Cryogenics

Spring 1968

Charles R. Royer
To solve America’s man-sized traffic jams, Westinghouse needs man-sized minds.

We have already built the first completely automated experimental transit expressway in Pittsburgh... been awarded contracts for the propulsion and control system for the 160-mph New York-to-Washington train... and a completely automated control system for San Francisco’s Bay Area Rapid Transit System.

Transportation is just one of many areas at Westinghouse that needs your talents, your capabilities, your interests. Talk to the Westinghouse recruiter when he visits your campus. Or write Luke Noggle, Westinghouse Education Center, Pittsburgh, Pennsylvania 15221.

An equal opportunity employer

You can be sure if it’s Westinghouse
Like Captain.


And you are there.

Some students really jam in every bit of opportunity they can grab hold of. Some just drift through.

Which are you?

Here's a good tip: If you join the Air Force ROTC program on your campus you'll know you're grabbing a big opportunity. Financial assistance is available. You'll graduate as an officer—a leader on the Aerospace Team. You have executive responsibility right where it's happening. Where the space-age breakthroughs are. You'll be able to specialize in the forefront of modern science and technology—anything from missile electronics to avionics. You can also be a pilot. You won't get lost in some obscure job with no future.

You'll also enjoy promotions and travel.

So graduate with our blessings.

And a commission.

---

**SLENDER-BODY THEORY**

ALL THREE WINGS

<table>
<thead>
<tr>
<th>$C_{Mq} + C_{M_3}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>-2.0</td>
</tr>
<tr>
<td>-1.5</td>
</tr>
<tr>
<td>-1.0</td>
</tr>
<tr>
<td>-0.5</td>
</tr>
<tr>
<td>0.0</td>
</tr>
</tbody>
</table>

0.5

0.04, 0.08

UNITED STATES AIR FORCE

ROTC (A.U.) BLDG. 500 (ART01)

Maxwell AFB, Alabama 36112

Interested in Flying □ Yes □ No

<table>
<thead>
<tr>
<th>NAME</th>
<th>AGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COLLEGE</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MAJOR SUBJECTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CAREER INTERESTS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>HOME ADDRESS</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CITY</th>
<th>STATE</th>
<th>ZIP</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Those inclined to political issues should find David Lawrence's guest editorial on page 10 provocative.

Courtesy of H. J. Minkus of Stewart-Warner, the Technic presents an analysis of plate-fin exchangers under cryogenic conditions.

Any Rose student who wants to find out what Rose stands for should enjoy the faculty statement on Rose education on page 14.

On page 18 Tony Tietz questions the need of mandatory R.O.T.C. in light of the aims of Rose education.

Draft conscious seniors can find some consolation in the A.S.C.E.'s letter to President Johnson regarding the new draft policy.

COVER NOTE: This month's cover expresses one of the extremely unusual phenomena which occurs in Cryogenic Science. Liquid helium when left in a flask will creep up the sides and flow over . . . "defying gravitation." The phenomena is a result of the "superfluid" characteristics of liquid helium.
Guest Editorial .............................................. David Lawrence
Cryogenics and the Plate-Fin Exchange .................. H. J. Minkus
The Rose Philosophy ...................................... Faculty Report
Rose Education & Mandatory R.O.T.C. ................... Tony Tietz
Dear Mr. President ....................................... William H. Wisely

* * * * *

Editorial
DG's at Rose
Sly Droolings

Printed by Moore-Langen Printing and Publishing Co.
140 North Sixth Street, Terre Haute, Ind.

Published Quarterly in Fall, Winter, Spring, Summer, by the Students of Rose Polytechnic Institute. Subscriptions obtainable by a $3.00 donation to the Student Activities Fund of Rose Polytechnic Institute. Address all communications to the ROSE TECHNIC, Rose Polytechnic Institute, Terre Haute, Indiana 47803.

Second Class Postage Paid at Terre Haute, Indiana. Acceptance for mailing at special rate of postage provided for in section 1103, Act of October 3, 1917, authorized December 13, 1918. This magazine does not necessarily agree with the opinions expressed by its contributors.
How Western Electric gets uplift from a downdraft

Picking something up by blowing a stream of air down on it may seem rather roundabout. But if you want to pick that something up without touching it, it turns out to be a most successful way.

The something in question is a paper-thin, eggshell-fragile slice of silicon destined for transistors. To touch it is likely to contaminate it, and probably to break it. Tweezers are extremely risky. Even a vacuum pickup is dangerous.

And so the engineers at Western Electric's Engineering Research Center invoked the Bernoulli principle and solved the problem. They developed a pickup device that directs a thin stream of air down onto the slice. The air flows out across the slice and since it is moving and the air below the slice is not, the pressure below is greater than the pressure above and the slice floats. And it doesn’t touch the head because the air is, after all, blowing down. Wire guides keep the slice from slipping off.

So now the workers in our transistor plants can pick up silicon slices handily, without worrying about breaking or contaminating them. That our engineers reached back to a classical principle of physics to help them do it only shows the extent of the ingenuity Western Electric applies in its job of manufacturing communications equipment for the Bell System.
Depends on the giant. Actually, some giants are just regular kinds of guys. Except bigger.
And that can be an advantage.
How? Well, take Ford Motor Company. We're a giant in an exciting and vital business. We tackle big problems. Needing big solutions. Better ideas. And that's where you come in. Because it all adds up to a real opportunity for young engineering graduates like yourself at Ford Motor Company.
Come to work for us and you'll be a member of a select College Graduate Program. As a member of this program, you won't be just another "trainee" playing around with "make work" assignments.
You'll handle important projects that you'll frequently follow from concept to production. Projects vital to Ford. And you'll bear a heavy degree of responsibility for their success.
You may handle as many as 3 different assignments in your first two years. Tackle diverse problems. Like figuring how high a lobe on a cam should be in order to yield a certain compression ratio. How to stop cab vibration in semi-trailer trucks. How to control exhaust emission.
Soon you'll start thinking like a giant. You'll grow bigger because you've got more going for you,

A network of computers to put confusing facts and figures into perspective.
Complete testing facilities to prove out better ideas.
And at Ford Motor Company, your better ideas won't get axed because of a lack of funds. (A giant doesn't carry a midget's wallet, you know.)
Special programs. Diverse meaningful assignments. Full responsibility. The opportunity to follow through. The best facilities. The funds to do a job right. No wonder 87% of the engineers who start with Ford are here 10 years later.
If you're an engineer with better ideas, and you'd like to do your engineering with the top men in the field, see the man from Ford when he visits your campus. Or send your resume to Ford Motor Company, College Recruiting Department.
You and Ford can grow bigger together.

What's it like to engineer for a giant?

Rather enlarging!
HIGH SCHOOL GRADUATES OF 1968

You are cordially invited to visit Rose Polytechnic Institute where you can earn a degree in:

BIOENGINEERING
CHEMICAL ENGINEERING
CHEMISTRY
CIVIL ENGINEERING
ELECTRICAL ENGINEERING
MATHEMATICS
MECHANICAL ENGINEERING
PHYSICS
In the next few years, Du Pont engineers and scientists will be working on new ideas and products to improve man’s diet, housing, clothing and shoes; reduce the toll of viral diseases; make light without heat; enhance X-ray diagnosis; control insect plagues; repair human hearts or kidneys; turn oceans into drinking water...

and anything else that you might think of.

The 165-year history of Du Pont is a history of its people’s ideas—ideas evolved, focused, and engineered into new processes, products and plants. The future will be the same. It all depends upon you.

You’re an individual from the first day. There is no formal training period. You enter professional work immediately. Your personal development is stimulated by real problems and by opportunities to continue your academic studies under a tuition refund program.

You’ll be in a small group, where individual contributions are swiftly recognized and rewarded. We promote from within.

You will do significant work, in an exciting technical environment, with the best men in their fields, and with every necessary facility.

Sign up today for an interview with the Du Pont recruiter. Or mail the coupon for more information about career opportunities. These opportunities lie both in technical fields—Ch.E., M.E., E.E., I.E., Chemistry, Physics and related disciplines—as well as in Business Administration, Accounting and associated functions.
EDITORIAL

To Our Readers...

When a racing team places an entry in a race, they refrain from entering a Formula II machine in a Formula I race. I feel that the Technic has been analogous to a racing car entered in the wrong type of race. In the past, the Technic has been a combination of Popular Mechanics, Scientific American and a Mickey Mouse comic book. Few, if any students, bothered to read, much less comprehend, the technical articles. Most students merely paged to the center of the magazine to gaze upon the physical attributes of the Miss Technic or chuckle over the jokes in the rear of the magazine.

Realizing that these two aforesaid items are an integral segment of the magazine, I feel that the Technic could and should be much more. It should be the voice of the important and far-reaching aspects affecting our lives as engineering students at Rose. It should be the springboard from which controversial and current opinions could be expressed openly and equally by both student and professor.

Many times I have heard both faculty member and student lament that “Something should be done but it’s useless even trying”. Remember, creating and destroying matter and pushing on a rope are about the only impossible things in the universe.

Therefore, I put a challenge to the members of the Rose community. See if you can make the impossible a reality by using this magazine to solicit the most powerful force in the world—public opinion. Write letters to the editor or articles and, even though the staff and myself are in disaccord with your opinion, we will gladly reprint them. Changes are requisite at Rose, maybe we can get the ball rolling.

D. J. R.
How good are you on the turns?

A strong stroke isn’t enough to win in freestyle swimming. Experts say: “Watch the turns.”

“A champion won’t touch with his hand,” they tell us. “He begins his overhead tumble with a downward stab of his right arm, twists as his feet hit, then explodes forward with a powerful pushoff.”

Their conclusion: “Experience and smart coaching develop a championship turn.”

We believe it. That’s why we’ve put together the most experienced and best-coached team of bearing and steel engineers in the world. To make doubly sure that Timken bearings give our customers a perfect turn.

If you’re up to facing the challenges of modern industry, if you’ve got the initiative, ingenuity and training to thrive on tough problems, join the team.

Write The Timken Roller Bearing Company, Canton, Ohio 44706.
Tell our Manager of College Relations that you’d like to talk it over.
THE CURSE OF DEFEATISM

By DAVID LAWRENCE

Reprinted from U. S. News & World Report

What the American people are reading today in their newspapers or hearing on radio and television is that the war in Vietnam cannot be won, that the American and allied forces are being checkmated, and that many members of Congress, sharing the view of the "demonstrators," want the United States to pull down the flag and surrender.

Again and again in the last half-century, the advocates of a doctrine of "peace at any price" have created situations which have brought on a major war.

Apparently we have not learned the lessons of history. It seems incredible that any member of Congress would desert the Commander-in-Chief and advocate a policy that is tantamount to a surrender. Yet several members have openly called for retreat and withdrawal from Vietnam.

At the recent hearings held by the Senate Foreign Relations Committee, one Senator told Secretary of State Rusk, in effect, that a nation which cannot defend itself does not have a right to exist and that there is no obligation upon any other nation to come to its rescue. Another member of the Committee insisted that, before the President makes any important decisions of a military nature, he must consult Congress. Divided authority when a war is in progress is self-defeating.

What is the natural reaction of the enemy when its major opponent becomes irresolute, wobbly and vacillating? What is the effect on the spirit of the troops at the battle front when they are told over the radio that they are not being supported at home?

The United States stands at the crossroads. Will it honor its pledges, or forsake them? In treaty after treaty covering commitments in Europe, Asia and Latin America, the United States has promised to come to the aid of countries which are the victims of aggression. The Charter of the United Nations itself provides for collective action by its members. But, except for the policies of the United States and some Asian nations, the concept of collective defense against aggression has not been effectively supported. Indeed, many countries have assumed they are immune from a Communist takeover. Yet if we fail in the Vietnam war, this can only open the way for the Communists to infiltrate and subvert the governments of small nations.

The right of self-determination cannot be ignored without serious consequences to the strong as well as the weak. The United States has not had in the Vietnam war the help it deserved from other nations. There are many countries which are wavering because they do not know whether the United States intends to go through with its commitments or will in a moment of expediency abandon them.

Moscow was doubtless pleased to read that one member of the Senate Foreign Relations Committee actually charged the United States with having been the aggressor in Vietnam. Also, the Chairman of the Committee declared in the presence of the Secretary of State that the resolution adopted by Congress in 1964, authorizing the use of our armed forces thereafter in Southeast Asia, was really based upon false information given to the Senate by the executive departments.

What is surprising is the amount of defeatism in America today. There was a time when patriotism was an overriding influence. It restrained American from openly giving aid and comfort to the enemy. But nowadays defeatism prevails in Congress itself, some of whose members think this is the best way to please the voters in an election year.

Despite the dignified and convincing way in which the Secretary of State presented the American case to the Senate Foreign Relations Committee, as he gave evidence that the United States was not an aggressor, criticism of the American position in the Vietnam war continues. We still hear demands for withdrawal and virtual surrender. These are couched in ambiguous phrases, but can lead the enemy to conclude that the United States doesn't possess the will to fight on and will settle at almost any price in Vietnam.

We are confronted today with a spirit of defeatism not unlike that which prevailed 30 years ago. At the Munich Conference in 1938 the Western powers tried to appease Hitler by acquiescing in the Nazi occupation of more territory. He thereupon took it for granted that he could enlarge his aggression. This miscalculation led 12 months later to World War II.

Winston Churchill, in a book written after the war ended, spoke in unequivocal language against appeasement and defeatism. He wrote that if a nation will not fight when victory will not be too costly, "you may come to the moment when you will have to fight with all the odds against you and only a precarious chance of survival." He added:

"There may even be a worse case. You may have to fight when there is no hope of victory, because it is better to perish than live as slaves."

Will our curse of defeatism encourage the Communists to challenge us and bring on World War III?
A unique combination of capabilities

UNIQUE... Because Allis-Chalmers serves so many industries in so many vital ways. No other manufacturer researches, develops, builds, markets, installs and services as many products and processes for as many specialized needs as does Allis-Chalmers. Our unique combination of capabilities serves all major industries including agriculture, electric utility, mining, metals, construction, cement, chemical, pulp and paper, food, material handling, general industry and aerospace.

WHAT DOES THIS MEAN TO YOU?... Simply this: If you want to work for a company with a broadly diversified range of engineering opportunities... with an on-the-job growth program... with an opportunity to continue your education through a liberal tuition refund program... with industry's most flexible training program, send for a copy of our latest career booklet. Expect a prompt reply.

WRITE: COLLEGE RELATIONS, ALLIS-CHALMERS, MILWAUKEE, WISCONSIN, 53201

ALLIS-CHALMERS
AN EQUAL OPPORTUNITY EMPLOYER
CRYOGENICS AND THE PLATE-FIN EXCHANGER
By H. J. MIKUS

Have you ever taken a moment to reflect on the word reliability? Webster defines this as trustworthiness, as dependability, or as a measure of confidence but, however it is defined, reliability as something that everyone of us looks for every day of our lives.

Reliability influences our choice of automobiles, of doctors and of major appliances for our homes. Reliability is the basis of hundreds of decisions we must make in widely diverse areas, ranging from finance to furniture, or from medicine to machinery.

It's no wonder then, that reliability is the word used to sum up the prime considerations of an operating plant and its component equipment as well, with particular emphasis in the critical heat exchange areas of low temperature processes. This word, reliability, certainly has a special meaning to each of us.

With this in mind, choice of a material of construction for Plate-Fin, Extended Surface Heat Exchangers designed to operate in the cryogenic range was given particular consideration. These exchangers are fabricated exclusively of aluminum primarily because of its physical properties, such as ductility and tensile strength, which actually improve with decreasing temperatures. Depending upon the alloy, improvements of from 20% to 50% in these properties at cryogenic operating temperatures have been realized. The 5 to 1 safety factor incorporated into the exchanger designs at ambient temperatures is also improved accordingly.

In addition, the comparative light weight and high thermal conductivity of aluminum contributes greatly to unit compactness. This same compactness of heat transfer surface in a plate-fin heat exchanger is further compounded by the unit's flexibility in multi-streaming. By multi-streaming, it is meant that the Brazed Aluminum Heat Exchanger can accommodate up to seven (7) different fluids simultaneously in heat exchange as compared to the two (2) fluids normally handled simultaneously by the more conventional, shell and tube type units. One Plate-Fin Heat Exchanger having four (4) streams could perform the same duty as would require three conventional two-stream, shell and tube exchangers. Economically, there are savings to be realized in eliminating multiple shells plus associated valves, supports and interconnecting piping. Further reduction of initial cost comes in the obvious savings of installation space or coldbox size. Less obvious, is another important feature of the plate—that is, depending on the choice of fin, up to 600 square feet of heat transfer surface can be put into one cubic foot of exchanger volume. This is more than ten times the heat transfer surface area per cubic foot of exchanger volume than that obtainable with shell and tube construction, so you can readily understand this third major advantage of a brazed aluminum heat exchanger.

To summarize, those three important advantages to remember are: first—high surface to weight ratio (another way of saying light weight); second—multi-streaming capability; and third—compactness. In addition, the high effectiveness that can be achieved with these exchangers, (offering temperature approaches as close as one ° Kelvin), reduces refrigeration horsepower in cryogenic service to a minimum.

But to return to our original theme of reliability, what makes the brazed aluminum heat exchanger so reliable in operation? To be sure, the answer is that it is built in strict accordance with section VIII of the ASME code for unfired pressure vessels, although our concern starts long before the final code stamp goes on the unit. In fact, our concern begins when the raw material, aluminum sheets, bars, plate, and coil stock, is checked in at the receiving inspection department.

The plate-fin heat exchanger as the name implies, is made up of heat exchange surfaces obtained by stacking alternate layers of corrugated, die-formed aluminum sheets (termed fins) between flat aluminum "separator" plates which can vary (Continued on page 30)

H. J. Mikus is the Sales Manager of the Industrial Products Division of Stewart-Warner Corporation in Indianapolis, Indiana. This report was presented at the Natural Gas Processors Association 46th Annual Convention in Houston, Texas on March 15, 1967.
There's new muscle in roadbuilding!

**Full-Depth Deep-Strength Asphalt pavements**

14 advantages of structurally designed Full-Depth Asphalt pavements...

1. Lower stress on subgrade.
2. Reduce total pavement structure thickness.
3. Make many lower quality aggregates usable.
4. Are frost resistant and do not lose strength during the critical spring-thaw period.
5. Protect subgrade from rain during construction, reduce construction delays due to bad weather.
6. Permit haul traffic on base without damage.
7. Prevent water accumulation in pavement courses, minimize need for costly subsurface drainage.
8. Permit large reduction of granular material customarily used in shoulder and base construction.
9. Improve surface riding qualities.
10. Provide for stage construction.
11. Aid uniformity of compaction.
12. Can be built faster and easier than any other pavement type.
13. Are more economical to build and to maintain.
14. Provide a safer driving surface.

FULL-DEPTH Asphalt pavement is an asphalt pavement in which asphalt mixtures are employed for all courses above the subgrade or improved subgrade. FULL-DEPTH Asphalt pavement is laid directly on the prepared subgrade. TA—a mathematical symbol used in The Asphalt Institute structural design formula to denote FULL-DEPTH.

**The Asphalt Institute**
College Park, Maryland 20740

---

Cross-section of Full-Depth TA Deep-Strength Asphalt pavement
THE ROSE PHILOSOPHY

The Pursuit of Excellence
In Engineering and Science Education

By a Faculty Committee

Editor's Note:
It seems that we, the students, should be cognizant of the philosophy affecting our lives at Rose.

The famous Socratic admonition, "Know thyself," applies to institutions as well as to individuals, and it is fitting that from time to time an educational enterprise re-examine its philosophy, taking stock of its heritage from the past and its position in the present in order to find substantial guidelines for its role in the future. This statement is the product of such an examination. Its purpose is to set out briefly and in language as concrete as possible:

1) The fundamental purpose of this educational institution.
2) The special means by which the goals defined by that purpose are achieved.
3) The special qualities of the Institute that make achievement of those goals possible.

The tradition of pragmatism in American education provides ample justification for the school that defines its educational purpose in terms of career preparation. It must be clear, however, that such a definition should not be construed too narrowly. Hence two important qualifications must be placed on it.

First, while the four-year Rose curriculum lays emphasis on education for the scientific and engineering professions, it also provides a broad and valuable analytical background for those graduates who choose to pursue careers in such fields as economics, business, the social sciences, biology, medicine, and law. As a graduate, the Rose student is prepared equally well to pursue immediately a productive professional career or to continue his studies in graduate school.

Second, Rose defines its program as a "liberal education in science and engineering." This means that sound preparation in scientific and engineering principles is set within the context of a study of the cultural and humanitarian dimensions of our society and of the Western and Non-Western traditions. Rose is concerned with graduating scientists and engineers who are technically and creatively competent. Rose is also concerned with developing in its students an awareness of the roles of engineering and science in solving social problems.

Doubtless there are many ways in which the goal of career preparation might be achieved, but at least four can be singled out for special attention.

First, Rose provides the student with the basic knowledge and fundamental principles on which science and engineering are founded. In addition to providing this sound theoretical base, we constantly stress the utility of these principles, including their practical application to real problems.

Second, Rose encourages the student to be a critical thinker, and places great emphasis on this aspect of his education. Innovative curiosity, scientific problem-solving ability, disciplined habits of mind—all are vital to the student's clear thinking and to his zest for learning.

Third, Rose encourages the student to recognize and fully exploit his potential, as well as to evaluate his abilities realistically. While many students survive in college by exerting only a fraction of their capabilities, Rose strives to motivate an increasing number to full achievement. At the same time, every student is encouraged to develop a spirit of healthy realism about himself and his abilities, including an awareness that humility can be very humanizing.

Finally, Rose provides the student with the elements of a liberal education. The responsibilities of an engineering and science school to acquaint the student with the great traditions of Western civilization, indeed of the world, are squarely met by a strong Humanities & Social Sciences program. By this means the student is introduced and made sympathetic to the large social and philosophical issues with which he must necessarily be concerned, both personally and professionally.

We intend to state here those special qualities that identify Rose Polytechnic Institute and that make the fulfillment of its educational purpose possible. Of the many distinguishing characteristics that might be mentioned, five seem most important.

First, Rose maintains significant standards. Academic admission requirements are high but realistic, with the result that the student who is admitted should be capable of completing the program and earning his degree. The Rose tradition has always included an insistence on performance, measured in terms of intellectual achievement. We are devoted to solid academic work (Continued on page 38)
School was out and no one had to call you... you were up at dawn. So many things to do—get out and work on the bike, find the rest of the gang and take off to explore your own private universe.

The universe is bigger now, you think ahead instead of back. At Teletype we’re thinking ahead too. As a part of the Bell System and one of the world’s largest message and data communications equipment manufacturers we have to. Maybe you’d like to join in—we need inventive young minds in our engineering group to help make our future as great as our past. You can find a future as bright as those memories at Teletype. Contact your Bell System recruiter when he visits your campus, or write to:

REMEMBER WHEN?

as those memories at Teletype. Contact your Bell System recruiter when he visits your campus, or write to:

TELETYPE CORPORATION
College Relations Department A48
© 5555 W. Touhy Avenue • Skokie, Illinois 60076

An Equal Opportunity Employer
"What I like about IBM is the autonomy. I run my department pretty much as though it were my own business."

"Tell some people you work for a big company, and right away they picture rows of gray steel desks with everybody wearing identical neckties.

"Well, that's the stereotype. When you look at the reality, things are a lot different. (This is Gene Hodge, B.S.E.E., an IBM Manager in Development Engineering.)

"IBM has over 300 locations. They believe in decentralization, and they delegate the authority to go with it. To me, it's more like a lot of little companies than one big one.

"Take my own situation, for example. I act as a kind of entrepreneur for my department. I decide if we should bid on certain government contracts for my group and then develop the proposal strategy. Of course, upper management reviews my decisions, but to a great extent I run my own show.

"Another thing that makes this like a small company is the close relationship with your boss. You're almost always hired by the manager you're going to report to. And you work for him on your own or in a small team. It's part of his job to know your long term goals and help you reach them.

"This same interest in the individual also shows up in IBM's educational programs. I'm getting my Master's now, and IBM's paying the entire cost, and some of the class time is on company time."

Gene's comments cover only a small part of the IBM story. For more facts, visit your campus placement office. Or send an outline of your career interests and educational background to I. C. Pfeiffer, IBM Corp., Dept. E, 100 S. Wacker Dr., Chicago, Illinois 60606. We're an equal opportunity employer.
There is a growing need for nonferrous metals.  
To grow with it, contact Anaconda.

Robert Lindsay (BSME, U. of Kansas ’64) is quality control supervisor of Anaconda Aluminum Company’s plant in Louisville, Ky.

Joel Kocen (BS Commerce, Wash. & Lee ’59; LLB, Wash. & Lee ’61) left, is senior tax analyst at New York headquarters of Anaconda.

David Madalozzo (BSEE, Bradley ’61) is plant engineer of the new Anaconda Wire and Cable Company mill in Tarboro, N.C.

Robert Zwelinzki (BSME, Rutgers ’57) is chief mechanical engineer with Anaconda Wire and Cable Company, New York.

Alvin Cassidy (BA Econ., Bellarmine ’54; MBA, U. of Louisville ’59) is director of financial planning of Anaconda Aluminum Company, Louisville, Ky.

Robert Ingersoll (BS Geol., Montana Tech. ’51 MS Geol., Montana Tech. ’64) right, is senior geologist, Anaconda’s mining operations, Butte, Mont.

Willard Chamberlain (BE Metal. Eng., Yale ’53) is manager of Anaconda American Brass Company’s Valley Mills, Waterbury and Ansonia, Conn.

Robert Zwelinzki (BSME, Rutgers ’57) is chief mechanical engineer with Anaconda Wire and Cable Company, New York.

Thomas Tone (BS Mining, U. of Arizona ’62) is foreman of the furnace dept. at the electrolytic copper refinery in Perth Amboy, N.J.

Richard Symonds (BS Met., U. of Nevada ’57) is superintendent of the lead plant at Anaconda’s smelter in Tooele, Utah.

Jay Bonnar (BS Met., M.I.T. ’57; MS Ind. Mgmt., M.I.T. ’62) left, is research administrator of Anaconda American Brass Company’s research and technical center, Waterbury, Conn.

Wilson McCurry (BSc, Arizona State ’64) is an assistant geologist in Anaconda’s new mines dept., currently working on development of the Twin Buttes mine near Tucson, Ariz.

Terrence McNulty (BS Chem., Stanford ’61; MS Metal., Montana Tech. ’63; DSc Metal., Col. School of Mines ’66) is senior research engineer, extractive metallurgical research, Tucson, Ariz.


ROSE EDUCATION
AND MANDATORY R.O.T.C.

By TONY TIETZ

Spring has arrived. One need only look outside to see the evidence; the sunbathers are back at their familiar post on the lakeshore, bermuda shorts and the corresponding pale hairy legs are back in the classrooms, and of course, the R.O.T.C. brigade has resumed its mission of molding Rose students into soldiers on our drill field. And, although the majority of underclassmen probably regard R.O.T.C. as a thorn in the side, most accept it as an integral part of the Rose education. Few have really questioned the reason for its presence at Rose.

The purpose of R.O.T.C. in general, according to the Rose catalogue, is "to produce junior leaders who, by their education, training, and inherent qualities will be suitable for commission in the United States Army upon attainment of a baccalaureate degree. The aim is to provide a basic military education, and, in conjunction with other college disciplines, to develop individual character and leadership attributes essential to a leader. It is recognized that the national security of the United States depends heavily upon the services of college-trained officers. The Reserve Officer Training Corps program (ROTC) offers the student an opportunity to earn a commission in the United States Army at the same time as he is earning his degree. The attainment of this second objective is, in large measure, dependent upon the student's willingness to become involved in the affairs of his country and to serve her in peace and in war."

This carefully worded statement conceals some assumptions that ought not to have been made. Although the country's need for college trained officers is certainly obvious, the goals of military training are not identical with the goals of the Institute, as stated by the administration; in fact, they are at times in opposition to the goals of the Institute.

The R.O.T.C. program attempts to "develop character", but who is the judge of the "character" they seek? —the military establishment. The Army builds "character", its character, dictated by its own values. Rose, however, has deliberately refrained from a statement of this nature in its statement of goals in the Rose Philosophy, since a true liberal educational institute cannot dictate the character of the students and still maintain the proper open-minded atmosphere that is described in the Rose Philosophy.

The R.O.T.C. program stresses the importance of the "student's willingness to become involved in the affairs of the country", but they are concerned only with military indoctrination of their students in conjunction with government policy, rather than the free and open evaluations of questions affecting the welfare of the country. Such practices, which preach only one side of highly debatable issues and teach these opinions as facts, jeopardize the atmosphere necessary for proper education. Whether or not the students are sympathetic to these opinions is irrelevant. The method of presentation is still anti-educational.

When viewed in this light, there seems no justification for making even the first two years of R.O.T.C. required of all Rose students. The school should honestly attempt to educate the student in conjunction with the goals it set for itself. Forcing the student to submit to non-educational activities such as R.O.T.C. is, in effect, a breach of contract with the student. Some may argue that the student is aware of R.O.T.C. before admission, but the school also “promises” to provide him with a liberal education, in its stated goals, which it cannot do by requiring R.O.T.C.

The only solution to this situation is the removal of two years of R.O.T.C. as a graduation requirement. Since there is a definite need for officers, the program should be allowed to remain on a voluntary basis as long as it does not interfere with the basic education process. If this is not done, the school should include as one of its goals the preparation of students for commission as military officers. All foreign students would have to be banned, and, of course, no American conscientious objectors would be admitted as is already the policy. In effect, Rose has already officially approved religious discrimination by refusing admittance to those who refuse to accept military training on religious grounds.

The "practical" problems involved with making R.O.T.C. voluntary are (Continued on page 36)
What's a good engineer like you doing in a local Bell Telephone Company?

Well, here are a few things you can do:

- Plan and design data communications networks.
- Engineer microwave relay, telemetry and switching systems.
- Advise and consult on total communications systems.
- Advance your education—at our 18-month work-study course at Bell Telephone Laboratories, or our data communications school at Cooperstown, N.Y., or one of many colleges we send men to for advanced study.
- Anticipate and plan the future of communications.

The opportunities for working with a Bell Telephone Company are endless, and challenging... and now!

You will work with the scientists and engineers at Bell Telephone Laboratories and Western Electric Company designing, installing and maintaining advanced communications services for government, industry and home customers in the area served by your local company.

You will be given immediate responsibility with a chance to prove your potential early. And from then on you'll have every opportunity to advance your career as rapidly as you can.

You may work with the Telephone Company in your home area or with any one of the other 21 Bell System Companies in other parts of the country.

If you'd like to be in the forefront of rapidly developing communications changes and innovations, call or write:

Personnel Manager, College Employment
American Telephone & Telegraph Company
196 Broadway, Room 2116A
New York, New York 10007
Phone: Area Code 212 • 393-3687

or contact your local Bell Telephone Company.
Some say we specialize in power... power for propulsion... power for auxiliary systems... power for aircraft, missiles and space vehicles... power for marine and industrial applications...
...they’re right. And wrong.

It might be said, instead, that we specialize in people, for we believe that people are a most important reason for our company’s success. We act on that belief.

We select our engineers and scientists carefully. Motivate them well. Give them the equipment and facilities only a leader can provide. Offer them company-paid, graduate-education opportunities. Encourage them to push into fields that have not been explored before. Keep them reaching for a little bit more responsibility than they can manage. Reward them well when they do manage it.

You could be one of the reasons for Pratt & Whitney Aircraft’s success... if you have a B.S., M.S. or Ph.D. in:
- MECHANICAL
- AERONAUTICAL
- ELECTRICAL
- CHEMICAL
- CIVIL
- MARINE
- INDUSTRIAL
- ENGINEERING
- PHYSICS
- CHEMISTRY
- METALLURGY
- CERAMICS
- MATHEMATICS
- STATISTICS
- COMPUTER SCIENCE
- ENGINEERING SCIENCE
- ENGINEERING MECHANICS.

And we could be the big reason for your success. Consult your college placement officer—or write Mr. William L. Stoner, Engineering Department, Pratt & Whitney Aircraft, East Hartford, Connecticut 06108.
Got an idea?

Detroit Edison’s interested.

1. Edison engineer, Dick Popeck, wanted to find a more effective method of determining the amount of pole decay.

2. Dick’s idea: Measure the time required for sound to travel through a pole. Sound takes longer to traverse a decayed pole.

3. Transistorized circuitry was designed. And a Sonic Pole Tester was built and tested.

4. Ed Hines, Director of Research, (left) discusses patent coverage with inventor Dick Popeck.

New ideas grow at Detroit Edison. The picture story here shows the progress of one, from its conception through its development, to finalization.

The development of the sonic pole testing device* has benefited the company and the young inventor both economically and professionally. The device helps Detroit Edison serve the electric industry’s customers better and more economically.

Uses for the sonic pole tester range from the examination of wooden railroad bridges to the determination of the soundness of standing timber. Detroit Edison’s forward looking management . . . its engineering and research facilities . . . along with its liberal patent policy . . . make it an ideal place for the young man with ideas.

If you are interested in putting your ideas and energies to work—write to George Sold, The Detroit Edison Company, 2000 Second Avenue, Detroit, Michigan 48226, or better yet, visit him when he interviews on the campus.

*U.S. Patent Applied for

Detroit Edison
AN EQUAL OPPORTUNITY EMPLOYER
What’s a down-to-earth outfit like us doing way out here?

For a company with a name like International Harvester we’re pretty far out. Right now we’re making antennae for spacecraft, and we’re developing an intricate communications plant to be left on the moon by the Apollo astronauts. We’re already producing gas turbines—and an ingenious jet aircraft ducting system that makes possible takeoffs and landings in about the space between the chicken coop and the farmhouse. We’re also leaders in motor trucks, farm equipment, construction equipment—three vital fields for tomorrow. Now our broad exploration of power is leading us in many other exciting directions. All of them spell more opportunity for you. Get more details at your College Placement Office. How about soon?

International Harvester puts power in your hands

AN EQUAL OPPORTUNITY EMPLOYER
Dear Mr. President

The President
The White House
Washington, D. C.

Dear Mr. Johnson:

This Society, which speaks for the civil engineering profession in behalf of its 60,000 civil engineer members, is deeply concerned over the National Security Council's February 15, 1968 Memorandum for Director of Selective Service.

With regard to occupational deferments, we submit that many civil engineers in both public and private practice are engaged in activities essential to the maintenance of the national health, safety and interest. We are concerned that Selective Service Directors may view the suspension of the lists of critical occupations, which included engineering, as an indication that civil engineers are not engaged in essential activities. Thus, local boards may be reluctant to grant the essential occupational deferments which are, in fact, left to their discretion.

The nation's manpower need for civil engineers in both military and civilian positions has never been questioned. Their contributions to the military effort of all branches of the service continue to be essential. Their work at all levels in the civilian realms of urban planning and development, transportation, water supply, waste disposal and the abatement of water and air pollution is clearly essential for the maintenance of the national health, safety and interest.

With regard to graduate students, we submit that the drafting of engineering students after they have received their bachelor's degrees and before they have completed graduate studies will seriously disrupt the educational programs of many of our most essential engineering educational institutions and will interrupt the studies of a great many promising civil engineering students before they have completed the academic program considered necessary for civil engineering careers.

The fact that an engineering student has received a bachelor's degree no longer indicates that he is prepared to undertake engineering work. The important final report of the Goals Committee of the American Society for Engineering Education on the Goals of Engineering Education recommends that "... basic engineering education be extended to include at least one year of graduate level education leading to the Master's Degree." Our Society has taken the position "that more and more students will pursue the five-year B.S.-M.S. combination or its equivalent, eventually making it the accepted standard of education in the engineering profession."

In view of the facts and convictions presented above, we submit that this is, indeed, essential for the maintenance of the national health, safety and interest to extend student deferments for post-baccalaureate study in civil engineering. We request that the National Security Council identify civil engineering as an area of graduate study that warrants qualifying for deferment in the national interest and advise the Director of the Selective Service System accordingly.

Respectfully yours,

William H. Wisely
Executive Secretary
If you want a career with the only big computer company that makes retail data systems complete from sales registers to computers, where would you go?

Guess again.

It’s NCR, and this is not the only surprise you may get if you take a closer look at NCR.

We’re a company alive with new ideas, research, development. A year never passes without NCR increasing its investment in research. We have hundreds of engineers, chemists, and physicists exploring their own ideas for the company that’s willing to wait and let them do it.

Take a closer look and you’ll see that NCR makes computers, electronic accounting systems, highly sophisticated solid-state communications systems for space and defense applications, and you’ll see that even our good old cash registers have become advanced information machines for businessmen.

In a list of “emerging ideas of 1966,” Business Management magazine credits NCR with two out of seven: pioneering in laser technology for recording data, and development of our new PCMI microform system that puts the Bible on a projector slide.

When you start looking, look closely at NCR. NCR can surprise you; maybe you have some surprises for us. Write to T. F. Wade, Executive and Professional Placement, NCR, Dayton, Ohio 45409.

An Equal Opportunity Employer.
CRYOGENICS

(Continued from page 12)

in thickness from 0.032” to 0.064” depending on the design pressure. The separator plates supply the primary surface and the fins supply the secondary, extended surface. In normal design practice, the secondary surface varies from 67% to 88% of the total heat transfer surface provided in an exchanger. Each layer is closed at the edges with solid aluminum bars of appropriate shape and size. The elements of one layer are joined by the brazing operation. This stack, including the side bars, is bonded together by a carefully controlled brazing process to yield an integral rigid structure with a series of fluid flow passages. The corrugated aluminum sheets (fins) which actually form the fluid passages and provide the extended heat exchange surfaces can be varied widely with respect to quality, shape, spacing, size, and type depending upon both thermal and hydraulic design as well as manufacturing economy. Dependent upon the fluids being handled, pressure drops through the exchanger of less than 1 PSI are not unusual.

However, it should be noted that unnecessarily low pressure drop specifications will require low fluid velocities with consequently low heat transfer coefficients and therefore large heat transfer surface area. This in turn means large exchanger cross section with attendant higher cost. On the other hand, pressure drop represents compression power loss which is an important factor in operating costs so an intelligent balance must be achieved. From such considerations as this, it can be seen that generally, there can be no unique solution to a given design problem.

Fins are normally furnished with straight corrugations in “plain” “perforated” or “lanced” configurations. For instance, the lanced fin will offer the best heat transfer coefficient but on the other hand, will require the highest pressure drop of the three types. Conversely, the plain fin offers the lowest heat transfer coefficients and requires the least pressure drop. Fin height can be varied from 0.200” to 0.375”, metal thickness from 0.008” to 0.025”, and fin density from 6 to 25 fins per inch. The actual selection of the most suitable fins for any particular application is therefore dependent upon the maximum working pressure, plus other variables such as heat exchange rates, allowable pressure drops, fluid properties, and fluid flow rates.

Because of the physical characteristics of the plate-fin exchanger, the fluids handled must be compatible with aluminum and relatively clean. A fouling factor of 0.002 is the maximum allowable in normal application. The upper limit of design pressure is currently in the 750 PSI range, and operating temperatures have been as low as -452°F in helium liquefaction plants.

Design of the blazed aluminum plate-fin exchanger then resolves into selecting a geometry and surface arrangement to give a product UA. From the right magnitude to satisfy the equation $Q = UA \Delta T_{in}$ where $Q$ (total duty) and $\Delta T_{in}$ (log-mean temperature difference) are known. The fluid flow rates, free stream areas, and fin types as mentioned previously, largely influence the convective heat transfer coefficients (which define U) and in turn determine the required heat transfer surface. Pressure drop considerations, as discussed earlier, also influence exchanger cross section and free stream area showing the complex interdependence of these various quantities.

Each of the several different fluids being handled simultaneously in a given exchanger is accordingly assigned a certain passage geometry also based on a careful optimization of calculated thermal and hydraulic performance. Then the different passage geometries are stacked up similar to a sandwich, alternating symmetrically into one of the several flow patterns available. The most common of these used in process plants is the counter-flow pattern. For simplicity, two fluid flow is shown with A & B designating the fluids in their respective layers. Gas-to-gas and liquid-to-gas boiling or boiling or condensing applications often use a cross-flow pattern which minimizes pressure drop in the exchanger, an important process consideration in the boiling stream.

The quality of all fabrication, assembly, and joining processes must be rigidly controlled by the manufacturer. Extremely close tolerances must be held on all fins and side bars to insure a perfect fit. Each part is carefully checked during all phases of the exchanger assembly process. Following the brazing and cleaning of the exchanger core, the collectors and nozzles are then welded onto the unit. Then another assurance of reliability is applied namely a pneumatic test at 125% of the design pressure to detect any interpass or external leakage. Following this, the exchanger is subjected to a hydrostatic pressure test at 150% of the design pressure which proves the structural integrity of the unit. It should also be noted here that not only do brazed aluminum heat exchangers comply with the ASME code but also that each exchanger is registered with The National Board of Pressure Vessel Inspectors.

Plate-fin exchangers can be supplied as single units or as manifolded assemblies which consist of multiple units connected together in parallel or in series. A typical exchanger is 30” square in cross section by 124” in length and weighs over 3000 pounds. This unit is arranged for three fluid flow with flanged connections. Also available are straight nozzles for welding directly into the piping system. Assemblies are installed into a field-erected coldbox structure. As many of you know, the enclosure housing cryogenic vessels and equipment in a plant is termed a coldbox. A difference (Continued on page 34)
They had the right idea.

17th-Century Space Flight. Cyrano de Bergerac's science fiction fantasy about a box propelled into space by rockets came close to fact. Before the end of this decade, Apollo and LM will indeed be thrust to the moon by rockets, guided by AC Electronics guidance and navigation systems.

Navigation, Second-Century B.C. Hipparchus's second-century astrolabe was used for celestial navigation until the mid-18th century. Today, ships still depend on stars for guidance...through such sophisticated help as AC Electronics' computerized Ships' Self-Contained Navigation System.

Leonardo's Tank. Leonardo da Vinci was one of the first to envision the use of tanks in warfare. Contributing to the advanced state-of-the-art in tanks, today, is AC Electronics, with a computerized fire-control system for military land vehicles.

Turtle vs. Eagle. In 1776, the American "Turtle" attacked the British flagship "Eagle" in the first wartime submarine action in history. Today, AC Electronics contributes to both the defensive and the scientific role of the submarine...with guidance components aboard our Polaris fleet, and with its own undersea research vessel.

Guidance Gets a Lift. Otto Lilienthal, 19th-century German glider, proved that the future of flight lay in man's ability to guide the aircraft. Tomorrow's superjets will be guided inertially...by systems like AC Electronics' Carousel IV, chosen for the Boeing 747.

At AC Electronics we believe every great achievement starts with an idea. That's why we put a premium on creativity, and foster it through such innovations as our Career Acceleration Program which lets you learn as you work. Ask your college placement officer about a General Motors/AC on-campus interview. Or write: Mr. R. W. Schroeder, Dir. of Professional and Scientific Employment, Box 703, AC Electronics Division, Milwaukee, Wisconsin 53201.

An Equal Opportunity Employer
Mondays never look the same to Bob Byse

When you're breaking ground on a new idea at Delco, you don't see a lot of your own desk. For Bob Byse, design engineering means work with two dozen solid professionals...people whose specialties range from microelectronics to model making to production. Wherever the project leads, Bob Byse is on his way. And every skill is at his disposal. Right through full production. And beyond. If there's trouble shooting under dealer warranty three years from now, Bob Byse is still the man we'll call for. That's why no two Mondays ever look alike to Bob Byse and his colleagues at Delco.

The question is...can you say the same? Take a good hard look at how your responsibility shapes up, compared with Bob's. In fact, why not discuss it with us. By letter or telephone. Collect. Area Code 317/459-2808.

Contact: Mr. C. D. Longshore, Supervisor, Salaried Employment, Dept. 300, Delco Radio Division of General Motors, Kokomo, Indiana.
Well, there goes the old ball game.

No matter! As they climb the ladder of success at Bethlehem Steel, that lost National Championship will be forgotten. You, too, ought to be thinking career.

Read “Careers with Bethlehem Steel and the Loop Course.”

Pick up a copy at your placement office, or write to Manager of Personnel, Bethlehem Steel Corporation, Bethlehem, Pa., 18016.

An equal opportunity employer in the Plans for Progress Program

BETHLEHEM STEEL
ent type of exchanger assembly configuration is commonly used in air separation plants. This is called an inverted “U” arrangement and minimizes field erection time and cost, since a major portion of the interconnecting piping has been done before the exchanger assemblies are shipped. Each leg of the “U” stream consists of nine units so the comparative sizes of coldboxes housing forty and thirty-six units respectively may be seen. The overall size of these assemblies is generally limited by the capacity of suitable transportation facilities and available field erection equipment. Still, the compact design of aluminum plate-fin heat exchangers makes it possible to furnish over 400,000 square feet of heat transfer surface in one manifolded assembly.

Industrial process applications involving gas separation, purification, or liquefaction in the low temperature ranges can benefit from the significant advantages in overall size, design flexibility, and cost offered by Brazed Aluminum Plate-Fin Exchangers. These exchangers are not being used internationally in such specific processes as helium liquefaction, helium extraction from natural gas, hydrogen purification and liquefaction, air separation, ethylene recovery, and natural gas liquefaction plus revaporization. The duties handled by plate-fin units in any given plant depend entirely on the process being used. Actually, this exchanger design concept can be applied to any heat transfer problem within the physical parameters discussed earlier. As further advancements in low temperature process technology contribute to the development of additional applications, Brazed Aluminum Plate-Fin Heat Exchangers will continue to make their contribution of proven reliability.
Be frustrated. As only a participant can be. We'll give you every opportunity to participate. To stretch your mind. To struggle with a problem until you get mad. Until you solve it. And get the credit you deserve. We don’t promise the world. Or the moon. Just the satisfaction of using your talents. Day after day. Whether you’re in research and development, marketing, refining, planning and engineering, or administration. Your pencils are waiting. That's what we promise. If it's enough, write our Recruiting Coordinator, American Oil Company, Dept. 3-N, 910 South Michigan Avenue, Chicago, Illinois 60680. AMERICAN OIL COMPANY

Come with us and be fulfilled.
R.O.T.C.
(Continued from page 18)
perhaps not as serious as some fear.
One common misconception is that
the school must have R.O.T.C. or a
physical education program to retain
accreditation. Neither is required.
Moreover, the school receives no
direct monetary benefit from R.O.
T.C. Only scholarship and advanced
students benefit monetarily from
the program. This money would
still remain to help these students
finance their education if a volun-
tary system were adopted.

Undeniably, due to the small size
of the school, a voluntary system
might lead to a situation where too
few students entered the program to
meet the minimum annual gradu-
ation of 25 officers necessary for con-
tinuation of the program. The aver-
age enrollment at most schools with
voluntary R.O.T.C. is 10% initially.
Assuming normal dropout rates this
could leave the R.O.T.C. program
short. However, due to the conser-
ative nature of the Rose student
body, it is likely that a larger per-
centage would apply. And the large
enrollment of Indiana State provides
another source of potential officers
to meet the minimum requirement.

Of course, there would definitely
be a smaller number of Basic stu-
dents on which Advanced students
polish their leadership techniques.
But the departure of these unwilling
guinea pigs would improve the
morale of the program as a whole,
increasing its effectiveness and
brightening its image at Rose.

In a final analysis, it must be de-
termined whether it is worthwhile,
or even just, to require all students
to submit to a program only a min-
ority benefit from. The school can
justifiably require all students take
humanities or calculus, because
these courses are a definite require-
ment in achieving the educational
goals of all the students. R.O.T.C. is
not an educational goal of the Insti-
tute; Rose is not a military academy.
The idea of offering the program in
the interest of national security is
noble, but this is a non-essential
sideline and should be treated as
such.

If a voluntary program did finall
result in the collapse of the program
due to lack of interest, it would be
unfortunate, but Rose would no
suffer severely, financially or edu-
cationally. Certainly some members
of the faculty and administration
feel that it is unfortunate that stu-
dents be required to take R.O.T.C.,
but since no serious opposition has
been raised, the program is contin-
ued on the rationale that as long as
no one feels wronged, why bother to
change? And on the other hand
Rose students have not been anxious
to voice any opinions publicly con-
trary to the established policy. They
know such behavior just isn't consis-
tent with the conservative identi-
y ty some powerful, established faculty
members would like to see main-
tained at Rose. Such an attitude is
unhealthy, not being in the best
interests of the students or Rose
atmosphere in general. Both student
and faculty should attempt to es-
tablish better communication to ar-
rive at a greater realization of the
atmosphere suggested in the Rose
Philosophy.

Everyone
ought to have
a good
photograph,
a Martin Shadocraft
Portrait

MARTIN’S PHOTO SHOP
681 Wabash Ave.

VERY
VERY
IN

SHOES
FROM
HAHN’S
at Meadows Center
Judge: “Officer, what makes you think this M.E. is intoxicated?”
Officer: “Well, Judge, I didn’t bother him when he staggered down the street, or when he fell flat on his face, but when he put a nickel in the mailbox, looked up at the tower clock and said, ‘My God, I’ve lost 14 pounds’ I brought him in.”

An impatient old lady making a trip by bus became irritated at the many stops. “Such a slow bus,” she snapped. “I believe we stop at every telephone pole.”

“Why not, lady?” replied the driver. “This is a Greyhound.”

The scene is a train compartment in Rumania. The characters: A Russian officer, a Rumanian, an old lady, and an attractive girl.
The train enters a tunnel. The passengers hear first a kiss, then a vigorous slap.

The old lady thinks: “What a good girl she is, such good manners, such fine moral character!”

The girl thinks: “Isn’t it odd that the Russian tried to kiss the old lady and not me?”

The Russian thinks: “That Rumanian is a smart fellow: he steals a kiss, and I get slapped.”

The Rumanian thinks: “Am I a smart fellow! I kiss the back of my hand, hit a Russian officer, and get away with it.”

Probably the reason that God made woman last was that he didn’t want any advice while creating man.

A lunatic was leaning out the asylum window watching the gardener.
“What are you doing there?” he asked.
“I’m putting manure on the strawberries.”
“I usually put sugar on mine, but of course, I’m crazy!”

Jim was a devoted Chemical Engineering student whose life revolved around test tubes and bunsen burners. This was true to the extent that he was slightly dense in everyday affairs. Thus, when he was trying to cash a check at the bank one day, he became quite perplexed when asked if he could identify himself. He momentarily excused himself and went to the men’s room and looked in the mirror. Returning with an enlightened look upon his face he replied, “It’s me alright.”

Then there’s the fellow who bred his parakeet to a tiger. He doesn’t know what he’s got; but when it talks, he listens—

Two men and a young lady on a pullman going to New York decided to get acquainted. One of the men said, “My name is Peter, but I’m not a saint.”
The other man said, “My name is Paul, but I’m not an apostle.”
The girl muttered, “My name is Mary, and I don’t know what to say.”

Whoever said, “Live and Learn” was a dreamer. At this institution, we have time to do one or the other, but not both.

At a county fair a strong man squeezed a lemon dry and then offered a prize to anyone who could get another drop from it. Many tried, but the lemon appeared dry. Finally a little man said he could squeeze some more juice from the lemon. Amid laughter the Hercules gave the lemon to the little man who squeezed a jet of juice.

“Extraordinary!” exclaimed the muscle man in admiration.

“Not at all,” the little man replied, shrugging his shoulders. “You see, I work for the Bureau of Internal Revenue.”

E. E. Prof. (to student who is half an hour late): “You should have been here at seven-fifty.”
Student. “Why, what happened?”

Two drunks wandered into a zoo and as they staggered past a lion’s cage, the king of beasts let out a terrific roar.

“C’mon, let’s get out of here,” said the first drunk.
“You go ahead if you want to,” replied his more inebriated cohort.
“I’m gonna stay for the movie.”
ROSE
(Continued from page 14)

without resort to educational gimmicks.

Second, Rose has a real concern for the student as an individual. Consequently, we are an educational community for a limited number of well-qualified students. We are small by choice. Further, what we offer the student is a total experience that goes beyond the formal curriculum. Each student receives the individual attention necessary to his healthy educational development and as much personal guidance as he needs or desires. Each student has the opportunity and is encouraged to participate in a broad program of extracurricular activities.

Third, Rose is proud that it has been and is a distinctively undergraduate institution. We believe that there is a place in our educational society for a science and engineering school that dedicates its program to the undergraduate student; hence graduate study is encouraged only in those areas where a modest graduate program will enhance the effectiveness of the undergraduate program.

Fourth, Rose emphasizes teaching. Every effort is made to recruit and to encourage professors who believe that teaching is their primary responsibility. There is no "publish or perish" atmosphere on the Rose campus. To be sure, professors are heartily encouraged to maintain their professional competence through continuing education, consulting, research, writing, and participation in other professional activities. But the qualities most encouraged in our professors—enthusiasm, concern, dedication, a willingness to innovate and pioneer—are qualities that identify the good teacher.

Finally, Rose strives to maintain a healthy balance between tradition and innovation. Colleges and universities must change with the times, and Rose is no exception; it is not the same kind of school it was when it was founded, nor indeed is it the same as it was ten or even five years ago. The basic purpose has, however, remained unchanged. In 1874 Chauncey Rose conceived his new institute as a school of industrial science, "an institution for the intellectual and practical education of young men." So it remains today: an undergraduate institution, concerned with the student as an individual, and dedicated to excellence in the performance and the character of its students and teachers alike.

Rose Prepares Students for Careers in Engineering and Science
—by developing technical competence
—by inspiring clear, critical thinking
—by stimulating humanitarian concern
—by maintaining significant standards
—by demonstrating concern for the individual
—by emphasizing good teaching
—by balancing tradition and innovation

POLYTECHNIC BOOKSHOP

Anton & Grace Hulman
Memorial Union
The world is full of willing people:
Some willing to work,
The rest willing to let them.

(Robert Frost)

At Whirlpool, all our engineers are willing and able to make their own significant contributions. That’s because they take their work seriously. Whether it’s assisting in the development of food, water and waste management systems for NASA or helping housewives get their dishes cleaner.

Whirlpool is where innovation is seldom uttered, but always seen... where motivation is part of our way of life... where preparation for the future is daily routine.

Sign up today and come in to see us... the working is fine.

Whirlpool
An equal opportunity employer
We've got the little pond you're looking for...

If you are looking for the opportunity that can only be offered by a large corporation... one that will offer you an interesting position now and not three to five years from now... investigate what Automatic Electric has to offer!

Automatic Electric is the telephone company that stresses youth and the development of new ideas in electronic systems. Our project groups are small because we want to avoid that "little frog in a big pond" feeling.

We have positions for you in applied research, design, development and manufacturing, if you're a degree candidate in any of the following fields:

- Mechanical Engineering
- Electrical Engineering
- Industrial Engineering
- Chemical Engineering
- Physics
- Mathematics
- Computer Science

Find out how you can take a dip in one of our exciting little "ponds"... have a talk with the man from Automatic Electric. He'll also tell you about our educational program, with tuition paid when you attend graduate classes at one of the many colleges in our area. Or, you may enroll at one of the courses we hold on our own premises to earn credit toward an advanced degree.

See your placement director to arrange a personal interview, or write to James G. Cobban, Manager, Professional Employment, Automatic Electric Company, Northlake, Illinois 60164.

AUTOMATIC ELECTRIC
SUBSIDIARY OF GENERAL TELEPHONE & ELECTRONICS

an equal opportunity employer
THE ARMY CORPS OF ENGINEERS

offers you a challenging civilian career with:

■ The world's foremost and largest engineering organization in the construction field, pioneering new and advanced engineering practices and concepts.

■ An organization whose work spans virtually the entire range of modern engineering, including comprehensive planning for development of water and related land resources of entire river basins; design and construction of multi-unit, multi-purpose, integrated systems that encompass navigation, flood control and major drainage, hydroelectric power generation, municipal and industrial water supply, irrigation, water quality control, beach erosion control and hurricane protection, water-oriented recreation, preservation and enhancement of fish, wildlife, and natural beauty values; and planning, design, and construction of complicated, advanced-concept military structures such as the Nike-X anti-missile system, launch facilities and bases for the intercontinental ballistic missiles, airfields, housing, schools, laboratories, and nuclear power facilities. In addition are the allied fields of cartography, geodesy, mathematics and engineer intelligence.

■ An organization that recognizes each engineer as an individual, providing well-rounded career development programs with on-the-job training; courses at government expense in colleges, universities, and seminars as necessary to assure steady progression to top professional and managerial levels; encouragement and assistance in attaining professional registration and recognition; and an opportunity to win national and international awards.

■ An organization with offices and projects in nearly every one of the 50 States and in many foreign countries that encourages employees to further their development by accepting new and challenging assignments.

■ An organization which provides excellent rates of pay with liberal fringe benefits, including generous retirement annuity, complete health and life insurance coverage, paid vacation leave, military training leave with pay, generous sick leave; and special pay awards for outstanding performance and suggestions that improve operating efficiency.

If you're thinking this is all too good to be true, you're wrong! All of the above is available to you in a civilian engineer career with the U. S. Army Corps of Engineers. If you are interested, you can get further information from the Chief of Engineers, Department of the Army, Washington, D. C. 20315.

AN EQUAL OPPORTUNITY EMPLOYER

WRITE FOR AN ILLUSTRATED BROCHURE "YOUR CAREER"
General Electric engineers and scientists are helping to satisfy the needs of society...

like beautiful cities

A technical career at General Electric can put you in the position to help beautify our cities.

Inquisitive minds in research and advance development at G.E. are evolving many concepts to give our cities a clean, all-electric look. Design engineers are translating concepts into components and systems, while manufacturing engineers are developing the methods and machines that bring designs into being as useful products.

Technical marketing specialists are working with electric utilities and city planners to give mushrooming urban landscapes like Phoenix, Atlanta and Chicago, a bright, all-electric face.

Urban living has already begun to change as a result of the contributions made by General Electric engineers and scientists, contributions like air and water purification systems, underground power equipment to preserve nature's beauty, all-electric heating facilities, rapid-transit systems, and a hundred more.

You can help develop new products and concepts, new facilities, processes, and manufacturing systems, or new applications and markets in your technical career with General Electric. For more information write: D. E. Irwin, Section 699-20, Schenectady, New York 12305.

GENERAL ELECTRIC
An Equal Opportunity Employer