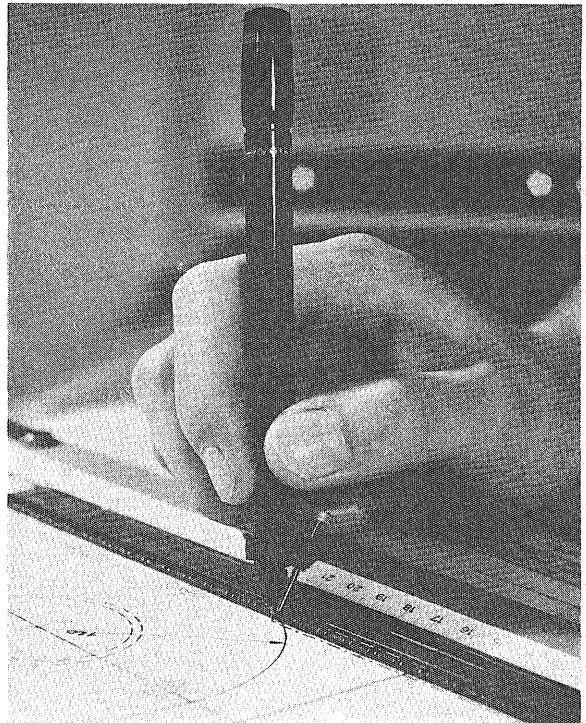
new plastic ruler

With the use of a new plastic ruler made in Holland, dashed and dotted lines can be drawn so that all of the markings and blank spaces, respectively, are of uniform sizes.

The new ruler is designed primarily for commercial artists, printers, cartographers and architectural draftsmen in the drawing of maps, diagrams, charts, blueprints and floor plans, among other things. It is manufactured by Fa. P.M.M. van de Kamp & Zonen C.V. of The Hague, The Netherlands, and is now available for export to the United States, Canada and elsewhere.

In the middle of the ruler, there is a standard measurement scale, while adjacent to it along one side there are ridges spaced out at regular intervals. When the guide pin is attached by a holder to the drawing pen, it lifts the pen from the paper or other material as it passes over a ridge. The guide pin returns the pen to the paper after hitting each ridge.

The ruler can be supplied in six standard models, to wit: One for dotted lines, two for dashed lines, two for chain dotted lines and one for chain double-dotted lines. Other patterns can be obtained by chiseling away some of the ridges. The guide pin holder, which comes with the ruler, is available in a variety of sizes to fit the different types of drawing pens.



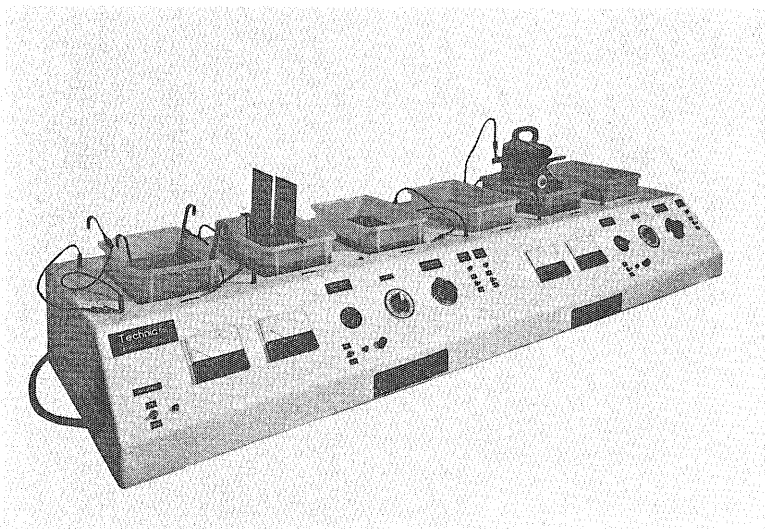
electroplating plant

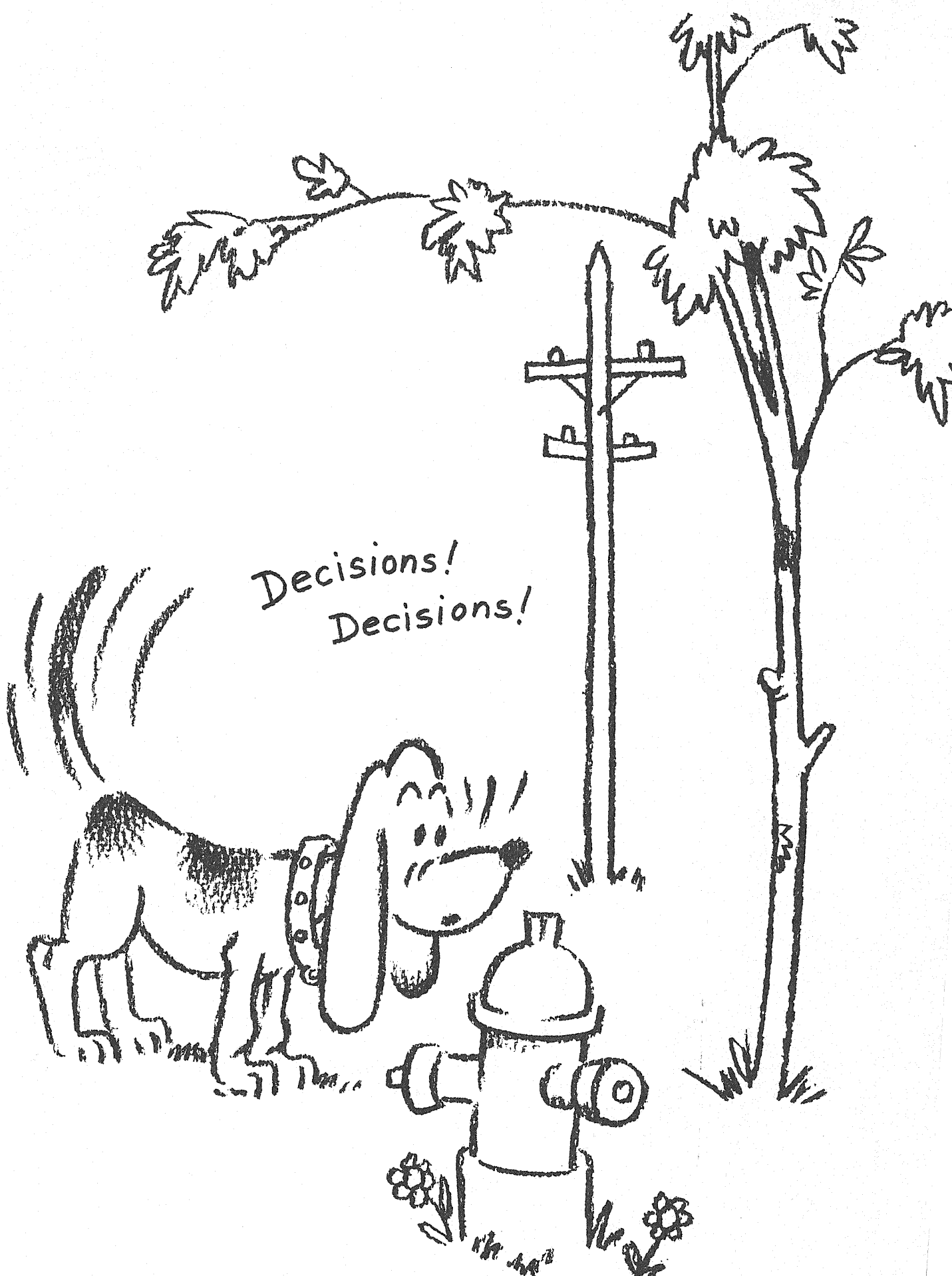
A table-top electroplating plant for small-lot and precision plating jobs is available from Technic, Inc., Providence, R. I., one of the nation's major suppliers of precious metal solutions and equipment.

The unit, called the Techni-Lab, is the first plating equipment designed and built expressly for small-scale production, plating of prototypes, and research and development work said Alfred M. Weisberg, Technic president.

The self-contained Techni-Lab, which can be located in a small area of the plating shop or lab can be used to relieve the shop's regular production line of handling specialty jobs that increase production costs.

The Techni-Lab is a complete plating facility, including tanks, rectifiers, heaters, and controls. It also is ideal for testing plating cycles on samples prior to duplicating the procedure on the production line.





Decisions!
Decisions!

Some decisions are relatively unimportant. Where you put your engineering talent to work is not.

As you contemplate one of the most important decisions of your life, we invite you to consider a career at Pratt & Whitney Aircraft. Here, you will find wide-open opportunities for professional growth with a company that enjoys an enviable record of stability in the dynamic atmosphere of aerospace technology.

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PATENTS

(continued from page 15)

former employees if obtained within a year after termination. The trend has been a shortening of this interval from no time limit to a limit as short as six months.

Many large companies derive most of their profit as the result of research and development. Trade secrets, special processes, and certain knowledge must be kept within the company. The company could be severely hurt if employees were not legally bound to keep these secrets.

What of the engineer who feels he should be allowed to profit from an invention unrelated to his work assignment? Employee agreements differ widely in this area. Some companies may not even require the signing of the agreement. However, they do have legal rights to ideas and inventions obtained by engineers in the course of their work. With no agreement, that is the extent of the company's rights, unless the engineer uses the facilities of the company to further a non-work invention. In this case the employer has the legal right to manufacture the invention but cannot restrict the inventor from doing the same.

Some employers may claim rights to an invention or idea if it is in their product line, regardless of whether

the inventor worked in that line. Justifications for this are that the engineer could have obtained ideas from the company by reason of his employment with them. Their product line could also give him an awareness of industry's needs which no outsider could have. Companies which claim all inventions or ideas do so because they believe environment, training, and research helped the inventor. This may be particularly true in the case of a beginning engineer who receives a great deal of on the job training.

Many employees do offer cash benefits for patents. Often it is very difficult to say specifically who had the brilliant idea, especially when many engineers work on a new project.

Graduating engineers who are concerned about their patent rights should attempt to see the employee agreement before accepting employment. This could be a delicate situation for a graduating engineer to be in. The colleges should obtain and make these available prior to recruiting. The student who thinks he has a marketable or profit-making idea should apply for a patent previous to employment. If the graduating engineer is faced with a very restrictive agreement he must consider all other factors of employment before making his decision. Perhaps geographic location, interesting work and company environment are enough to outweigh any bones over the agreement. □

Employee Contract

In consideration of my employment and of the wages or salaries paid me, I agree that:

1. All papers and apparatus relating to the Company's business, including those prepared or made by me, shall be the property of the Company and, except as required by my work, I will not reveal them to others nor will I reveal any information concerning the Company's business including its inventions, shop practices, processes and methods of manufacturing.

2. I will promptly disclose to the Company all inventions usable by the Company in its business which I make individually or jointly with others while employed by the Company and for a period of six (6) months thereafter, whether made on Company time or my own time; and, at the expense of the Company, I will assign to it all my interest in such inventions and will sign all papers and do all other acts necessary to assist the Company to obtain patents on them in any and all countries.

3. I will promptly disclose to the Company all copyrightable material relating to the Company's business which I produce, compose or write, individually or in collaboration with others, while employed by the Company, whether made on Company time or my own time; and at the expense of the Company, I will assign to it all my interest in such copyrightable material, and will sign all papers and do all other acts necessary to assist the Company to obtain copyrights on such material in any and all countries; provided, however, that no such assignment need be made in respect to any such copyrightable item upon which a specific written

agreement is executed, attested and sealed by the authorized officers of the Company.

4. The above provisions will be binding upon my heirs and may be transferred by the Company to its successors.

Employee Release Contract

WHEREAS company does not desire to commercialize or patent these ideas and said employees are desirous of so doing;

NOW THEREFORE, in consideration of the premises, the parties hereto agree as follows:

1. (Company) hereby releases (employee) from their obligation to assign to (company) any rights they may have in the ideas above described and hereby consents to the filing of a patent application on, and to the commercial exploitation of, such ideas by (employee), to the extent that they are the inventors thereof.

2. (Employee) grants to company and its subsidiaries or controlled companies, both present and future, a nonexclusive, royalty-free license and right to make, or have made, use and sell apparatus embodying the above described ideas and all improvements made thereon by (employee), said royalty-free license including a license under any and all applications for patent, and patents which issue thereon, that employee file or cause to issue.

3. The license and rights hereby granted to (company) and its subsidiaries or controlled companies shall be assignable by each of them with the sale or assignment of the major portion of its business. □

We developed TV transmission. But a lot of engineers still don't get the picture.

Like, we'll ask a graduating engineer:
"What opportunities do you think an engineer has
if he works for the telephone company?"

And, zap—we get a blackout!

Well, we think the company responsible for
engineering innovations such as the transistor, radio
astronomy, high fidelity and stereo recording,
magnetic tape, synthetic crystals, negative feedback,
sound motion pictures, microwave relay, electronic
switching, the solar battery and telstar deserves a
consideration that's strong and clear.

When the Bell System recruiting team comes
to your campus, be sure to talk to them. Or ask your
Placement Director for the name of the Bell System
recruiter at the local Bell Telephone Company,
an equal opportunity employer.

We'll turn you on.



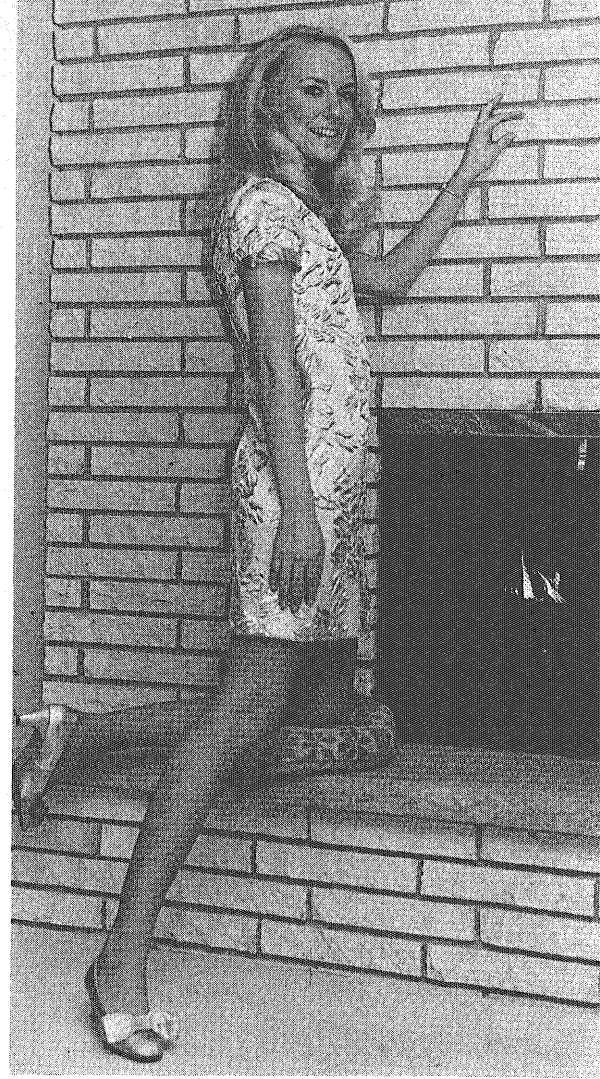
miss february . . .

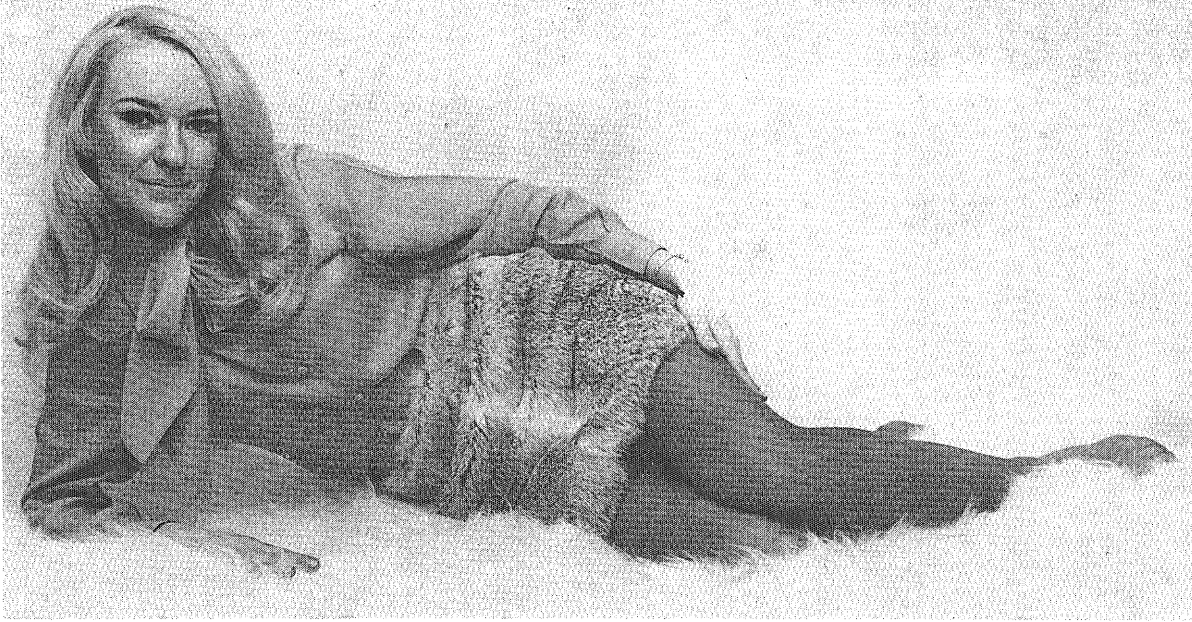


Vicki Mahood

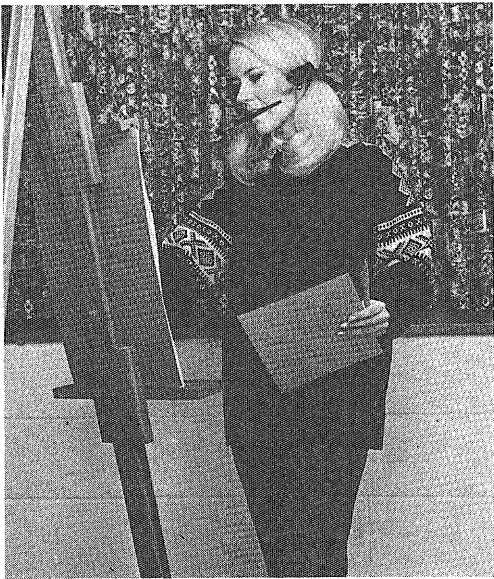
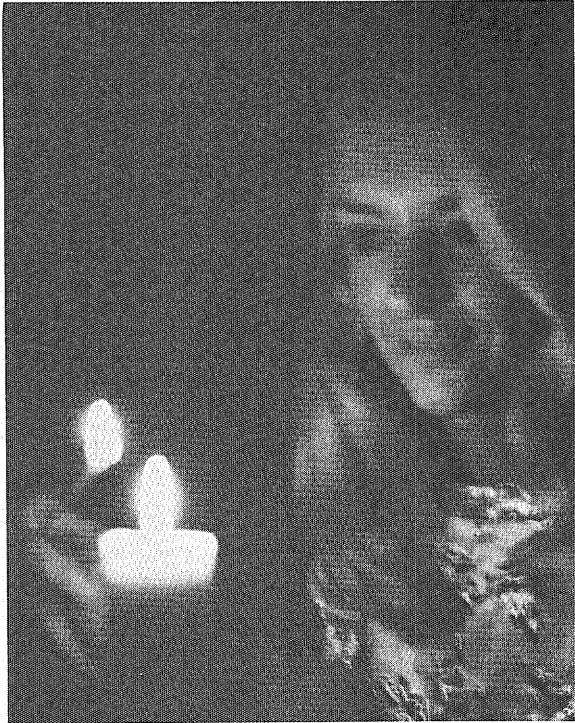
Technolog's 1969 Valentine treat is Miss Vicki Mahood, a junior at the U of M. Vicki, an Alpha Delta Pi, is majoring in speech and minoring in art history. With this unique combination Vicki plans to go into public relations in the area of sales promotion.

Vicki herself needs little promotion. A diverse five-foot seven-inch blonde, she supplements her academic life with painting, playing the piano, and skiing. She even manages to find time to shoot a twenty-two caliber rifle. So . . . next time we need help at Morrill Hall we know who to call.





vicki, a girl of many moods





Do you keep an eye on the time line?

To gain the competitive edge, the experts in downhill slalom have this advice: "Watch the time line — the fastest course line."

"In the race against time, if a skier slips off and goes too low in the traverses, he'll lose precious seconds."

As you look to your future course, watch for the company whose progress is on a time line with your own.

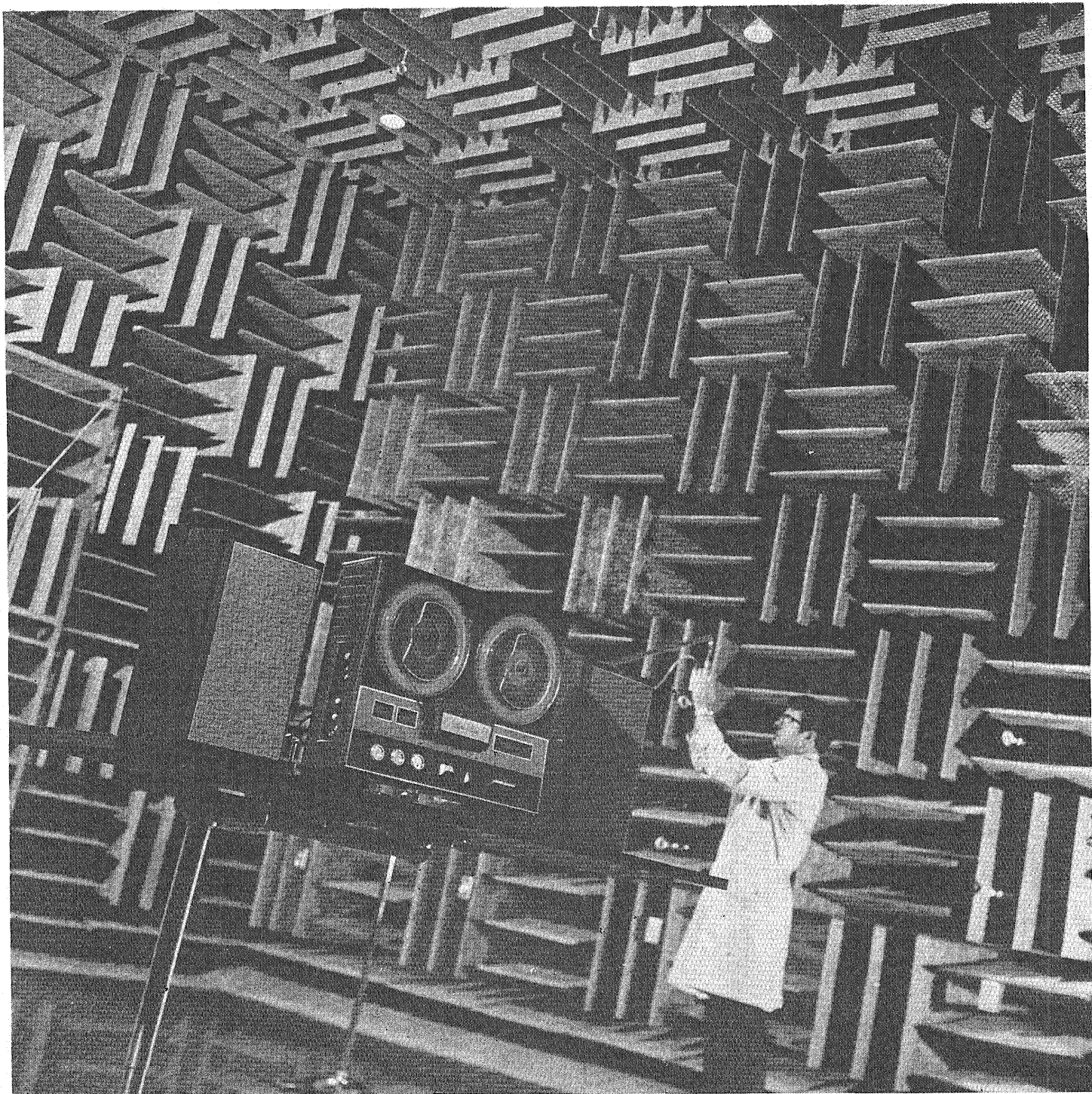
Ask companies how their expansion and modernization programs stack up in their industry. Find out if you're interested in the markets they're interested in. If they have a position that fits the course you've set.

Don't settle for salary and status quo. We don't. Pick a time at your college placement office. Let's discuss your future. The Timken Roller Bearing Company, Canton, Ohio 44706.

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Wollensack 6300 tape recorder being prepared for testing in the anechoic chamber of 3M's acoustical research laboratory. The equipment and scientist are standing on a steel mesh suspended floor.

"THE WHOLE PROBLEM of noise in society is a great one today, and it is not as well recognized as it is going to be in the future." This statement of Mr. Henry S. Knoll, research engineer in the acoustic facility of the 3M Co., seems to indicate the general purpose of the Acoustics Testing Laboratory which Mr. Knoll supervises. Noise pollution, which is of prime concern to firms like 3M, is the amount of unnecessary noise each person is subjected to without his consent and often without the realization that it is unnecessary. Mr. Knoll feels that the government will eventually set specifications controlling the amount of noise produced by machines. The noise entering and leaving dwellings will

probably also be controlled, and the Federal Housing Administration (FHA) and some major cities have already changed building requirements to limit the noise in dwellings as well as noise leaving the dwellings.

3M feels that it is better to design machines that are not noise pollutants, instead of waiting until the government passes noise control regulations. The cost of re-designing machines already in production can be a crippling economic blow to any company. 3M has already taken a step with its acoustics facility which reduces the noise level of machines still in the prototype stage. 3M maintains that it makes good economic sense to have this facility available and functioning now. One reason,

noise pollution

of course, is the possibility of noise pollution laws. Primarily, however, an office machine that is quiet to operate is more marketable than a machine that sounds like a "supercharged Ford flat out on the Indy straightaway."

The Revere Wollensack Division of 3M uses this acoustics facility to produce the sensitive microphones, speakers, and speaker enclosures for its tape recorders. One of the corporation's latest successes is the tape recorder model 6300, which according to Mr. Knoll is "unlike any other tape machine 3M has produced." The electronic and transport mechanism were redesigned for this machine, and the acoustical facility was used to design a speaker, speaker enclosure, and microphones which were then specially produced for this model. By use of the lab, an optimal acoustical design was achieved through applications of the mechanics of sound while the machine was still in the pre-prototype design stage. This optimal design was then implemented at a lower cost of manufacture than is usually the case for a machine having this quality of sound reproduction.

The acoustic facility at 3M consists of an anechoic chamber, two reverberation chambers, and all the necessary sound equipment. The anechoic chamber is constructed of 12-inch thick poured concrete walls, floor, and ceiling. All six surfaces of this room are lined with 34-inch glass wool wedges which number about 3000. These wedges give the room a characteristic energy absorption of 99 percent, from 100 Hz (cycles per second) up through the entire audible sound range. For the room to retain this energy absorption at such a high percentage, the machine or speaker being tested must be at least $\frac{1}{2}$ wavelength from the wall. 3M uses a conservative figure, and says the distance from the center of the room to the closest surface is 5.5 feet. If the speed of sound is taken at 1100 feet per second, the minimum frequency is given by the equation

$$c = f \lambda$$

c = speed of sound
 f = frequency
 λ = wavelength.

From this equation, Mr. Knoll arrives at his minimum frequency of 100 cps for test purposes. Actually, the

room measures 25 x 25 x 25, and this factor of 5.5 feet toward each wall subtracts $2 \times 5.5 = 11$ ft from each dimension which leaves Mr. Knoll an effective working space of 14 x 14 x 14 ft.

The reverberation chambers are exactly opposite the anechoic chamber in that they are nearly 99% reflective. Any noise in the room decays only after being reflected many times from the room's six surfaces. Where the anechoic chamber is characterized by the suspended wire floor and the 3000 glass wool wedges, the reverberation room is coated on all six surfaces with an epoxy paint. Then, sound-reflecting vanes are suspended on skew planes in the room, with a revolving set of vanes in the center. These vanes function to eliminate standing waves in the test room itself.

Both rooms have some common characteristics, which make possible the tests conducted within their walls.

- 1) They are built on separate foundations poured on a sand base, which functionally separates them from building vibrations, highway traffic vibrations (I-94 is less than a $\frac{1}{4}$ mile away) etc.
- 2) The construction of the walls are such that a double wall effect is employed, and results in a high acoustic transmission loss, which prevents extraneous outside noise from entering the test chamber.
- 3) The temperature and humidity of the rooms are controlled, for they are very important in consideration of test results.

Each room functions for different tests, and test procedures. The anechoic chamber is used for testing items such as loudspeakers and microphones for their particular directional characterization. The reverberant room is used for many more and varied tests, such as sound absorption coefficient, Acoustic impedance, sound transmission loss, and sound power measurements.

The anechoic chamber was used extensively for the tests of the new tape recorder Model 6300, for the directional characteristics of the speakers and microphones had to be determined. The testing procedure of a speaker is accomplished by use of a unidirectional microphone with a flat response from 20 Hz all through

"Eventually the government will step in to specify a maximum noise production level for every machine."

the usable frequency range of the speaker in question. The flat response in the unidirectional test microphone eliminates any possible acoustical quirks from displaying themselves in the test response, which could possibly lead to erroneous conclusions about the speaker in question. The test generator then drives the speaker being tested at a constant voltage, but at varying frequencies. The microphone then hears this generated frequency after it is driven through the test speaker. The sound the microphone hears is then recorded on a graph in decibels as a function of frequency. The flatter this curve, the more efficient the speaker in question.

The reverberant room was also used in the development of the tape machine, for speaker efficiency is found by measuring the total sound energy output, and dividing that figure by the electrical power supplied to the speaker. The reverberant room, because it does not absorb any energy, allows the easy measurement of the total acoustic power developed. 3M measures this efficiency as a function of frequency, in $\frac{1}{2}$ rd octave bandwidths, and this curve is the one which really determines the worth of any speaker. Also, the reverberant room can be used to measure the machine noise of the tape machine, i.e. fan noise, capstan drive noise as a total noise output of the machine. If perchance the machine had a noise whose source could not be determined, the anechoic chamber would be used, for the unidirectional mike would locate the direction from which the noise was being emitted. Once that direction was found, it would lead to the mechanical part generating the noise.

For the new tape recorder, these results were studied, and modifications offered by Mr. Knoll to the designers until the proper design was achieved in the prototype being tested. This optimum prototype was then put into production, and this particular tape machine is now the finest machine Wollensak produces.


The tests in the chambers deal not only with sound generation, but also sound absorption. Two such tests are for the sound absorption coefficient, and the normal sound absorption coefficient. The sound absorption coefficient is the fraction of the randomly incident sound power. For instance, 3M tested their new Tartan Turf in this manner to be able to inform architects who were interested in the sound absorption of the material. The procedure for the test is simple. First, a sound generator feeds white noise into the empty reverberant room. The time it takes the noise to decay 30 decibels at a certain bandwidth is then recorded. Then the specimen, in this case, 48 sq. ft. of turf, is placed in the room. The test is repeated, and the time it takes to decay the 30 decibels at a particular bandwidth is then recorded. The material usually absorbs some of the sound, and reduces this time from the original empty room. The sound coefficient is the original decay time divided into the decay time with the turf present.

The normal sound absorption coefficient is the fraction of the sound reflected from the material which was incident to the surface in a normal (perpendicular) direction. This test is conducted in the anechoic chamber,

with white noise incident in the normal direction, and a unidirectional microphone reading the reflected sound power as a function of frequency.

The reverberating room is used in another test for the sound transmission loss. 3M is equipped with two reverberating chambers which are adjacent to each other and connected by a doorway. White noise is fed into one chamber, and the noise the other chamber receives is the maximum transmission capability of the chambers. When various materials are placed in the doorway, their transmission losses can be measured. Depending upon the material and purpose of the material, the transmission loss can be either high or low. Recently, Mr. Knoll tested door sealant material for its transmission properties. First he placed a door in the opening, and caulked and tarred the door shut, for this was the maximum seal that could be applied to the door, even though it rendered the door useless. Then he freed the door, and placed 3M door sealant in position. The transmission loss test was conducted, and it was determined that there was only a 2 decibel increase in noise transmitted through the door. A test was run on a door which was not sealed at all, and a 16 decibel increase was found over the caulked door. So acoustically, this material was a success, and could find application in apartment buildings for noise control.

The reverberant room is also used in the testing of machines for noise generation properties. The Thermo-fax copying machines, or the overhead projectors which 3M manufactures come to Mr. Knoll in the prototype stage, and he tests them for the amount of noise they produce. They are placed in the reverberant chamber, and the sound power produced as a function of bandwidth is measured. High peaks on this curve are studied, and Mr. Knoll and his staff try to determine the source of the noise within the machine, and suggest ways to quiet or eliminate the noise. The anechoic chamber is also used here, to locate the source of a noise, if it can not be determined just by listening. Also, the anechoic chamber is used to test localized noise in a machine, or the amount of noise the machine is directing at the operator. Unidirectional microphones are used, and during the test are rotated to sweep out the surface of a sphere which effectively integrates the noise which would be directed at a machine operator.

The problem of noise pollution is one that is of prime concern to every manufacturer, as more people become aware of the problem. Eventually the government will step in to specify a maximum noise production level for every machine, from the jet aircraft to the mixer in the kitchen. Business concerns such as 3M believe that foresight is better than hindsight and in practicing that philosophy, have invested the time, money, and materials in this laboratory. Perhaps 3M is one of those rare businesses who feel the public good is of more importance than the profit-loss statement. But perhaps they lead into such research more easily due to the wide diversity of products they do manufacture. Quiet office and classroom machines are more marketable than noisy equipment. And tape recorders sell only if they are capable of quality reproduction of the sound fed into them. Maybe, just maybe, the public good is of more importance to them, and if so, we congratulate them on a job well done. 

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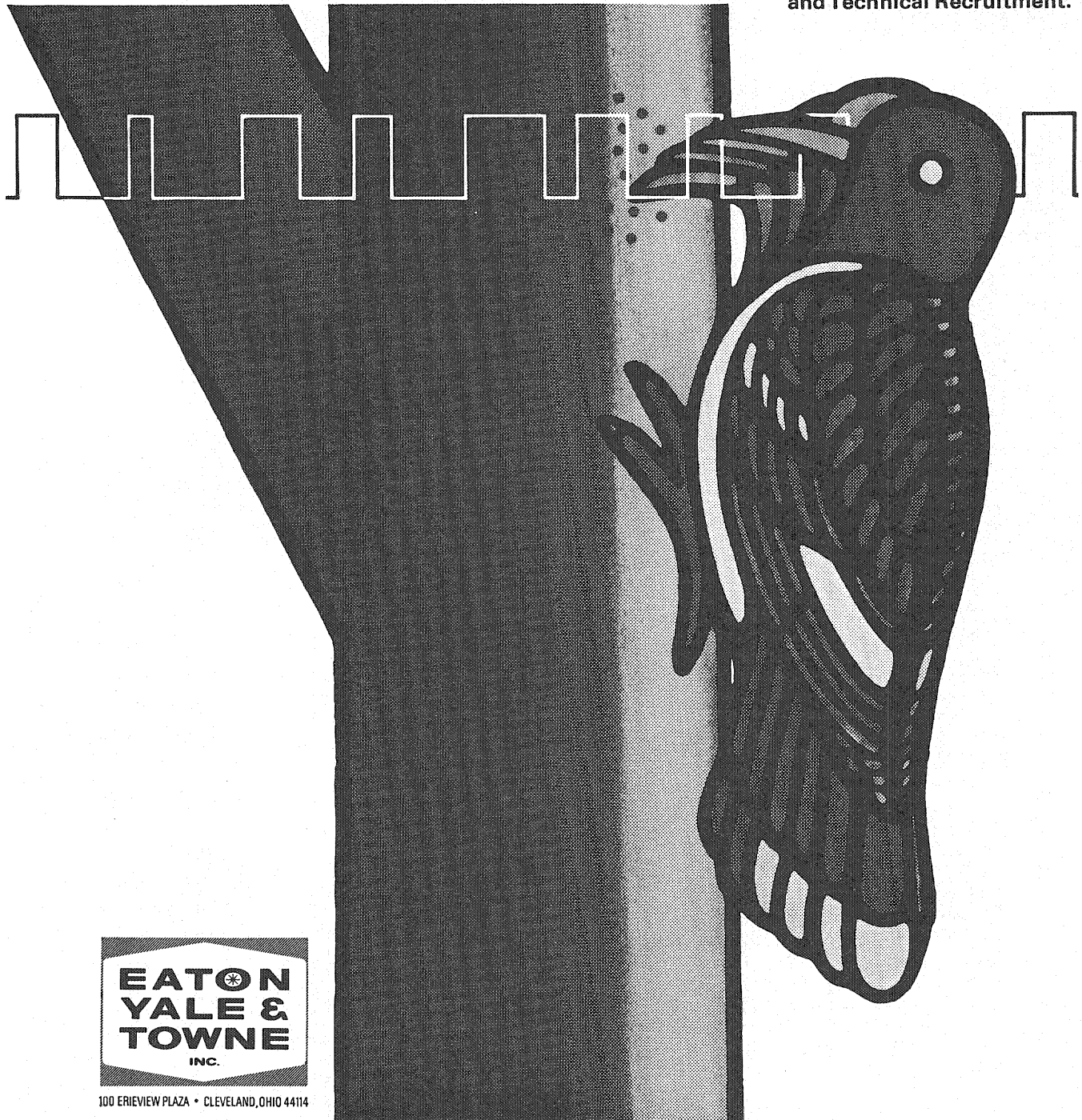
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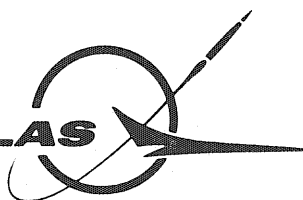
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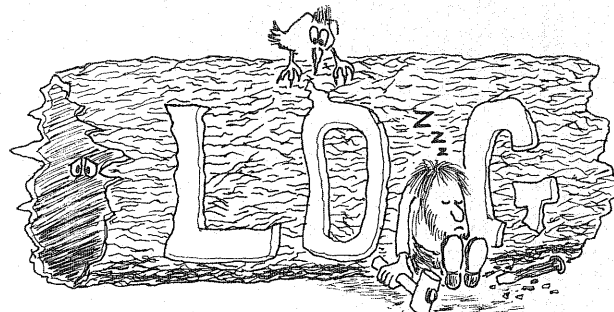
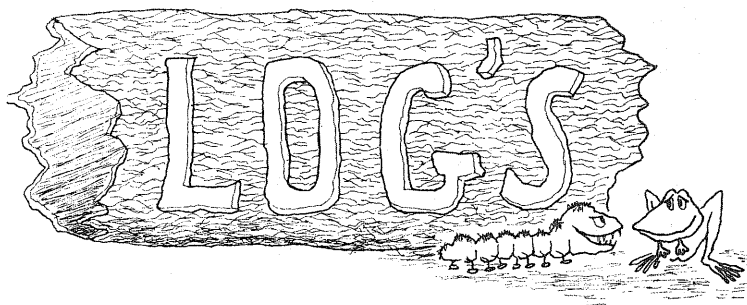
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jai byrd

And here he is, in the true spirit of last-minute copy, Mr. Xerox himself, jai byrd, entering to the strains of a medley of tunes: "I've Got a Bluebird on My Shoulder"; "Dandruff is Not My Problem"; "I've Got the World on a String"; "My Sweater Keeps Unraveling".

This month's confusion begins with none other than Ralph Groop and his analysis of the Middle East Problem. Obviously, he thinks that Washington, D.C. should be thrown into the ocean, but I am of the opinion that our waters are polluted enough.

Then, you knights-of-the-round-table fans can savor the thrilling tale of "Sir Snatlink Meets Mervin the Rat". For those with weak stomachs, the editors suggest a girdle.

Then, of course, there is the usual Playboy calendar. I hope you get your copy before Cheap Joe pulls out the pin-ups.

sir snatlink meets mervin the rat

In all of Knighthood, there is no name more revered than that of "Sir Snatlink"—defender of the poor, the meek, the wretched . . . in short, of his faithful sidekick Sir Cumference ("Sir Cum" to his acquaintances).

A cloud of dust and a hardy "Lettuce, away"—Sir Snatlink rides again:

In the service of King John, the Constipated, Sir Snatlink ventured forth to avenge the murders by one Grendel, who is the henchman of the evil heavy, Prince Ton.

As Sir Snatlink entered the castle grounds of King John, a hairy figure leaped from the wall and onto a guard. "I heard what you said about my mother!" screamed the monster, proceeding to rip the poor fellow limb from limb.

"Why, if it isn't Mervin, the Court Psychiatrist!" exclaimed Sir Snatlink. "Too bad about Ed!"

"Yes, isn't it," replied Mervin, once again giving Ed a pull, "but he shouldn't have said those things about my mother." Mervin wiped the tears from his eyes with his pointy tail and retired to the steam tunnels underneath the castle.

"By the way, Sir Snatlink," said Mervin as he left,

"I caught Grendel snatching some of my grain last night, so I tied him to four quartering horses; but he slipped out of one of the ropes and escaped on three of the horses—obviously intent on regrouping later."

"Good old Mervin—just like the good old days in the psych. classes working with rat mazes."

Following the trail of blood, Sir Snatlink and Sir Cum came upon a boiling pool of an odious liquid.

"This must be the place," said Sir Cum. "Look at all those bottles of Elmer's Glue-all on the other side. We'll have to watch out for pot-holes as we go around."

"You're better at spotting them than I, so, Sir Cum, navigate."

Will Sir Snatlink triumph? Or will he succumb?

Is Grendel a monster that Sir Snatlink must deal with? Or is he Sir Cum's size?

Will Grendel's mother offer the two weary knights some of her special Mulligan Stew?

Will Sir Snatlink have to resort to trickery? Can he pass as the infamous "Dragon-mouth of the Baccus-viles" and escape by the scum of his teeth?

modesty blaze

Male students and Institute of Technology administrators reached a compromise yesterday afternoon over three demands presented two days earlier by the Co-ordinated Can Committee Associated (CCCA), and the male students walked out of EE 31, the men's room in the basement of Electrical Engineering.

The agreement, read by a spokesman for Dean Cheston at an afternoon news conference, included these points:

1) The Dean would give support to student demands that doors be put back on the stalls.

2) Private funds would be found for a men's room architects' conference that will be held at the University in the spring of 1969.

3) Administrators would negotiate with the janitors to keep a constant supply of paper towels in the boxes, and to keep the trash baskets from overflowing.

The occupation of EE 31 began two days ago when the militant student group set 1 p.m. as a deadline for the acceptance of their demands. Leaders of the

group, Marigold Slave and Boris Brinkley, waited in Dean Cheston's office until the deadline had passed, then after receiving no reply, led their group downstairs into EE 31.

While some students guarded the door, they announced they were occupying the room and would allow no unauthorized people to enter, although they would allow those in the room to complete their business and leave.

Dean Cheston, although having to attend a meeting on the West Bank, kept in constant touch with his negotiating team staffed by Paul Cartwright and a representative from Plant Services.

The negotiating sessions continued until early yesterday morning, when a recess was taken until 9 p.m. this morning. Negotiations continued until the afternoon settlement was reached.

The spokesman for Cheston said the delay on the settlement came over the time factor on the door installation. The breakthrough came when the Plant Services representative said he would personally install the doors if the work was not completed by the end of the month.

The spokesman for Cheston announced that EE 31 would be closed for some time to repair damage that was done in the occupation.

A Mr. Whipple from Plant Services supply said that most of the cost of the repair would be in replacing the Charmin. "Great quantities of the tissue were strewn about the room and the rolls that were stored there had apparently been squeezed vigorously.—R.W.

back from the front

Remember how badly the Indians treated the "White Man" during the early years of American history? Well sir, the Israelis feel the same way about the response of the Arabs.

Here is a good example of Arab atrocities during the last war:

Picture an Arab tank speeding across the desert, out of ammunition, trying to get back behind the lines. Speeding around a sand dune, it rams into the back of an Israeli tank.

The Arab tank-driver leaps out screaming, "I surrender!"

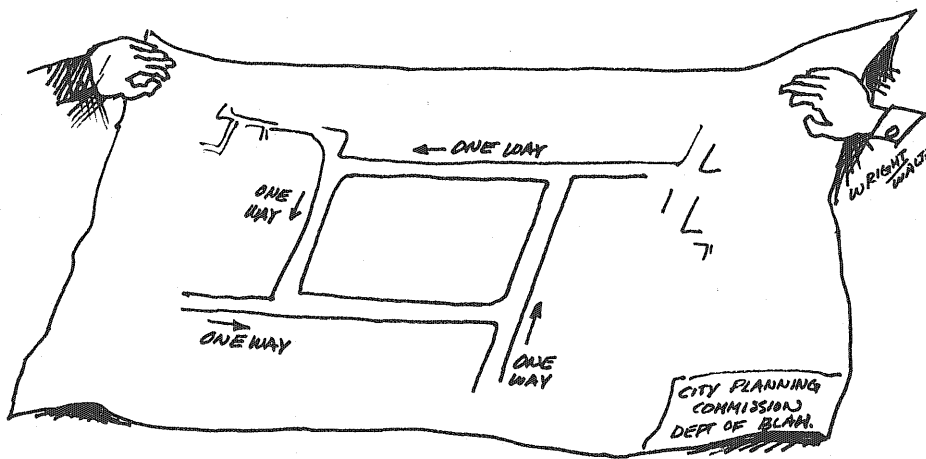
The Israeli exits yelling, "Whiplash, whiplash!"

General De Gaulle is being a real spoil-sport. What right does he have cutting off the supply of replacement parts for the Mirage jet which France sold to Israel. I mean, if you're going to be in the business of escalating the war by supplying arms, then you ought to supply parts just like car manufacturers have to.

I surely hope that the new jets that we sell to Israel help to keep the wars going forever. Without wars to kibbutz about (a la Monday Morning Quarterback) what fun would there be in life?

official daily bull

- Feb. 12—Special sale of jig-saw puzzles using posters from old John Wilkes Booth fan club.
- Feb. 14—Wire flowers, eavesdrop on your "friends."
- Feb. 19—Hollywood to film gangster movie in Hawaii —David Jansenn to star as finger man—title: "Digit Goes Hawaiian"
- Feb. 21—University student arrested for jumping the season on cherry trees.
- Feb. 28—U Thant announces settlement of Mid-East crisis—Arabs to get Palestine/Israel; Jews to inhabit land-fill covering what used to be the Eastern Mediterranean.
- March 5—Winter enters last three months.



HEY JOE! THIS ONE WILL REALLY GET THEM! Y



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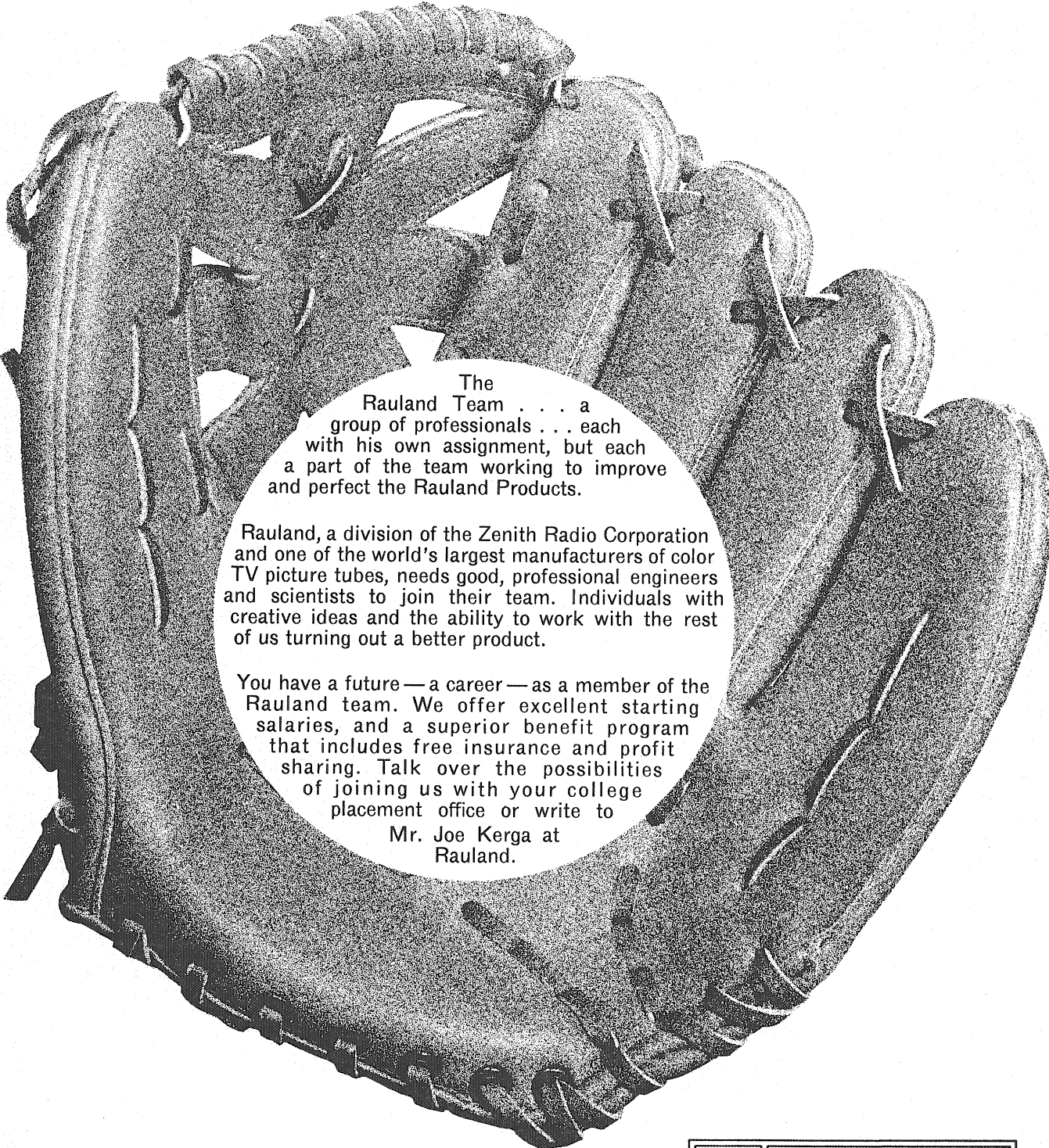
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Rauland, a division of the Zenith Radio Corporation and one of the world's largest manufacturers of color TV picture tubes, needs good, professional engineers and scientists to join their team. Individuals with creative ideas and the ability to work with the rest of us turning out a better product.

You have a future — a career — as a member of the Rauland team. We offer excellent starting salaries, and a superior benefit program that includes free insurance and profit sharing. Talk over the possibilities of joining us with your college placement office or write to
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Little Boy (a future Aero.): "May I come in your yard and get my arrow?"

Neighbor: "Yes, where did it fall?"
 Boy: "I think it's stuck in your cat."

The day after finals a disheveled M.E. walked into a psychiatrist's office, tore open a cigarette, and stuffed the tobacco up his nose.

"I see you need help," said the doctor, startled.

"Yeah," agreed the M.E. "Got a match?"

The boys in the safety lab came up with a new seat belt for people who don't like to be seen wearing the wide belt. Now all they need to market it is a large supply of piano wire.

We have a report that on Jan. 18, a Forester froze to death. It seems he was standing in front of the local House waiting for the light to change.

Donovan Construction Co.

Donovan Construction Company has need for Civil, Mechanical and Electrical Engineers.

The Construction Industry is one of the largest industries in the world and is growing, because of our population explosion, at a much faster rate than most other industries.

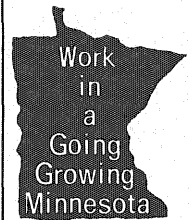
Donovan Construction Company with 50 years of experience, is one of the largest construction firms in the United States with offices in St. Paul, Detroit, New York, Phoenix and Los Angeles and is involved in large commercial and institutional buildings, dams, power plants and other heavy engineering projects, as well as construction of transmission, distribution and substation facilities for the Electrical Industry.

Donovan Construction Company offers, in addition to a good starting salary, generous fringe benefits including bonuses and profit sharing, advancement opportunities in a business atmosphere motivated by excellence and desire to expand. To be associated with Donovan Construction Company is a lifelong career rewarded by advancement commensurate with achievement.

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All things equal, Northern Ordnance is unequal. If you think you are too, contact Earl R. Wigand, 788-8601.



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The forgetful professor had left his umbrella in his hotel room when checking out; he missed it on his way to the train station and, still having time to spare, he hurried back. He found the room and was about to ask a passing chambermaid to open it for him, when he became aware of voices within and realized that, in the brief time since his departure, the room had been let to new occupants.

"Whose little baby are you?" asked a youthful male voice from behind the door, and the question was followed by the sound of kisses and a girlish giggle.

"Your little baby," said the youthful female voice.

"And whose little hands are these?" asked the boy.

"Your little hands," responded the girl with giggles of delight.

"And whose little knees . . . and whose little . . ."

"When you get to the umbrella," said the professor through the door, "it's mine."



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WILL ENGINEERS HAVE TO DO THE DIRTY WORK?

Yes, because engineers are the only group with sufficient technical knowledge.

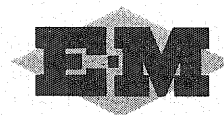
They'll have to deal with the dirt that pollutes the air we breathe and the water we drink. They'll have to find new ways to prevent and control pollution. They'll have to develop new methods of waste treatment. As economic growth expands and our population increases the need becomes increasingly urgent.

Technology must be used for industrial development, but it must also be used to control pollution — an inevitable result of industrialization. Pollution prevention and control must grow hand-in-glove with industrial growth or our cities will become increasingly unlivable.

To do this, engineers of every discipline are required. It's a job that can be done only with hard work and imaginative engineering.

That's how E-M is contributing. We are supplying electrical equipment for nearly all types of pollution control systems. We design, manufacture, and market electrical equipment to serve the basic needs of man (water, transportation, health & sanitation, food, and energy).

E-M is a place where you can contribute. This is the place where solutions to technical problems result in fulfillment of man's needs.



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We have a report that the Vatican has approved of priests dating nuns; just so they don't get into the habit.

* * *

Last week a Slobovian surgeon achieved fame by completing the world's first hernia transplant.

* * *

"A man is responsible for the good name of his family," said the lecturer grandly. "Is there a man among us who would let his wife be slandered and not rise to her defense?"

One meek fellow in the rear of the room stood up.

"What's this?" exclaimed the speaker. "You sir,—would permit your wife to be slandered and not protest?!"

"Oh," apologized the little fellow, resuming his seat, "I thought you said slaughtered."



NOTICE: This month's jokes were stolen from the *Rutgers Engineer*.

* * *

Did you hear about the farmer who couldn't keep his hands off his wife, so he fired them both.



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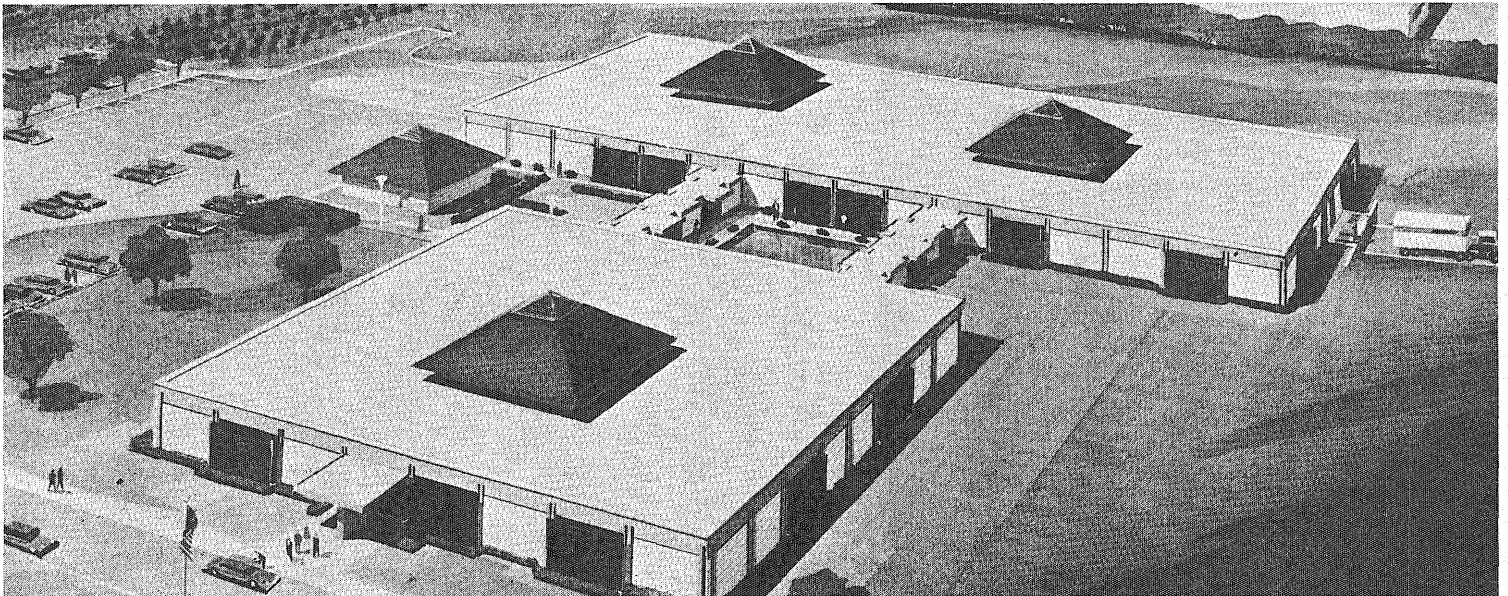
Box 6191, County Road 18, 1/2 Mi.
N. of 1494, Minneapolis, Minn. 55424
Telephone: (612) 941-1100

A pink elephant, a green kangaroo,
and two yellow snakes strolled up to
the bar.

"You're a little early, boys," said
the bartender, "Doc ain't here yet."

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in a
Minnesota
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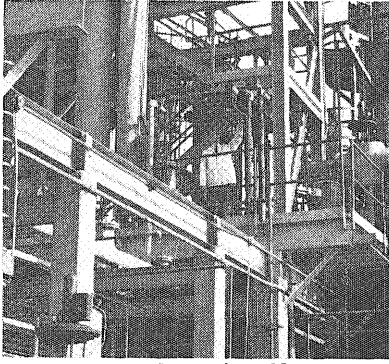


Donaldson Company, Inc., General Offices and Technical Center, Bloomington, Minnesota

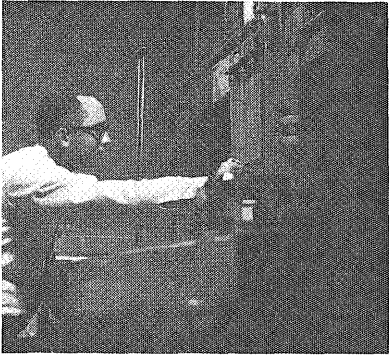
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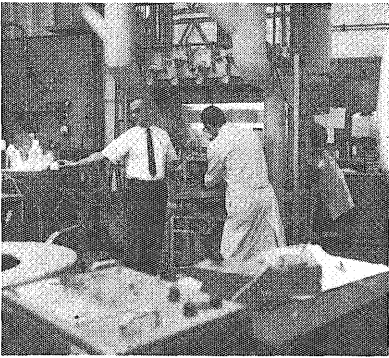




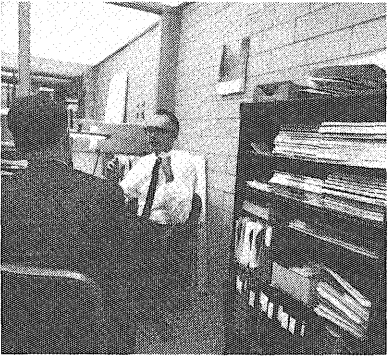
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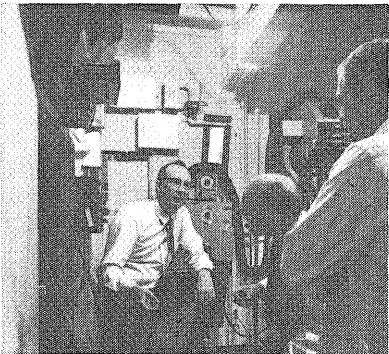
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Joined June '62



Joined November '59



Joined March '56

At Kodak
you can go
◀ this way

or

you can go
that way ▶

Your ambitions may lead you close to the cutting edge of the state of the art in your profession, whether it's industrial, chemical, mechanical, or electrical engineering. In the set of pictures on the left you see the environments of some Kodak chemical engineers, for example, who have not drifted away from chemical engineering.

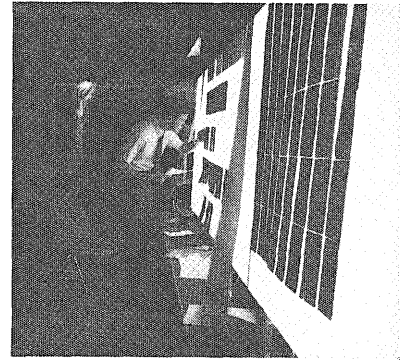
The other column shows the work environments of other real Kodak chemical engineers who have chosen to broaden out into work more involved with people, as in administration and marketing. Perhaps this is the direction you prefer.

Drop us a line telling us in which column your picture belongs. A wrong answer now will not count against you.

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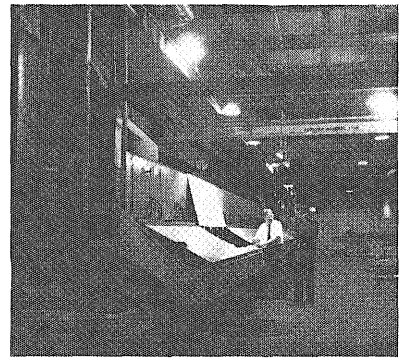
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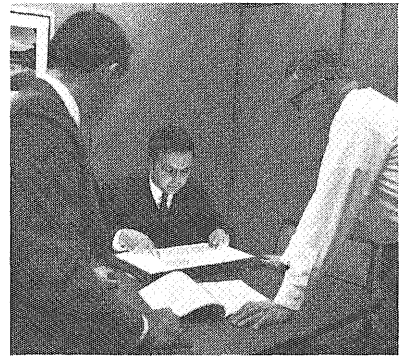
Joined July '68



Joined June '64



Joined June '63



Joined February '59



Joined June '55



Dan Johnson has a flair for making things.

Just ask a certain family in Marrakeck, Morocco.

A solar cooker he helped develop is now making life a little easier for them—in an area where electricity is practically unheard of.

The project was part of Dan's work with VITA (Volunteers for International Technical Assistance) which he helped found.

Dan's ideas have not always been so practical. Like the candlepowered boat he built at age 10.

But when Dan graduated as an electrical engineer from Cornell in 1955, it wasn't the future of candlepowered boats that brought him to General Electric. It was the variety of opportunity. He saw opportunities in more than 130 "small businesses" that make up General Electric. Together they make more than 200,000 different products.

At GE, Dan is working on the design for a remote control system for gas turbine powerplants. Some day it may enable his Moroccan friends to scrap their solar cooker.

Like Dan Johnson, you'll find opportunities at General Electric in R&D, design, production and technical marketing that match your qualifications and interests. Talk to our man when he visits your campus. Or write for career information to: General Electric Company, Room 801Z, 570 Lexington Avenue, New York, N. Y. 10022

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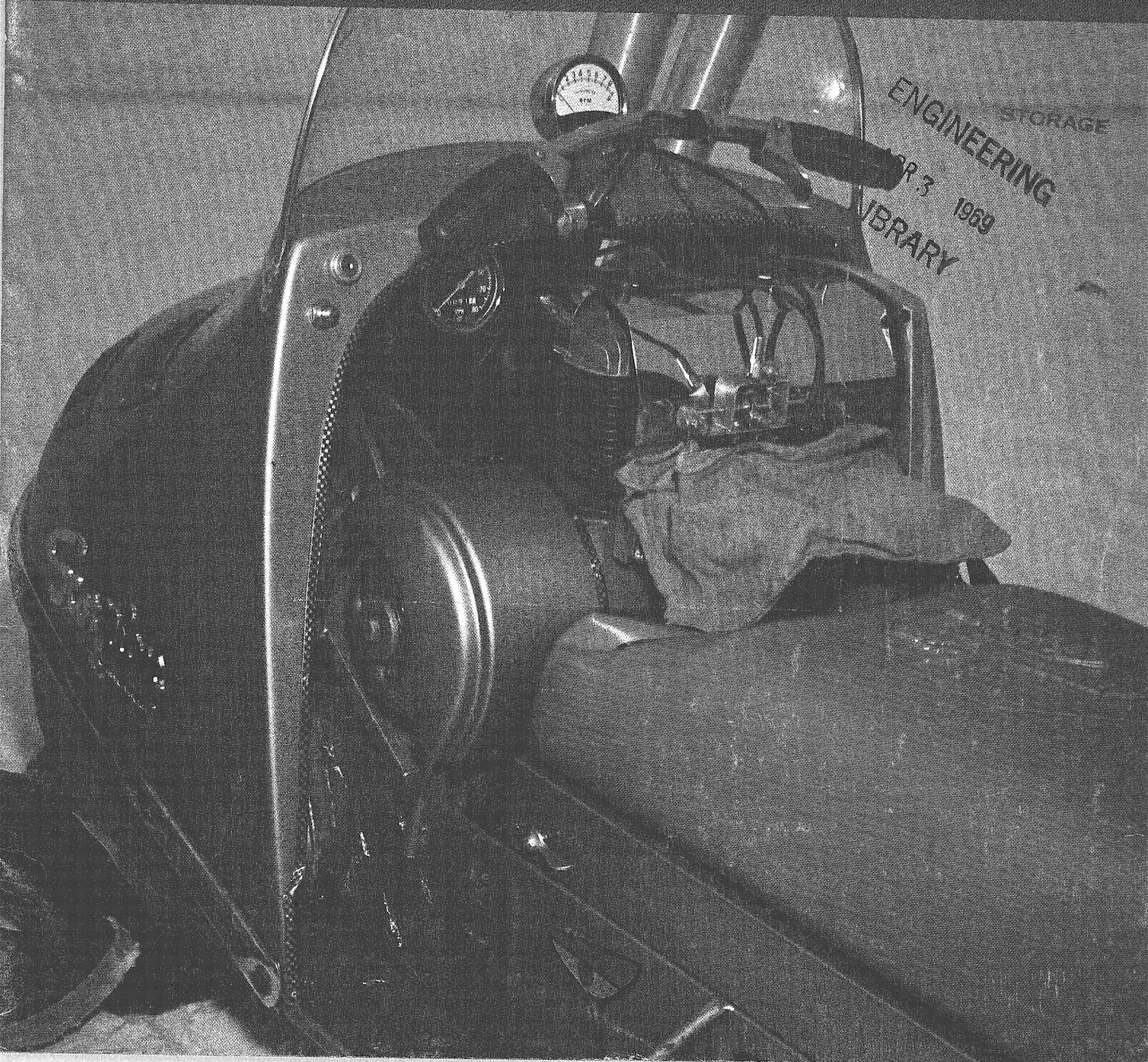
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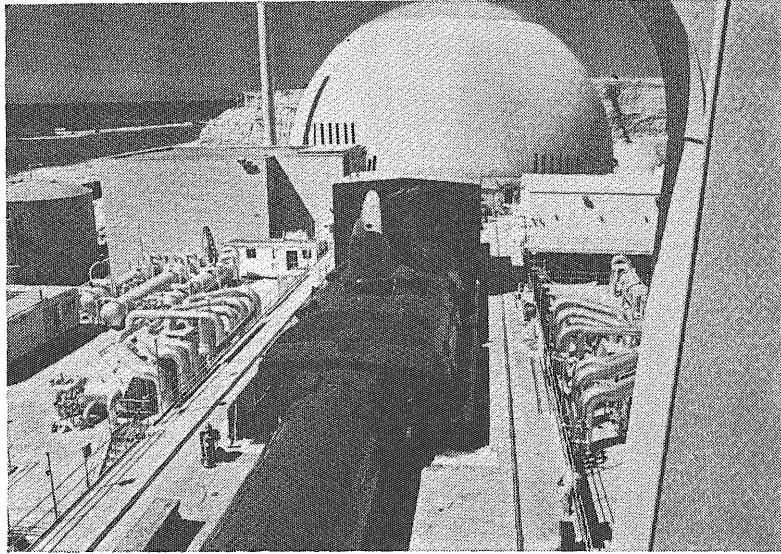
March 1969

snowmobiling at donnybrook

the ham lake airport: public reaction



Westinghouse needs engineers who understand this generation



or this generation.



In the next ten years, demand for electricity will double. What's Westinghouse doing about it? Plenty. We're number one in commercial nuclear power. We're working on an advanced breeder reactor. We're spending \$450 million to boost our production capacity.

Okay, that's Westinghouse, the

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computers, transportation, medical science, air pollution, oceanography, and more. Is that any way to run an electric company?

We think so. If you think so, talk with our campus recruiter, or write Luke Noggle, Westinghouse Education Center, Pittsburgh, Pa. 15221. An equal opportunity employer.

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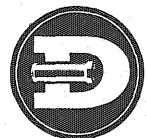
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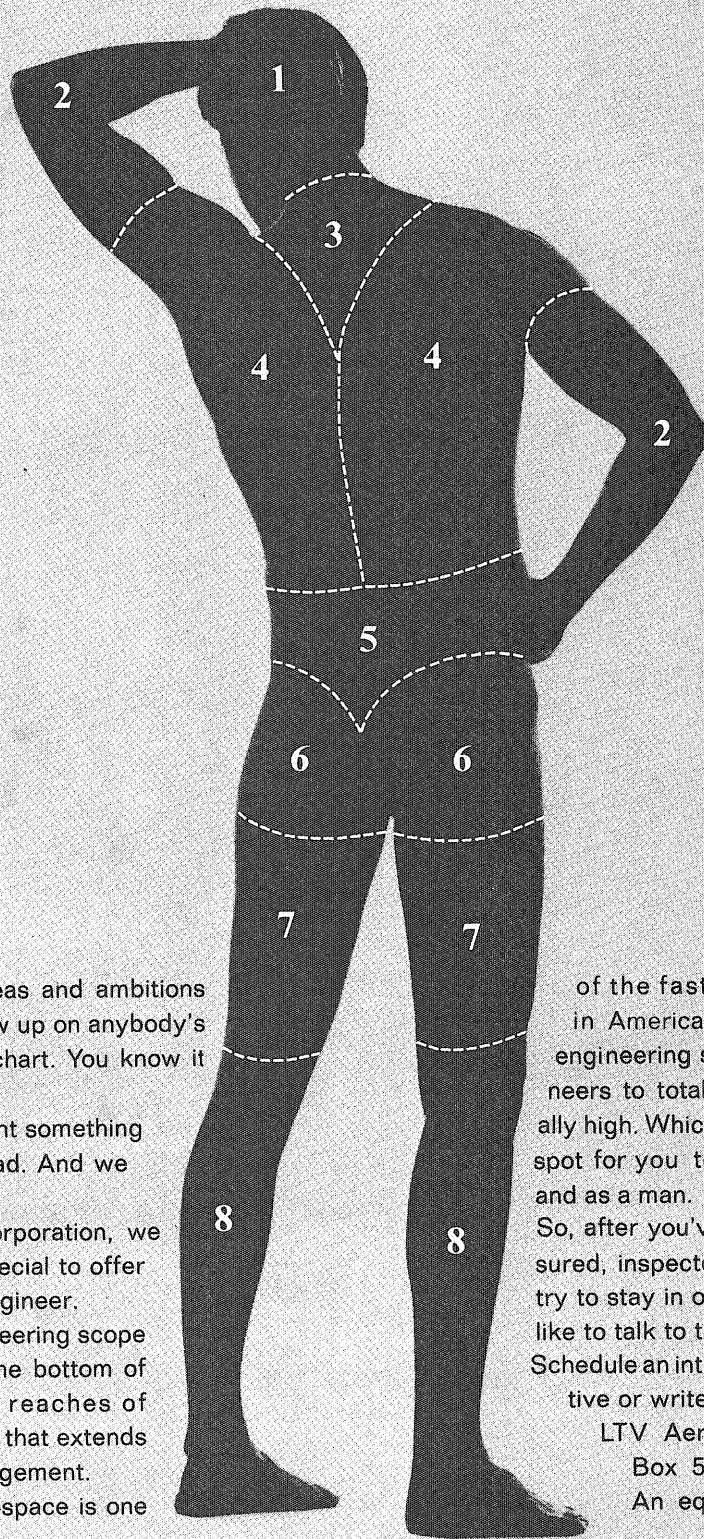
For more information about the Perma-T, contact these Dickey offices: Birmingham, Alabama; Ft. Dodge, Iowa; Kansas City, Missouri; Meridian, Mississippi; St. Louis, Missouri; San Antonio, Texas; Texarkana, Texas-Arkansas.

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Official Student Publication of the Institute of Technology, University of Minnesota

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COVER: This modified Scorpion snowmobile was a contender in its class at the Paul Bunyan Snowmobile Derby. Note the shop rag protecting the carburetor from falling snow, and curious onlookers.

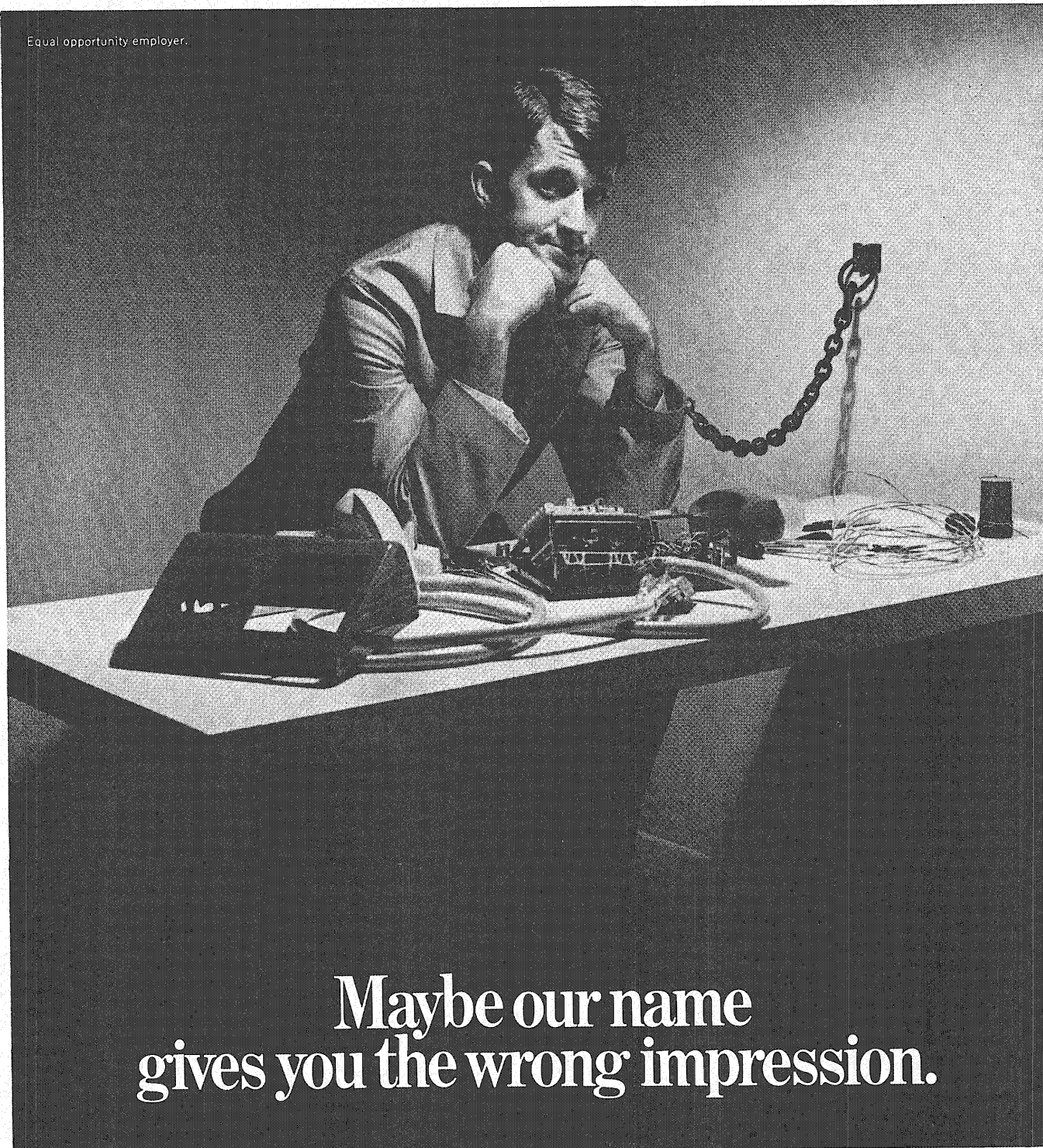
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Uh-uh.

Don't be misled by the word *Telephone* in our name.

Actually we're a group of over 60 companies and some of them happen to be in the telephone business. They're in our General Telephone group and are involved in developing new ways for man to communicate.

So if you want to work for our phone group, you can.

But if your interest lies in other things, you might prefer working for another of our com-

panies, like Sylvania.

Sylvania manufactures over 10,000 products alone, knocking out everything from Micro-Electronic Semi-Conductor Devices to Educational Communications Systems.

The communications field is one of the fastest-growing industries around. The more it grows, the more we grow and the more room you have to stretch within us.

We're looking for Scientists and Engineers with ambition and ideas.

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Or make an old one easier to live in.

General Telephone & Electronics

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Help wanted:

Could you engineer the changeover economically?

Situation: Complete design scheme for tools, jigs, and fixtures needed. Also need plans detailing how much time will be required, under optimum conditions, for line changeover.

Question: Is there some way we can implement this change by utilizing most of the existing machinery at the plant?

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Log Line

Gosh,

A Letter

I would like to comment and/or object, to some of the statements Dean Cheston made in the January issue of the "Technolog". In his article about the "man in space" program, he has made a few startling comments which I feel hard to believe. He says that the "man in space" program has doubtful scientific validity. This is pure nonsense. Most of the money spent in the program, manned and unmanned, goes into developing technology and not for the hardware. Science has certainly been advanced in putting men into space. Furthermore, a manned observatory on the moon or in Earth orbit would have tremendous scientific validity. A telescope outside our atmosphere would be invaluable, especially when manually operated.

Dean Cheston next says that the absence of any well considered scientific goals has been irrelevant. This statement is irrelevant. The moon is just a point of focus in building and developing our technology. We are going to the moon because man is both a curious and greedy creature. Man has always possessed a drive and desire to explore and exploit his surrounding environment. Space has now become our environment. Must we shy away from a manned program because we cannot foresee any great scientific or social benefits. Exploration of the planets and our solar system may prove to be very beneficial. Must we see the pot of gold at the end of the rainbow before we act. Discovery and exploring the unknown is a significant part of science.

Our Dean's most shocking statement, however, concerns our country's "man on the moon" policy. Dean Cheston says this policy has neither

scientific or human relevance. He is mistaken. This policy offers satisfaction for man as an outlet to his curiosity. Furthermore, President Kennedy did not initiate the "man on the moon" project *just* for science. President Kennedy saw a need for rejuvenating the nation's spirit and broadening our world prestige. The "man on the moon" policy is something in which everyone can feel a sense of participation. President Nixon calls our society rich in goods, but ragged in spirit. Our manned flights help provide this much needed ingredient to our lives. The achievement of Apollo 8 has demonstrated this. As Comedian Bob Hope recently said, "Apollo 8 makes us all stand a little taller". If we drop the manned program, the entire program will become a second-class effort. The opportunity to unlock a whole new dimension of life would be tragically delayed. Space acts as a barometer for the rest of the world in evaluating Russia and America both in science and in leadership. Why should we let Russia enjoy the entire playground of space. As a NASA official once said, ". . . one cannot help but anticipate with wonder the surprises to come". I hope Congress feels the same way.

Jerry Schiebe
Senior—A.E.

History-12 B.C.

When was the last time you needed reference materials from the Engineering Library? Was the information found current with manufacturing methods? Did it contain up to date theory related to your topic? Chances are the information found was outdated, antiquated, and only semi-related to your technical needs. As an example, try locating material on reinforced fiberglass plastics. Extensive

searching will yield three books, a British publication dated 1954, a second semi-related book on polyester resins, and a third book on the immediate topic published in the early 60's. Is it that this field of technology has grown stagnant, and is not advancing in methods and applications? One hardly thinks so in view of the fact that fiber glass is becoming increasingly more important in molded bodies for boats and automobiles. A more likely postulate is that the Engineering Library is failing to serve the technical needs and interests of the students.

Undoubtedly numerous other examples of finding only obsolete reference materials can be brought to mind. In light of the above, I propose that the name Engineering Library be changed to University of Minnesota Technical History Library.

Why No Change

Engineers must have a background which is not strictly technical. This is recognized by IT students and some administrators who are working to change the present University curriculum. Changes are required to allow IT students to have a broader liberal arts background.

Committees are ponderously working to present possible curriculum changes. How long it will be before any action is taken remains to be seen. The Engineer's Council for Professional Development (ECPD), the accrediting agency for technical colleges including the University, prepared a statement in 1967 which outlines an acceptable engineering curriculum. It suggests that about two and one-half years of study be devoted to mathematics, the basic sciences, and the engineering sciences. ECPD also recommends that one-half to one full

year be spent in the humanities and social sciences. Since this proposal totals less than four years, ECPD states that the additional time (up to one full year) is available for the students to concentrate on EITHER technical courses OR humanities and social sciences courses.

Why doesn't IT curriculum allow this choice? Dean Cartwright stated that he will accept, by petition, any change in a student's course of study which "is in the student's best interests". But why should students be required to petition for a course of action already ECPD approved?

ECPD "continues to favor broad basic undergraduate programs in engineering which will prepare a student to take advantage of as many different opportunities as possible, and prefers

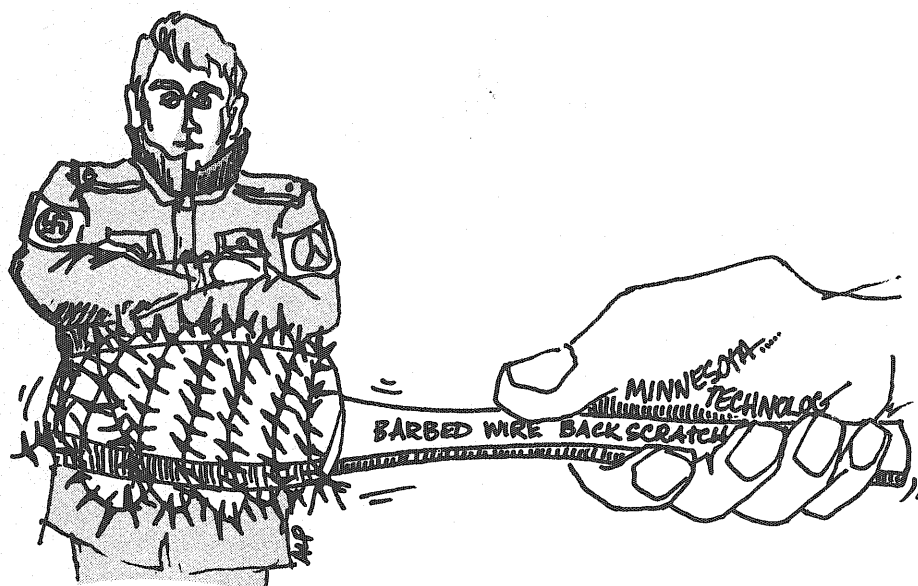
to minimize the number of specially designated curricula to be considered for accreditation." When will the Institute of Technology at Minnesota accept and implement ideas proposed two years ago by ECPD?

E-Day Cometh

April showers bring May flowers and right along with the flowers comes E-Day. This E-Day will, we hope, be the start of a new trend toward having fun on E-Day. A lot of work and thought has gone into making this coming E-day a classic. We've tried to eliminate most of the work and provide more time for the fun we feel should be synonymous with E-Day. The tournament committee is

expanding the number of tournaments and spreading them out over a two-week period. The brawl will be, hopefully, an outside dance with no or nominal admission. The knighting ceremony will be highlighted by a homemade car race. In short, E-Day should be a real riot! We're still open for further suggestions so we would like your comments.

Ken Veith
E-Day
General Chairman



For a job well done!

While searching through some old TECHNOLOGS we noticed that during the 1920's it was the practice of our predecessors to give the Barbed Wire Backscratcher Award to deserving individuals and organizations. Realizing that the Barbed Wire Backscratcher had long preceded the Green Weenie or the Flying Fickle Finger of Fate, we decided to renew this award. This month's Barbed Wire Backscratcher goes to the SDS for hypocrisy above and beyond what is normally expected from this group. The action that won the SDS this award was their decision the ROTC should be banned from the University of Minnesota. It seems that the SDS, while studying and employing the techniques of a classical guerilla insurrection to accomplish their goals (whatever they are), does not want other students and tomorrow's leaders to be aware of these tactics and their countermeasures.

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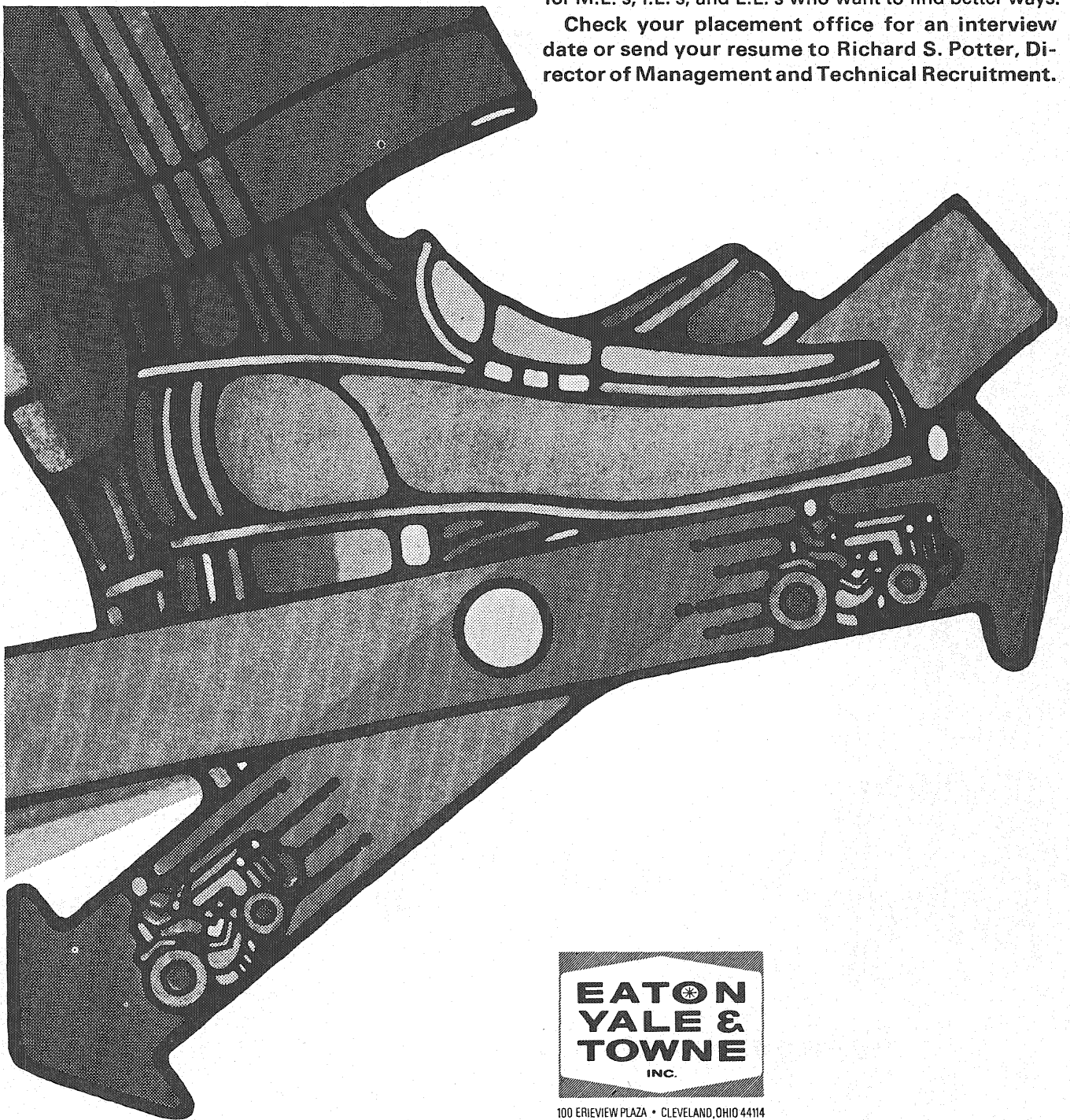
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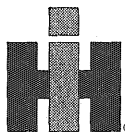
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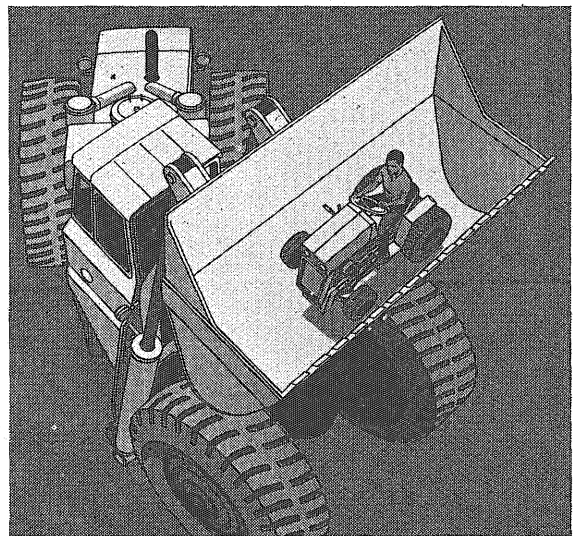
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speaking with the dean

AS MANY OF YOU who read this column know, I am relatively new at the “deaning” business and, as a consequence, much of my time in the past year has been spent talking to people with experience and ideas on education. A year ago I felt fairly confident of the soundness of my views on undergraduate and graduate education in physics, was somewhat insecure in views of chemistry and mathematics education, was not to be trusted at all in the earth sciences and architecture, and the most generous statement I could make about my ideas on engineering education was that they lacked focus. I have learned a few things in the past year, some of which do not come as much of a shock.

First of all, for those students who intend to enter graduate school, there is little to distinguish or differentiate one discipline from another. Those qualities which are necessary in a physics undergraduate curriculum to prepare the student for graduate study are precisely the same as those in chemistry, mathematics, electrical engineering, etc. What one knows certainly is that the mistakes we make in the undergraduate curriculum can be compensated for by those who provide the graduate training. What is essential is that we stimulate the curiosity, nourish the desire to learn and create. At the end of four years, the graduating senior preparing to enter graduate school must feel an overwhelming desire to continue his exploration of his field. Naturally, the student must accumulate certain skills, certain modes of thought; it's difficult to imagine any drive to continue beyond a baccalaureate degree which is not based upon such skills and acquired “professional” attitudes. The life of a graduate student is not that of a dilettante, and pre-graduate education must take this fact into account.

However, a majority of those who graduate from IT with a baccalaureate degree do not go on to graduate school and their bachelors' degrees must be looked upon as terminal degrees. It is then necessary to inquire of their prospective employers: “What should be characteristic of the undergraduate curriculum of a typical IT student who will be seeking employment after obtaining a bachelor's degree?” The answers come through loudly and clearly, the message is unequivocal: a graduate of IT should be versatile—he should be able and willing to tackle a variety of assignments whose only common characteristic is the challenge they possess to those interested and educated in the broad field of physical science and engineering.

At present, a group of faculty and students are conducting an in depth study. This group will recommend major changes in our approach to undergraduate engineering education at Minnesota to reflect more clearly than our present curricula the needs of students and prospective employers.

Warren B. Chester

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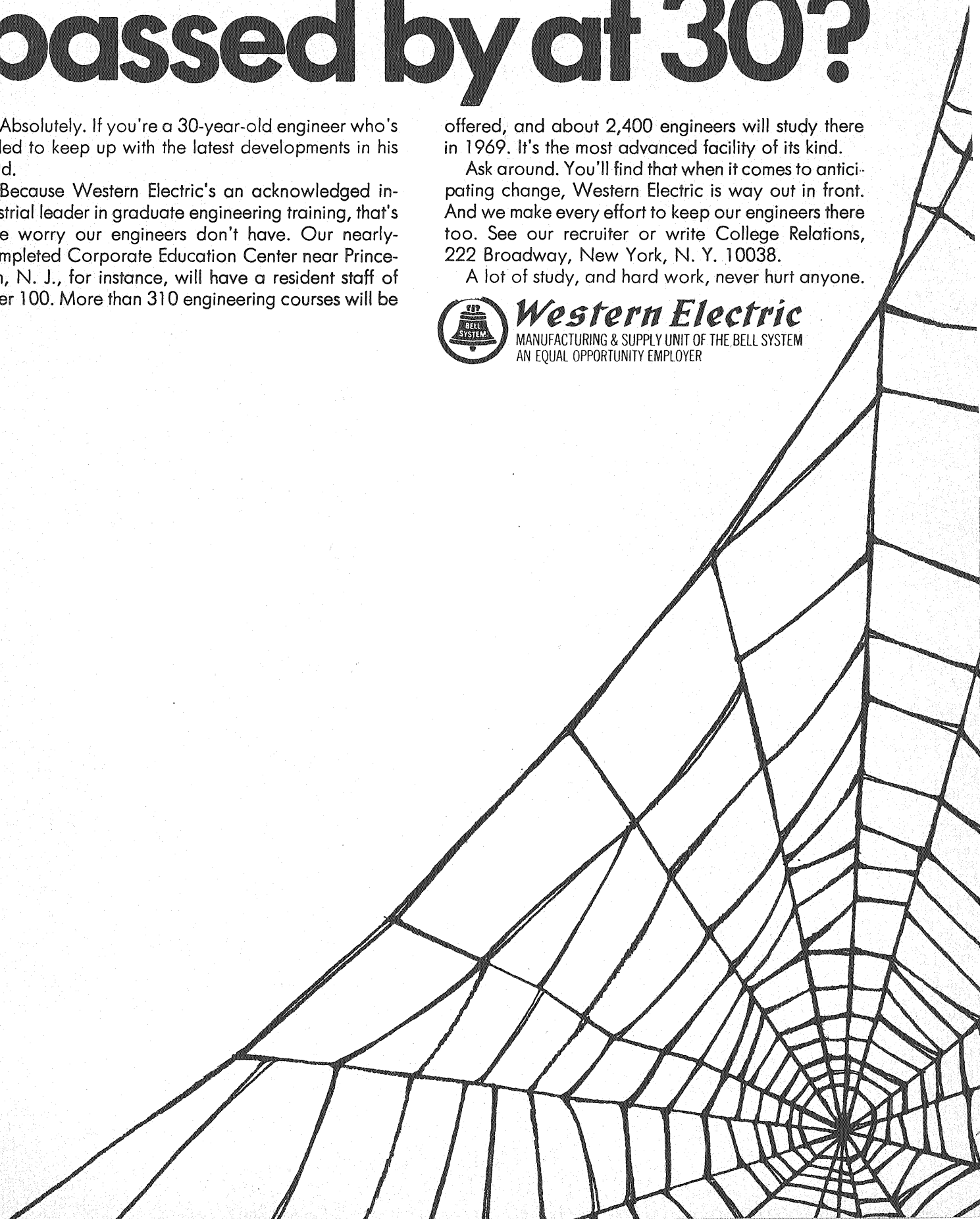
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ONNYBROOKE



Paul Bunyan

Snowmobile Derby

So you say you like to race cars, but that it is too expensive. Well, we have the racing sport for you—snowmobile racing.

On February 23, four of our intrepid staff members went up to Brainerd, Minnesota, for the second day of races in the Paul Bunyan Snowmobile Derby and Races. The races were being held at the Donnybrooke raceway outside of town.

The enterprising owners of Donnybrooke, to keep their auto road racing circuit from lying unused and unprofitable during the winter months, decided that snowmobile racing would be an ideal source of revenue. The raceway itself consists of a three-mile road racing circuit, a quarter mile oval track, and an official drag strip. All three areas plus a special distance jumping area were being used at various times during the day for the snowmobiles.

After picking up our two press passes and buying two tickets, we drove over the bridge to the infield parking lot. Their parking facilities may be great for summer race traffic, but it just is not adequate for the winter season. Of course, we had the disadvantage of pulling a snowmobile on a trailer so we had to find a long parking spot. But it seemed as

though everyone must have been pulling a trailer with one or two machines, because no matter which way you looked, a snowmobile was whizzing by on the parking lot roads.

The two days of races were sponsored by the Brainerd Jaycees, who think of their town as the "snowmobile capital of the world. Although they may have been a little boastful in their slogan, practically every make and model of snowmobile must have been represented on the track and in the gallery. In many cases the same machine seemed to be used for family recreation and for competition. And the competition was not limited to the old man—wives and daughters could compete in the powder puff races on the oval track.

The Jaycees, in promoting the race for the fourth year, raised \$20,000 in prize money and \$1,000 in trophies, which was divided up among the top finishers in each class. The classes were as follows: stock class A through D; modified class 1 through 4, non-production class 5 and 6, and powder puff. All the classes compete on the oval track and all except the powder puff compete in the Grand Prix endurance races. For the two-and-one-half hour Grand Prix races, stock class A and C and modified classes 1 and 2 ran on Saturday and stock classes B

and D, modified classes 3 and 4, and non-production classes 5 and 6 ran on Sunday in the big event of the weekend.

The biggest competitors are the manufacturers who sponsor and maintain racing teams. The racing machines are painted the same as the machines that are sold in the showrooms. The drivers are usually men who have summer occupations like farming or construction work. For their winter racing activities they receive support either from dealers or manufacturers and this support ranges from price breaks to the "loan" of a race-prepared machine and pit crew. Strangely enough, the top drivers often end up on the manufacturers' payrolls. Since the companies are always looking for top drivers, a new man can possibly make the big time in less than a season. Of course, the scramble for money in the big time racing has left the amateur in the snowbanks. More and more of the regional and local races are dropping the stock category in favor of the faster modified and non-production machines. Thus the family that owns a showroom machine is less likely to have father take it out to the race track on Sunday afternoon.

(Continued page 16)

From right to left: At the end of the sharp drum roll the drivers sprint the 20 yards to their machines, tug at the starter rope, and amid the cracking roar and billowing blue smoke, tear off down the ¼ mile straightaway for a 2½ hour ride at 70+ mph.



Snowmobile Derby Cont.

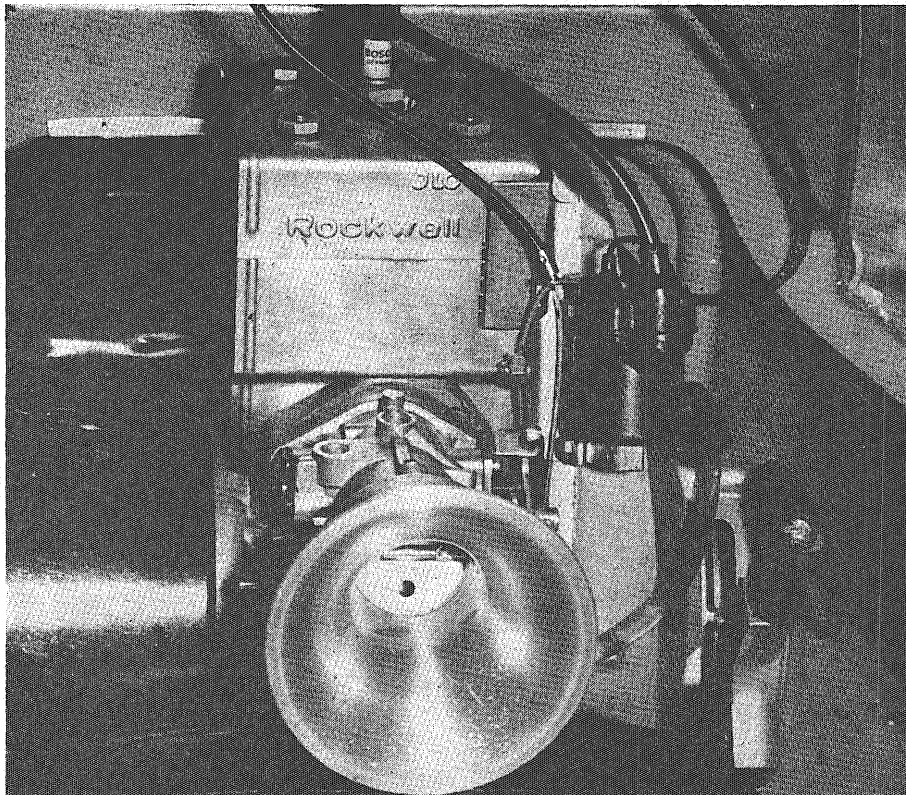
Inspection and Modification

In races at Donneybrooke the winners (first 5 places in each class) have their snowmobiles inspected after the race. The "inspection" given is tougher than the inspection given to new cars rolling off Detroit's production line. The snowmobiles running in production classes must meet the specifications as set forth in the production manuals. A winner, then, after spending 2½ hours racing his machine, must dismember the object of his tender loving care. Driver and mechanic work quickly and faultlessly to prove to a U.S.S.A. official that they have not modified their steed.

As preliminary work the heads are pulled off along with the intake and exhaust manifolds, and carburetor. The U.S.S.A. official mikes the stroke, and bore of the cylinder block checking the displacement. He also mikes the head and head gasket. Any stroking, boring, milling, etc. is illegal. The driver is usually disqualified if anything is found amiss. Juiced up carburetion, oversized valves and ground and polished cylinder ports are additional causes for disqualification.

Of course, if you run in the unlimited modified class anything the weekend mechanic can engineer into the machine is acceptable. This leaves the field pretty wide open, and some mechanics are pulling 70 hp out of a 55 hp stock twin cylinder engine. Special fuels are allowed in the modified class, but production class models must run on a premium or regular gasoline. Some of the heavily modified machines use high octane aviation fuel. The aviation fuel provides slightly more power at a cost which is in the price range of most snow racers.

(Continued page 24)



Below: After winning a race the United States Snowmobile Association official mikes the bore, checking the displacement of the engine. Above: Most snowmobiles come equipped with Rockwell JLO engines.

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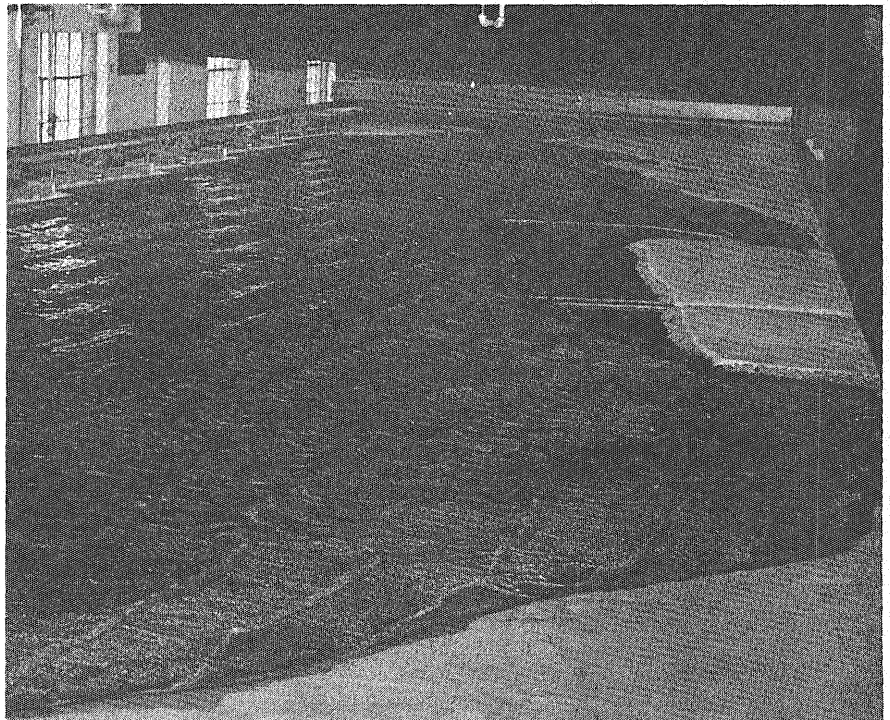
st. anthony falls

hydraulics laboratory

On a small island just below the St. Anthony Falls on the Mississippi River, stands the University's St. Anthony Falls Hydraulics Lab. A great variety of hydraulic experiments, supported by government agencies, the University, and public companies, are conducted here. The projects, which are staffed by both full-time employees and students, include graduate student research projects involving a staff professor's special interests, and company sponsored experiments used to test theoretical plans.

The Bethlehem Steel Company is supporting research to determine whether waste slag can be deposited along the banks of Lake Erie. A scale model of the eastern end of Lake Erie has been built, including machines which produce waves up to an equivalent of twelve feet. The lab is testing a proposal to deposit the slag behind a dike. Tests must be conducted to find out how large waves reflected off the dike will affect ships, how the flow of polluted water is deflected near towns, and how sand and beaches will move with different waves and currents.

Next to the model of Lake Erie is a research project sponsored by the

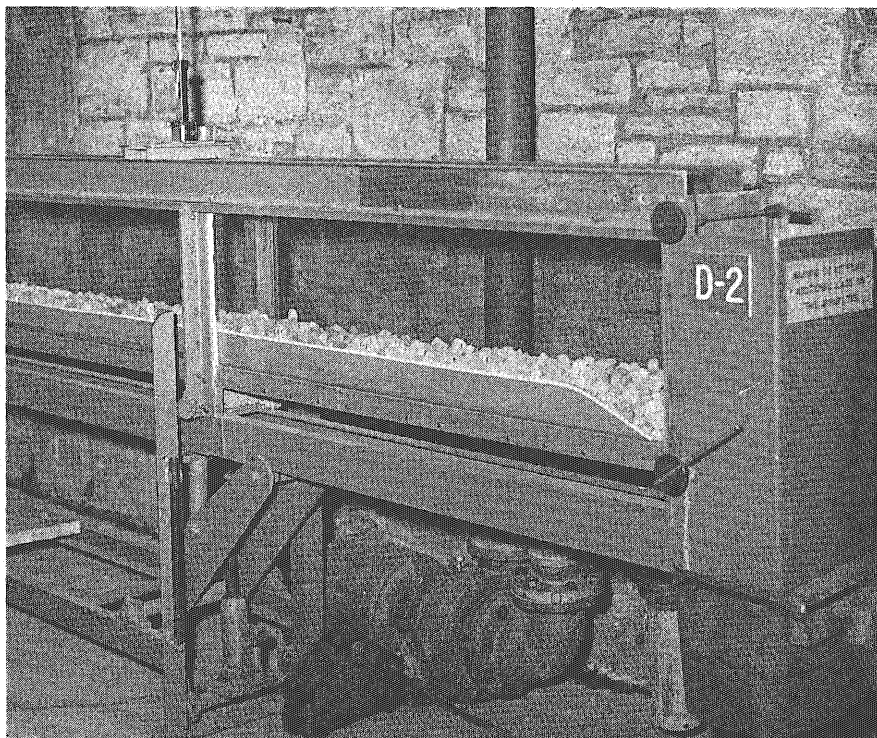


The miniaturization of Lake Erie includes wave machines in the upper left, and shoreline on right side of picture.

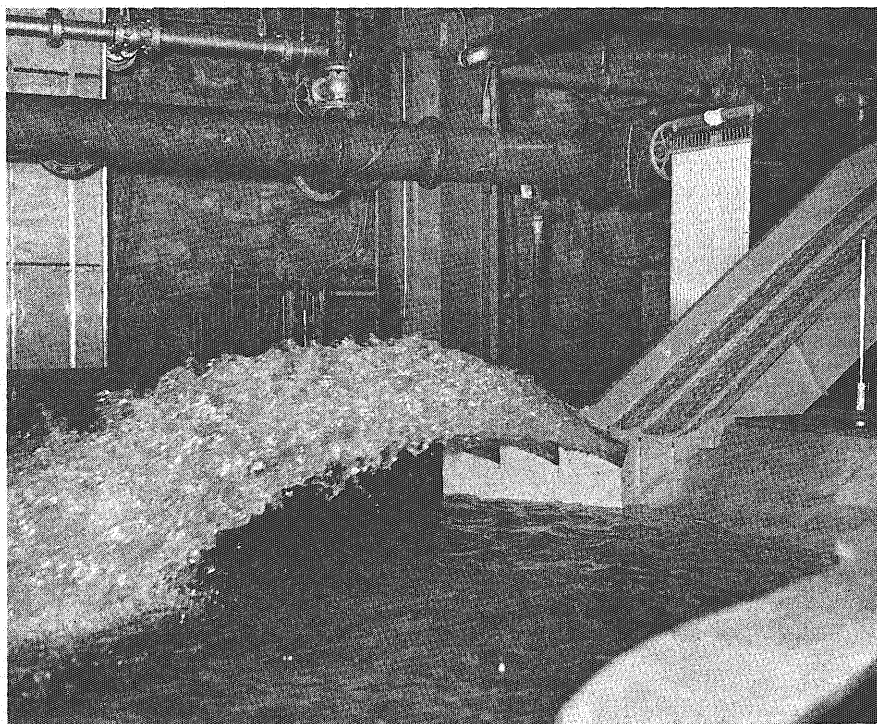
Federal Water Pollution Control Association. Warm water is poured from a horizontal funnel onto cold water sitting in the bottom of a tank. Then a study is made of the basic flow to determine how the water mixes.

Another experiment is the study of the flow of sand and gravel in ditches along southern U. S. roads. Since most of this area consists of sandy soil, the bottom of the ditches erode very quickly. The lab is trying to determine what size pebbles can be spread on top of the sand to keep erosion at a minimum.

A breakthrough in easier ship travel has also been discovered at the Hydraulic Lab. An analysis is being made of how polymers (long chains of molecules) reduce the friction and drag of water. This could possibly enable ships to travel faster through narrow channels.



Sand and gravel behavior in flowing water is studied for reduction of erosion in roadbed drainage ditches.



The Iranian Spillway project is dramatic in operation, while serving as an extremely valuable scientific project.

Currently the most spectacular project is a model of a proposed spillway in Iran. A group of consulting engineers from the U. S. working for Iran is sponsoring this project to decide if the model they designed will effectively solve the problem of overflow water. When a model was built as the engineers had first planned the spillway, it was discovered that an island farther downstream would have eroded away after a few years. By testing a model of the spillway, built at one eightieth of the actual size, the direction of the lip that causes the least amount of erosion was determined.

These are only a few of the many intriguing and interesting experiments being conducted at the St. Anthony Falls Hydraulic Lab.

HAM LAKE SITE:

PUBLIC REACTION

By Myon Hanson

THE PURPOSE OF THIS report is to explore, analyze, assess, and, if possible, evaluate questions relating to the community reaction to a major airport in the Blaine or Ham Lake areas. In general, what are the social problems involved in designing an airport acceptable to the north suburban communities? Specifically, what are the local conditions or pressure groups aiding or abating such a development? Three major areas will be explored: the capacity of community expansion in the areas of housing and industry, and public acceptance on the airport issue.

The population density of the northern suburbs is the lowest in the Twin City metropolitan area. The term northern suburbs refers to the villages and cities of Mounds View, Spring Lake Park, New Brighton, Coon Rapids, Anoka, Blaine, Lexington, Circle Pines and surrounding areas. The City of Fridley is experiencing some of the growing pains similar to those of Bloomington. Each community is providing city water, sewer, gas, improved streets and fire and police protection. The capacity to absorb more people is best exemplified by examining the vast amount of undeveloped land in the whole area. Coon Rapids and Blaine are the two most under-populated communities. These communities and nearby areas would be able to provide homes and services for persons employed by a second airport.

Another factor in community expansion is local industrialization. Currently, the two large-scale industrial complexes are Food Machinery Corporation, located on Hiway 694 and East River Road, and the Twin City Arsenal, operated by Donavon Company and Federal Cartridge, Inc. in the New Brighton-Mounds View area. The arsenal employs approximately 2,000 people, but with the present situation in Vietnam, this represents little long-range financial security. In like manner, Food Machinery Corporation has many associated uncertainties, as much of this firm's income is derived from government contracts.

The other communities are mainly small business and residential in nature. Using Mounds View as an example, the industry consists of three off-sale liquor stores, three night clubs with on-sale liquor, and nine service stations. All of these businesses are located within a one

and one-half mile section of Hiway 10. This type of industry is hardly capable of generating any tax base for the 8,000 people living in the 2,500 acre Village. Other communities, although not generally as limited as Mounds View, have the same kind of businesses. It is obvious that major industry has avoided this region. A Metropolitan Airport and its related industries—airlines, service facilities, post office, express, parking, restaurants, airport staffs, etc.—provide employment for approximately 16,000 people with a payroll in the millions. Clearly, the resulting industries and population expansion would have immeasurable tax benefits, improving the economic outlook of the entire north suburban area.

There are many pressure groups lobbying for an airport in this northern locale. It is the general public opinion that the Ham Lake site is more favorable than expansion of the current Anoka County Airport or Blaine site. Factors influencing this opinion are: The population expansion (which is already up to the southern and western boundaries of the Anoka County field), the noise level, traffic complications and other related problems. These problems do not warrant further expansion of the Anoka County Airport. For example: The Blaine site would have a main runway in a north-south direction. When one considers the location of the approach strip—approximately two miles in length and one-quarter mile in width, directly over the New Brighton-Mounds View area—the potential danger to the dense population in this area (including seven schools and six churches) increases drastically. The noise level would be in the range of 100 decibels on a projected rate of 200,000 flights annually. Distribution-wise, according to Frank Liebl, Fridley Councilman, this would mean a flight every two minutes and thirty seconds. This projected noise level is probably somewhat biased since Mr. Liebl heads the committee of Concerned Citizens Against the Airport. It is for these reasons that the proposed Ham Lake site, further removed from the populace, is the most favorable location.

Dissention prevails whenever any statement is made about the fate of the Ham Lake site. Consider the endorsement of the Ham Lake site by local governing bodies and agencies. Both the Anoka Area Chamber of

“In the final Analysis . . . it appears certain that the location of a second airport will eventually become a political rather than technological issue.”

Commerce and the Anoka County League of Municipalities give unqualified endorsements to the Ham Lake site. The League's resolution was adopted unanimously with seven of the eleven municipalities present at the meeting. It should be noted that both these organizations have a sphere of influence, but no real governing power. Conversely, the Village Council in Mounds View has been recorded as being definitely against a northern airport. This statement was made in support of a petition signed by 80% of the 8,000 residents in the Village—instigated by a group of sportsmen often frequenting the Carlos Avery Wildlife Area. In generalizing then, it

can be noted that financial interests support the airport while a majority of the citizens in the area are opposed to a northern airport development.

The eventual effect on Carlos Avery is also a subject of debate. The following is a quotation from Sam Montean, a state conservationist from Fridley:

Sportsmen and friends of wildlife should be concerned about the MAC's recommendation to place an airport . . . next to the Carlos Avery Game Refuge.

(Continued page 27)

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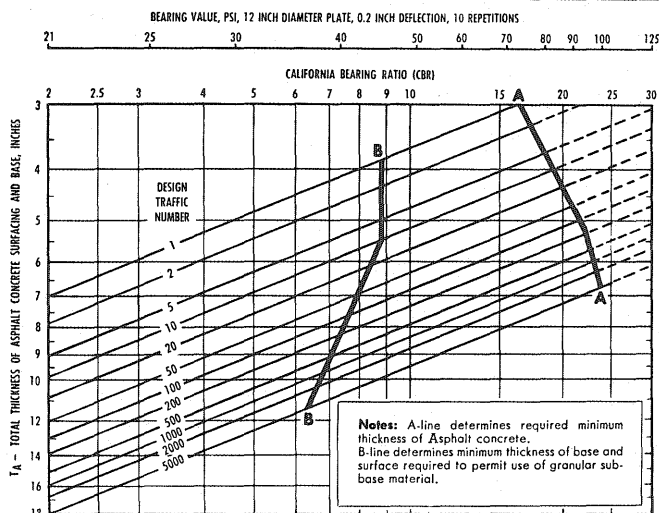
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The Asphalt Institute

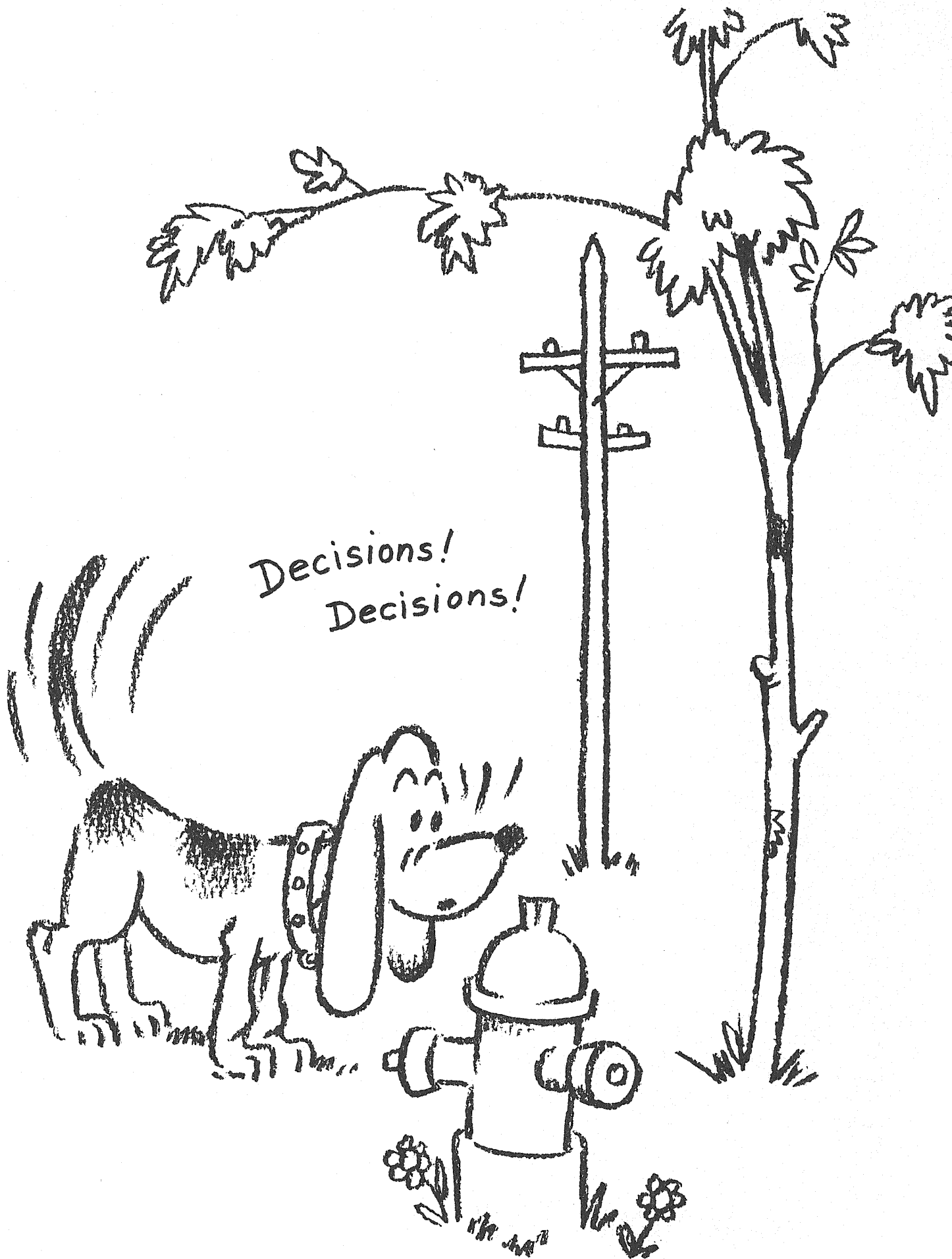
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Snowmobile Derby Cont.

But in spite of the professional trend in snowmobile racing, the ranks have not become closed to the aspiring winterized Sterling Moss. The machines, while hitting speeds as high as 80 mph are not as dangerous as high powered race cars or even low powered minis. The reactions of the driver need not be as fast since the machine tends to continue in a straight line no matter how far the steering handle bar is turned. As a matter of fact, the driver must literally "hang it out," leaning far over the inside ski to get his weight over the inside, turning ski.

The big names in snowmobiles in the racing world are Scorpion, Arctic Cat, Ski-Doo, and Polaris. Polaris does the most impressive work in public relations, with the second spot going to Scorpion and their Para-Sail. The Polaris Thrill Show brings to mind bad memories of the Joey Chitwood Auto Daredevils. "A member of the Thrill Team riding a Polaris Snowmobile will loop the loop attaining six

Below: The Rupp dragster is one of a kind. A Ford engine supplies power to dual tracks which push this "snowmobile" up to 150 mph.

G's at the top of the loop and on the main straight a member of the Polaris Thrill Team will roll his snowmobile over three, yes three times, before coming to a stop."


The people from Scorpion did not have the luck of Polaris. They hooked three machines together and tried to pull somebody's wife 150 feet in the air at the end of a para-sail. After three attempts at the effort and after three trips into a snowbank for the fearless lady, Scorpion called it a day. It was a good thing, because we were getting pretty tired of hearing the announcer "here at Donnybrooke Speedway" say, "you have to give Mrs. Simlach of the Scorpion Para-Sail team of Crosby, Minnesota, a lot of credit for trying to do this difficult demonstration."

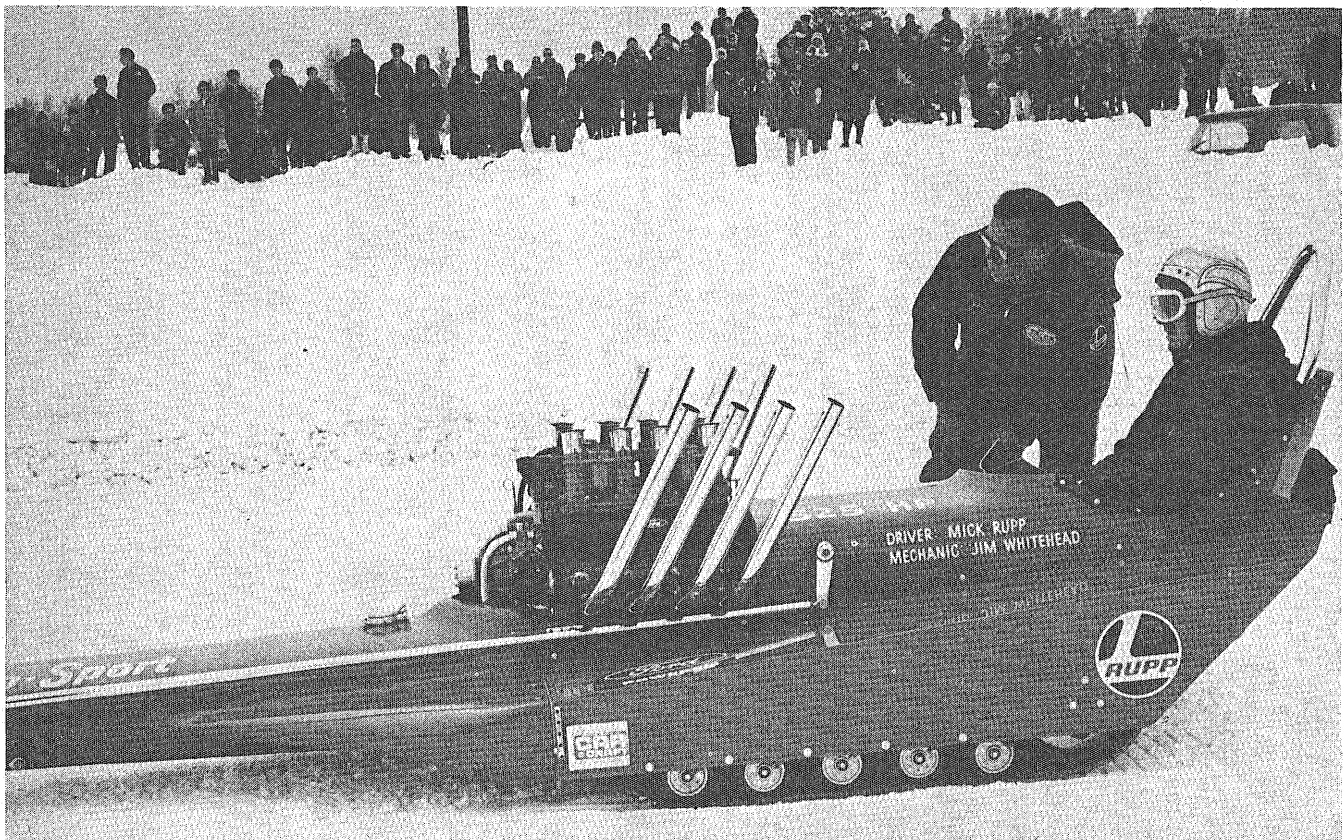
We went over to the starting area at about noon to catch the start of the main event—the 2½ hour Grand Prix Endurance Race for the big machines. Unfortunately, the race, LeMans start and all did not get under way until about 2 p.m. The reason ostensibly was an attempt by the management to put snow back on the track. The Paul Bunyan Snowmobile Derby and Race was held on a warm weekend, and any snow that remained on the track after the Saturday races was swept off by the Sunday morning races. Conse-

quently, a grader apparently spent the two hours pushing snow out onto the track.

Actually, it is strange that more snow was not on the track, because there was a six-foot mound of snow piled around the circuit, blocking the spectator's view.

For the LeMans start, the snowmobiles were lined up in the traditional manner with the drivers 20 feet behind their machines. The machines and drivers started out in three groups, with the most powerful non-production machines being first off the line, followed by the modified class and finally the stock classes. When the signal to start was given, the peaceful cold and clear countryside was filled with the deafening roar of foul smelling, blue-smoking, hot machines. When the final machine got off the line in a flurry of broken starter cords and cuss words, the first machine was coming around the final turn, 2 minutes and 55 seconds after it had left the starting line.

Since we were not properly dressed in snowmobile suits and we had no inclination to fight traffic after the race, we went home. If you want to find out who won, you can look in the paper. But if you are interested in an inexpensive and exciting sport, maybe you should try snowmobile racing. 



FINAL EXAM

What company was responsible for the following engineering innovations?

The transistor _____
Radio astronomy _____
Negative feedback _____
High Fi and Stereo _____
Synthetic crystals _____
TV transmission _____
Magnetic tape _____
Sound motion pictures _____
Microwave relay _____
Electronic switching _____
The solar battery _____
Telstar _____

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We hope the above final can be the start of something great.



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LIGHTLY TO THOUGHTS OF . . .



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ENGINEER'S BOOKSTORE

Ham Lake Site Cont.

This 22,900 acre haven for waterfowl, deer, bird life, beaver, mink and muskrat is being threatened by a \$27,000,000 drainage project that would be necessary to drain the peat for this proposed jet port. There will also be adverse effects of aircrafts pollution resulting from fuel wastes and noise pollution on the waterfowl and animal life reproduction.

There is the danger of the jets sucking up geese and blackbirds (the jet's engines are like giant vacuum cleaners) so upon FAA recommendations, the bird hazards will have to be removed by drainage and removal of food bearing plants and other vegetation thus destroying Carlos Avery.

This opinion sharply contrasts that of George Pennock, Metropolitan Council member. He feels that there is no evidence that the Carlos Avery game refuge would be destroyed by the airport. He also thinks it possible that they can exist side by side. He also states that testimony by experts has completely eliminated the question of the bird hazard. No United States airport has instituted changes because of a bird problem and no accidents have been reported.

It is also interesting to note how readily deer and other wild animals adjust to such conditions. Witness the apparent calm with which the deer herd lived at the Twin City Arsenal while surrounded by heavy motor traffic, and even the testing of some artillery shells on

an open range. In fact, it was the effort to remove them from this environment which caused the most problems. Apparently there is no agreement on the effects an airport would have on the Carlos Avery Game Refuge.

Examine the differences in opinion of the individuals and the organizations investigating the fog situation in the Ham Lake region. These opinions were expressed at a recent MAC meeting:

Homer T. Mantis, professor of physics at the University of Minnesota: Ground fog is reported more often at Minneapolis-St. Paul International Airport than at Anoka County Airport, which has meteorological conditions similar to those at the Ham Lake site.

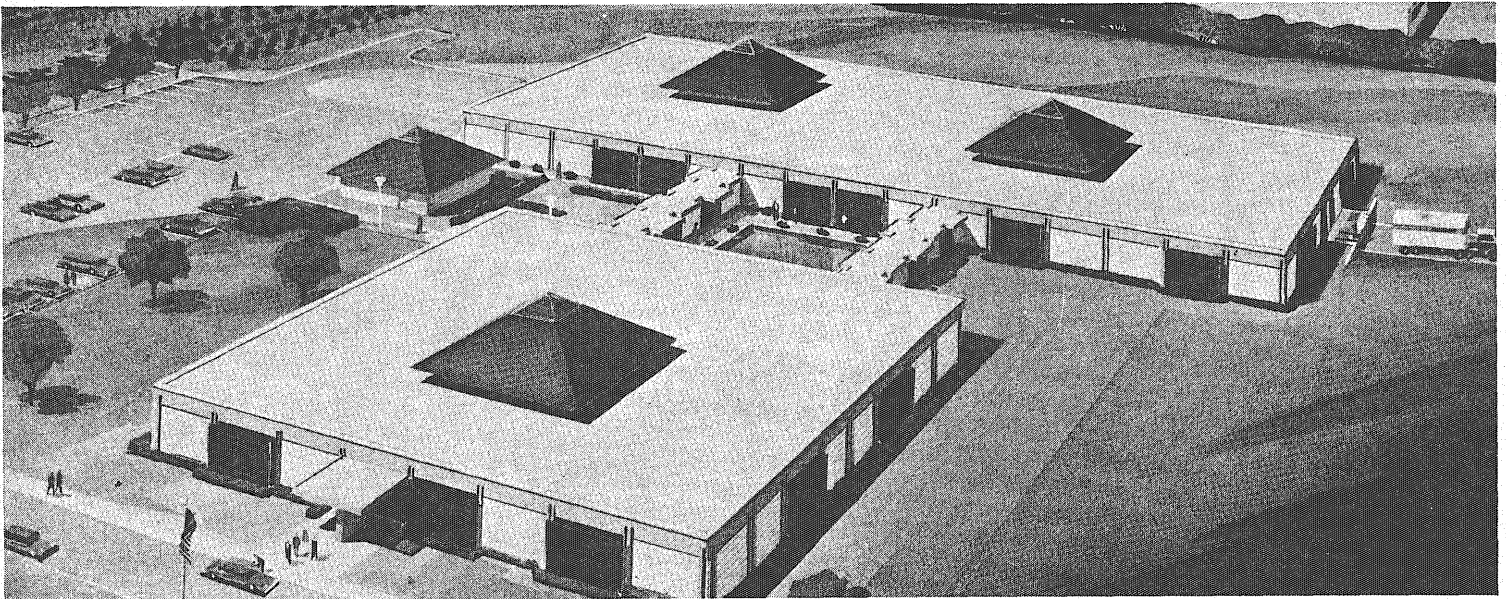
Daniel F. Sowa, meteorology superintendent for Northwest Airlines, Inc.: The Ham Lake site is the most prone area within a 40 mile radius of the Twin Cities to have ground fog.

In the final analysis, each interest group has its own reasons for either promoting or opposing an airport development. The citizen's group oppose the airport because it would impose many unwanted problems on the residential districts. Most financial concerns promote the airport for reasons of industrial and monetary gain.

The issues concerning ground fog and the Carlos Avery Game Farm have been argued in favor of both interest groups. It appears certain that the location of a second airport in the north suburban area will eventually become a political rather than a technical issue.



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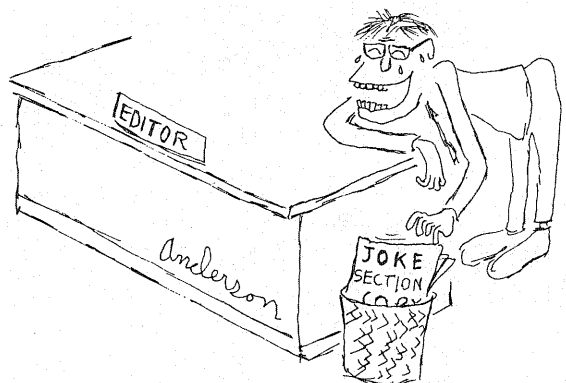
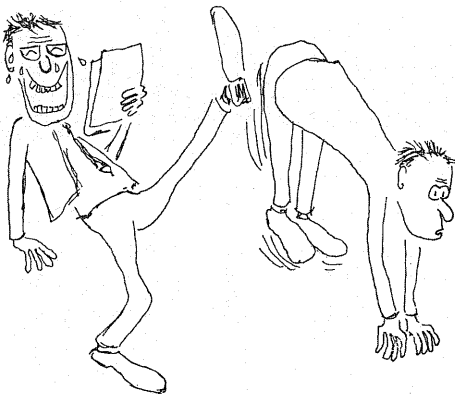
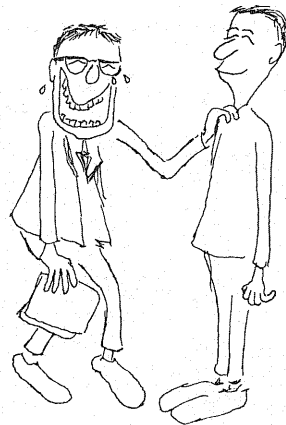
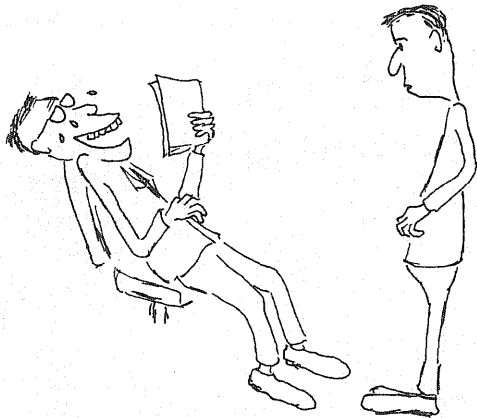
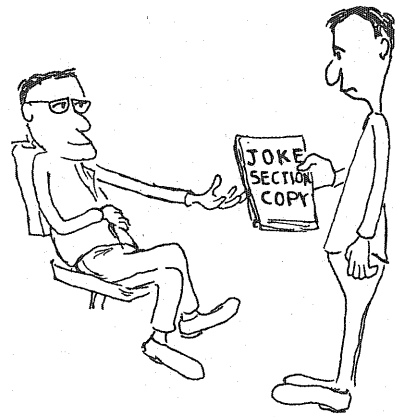
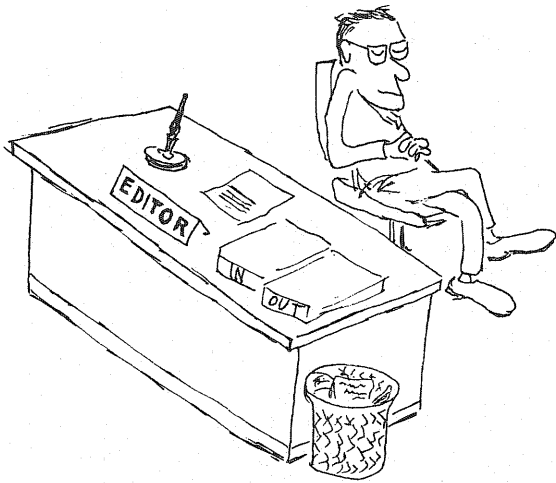
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Don earned a B.S.E.E. in 1965. Today, he's an Associate Engineer in systems design and evaluation at IBM.

Most of his work consists of determining modifications needed to make complex data processing systems fit the specialized requirements of IBM customers.

Small teams

Depending on the size of the project, Don works individually or in a small team. He's now working with three other engineers on part of an air traffic control system that will process radar information by computer.

Says Don: "There are only general guidelines. The assignment is simply to come up with the optimum system."

This informal working environment is typical of engineering and science at IBM

Don sees a lot of possibilities for the future. He says, "My job requires that I keep up to date with all the latest IBM equipment and systems programs. With that broad an outlook, I can move into almost any technical area at IBM."

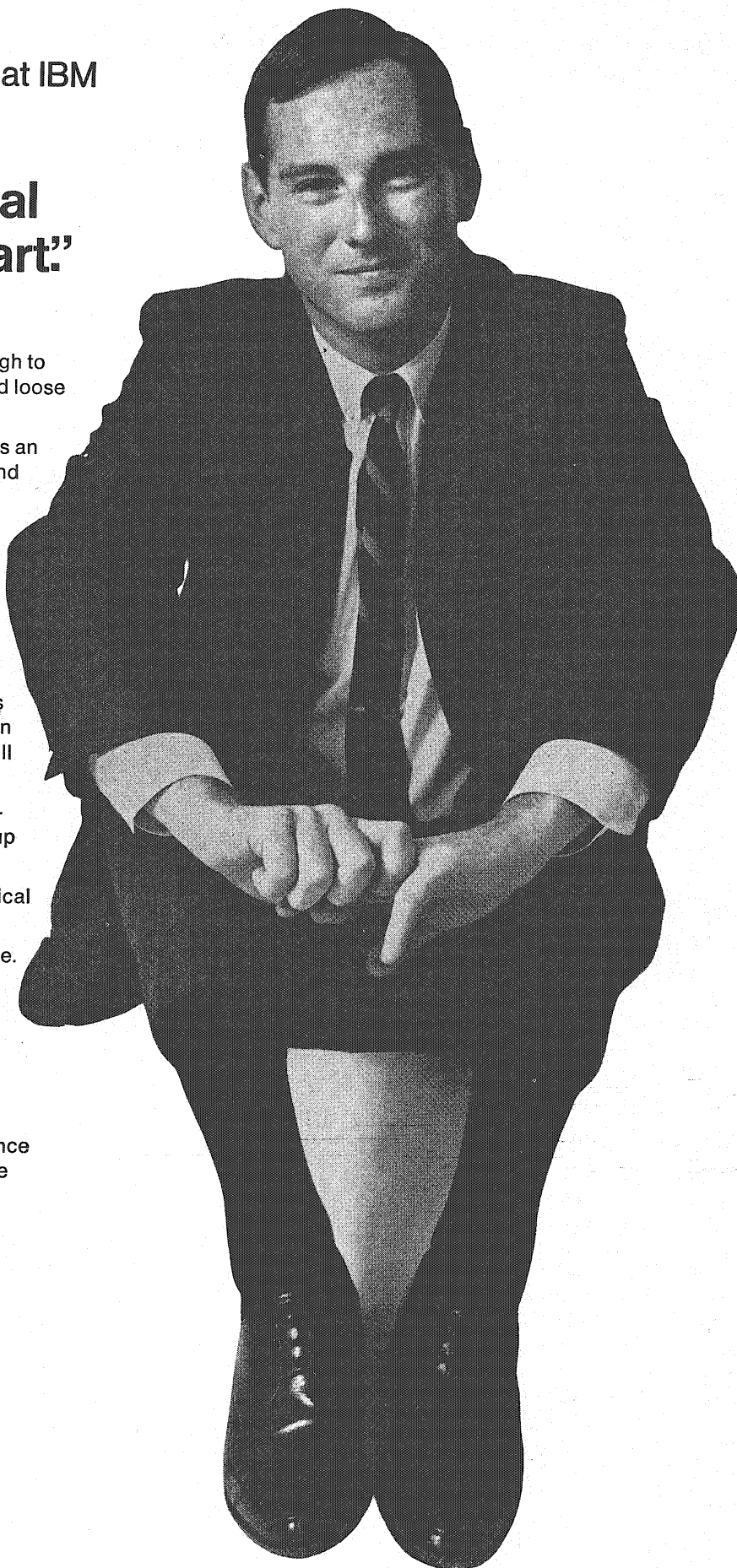
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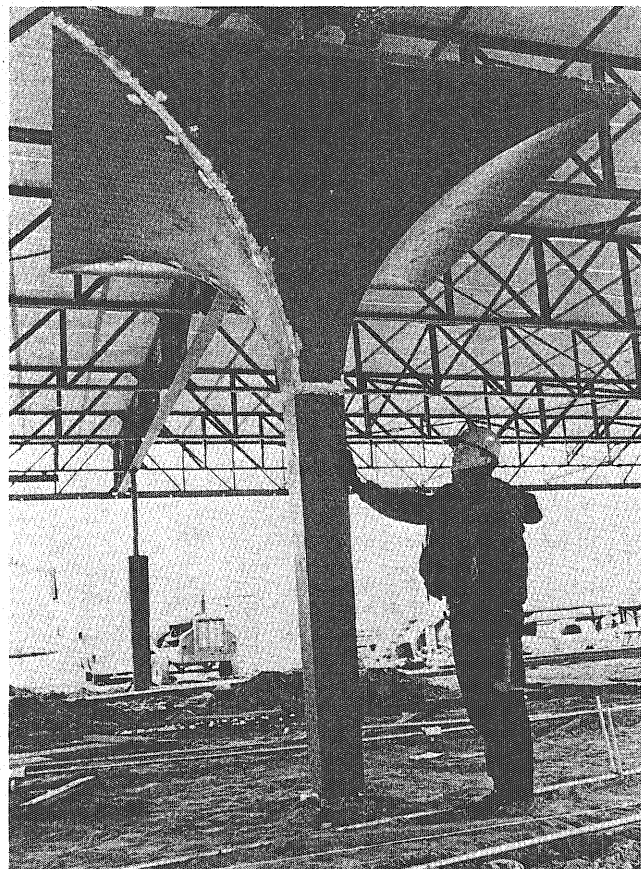
flared columns

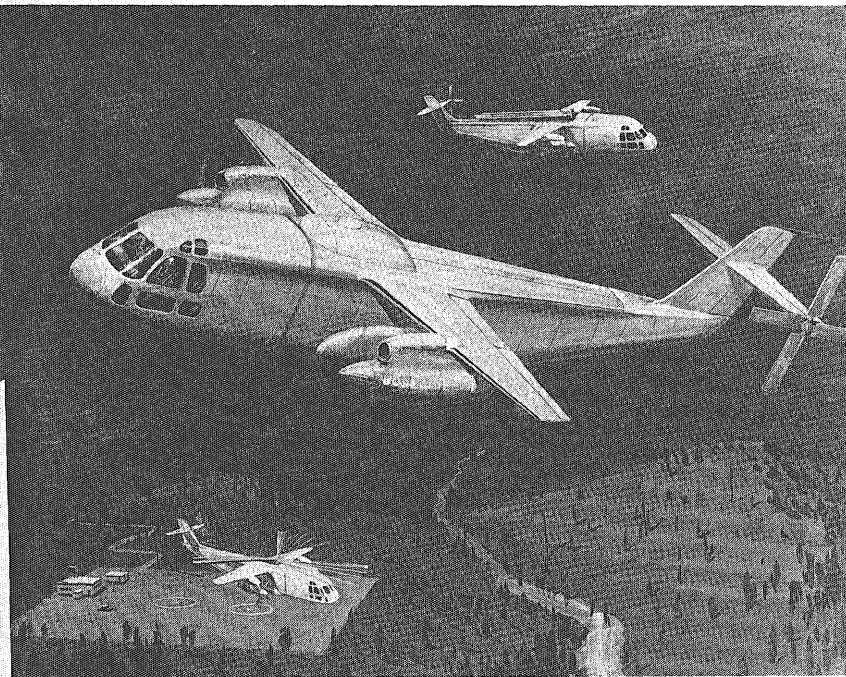
Graceful, flaring steel column shells serve both decorative and functional purposes at the Inland Steel Company's new employees credit union building, slated for completion during the spring of 1969.

Designed by architects Richard E. Glass & Associates of Gary, Indiana, the column shells carry live loads—including wind—up to 35 pounds per square foot, and enclose three-inch XXH steel pipe columns which carry the entire dead load of the roof structure.

Made of $\frac{3}{8}$ -inch A-36 structural carbon steel plate produced by Inland, the shells stand ten feet tall and flare upward from eight inches square at the base to eight feet square at the top. Shell panels were fabricated by Strand Structural Steel, inc., of Chicago, and field-welded together at the site. Pipe columns within the shells are made of Inland INX high-strength steel.

The one-story, 11,000 square foot building will feature 14 of the graceful columns. Steel window frames will be recessed into columns on the building's perimeter, giving the appearance of glass recessed into the columns.





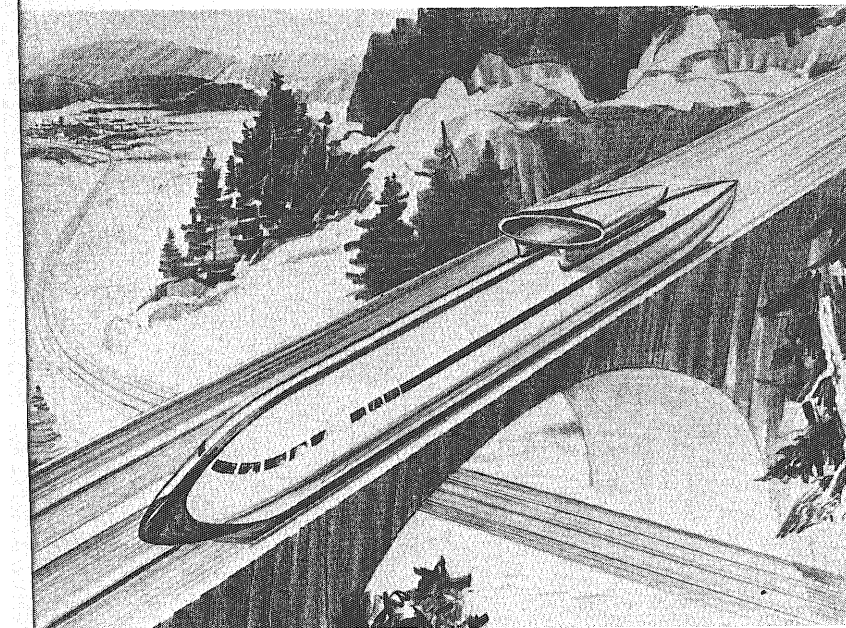
winged helicopter

A winged helicopter that folds back its rotor blades in flight and turns into a swift airplane may well be the next major aviation advance, a Lockheed-California Company engineer said.

This composite aircraft would combine the vertical takeoff and landing capabilities of the helicopter with the efficient high-speed and longer range advantages of the fixed-wing plane.

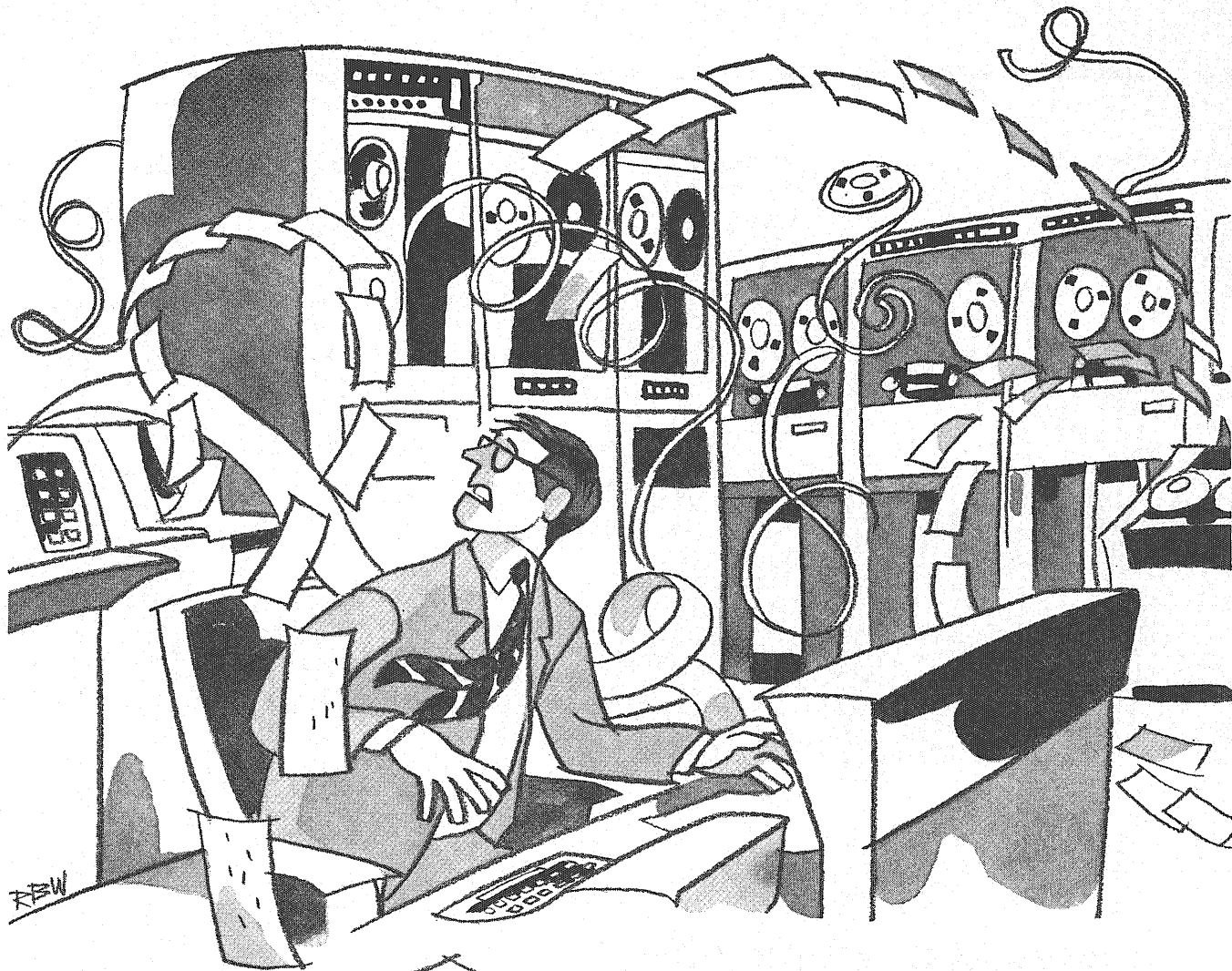
Feasibility of starting and stopping a helicopter-type rotor during high-speed flight has already been established in wind tunnel tests of full-scale models.

Following a helicopter-type vertical takeoff and acceleration to a forward speed of about 140 to 180 miles per hour, the rotor blades would be stopped, folded, retracted, and nested atop the fuselage. The aircraft could then fly at speeds of 400 miles per hour or better over a nonstop range in excess of 500 miles. When destination is reached, the aircraft would slow down, raise its rotor, extend the blades, and start them spinning for a vertical landing.



high-speed vehicles

Prototypes of high-speed vehicles like the one envisioned in this artist's sketch are expected to be tested for the U. S. Department of Transportation in the early 1970's. Westinghouse Electric Corporation has received a contract from the department to study power collection, conditioning and distribution systems and types of electric motors—including linear motors—that would enable the vehicle to travel at speeds in excess of 200 miles an hour. The linear motor part of the study will focus on the reaction, or middle, rail which is the equivalent of the rotor in rotating electric motors and reacts with motor coils in the vehicle itself. Experts at the Westinghouse Transportation Center in nearby Forest Hills will complete the study in six months.



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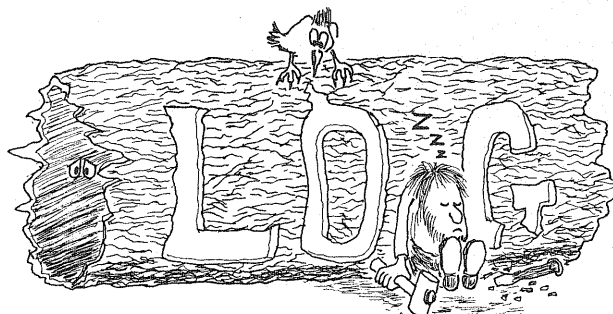
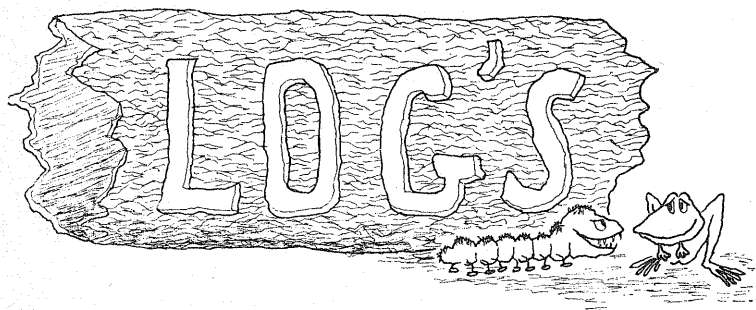
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jai byrd

The stories you are about to read are real, the names have been changed to protect us from a libel suit:

the twisted thing

Winthrop Hammer—Crime Reporter

As I left our offices in the basement of the Seedy Theatre ("Love Me Or Lease Me" was showing), I stumbled over a body. His eyes were glazed like a dead doughnut. His pupils had left for the day—giving his eyes a vacant look.

Stiffening had not started, but his heart had stopped, so I stomped up and down on his chest in rhythm. He began to revive.

The porcelain-white color of his face disappeared as a red flush returned. It would have been very unsanitary otherwise.

People began to stream out of the Cafe Ole and the Bar & Girl. A passing wine-o gave the former corpse a blast.

He turned out to be a hobo who had hidden in a half-empty grain car which unfortunately was this month's tribute payment from Minneapolis to Mervin the Rat. Mervin took him to be a poacher or a spy and . . . (the details are too horrible).

I decided that it was time to have a talk with Mervin, so I let it be known around the Psych labs that I would be wandering the steam tunnels that night in search of the Holy Grail.

I was not disappointed; the minute I hit the lower level of the tunnels, a huge replica of the famed goblet came rolling down the tunnel toward me. Mervin was on top doing the fancy steps that won him the 1964 Forester's Day log-rolling championship.

"My cup runneth over," quoth Mervin.

The resulting crash would have been as bone-jarring as pickled pigs' feet had I not scrambled up the ladder and then hopped aboard the speeding goblet.

It was a rematch of the 1964 and 1965 log-rolling championships. In the tradition of those events, we battled for two straight hours, whereupon we both collapsed from fatigue.

As we lay panting, Mervin invited me to his lair. "I haven't had this much fun since the 'Kampus Kops Massacre' back in '66!"

Back at his lair, Mervin told me the sad tale of his childhood: about how his mechanical mother had rejected him and how the psychology students put him on a partial re-inforcement schedule. As a result, Mervin had developed an unbounded desire for food and had grown to his present 6-foot height.

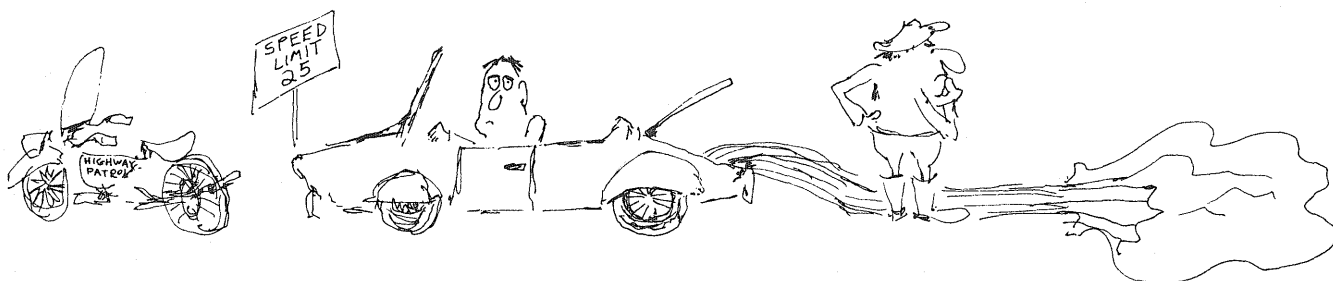
As I left Mervin that night, I had a tear in my eye—nothing that surgery couldn't correct, though.

the gospel according to st. linus

Shortly after the Thirty Years War, there arose in Europe several small religious sects. The following is the Gospel According to St. Linus, chief prophet of Great Pumpkinism: (Genocide 1:1).

"In the beginning, there was the word; and the word was *Squash*. And the world was without form and void. (Not much has changed). And on the first day HE rested.

more

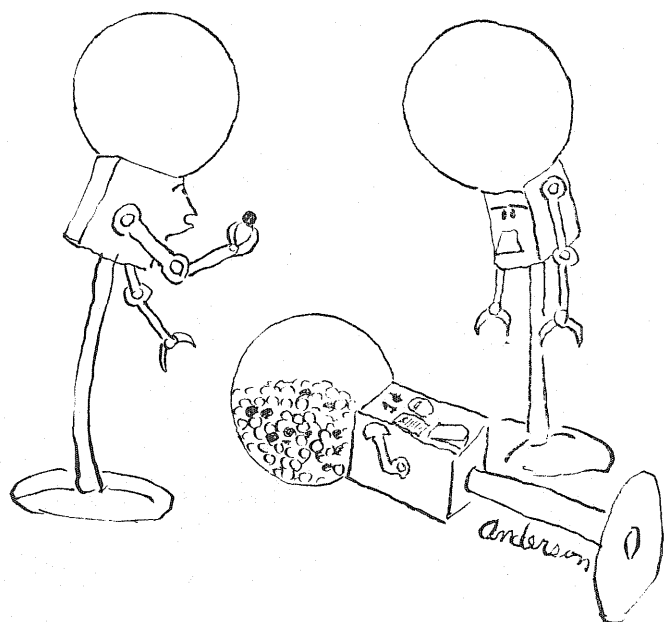


HE then separated the light from the dark (because he was basically a racist), and he called the light "light" and the dark "dark". HE named the grey too, but whoever said *Squash* in the first place coughed and I didn't quite catch that one.

Then the *Inter-Galactic Squash* gave to the world his only ill-beggotten Son who will rise from the Pumpkin Patch for our sins ("Take. Eat. This is my Pumpkin Pie, with Calcium Propionate added to retard spoilage.")

And the Great Pumpkin was out walking with HIS disciples, and said: "One among you will betray me ere the day is out!" And his disciples protested saying: "Is it I, Master?" "Is it I?" (All except for Mervin the Rat, who said, "In twenty years, who will care?").

Thus ended the morning and the evening of the 3,958,407,263,544th day.



He must have taken too many of these!

back from the front

Ralph Groop—Ace War Correspondent

As we all know, "an army moves on its stomach", thus laying claim to being the world's largest gastropods. Our army in Viet Nam is no exception; we spend millions of dollars each year sending supplies there. That will all soon change.

The Dough Chemical Company, in its further research to help our boys in Viet Nam, has developed the quick-cooking, instant meal. This new cheap source of food is the result of mixing two successful products to create another. In a new plant to be built in Corpus Crispi, Texas, Dough will add Colonel Sanders' Special Coating to its already effective and world-famed Napalm.

Marine Corps Public Relations man, Corporal Necromancer, met me at the local personnel factory (where the Marine Corps builds its men) and gave me the official Marine view of the new Dough product.

"Often times, our use of Napalm has been compared to the killing of wildlife for sport . . . barbaric, a waste of mankind. With the new additives, Napalm eliminates senseless killing, because we are now killing for food."

I felt very uneasy over the corporal's remarks, thinking that this was some special form of genocide reserved for the Vietnamese. I was quickly reassured as I passed General Ed Mission's office on the way out. From his office came the distinct words: "Fee, fie, foe, fum; I smell the blood of an Englishman."

"Yum, yum," I thought, "chocolate covered WASP's!"

official daily bull

- March 10—British linguist Prof. Issey publishes a study of Mao Thought epigrams. Special note was given to the particularly difficult-to-pronounce phrases, labeled "Mao Tse-tung-twisters."
- March 16—New movie portraying the evils of the fashion world and the fight between avante-garde and traditional styles—"Quo Bodice".
- March 19—Seedy Theatre shows brand-new skin flick: "Chiquita and Her Banana Peel."
- March 22—Spring arrives—the rest of the car falls apart in transit.
- March 23—Former Nazi and anti-Semite, Martin B. to teach I.T. course in "progroming" computers.
- March 28—"Miss Minnesota" Contest begun by Wisconsin Tourist Bureau.
- April 1—General De Gaulle celebrates his birthday by blowing out the candles on his cake. Only one remains lit; it has a large bulbous lump on it.
- April 6—Ether Bunny exposed as "speed freak"!

asbestos

If it doesn't shrink on their backs, why should it shrink on yours.

Animals wear leather all their lives. And they don't worry about rain or dirt or cracking or hardening.

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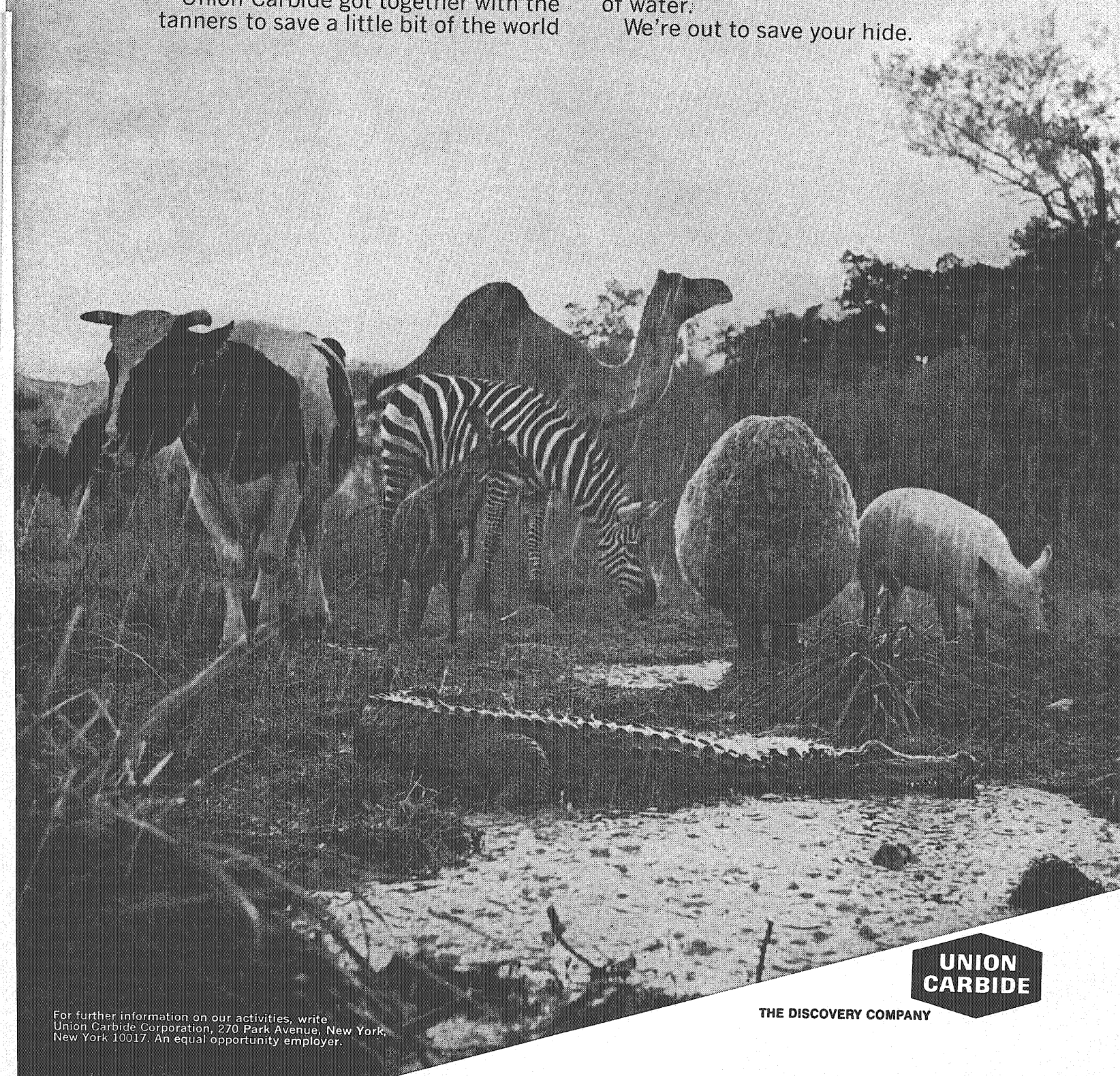
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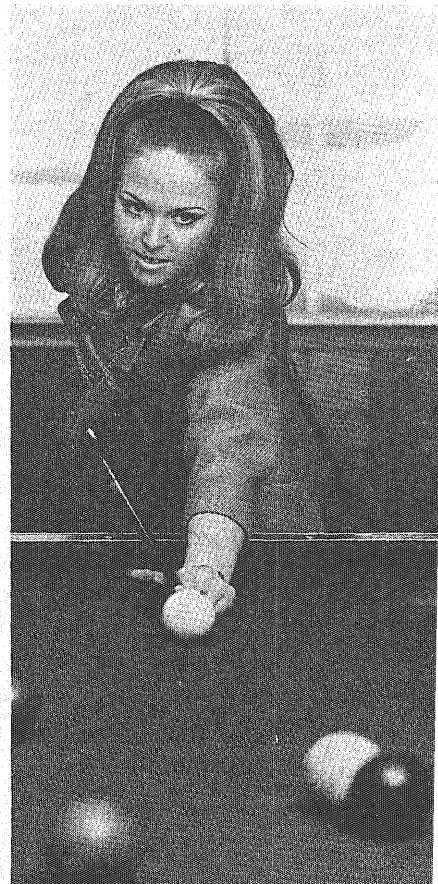
THE DISCOVERY COMPANY

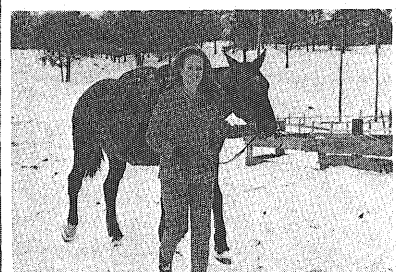
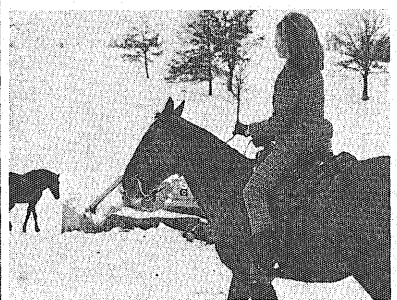
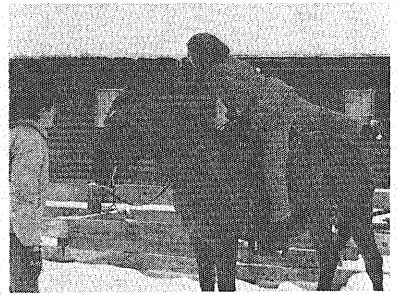
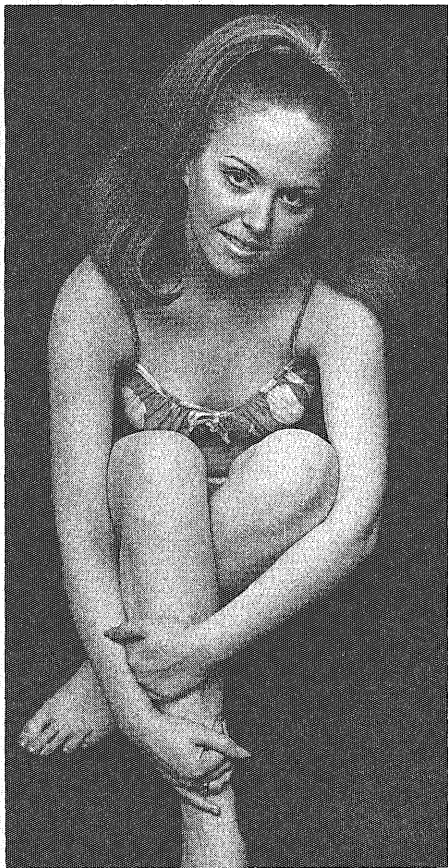
miss march

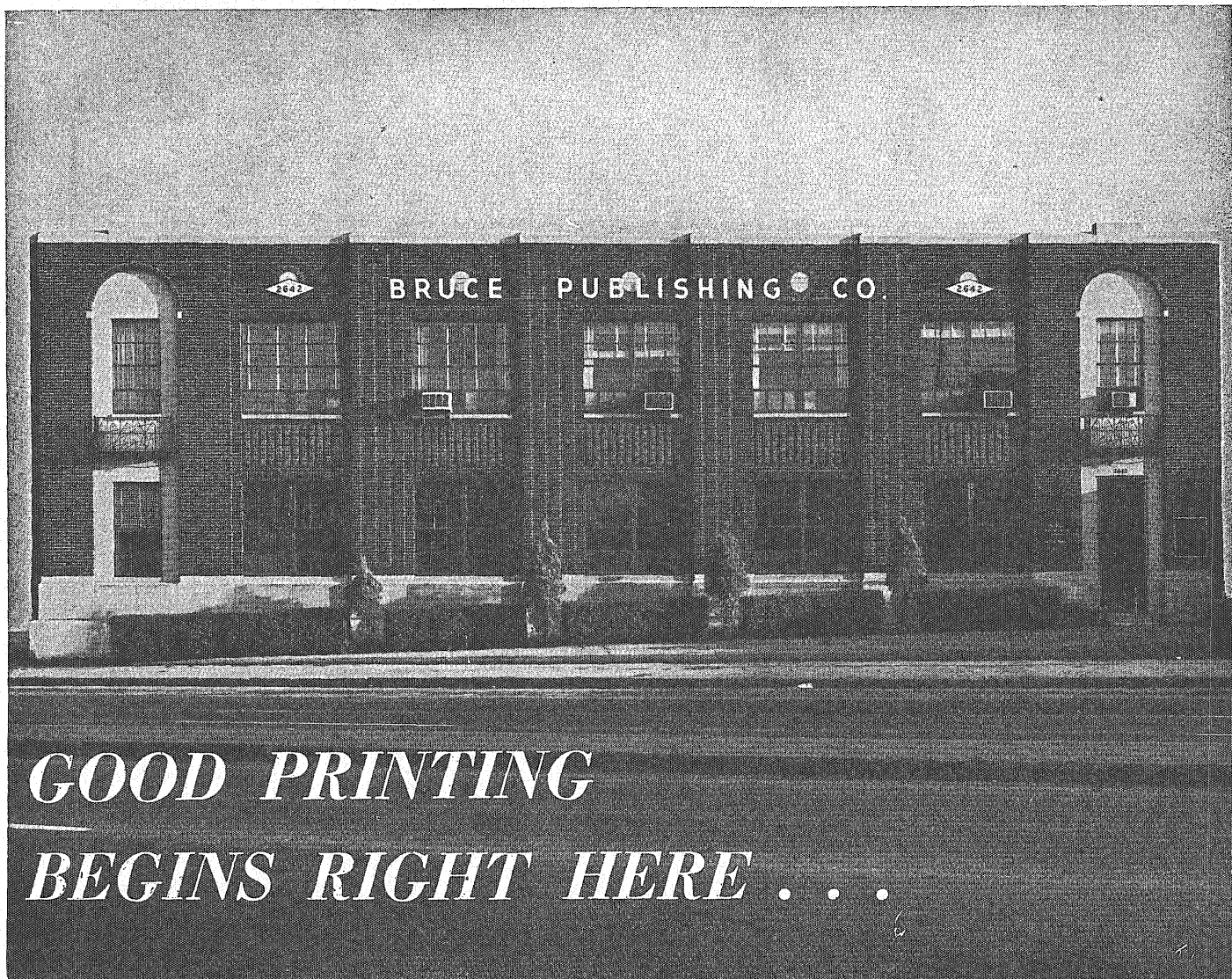
Terri Schulte

Her eyes gleam with enthusiasm as she explains that she will soon be off for Texas to become a hostess for American Airlines. Terri, in a most amazing way, is able to adapt to any situation and to make those with her feel at ease. Conversation flows gently for her. Experience has been her teacher. A graduate of Estelle Compton's, she always maintains her charm and style.

She seems right at home mounted on a horse at Eaton's Ranch—but then she has been riding for years. Occasionally she finds a moment for skiing or snowmobiling. She's game for just about anything, but admits that pool is not "her game." She's willing to learn, though. Any teachers?? 







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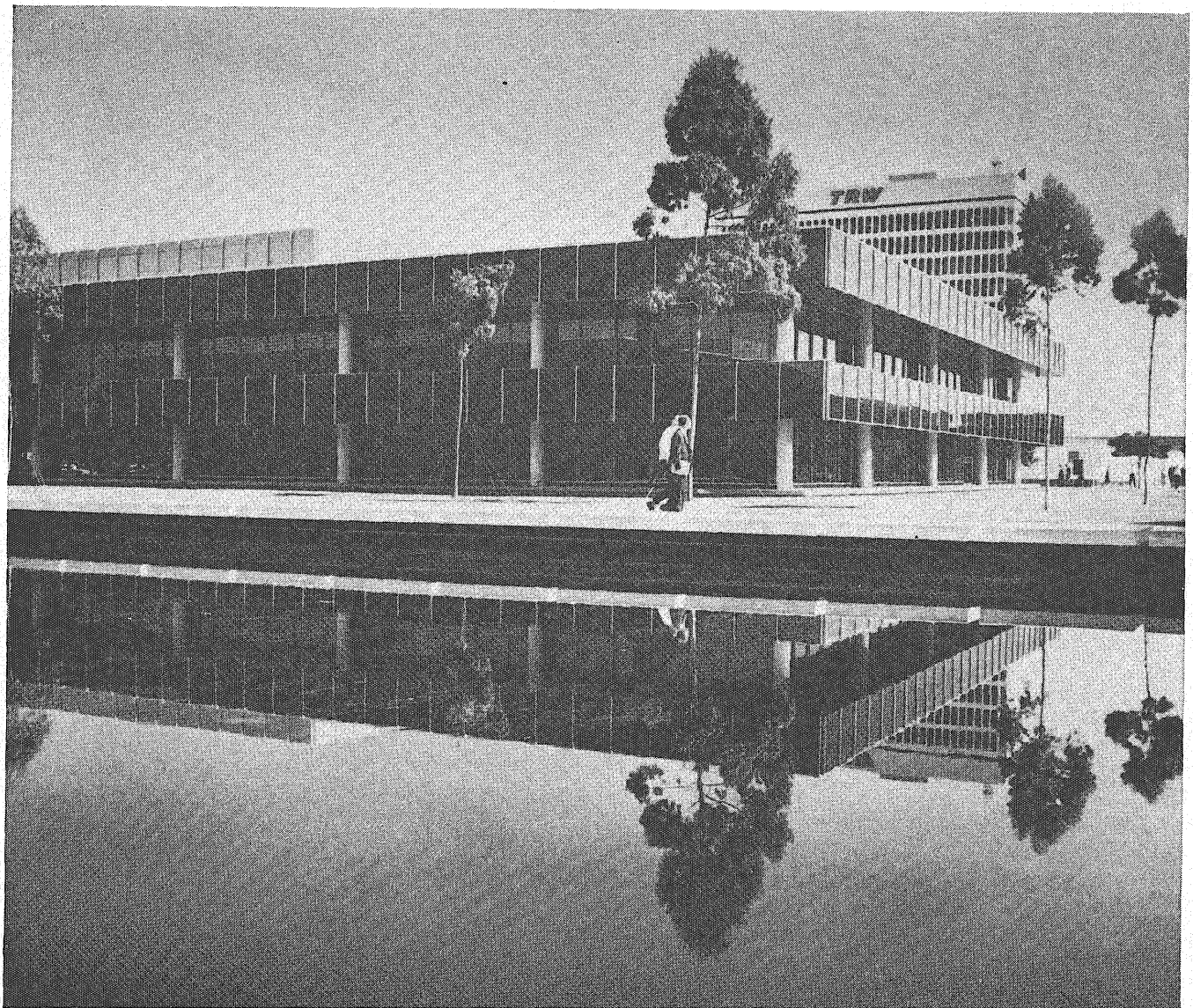
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It's characteristic of TRW Systems Group that many of our employees continue to do advanced and applied research in the same area of specializa-

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For our challenges are much like yours.

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so many people have found the move from their campus to ours a natural and rewarding one.

Perhaps you'd like to consider the same move. Make an appointment to see us when we're on your campus (see below), or write to Dr. W. D. McIvers, College Relations, Room 7001-J, TRW Systems Group, One Space Park, Redondo Beach, California 90278. TRW is an equal opportunity employer.

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If she calls you in her bedroom in
the middle of the night
And thru her half-closed eyelids you
detect a tell tale light,
If her bosom heaves in tumult like
the tide upon the ocean
And her voice is soft and tremulous,
betraying her emotion;
If her nostrils dilate wildly with
each panting, labored breath
And her luscious body trembles, as
does one approaching death;
If she begs you and implores you,
as she grasps with trembling
hand
To alleviate her suffering with a
pitiful demand . . .
Buddy, that's asthma!

* * *

A virile Texan went to an Alaskan
bar where he was told there were
three things he had to do to prove
himself a man. First, he had to drink
a fifth of whiskey straight down. Then,
he had to make love to an Eskimo
maiden. Third, he had to kill a polar
bear. He had no trouble with the
whiskey which he drank straight
down. He then left the bar and re-
turned an hour later, his clothes
ripped to shreds, his body badly
lacerated.

"Now," he moaned, "where's the
Eskimo I have to kill."

* * *

As the drunk Ag.E. staggered up to
the bar, he spoke to a woman and
her pet duck who were having a drink.

Drunk: "Boy that sure is a good
looking pig you have there."

Woman: "That's no pig, you idiot,
that's a duck!"

Drunk: "I was talking to the duck!"

* * *

Min.E.: "Do you know what you
get when you mate a lawyer and an
ape?"

Chem.E.: "A retarded ape."

* * *

A bosom companion sometimes
turns out to be false friend.

* * *

Aero: "Did you hear what happened
to the woman who backed into an
airplane propeller?"

C.E.: "Why, no! What happened?"

Aero: "Disaster"

* * *

M.E.: "Does your girl smoke?"

E.E.: "Almost at times."

* * *

Ad in local paper: "Girl needs job.
Is willing to struggle if necessary."

Econ. Prof: "You boys of today
want to make too much money. Why,
do you know what I was getting when
I got married?"

Voice from the rear: "No, and I bet
you didn't either."

* * *

Every day the guard in a Russian
work camp checked out the workers
as they left the grounds to prevent
stealing. For several days a guard had
been watching one particular man
pushing out a wheelbarrow full of
straw. Every day he examined the
straw suspiciously but could find
nothing hidden in it.

One day, after inspecting the wheel-
barrow, he said, "Look, Comrade,
tomorrow I am being transferred to
Siberia, I'll never see you again, and
I promise to keep your secret—what
in the devil are you stealing?"

The worker looked around cautious-
ly and whispered, "Wheelbarrows."

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An E.E., convinced that he was about to die, bought a cemetery plot and dug his own grave. That night a jackass wandering around in the cemetery fell into another newly dug grave and couldn't get out. The next morning, when the man came to inspect his work, there were several caretakers and the old farmer who owned the jackass gathered around trying to get the animal out of the grave. The E.E. asked, "What's that critter doing in my grave?" and the caretaker replied, "Man, don't you know your own hole from an ass in the ground."

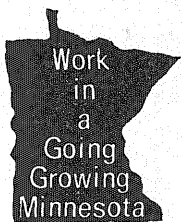
* * *

A lawyer and an Engineer were walking to class together (strange as it may seem) when the Engineer spotted a coed some distance away. Pointing her out to his companion, he remarked, "She's a vision of beauty; a regular mirage."

"I get what you mean," the lawyer replied, "but you're using the wrong word. A mirage is something you can see but can't feel."

"That's her."

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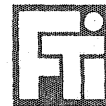
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EE Frosh in hardware store: "Have you got any four volt, two watt bulbs?"

Clerk: "For what?"

Frosh: No, two."

Clerk: "Two what?"

Frosh: "Yeah."

* * *

"I'll teach you to make love to my daughter, young man."

"I wish you would, sir, I don't seem to be making very much headway."

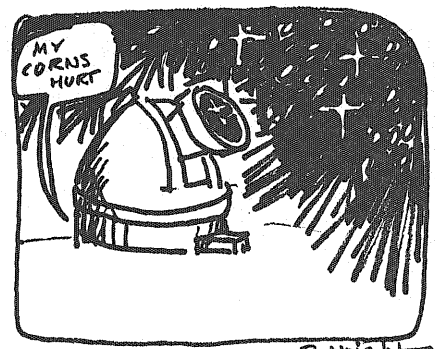
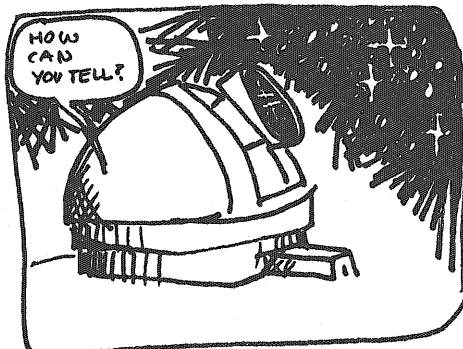
* * *

Fashion tip from the Log: Girls will be wearing the same thing in brasieres this year that they wore last year.

An engineer of a large instrument company was looking over drawings and specifications for a new instrument which had been ordered by one of the firm's largest clients. Attached to the papers was the coded instructions: MILTDD-41. Not being familiar with these designations, the engineer looked in his technical journals, but was unable to find them. Finally, in desperation he placed a long distance call to the customer.

"Would you mind telling me what 'miltdd-41' means?" he asked.

"Sure," replied the customer, "It means 'make it like the damn drawing for once.'"



B. Wright

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St. Patrick was an engineer

A Med student got a job last summer as a waiter in one of the resort hotels in Northern Minnesota. One morning during a medical convention, he was waiting on a table of doctors and scratching his fanny at the same time.

"Hemorrhoids?" asked one of the doctors.

The medic replied, "Sorry, sir, no substitutions on the regular breakfast."

The difference between a married man and a bachelor is that when a bachelor walks the floor with a babe in his arms, he's trying to sober her up.

* * *

"What's the matter little boy?"

"Ma's gone and drowned all the kittens."

"Dear me, that's too bad."

"Yeah, she promised me I could do it."



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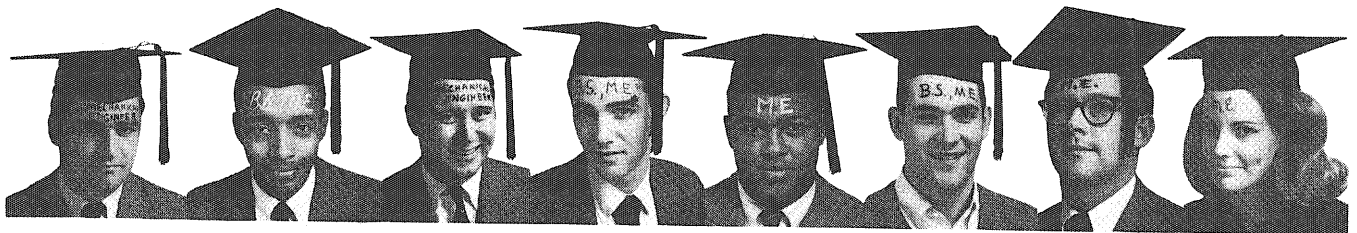
All things equal, Northern Ordnance is unequal. If you think you are too, contact Earl R. Wigand, 788-8601.



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In general, however, the label does not guarantee a uniform product. That's good.

It is worn by some who have never dipped below the five percentile academically, who enjoyed doing a paper on the psychodynamic roots of Buddhist theology almost as much as they enjoyed constructing five different thermodynamic models of the pulsar phenomenon. That kind of mind can find comparable fulfillment in some problems ultimately in-

volving our photographic systems, plastics, or fibers. Hard to believe but true.

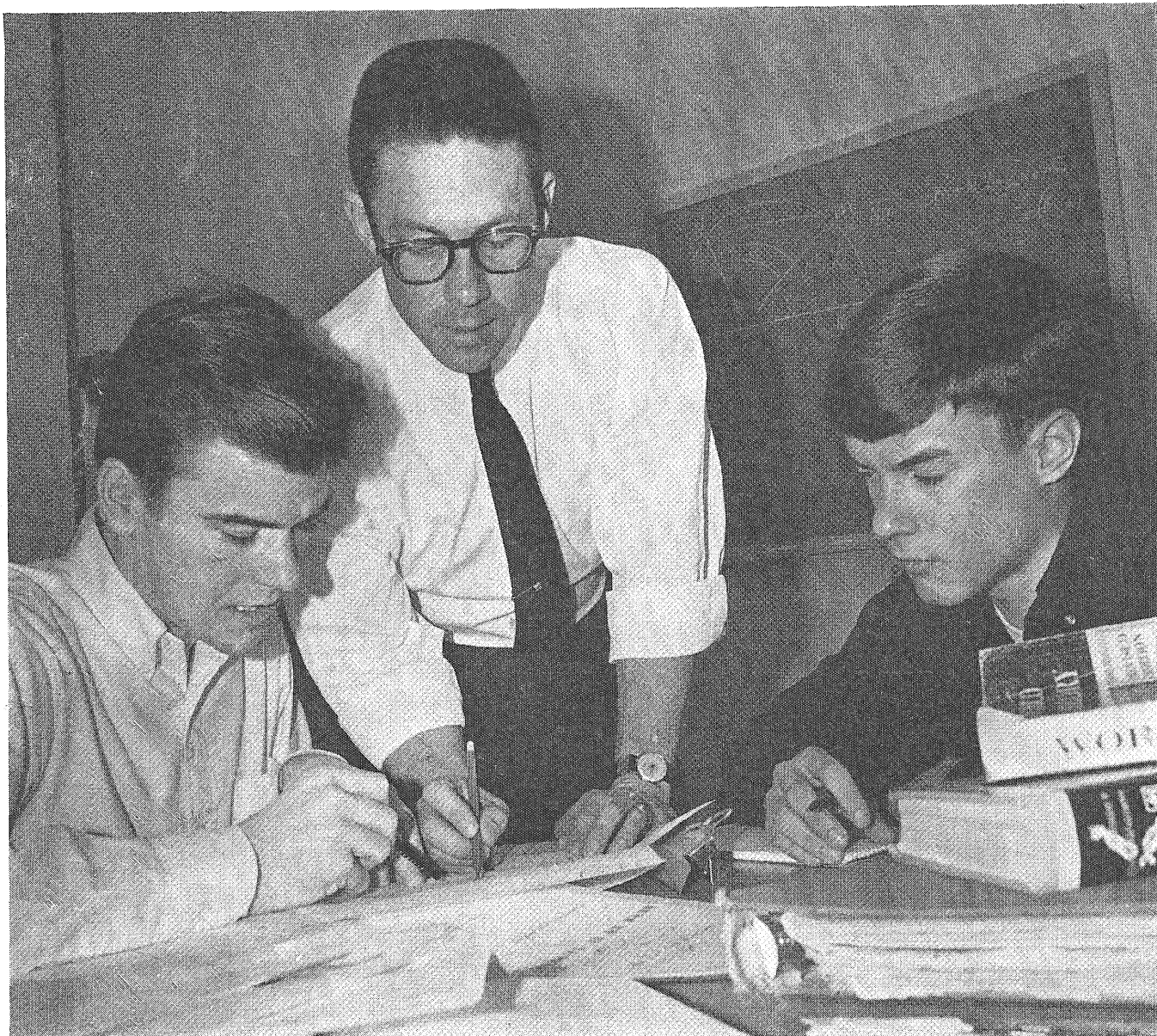
The label is also worn by some who had to struggle for it because their minds don't work the way a professor's mind works. They are not unhorsed, however, to learn that sometimes a remark passed casually in a washroom can accomplish more than a 117-page technical report with 50 references in the bibliography.

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But when Pete graduated from Rutgers in 1964, it wasn't these youngsters with their homework problems that brought him to General Electric. It was the chance to help people in industry solve tough technical problems. A career in technical marketing at General Electric gave him the opportunity.

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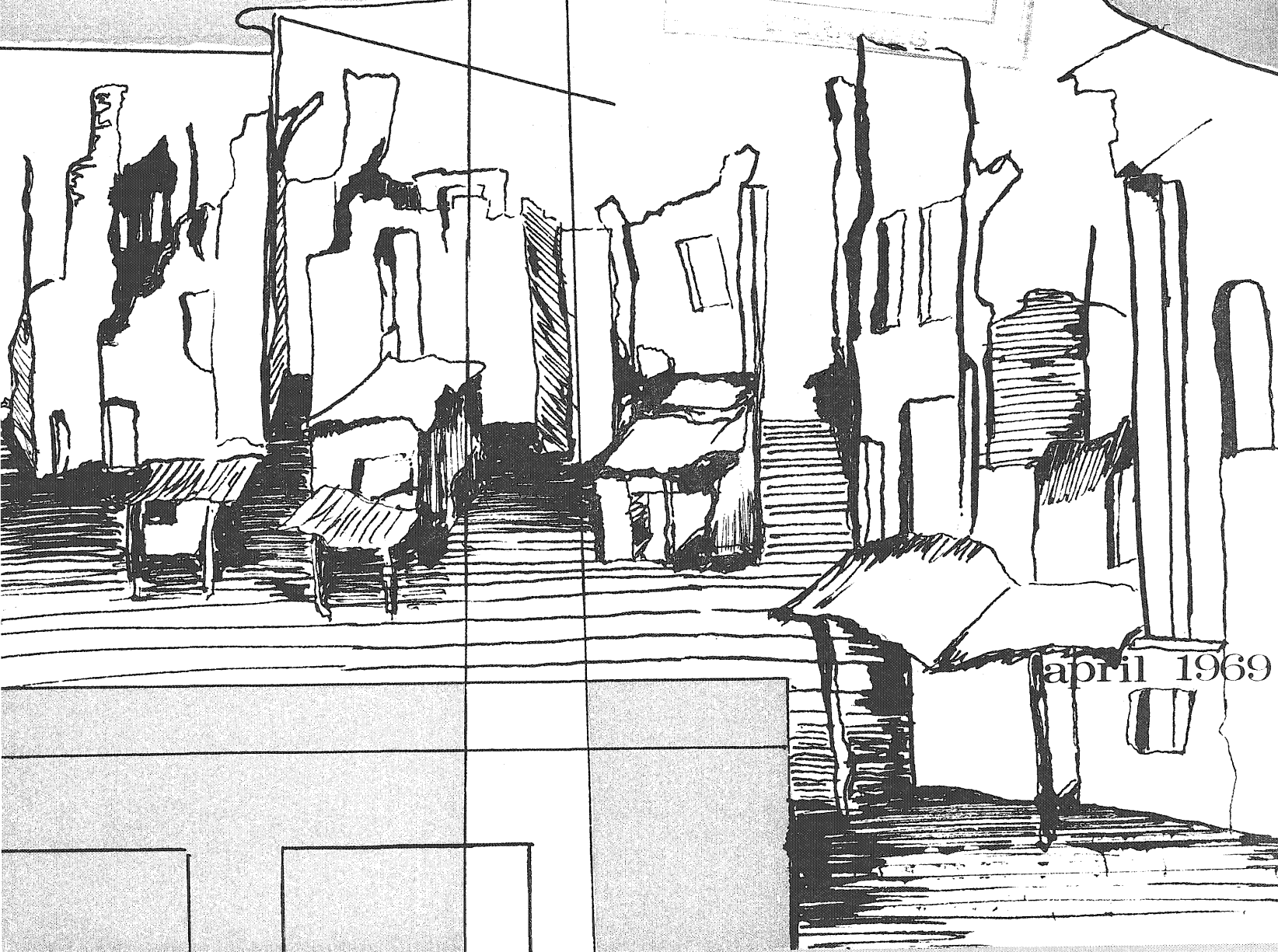
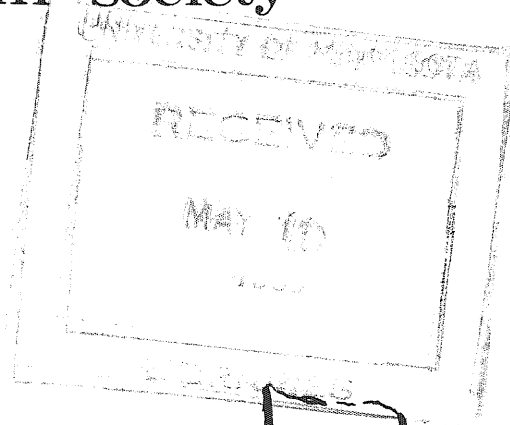


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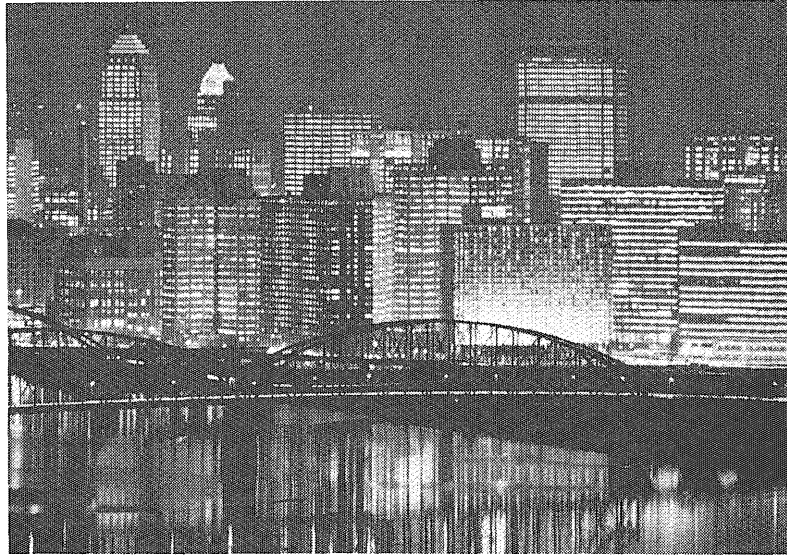
consulting engineering opportunities

an engineer's role in society

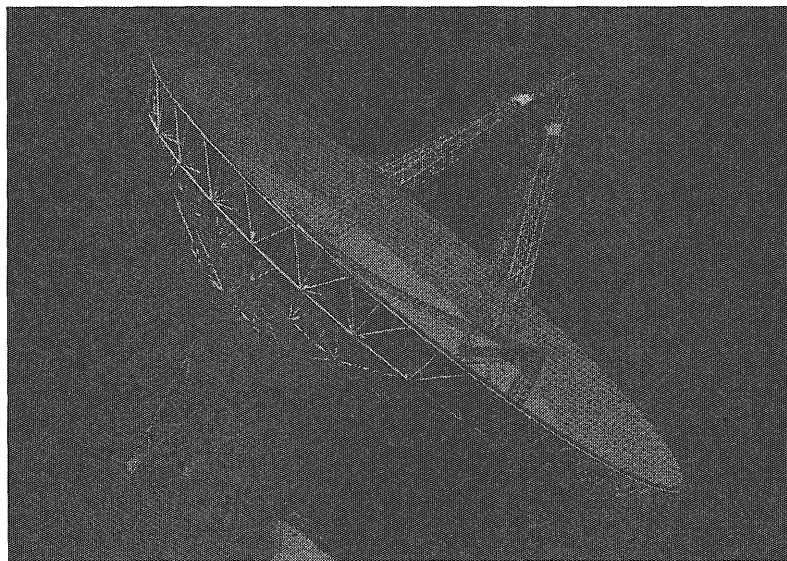


april 1969

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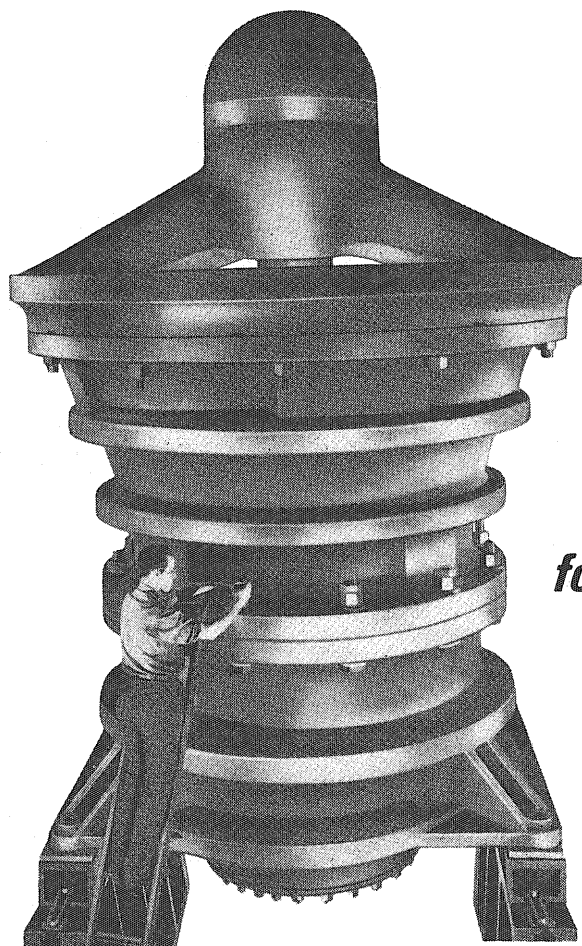
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COVER: The engineers role is to improve society. However, in order to improve it is sometimes necessary to destroy. Artwork by Cheri Grotewold.

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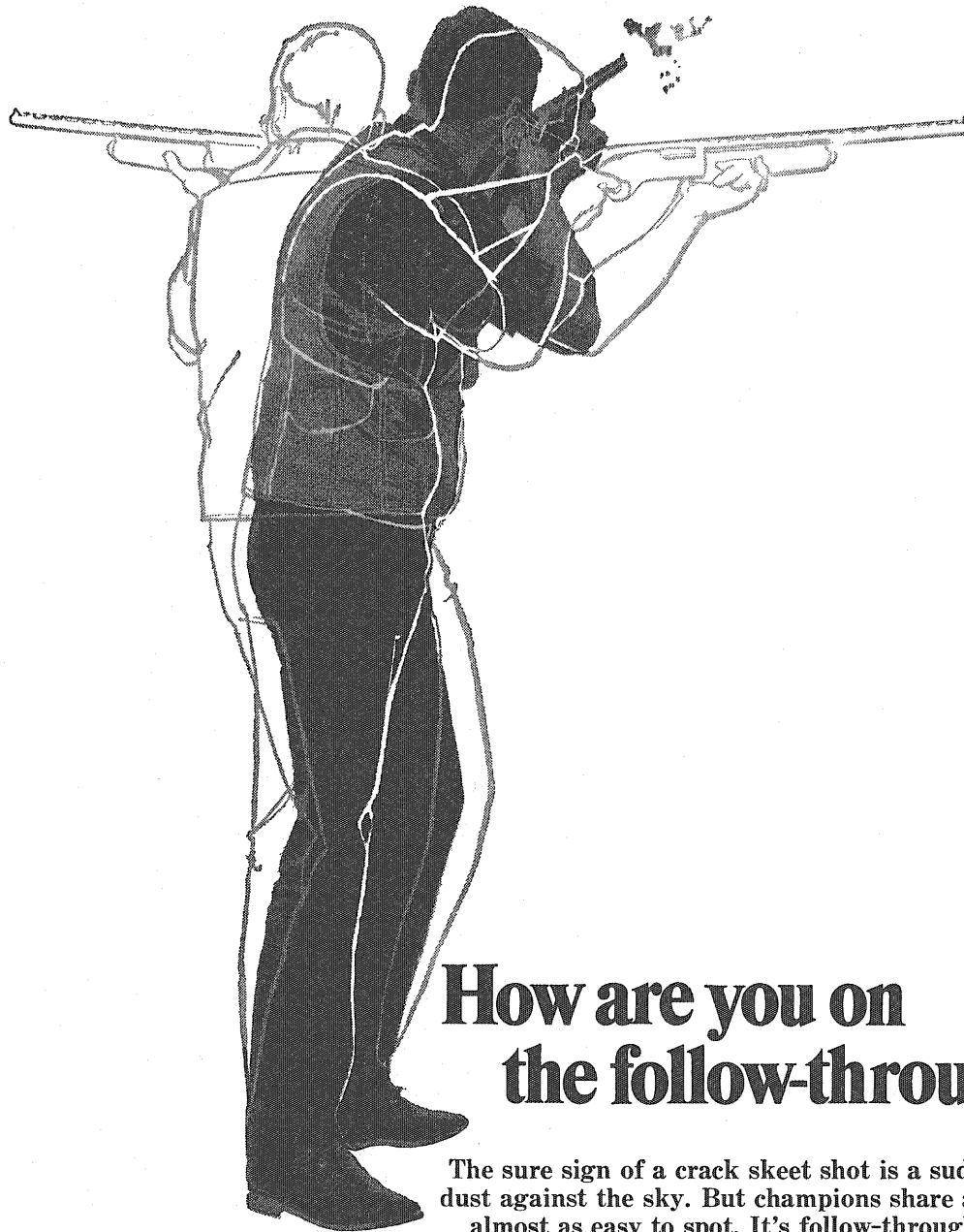
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speaking with the dean

It is always gratifying to participate in an enterprise with interesting and talented associates. I am not certain that students in the Institute of Technology realize the level of their own talent and achievement. Therefore, I feel it to be one of my responsibilities to remind you of your talents and to distribute appropriate accolades.

The average freshman who entered IT this fall was in the top ten per cent of his high school class. He (or she) has performed remarkably well in the freshman year. The fail and dropout rate has been significantly lower than in previous years. The IT freshman student not only performs well in his technical courses such as physics and mathematics, but also in his liberal education courses as well. According to statistics recently assembled by Assistant Dean Cartwright's office, only three per cent of our freshmen failed a liberal education course in the fall quarter. What is equally revealing is that fifty per cent of our freshmen obtained grades of B or better in these liberal education courses. These freshmen performed particularly well in geography, anthropology, philosophy, and languages. The stereotype of the engineer and scientist as one whose talents and interests are narrowly focused is just not consistent with the above statistics.

Another measure of the quality of the IT student body is the salaries commanded by our graduates. In 1968, the starting salaries of graduates of IT with bachelors' degrees was \$778 per month, which is three per cent above the national average. There is one measure of our graduating seniors which is somewhat disturbing: an abnormally small number of our students continue their education beyond the bachelor's degree. Of course, the present draft regulations almost force many of our able graduates into the apparently safe haven of an industrial job with deferment. If and when the draft regulations are altered to allow deferments for graduate education, the percentage of our graduating seniors entering graduate school should increase. Let's hope so. All statistics point to a very talented student body with, at present, rather low aspirations.

Warren B. Chester

**Down your E-Day cheer with
"The ENGINEERS Song."**

Log Line

Sing to the tune of "The Battle Hymn of the Republic."

Chorus:

We are, we are, we are, we are
We are the engineers
We can, we can, we can, we can
Drink all of forty beers
Drink up, drink up, drink up, drink up
up and come along with us
For we don't give a damn for any man
that don't give a damn for us

Godiva was a lady who through Coventry did ride
To show to all the villagers her bare and lovely hide
The most observant man of all, an engineer, of course
Was the only man to notice that Godiva rode a horse.

Chorus.

"I've come a long, long way," she said, "and I would go so far
With the man who will take me now and lead me to a bar"
The men who took her from her stead and stood her to a beer
Were a bleary eyed surveyor and a drunken engineer.

Chorus.

My father was a miner from the Northern Malamute
My mother was a mistress from a house of ill repute.
They kicked me out at an early age for drinking all their beer
Sent me to the U of M to be an engineer.

Chorus.

The army and the navy boys set out to have some fun
Down where the women and the fiery liquid run
But all they found were empties for the engineers had come
And traded all their instruments for gallon jugs of rum.

Chorus.

An artsman and an engineer once downed a gallon can
Said the artsman to the engineer, "Outdrink me if you can"
The artsman had three drinks and died, his face was turning green
But the engineer kept going for it was only gasoline.

Chorus.

Now Venus is a statue made entirely out of stone
There's not a fig leaf on her, she's as naked as a bone
On noticing her arms were broken, an engineer discoursed
"She's a busted chunk of concrete and she should be reinforced".

Chorus.

Now Caesar went to Egypt at the age of 53
But Cleopatra's blood was warm; her heart was young and free
And every night when Julius said goodnight at three o'clock
There was a Roman engineer waiting around the block.

Chorus.

A maiden and an engineer were sitting in the park
The engineer was busy doing research after dark
His scientific method was a marvel to observe
While his right hand wrote the figures his left hand traced the curves.

Chorus.


Sir Francis Drake and all his ships set out for Calais Bay
They heard that the Spanish rum fleet was heading out that way
But the engineer had beat them by a night and half a day
And though as drunk as hooligans, you could still hear them say.

Chorus.

Hey guys, is your nineteen credit spring quarter getting you down? How about a vacation? Yes, the annual spring quarter vacation for engineers and scientists is upon us. The annual I.T. Week and Engineer's Day is coming. However, this vacation should not be taken as a literal vacation. The purpose of I.T. Week is not to provide "extra sack time." Many people have been working hard throughout the year to create new ways to give everyone the opportunity to participate. And how can you participate? By entering and sponsoring teams in the tournaments. Come on out and watch the blood thirsty I.T. organizations compete for All-Par points. We understand that the I.T. girls are getting up a softball team. It might be quite interesting to watch a team of guys lose gracefully.

Another way of participating is to spectate at the First annual home-made car race. The race will be held on E-Day, May 9, immediately following the parade. The "race track" is Church Street, and with the promised three entries, it should prove to be quite a show. Also on E-Day a new Queen Colleen and a new St. Pat will be crowned. And of course the traditional E-Day picnic will follow. These activities will happen in the Engineering courtyard.

One of the last things to happen on E-Day, also the newest event will be the First Annual Engineers' Automobile Rally. Scheduled to start at 2:00 P.M. on E-Day the rally will be about two hours long, and will offer a first prize of \$25.00. The starting point is yet to be determined. The last event of E-Day is the traditional Brawl, the official E-Day dance. This year the affair will feature a rock band playing at an outdoor location (weather permitting). There are some rumors circulating that it will be held on the Northrup Plaza. A small admission may be charged, but it will probably be a rather insignificant amount.

All these activities are in addition to the open house displays and convocations. So there it is, guys. The only thing yet needed is your participation. 



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Consulting Engineering Opportunities

A consulting engineer is a registered, professional engineer engaged in private practice who performs engineering services on a fee basis.

He has no commercial affiliation with manufacturers, suppliers, or contractors and is thoroughly trained and experienced in the application of scientific principles to the solution of engineering and economic problems.

He serves private, government, industrial and commercial clients in a variety of ways, ranging from brief consultation to the complete planning, design, and supervision of major engineering projects.

The official organization which represents virtually all professional consulting engineers in Minnesota is the Minnesota Association of Consulting Engineers. The objectives of the MACE are 1.) to foster harmony throughout the engineering profession, 2.) to promote the professional and economic welfare of its members, 3.) to maintain professional standards as outlined in the Code of Ethics embodied in the rules and regulations of the Minnesota State Board of Registration for Architects, Engineers and Land Surveyors, 4.) to advance the value of the consulting engineer to the public at large and 5.) to act as a clearing house for the dissemination of information to its member firms.

So much for the formal definitions and objectives. In order to get a clear picture of just what the Minnesota Association of Consulting Engineers and the consulting engineers do, the **Technolog** interviewed Mr. Earl Oxley, Executive Secretary of the Minnesota Association of Consulting Engineers, and Mr. Douglas Wolfangle, a consulting electrical engineer for Ellerbe Architects and a 1949 graduate of I.T. The following is a summary of that interview.

TECHNOLOG: What exactly are consulting engineering firms and what is a consulting engineer?

MR. OXLEY: A consulting engineering firm is actually a firm that is in private practice—they don't manufacture a product but actually sell their services to the public.

MR. WOLFANGLE: A consulting engineer is generally a registered, professional engineer. Today it is becoming more and more common that the easiest way to become registered in any of the 50 states is through education. Every undergraduate, as he gets to his senior year, takes parts one and two of the state registration examination if he elects to do so. If he passes these two at this stage of the game then he can work for four years in any of the specialties he wishes to work in, after which he has a reexamination, oral and written, in parts three and four of the registration exam. Upon passing these exams he may then represent himself to the public as a consulting engineer. The registration laws are a protection to the public so that there are well-qualified people practicing before the public. Most of the engineers employed by our office are involved in some way or another with building design. This is just a fragment of the work done by consulting engineers. Yet our office has civil engineers that are developing sight plans or master plans for a client, we have structural engineers that are designing the structural framework of the building who are working with our architects, mechanical engineers who are designing the heating, air-conditioning, and ventilating systems and special piping systems for various industries. We have electrical engineers designing lighting and power supply systems, transmission lines, substations, etc. So all the specialties you find represented in industry you find also in private practice.

MR. WOLFANGLE: The consulting engineer, as a licensed professional, like a doctor or an attorney, practices his profession in his specialty, whatever it might be. It is really the only area of engineering where an engineer is a professional. It's the only area, in fact, where a young fellow, if he is interested in owning his own practice, may do so. He starts with a firm, for instance, where he may be involved in bridge design or highway design, and after he is with them for four years prior to his registration, he might decide after another two years that "I know this business well enough . . . I want to go into business for myself," and he opens his own office, with all the attendant headaches of heading a business and running a professional practice. He will probably hire people to do drawing work and write specifications, experts in the fields in which he wishes to practice.

TECHNOLOG: What is the pay scale for the consulting engineer as compared to that of industry-employed engineers?

MR. WOLFANGLE: For the man who has his own office, his remuneration is entirely a function of his skill and energy to get work. He can't advertise—just as a doctor or attorney, by the nature of their profession cannot advertise. Our office, for example, has a reputation for hospital design—we do not need to solicit work, people come to us, because they know we know how to solve hospital building problems. Getting back to salaries, we have realized, especially in the past five years, that if we are going to get highly qualified graduate engineers into our offices, we are going to have to compete with the pay scales offered by industry. Consulting engineering is not merely a job, but

rather it is a unique opportunity for the man who wishes to start and run his own business. Last year, the pay scales for a starting engineer was something like \$8400-\$8600 a year—that's what we paid in order to get the people we need. It's not unusual for an owner of a firm to be making anywhere from \$25,000-\$50,000 a year. \$25,000 a year for a consulting engineer is not an unusual thing. It depends largely upon the individual engineer—is he aggressive, does he want his own business and so forth.

TECHNOLOG: What precisely is the Minnesota Association of Consulting Engineers?

MR. OXLEY: The Minnesota Association of Consulting Engineers is just that, an association made up of engineers who specialize in consulting work. We are the only organization in the state of Minnesota that has a voice in the state legislature representing the consulting engineers. They are banded together in order to reach a common goal of understanding among the consulting engineers. We also publish a suggested fee schedule. All the firms in the association go by a suggested fee schedule for the work that they perform. It is, therefore, not a competitive or bidding market.

TECHNOLOG: What could a graduating engineer expect if he were to work for a consulting engineering firm?

MR. WOLFANGLE: Coinciding with your coming to our office, there would be a particular project, let's say a commercial building structure. During the first year with our office we would try to familiarize you as quickly as possible with all of the facets of the particular work. One of the main problems of new people is learning the basic language of our effort—i.e. production drawing. You must be in a position, in a relatively short time, of supervising technicians. Therefore, you must be able to do all of their tasks yourself. So in this period of a year's familiarization time you'd be given specific design problems, problems which you have never encountered in your college classes. You'd be taught how, at the beginning of a project, an engineer is able to evaluate the project in terms of preliminary design information. What are the basic dollars about which we

are talking in order that the architect's budget figure going to the client can include the necessary elements of the design? You'd be given an overall picture of drawing, specification writing, of the construction process itself, training in the specific disciplines our firm is involved in. Basically, the starting engineer must establish himself firmly in the language and methods of the firm for which he is working.

TECHNOLOG: What type of engineers can be found in the Minnesota Association of Consulting Engineers?

MR. OXLEY: There is virtually the same amount of demand in all fields of engineering. In Minnesota, the big fields of the consultants are primarily the civils, the structurals, the mechanicals, the electricals, and the soil engineers. Those are the prime ones.

TECHNOLOG: Is it very difficult to start your own firm?

MR. WOLFANGLE: Sure. Here's how it normally takes place. We have a fellow in our Minneapolis office who after eight years in our office decided that he wanted to go into business for himself. He started preparing himself maybe four or five months before the time he decided to leave by beginning to line up some clients, because now he was not only going to be a design mechanical engineer, he had to feed his family, etc. by getting work for himself. So, surreptitiously, he worked out arrangements with some small architectural firms and now this fellow is shopping work out, because he was a good enough organizer in getting these jobs that he had more than he could take care of. Now he's having people in other offices help him! So he's got a start. But it's a big struggle. A fellow should have, in order to get involved, a minimum of what he considers to be one year's normal income put away before he starts.

MR. OXLEY: Most architects and engineers that own their own firm will tell you that in their past history, they originally worked for some big firm. They had to train under somebody. The engineer first earns his reputation with some firmly established, reputable consulting firm and then, on this basis, goes out on his own. This is also how they get to meet clients.

MR. WOLFANGLE: Each time one of these fellows leaves a firm, we're really sorry to see them go, because these fellows are the good engineers. That's why they were what they were. You find this kind of a person in engineering in the consulting profession where you don't find him other places. You find more of our fellows who have to work by themselves, they have to shape their own destiny and this is one place you can do it without a board of directors. When you've gotten to the point when you think you know the business, and you'd like to deal with your clients, and you've got a year's salary put away; you strike out on your own.

Consulting engineering is the only field of engineering in which registration is important. Anyone who gets involved with a consulting firm, if he's going to do anything at all, must get his registration. It's as important as medical exams are to a doctor, because it's our license to practice before the public. We're the only engineers that practice before the public.

MR. OXLEY: When you think of the multitude of engineers that graduate out of this school, most of them never become registered. It doesn't mean anything to them. They lose their identity. Every so often I get a call from an electrical engineer who is working for one of the big companies. Now he thinks he's nothing but a high-paid technician. He's lost his identity as an engineer because he's working on the same old project, like one fellow described it to me, "I'm just putting two wires together, any technician could do the work I'm doing, yet I'm a graduate electrical engineer."

MR. WOLFANGLE: They never are encouraged to get their registration, which means professional status. We're in a profession, if we want to make it that, but the public will not accord us professional status unless we feel it has some merit.

TECHNOLOG: What experiences should one have before he starts out on his own?

MR. WOLFANGLE: We've had fellows leave our office the day after they get their registration, four years after they finish college. The

(Continued on page 13)

It does 0 to 150 in 2.1 seconds.

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And if you hit the floorboard it'll do 600 miles an hour. Almost as fast as your voice can reach someone sitting in the same room. It takes more than a nice sense of balance and a healthy ego to fly one. It takes algebra, geometry, physics, common sense, and many other skills. Unless you've got something really great lined up, it might be worth your time to hang around a Naval Airbase some weekend and watch the action.

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An Engineer's Role in Society

This article is taken from a speech titled "the Urban Crisis and You" which was presented by H. R. Ball at the Big Ten Engineering Conference at the University of Michigan on October 19, 1968. Mr. Ball is a registered Professional Engineer, and is presently Director of Corporate Planning for the Whirlpool Corporation in St. Joseph, Michigan.

EVERY PROFESSIONAL ENGINEER, regardless of branch and specialty, has an obligation to his profession. He owes a measure of support to the organized effort which seeks to raise the standards of the profession and hence brings about a greater measure of respect for its services to mankind. Today's engineer must become socially aware — "people oriented" — and set about helping to cure those very ills we and our predecessors helped to create. It is the engineer's responsibility to do so, for without his particular talents and capabilities, the job just won't get done.

He can provide food and shelter in abundance. He can restore purity to our air and water, heal the blight of our cities, untangle the snarl of traffic, harness our rivers, reap harvest from the oceans, husband our resources, and develop power from the sun and atom. He can control floods, minimize the danger from storms and earthquakes, and eventually control the weather. He can perform new miracles in the field of medicine, communication and transportation, and develop a continuous stream of marvelous fabrics and household appliances.

the professional role

However, if the engineer is to play a truly professional role in a society that is greater rather than merely affluent, he must contribute more than technical brilliance, more even than technical brilliance guided by taste and sensitivity. He must help shape

public philosophy, he must participate in public discourse, and he must help conquer dissatisfaction.

the engineer's skills

The engineer, with his special skills, the understanding of technology, the ability to plan and to solve complex problems, the unique training that permits him to develop total working systems out of many seemingly unrelated parts, is essential to the continued progress of this nation.

Take a brief look at the major problem areas within the scope of today's Urban Crisis, solutions to which will require the particular talents of the professional engineer.

There is much talk these days of the contributions each of us must make on our own time. These are essential and the opportunities for the engineer in this area are many.

housing

Looking at housing, our system includes community planning, zoning codes, inspection, replacement, rehabilitation, and modern low cost housing and financing.

The present system is out of balance. There are too many areas of deplorable housing in our wealthy nation and housing is a massive complex problem. There are a few simple things that are universally necessary. We must have decent housing codes and ordinances and strong provisions

for enforcing them. We must take the profit out of slum and substandard housing for the unscrupulous landlord. We must embark on long range planning. When you break down a three family occupancy into one, there's got to be a place for the other two. It isn't sufficient to clear a slum area and have no place for the people to go.

There are many areas of engineering which relate to housing such as community management and city engineers, consulting firms, material complexes, housing manufacturing, government and education.

Within any of these areas you will find a challenge, where you can, on the job, be involved and can be making a contribution to solving one of society's greatest problems.

transportation

A second factor in the Urban Crisis is transportation. There is less transit riding in the United States today than there was in 1907, although the population has doubled in the last 40 years and most of it is concentrated in urban centers.

Congressmen and others have been warning us for years that the nation faces a transportation "crisis" if it doesn't develop realistic plans for mass transit systems, not only within cities, but between them. It is evident the crisis will not take the form of a sudden calamity but rather by a gradual slowdown in mobility caused by ever-increasing congestion. Freeways no longer are the answer to increasing population. Nor are jet airliners a so-

"Every professional engineer has an obligation to his profession."

lution for any but cross-continent or transoceanic traffic.

In any realistic yardstick, especially economic, mass transit rail systems are keys to urban mobility. But there is still no workable plan on the drawing boards beyond initial pilot projects. Areas which will require actions are integrated transportation systems and concepts, automobile transportation and controls, rail and other land transportation systems and controls, and short haul transportation systems.

Electronics and aerospace technology is viewed by many as the base from which to create the new systems and equipment that must be developed to keep the U. S. from grinding to a frustrating crawl. Your on-the-job opportunities are great in the field of transportation, including opportunities in government, private practice, and industry control systems.

pollution

One more area should be examined—pollution. Pollution covers water, air, noise, and thermal problems, and it is classified by some as our biggest crisis.

It's no surprise then to learn as we study man and his environment that man's future depends on his ability to keep in balance the forces of his own technological society.

How can you contribute? We don't have a "satisfactory" balanced program to solve our pollution problems. You can pick your area of challenge—water, air, noise, and so on.

Closely related to pollution is trash

and waste disposal. As the total waste handled increased from the present 150 million tons to more than 200 million tons by 1980, costs could rise to six billion dollars a year for refuse disposal or higher if expected improvements in equipment and techniques are not forthcoming.

Such changes can and will occur, spurred partly by growing government research programs and regulations, and by public concern as pollution and disposal costs grow. But must we engineers wait for public pressure to solve a society problem?

your contribution


As an engineer, you will be uniquely qualified to make meaningful contributions to society, both on and off the job, no matter which of the four traditional channels of engineering application you choose—private practice, government, education, or industry.

The business of the engineer will always be to engineer. The future of our country will, to a considerable degree, be determined by how, what, and for whom we engineer.

Regardless of your field and your particular specialty within that field the results will ultimately affect people.

A factory may be the most efficient ever designed, but if its wastes pollute the water nearby, or the air above, it cannot be considered a properly designed facility.

Similarly, if your professional career flourishes while your community languishes for want of the professional guidance you can provide as a concerned citizen, then yours cannot be considered a properly designed career.

Hopefully, historians will look back upon these years as the time when professional engineers decided that they too, had a stake in the future of our society, a future badly in need of some good engineering. 

Consulting

(Continued from page 10)

fellow I'm thinking of worked for us for four years, he became eligible for his registration exams, he passed them, and he left to open his own office. The point is that he has to work for himself. He shapes his own destiny. If he doesn't want to work this month, he doesn't.

TECHNOLOG: Is the field of con-


sulting engineering growing as fast as engineering outside the consulting field?

MR. WOLFANGLE: I would say that there are not five firms out of our 60 some firms in the Minnesota Association of Consulting Engineers that couldn't hire men right now, and the shortage is getting worse and worse.

MR. OXLEY: And I don't know of any firm right today that is crying for business . . . they're so tremendously busy. All the suburbs around the Twin Cities hire consulting engineers for their suburban work.

MR. WOLFANGLE: A consulting engineer is much more flexible, for it is almost always cheaper, in the long run, for a corporation or government agency to hire a consulting engineer than to develop its own inhouse capability. The advantage of hiring someone is that if you don't like his work, you just fire him and get someone else. So your livelihood as a consulting engineer depends upon your production. Often, small firms and communities pay an engineer a retainer just as with an attorney, for any engineering work they might have to do.

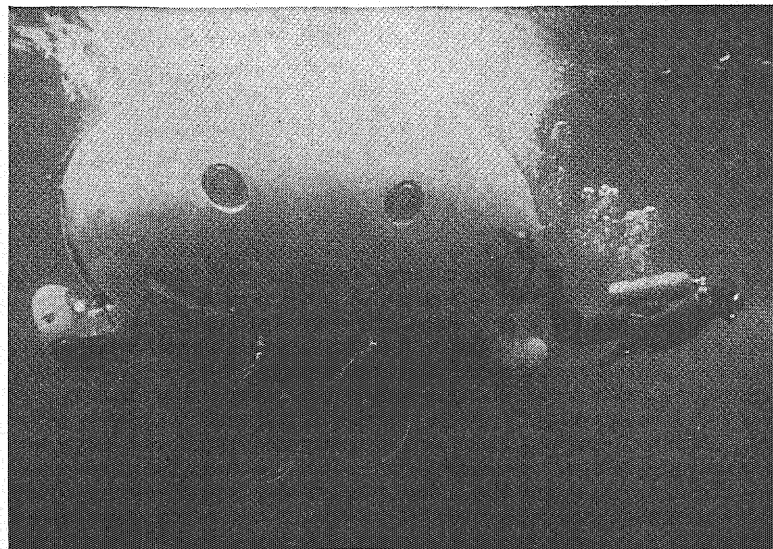
The message we wish to get across to young fellows leaving college is that there is an area of engineering practice in the private sector that we call consulting engineering work. It is a very rewarding and a very challenging part of the profession. You're not part of a union—you're paid on recognition of things that you do and are encouraged to continue progressing. A consulting engineer is more than just an engineer. Consulting engineering involves client contact, contact with the utility industries and negotiations between the project engineers and architects, etc.

So, engineers, if you're looking for a challenging and profitable future in engineering, you might investigate the opportunities available in the field of consulting engineering. If you would like more information concerning consulting engineering and the Minnesota Association of Consulting Engineers, just call or write Mr. Earl G. Oxley, Executive Secretary, Minnesota Association of Consulting Engineers, 3033 Excelsior Blvd., Minneapolis, Minnesota 55416, 922-9696. 

"We've got to stop



"These old fishing boats have had it. We need more floating factories, taking the haul from dozens of trawlers, processing it on board, into frozen fish fillets, canned fish, fish oil, fish flour. This takes materials that can survive the sea."



"Take Lockheed's *Deep Quest*. Nickel maraging steel from our research, enabled it to dive to a record depth of 8,310 feet. Whether you start with steel or copper, nickel adds properties that make it work—strength, toughness, resistance to corrosion."

"Drinking water? In desalting the sea, the name of the game is heat transfer. You need a conductor, so you need a metal. But you need one that will stand up to saltwater corrosion. Copper-nickels helped make multi-million-gallon-a-day plants practical."



fishing like St. Peter™

Art Tuthill of International Nickel talks about working the sea—and the role of metallurgy in solving population problems.

“With a world population of roughly three billion, one billion are underfed,” says Tuthill. “Yet in the sea there’s enough protein for thirty billion. But harvesting it takes more than the will. It takes hardware.”

Tuthill covers the marine industry—shipbuilding, ocean engineering, water desalting. He talks like an ecologist, an economist, an engineer. He’s a materials expert, on call for any problem in his field.

“And,” he says, “we need more from the sea than you can get with a net. Our demand not only for food, but water, and minerals, is growing relentlessly. It takes machines the sea can’t destroy.

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We count our blessings and respect our surroundings. From nickel ores we also recover platinum, palladium, and twelve other commercially useful elements. We make iron pellets for steel. Smoke in our stacks is converted to chemicals for still other industries. And on sand left from processing ore, we grow meadows of hay to control dust storms.

We are 32,500 people in 18 countries—miners, market builders, researchers. We work at the whole job—from geodesy to agronomy, metallurgy to economics, theory to practice. We bring new opportunities to underdeveloped lands, new payrolls, new tax income.

Nickel in the ground is useless. We put it to work.

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the engineering library

THE ENGINEERING LIBRARY is located in the basement, main floor, and balcony of the north wing of Main Engineering. It consists of approximately 55,000 books and bound periodicals in the fields of engineering and applied mathematics.

The key to the library's holdings is the card catalog on the main floor where most books are listed alphabetically by author and title. Bound periodicals are arranged alphabetically in the balcony and basement. Both floors are equipped with "revolving finding lists" which list the available periodicals alphabetically by title and show their location.

Reserve books and those in constant demand are shelved behind the circulation desk. A complete list of these books may be obtained from the librarian.

Other materials on reserve are E.I.T. exams and several files on different codes and specifications. The reserve books include handbooks of compiled technical information on specific subjects, such as the **Handbook of Chemistry and Physics** and **Machinery's Handbook**.

The main floor shelves contain indexes and abstracts (see map) to help the reader find articles on specific subjects in periodicals and other sources. These indexes and abstracts list the articles by date, volume number, and title of the periodical. The indexes include:

Applied Mechanics Reviews An abstract journal which gives critical reviews of the world literature in applied mechanics.

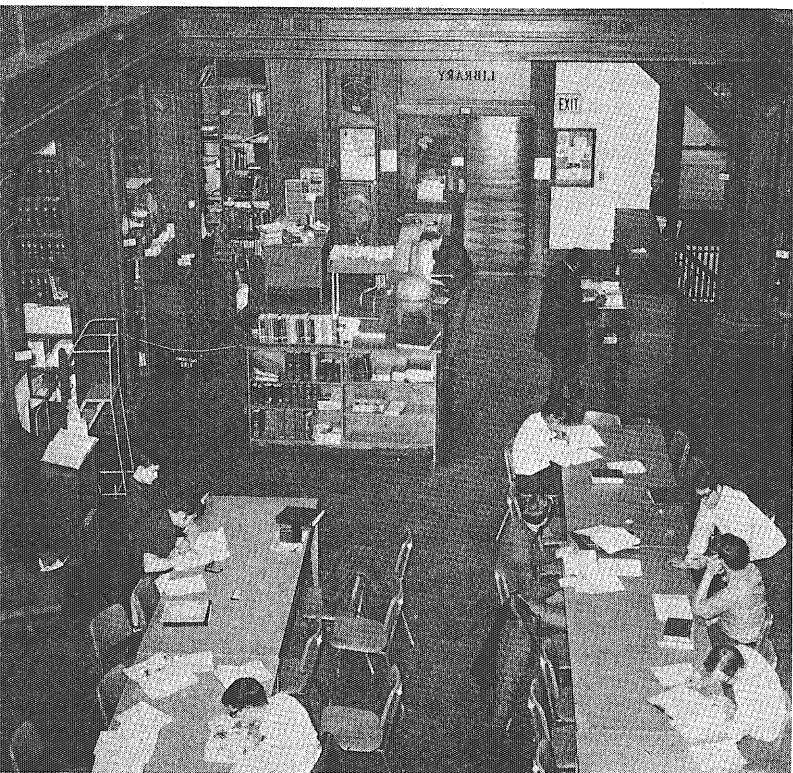
Applied Science and Technology Includes books, pamphlets, public documents, and periodical articles from 1913 to the present. It is especially strong in the fields of business and applied science and indexes a few foreign journals.

Engineering Index Gives abstracts of articles appearing in engineering magazines, government documents, society transactions, and engineering college bulletins since 1884.

Physics Abstract This is a British publication and lists abstracts from many foreign publications since 1898.

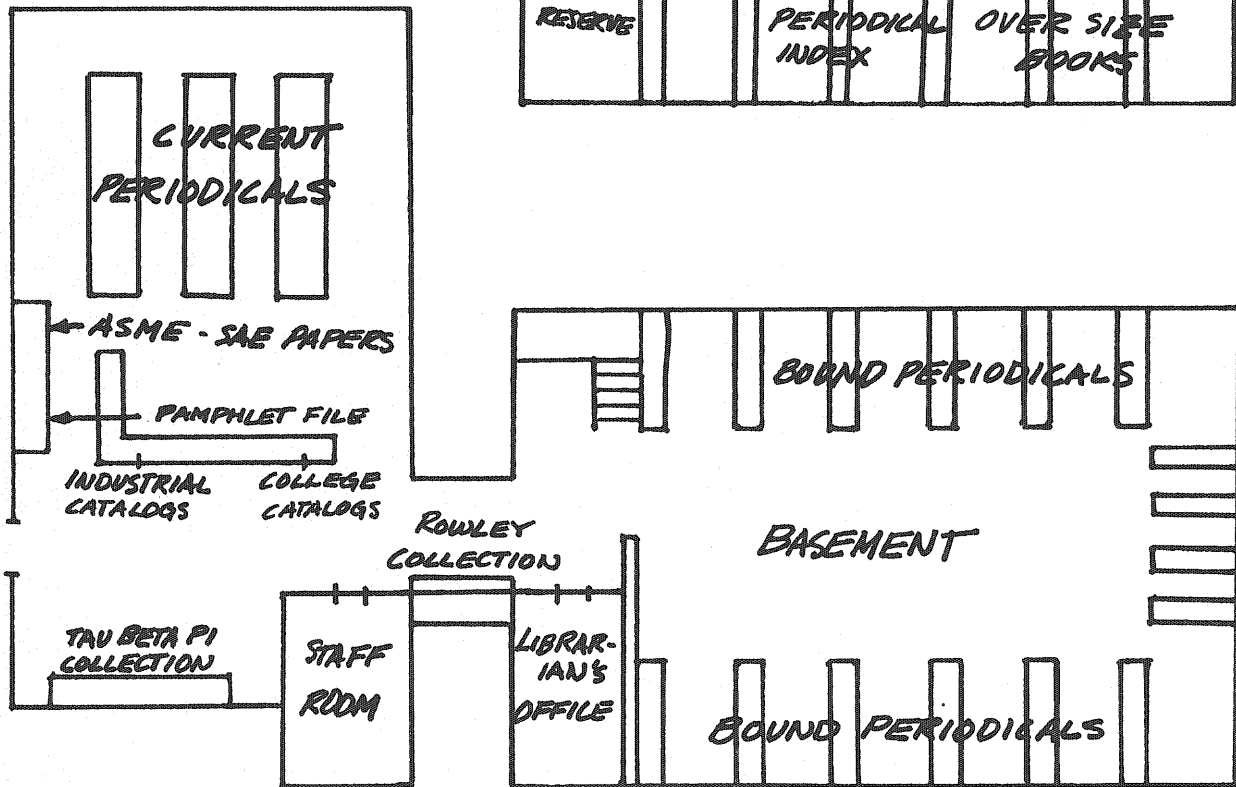
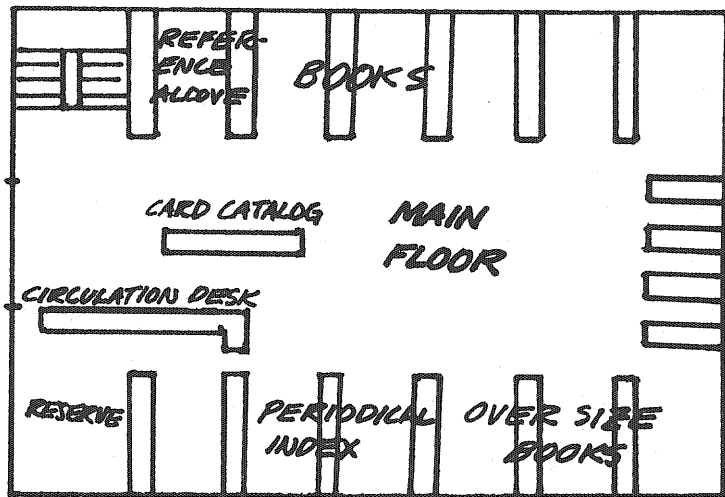
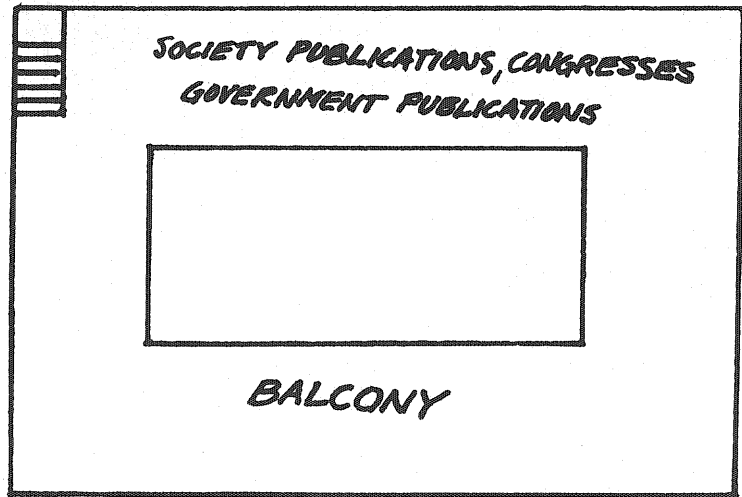
Electrical Engineering Abstracts Same as the above.

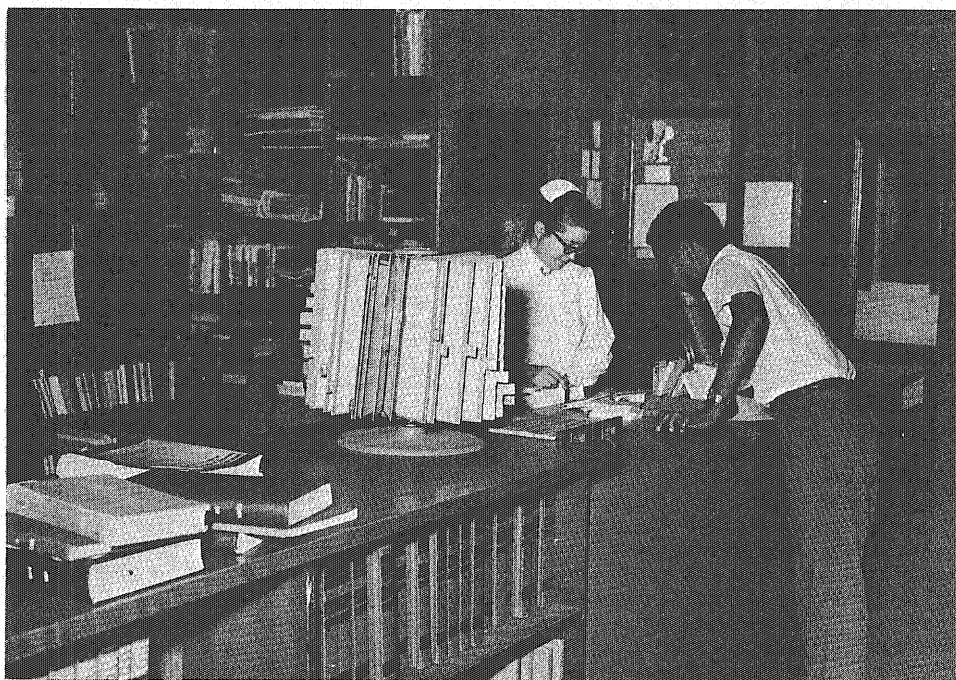
(Continued on page 18)



Balcony view of main floor study space with reserve books on the left and the card catalogue on the right.

General floor plan showing space allotments for library resources.





Main circulation desk with "revolving finding file" for listings and locations of periodicals and journals.

International Aerospace Abstracts Indexes bibliographies, articles, special bibliographies, etc.
U.S. NASA Scientific and Technical Aerospace Reports Abstracts and other aerospace literature of interest to NASA contract holders.

Although more than half of the books and periodicals borrowed from the Engineering Library are borrowed by faculty and graduate students, the librarians have tried to make the undergraduate feel that he is important as any other patron using the library.

Because of the respect with which the students have treated the library and its collection, it has been possible to avoid the turnstiles and checking of brief cases as is done in Wilson Library and

Diehl Hall Library. Efforts have been made to keep the advantages of a large library with a good collection and a smaller library where strict rules do not need to be applied.

Expansion plans for a new IT complex (*Technolog*, December) include a new library currently scheduled for the tenth year of building. With the present legislative trend of financial cutbacks for education, this time scale appears premature. Both the library administration and the Library Faculty Committee have stressed the need for expansion of current facilities and a new library before 1978. Student and faculty interest and concern could do a great deal to help the situation. □



Basement desk showing manufacturers catalogs and current periodicals.

We developed TV transmission. But a lot of engineers still don't get the picture.

Like, we'll ask a graduating engineer:
"What opportunities do you think an engineer has
if he works for the telephone company?"

And, zap—we get a blackout!

Well, we think the company responsible for
engineering innovations such as the transistor, radio
astronomy, high fidelity and stereo recording,
magnetic tape, synthetic crystals, negative feedback,
sound motion pictures, microwave relay, electronic
switching, the solar battery and telstar deserves a
consideration that's strong and clear.

When the Bell System recruiting team comes
to your campus, be sure to talk to them. Or ask your
Placement Director for the name of the Bell System
recruiter at the local Bell Telephone Company,
an equal opportunity employer.

We'll turn you on.

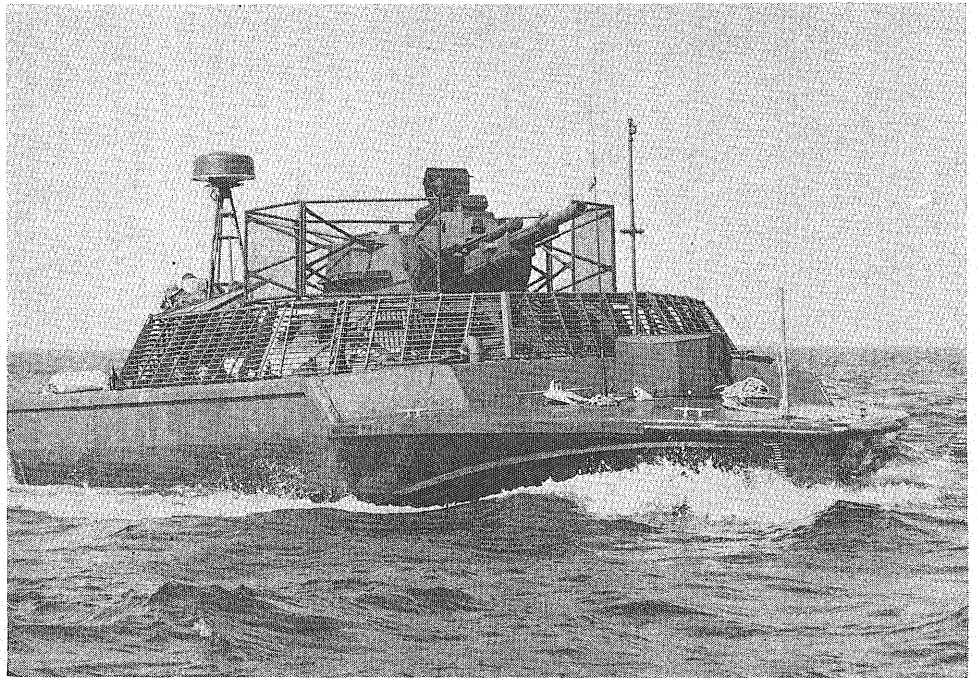


what's new in science and engineering

Edited by Mike Voegele

waterjet gunboats

Heavily-armed and heavily armored prototype Assault Support Patrol Boat (ASPB), designed and built by Sikorsky Aircraft for the U. S. Navy, is now undergoing builder's trials in Long Island Sound. The boat's planing hull is constructed of fiber glass. It is propelled by three waterjet pumps built by the Buehler Corporation. The pumps are powered by ST6 gas turbine engines produced by United Aircraft of Canada Limited. Use of waterjets eliminates need for propellers and rudders, enabling boat to operate with shallow draft.



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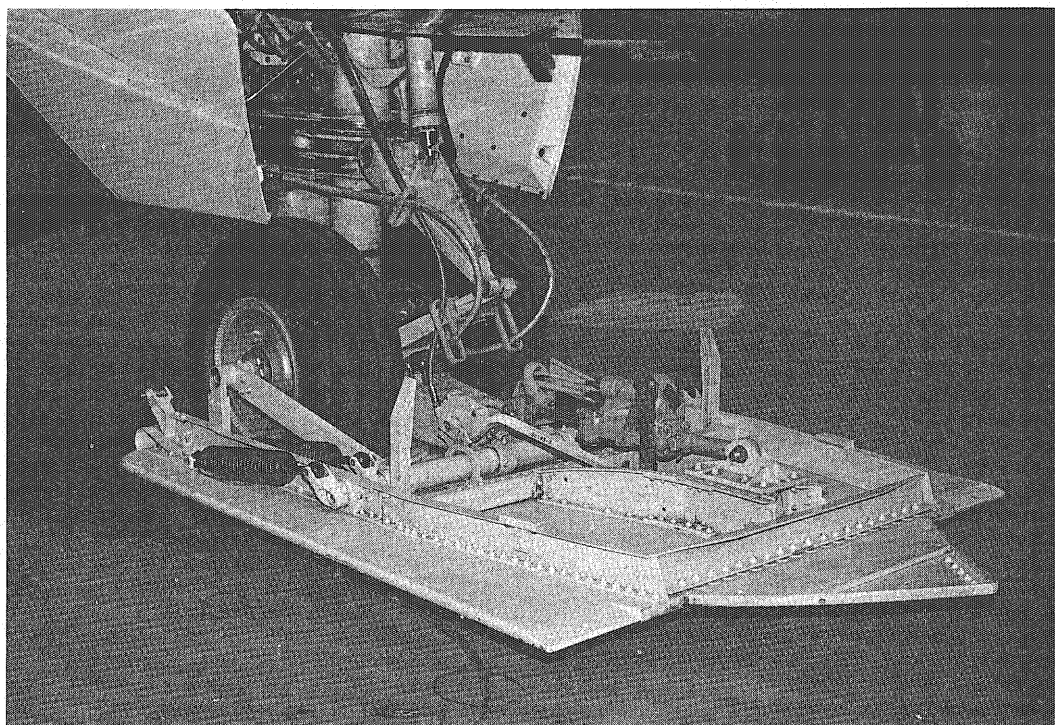
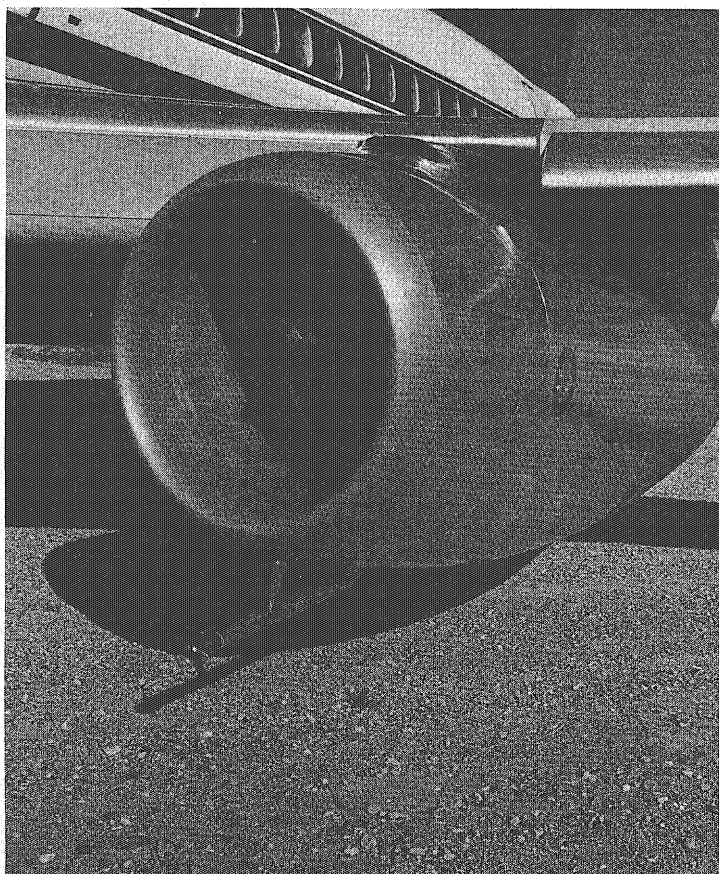
737's go to gravel

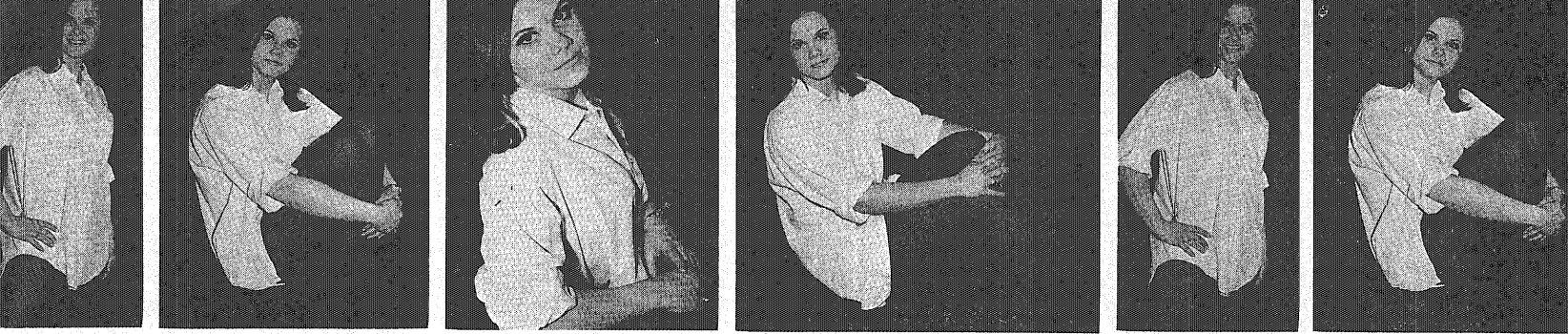
The Boeing Company has obtained U.S. Federal Aviation Administration certification to operate the Boeing 737 twinjet commercial airliner out of unpaved or gravel runways. Certification followed research, design, development and proving flights.

Eight items are included in the unimproved field kit, as stipulated by the FAA. They include a vortex dissipator, a gravel deflection "ski" on the nose wheel, deflectors between the main landing gear wheels, and protective shields over hydraulic tubing on the main landing gear leading edge. Also included are a fiberglass reinforcement of the lower inboard flap surfaces, the application of a teflon-base paint on the underside of the fuselage and wings, installation of a higher-strength DME (Distance Measuring Equipment) antenna and substitution of a retractable rotating beacon on the lower fuselage to prevent breakage.

The major item in the package is the vortex dissipator, a stubby hollow boom protruding slightly from under each engine's lower leading edge. The boom is capped by a plug containing downward-facing orifices. Pressurized air from the engines is forced through the orifices at the ground in front of the engine. The air blast destroys any ground-level vortex—or air current—which could lift small bits of gravel from the runway into the engine.

The deflection "ski" on the nose wheel, and the deflectors between the main gear wheels, both serve to hold down pieces of gravel stirred up by the aircraft wheels. The shields over the main landing gear struts prevent damage to the important hydraulic lines. The reinforced covering on the flaps and underside painting protect those areas.





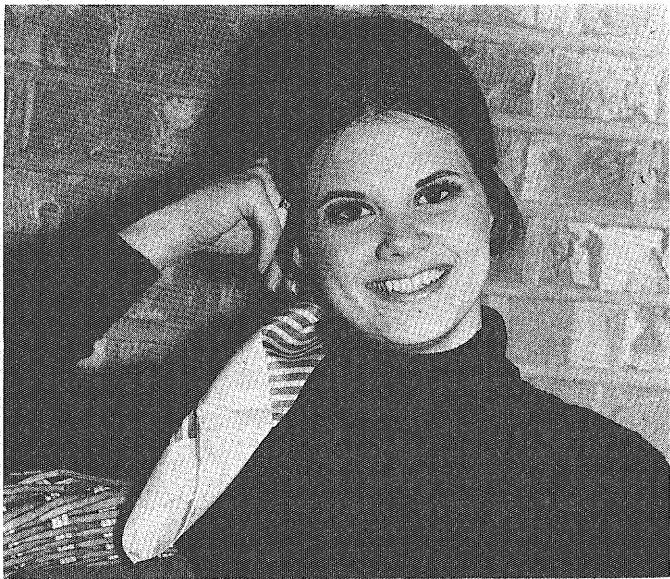
miss april

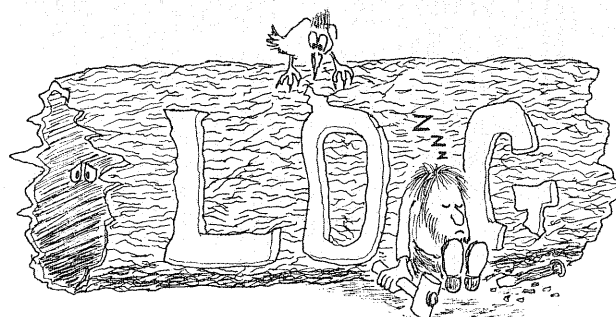
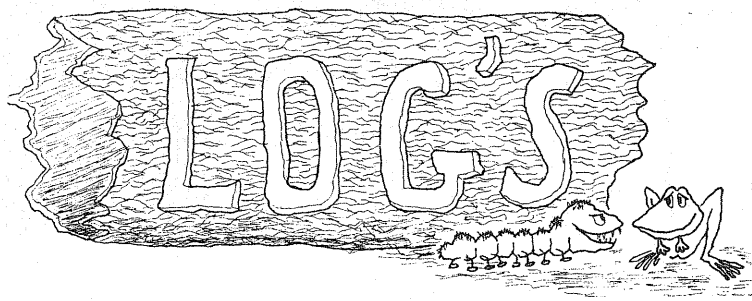
Sharon Nye





April showers bring not only May flowers but also Sharon Nye as Miss April. Because Sharon is equally interested in fashion as well as traveling she's having a hard time choosing between becoming a fashion buyer or an airline hostess. In the meantime, when not pondering her future, Sharon is a sophomore at Metropolitan Junior College. She's a real summer sports enthusiast too! Tennis and water skiing have top priority this summer. Like everyone else she can't wait for summer to come, but with a bright smile like hers around who cares if it rains in April?





jai byrd

banana-ed in boston

Winthrop Hammer

Crime Reporter

There has been a lot of flap about marijuana use on the West Bank, but little attention has been directed toward the real local criminals: the Banana Fiends. To get the inside dope on these degenerates, I interviewed Minneapolis' answer to Ralph Nader (none other than Dr. Morris Barnacle, Chiropractor).

From our offices below the Seedy Theatre, it is only a short walk to "The Joint," the good doctor's chiropractic clinic.

As I entered, Morris shook my hand and gave me a pat on the back. "I thought I noticed a slipped disc," he said, sounding like a broken record.

I pressured him into telling me all he knew about the Banana Fiends and their leader, Billiam Goodfellow. Morris reluctantly agreed as he arose from the floor.

As it turns out, Mr. Goodfellow is a northern Minnesota transplant (from the heart of the Iron Range) who became an auricle of Banana Fiendom.

Dr. Barnacle has been fighting for years to have a bill introduced in the legislature to establish a bounty on Banana Fiends.

"I worry about my daughter. I'd sooner have her de-flowered by a hippie than to have her become one of those Banana Fiends," the Doctor said.

I looked down at Cedar Avenue through his stain-glass window of Johnny Appleseed, and I could not but admire his honesty.

"These crack-pot Banana Fiends keep trying to intimidate me with warnings that the Great Spider, their Tarantula God, will reek his vengeance upon me. They can't scare me with that non-sense!"

I left his office after a brief spine alignment. I was the last to see him alive, unless you count that eight-legged guy who walked with a stoop. The police have a warrant out on him as a material witness.

back from the front

Ralph Groop

Ace War Correspondent

Around the Sixteenth Century, there occurred a change which would greatly affect the subsequent

history of Europe. The formerly peace-loving inhabitants of Eastern Poland and the Ukrainian Steppes, the Hassocks, became tired of being used as a boot rest for invading hordes such as the Sandals.

The Hassocks arose against their oppressors to form a fearsome cavalry band—putting out two smash hits per month. They soon began to expand territorially with the aid of the traitorous Dupes and Dupchesses of Central Europe. If discovered, these Hassock Quislings would be boiled in oil (or in melted cheese—thus giving rise to the term, "Personna au Gratin").

Chief among the leaders of this ring was Taras Bilbo. He succeeded in getting an alliance with a tribe in North Africa, the Cartilaginians. These people from Cartilage had a bone to pick with the Italians going all the way back to the Roman Empire.

The Cartilaginians hired an English mercenary named Towne to direct their army. Thus it was that Towne and Taras joined forces and marched on Rome.

Pope Innocent XXIV, nobody's fool, quickly sued for peace and was awarded \$200,000 by the court.

The former allies soon fell to fighting with each other, and, in the end, only the Pope and his meager army were left.

As Dr. Guillotine used to say, "If you can keep your head, while all around you they are losing theirs, then, my son, you are shorter than the mower blade."

the heat of the knight

In the days when Knighthood was in flour, and the Crusades had not yet discovered the secrets of the mysterious Yeast; one name stood above them all on elevator shoes: Sir Snatlink.

Come with us now into those days of "You're . . . and I'm . . ." A cloud of dust, and a hardy "Lettuce, away!"

As our faithful followers will remember from last time, Sir Snatlink had won first prize in the Smiling Madonna Camel Lot drawing, being the only one to survive being tied to four wild quartering camels.

The first prize turned out to be a sway-backed camel or else a week-end in beautiful downtown Paris. Needless to say, Sir Snatlink took the week-end in Paris.

Upon arrival, Sir Snatlink decided to look up an old friend, the Scarlet Pimpernel—the original flower child. Along the way, he picked up the latest week-old paper.

The headline read: Scarlet Pimpernel Strikes Again—Demands Higher Wages—King Refuses to Compromise.

Sir Snatlink's loyal sidekick, Sir Cumference asked solicitously, "Geegolly, Sir Snatlink, how come the Scarlet Pimpernel gets paid 25c an hour and I only get 5c?"

"Well," said Sir Snatlink, "I think it's probably because of the inflation here in Paris."

"Sounds like a lot of hot air to me."

"That's what I said, 'Inflation'."

"You may be right, Sir Snatlink. We super-heroes should stick together during these wage disputes. Why don't we go down to the Royal Palace and I will stomp all over the King until he sees, under Sir Cum's stance, that he should give in."

"That's no way to get around the King, Sir Cum, venting your anger."

Just the same, Sir Snatlink and Sir Cumference soon found themselves outside of the Royal Palace.

"I'm sorry, the king wishes to see no one today. He is very ill," snapped his Prime Minister.

"Boy, Sir Snatlink, this King sure acts like a weasel." (King: Kachou.)

Will Sir Snatlink and Sir Cumference use their famous pincer strategy to gain an audience with this King crab?

Will they use the old Wooden Humpty-Dumpty trick to sneak in, thus egging on all the king's men?

Join us next time—you will hear the King say, "L'etat c'est blah!"

official daily bull

April 20—Have your pupils dilated for an eye test on the day of the nude sit-in.

April 23—MacHenry's beef passes U.S.D.A. inspection. You can tell it's good meat; the maggots all wear white hats.

May 1—Your arch-enemy prof, has a change of heart; he gives you a red star for your forehead.

May 2—AFROTC member shot down by all the members of Angel Flight.

May 3—I.T.'s "body beautiful" contest is won by a Buick GS.

May 5—Econ. Prof. Maynes injures his ankle in a fall from his bicycle; again proving—the Maynes in pain falls plainly to a sprain.

May 11—Today, flaunt your Oedipus complex.

MAY 9th IS



a picnic in the court

A CORONATION

a new queen colleen

A NEW ST. PAT

a model car race

KNIGHTS of the Senior Class

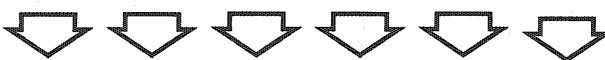
a chariot race

A CAR RALLY?

free food [wear your button]

FEMALE COMPANIONSHIP

an evening brawl



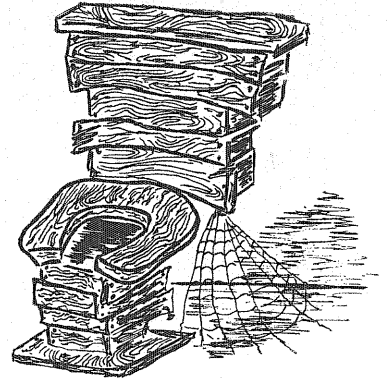
MAY 9th IS

E-DAY

so come and see!

Splinters

by Paddy Hooligan



—vilitas et crudus semper eternam

Ah, pity the Joke Editor.
 The man with the scissors and paste;
 Oh, think of the man who must read
 all the jokes
 And think of the time that he wastes.
 He sits at his desk until midnight,
 How worried and pallid he looks,
 As he scans through the college comics
 And think of the time that he wastes.
 This joke he can't clip—it's too dirty.
 This story's no good—it's too clean.
 This woman won't do—she's too
 shapely.
 This chorus girl's out—it's obscene.
 The jokes are the same; full of coeds
 And guys who get drunk on their
 dates,
 Bathtubs and sewers and freshmen,
 And stories of unlawful mates.
 Jokes about profs and the readers,
 Jokes about overdue bills,
 Jokes about girls in their boudoirs
 And each one as old as the hills.
 Sprinkled with "damn," "louse," and
 "hell,"
 The blurbs must be pure yet filthy
 Oh pity the man with the clipper,
 He's only a pawn and a tool.
 In trying to keep his jokes dirty and
 clean
 He's usually kicked out of school.

Four young boys were taken before
 a justice of peace by a city constable
 who exclaimed, "Your Honor, these
 boys were making all kinds of trouble
 at the zoo this morning."

The judge replied, "Boys, it makes
 me sad to know this. Now each one
 of you give me your name and tell me
 what you were doing at the zoo."

"Sir, my name is Tim and I was
 only throwing peanuts to the ele-
 phants."

"My name is Ricky and I was just
 throwing peanuts to the elephants."

"My name is Jim and I was throw-
 ing peanuts to the elephants too."

"My name is Peanuts. . . ."

OHM ON THE RANGE

Opus 3.14159—In Three-Phase Time
 Oh give me an ohm
 Where impedances roam,
 Where the fields are not fluxing all day,
 Where you'll never see
 A field without phi,
 And the flux is not leaking away.
 Ohm, ohm on the range
 Where the flux is not changing all day,
 Where never is seen
 A shunt field machine,
 With the armature running away.

• • •

Nine out of ten Engineers who
 tried camels preferred women.

Overheard in the Chem. E. Lab:
 "When mixing vodka with orange
 juice, you get a screwdriver. When
 mixing vodka with prune juice, you
 get a piledriver."

• • •

Geologist: "I wish I had a nickel for
 every girl I've kissed."

Pet. E.: "What would you do? Buy
 a candy bar?"

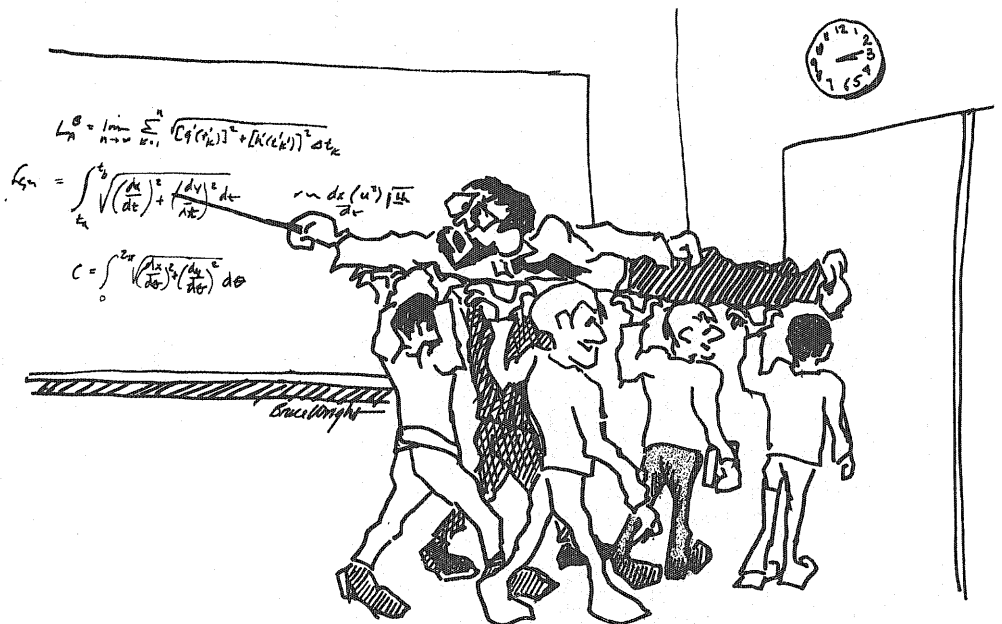
• • •

Freshman: I think your girl is
 spoiled.

Senior: No, it's just the perfume
 she's wearing.

• • •

Nine out of ten women who tried
 Engineers preferred camels.



*And in the remaining thirty-five micro-seconds I will explain the funda-
 mental theorem of calculus.*

A man was having trouble with his parakeet. Every night when he came home from work, the bird would fly up on his shoulder and pick holes in his shirt. After thoughtful deliberation the man decided that the only solution was to file off the bird's beak. So he went to the hardware store to buy a file.

When the salesman found out why the man wanted the file, he tried to talk him out of it, explaining that the parakeet could not eat without his beak. But it was all to no avail, so he reluctantly sold him the file.

A few weeks later the man was back in the hardware store and the salesman recognized him.

"How's your parakeet?" asked the salesman.

"Oh, he's dead," the man replied.

"See, I told you so! I knew that your bird would die because he couldn't eat with his beak filed off!"

"Yeah," replied the man, "but I think he was dead when I took his head out of the vise!"

• • •

C.E.: "What's the best way to keep a horse from frothing at the mouth?"

I.E.: "Teach it to spit!"

The board members of the Cordial Catsup Company were wowed by the idea their ad agency had come up with for their billboard campaign. It showed a husband type seated before a delectable steak in a smart restaurant, and a pretty young waitress in a tight-fitting uniform was handing him a bottle of catsup.

"This is great," said the prexy of Cordial Catsup, "but remember, our appeal here is to housewives, so let's clean that title up a bit. 'What does she know about your husband that you don't know?' is too suggestive."

A week later the billboards were attracting attention all over the country with the caption: "He gets it downtown—why not give it to him at home?"

• • •

Did you hear about the Indian who couldn't tell the difference between head and tails? . . . You should have seen some of his scalps.

• • •

Ray (over phone): "Is Carole in?"

Roommate (also over phone): "She's taking a bath."

Ray: "I'm sorry, I have the wrong number."

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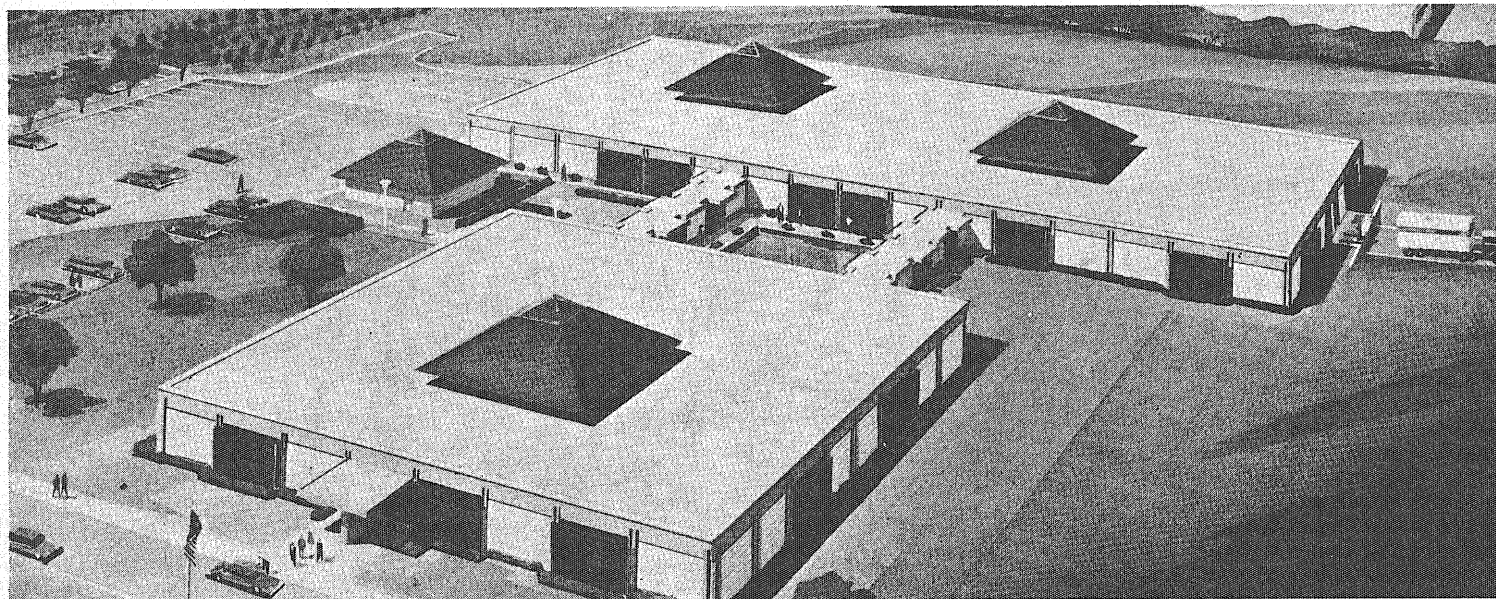


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The problem is not in energy sources. We have enough raw energy in oil, gas, coal and nuclear sources to last thousands of years.

The real challenge is converting the raw energy to the most usable form — electrical energy.

We've been doing it for years. What's the problem? The fact is, we've been doing it at the cost of our environment. We can't continue this. Of course, energy conversion is needed for economic growth. But it must not be at the cost of society.

As engineers, we must concern ourselves with these problems. We must look at the future effects as well as the present needs. We have a duty to direct our efforts for the good of mankind. As a matter of fact, we must hold ourselves directly responsible. We have the knowledge, the knowhow to promote industrial growth. But we must also concern ourselves with making the world more livable.

We at E-M do our best. We design, manufacture, and market generators and motors for production and conversion of electrical energy. We know we are providing a valuable service to mankind. We have equipment which is used to supply all the basic needs of man (water, transportation, health & sanitation, and food as well as energy).

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M.E. Dad: "No, son, C.E.'s build skyscrapers."

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The archeologists were exploring some old ruins when they came across a strange tomb. On the massive stone door was chiseled in old German, the name "Ludwig Von Beethoven." Wild with excitement, the archeologists peered into the tomb and found the great master at his piano, madly erasing the notes off his famous works. Bursting with curiosity, the archeologists rushed into the tomb and asked, "What in the blazes are you doing, man?"

Came the reply, "Decomposing!"

• • •

The waiter approached the college boy, who was sitting with a friend and two girls, "Pardon me, but did you order the zombie?"

"No," said the college man, "This is a blind date."

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Through medical electronics we have been able to create and develop prosthetic devices with which physicians rebuild man. Today, on our expanding horizon, there is electrochemistry, metallurgy, thermionics, biophysics... This is biomedical engineering — applying the total spectrum of physical sciences to man.

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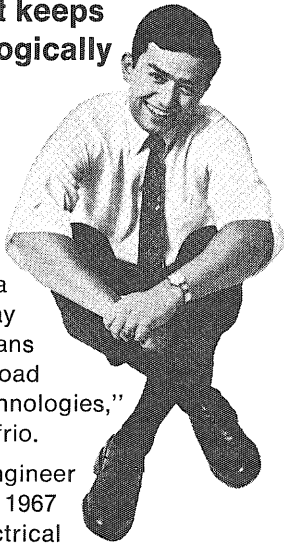
Recently, *Fortune* estimated that the value of general purpose computers installed in this country will more than double by 1972.

Other publications have other predictions, but most agree that information processing is one of America's fastest growing major industries.

To somebody just starting out, this growth means exceptionally good chances for advancement. Last year, for example, we appointed over 4,000 managers—on performance, not seniority. Here are three ways you could grow with IBM:

Engineering and Science

"The interdisciplinary environment keeps you technologically hot."



"Working in data processing today pretty much means you work in a broad spectrum of technologies," says Nick Donofrio.

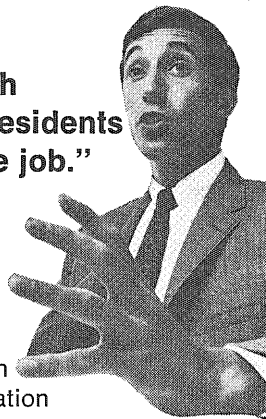
An Associate Engineer at IBM, Nick is a 1967 graduate in Electrical Engineering. He's using his technical background to design circuits for computer memory systems.

Nick says, "Your specialty at IBM can take you into the front yard of half a dozen different fields. In my job, for example, I work with systems design engineers, chemists, physicists, metallurgists, and programmers."

Career areas in engineering and science at IBM include: Research, Design & Development, Manufacturing, Product Test, Space and Defense Projects, and Field Engineering. You'll need at least a B.S. in any technical field.

Marketing

"Working with company presidents is part of the job."



"I'm pretty much the IBM Corporation in the eyes of my customers," says Andy Moran. "I consider that fairly good for an engineer who graduated only two years ago."

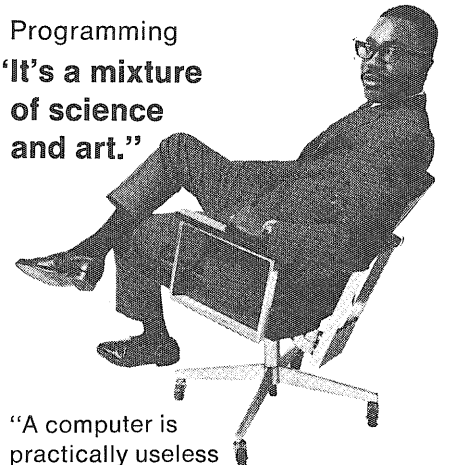
Andy earned his B.S.E.E. in 1966. Today, he's a Marketing Representative with IBM, involved in the planning, selling and installation of data processing systems.

Andy's customers include companies with annual sales ranging from 20 million to 120 million dollars. He often works with executive vice-presidents and presidents.

Career areas in marketing at IBM

include: Data Processing Marketing and Systems Engineering, Office Products Sales, and Information Records Sales. Degree requirement: at least a B.S. or B.A. in any field.

Programming
"It's a mixture of science and art."



"A computer is practically useless until somebody writes a program for it," says Earl Wilson.

Earl got a B.A. in Modern Languages in June, 1967. He's now an IBM programmer working on a new teleprocessing system linking IBM divisions.

Earl defines a "program" as a set of instructions that enables a computer to do a specific job. "Programming involves science," says Earl, "because you have to analyze problems logically and objectively. But then you have an infinite variety of ways to write your program."

Career areas in programming at IBM include: Systems Programming, Applications Programming, Programming Research, and Internal Programming for IBM's own use. You'll need at least a B.S. or B.A.

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He began by rediscovering firsthand some of the vibrant situations that confront young teachers. With that background he was ready to coordinate the nominating and judging.

Planning and coordinating come naturally to Bob. As a Production Control Specialist with General Electric's Medium AC Motor and Generator Department, he keeps production lines running smoothly. Coordinating machinery, raw materials and labor is crucial to any efficiently run business.

With a mechanical engineering degree from Cornell, in 1962, and an MBA in personnel administration from George Washington, in 1963, Bob sought to plunge

directly into meaningful work. He'd had enough theory and simulations to last him for awhile.

At General Electric he found people that agreed with his thinking, and what's more, GE offered him immediate responsibility via the Manufacturing Management Program.

Like Bob Nerad, you can get a fast start at General Electric, in R&D, design, production or technical marketing. Talk to our man when he visits your campus. Or write for career information to: General Electric Company, Room 801B, 570 Lexington Avenue, New York, N. Y. 10022

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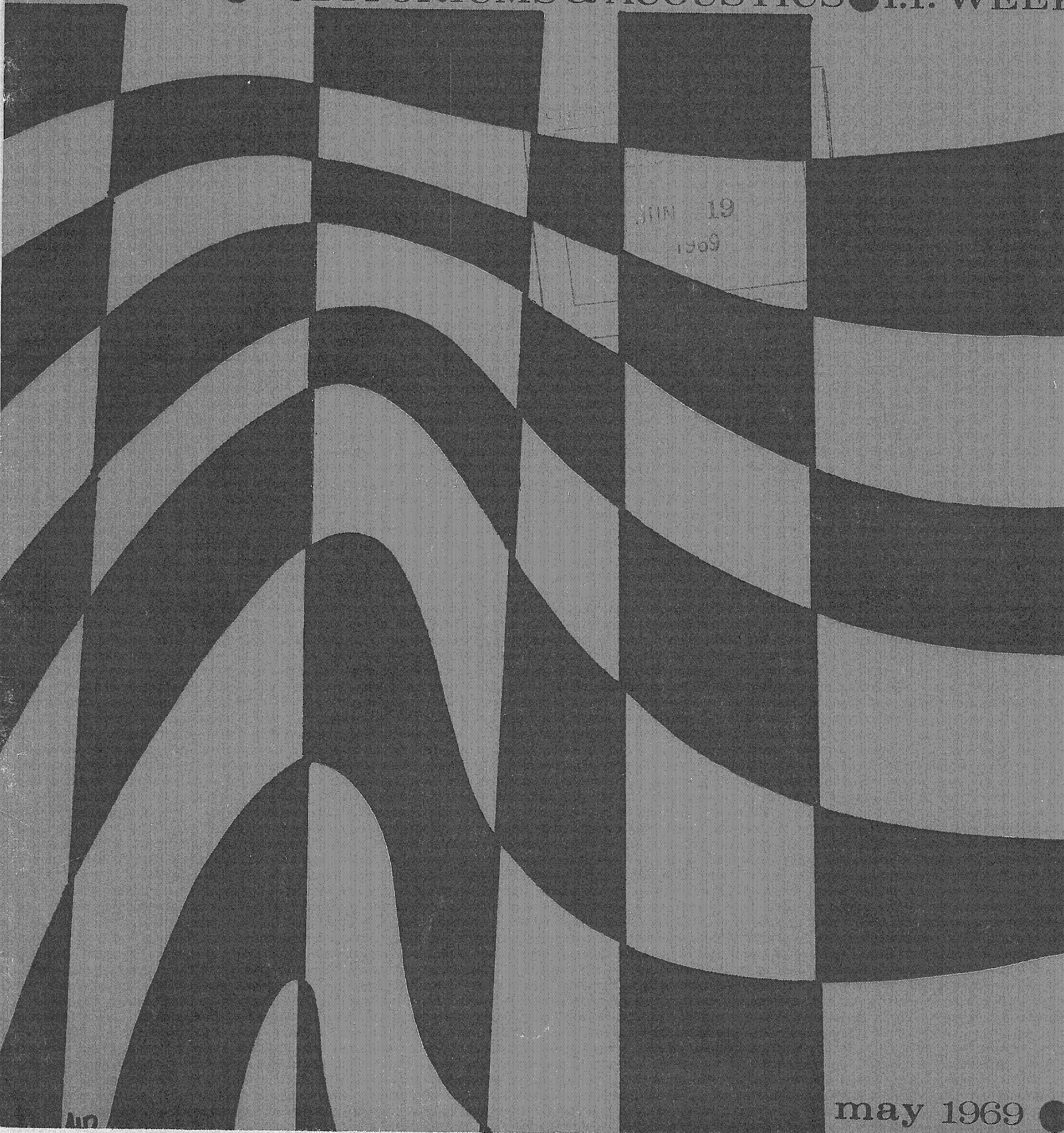
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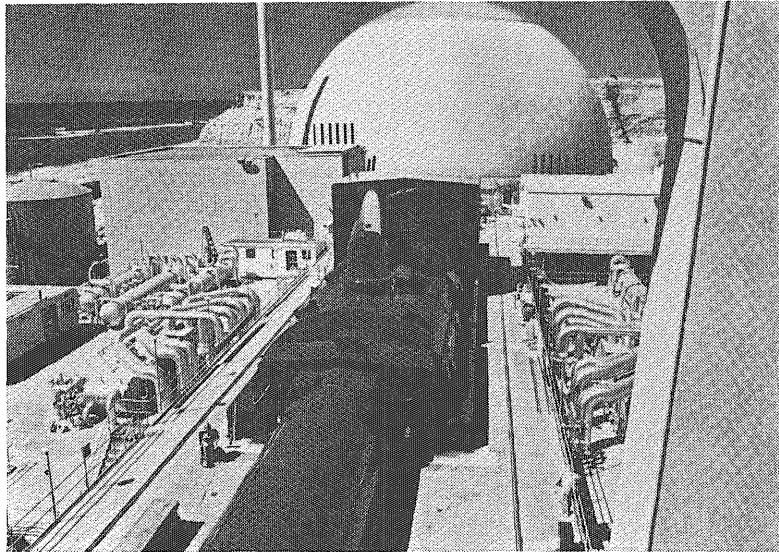
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Okay, that's Westinghouse, the

electric company. What about Westinghouse, the schoolteacher? In its first two years, Westinghouse Learning Corporation had over 60 government and private contracts, including training for the Peace Corps, Job Corps, and private industry.

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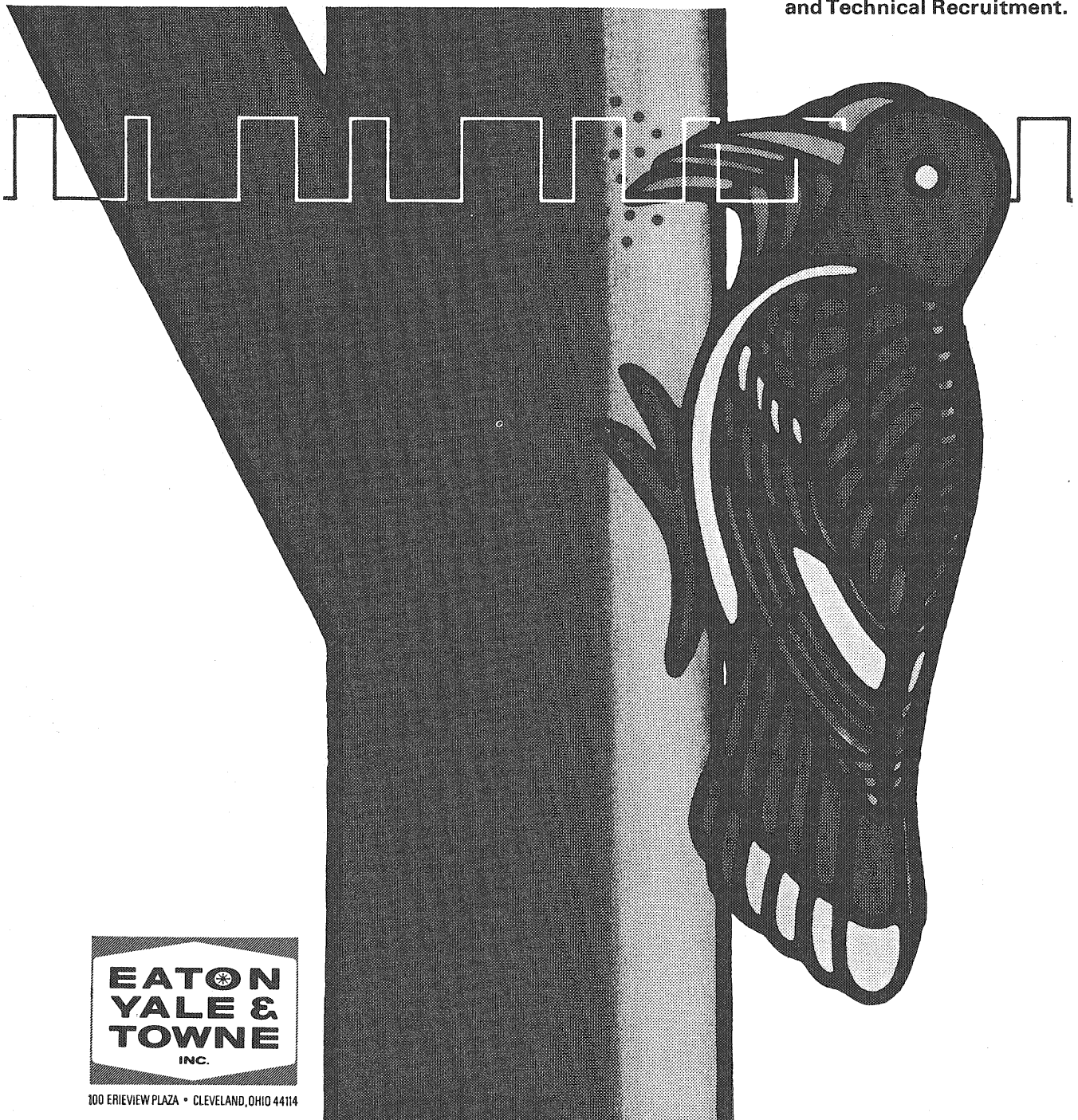
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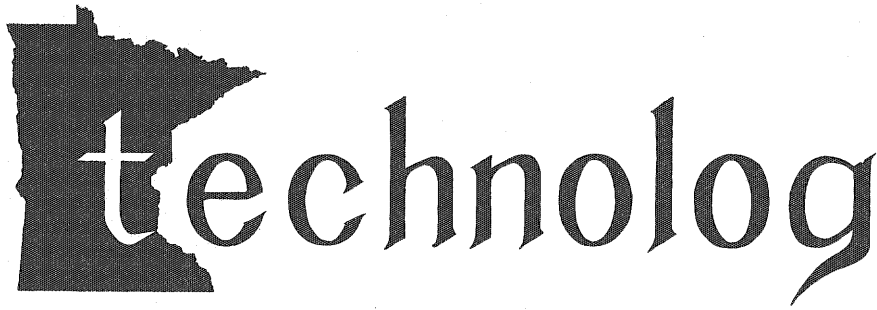
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COVER: A geometry of sound. By Ann Polkinghorne.

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AUDITORIUMS

and

ACOUSTICS

by Rodger Whipple
and Bruce Wright

ON April 25 and 26, architects, city officials, and educators from Colorado, Minnesota, Wisconsin, Michigan, Montana, North Dakota, South Dakota, and Illinois attended a symposium on performing arts facilities at the Sheraton-Ritz Hotel in Minneapolis.

Presented by the acoustics, illumination, and theatre consulting staffs of Bolt Beranek and Newman Inc. (BBN), the Minneapolis symposium was the third in the 1969 spring series, "Theatres, Auditoriums, and Concert Halls: The Effective Collaboration," scheduled for major metropolitan areas throughout the U.S. and Canada.

While the symposium was organized to provide architects and concert hall owners with information on the latest techniques and successes of auditorium acoustic design, it also destroyed the double myth of the unpredictability of acoustics and the uncertainty of auditorium success.

Each speaker presented arguments, backed by evidence, about the construction of multi-purpose auditoriums, ranging from administration and fund raising to acoustics, lighting, and stage machinery. They also pointed out the reason for auditorium failures.

One problem is finding architects with acoustical training, especially in auditorium acoustics, because architects in school get very little or no acoustical training. Consequently, there are not many more than two dozen acoustical experts in the country.

Another problem is the lack of appreciation auditorium owners have for the uses their building will see. Prospective builders will tell BBN that they want a hall designed for opera, ballet, and symphony, and find, in a few years, that musical comedy and drama are the prime users.

So when BBN is contacted by an

organization for advice on auditorium construction, they conduct a feasibility study which determines the needs and desires of the community along with the artistic, administrative, operational, and financial range available.

The feasibility study also looks at factors such as: the support available from and benefits to existing civic and community agencies, and educational and private groups; the existing and projected activities of local professional, educational, and amateur performing groups; the features of facili-



ties; the audience to be served and the methods of its development locally and regionally; the types of presentations and activities to be accommodated, and their space requirements; optimum seating capacities; projected construction and operating budgets.

Once the feasibility studies are completed, the design of the hall can be drawn up. Historically, auditoriums have been divided into two categories—open stage recital halls and stage house opera houses (see box).

If a stagehouse auditorium is going to be built, acoustic flexibility still can

be provided through the use of a concert shell which produces the high reverberation or "wet" acoustics needed for musical events. For instance, Northrup Auditorium uses a steel shell which folds into a space at the upstage wall of the stage house. Unfortunately, concert shells, especially large ones, are not readily moved about, and acoustical changes cannot be made easily.

The cloth hangings of the stage house and the proscenium absorb sound and are harmful to music performances where high reverberation and low articulation is needed. The relatively small opening of the proscenium and the usually cavernous stage house add to the musicians' miseries, although the speaker or the dramatic actor is happy with "dry" acoustics and high articulation.

However, the open stage approach to multi-purpose auditorium construction is much more adaptable to flexible acoustical systems, and easily lends itself to low or moderate budget operations. It is for these reasons that many high schools and colleges use the open stage approach.

Figures 5 and 6 show a hypothetical, but typical open stage, multi-purpose auditorium that incorporate equipment for varying the acoustics. Notice how the front portion of the audience chamber is relatively narrow and then widens considerably behind the eighth or tenth row. This promotes clarity for music performances and intelligibility for speech.

Along the sides of the front of the auditorium, and above the stage and front rows are poly-cylindrical sound diffusing panels which are hidden by a sound transparent screen. This screen might be constructed of small widely spaced wood strips or of perforated or expanded metal or open

A SHORT HISTORY

Auditoriums can be categorized into two broad groups:

1. Multi-purpose auditoriums
2. Specialized auditoriums

The second category includes auditoriums such as recital halls, playhouses, cinemas, concert halls, and lecture halls.

Specialized auditoriums were particularly adapted for their intended use, acoustically and seatwise and therefore, the halls did not lend themselves to other uses. For instance, it is difficult to stage operas conventionally in a standard recital hall.

Modern specialized auditoriums are an evolution from earlier building types. Opera and public concerts became a part of the Western culture in the 16th and 17th centuries and consequently developed specialized auditoriums for productions and concerts. These halls were evolved from other building types including churches, courtyards, inn yards, tennis courts, banquet halls and audience halls. The theatres in London from Shakespeare's time, like the Blackfriars and the Globe were also evolved from other building types, especially the courtyard.

Halls originally used for the occasional production of speech plays and operas, and for the presentation of concerts were usually long, narrow, rectangular, high ceiling rooms, often with side galleries and a platform at

one end. This style of architecture was not so much a result of acoustical knowledge, but from lack of knowledge about ceiling construction for large wide or square ceilings.

Many of these rooms, designed as banquet halls or auditoriums were used for plays, masques, or ballet and had one or two balconies or galleries surrounding the room, which served to increase the seating capacity.

The 16th and 17th century halls (see diagrams), both with and without demountable platforms, were small and, in addition, put the performer in the same room with the audience.

The modern descendents of these halls are New York's Carnegie Recital Hall, the Salle Gaveau in Paris, Vienna's Musikvereinsaal, and Boston's Symphony Hall (see Figure 4).

On the other hand, the opera house developed from the same beginnings into a vehicle for spectacles. This evolution developed along with the need for elaborate scenery for opera and court masques. The platform which had been semi-permanent gradually became a monstrous stagehouse which in "Italian" opera houses on the continent, dwarfs the audience chamber.

This is largely the tradition that is with us today . . . witness Northrup Auditorium . . . in the form of large stage houses that communicate with the audience chamber through a proscenium opening.

weave plastic cloth. Often the ceiling sound reflecting panels are constructed to have curvature in two planes (a surface section of an oblong sphere).

In addition, three layer cloth curtains on traveler racks are used for acoustical adjustment. When not in use, the curtains are retracted into dry wall storage pockets. The curtains are located above the poly-cylindrical surfaces and in the ceiling above the sound transparent screen. When high reverberation is desired, the curtains are retracted and as more dryness is needed, the curtains are pulled out of their storage pockets.

In constructing both the open stage and stagehouse auditoriums, steps are taken to insure acoustic isolation, i.e., eliminating or minimizing air conditioning and other physical plant noise, and outside noise and vibration. At one hall, the cascading sound of flushing toilets was distinctly heard during the second movement of Beethoven's "Fifth."

Solutions to these problems are found by constructing double walls and ceilings, and doing everything possible to silence the thermal control systems.

A sound reinforcement system is necessary if the auditorium is to be multi-purpose, however such a system is expensive. The BBN sound reinforcement expert Ronald McKay estimated \$10,000 for a simple system in a 1,000 seat auditorium and \$100,000 for a five channel system in a 5,000 seat auditorium. Factors such as directional realism, and easy control insure naturalness of both music and voice. "With a good system," McKay said, "you should not be aware that it is in operation."

The sound reinforcement system is not used just for projecting sounds

(Continued on Page 20)

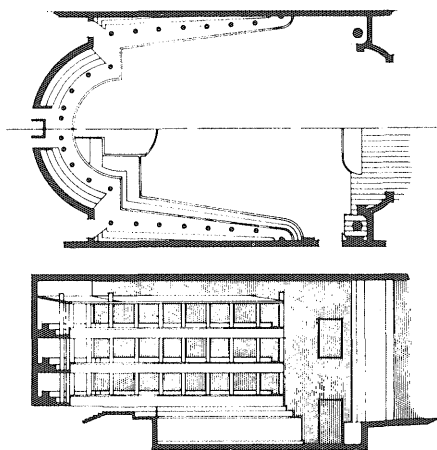


Figure 3. This plan and section published by Fabricio Carini Motta in 1676, shows close relationships with the theatres of 1630 and 1660 in the Palais-Royal, Paris, and the later Bibiena Markgraffische Opernhaus in Bayreuth (1748), and the Dresden Opernhaus (1719).

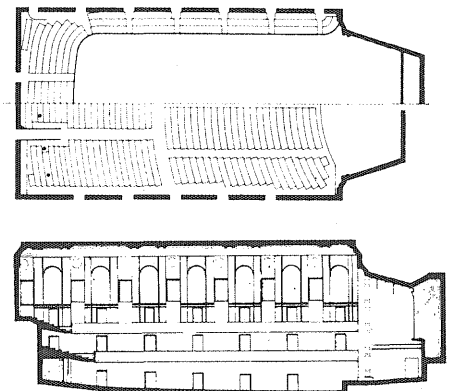


Figure 4. Symphony Hall, Boston, 1900. One of the best known concert rooms in the United States. In its predecessor, the Boston Music Hall, the concert platform was completely open to the room and flanked on the sides by audience seating.

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SPOKEN HERE**

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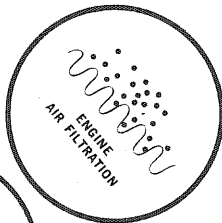
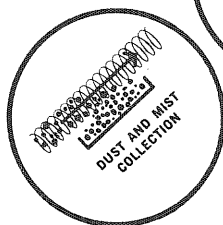
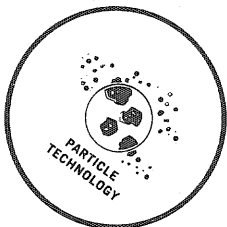
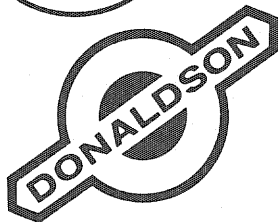
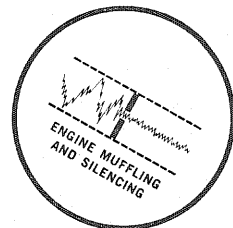
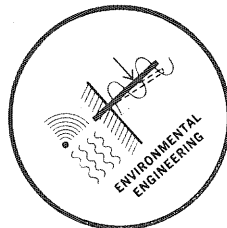
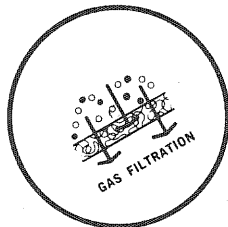
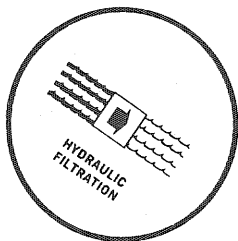
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Research opportunities in highway engineering

The Asphalt Institute suggests projects in five vital areas

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Here are five important areas of highway design and construction that America's roadbuilders need to know more about:

1. Rational pavement thickness design and materials evaluation. Research is needed in areas of Asphalt rheology, behavior mechanisms of individual and combined layers of pavement structure, stage construction and pavement strengthening by Asphalt overlays.

Traffic evaluation, essential for thickness design, requires improved procedures for predicting future amounts and loads.

Evaluation of climatic effects on the performance of the pavement structure also is an important area for research.

2. Materials specifications and construction quality-control. Needed are more scientific methods of writing specifications, particularly acceptance and rejection criteria. Additionally, faster methods for quality-control tests at construction sites are needed.

3. Drainage of pavement structures. More should be known about the need for sub-surface drainage of Asphalt pavement structures. Limited information indicates that untreated granular bases often accumulate moisture rather than facilitate drainage. Also, indications are that Full-Depth Asphalt bases resting directly on impermeable subgrades may not require sub-surface drainage.

4. Compaction and thickness measurements of pavements. The recent use of much thicker lifts in Asphalt pavement construction suggests the need for new studies to develop and refine rapid techniques for measuring compaction and layer thickness.

5. Conservation and beneficiation of aggregates. More study is needed on beneficiation of lower-quality base-course aggregates by mixing them with Asphalt.

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A Bonny Queen

E-DAY 1969



One of the lovely floats



Plumb Bob is on the wagon again



St. Pat Gordy Lipsey and Queen Colleen Kris Deeds

7!!!

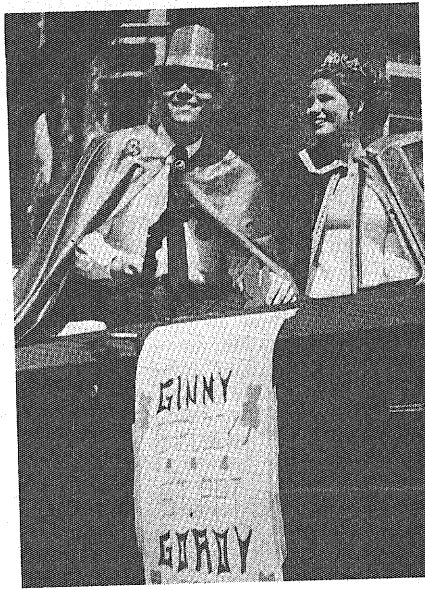


The finalists received rave reviews . . .



. . . from Dean Cheston

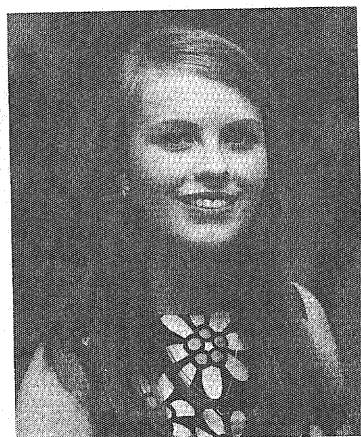
Queen Colleen Leads the Parade



One of the most pleasant activities of E-Day is selecting a new Queen Colleen to reign over the festivities, to compete for the Minneapolis Aquatennial Queen of the Lakes title, and to lead the 1970 E-Day parade.

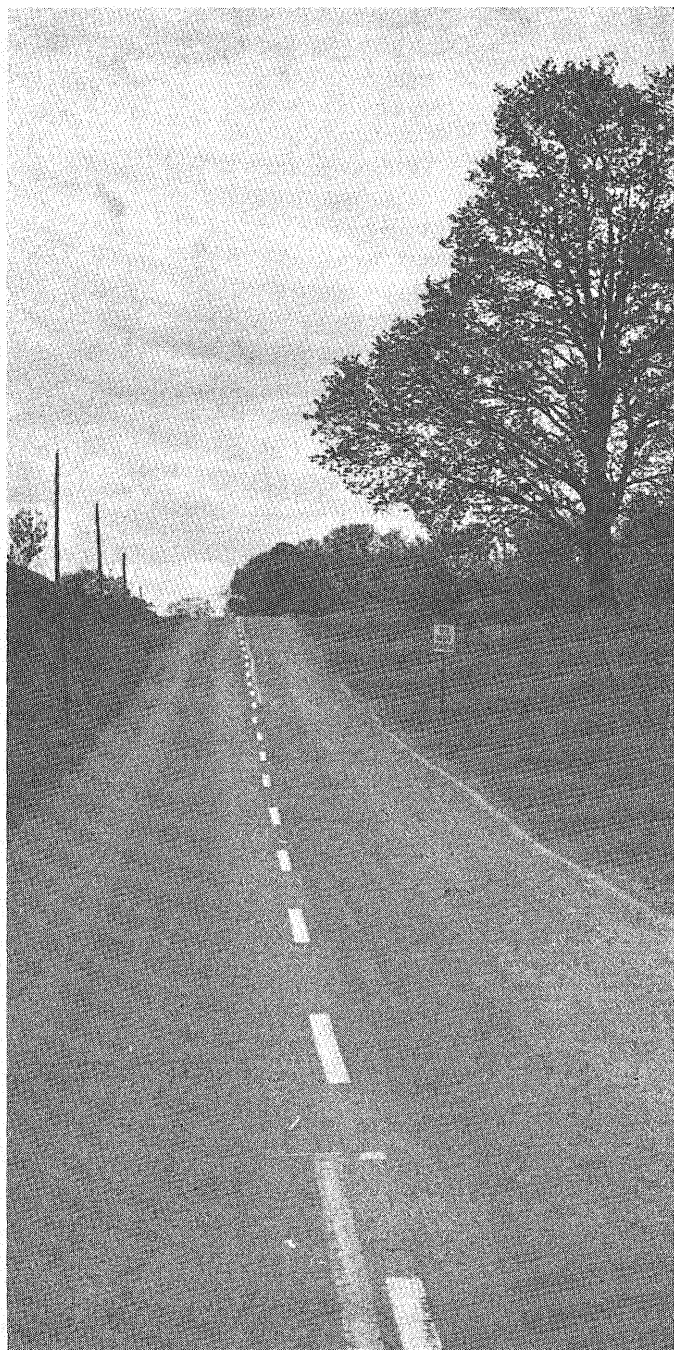
The five queen candidates that graced this year's parade had been selected by their sponsors and had survived two interviews. The final selection was made by voting IT undergraduate students. The choice by popular vote—Kris Deeds.

Nineteen-year-old Kris is an IT math major with an interest in computer science. An active member of Alpha Gamma Delta sorority, she has been involved in MSA, UBOG, MSPE, and Physics Club. She specializes in gymnastics and free exercise. Her sponsoring organization, Theta Tau, deserve many thanks for their lovely choice. We are certain that next year's St. Pat will enjoy riding with Kris in the 1970 E-Day Parade.



E-DAY

ROAD RALLY



It was getting on towards four o'clock, and the people at the second checkpoint knew that there was something wrong. The first annual E-Day Rally was almost two hours old, and not one car had yet shown up at the point which was supposedly one hour's drive from the start. Two farmers in a field across the road struggled with a balky plow and regarded the checkpoint personnel with a suspicious air. The small red car and the strange checkpoint sign on the side of the road in the middle of nowhere—what did it mean? Were they selling something? Establishing another of those degenerate hippie communes? Maybe right here north of *Lake Elmo*? The farmers shrugged and returned to their work, while the people in the little car across the road glanced nervously at their watches and looked expectantly up the road. Something had to be wrong. . . .

The rally this year was sponsored by the Technolog, and was billed as a beginners rally—and one especially tailored to appeal to the engineering mind. The instructions included distances in centimeters, speeds as functions of polynomials and road numbers as currents in an electric circuit; in some parts they were difficult, in others, just illegible. The rallyists—15 teams in all—started the seventy mile course at one minute intervals after two o'clock. The course led them east through St. Paul and on into Washington County, as far as Afton. From there it turned north along the St. Croix up to Stillwater, through some rather rural sections of the county, and finally terminating in a park on the shores of White Bear Lake. A pleasant drive to be sure, on a cool, windy afternoon, and the possibility of winning the 25 dollar first prize—all added up to a good time.

(Continued on Page 16)



Your money and your life.

PHOTO: ERNEST BRAUN





You're living dangerously, and you love it.

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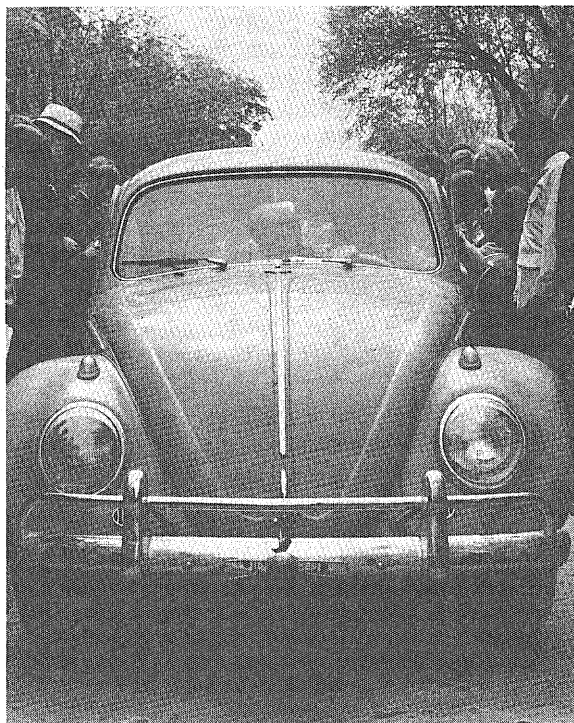
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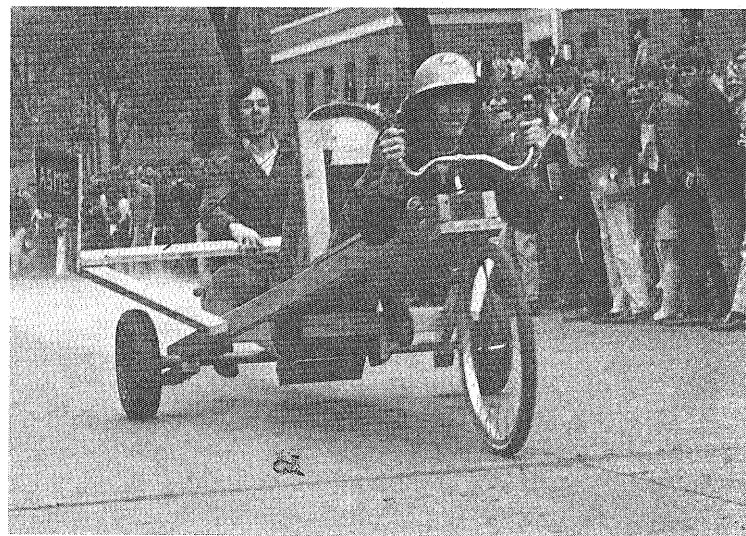


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The Homemade Car Race





Top left: The experimental VW, powered by compressed air feeding the cylinders, scored a DNF in the race. It attained a maximum speed of about 5 mph while being pushed to the starting line, and then settled down to a comfortable 2 mph until it ran out of air 15 feet from the finish.

Bottom left and right: The A.I.A.A. entry proved to be the best in the field. It was definitely hampered by the 20 mph speed limit. Later trial runs showed that the compressed air "jet engine" could push the car along at close to 45 mph.

Center: This bicycle-built-for-two you don't have to pedal. But you have to spend some time winding up its rubber band.

Top right: This front wheel drive version worked on the principle that two motors are better than one. The wheels are bolted right to the armatures; the passenger sits on the three 12 volt batteries powering the rig.

Bottom right: The water spitting bomb built by A.S.M.E. ran a close second to A.I.A.A.'s car. Many spectators standing at the starting line were sprayed as the water under pressure gushed out in an even stream propelling the car forward.

Road Rally


(Continued from Page 11)

Meanwhile, back at Lake Elmo the problem was fairly well defined . . . two cars had stumbled into the checkpoint shortly after four and the complaint was the same—the curse of the ditto master, a blurred exponential in an instruction had sent the entire field of cars speeding past a turn-off and into Bayport. These two had picked their way back somehow, and it appeared as though the rest of the starters were not going to be finishers. But just as the checkpoint was about to be abandoned a white blur appeared over the far hill. It was the number nine Saab, driven by the eventual winner, Leroy Nyhus, desperately trying to make up time and doing pretty well, too. Inside, the car was all business—rally clocks and engine instrumentation, no back seat and a small fire extinguisher. There was a small sign on the dash in front of the navigator's seat: Don't sweat it—it's not your car. The navigator didn't really look convinced, and the driver worked the strangely-patterned Saab gearshift into first, confiding that they had really only found the checkpoint by accident.

At the same time, at a point west of Stillwater and some ten miles away, entries had already started to trickle into the third checkpoint. Some of the more resourceful contestants had abandoned the search for the missing second checkpoint and had picked up the trail outside of Stillwater with the aid of clues on the instruction sheets. In all, ten cars found their way to the third checkpoint, but most incurred rather heavy time penalties in doing so.

The latter portion of the rally was orderly and straightforward compared to the instructional curveballs which marked the early stage of the course. All those who made it as far as checkpoint three finished the rally, although five of the entries did not finish. Indeed, the rally organizers are still unsure if these five ever returned.

And back at checkpoint two, things were getting very quiet again. One more straggler had ventured upon the location, and the farmers had given up on the immobile plow and returned to wherever farmers go when their plows don't work. A clapped-out dark blue pickup pulled up across the road. The markings identified it as being from the state prison near Stillwater, and the darkly-tanned man at the wheel was evidently a trustee. He chatted amiably for a few minutes, but declined an invitation to join the rally as a contestant, saying: "The guards even keep us trustees under pretty close scrutiny." "Close scrutiny" . . . good God, what was he in prison for? Perhaps he beat someone to death with his florid prose or something.

But as he drove off down the road toward the prison on that sunny late afternoon, he probably couldn't help wondering what would possess people on the outside to spend an entire free afternoon running around Washington County. And although some of the contestants might have been thinking along the same lines towards the end of the afternoon, another opportunity will come on another day, and they will probably be there. 

introducing . . .

WMMR campus radio

ON THE THIRD floor of Coffman Union is WMMR, the university's carrier current station. It broadcasts to most of the dorms from 7 a.m. to 9 a.m. and 4 p.m. to 3 a.m. on Monday thru Friday, and from 2 p.m. to 3 a.m. on Saturday and Sunday.

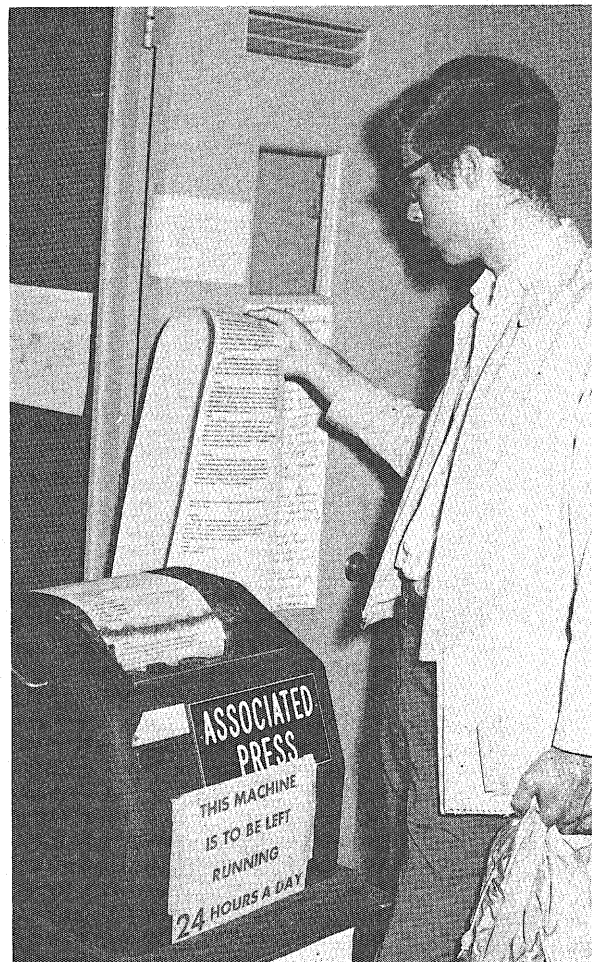
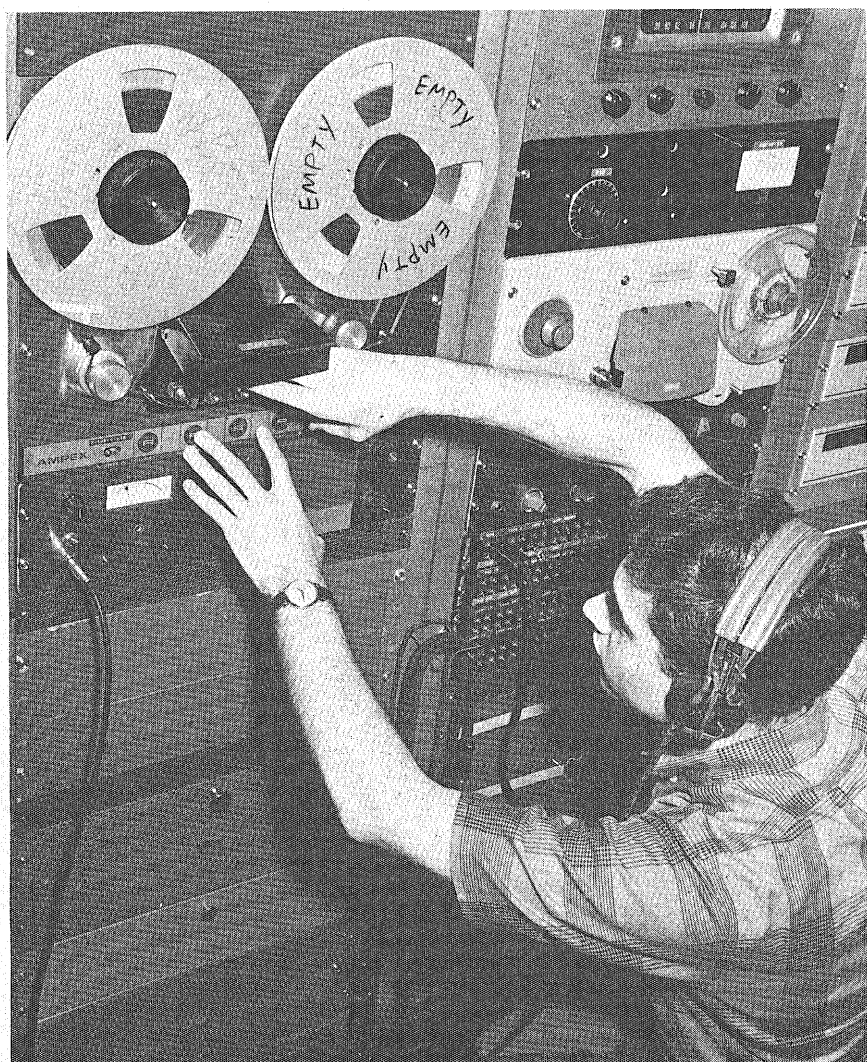
The station is staffed by 45 people, which includes students sent by the speech department. Others are there for their own interest or personal experience. During broadcasting there are usually only one or two people working at any time.

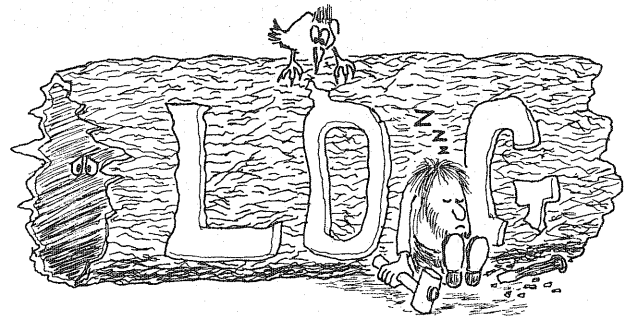
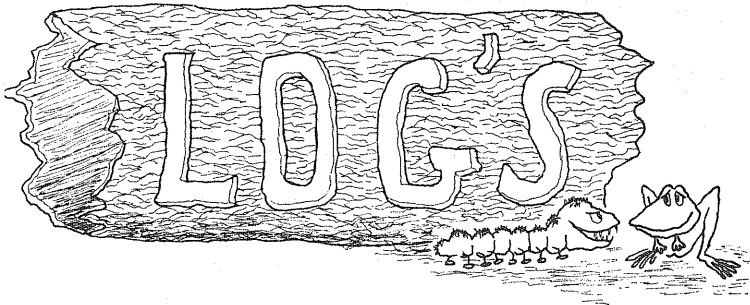
The main transmitter, located in Coffman's basement sends the feed signal by carrier current over coaxial cables. At Sanford, Comstock, Pioneer, Frontier, Territorial, and Centennial (the dorms that receive WMMR) the radio frequency signal is coupled to the AC electrical wiring which acts as the antenna. Since the signal strength can not exceed 15 microvolts per meter at 212 feet, only those in the immediate vicinity of the dorms can pick up the station.

Top right: The console of WMMR is no place to sleep, as any D. J. can tell you. Besides keeping the two turntables fed, he also must take care of any electrical fires which erupt.

Bottom left: WMMR also has tape facilities. Here the operator threads the tape from the 10½" reels through the Ampex deck.

Bottom right: All national and international news comes in via Associated Press teletype.





jai byrd

This is the product of a deranged mind. The editors wish to express that any opinions held here-in are solely those of a jai byrd.

No tipping please.

—the management

Well, this is the last edition of the **Technolog** for this year. I hope you enjoyed Log's Log, but even more I hope that some of you will turn up down here in the Log office next year to help make the Technolog an even better magazine that it has been this year. I can always use some help writing Log's Log and so can the rest of the staff.

back from the front

Ralph Groop

Ace War Correspondent

In the 1880's, the Indians decided that they had had enough of the White man's treaties. The White man had promised to respect the Indian's land rights as long as there were fish in the stream and birds in the sky. (The Whites thought they could kill off all the animals in short order and then take over the Indian's land.)

So, the Indians decided to have a Convention. As usual, there were the Hawks, the Doves, the Crows, the Blackfeet, etc. The leading figures in this meeting were Chief Psycho Horse, Chief Slinging Bull, and Geronimo.

The "authorities" decided that the Convention was an unlawful assembly and sent Colonel Cuss in with a "cease and desist" order.

After weeks of travel, Cuss arrived within a few miles of the Indian encampment. Realizing that incisive action was called for, Cuss took a page out of a book written by a famous Minnesota surgeon, **Mayo Thought**. He decided to use the pincer tactic. It was a pity that his force was already small and that the resultant division into two groups made the maneuver resemble more closely the Tweezer movement.

It has been said many times that the Indians massacred his forces. It has also been alleged that Colonel Cuss was the last to die. All of that is sentimental bunk!

The truth is that as the thousands of Indians rode down upon Cuss's men, Colonel Cuss's girdle rode up on him, collapsing his chest and killing him instantly.

the wizard of libido

Winthrop Hammer

Crime Reporter

I've seen a lot of con-men in my day, but these "religious kooks" take the cake. Every so often I find that another religious sect has popped up. This month's High-mucky-muck of sanctity calls himself, "The Wizard of Libido" (formerly known as the "Whistling Rapist").

With his female partner, Ophelia Rass, he has set up shop along Nicollet Avenue (near Lake Street) to bilk the disorganized, disoriented and the like. At 8:00 last Wednesday night, I took in his show.

As I walked in, I was accosted by an elderly gentleman (a wine-oh, actually).

"Got a dime for a prayer book?"

I gave him some money.

"Thank you, sir," he said, choking back a dollar bill.

I looked around for "the Wizard" just as the assembled crowd began their weird chants. They wound up with a few choruses of "We're off to see the Wizard." (The scene reminded me of my days as a pledge to πr^2 Fraternity.)

Just as Overland Express (for that was the Wizard's stage name) began his pitch, Ophelia spotted me and walked over to where I was standing in the back of the room.

"Bells, man," she said.

"Well, ring my chimes!" I replied.

"I haven't seen you since you beat Sam Spade in finding that valuable art treasure. What was it called again? The chocolate-covered bunny-rabbit?"

"The Malted-milk Falcon."

"Whatever . . . any way, so how's the reporting game?"

"About the same as the Charity-Religious game I suppose."

Then from the front of the room thundered, "Send me your tired, your poor, your huddled masses yearning to breathe free. Come forth, Soul Brothers, and be healed."

"Hate to run, Winthrop-baby, but that's my cue."

Quickly she got down on her hands and knees and began to crawl down the aisle toward the Wizard.

When she reached half-way down the aisle, the Wizard asked, "And what, my dear, is your problem?"

"For one thing, I haven't been able to walk thinth birth, but my real problem ith that I have a lithp."

"Come up here, Child."

As she crawled up the stairs to the platform, the crowd empathized with moans and comments like, "God, that mini-skirt rides high when she crawls."

Finally, Ophelia was before the Wizard. He put his hands upon her.

"Not in front of all these people, you clown," she whispered under her breath.

"Heal!" he screamed, "Heal!"

The crowd gasped in wonder as Ophelia sat down next to the Wizard's left side (as any good dog might).

"Heal!" yelled the Wizard.

Slowly Ophelia rose.

The crowd clapped and "Amen"ed.

"Not bad," she said, "but I still walk with a lithp."

A lot of the assembled people commented, "How can you follow an act like that?" and left. I was among them.

Going out the door I brushed past a tall, thin, deathly white fellow. His eyes were so deeply sunk that they looked like two holes in his skull. Come to think of it, his bones rattled as I brushed by him. There are always those who will not go to a doctor, but are always looking for that miracle cure.

official daily bull

May 25—Declared 4-F because of fallen arches; earthquake toppled building on top of you

May 30—(Memorial Day)—Make a wrong turn on the freeway and win Indianapolis 500.

June 2—Treat softly and carry a big crib sheet.

June 3—President Nixon pushes through lottery draft system. New era begins: You bet your life.

June 5—Blind date turns out to be pitted.

June 7—(Atlantic City)—Mr. America body-building contest won by a Dr. Frankenstein.

June 10—Happy Father's Day.

July 4—Elliot Ness raids fireworks bootleggers. Seven-year-old ringleader questioned about Mafia ties.

TOUGHNESS

One of the outstanding advantages of Malleable Iron Castings.

Toughness is the ability of a material to withstand impact or repeated loading.

Any material will fail. The key in Malleable is that it will not fail suddenly. Under severe impact, Malleable will bend or stretch before fracture occurs.

Malleable's impact strength is illustrated in this test by a truck manufacturer. To be absolutely sure

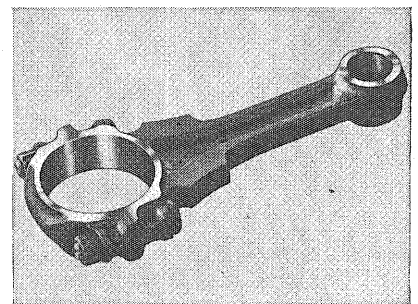


of the strength of many components in the cab, including the Malleable iron cab support hinges, the truck was crashed at high speed into a barricade of ice. Although the cab itself was battered beyond repair, there was no damage to the Malleable parts, proof of the outstanding impact resistance of this material.

Another facet of toughness is a material's ability to withstand repeated loads of low magnitude. Failures of this type are due to fatigue, and usually start with the appearance of a crack at the stressed area which progresses through the part until fracture occurs.

Fatigue strength is a major factor in design of automotive connecting rods. The loads on these parts alternate between tension and compression of varying magnitudes. In de-

signing a Pearlitic Malleable iron connecting rod, a thorough series of experiments was conducted which



demonstrated that the castings have fatigue properties which exceed the performance requirements of modern automobile engines.



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AUDITORIUMS AND ACOUSTICS

from the stage. For more money, the owners can have:

- a sound effect system (modern dance companies use tapes)
- a recording system
- a monitoring system that is visual and aural, so that backstage choruses and equipment operators can see what is happening on the podium or on stage
- a production communication system for cueing performers and production people
- an audience recall system
- systems for paging patrons and entertaining them during intermissions
- a motion picture sound system with speakers behind the screen
- a system to wire each seat for simultaneous translation that uses throw-away earphones
- a system for television and radio broadcast with options or closed circuit, tape, or outside transmission.

While feasibility studies and acoustic design are not the only services that BBN provides, they are the two services that contribute the most to the success of a cultural center.

Unfortunately, BBN is hired only to give advice. They can use advanced laboratory techniques to synthesize hall acoustic techniques and they can construct scale models to predict the acoustical qualities, but they cannot keep mistakes from being made. Leo J. Beranek, a senior and founding partner of the firm, said that they can see the political mistakes coming. "You're making the wrong non-acoustical decision," we can say. If they persist, the public and the musicians never know whether an acoustical or a non-acoustical mistake was responsible."

Those who direct the fate of performing arts centers and auditoriums across the country would do well to listen to the advice of the experts if they really desire to help the arts instead of building monuments that are functional failures. □

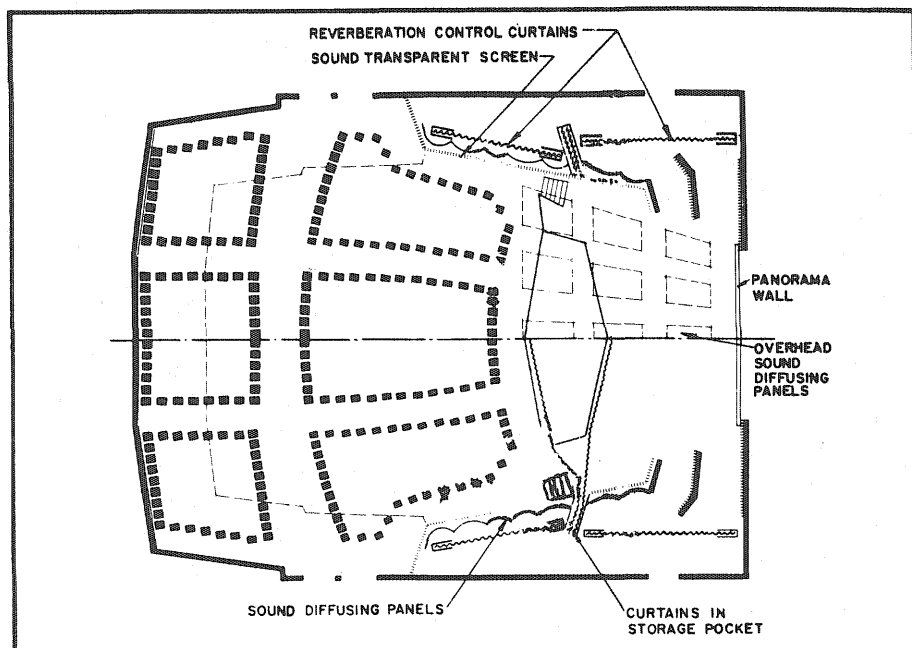


Figure 5. Plan of a multi-purpose, open-stage auditorium for a hypothetical campus showing partial height sound diffusing panels.

Macalester Concert Hall

ONE OF THE ACOUSTICALLY adjustable halls for which Bolt Beranek and Newman were the acoustical consultants is the Macalester College Concert Hall in the Janet Wallace Fine Arts Center.

The movable false ceiling or clouds of the concert hall is the chief element for changing the acoustics.

Twenty-four steel panels, shaped like shallow inverted pyramids, are hung from the real ceiling in three groups of eight panels each.

The movable acoustic ceiling covers the platform and most of the seating area. The 8 foot square panels are spaced 2 feet apart, and at their raised position hang 10 feet below the real

ceiling and in their lowered position are 12 feet above the platform, traveling 16 feet from bottom to top position. Each of the 3 groups of panels is separately controlled by a motor driven winch and may be put in a horizontal plane or stepped.

The side walls from the top of the balcony to the true ceiling are acous-

tically transparent loudspeaker grill cloth. Sixteen inches behind this cloth is the outside concrete wall, and between the wall and the cloth are heavy velvet draperies hung from near the true ceiling. These can be exposed to deaden sound or pulled behind plywood panels to increase reverberation.

On the near wall are 120 steel pyramids (8x8, 4x8, 4x4) pointed toward the platform which reflect and diffuse sound. Draperies cover these pyramids if reflection is not desired.

The first concert was a piano recital for which the hall should have fairly low reverberation. During rehearsals, it became obvious that if the artist set the clouds to suit his own tastes, the sound may not be acoustically correct for the audience, and settings recommended by an assistant from the house may not be suitable for the performer.


The performer must hear himself correctly to have rapport with the audience. The listeners want to hear him clearly, i.e. they want to hear every tone, and they want to hear him accurately, i.e. without acoustic emphasis.

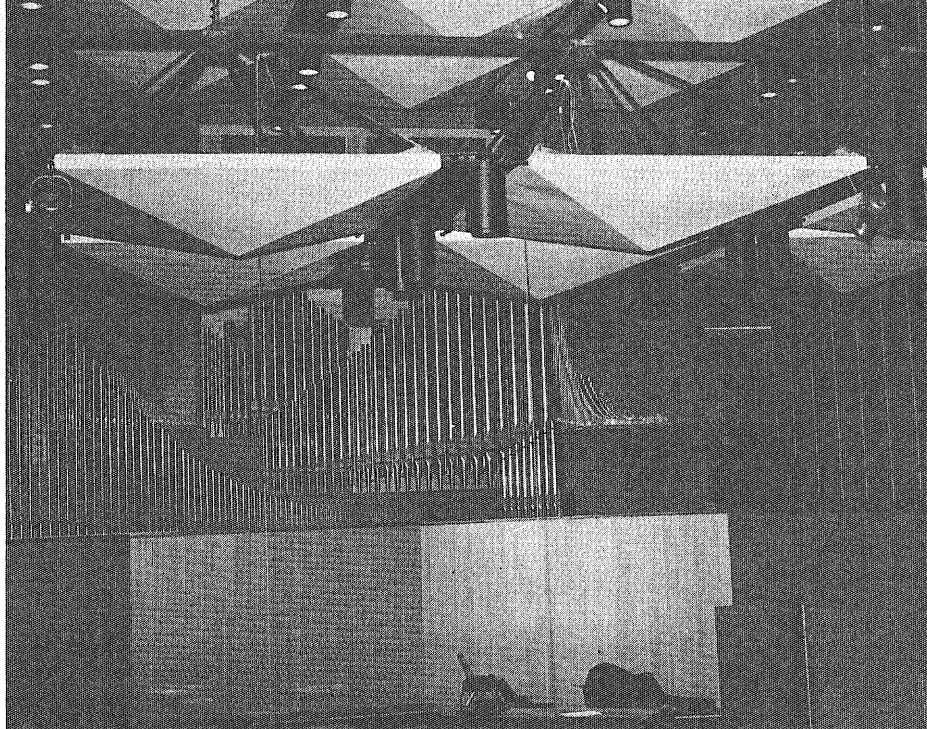
After testing the settings for several hours with perceptive friends, the performer selected the settings for the clouds. Cloud 1 was about half way down; cloud 2 was about $\frac{2}{3}$ of the way down, and cloud 3 about $\frac{1}{3}$ of the way down.

During the actual performance, it was noticed that the conditions brightened due to the presence of the audience which is more reflective than just the carpeting and the velvet seating.

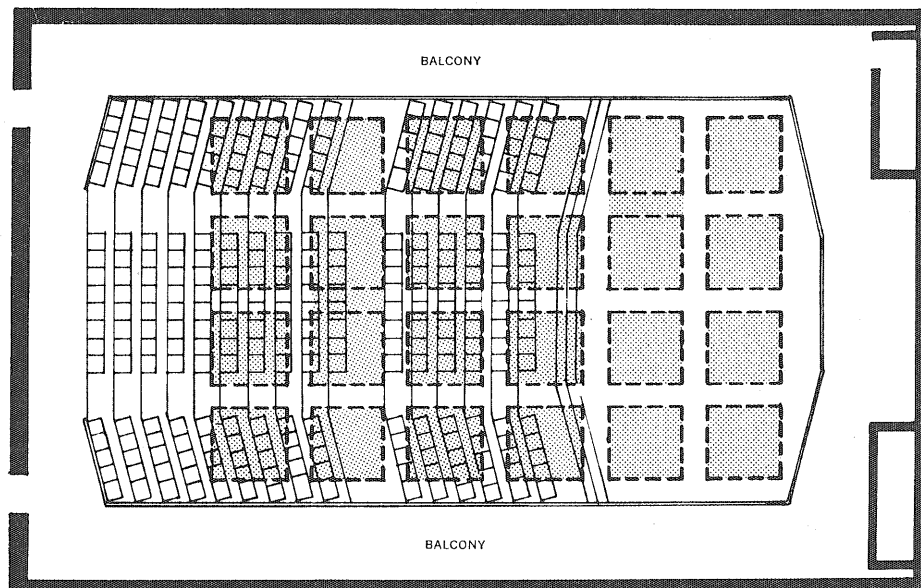
For chamber music, dryer conditions are desired and clouds 1 and 2 are brought almost all the way down while cloud 3 is about half way down.

For a large ensemble like the 150 voice Macalester Choir, the clouds are raised fully and the side draperies are all gathered behind the plywood panels. The sound is amazing, however page turning and casual comments from the singers must be done with care. One hundred fifty pages turning at the same time sounds like a rainstorm, and comment and other individual noises from the choir provides interesting and sometimes startling results.

With the clouds completely lowered and the draperies all exposed, normal conversational speech can be heard from the platform for all public lectures, classes, and meetings. Audience members, by raising their voice slightly can be easily understood. 

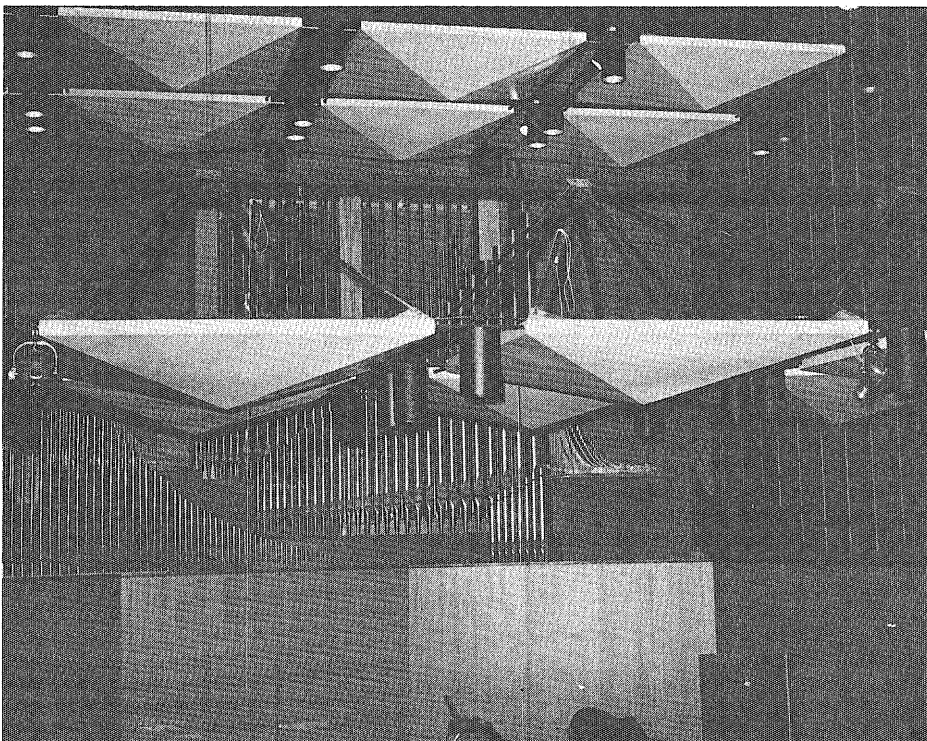


The interior of the hall with cloud 2 about $\frac{1}{2}$ down.



Reflected ceiling plan of clouds (shaded squares) is superimposed on floor plan of hall.

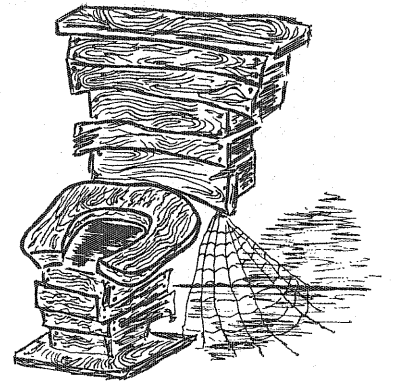
The interior of the hall with cloud 2 all the way down.



Splinters

by Pete Hovde

—vilitas et crudus semper eternam



Once upon a time (I/T) pretty little Polly Nominal was strolling across a field of vectors when she came to the edge of a singularly large matrix.

Now Polly was convergent and her mother had made it an absolute condition that she must never enter such an array without her brackets on. Polly, however, who had changed her variables that morning and was feeling particularly badly behaved, ignored this condition on the grounds that it was insufficient and made her way in amongst the complex elements.

Rows and columns enveloped her on all sides. Tangents approached her surface. She became tensor and tensor. Quite suddenly, three branches of a hyperbola touched her at a single point. She oscillated violently, lost all sense of directrix and went completely divergent. As she reached a turning point she triped over a square root which was protruding from the erf and plunged headlong down a steep gradient. When she was differentiated once more she found herself, apparently alone, in a non-euclidan space.

She was being watched however. That smooth operator, Curly Pi, was lurking inner product. As his eyes devoured her curvilinear coordinate, a singular expression crossed his face. Was she still convergent, he wondered. He decided to integrate improperly at once.

Hearing a vulgar fraction behind her, Polly turned round and saw Curly Pi approaching with his power series extrapolated. She could see at once, by his degenerate conic and his dissipative terms that he was bent on no good.

"Eureka," she gasped.

"Ho, ho," he said. "What a symmetric little polynomial you are. I can see you're bubbling over with secs."

"O Sir," she protested, "keep away from me. I haven't got my brackets on."

"Calm yourself, my dear," said our suave operator. "Your fears are purely imaginary."

"I, I," she thought, "perhaps he's homogeneous then."

"What order are you?" the brute demanded.

"Seventeen," replied Polly.

Curly leered. "I suppose you've never been operated on yet?" he asked.

"Of course not," Polly cried indignantly. "I'm absolutely convergent."

"Come, come," said Curly. "Let's off to a decimal place I know and I'll take you to the limit."

"Never," gasped Polly.

"Exchlf," he swore, using the vilest oath he knew. His patience was gone. Coshing her over the coefficient with a log until she was powerless, Curly removed her discontinuities. He stared at her significant places and began smoothing her points of inflexion. Poor Polly. All was up. She felt his hand tending to her asymptotic limit. Her convergence would soon be gone for ever.

There was no mercy, for Curly was a heavyside operator. He integrated by parts. He integrated by partial fractions. The complex beast even went all the way around and did a contour integration. What an indignity. To be multiply connected on her first integration. Curly went on operating until he was absolutely and completely orthogonal.

When Polly got home that evening, her mother noticed that she had been truncated in several places. But it was too late to differentiate now. As the months went by, Polly increased monotonically. Finally she generated a small but pathological function which left surds all over the place until she was driven to distraction.

The moral of our sad story is this. If you want to keep your expression convergent, never allow them a single degree of freedom.

NEWS FLASH: The Engineering Library was forced to close yesterday. It seems that someone stole the book.

• • •

Prof. Nuckolls received the "Purple Shaft Award" from the M.E. students. This should make all you other M.E. instructors try a little harder.

* * *

Two men sat at the club and the one said, "Say, how is that gorgeous secretary of yours?"

"Oh, I had to fire her."

"Fire her! How come?"

"Well, it all started a week ago last Thursday on my 38th birthday. I've never been so depressed."

"What has that got to do with it?"

"Well, I came down for breakfast and my wife never mentioned my birthday. A few minutes later, the kids came down and I was sure they would wish me a happy birthday, but not one word. As I said, I was most depressed, but when I arrived at the office, my secretary greeted me with 'Happy Birthday,' and I was glad that someone remembered.

"At noontime, she suggested that it was a beautiful day and that she would like to take me to lunch at a nice intimate place in the country. Well, it was nice and we enjoyed our lunch and a couple of martinis. On the way back she said it was much too nice a day to return to the office and suggested that I go to her apartment, where she would give me another martini. That also appealed to me and, after a drink and a cigarette, she asked to be excused while she went into the bedroom to change into something more comfortable.

"A few minutes later, the bedroom door opened and out came my secretary, my wife and the two kids with a birthday cake, singing 'Happy Birthday,' and there I sat with nothing on but my socks."

Groom: So you didn't realize I wore elevator shoes and a toupee.

Bride: No, but don't worry, I have a couple of surprises for you, too.

* * *

Sign in the cloakroom of the Cathedral above a row of hooks: "For faculty members only." Underneath it someone has added: "May also be used for hats and coats."

* * *

It's hard to keep a good girl down but lots of fun trying.

* * *

Civil: "I failed my physics exam."

M.E.: "But I thought you had all the answers written on your cuff."

Civil: "I did but I put on my calculus shirt by mistake."

* * *

After shaving (or "working over") the big fellow on the chair, the barber asked, "Now sir, would you like me to wrap your face up in a warm towel?"

The young man answered, "No, that's fine. I'll carry it under my arm."

* * *

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Judge: "Did you say this man stole your money out of your stocking?"

Girl: "Yes your honor."

Judge: "Well why didn't you put up a fight?"

Girl: "I didn't know he was after my money!"



A guest professor was coming to the university to speak to three branches of engineering and discuss their fields in relation to some form of production. The first group were mechanical engineers and as the professor entered the room he immediately said good morning. The students promptly responded by saying good morning, whereupon the professor gave his talk. The chemical engineers were next and the procedure was much the same as before. When the professor entered he said good morning and the students immediately replied with a good morning. However, when the industrial engineers turn came and the professor said good morning wouldn't you know that they all wrote it down.



HOW
DOES
AN

ENGINEER BLOCK PROGRESS?

By being narrow; by not broadening his outlook; by not considering alternatives to every problem; by being too content with the way things are; and most important, by staying in an environment that does not take part in and actively contribute to progress.

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Annoyed by the professor of anatomy who told racy stories during class, a group of coeds decided that the next time he started to tell one they would all rise and leave the room in protest. The professor, however, got wind of their scheme just before class the following day.

Half way through the lecture, he began, "They say there is quite a shortage of prostitutes in France." The girls looked at one another, arose, and started for the door. "Young ladies," said the professor with a broad smile, "the next plane doesn't leave until tomorrow afternoon."

Sign in a pharmacy window: For the Girl who has everything—Penicillin.

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Math professor: "Give me an example of an imaginary spheroid."

M.E.: "A rooster's egg."

A friend of ours got a telegram lately which certainly gave him a thrill. The message read:

"Married Bessie yesterday in Miami. Going to Tampa with her tonight."

Art Student: "Perhaps you, too, are a lover of nature. Have you seen the rosy-fingered dawn spreading across the eastern sky, the red-stained sulphurous islets floating in the ladle of fire in the west, ragged clouds at midnight blotting out the shuddering moon?"

M.E.: "Nope, not lately. Been on the wagon for more than a year."

Stokley's Theory of Integration:

$I > > U$

(I is much greater than you.)

I.E. Professor: "Young man, why aren't you taking notes?"

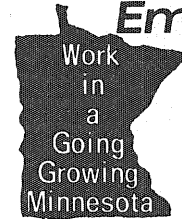
Student: "I don't need to. I've got my father's."

A pharmacist found it necessary to leave his drugstore one day. He asked the soda clerk to keep an eye on things until he returned. No sooner had the pharmacist left than in staggered a lushed up character demanding in a loud voice some medicine to cure his hiccups. The druggist returned and asked if there were any customers, and the soda clerk replied: "Only one, a drunk with a bad case of hiccups." "Well," asked the druggist, "Did you tell him to come back when I was here?" "Oh, no," answered the kid soda jerk. "I took care of it myself. I mixed him a cup of epsom salts, with Citrate of Magnesia, Castor Oil and Mineral Oil, than I gave him some Exlax to nibble on. He took it right then." "Great Scott," said the druggist, turning pale, "that mixture won't stop the hiccups." The soda jerk smiled, "Want to bet? Take a look outside. There he is holding on to that lamppost; he doesn't dare hiccup."

A closed mouth gathers no feet.

We've just heard about the girl who was picked up so often that she began to grow handles.

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indefinitely.

This breakthrough makes possible the storage of vast supplies of blood so that even the rarest and most desperately needed types need never again be in short supply.

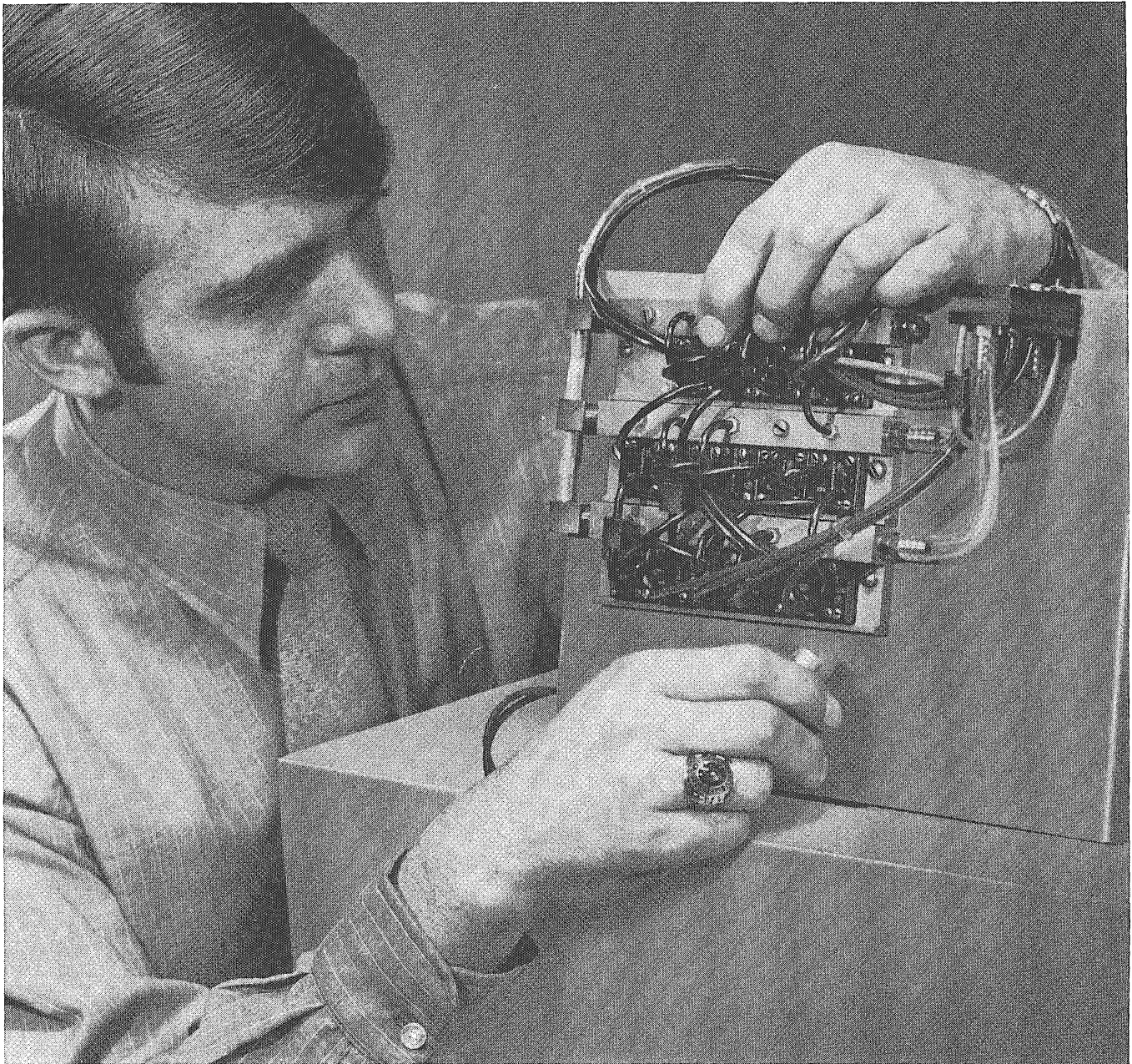
Union Carbide helped perfect the equipment and procedures for blood preservation by cryogenics. We've also developed many other uses for this new science. But none is more rewarding than keeping blood in readiness for today's needs. Or perhaps those of a century from now.



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Fluidics is one of many fledgling technologies General Electric people are pursuing to improve man's life in and beyond the 70's. If you'd like to know more about fluidics or another area of technology, write and tell us of your interests. General Electric Company, Dept. 801R, 570 Lexington Avenue, New York, N. Y. 10022.

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