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Rose Technic

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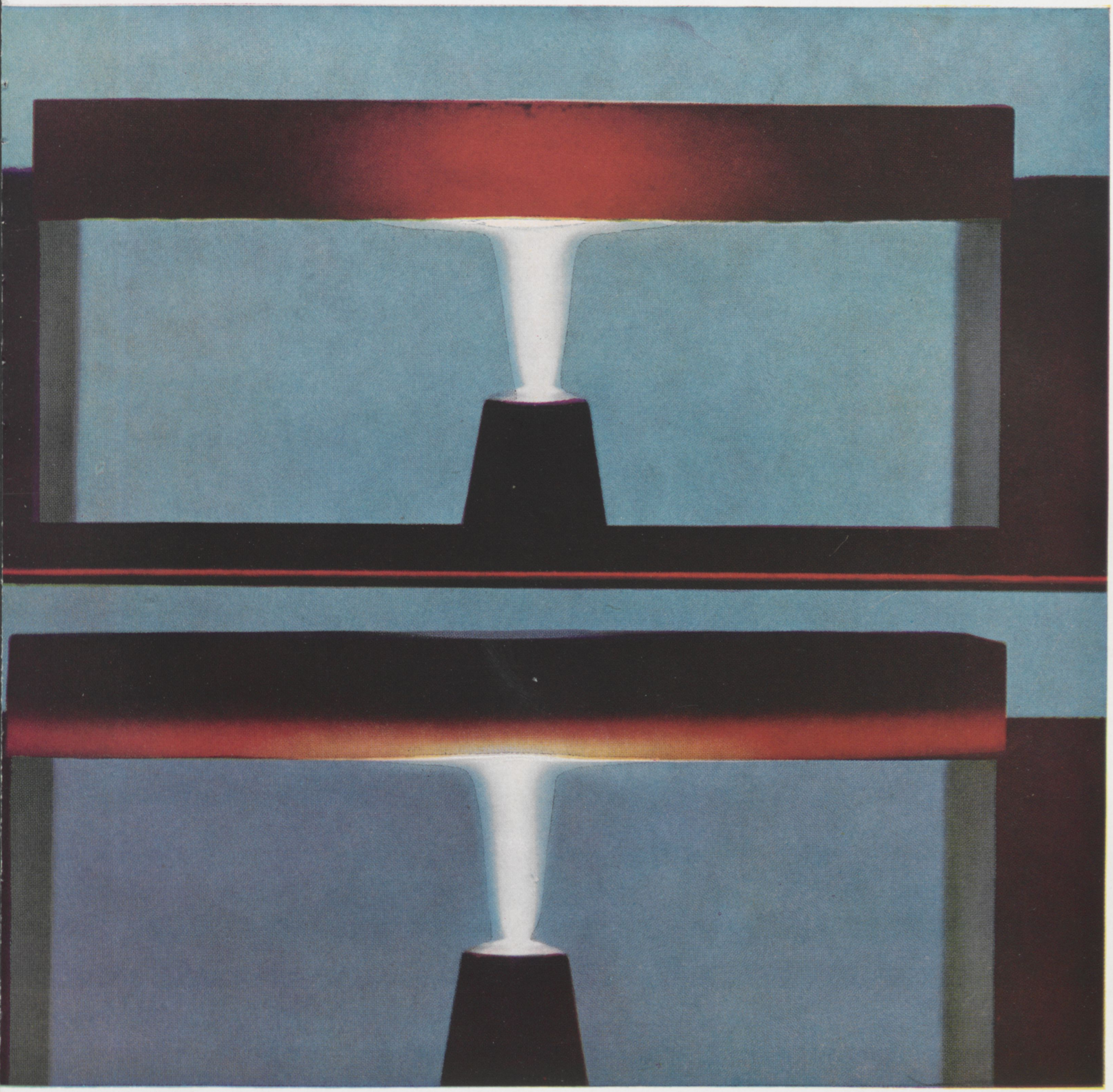

A ROSIE PHILOSOPHY
LOW TEMPERATURE RESEARCH
THE CHANGED FACE OF ENGINEERING
NEED A DATE?

New **Westinghouse** *Ideas in Electronic Medicine*

Volts may do you more good than Aspirin...

An electronic device has successfully steadied hearts that were fluttering at the verge of failure. Slim electronic tubes, mounted as a test in the ceilings of 15 operating rooms, cut the rate of post-operative infections to a *fortieth* of what it was before. A new fluoroscope system makes the patient more comfortable and permits the doctor to make his examination from a distant location where he observes by television. Indeed, several doctors may observe at one time. Future possibilities include a "listener" to tell just how the heart of an unborn infant is doing and a "looker" to locate bone fractures without radiation. Scientists over the world are working on new ways to help doctors treat the complex machine we call the human body. "Electronic Medicine" is a major research area at Westinghouse. *You can be sure . . . if it's Westinghouse*

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write L. H. Noggle, Westinghouse
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Paul Rand

Calvin W. Emerson, Purdue BSME '60, MSME '62, inspects hollow air-cooled turbine blades after a test run of a first-stage prototype wheel in a turboprop engine power section. Emerson is one of numerous young engineers engaged in applied research on advanced gas turbine engines now under development by the Allison Division of General Motors. Blades of the type shown in the wheel have played a major role in boosting horsepower as much as 63% in development engines. These air-cooled blades operate in higher inlet gas temperatures with a lower blade surface temperature than uncooled blades, making possible improved fuel consumption as well as increased horsepower output.

● **ADVANCED TURBINE ENGINE DEVELOPMENT**—Allison, world leader in the design, development and production of turbo prop engines, is extending their capabilities to meet changing military needs.

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(See Page 15)

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Rose Technic

May 1963

VOLUME LXXIV, NO. 8

AMERICA'S OLDEST ENGINEERING COLLEGE MAGAZINE IN CONTINUOUS MONTHLY PUBLICATION — 1891-1963

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let's develop "professional pride"

Probably of great satisfaction to any individual is to be known as a professional. Doctors, lawyers, engineers, and even athletes are known as professionals. To each one, professionalism means a different thing. Professionalism means many years of extra study to the lawyer and doctor; it's public recognition of need and attainment to the engineer; and it's outstanding physical dexterity to the athlete.

But whatever it is that makes a person a professional, he is set in the public's eyes as someone of special capabilities in all areas. He is noted as dependable and intelligent. His opinion on almost any subject, particularly matters of public concern, is regarded as valuable. And he is expected to be civic minded.

The professional does many things that are not directly connected with his particular field, but which society connects with professionalism. A professional is expected to be able to speak on a wide variety of topics. He is expected to air his views in a ring with professionals from greatly varying backgrounds. Professionals are Rotarians and Kiwanians; they become experts on boys camps, street signs, and high school athletics. Professionals are asked to write articles for magazines and newspapers. They are expected to be well informed.

It's ironic in our society, which preaches democracy and the supremacy of the individual, that so much power is placed in the hands of groups. The election returns are even analyzed according to groups and geographical areas. Political issues are designed to sway whole factions, not just the individuals whom the issues ultimately affect. Labor, management, and the farmers work to keep their power effective in Washington.

But the professional is typically individualistic. At least he seems to realize why a particular group is right. Many think that the laborer might accept anything if the "union" told him it was for his benefit. Not so with the professional. He is regarded as a free thinker with ideas of his own and concrete reasons for his conclusions. Therefore, his opinion is respected, and even sought.

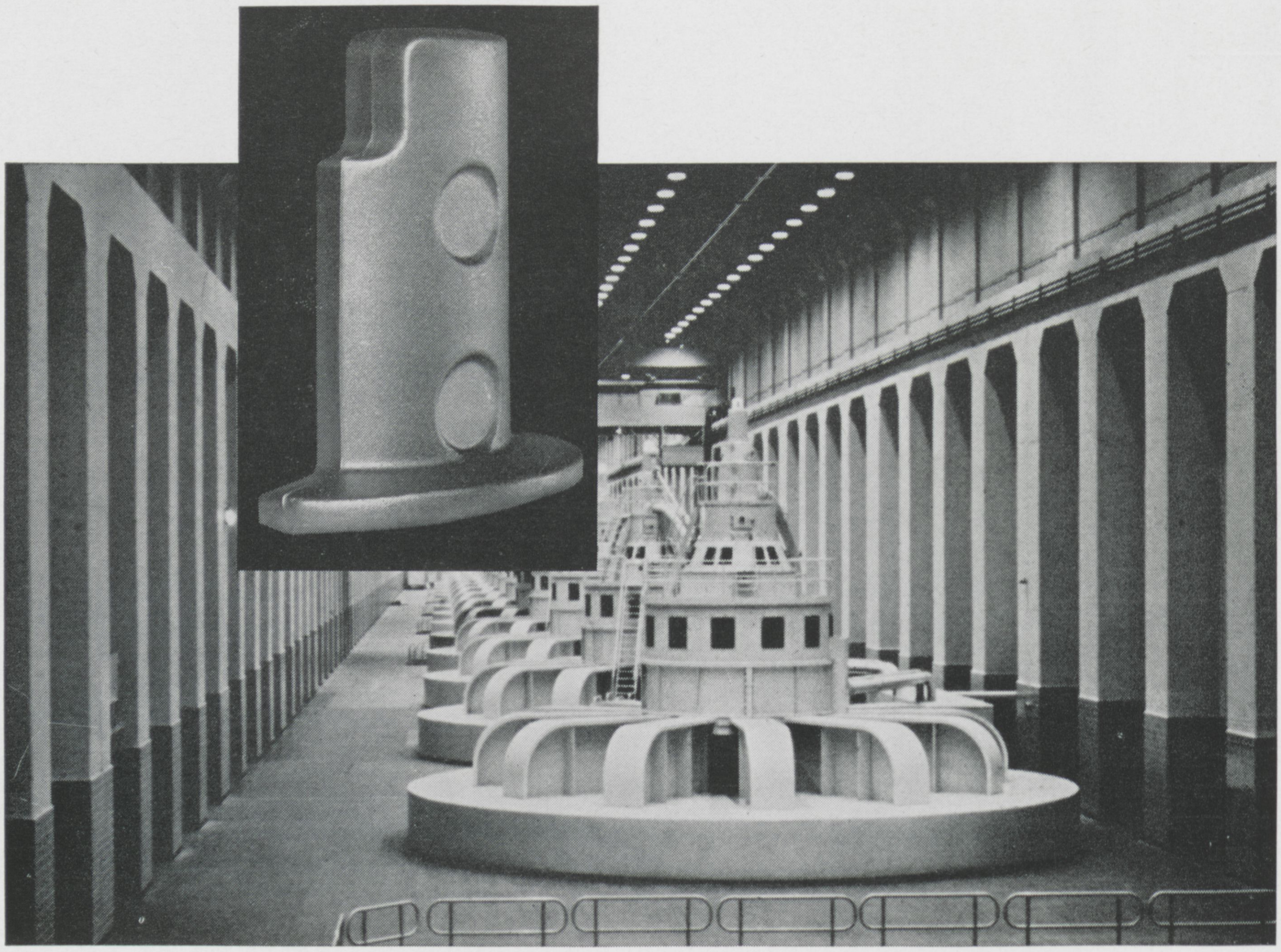
It just might be that "professional pride" contains more meaning, then, than designing an efficient hydroelectric power generator or a satelite communications system. These things are a major part—but we, as professional engineers, might be expected to live up to an ideal before we have real "professional pride." Maybe we should know something about government; maybe we should be at least familiar with the current "best seller", broadway shows, or political issues.

Albert Schweitzer is not only a famed theologian and doctor but also a celebrated musician. Werner von Braun, one of our most noted missile experts, is also conscious of the political implications of his inventiveness. These people are not unaware of the world. They are prime examples of professionalism and "professional pride".

But they didn't broaden themselves from a textbook. And neither will we. We are attending Rose for a technical education. They don't teach music or drama here. We can't find a course in periodical readings. These things we will have to find for ourselves. We won't learn at Rose how to dress like a professional. But the ambitious person will have to take upon himself the task of broadening himself by association, discussion, and meditation.

If we set only one goal for ourselves, it should be the attainment of "professional pride". Although each person's definition may be different, a half-hearted effort or a slovenly attitude toward "professional pride" will be unrewarding. Anything we do to attain "professional pride" is a small price to pay for satisfaction.

R.E.V.



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For more information, see our 4-page, full color advertisements in these magazines: MACHINE DESIGN, PRODUCT ENGINEERING, STEEL, MATERIALS IN DESIGN ENGINEERING *and* AUTOMOTIVE INDUSTRIES.

When it's a vital part, design it to be

FORGED

The President Comments

1962-63
to the seniors

In just a short time the academic year will be over and for the seventy-six graduating seniors a new life will be beginning. All of the Rose faculty wish you well—you have completed a demanding and rigorous program and we think that you are unusually well prepared to face the future regardless of what it may bring.

For most of you, this will be your last year at Rose; the classes have probably seemed no more difficult, the dances not particularly unique, the convocations and lectures fitting more or less into the pattern of the past.

As a newcomer, my reactions have been different in degree at least; I wonder, however, if they aren't basically the same as all of those who become a part of the Rose family—the pleasure of hearing DEAR OLD ROSE sung by the Glee Club—the beauty of our trees and the campus—skaters on the lake in January—the excitement of homecoming with its bonfire and Rosie careening down the sidelines spurting water—the pleasure in talking to old grads—the O'Grady Drill at the Military Ball—pride in THE TECHNIC—the solemnity of a Tau Beta Pi initiation—my first visit to St. Mary's (with Mrs. Logan)—John Rohr's FM concert series—visits with the Rose Tech Clubs in Terre Haute, Indianapolis, Chicago, Philadelphia, New York and St. Louis—the list seems endless, but it all adds up to the important intangibles of the Institute.

Rose doesn't pretend to be Harvard, Yale, Princeton, or even Cal Tech; but, as Daniel Webster said long ago about another equally fine school—"there are those who love her." We are proud to have you join the ranks of the distinguished scientists and engineers who have preceded you in graduation.

JOHN A. LOGAN

A ROSIE PHILOSOPHY

The following article was submitted by the Tau Beta Pi spring pledge class of 1963.

The article concerns itself with the future developments here at Rose.

Rose's ten-year expansion program is probably the most misrepresented, and least understood issue on campus at the present time. The Board of Managers, faculty, and administration asked Tau Beta Pi to appoint a capable group to write a guiding philosophy which they believe should be followed in planning for Rose's role in the future.

Colleges and universities are changing with the times, and Rose is no exception. In the past there were trade journals in the library to keep the young engineer abreast with the changing times; today the young engineering student reads *Playboy,* illustrating overhanging cantilever beams and giving the relationships of the attraction of bodies.

The atomic age itself presents many new problems alone. Fifteen years ago man didn't even conceive such an atomic world as we now live in. Fallout shelters are becoming numerous and at the same time being stocked with all kinds of goodies—women.

One thing that has remained unchanged throughout Rose's 89 years existence is each's individuality. Today one can witness this in action by observing teachers sporting beards of the Abe Lincoln era; students wearing haircuts styled after Sampson, perhaps trying to capture a Delilah; and with a keen eye, even a few carrying slide-rules on their hips.

When Chauncey Rose conceived Rose Polytechnic Institute it was "an institute for the intellectual and practical education of young men." Today anyone walking through the halls can easily realize that this atmosphere still persists; whether viewing the Edward G. Watterbags Computer Center in operation or seeing a freshman student eagerly mixing up conglomerations in the chemistry laboratory, and thus giving each a liberal education in engineering and science.

The humanitarian nature of science and engineering must be more dramatically portrayed. Along with creating a six year program and teaching a math department member that there are 26, not 25 letters in the alphabet a program will be instituted to humanize the engineer. The bearded species of five toed sloth sometimes found sleeping in the laboratories—proudly classified by old and new alumni as members of the phylum "wramblin wrecks"—must be cross bred with the species known as intellectuals and thusly humanized.

To provide an environment conducive to such development the institute must become an educational community. To accomplish such a broad program will require much greater flexability within the faculty, thus engineers will be called upon to teach philosophy and art appreciation while sound scientists will naturally be expected to teach vector analysis and reaction kinetics.

Obviously since such an advanced program cannot economically be carried out in its entirety by the institute so as to obtain a full breadth of courses, it will be mutually advantageous for Rose to cooperate with neighboring universities and colleges. This should not be too difficult, as it seems that there is already a certain degree of cooperation. Thus Saint Mary's girls can take such invaluable (or nonvaluable) courses as Modern Physcs or Professional Orientation, while Rose students can obtain excellent experience in the Woods.

Written by

Jacob Hoffman

Richard Rapson

Bryce Drake

Curtis Jones

David Rennels

William Teeguarden

James Watkins

Also, on an exchange agreement with Indiana University, while they take some of Rose's engineering courses, we of Rose can take such practical courses as "How to Grow Poppies for Fun and Profit."

Further extension of this program would give DePauw students the opportunity to learn all about the complex operation of an industrial, high speed computer. In turn, Rose men could study psychology of the DePauw coed, otherwise known as Freudian Pshchology.

And finally, while Indiana State students could gain a more sympathetic view of the plight of the overworked, undernourished, mentally shot, sex starved, physical wreck called an engineering student; we of Rose could study the Late Evening Architecture of Modern Buildings (better known as Some Girl on Third Floor Burford Never Closes Her Curtains) or something else valuable, such as physics.

To further the student in his cultural development we feel that the next convocation must be made compulsory when Miss E. O. Slockunphul plays T. S. Bach's 3rd Harp Concerto transcribed for glass harmonica, alto recorder, jew's harp and wash board.

Research, investigation, and professional achievement must be a fundamental part of the program.

Students must be motivated by a sense of excitement and interest in pioneering. Although this sense of pioneering has been obtained by the students who cleaned out the electrical engineering basement, after teaching physics majors to read meters it will be possible to integrate undergraduate work by encouraging research in both an undergraduate and graduate level.

Last, but most important, Rose must have great teaching with all its implications. As a first step in this direction several faculty members will be replaced with teaching machines. We presently have contractors working on a machine that teaches electromagnetics which can be unplugged when the bell rings. The contracting firm is also working on a chemistry teaching machine —it's called the space saver model and is readily attached to a gas pipe. It has been suggested that a diploma dispenser be mounted in the main hall; ten cents for a B.S., twenty-five cents for a M.S., and fifty cents for a Ph.D., this arrangement having worked well for several years at nearby colleges.

Thus it becomes obvious enthusiasm, a willingness to inovate and pioneer and a dedication to the pursuit of excellence—all are inherent in the Rose approach.

In order to lay down our philosophies in an orderly manner we hereby state the completely unabridged verison of the Credo."

CREDO

It is our desire to create an environment and provide guidance for young men:

To learn that life is almost worth living until you have to get up for an eight o'clock lab on Saturday morning.

To develop a power of concentration that can be obtained only by studying in the library while the maintenance men are at work.

To learn early in life how to treat an ulcer. (Newly acquired since attending Rose.)

To better understand the world in which they live. This is done essentially by essentially remembering that the essential things in life are essentially essential.

To comprehend the value of coeducation!

To learn that integration is not always a desegregation movement and that differentiation does not consist of finding out the difference between boys and girls.

To discover that traditions are a passing thing!

To learn how to be a good loser. (After Rose's football seasons, what else?)

To learn how true is the saying "everything looks greener on the other side of the fence." (All schools seem easier than Rose.)

To find that lakings are not for the masses and hazing is to be conducted in an orderly manner.

To learn that the Detroit Rams and the Los Angeles Lions are two new professional football teams.

To discover how to improvise. (The only way to get through many labs.)

To carry out hand to hand combat with the bugs while studying in the dormitory each spring and fall night.

To resolve each June never to come back.

To find that nine may be an unlucky number with respect to time (weeks or months).

To discover that an engineer's diet consists of starches, starches, and more starches. ° Saltpeter

To discover that "Finegler's Theorem" and "Fudgedian Factor" are an engineer's best friend.

To learn that when an engineer gets stuck on a problem, the "zero factor" can be used to eliminate the problem.

To find that to become an engineer may be a five year task.

To discover some of the courses and professors are the biggest. . . , while others are good.

To discover that Monday afternoons can be unbearable.

To learn that when you get out of Rose, boy you got something by golly.

LOW TEMPERATURE RESEARCH

by Dave Morgan
Junior Physics

After many years of low temperature research, the properties found are of increasing interest to industry. More and more uses are being found for materials at low temperatures. Storage of gases such as oxygen, nitrogen, hydrogen, and methane at low temperatures in the form of liquids has been found to be very economical, especially for large metropolitan areas. As more applications of materials at low temperatures are found, the need for large scale liquefaction equipment is developing. The equipment used for liquefaction of a gas is practically the same for any gas at cryogenic temperatures.

There are two basic types of cycles for liquefaction of gases—the cascade cycle and the expander cycle. In the cascade cycle, a series of successively lower-boiling fluids vaporizes to condense the next lower boiling fluid until the product stream is condensed. A relatively complex plant is required for this system, but power requirements are low. In the expander cycle, the gas to be liquefied is used to provide its own refrigeration by recirculating a portion of the stream through a compressor, heat exchanger, and expander. Although the plant is simpler in design, it is less efficient than the cascade design. Most low temperature refrigeration cycles require compressors, heat exchangers, and expanders. Liquefaction processes can be operated at almost any head pressure greater than fifty pounds per square inch. The same type of equipment can be used in the range from fifty to seven-hundred pounds per square inch. Above one-thousand pounds per square inch a different type of equipment is needed.

At low temperatures, heat exchangers of the aluminum plate and fin variety are used. Heat exchangers of this type are much lighter than other types and can be adapted to obtain almost any desired characteristics. Pressure up to six-hundred sixty pounds per square inch may be obtained in this type of apparatus. For high temperature duty, there are three primary types of design of heat exchanger. The first type uses spiral finned tubes in a baffled shell. A multiple crossflow arrangement provides an over-all effect of counter-current exchange. The second type of high pressure heat exchanger utilizes a wire wound tube. In this design, a drum is wrapped with high pressure tubes separated from each other by wire wound around each pipe. The tube wound drum is enclosed in a shell to provide a low pressure pass counter current to the tubes. A suitable method of heat exchange if two high pressure streams are to be exchanged with a low pressure stream is to bond two tubes together and wind them on a drum as in the method described above.

Reciprocating expansion engines are convenient means of expanding relatively small flow volumes over large pressure ratios. Operating pressures generally range from five-hundred to three-thousand pounds per square inch, expanding down to one-hundred pounds per square inch or less. The thermal efficiency of the expander varies from seventy to eighty-two percent. Expansion engines have been built for handling air, nitrogen, hydrogen, and helium as well as methane and other hydrocarbons at temperatures as low as -432 degrees Fahrenheit.

Expansion turbines are in use generally where pressure ratios of less than ten to one are involved with large flows up to more than one and one half million cubic feet per hours. The most commonly used forms now are either axial flow impulse or radial inward flow reaction. Radical flow machines are usually single stage units while axial turbines may be multistage. Efficiencies vary from sixty-five to eighty percent.

Impulse turbines control flow by the use of valves on banks of nozzles. The enthalpy drop occurs in the nozzles while the wheel only turns the flow. Turbines of this type operate at constant speed, which can be varied to optimize efficiency. In the radical reaction type of turbine expanders, one-half of the enthalpy drop occurs in the nozzles and the other half in the wheel. Larger radial turbines operate at speeds of fifteen thousand to twenty thousand revolutions per minute and may be coupled to generators through reduction gears to permit recovery of useful work. Radial inward flow reaction turbines are not suitable for expansion into the liquid region as

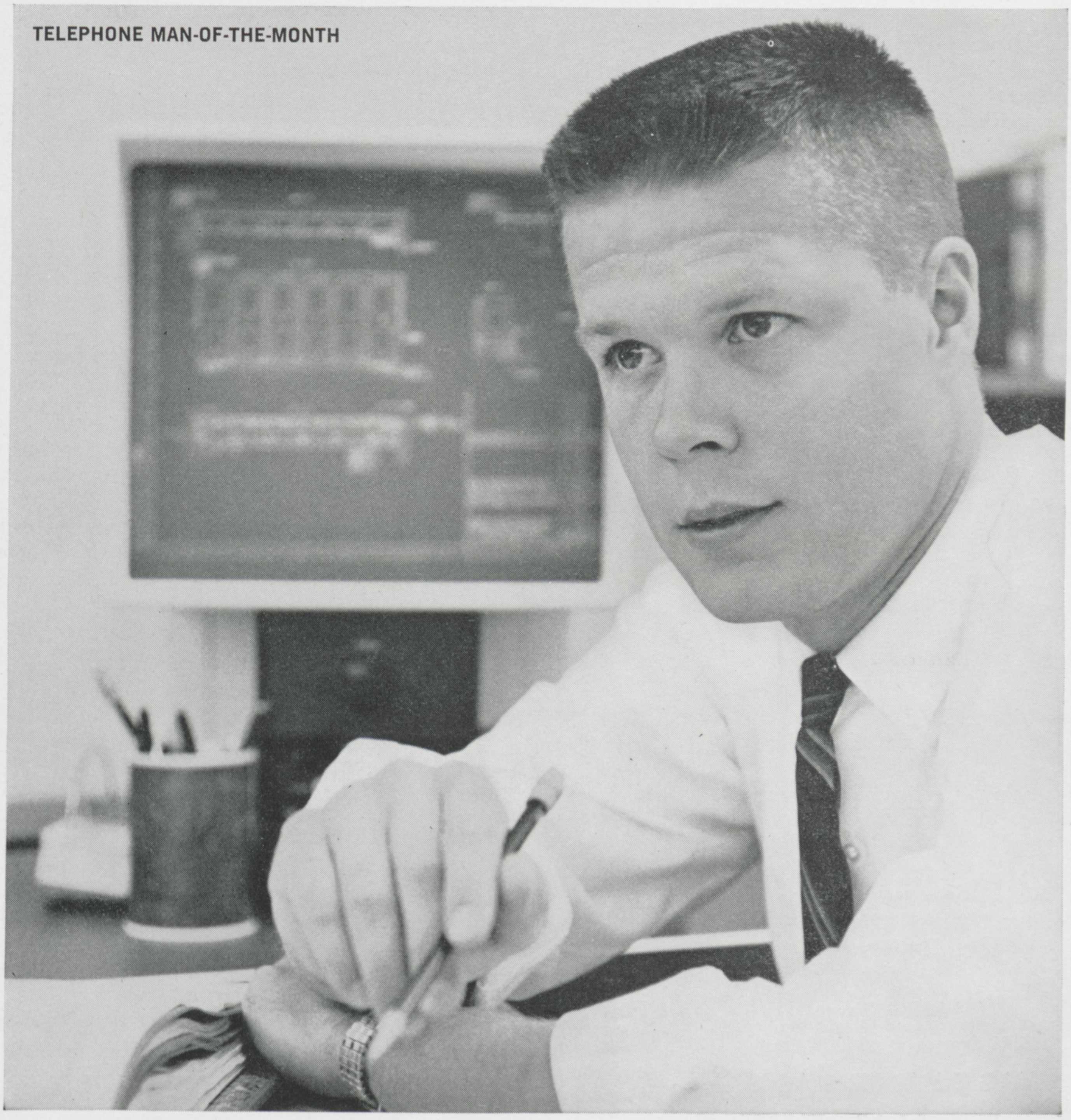
THE BELL TELEPHONE COMPANIES SALUTE: TOM HAMILTON

When the Bell System recently product-tested the new Touch Tone telephone in Findlay, Ohio, they called on Ohio Bell's Tom Hamilton (B.S.E.E., 1960) to coordinate the project. Quite an honor since this was one of two Touch Tone trial areas in the entire country.

This happened on Tom's second assignment with the company. Since completing the project, Tom has joined the Fundamental Planning Engineer's Group. Here he makes engineering economy studies and submits programs for capital expenditures. Tom's performance has earned him the opportunity to attend a special six-month Bell System engineering course in Denver.

Tom Hamilton and other young engineers like him in Bell Telephone Companies throughout the country help bring the finest communications service in the world to the homes and businesses of a growing America.

BELL TELEPHONE COMPANIES



they have an inherent tendency to reject and recycle the liquid droplets, causing damage by erosion to the wheel tip and nozzles. This also applies to solid particles such as carbon dioxide, water ice, dust, or scale from the process piping. The axial flow expander is better suited to handle small quantities of liquid since the liquid particles are not recycled, but pass through and out of the turbine.

Pumps, because of the necessity of moving parts, present a special problem for low temperature applications. Low temperatures destroy the lubricating properties of ordinary lubricants. Workable solutions are self-lubricating materials and ball bearings. Carbon is very suitable as a low temperature lubricant, but it is fragile and expensive. Teflon type plastics have proven quite useful. Centrifugal pumps are used for moving cryogenic materials, at low and medium temperature ranges. High pressures of four thousand to fourteen thousand pounds per square inch can be handled by a reciprocating, single-acting plunger-type pump arranged for immersion in the pumped fluid.

The insulation used for large liquefiers is usually Perlite or an equivalent, operating at essentially atmospheric pressure. Several high quality insulations have been developed which possess much higher insulation properties, but they require a high vacuum for their high insulation properties, and are not conducive to rapid repair of equipment. Perlite, however, may be pumped in and out of the casing around the areas to be insulated. Low temperature piping may be insulated with Foamglas or closed cell plastics.

Liquefied gases existing at temperatures below -150 degrees Fahrenheit are classed as cryogenic liquids. At such extremely low temperatures, materials do not have the same properties, in general, that they have at room temperature. For example, many metals have drastically increased notch sensitivity at low temperatures which causes them to break easily. Thus they are not suited for low temperature work. Nickel alloys are particularly good for low temperature work.

Metals may be classified according to their crystalline structure, and from this their properties at low temperatures may be predicted. Three general classifications are: (1.) Face center cubic lattice. This class shows no loss of ductility at low temperatures (in general). (2.) Body centered cubic lattice. This class of metals sufers a great loss of ductility at low temperatures. (3.) Hexagonal lattie. This class is entirely unsuitable, even at room temperature. Some face centered lattice metals even improve their ductility at low temperature.

According to the Linde Corporation, which has had years of experience in the field of cryogenics handling in the form of liquefied gases, operating problems in crogenic systems can be traced, in general, to faulty design or lack of design information. They have found that for optimum operation, the equipment must be kept clean, free of all types of impurities. Impurities are disastrous to cryogenics systems.

the technic - 1924

Indy - '24'

edited by Bill Royer

What better place is there to be this month than the race track, which is precisely where we go with the "Old Technic". This article, extracted from our December 1924 issue, tells of racing's role in making the 1924 cars so safe and *powerful*(?).

RACING—THE LABORATORY OF THE AUTOMOBILE

Every Science has its Laboratory, and the speedway is that of the Auto—Racing has caused the development of the Auto Engine to its present status.

The average person witnessing an automobile race seldom considers it as anything other than a sporting event which provides a maximum of thrills both to the drivers and to the spectators in the grandstands. Even when the race is over and the layman drives away in a spick and span little coach or roadster, he does not realize the part that racing has played in the development, perfection, and present design of his own car.

Twelve years ago, the entries for the second 500-mile race to be held on the Indianapolis speedway, were as huge of motor and almost as heavy of chassis as a two-ton truck of today.

The motors were bulky, with piston-displacements close to the 600-cu. inch mark and relatively slow in R.P.M. They developed most of their power and car-speed from sheer size.

The tires were huge 37-5 fabrics that were long on cost and ruinousy short on mileage. The pleasure car of that period, for the most part, was even more bulky than its brother of the race track—square lined bodies with high spring suspensions: large wheel and tire diameters—in short, old time battleships on wheels that chugged down the roads at eight miles per gallon of fuel.

But as the manufacturers entered their cars in the various races from year to year, their cars were continually improved owing to experience gained in the greatest of automotive laboratories—the speedways.

The American Automobile Association gradually cut the piston displacement allowed, so that by 1916 the high pitched roar of the 300 inch motor was heard instead of the slower "boom-boom" of the now obsolete five-and six-hundred-inch motors.

The design in pleasure cars was also keeping pace—the tendency was towards smaller cars with smaller engines; and the "light-sixes" of various makes began to appear on the floors of the dealers' salesrooms. Although engines were being cut in size on the race-tracks, the speed averages, contrary to popular prediction, instead of declining, were gradually on the rise.

In 1920, the 183-inch, straight-eight was the marvel of the automotive world in that an eight-in-line motor of "such small size" has hitherto been given up as impracticable.

The motto of the racing-shops had become "build them small and turn 'em fast!" so that many of these motors had speeds in excess of 4000 R.P.M.

The pleasure car manufacturers were quick to pick all the advantages in the newer cars, and many companies made radical changes in motors and chassis design after 1920. In 1921, the A.A.A. announced that the cars for 1923 would be 122 cubic inches or less displacement and that the bodies might be of the one man type.

The first season for these small cars started out with relatively slow averages, but the pace rapidly mounted until this year the late Jimmy Murphy shattered all previous track records in the 1924 race at

(*Continued on page* 18)

" the engineers's psalm "

Verily, I say unto you, marry not an engineer for the engineer is a strange being possessed of many devils; yea, he speaketh eternally in parables, which he calleth "formulas," and he wieldeth a big stick which he calleth a slide rule, and he hath but one Bible—a handbook.

He talketh always of stresses and strains, and without end of Thermodynamics. He showeth always a serious aspect and seemeth not to know how to smile; and he picketh his seat in the car by the springs therein and not by the damsel beside him; neither does he know a waterfall except for its power, nor the sunset except for her specific heat.

Always he carrieth his books with him, and he entertaineth his maiden with steam tables. Verily, though his damsel expecteth chocolates, when he calleth he openeth the packages to disclose samples of iron.

Yea, he holdeth his damsel's hand, but only to measure the friction, and kisses but to test viscosity. For in his eyes shineth a far-away look which is neither love nor longing—but a vain attempt to recall a formula.

There is but one key dear to his heart, and that it the Tau Beta Pi key; and one love letter for which he yearneth, and that an "A"; and when to his damsel he writeth of love and signeth with crosses, mistakes not these symbols for kisses but rather for unknown quantities.

Even as a young boy he pulleth a girl's hair to test its elasticity, but as a man he discovers different devices; for he would count the vibrations of her heart strings and reckon her strength of materials; for he seeketh ever to pursue the scientific investigations, and inscribeth his passion in a formula; and his marriage is a simultaneous equation involving two unknown and yielding diverse answers.

miss technic for may

This month's Miss Technic is Miss Sue Ellen Joyce, a junior at ISC shere she is majoring in dietetics. Miss Joyce is from Vincennes, Indiana and is a member of the Chi Omega sorority. She is 20 years young, weighs 4.1 maunds (Bombay) and has rounded out to an attractive 28.6 chuns-2.1 shakus-1.285 arshins.

(Photography by Andy Breece)

the unisphere

Edited by

Bill Sims

Can a beach ball be fastened to a golf tee and still maintain its beauty, grace and stability? That is what a group of engineers has done in creating Unisphere, an open structured globe, which will loom over the 1964-1965 New York World's Fair.

The Unisphere, which will symbolize the world's past and future in the 1964-1965 New York World's Fair, is unique in the history of monumental architecture. While no more original than the Eiffel Tower at the 1889 Paris Universal Exposition, it did create a giant mental exercise for the team of experts who have turned this idea into reality.

Usually in the design of a twelve story structure, engineering feasibility is determined first. But in this case the basic esthetics were determined, then a way was sought to meet the requirements with sound engineering and good design.

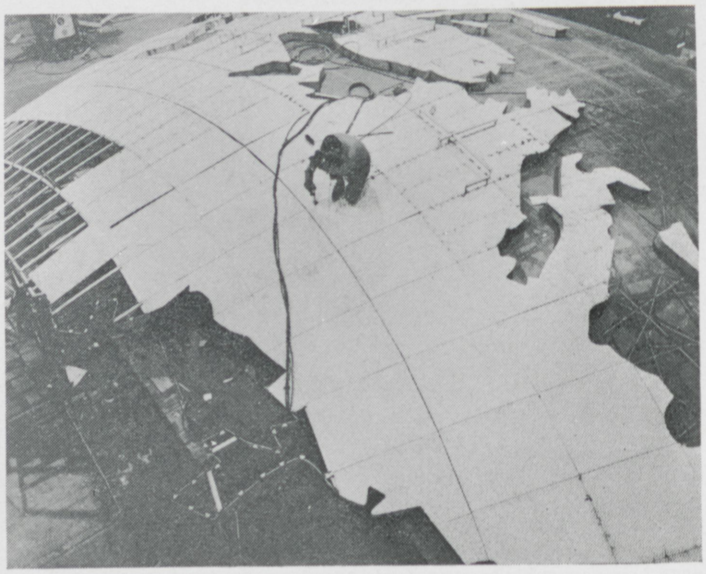
Just what were the requirements? The Unisphere had to be graceful yet grand, light yet massive, solid yet transparent, bright yet diffused. It had to be pleasing to the eye at any hour from dawn to dark, in shadows or sunlight, rain or snow, and at night appear with the same beauty under floodlights.

Further: Unisphere had to be spherical and detail the continents of the earth, where each line performs the work of holding it together. It had to be one-hundred twenty feet in diameter, weigh three-hundred twenty tons, support three orbits weighing three tons each, tilt at a natural angle of twenty-three and one half degrees, and withstand the forces of nature.

Finally: Unisphere had to appear effortless, as if creating it and building it were of no consequence at all.

This meant that over one-thousand five hundred unknown forces had to be solved to determine unit stresses in order to use steel to its maximum. These complex problems were broken down into three separate sections, the largest of which involved six-hundred seventy simultaneous equations.

It is safe to say that a few years ago this particular design of the Uni-



An artist's conception of tht Unisphere as it will appear at the 1964-1965 New York World's Fair. This structure will symbolize both the world's past and future. The past by the ruggedness of its land masses—the future by its very design and the three man-made arbits which encircle it.

sphere would have been impractical because it would have taken in the order of ten years to solve these equations manually. However, today they were solved electronically in only a few weeks.

What did man and computer come up with for answers to these problems?

The base, a mere seventy tons will rise twenty feet above a reflection pool, support a two-hundred fifty ton world ball and also withstand wind loads up to three times the weight of this sphere. Yet its open sculptured nature will convey lightness, grace, and simplicity to viewers.

The next consideration was the structural members of the sphere itself. These meridians and parallels had to appear slender and light yet withstand the weight of the continents and wind turbulences which will whip through the sphere year-round. Curved stainless hollow shapes, eight inches wide and twelve inches deep, highly polished on the outside surface and dull-finished on the other three sides, were chosen for the meridians. The parallels will be curved stainless tubing six to twelve inches in diameter with a dull finish. The members will be butt-welded together.

It was decided that land masses could best be represented by a built up 'layer cake" style lige huge contour maps. It was necessary to expand the earth's contour scale forty-four times to make the elevations distinctive. Each and layer will be five inches thick and represent an elevation change of one-thousand meters or three-thousand two-hundred eighty feet. The land masses will be fabricated in ten by thirty-five foot sections and fastened by hidden bolts to the the meridians and parallels.

The last major problem was that of supporting the three orbits. Simple — just treat them as rims of a bicycle wheel and suspend them with taut high strength stainless steel wires one eighth inch in diameter, radiating from the Unisphere to the orbits. They, of course, will be too small to conflict with the rest of the sphere.

That is Unisphere, which, when the New York World's Fair opens in 1964, will not only represent the world's past and future, but also will stand as a symbol of what American technology and art can achieve when teamed together. May all who view this piece of open sculpture realize that America as a nation has the will, the strength, the patience and the skill to lead the world into the future.

OLD TECHNIC

(Continped from page 13)

Indianapolis by hanging up an average of more than 98 miles an hour.

Gone was the day of the big automobile. The deafening roar and crack of the "old timers" of the racing game had been superseded by the long winding metallic whine of the tiny eight cylindered cars that have broken almost every track-record in the United States —and close on the heels of this comes the new A.A.A. ruling that the cars for 1926 will be 91 cubic inches maximum displacement with a minimum total car weight of 1400 pounds. The automobile world gasps and asks "why?" but the builders of racing cars have built the 122 inch car to point of perfection where there is more speed than the car can use, and the life of the pilot is constantly threatened. Even the board speedways with their almost vertical banking will not permit speeds in excess of 125 miles per hour with any degree of safety or certainty.

The layman is eager to know the useful things learned from racing. Two years ago four-wheel brakes and balloon tires were practically unknown as far as car equipment on stock models was concerned, although four-wheel and front-wheel brakes have been the customary equipment on race cars for several years. Tires such as the 28 x 4 and the 29 x 4½ predecessors to the full-balloon type, were the "tried and true" tire size on the 122-inch cars.

Ignition of the coil-dsitributor type is practically universal equipment, and tests on the speedways by such companies as Delco and Bosch have brought forth an ignition system that is well-nigh fool proof, well standardized, and one which will function under a wide variation in motor and weather conditions.

Carburization has also made some mighty strides: methods of vaporizing and of conducting the gas have been greatly improved. Manifolds are made smoother and shorter—the multiple jet carburetors of various makes have become popular owing to their high efficiency combined with an equal simplicity.

At present the supercharger is proving its worth in the racing-world. This device is used to force the mixture into the cylinders under pressure instead of relying upon the vacuum of the intake stroke.

In present day engines all reciprocating parts are being made lighter; crankshafts are being made heavier and with more main bearings to secure greater rigidity and less motor vibration.

Valve mechanisms are being made simpler and more accessible, while the combustion chambers are being redesigned to increase efficiency. Annular-ball and tapered roller bearings are rapidly crowding out the more inefficient types of axle and transmission bearings, mainly because racing demanded minimum friction from all moving parts. Alloy steels of a more uniform texture, which were used to make axles that were stronger and safer for racing, are now used by motor-car manufacturers to produce a safer and stonger car of no greater weight.

And thus it is seen that we could all find points of connection between racing and the construction of pleasure cars, but even so we annually (and oftener) hear someone's denouncement of racing as a mere dangerous and blood thirsty sport.

We all appreciate the boys who fought for us over seas. We call the men heroes who give their time and lives to finding new ways to combat diseases, but what about those fellows, famous stars or amateurs, who tear around the board and brick ovals at speeds way beyond the hundred-mile mark?

Those fellows are staking their life on some kind of cotter pin, bolt, axle, or steering-arm. Their attitude says, "If I finish safely, the part is good enough for your car; if it breaks, I, and not the public, am the one who'll suffer-"—It's a hard-work game! It's a game where the wind resistance will cut and bruise one's face and lips—where the sun and exhaust line vie with each other to make the heat unbearable— and where the nervous strain and mental fatigue have caused more than one driver to lose control and go crashing end over end, over a retaining wall.

Yes—they do drive for "the sport, the glory, and the gold" but there's another reason. Racing is making your car safer for you!

THE CHANGED FACE OF ENGINEERING

by Jerry Hahn

"When you think of the chances and stumbling, the flashes of insight and the sheer mistakes, that have gone to every discovery since science began! And then to expect to teach in that way."

Many can remember the Dean's admonition at the first meeting of freshmen science and engineering students. "Look at the man on your right, the man on your left! One of these men will not be around in four years." Although it may sound cruel, it is true. Present attrition rates of science and engineering students are close to 50%! Although Professor Step-and-Fetch-It is the worst man on the faculty with two speeds, slow and stop, I sometimes feel that the only group unaware of the problems of education are the students. With this brief introduction, permit me to digress a moment.

Recently the Engineers Council for Professional Development (ECPD) modified its definition of engineering. The present version is,

> "Engineering is the profession in which a knowledge of the mathematical and natural sciences, gained by study, experience, and practice, is applied with judgement to develop ways to utilize economically the materials and forces of nature for the benefit of mankind."

This sounds fine; however, the word knowledge bothers me. It seems that "knowledge" contradicts the broad nature that engineering education is presently working toward. Knowing permits a limited, specific development, while understanding implies a perpetual recognition of the potential for universal development. From the ECPD definition one might be lead to believe that our great research complexes have men and women "collectively" solving the great problems of the universe. I am inclined to believe that there is no such thing as "collective thinking" and "collective knowledge." Knowledge, imagination and all creative thnking are individual processes that can happen only in the lonely mind of one unique, individual human being.

I feel certain that I am dangerously close to that mystical, beguiling creature—creativity. What is creativity? Almost everyone has attempted to define this creature. Popular conception contends that creativity has a basis in originality or a response to a new or unusual position. I submit that this is not sufficient. If "something" is to be called creative it must be adaptable to our present society. Also, the original idea must be expanded so that (in the jargon of network systhesis) it is realizable. It will be many years before we isolate a factor that makes an individual creative. If such a factor exists.

In a few weeks the members of the Class of 1963 will take their places among the statistics of science and engineering graduates. I would ask these graduates to inspect their respective curricula. Does it in any way resemble the program that was listed in the catalog of your alma mater four years ago A year ago, when I made this brief inspection, the result was the same. So it becomes very easy to verify the changes in engineering education. On the new program, could you have done as well as you have? I found it unpleasant to admit, but I don't feel I could. Of course I am

neglecting the better preparation of today's freshmen class; but, there is a cloud of doubt.

I would hope that most engineering students would have some interest in the elite group that they hope to join. This group appears to have a real membership problem in the near future. The number of pledges is decreasing. For the last three years engineering enrollments have declined. A recent survey by the Engineering Manpower Commission of the Engineers Joint Council shows a 2.3% drop in freshmen engineering enrollments from 1962 and a 6% drop in B.S. degrees from 1962.[1] Hence, we can look forward to at least four years of decreased engineering graduates. In this same survey the reported enrollments in mathematics are up 9% and in the physical sciences, up 7%. However, the net result is still a loss of technicaly trained people. These figures become worrisome when we realize that many schools have not been able to fill their freshmen class for the coming year. Not only does this present a serious problem for science and engineering, it also places a serious financial handicap on the institutions involved.

Should we lower admission standards and requirements I fail to see how this will help the problem. However, it does yield an opportunity for the student to exercise his American heritage a bit earlier in life.

At a time when there are more college freshmen than ever before, why have engineering enrollments declined? Perhaps these men and women have had it too easy for so many years that they lack drive, initiative and the desire to excell. There is only one place to lay the blame—Parents. Once the students are in college, I feel, that the problem of motivation rests with the faculty. This is the real challenge of teaching.

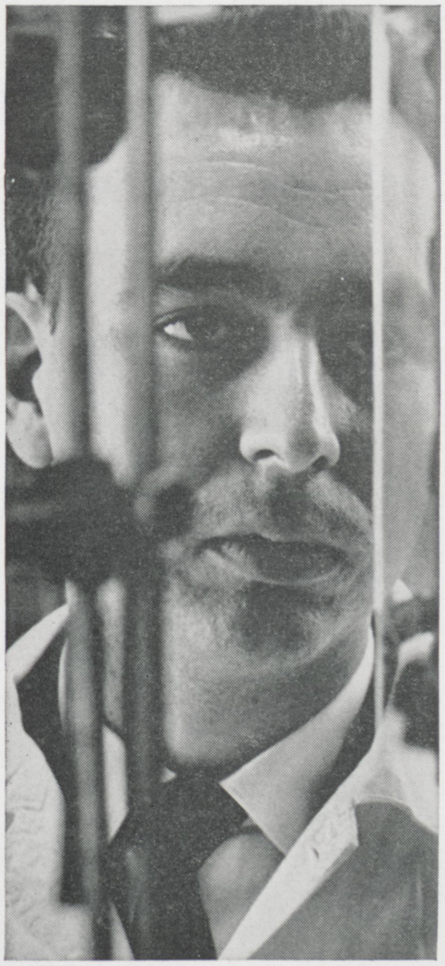
Several reasons may be proposed for the decline in engineering enrollments. First, the increased interest in science. This is a "healthy" reason. It offers a challenge to engineering education. Secondly, there is a growing concern over the roughness of engineering education. Maybe some of us are die hards for hard work; but the title, professional enfineer, means just that to me. We might also cite the decline of applications from disinterested people.

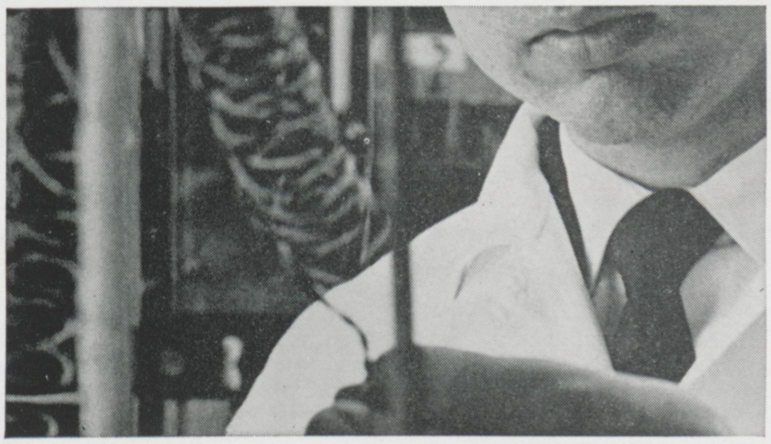
Whatever the reasons are, what can be done to improve the situation? I'm sure I don't know. The answer must come in part from the students themselves. Why did you choose a science or engineering curricula? This is not an easy question to answer.

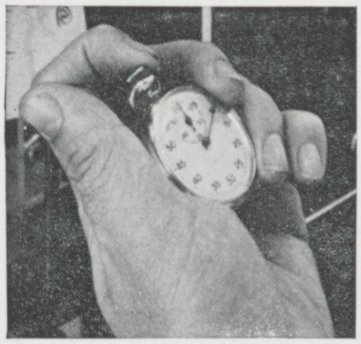
Even though the starting salaries for science and engineering graduates increases every year ($600 per month is common), it seems that a large salary no longer provides suffiicent compensation to lure students. Other graduates are starting to receive roughly comparable payment, when we consider four years of hard work versus .... Before you pat yourself on the back too much, spend a few minutes considering the life of a medical student. We must realize that an increasing number of students enter science and engineering only to discover that they have made an error. Beware, the bright glow of glamour fades around 1 p.m.; however, some can say that it's worth it.

By the time students are juniors and seniors, they must realize "a certain degree" of maturity in their actions and thinking if they are to be successful. These students have an opportunity and duty to help solve the present problems and plan the education of future scientists and engineers.

Here we have another problem. Scientist or Engineer? Throughout the academic world there is a trend to increase the science content of engineering curricula. Dean Gordon Brown of MIT says, "The present widescale activity to increase the science content of engineering curricula, if not skillfully accomplished, can result merely in the teaching of science . . . "[2] I feel that we must adjust our thinking along these lines if engineering understanding is to







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STANDARD

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improve. Before long a student will have to decide in his junior year if he wants a graduate education. Why must we attempt to penalize such men with courses that will not be beneficial? These men should be permitted, if they have shown promise during their first two years, to take science oriented engineering curricula. Require courses in theoretical mechanics instead of applied mechanics, statistical themodynamics instead of engineering thermodynamics plus increased math along the lines of advanced engineering mathematics and complex variables, so essential to electrical engineers. How about the man who is now going on with his formal education. He can't possibly hope to assimilate information about all the present devicess, so let's explain the general principles a little more thoroughly. Alas I can hear the cry already. There is not enough time to do all this in four years and increase the humanization of the engineer. The serious problem of intense emotional stress from these programs will weed out all but the strong. Maybe we are condensing too much into four years. I don't see how a general increase to a five year curricula will help things. A small book, which should be recommended reading for all, holds the answer to this question. Parkinson's First Law states, "Work always expands to fill the available time."

The newest development in science and engineering education is the "core" curriculum. Basically, this program requires a prescribed sequence of foundation courses, not just restricted to the first two years, for all students in the physical sciences, engineering, life sciences and others. This type of program will to some extent help the vast shortage of teachers and at the same time open a new chapter in education.

Although recent technical advances have overshadowed the attempts to introduce better teaching methods and improved curricula, I envision teaching as the most exciting phase of science and engineering. An old timer must have tears in his eyes when he views the changes since the "Grinter Report" (June 1955) [3] and ponders the changes of the coming years.

How does this affect Professor Step-and-Fetch-It? He has the greatest challenge of the 20th century. Perhaps he should use the following as a guide. It is better and more profitable for the student to learn from one who is learning than from one who thinks he knows all there is about his subject.

I would ask your pardon for very free usage of science and engineering and hope you read between the lines to find an engineer who considers the task of pure science with the very few. Engineer, scientist and laymen would do well to consider carefully where our educational processes will lead us in the coming years.

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1. This survey available from Engineering Manpower Commission, 345 E. 47th St., New York 17, New York. Cost 25¢.

2. "Today's Dilemma in Engineering Education," *IRE Transactions on Education*, Vol. E-4, June 1961, p. 48.

3. Removed such courses as woodship, etc. from engineering curricula.

NEED A DATE?

by Will Stratten
Junior Math

The study of radioactive dating was initiated with the advent of the study of geochronology and its associated ideas which were based upon the lead-uranium ratio in granite rocks. This work was started in 1907 by the American physicist, Bertram Boltwood. Resulting from the work of the Curies in the first years of the century, it was found that radioactivity was a function of the element and not the compound. It was discovered that there were radioactive chains which started from large unstable elements, or rather isotopes, which after a number of radioactive disintegrations decayed to a lighter stable isotope of another element. Two prime examples were uranium-238 which led to lead-206, and thorium-323 which decayed to lead-208. It might be noted that lead-206 and lead-208 are called isotopes since they are the same element but differ in the number of neutrons they contain.

It was found that these chains decayed at a steady rate which was unaffected by temperature, pressure, etc. This rate was such that the time it takes exactly half of a certain quantity to decay is constant regardless of the magnitude of this quantity; this time is called the half-life and it is a property of the isotope, i.e., the decay is exponentially decreasing. You may possibly visualize the possibilities. If you could find a radioactive element trapped in "sealed chamber" since the time of the event you want to date; it might be possible to compare the amount of stable end-product to the amount of active substance and then, since the half-life of your active substance is known, the time the "chamber" was sealed can be calculated. It just happens that nature provides us with just such a chamber, namely granite rock. The chamber is sealed and the radioactive substance begins decay when the molten rock solidifies to crystal form.

The situation in nature, however, is far from being such a simplified situation. It may be guessed that such measurements are only general because of impurities, other active materials being present, leakage, etc. A good example to illustrate this would be the experiment by H. V. Ellsworth, a Canadian geologist, who in 1931 analyzed a uranite sample. This sample was composed of 15.5 percent lead, 55.01 per cent uranium, and 12.25 percent thorium. Using one element at a time to check the age of the sample, he reached a value approximately five billion years using the half-life of uranium, and a value of about fourteen billion years using the half-life of thorium. Using a test which set a ratio between lead isotopes he calculated a value of 1722 million years. As can be seen, there is considerable error to overcome before our chronometer will be of much use.

Since World War II great improvements have been made in dating methods. New radioactive chains have been found, and elements with shorter half-lives found to allow a more accurate dating of objects in the pre-million year range. The biggest improvement in this line was the discovery of the radioactive carbon methods developed by E. C. Anderson, W. F. Libby, and others at the University of Chicago.

The reason for this search for a chronometer of the past is inherent in man's nature. The emphasis on the search has increased a great deal since the middle of the nineteenth century when Darwin came forth with his "sacriligeous" theory that man could find out more about himself and the secrets of life by delving into the secrets of the past. This is the major motivating force in the study and developments of radioactive dating. The modern dating methods are major contributions to the anthropologists and ethnologist. Besides the search for the origin of life in our modern "time machine," we ride even farther into the past in search of answers to, "How old is the earth?" or "How old is the uni-

verse?" As a result methods have been invented to check the evolution of geophysical structure, and by testing meteors we can discover more clues in our investigation of the universe. Just how are these tests carried out.

There are a great number of dating methods; but since we've become acquainted, to some extent, with the possibility of crystallized granite, we will use this method as an example. In particular we may consider a test to find the last Appalacian building phase by Alfred O. Nier. He used samarksite, a velvety black, crystalline material taken from the Spinelli Quarry in Glastonbury, Connecticut. The mineral was found to contain both uranium and thorium along with the end-product lead. There was seven percent, three percent, and three tenths of a percent respectively of these materials. The immediate problem was to find out how much lead came from the breakdown of uranium, how much came from the break-down of thorium, and what quantity was present in the crystal immediately after solidifying. It was known that lead-206 was the product of uranium, lead-208, the product of thorium, and lead-204 is the stable form. The first requirement was the separation of these isotopes, which could not be done chemically. They were separated and the quantity of each was estimated by Nier with the use of the mass spectrometer.

Nier made his rough approximation of the materials age, by first assuming that the lead-204 was the only isotope originally present. Using this assumption he compared the quantity of lead-204 to the quantity added. Later he corrected this and assumed that the lead in the original crystal had relative quantities comparable to a natural sample of pure lead in isotopic equilibrium. For example, say you have a 100 gram sample and find 0.0004 gram of lead-204 in it (samarksite). Then you take an amount of naturally occurring lead such that it contains 0.004 gram of lead-204. The natural sample is measured and found to contain 0.9142 gram of lead-208. The samarksite contained 0.9518

gram of lead-208. The difference is 0.0376 gram and, excluding "leakage," is the amount produced by decay of the original thorium. The original thorium can then be computed and since the half-life is known, the time which has elapsed since crystallization can be figured. The samarksite has a built-in check, since the age can be figured using uranium decay, thorium decay, and since the half-lives are different a lead-208 to lead-206 comparison. The results were 255, 254, and 256 million years respectively.

There are many problems inherent in our dating methods as developed to this point, and most of the problems are unsolved to this day. Since man's knowledge of the atom is so limited we cannot consider any chronometer truly trustworthy. Some elements may escape from our "chamber" or the alpha particles which are omitted from the decaying nuclein may strike another nucleus and change it to an active isotope completely strange to the original crystal. Also, there are a great many areas which don't contain such large quantities of active material as mentioned previously. How are these to be dated? Some check is required which can date very small quantities of active material. It was thought that the testing of the presence of helium in the "chamber" would be a good test since each ^{238}U ^{206}Pb breakdown gives off eight alpha particles which are helium nuclei. In the first tests the results seemed to agree with the lead dating but it turned out to be wishful thinking. The agreement was due only to the overlapping of the margins of error. Evidently too much helium escapes. The only material found so far that the test works for, is magnetite. The previous puzzles are minor compared to the problem of there being no "minute hands" on our chronometer. We are unable to tell "what time" things occurred if it happened to be of an order of magnitude less than a million years. That is unless we stick to the old standbys like tree-rings, glacier flow, and sedimentary layers which have considerable error margin themselves.

In the search for more accurate dating methods which would be valid in the period of the last million years, there have been several discoveries; some have been poor, however. Potassium decay to calcium and argon was used because of the shorter half-life but is a relatively poor "clock" since the value of the half-life is not too definite. The rubidium-strontium decay (half-life, 58 billion years) was also discovered; but although it is a test which can be used over considerable geographical area because of the rubidium content in lithium mica, it is not a very accurate device. The ocean sediments have proven to be a most accurate recording device of surface climate and temperatures. The micro-organisms settle to the bottom and take along with them thorium-230 from the water (half-life, 8300 years). The thorium-uranium ratio decreases with depth and when a core is extracted from the ocean floor, the age of the various depths can be compared with the types of organisms present. The most valuable discovery in radioactive dating, however, is the carbon-14 test.

The radio-carbon dating started in a study of cosmic rays and their effects on the earth. This was no way to predict the effect of the collisions of these rays in the billion-electron volt range. In 1939, Serge Korff of New York University discovered that the cosmic rays produced secondary neutrons in their collisions with air molecules at high altitudes. The neutrons were in the million-electrovolt range and tests *could* be made on these. In fact, the results of such tests were already known. When the neutron struck a nitrogen-14 atom it released a proton and the end product was radioactive carbon-14. The amount of carbon-14 on the surface is at an equilibrium over the surface of the earth. Living matter composed of organic molecules is also at this equilibrium. When the organic material is buried, it is no longer bombarded by these neutrons and the amount of carbon-14 decays exponentially. Since the half-life of carbon-14 is known the time elapsed since the matter was buried can be calculated.

library notes

by Carson Bennett

"His work is to be a factor and trader for helps to learning, and a treasurer to keep them, and a dispenser to apply them to use or see them well used, or at least not abused."

John Dury: Letter to William Dugard, 1649, (Dury was deputy keeper of the king's metals and library.)

We usually try to bring you some information about the new books we are getting in our library; however, after finding an article taken from The Gazette (Terre Haute), December 15, 1900, we thought we might step back into the past for a bit. Quoting from the article:

"Hidden away in dark corners or gathering dust in some obscure nook, there are in many libraries curous old volumes that, through age or association, often prove of deep interest to him who seeks by their aid to catch some glimpse of the past.

"The very thought of old books brings to mind more or less romantic visions of bygone days . . .

"There are a number of interesting volumes in the Rose Polytechnic library, many of them being the gift of the late Josephus Collett. The oldest of these, and likewise the most ancient of any of the volumes by Flavius Vegetius Renati, 'Illustrating the Epitome of the Art of War', as the title reads. This vellum bound, time stained volume almost falling apart in pieces from age, was published in Erfurt in 1511 . . .

"Next in importance is a first edition of Pope's 'Shakespeare' in six volumes, printed for Jacob Tousen, London, 1723.

The first edition of Bishop Burnet's 'History of His Owne Time' in two volumes, the first volume published in 1724, the second ten years later, is interesting to the student of history. The good Bishop was anything but retiring and while he deals with the great in his history, his own name appears with unusual frequency.

"Other books worthy of note in the Polytechnic library are:

The second edition of 'The Dictionary Historical and Critical' of Mr. Peter Bayles, London, 1734."

The article continues at some length; however, we especially wanted to mention this part because the library still has on its shelves three of the four items mentioned. We regret that somewhere along the line the first book mentioned has been disposed of; however, we do have other interesting old volumes stored on our shelves.

Some of our current acquisitons are:

ADVENTURE UNDERGROUND,
by Joseph Gies. Doubleday, 1962.

In dramatic stories of the greatest tunnels ever built, the author has captured the flavor and excitement of these engineering feats and far thinking men whose hopes and lives made possible their existence. Here is the story of the English Channel project, dating back to the time of

Napoleon and still in the planning stage after 150 years; the progress in tunnel building from the time of the Romans — who used fire and water to break through rock — to the introduction of compressed air and the tunneling sheld. The conquest of rock and the mountains is only part of the story. The men who risked their lives, capital, and engineering reputations to defend ideas they believed in are the real heroes of Adventure Underground.

DAYS OF GOLD by Irwin R. Blacker. World Publishing, 1961.

This is a novel of the Yukon country. Mr. Blacker, who himself traveled in winter along the gold creeks that flow full into the Klondiks and the Yukon, has captured both the harshness and the beauty of that remote corner of the continent against which he has set his story.

THE GREAT ASCENT by Robert L. Heilbroner. Harper & Row, 1963.

In this sober and yet exhilarating book, the author takes a hard look at the worldwide problem of underdevelopment and urges a radical rethinking of our attitude toward it. Mr. Heilbroner asks "What is the missing ingredient in the American viewpoint of development?" He continually emphasizes, that economic development comes to underdeveloped nations "not as the culmination of long process of social evolution, but as a discontinuous jump from one social system to another, radically dissimilar one." "It is not only wrong, but dangerously wrong," he warns, "to picture economic development as a long, invigorating climb from achievement to achievement . . . it is better imagined as a gigantic social earthquake." Ths book offers an important contribution to the thinking of our times.

IMAGES OF TRUTH, by Glenway Wescott. Harper & Row, 1962.

One of our most eminent novelists brings vigorous intelligence to bear on the life work of six fellow novelists—all masters of the art of fiction. They are: Katherine Anne Porter, Thornton Wilder, Colette, Somerset Maugham, Thomas Mann and Isak Dinesen. Here the mysteries of creative writing are explored.

MICROECONOMICS AND THE SPACE ECONOMY, by M. L. Greenhut. Scott Foresman & Co., 1963.

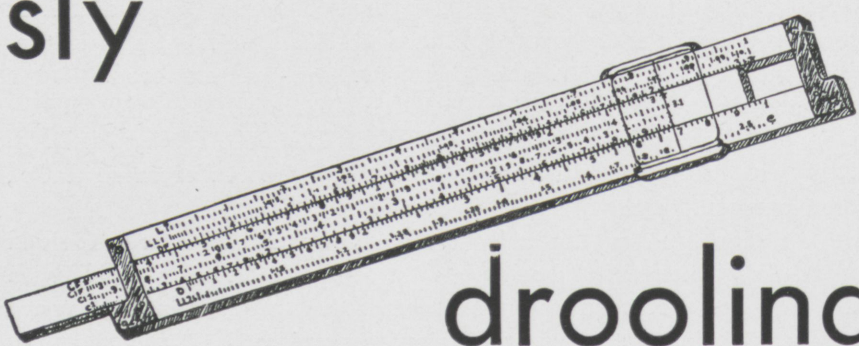
Here you will find a book divided into three parts: the first deals with concepts and methodology of space microeconomics; the second with product pricing, factor pricing, and space market efficiency; the last deals with equilibrium and social policy.

RING OF BRIGHT WATER, by Gavin Maxwell. Dutton, 1962.

In this beautfully written, thoroughly delightful book, Gavin Maxwell gives a superb account of his life in a lonely cottage on the northwest coast of Scotland. If you have a desire to travel, you will most certainly enjoy reading "Ring of Bright Water."

Quoting Shakespeare: "Come, and take choice of all my library, And so beguile thy sorrow."

sly



droolings

Stolen by Gerrand Mellinger, Jr. E.E.

The plumber was introducing his new assistant to the nicities of the trade.

"Above all," he said. "You must exercise politeness and tact."

The assistant allowed as how he understood about politeness but, "What about tact?"

"Well, son," he replied, "It's this way. If you walk into a bathroom to fix a pipe and a young lady is in the tub, you close the door and say, 'beg your pardon', sir!' The 'Beg your pardon' is politeness. The 'sir' - that's tact."

* * * * *

What is conscience?

Conscience is the thing that hurts when everything else feels good!

* * * * *

Angry father: "What do you mean by bringing my daughter home at this hour of the morning?"

Engineer: "Have to be in class by eight."

* * * * *

"It's quite simple," explained one of the seniors in E.E., "to hook up an electric power circuit. We merely fasten leads to the terminals and pull the switch. If the motor runs, we take our readings. If it smokes we sneak it back and get another one."

* * * * *

There's a new gadget that keeps the inside of your car quiet. It fits tightly over her mouth.

A kindhearted gentleman saw a little boy trying to reach a doorbell. He rang the bell for him, then asked, "What now, my little man?"

"Run like hell," said the little boy. "That's what I'm going to do."

* * * * *

In Russia you can say anything you want to—once.

* * * * *

During a grouse hunt one sportsman was shooting at a clump of trees near a stone wall. Suddenly an angry face popped over the top of the wall. "Curse you, you almost hit my wife!!"

"Did I?" cried the man, "I'm terribly sorry — have a shot at mine over there."

* * * * *

He: My wife worships me.

Him: Is that so?

He: Yeah, she places burnt offerings before me every evening.

* * * * *

"I don't like Bill," confined a coed to her roommate. "He knows to many naughty songs."

"Does he sing them to you?" asked her friend.

"Well, no — but he whistles them."

* * * * *

We point with pride to the purity of the white space between our jokes.

This kind of engineer designs jobs instead of things

Once upon a time there was a creature known to jokesmiths as "the efficiency expert." When he wasn't being laughed at, he was being hated. Kodak felt sorry for the poor guy and hoped that in time he could be developed into an honored, weight-pulling professional. That was long ago.

We were then and are much more today a very highly diversified manufacturer. We need mechanical, electrical, chemical, electronic, optical, etc., etc. engineers to design equipment and processes and products for our many kinds of plants, and make it all work. But all the inanimate objects they mastermind eventually have to link up with *people* in some fashion or other—the people who work in the plants, the people who manage the plants, and the people who buy the products. That's why we need "industrial engineers."

A Kodak industrial engineer learns mathematical model-building and Monte Carlo computer techniques. He uses the photographic techniques that we urge upon other manufacturing companies. He collaborates with medicos in physiological measurements, with architects, with sales executives, with manufacturing executives, with his boss (G. H. Gustat, behind the desk above, one of the Fellows of the American Institute of Industrial Engineers). He starts fast. Don Wagner (M.S.I.E., Northwestern '61) had 4 dissimilar projects going the day the above picture was sneaked. He is not atypical. *Want to be one?*

Kodak

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How Industry Tempers Theory with Practice to Get Good Design

An Interview with G.E.'s F. K. McCune, Vice President, Engineering

As Vice President—Engineering, Francis K. McCune is charged with ensuring the effective development, use and direction of General Electric's engineering talent. Mr. McCune holds a degree in electrical engineering and began his career with the Company as a student engineer.

For complete information on opportunities for engineers at General Electric, write to: Personalized Career Planning, General Electric Company, Section 699-07, Schenectady 5, N. Y.

Q. Mr. McCune, how do you define engineering design?

A. First let's look at what engineering really is. The National Society of Professional Engineers calls it "the creation of technical things and services useful to man." I would paraphrase that to add an industry emphasis: engineering is linking an *ability to do* with specific customer *needs and wants*. The link is an engineering design of a useful product or service.

Q. In the light of this definition, how can the young engineer prepare himself for industry?

A. In college he should absorb as much theory as possible and begin to develop certain attitudes that will help him later in his profession. The raw material for a design, information, flows from three general funds: Scientific Knowledge of Nature; Engineering Technology; and what I call simply Other Relevant Information. Academic training places heavy emphasis on the first two areas, as it should. Engineers in industry draw heavily on theorems, codified information, and significant recorded experience basic to engineering disciplines taught in college. The undergraduate must become knowledgeable in these areas and skilled in the ways of using this information, because he will have little time to learn this after graduation. He also must develop a responsive attitude toward the third fund.

Q. As you say, we learn theory in college, but where do we get the "Other Relevant Information"—the third fund you mentioned?

A. This knowledge is obtained for the most part by actually doing engineering work. This is information that *must* be applied to a design to make sure that it not only works, but that it also meets the needs and wants that prompted its consideration in the first place. For example, we can design refrigerators, turbines, computers, or missile guidance systems using only information from the first two funds of knowledge—heat flow, vibration, electronic theory, etc.—and they will work! But what about cost, reliability, appearance, size—will the prospective customer buy them? The answers to these important design questions are to be found in the third fund; for example the information to determine optimum temperature ranges, to provide the features that appeal to users, or to select the best manufacturing processes. In college you can precondition yourself to seek and accept this sort of information, but only experience in industry can give you specific knowledge applicable to a given product.

Q. Could you suggest other helpful attitudes we might develop?

A. Remember, industry exists to serve the needs and wants of the market place, and the reasons for doing things a certain way arise from the whole spread of conditions which a given design has to satisfy. Learn how to enter into good working relationships with people. Much of the Other Relevant Information can be picked up only from others. Also train yourself to be alert and open-minded about your professional interests. In industry you'll be expected to learn quickly, keep abreast in your field, and to grow from assignment to assignment. Industry will give you the opportunity. Your inherent abilities and attitudes will largely decide your progress.

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