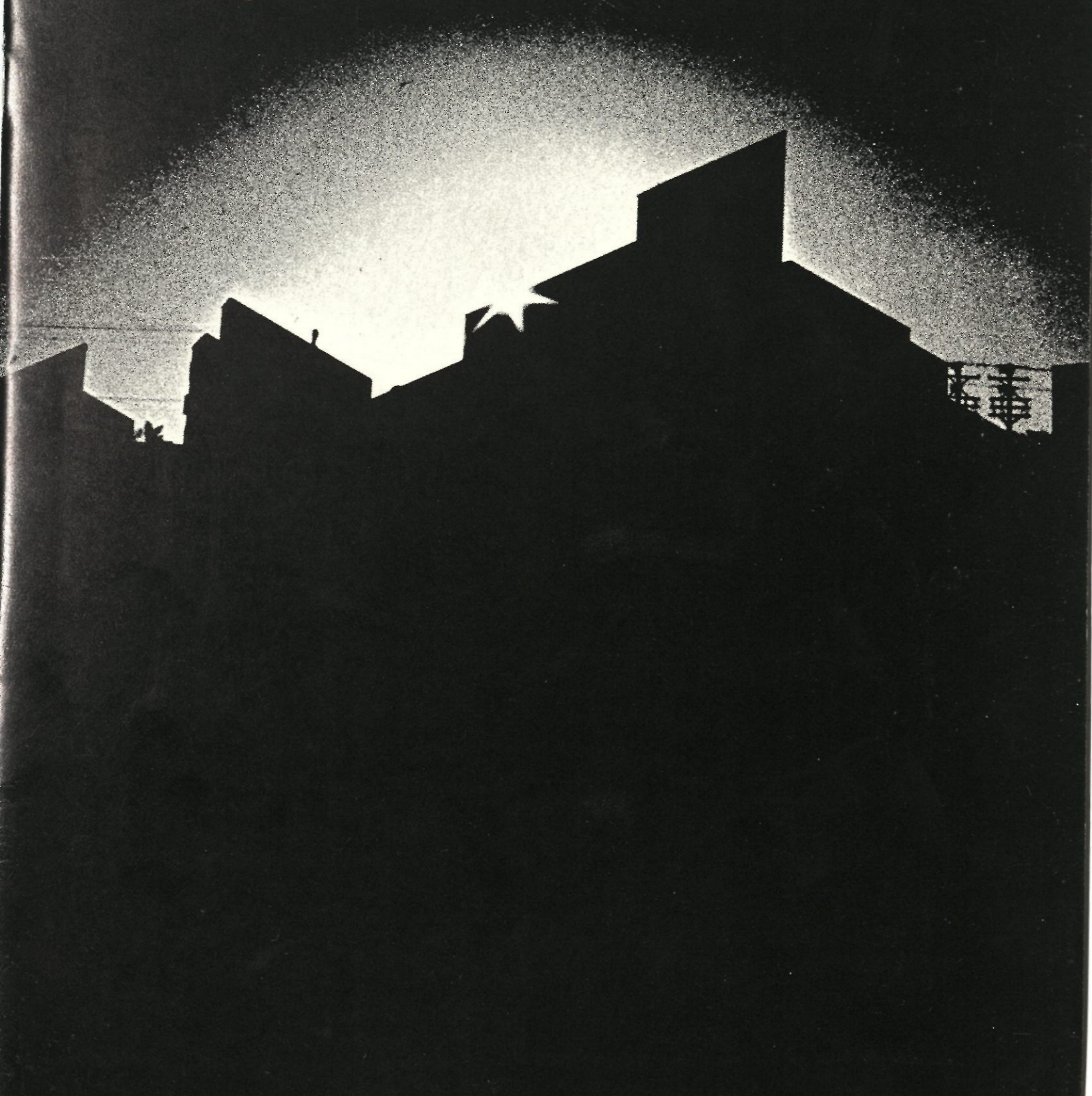


# Colorado Engineer



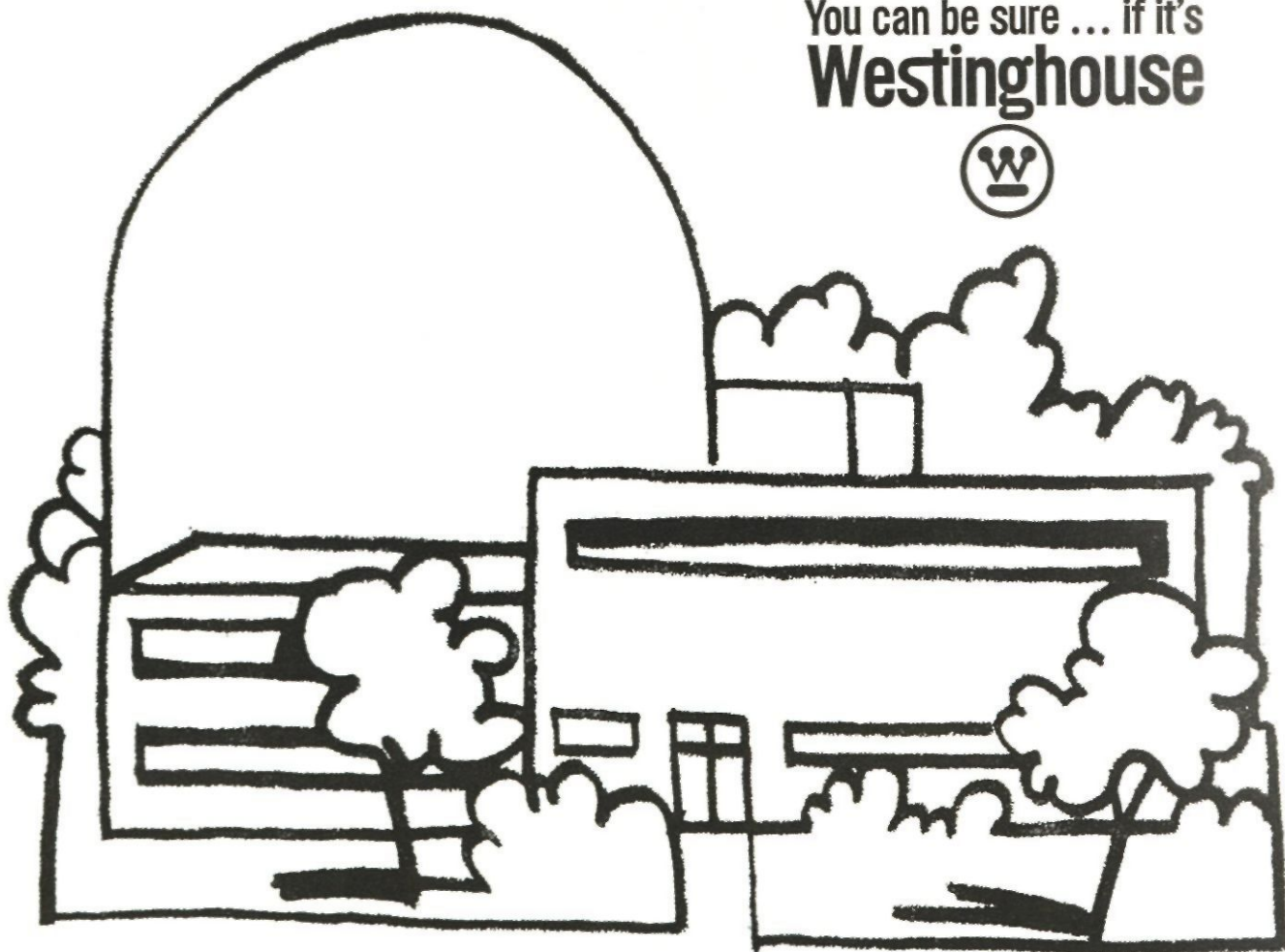
May 1972

Member ECMA

**Who's the No. 2 maker  
of nuclear powerplants?  
It isn't Westinghouse.  
You bet we're hiring.**

If you can't wait for the recruiter,  
write today to George Garvey,  
Westinghouse Education Center,  
Pittsburgh, Pa. 15221. An equal  
opportunity employer.

**You can be sure ... if it's  
Westinghouse**





"My husband, Eugene, is a Lieutenant-Commander in the Navy. He's been a prisoner in Vietnam for 4 years. They're bargaining to get the prisoners released. But what I want to know... is he still alive? Is he well? I can't find out. Hanoi won't tell our government. Hanoi won't tell me."

## There need be no "bargaining table" when the plea is for humane treatment of prisoners of war.

**T**HE prisoner-of-war issue is complex and confusing. It is loaded with political overtones and emotional tension.

But one side of the prisoner-of-war issue is simple. That's the part which deals with the condition of prisoners.

Who are they? Where are they? How are they?

Those are the questions the families of American prisoners want answered. Those are the questions the conscience of the world wants answered...now.

Of course, they want the war to end and the prisoners of war to be released as soon as possible.

But meanwhile there is no need for Hanoi and its allies to delay

even a day in answering this plea:

Admit official neutral observers into the prison camps in North Vietnam, South Vietnam, Cambodia and Laos, where Americans are being held in secret captivity.

Assure the world, through these neutral observers, that American prisoners are being decently and humanely treated, according to the standards of civilized nations.

Hanoi can do this without bargaining, even without consultation.

By opening the prisons now to official neutral observers, Hanoi would earn the gratitude of millions of Americans and find new stature in the eyes of the world.

We ask and pray they will.

**SUPPORT  
OUR PLEA  
TO HANOI  
AND ITS ALLIES:**

Clear away the doubts —  
Open your prison camps to  
neutral observers...  
now!

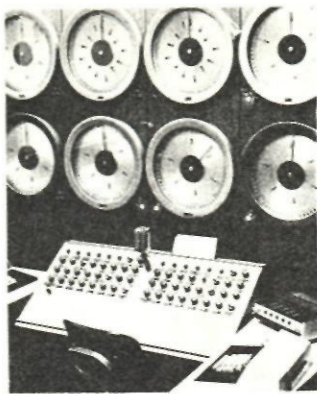
We ask no more than we give. All American and South Vietnamese prison camps are inspected regularly by official neutral observers — The International Committee of the Red Cross.

✚ American Red Cross

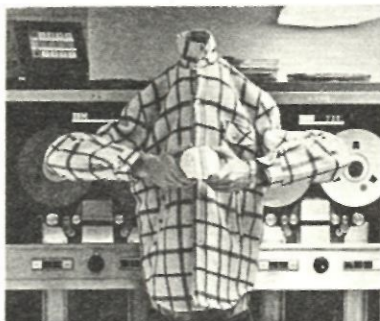
National League of Families of American Prisoners and Missing in Southeast Asia.

1608 "K" Street, N.W., Washington, D.C. 20006

Advertising contributed for the public good 

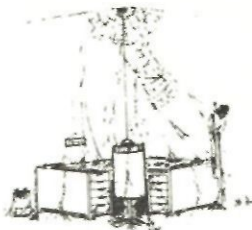


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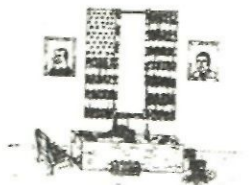
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### Prof's Corner



### Editor's Desk

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The contents of the Colorado Engineer is published by the students of the University of Colorado, College of Engineering, four times per academic year in October, December, February, and April. No part of this magazine may be reproduced without the express written consent of the editor. Entered as second-class matter March 9 1916, at the Post Office at Boulder, Colorado, under the Act of March 3, 1879. Subscriptions: Controlled free distribution to undergraduate students in the College of Engineering: Otherwise \$2.00 per year. \$5.00 for three years. General Office: Engineering Center, OT1-7, University of Colorado, Boulder, Colorado. Publishers Representative—Littell-Murray-Barnhill, Inc., 369 Lexington Avenue, New York 17, N.Y., and 737 North Michigan Avenue, Chicago 11, Illinois . . .

# Colorado Engineer

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VOLUME SIXTY-EIGHT

NUMBER 4

MAY 1972

MEMBER ECMA

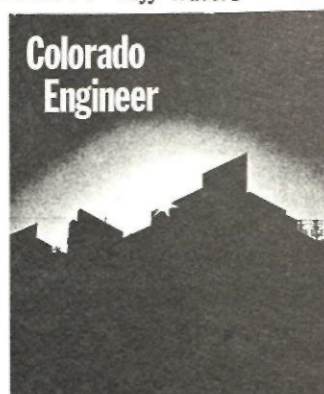
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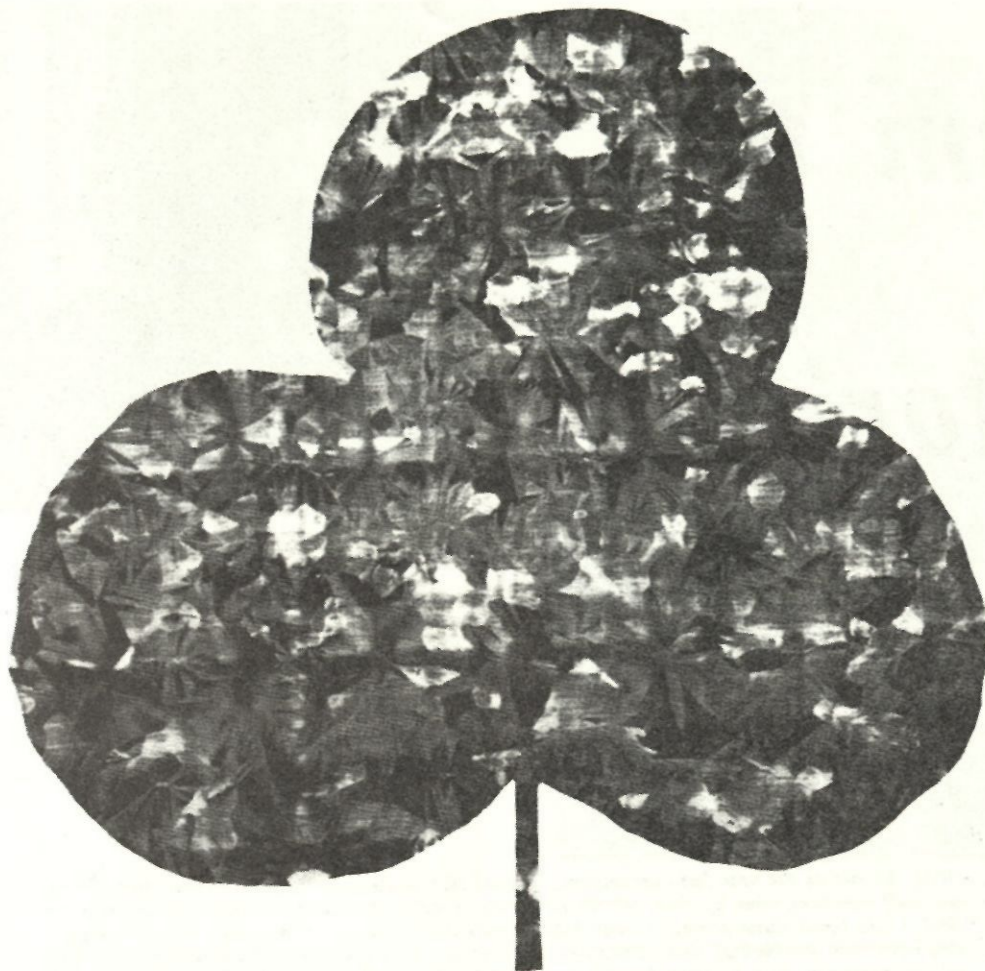
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**About the Cover:** Sunrise! This month's cover depicts a spring dawn behind our "Concrete Castle", with the first gleams of the sun's rays just breaking beyond the main tower. The air is fresh, the sky clear, and the birds sing; soon a new crop of scientific talent will emerge into the "real world" to take their place among the builders of America. Let us hope their accomplishments will uphold our proud tradition, and be in the service of mankind. Photo by Gary Pfiefer





## How FLOWERS OF ZINC guard steel against rust for 20 years and more

The myriad of shining zinc "petals," which galvanizing deposits on steel, form both a shield and an "electric fence" against rust. □ The layer of zinc protects first as a mechanical barrier which completely covers the steel to seal out corrosion's attack. Zinc's secondary defense is called upon when the protective coating is scratched, gouged or worn through to the steel itself. Then, an electrochemical current of galvanic action fences these gaps and the zinc slowly sacrifices itself as it continues to protect the steel. This action takes place because, in the galvanic series, zinc is less noble than steel and will corrode sacrificially... fighting a stubborn delaying action against corrosion's attack. □ No other material provides the combination of strength, corrosion-resistance and economy found in galvanized steel. That's why it's

so widely used in guard rail, bridges, transmission towers, reinforcing rods, automobiles and many other industrial applications.



Galvanized steel guard rail on the New Jersey Turnpike has a record of no passenger vehicle breakthrough and no maintenance after ten years.

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# *From the Editor's Desk*



*(With the end of the year fast approaching, I would like to take this opportunity to thank all of our staff members, who, by their efforts, have helped make this magazine one of the finest in its field. I also thank those professors who helped make such a success of this year's "Prof's Corner", and hope that this type of communication can continue. It is with pleasure that I turn the future of the magazine over to Dave Slusher, next year's editor and one of the most capable minds available. I have no doubt that he will continue and expand our present high achievement levels. Also, all persons interested in joining the staff next year please feel free to contact Dave or me for any questions you may have. To Dave and next year's staff: BEST OF LUCK!)*

## WHY BE A SLOB?

It has been said that there are two classes of people in this world: those who express sincere appreciation for a job well done, and those who are incontrovertible slob. No doubt we all have had those "professors" whose only mark of distinction was their superior stupidity as teachers, their delight in giving "killer" exams (i.e., designed to trick and confuse), and their fondness for talking to themselves in unintelligible equations (which they dare to call a lecture). In cases like these the griping is loud and clear, and rightfully so. But how many of us ever stop to *thank* a professor worthy of the name? One who, for instance, really *teaches*, inspires, shows concern for students, is receptive to feedback, is relevant and understandable, and gives a "fair shake" in exams and grading. Or don't we even give a damn?

In complaining, we show an awareness of what we *want*; in expressing appreciation we show we are aware of what we have *received* and, intelligent enough to recognize its worth.

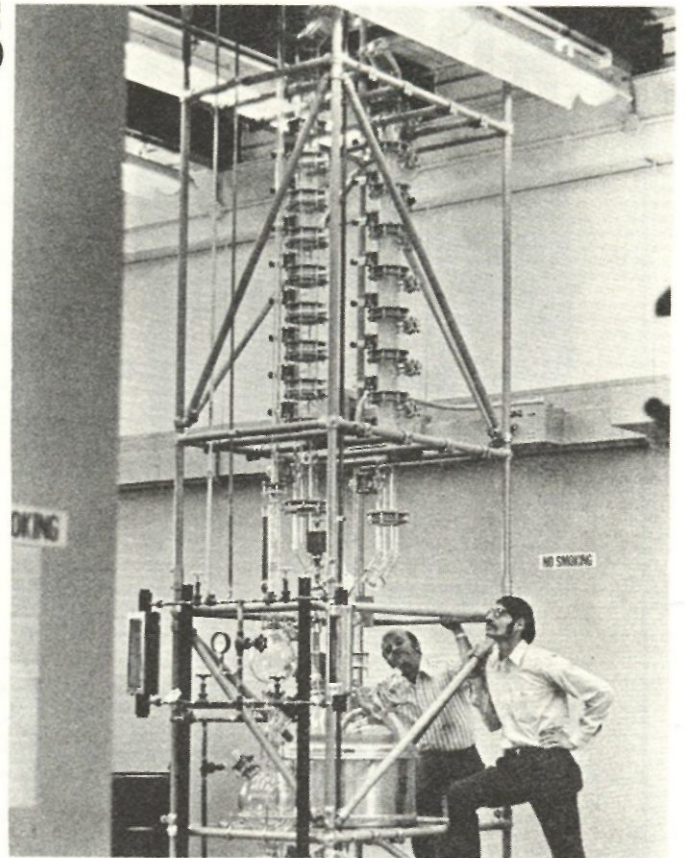
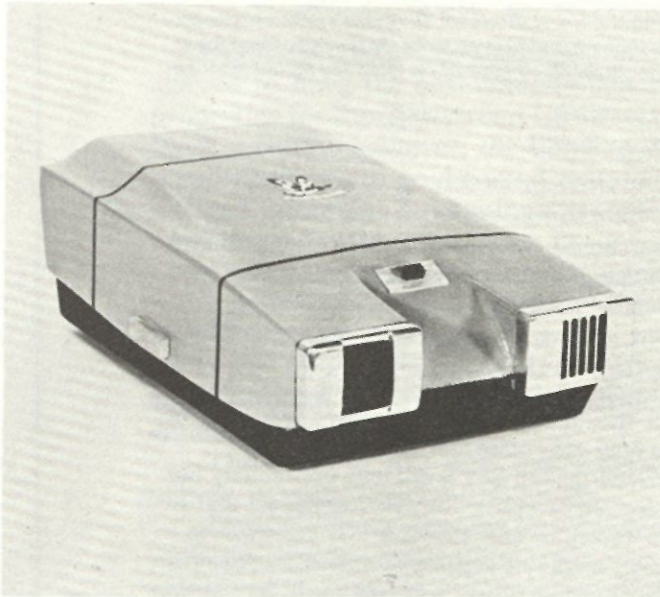
We all seek recognition for honest, successful effort put forth, so by the same token, it is also up to us to *give* recognition to those who have really helped *us* along the way. With this in mind, some of us (hopefully) will take the effort to *thank* those profs who have helped provide us with an uplifting educational experience, and some of us, of course, will remain slob. Where do you care to rank?

*Ron A. Fattor*

# TECH TIDBITS

"But Harry, wouldn't it just be easier to *buy* a bottle of whiskey?"

All-glass construction of a dual-purpose distillation tower at the University of Cincinnati allows students to watch each step in the process as it happens. Manufactured by Corning Glass Works, the Pyrex brand glass unit features a six-foot high packed column and a separate bubble cap column and related equipment. The tower is one of six scaled-down chemical process teaching units made by Corning for use in university chemical engineering laboratories.



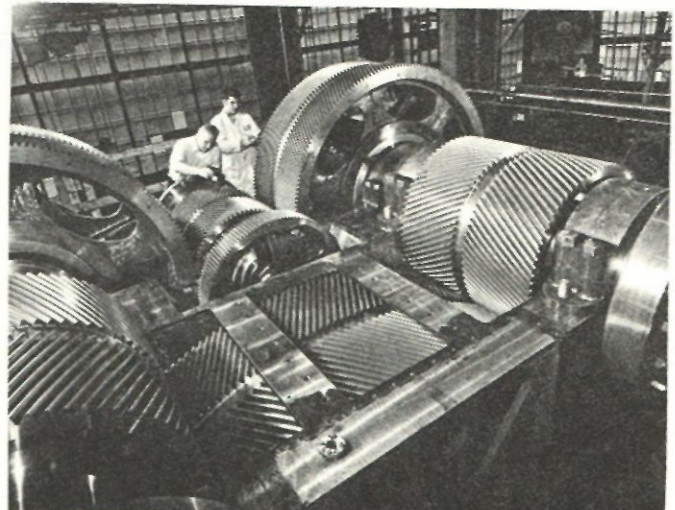
For the man that has everything: A bird plucking machine.

A totally new device that quickly and gently removes feathers from all types of game birds is now available. Called Duck-A-Minit, the new machine has a unique design that permits feather removal with no bruising of the bird, no tearing of the skin, and without using water or wax. The device utilizes two rotating rubber rollers that rapidly open and close to simulate a hand plucking action and a soft rubber roller to remove down from ducks and geese. A 1/4 horsepower motor drives the plucking heads and an independent high-volume vacuum motor is used to collect the feathers, which are deposited in a removable container so there is no mess to clean up. Size: 31" long, 15" wide, 8" deep, weight 50 lbs. Price: \$229.00. Produced by: HAGEMAN CO., 102 5th Street, Arbuckle, California. For those of you who like to be unique in gift giving, this is the ideal choice and is an excellent example of "sportsman engineering!"

"Amazing what you can build with these old Erector-sets!"

This giant gear drive, only partially visible in this picture, may be the largest enclosed gear drive ever built. Designed and manufactured by the Falk Corporation, Milwaukee-based subsidiary of Sundstrand Corporation, the completely assembled unit will measure 22½ ft long by 21½ ft wide by 20 ft high and will weigh 288 tons. The main bull gear (top visible in center foreground) is more than 14 ft in diameter and is over 4 ft wide.

With an input speed of 60 rpm from a hydraulic turbine, this speed increaser will provide 33,800 horsepower at 514 rpm to drive a generator producing approximately 20,000 KW. Falk, as a subcontractor to Allis-Chalmers Corporation, Hydro Turbine Division, York, Pennsylvania, is furnishing eight such drives for the Arkansas River Project being constructed by the U.S. Army Corps of Engineers.



# PROF'S CORNER

By Dr. Jerold H. Krenz



*This month, we are proud to present one of C.U.'s true engineer-philosophers—Dr. Jerrold H. Krenz, head of the Engineering Honors dept. and professor of electrical engineering. Dr. Krenz received his Ph.D. in atomic physics from Stanford and is deeply concerned with the sociological implications of engineering technology. He is especially interested in the work of Jay W. Forrester, concerning World Dynamics (mathematically modeling the world's political, technical, and social parameters to give interaction curves and predict optimum levels of usage). Dr. Krenz has also taught in the Middle East (1967-68 school year) and has attended many international conferences. (He is an avid student of philosophy and political science). However, Dr. Krenz's primary concern (which he stresses to point out) is teaching and relating to students and helping make the process of learning as smooth as possible. His comments in this issue are "relevant" in the truest sense of the word and should provoke many questions for engineers.*

Our goals and values are increasingly being questioned by concerned students and faculty throughout the university community. Very often, questions concerning the meaning of life are raised. Often underlying these questions is the profound doubt that a purpose does exist.

Many past values and goals associated with the process of industrialization are obviously outdated by our modern post-industrial society. Technology per se, that is, the technological imperative that served the initial process of industrialization, is clearly outmoded. Simply because something can be done is no reason it should be done. A thorough evaluation of technological needs is necessary for technology to fully serve mankind.

Within the United States, at least, we have decided that an SST is not only unnecessary but that it might also be a detriment to society. We decided by only a very narrow margin that an ABM system was desirable. Present debates over projected cost increases may yet result in a reversal of this decision. Engineers, it would seem, should be capable of demonstrating their technical virtuosity in more productive endeavors. The three billion dollar electronic battlefield being used in Laos and Cambodia can hardly be considered an achievement that its designers can take much pride in.

Science and technology are not neutral in their societal impact. As for a lack of direction, Teilhard de Chardin (*The Phenomenon of Man*) summed up our present predicament as follows:

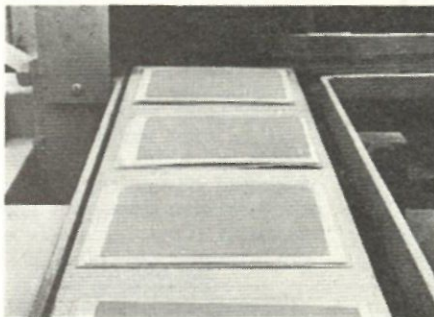
"Science in its development — and even, mankind in its march — is marking time at this moment, because men's minds are reluctant to recognize that evolution has a precise orientation and a privileged axis. Weakened by this fundamental doubt, the forces of research are scattered, and there is no determination to build the earth."

It is not that complex and challenging problems do not exist. Indeed, present problems dealing with cities and world development far outweigh in complexity the Apollo program. We are presently dealing with very sophisticated technological networks whose solutions are going to require every bit of human ingenuity that we can muster.

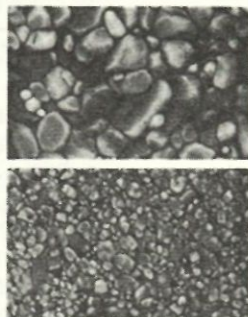
Unfortunately, a fundamental understanding of industrialization is lacking. Without an understanding of the process by which the developed third of the world has reached its present status, it is no wonder that we have been unable to offer much significant technical assistance to developing nations or understand many of the crises within the United States. In short, despite our amazing technological achievements, we are still floundering.

*Continued on page 15*

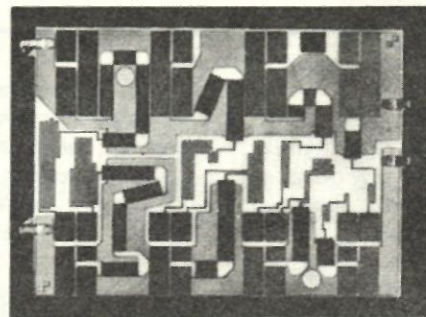
# WESTERN ELECTRIC REPORTS



1500° C furnace was specially designed to fire these new substrates. The relatively low temperature results in smooth substrate surfaces for practically fault-free thin film bonding.



Electron micrographs show the great difference in grain size between new ceramic material (lower) and the previous material (upper).



Thin film integrated circuit shown here is part of a resistor network. It is one of many that benefit from the improved substrate. Metal leads on sides are bonded by thermocompression to tantalum nitride resistor film.

## Smoothing the way for perfect thin film bonding.

Aluminum oxide, or alumina, is considered to have the best combination of properties for thin film circuit substrates. Until recently, however, the bonding of metal elements to gold-coated tantalum nitride resistor film on alumina was somewhat unpredictable.

Now, an advance at Western Electric has made it possible to get practically fault-free bonding of these materials.

This new perfection in bonding came through the development of finer grained alumina substrates.

The process has four basic steps: milling, casting, punching and firing.

During milling, alumina is combined with magnesium oxide, trichlorethylene, ethanol and a unique deflocculant. For 24 hours, this mixture is rotated in a ball mill. In a second 24-hour period, plasticizers and a binder are included.

The deflocculant plays a major role by dissipating the attraction forces that exist between the highly active alumina particles. This prevents thickening, which would ordinarily make an active alumina mixture unworkable.

The 48 hours of milling is followed by casting. When the material comes off the casting line, it is in the form of a flexible polymer/alumina tape, dry enough to be cut into easily handled sections.

After casting, a punch press cuts the material into the desired rectangles or

other shapes. Holes can be punched at the same time.

Finally, because of the use of active alumina, the material is fired at an unusually low temperature which results in smooth substrate surfaces for reliable thin film bonding. The finished substrate is then ready for the various processes of thin film circuit production.

In developing this new process, engineers at Western Electric's Engineering Research Center worked together with engineers at the Allentown plant.

**Conclusion:** This new way to produce substrates is a truly significant contribution for thin film circuit production.

The ultimate gain from this smoother substrate is for communications itself. For through the achievement of nearly perfect bonding of metal leads to tantalum nitride, thin films can be produced with even greater reliability and economy.



## Western Electric

We make things that bring people closer.



# SMOOTH SELLING

by George N. Kahn, Marketing Consultant

© 1967 George N. Kahn

*Editor's Note: Over 50% of all graduating engineers will sooner or later go into some field of sales (field engineer, management, salesman, etc.). With the present economic situation, this percentage will undoubtedly increase, and engineers will find themselves dealing more and more with people and less and less with the impersonal computer. Whether in dealing with management to get funding for a new project or dealing directly with the consumer to sell equipment, the better the salesmanship, the greater the chances of success for the company and the individual. With this in mind, we are beginning a series on some of the aspects of selling, written by George N. Kahn, internationally recognized marketing consultant. It is hoped that these articles may be of help to the majority of pre-engineers at this university, who will eventually go into some aspect of selling. For the technical men who plan to do research, these articles provide valuable insights in interpersonal communication and interaction—and this is vital to living in today's world, since it is by dealing with people that we ultimately progress.*

## THE SALESMAN IS A V. I. P.

There is a foolish idea in some circles that selling is not dignified. For this attitude we shower blame on the colleges, the professors, and anyone else within range. Rarely does anyone put the blame where it really belongs—the salesman himself.

Selling will never achieve its rightful status in the business world until salesmen start thinking of themselves as Very Important People. The salesman's image in the public's mind will improve only when he starts giving himself a higher rating. You can't convince prospects of the value of your product or your company unless you can first convince them of your own value.

### Rate Yourself High

The salesman who speaks apologetically of his vocation or derides his colleagues is simply cutting his own throat. When the salesman gloats of "pulling a fast deal," he is doing great harm to himself and his profession. In short, if you talk and act like a sidewalk pitchman, that's the way you'll be treated.

Management is much quicker to recognize the salesman's importance than he is himself. Businessmen know that creation of demand is a vital factor in their profit and loss statements. These days all top executives and even technical personnel are sales oriented. Engineers must think like salesmen to design products that appeal to consumers. Even the production department must gear its effort to a sales campaign.

### Salesmen Are First Class Citizens

The salesman is the key person without whom there would not be any business. But many salesmen behave like second class citizens—and too often that's the kind of reception they get in a prospect's office.

I remember running into an old friend, Jack Creswell, whom I hadn't seen in years. I asked him what he was doing. Jack smiled deprecatingly and said he was "on the road" for a flooring company, adding:

"Of course, this is just until I can find something better."

He made his job sound as if he were washing dishes in a cheap hash house.

"Jack," I said, "there is probably nothing wrong with the job except yourself. Before you move to what you think are greener pastures, why not give this job your best. If you think of yourself as a failure in selling you'll wind up as one. But if you see this as an opportunity to push ahead to success, your future is assured."

I think the advice took, because Jack stayed in selling with the flooring company and became a top producer with a loyal following of customers. Years later he told me: "You hit pretty hard that day, George, but you opened my eyes to what I was and what I could become."

### No Room For Amateurs

In today's competitive market there is no room for amateurs and dabblers in selling. For those who really want to make selling a career, there is a rich reward. But you must be willing to work for it.

Selling has its problems, heartaches and frustrations. It's a lonely job. But these very factors are what separate the men from the boys.

Millions of people are embedded in dull, prosaic jobs that afford them little or no excitement, drama or challenge. The salesman can look forward to steady growth and can enjoy a stimulating, lively life on the way. His future is limited only by the strength of his desire to succeed.

## Frontier of Selling

The trouble with many uninspired salesmen is that they don't understand the dynamics involved in selling. They are really clerks at heart whose horizons are limited.

The earnest, imaginative salesman can write his own ticket to wherever he wants to go. With faith in himself, drive and the right tools, he can make big money and climb high in his firm.

But he must feel and act important to accomplish this goal. He must think of himself as one of the world's key people—a man who rates high in the scheme of things.

### Act Like A V. I. P.

Do you stride boldly into a prospect's office or do you sidle in, glancing back at the door as if it were an escape hatch? Do you apologize for taking up a buyer's time? Do you feel like an intruder in his office?

If the answers are yes you are letting yourself, your family and your company down. To be a V.I.P. you must act like one. That's the only way to command respect and so sell merchandise. Only then will you earn what you are dreaming of earning.

The head of the sales training program of a big paper manufacturer once said to me:

"About the fifth day of the program my instructors can usually spot those who will be top salesmen. There's something about their attitude, they handle themselves in a certain way. They act like they are proud to be here. It's almost like getting a successful salesman ready made."

That man put his finger right on the heart of the matter. Pride. Are you proud to be salesman? If not, something is wrong. If you're not proud of your work, chances are you are not acting like a Very Important Person.

Here is a periodic Aptitude Test to enable you to find out what your feelings are toward your selling job. If you can answer "yes" to at least seven of ten questions you are probably headed for success.

### If you score below seven, it's time to take self-inventory:

1. Do I think of my job as a real opportunity?  
Yes ☐ No ☐
2. Do I discuss my work with my wife very often?  
Yes ☐ No ☐
3. Would I tell a stranger on a plane my occupation?  
Yes ☐ No ☐
4. Am I happy in selling?  
Yes ☐ No ☐
5. Would I want my son to be a salesman?  
Yes ☐ No ☐
6. Do I try to improve my earning power by studying salesmanship, attending meetings, etc.?  
Yes ☐ No ☐
7. Do I let prospects do most of the talking?  
Yes ☐ No ☐
8. Do I avoid telling jokes which put salesmen in an unflattering light?  
Yes ☐ No ☐
9. Do I see myself as playing an important part in the economy?  
Yes ☐ No ☐
10. Have I really thought about the tremendous future that is available to me through selling?  
Yes ☐ No ☐

## ARE YOU A SALESMAN?

Certain words mean different things to different people. Rich, poor, smart, dumb—all these terms take on various shades of meaning, depending on the person using them. A Calcutta beggar would consider any American rich; a man who can read and write is thought of as smart by an illiterate.

The term "salesman" produces the same kind of semantic problem. To many people, the noun would apply to anyone who sold anything to anybody. This would include sidewalk pitchmen, door-to-door gadget vendors, newsboys and store clerks as well as the man making \$100,000 a year selling highly technical industrial equipment.

A salesman is a creative individual. He also is a man who develops markets, who aids the buyer as well as himself, and who is constantly trying to increase his sales through bold, imaginative thinking.

### Selling Credentials

Unless you can really communicate with a customer so that he thinks like you and is motivated to buy through your persuasive powers, you are not a salesman.

Unless you can see the customer's point of view and turn it to your advantage, you are not a salesman.

Unless you can determine what a customer needs—not what he wants—you are not a salesman.

Unless you have a thorough knowledge of yourself, you are not a salesman.

Unless you have studied other people so you have some insight into their character, you are not a salesman.

### Don't Stop Growing

Are you still growing? Growth is at the heart of salesmanship. Even if you have been selling for 25 years you should still look for new ideas and methods.

One of the nation's leading insurance salesmen surprised his supervisor one day by volunteering for the firm's training course for sales recruits.

"But, Dan", the boss said, "you sell more insurance than anyone in the organization. This will be kid stuff to you."

"Jack," Dan replied, "not a day goes by that I don't learn something new."

In that training course, no matter how basic it is, I'll pickup some piece of information that will help me sell more insurance.

Some people stop learning the day they leave school, whether its grammar, high school or college. These are the individuals who are passed by in earnings, promotion and prestige.

### Qualities Needed

A mark of the successful salesman is his work habits. If you are committed emotionally or philosophically to the eight-hour day, then forget salesmanship. The man who writes the big ticket thinks nothing of putting in a 10, 15 or 18-hour day.

Thomas Edison said that genius is 99 percent work. The salesman's in-

come will invariably be related to the time he puts on the job. Planning is also important.

A sales manager for a well-known rubber company once asked a discouraged salesman how many prospects he had seen that day.

"Two," the salesman said.

"How many had you planned to see?" the boss continued.

"As many as I could," the salesman answered.

"That isn't planning, that's hoping," the supervisor said.

There is a lot of concern today about whether this country is on the moral skids. The television quiz scandals, the price fixing conviction of some businessmen, the link between sports and gambling—all these have prompted serious soul searching.

I'm also concerned about this question, but I do not believe for a minute that morality — particularly business morality—is an outdated product.

No salesman should think honesty is old fashioned. The man who cynically disregards business principles is deluding himself.

Honesty and dependability are not outworn attributes. The salesman who has them is endowed with human values that will translate into earning power.

Let me mention another equally important: maturity.

A man who flies off the handle at criticism is not mature. The mature individual, who is criticized, will use the censure as a lever for improvement.

### About People

It's human nature that men are drawn to individuals who are understanding and sympathetic. If someone knows that you care about him, he will care about you. This is especially true of the customer-salesman relationship. A genuine liking for people is another invaluable asset for a salesman.

A buyer for a midwestern electrical firm was such a grouch that salesmen used to go miles out of their way to avoid him.

"Who wants to be insulted by that crank?" they would say.

Fred Naylor, had a different idea. He breezed into the buyer's office one day, stuck out his hand and announced:

"Mr. Grant, I've made up my mind about two things: I'm going to like you and you're going to like me."

The crusty purchasing agent was so surprised that for a few seconds he simply stared at Fred, open mouthed.

Then he began roaring with laughter and put out his hand.

Fred walked off with a huge order.

There must be sympathy before a salesman can truly cater to the needs of his customers. You can't be expected to read a customer's mind, but you should have a fairly good idea of the things which motivate him—his fears, aspirations, likes and dislikes.

This quiz will test your self-honesty and help you answer the question: Am I a salesman or an Order Taker? A score of ten or more "yes" answers means that selling is for you.

### Am I a Salesman or an Order Taker?

1. Do I actively seek new knowledge about selling? Yes ☐ No ☐
2. Do I spend extra time with a customer on his problems? Yes ☐ No ☐
3. Do I work beyond 5 o'clock on some days without thinking of it as a burden or chore? Yes ☐ No ☐
4. Do I plan my working day? Yes ☐ No ☐
5. If the competition uses unfair tactics, do I maintain my dignity and composure by not emulating them? Yes ☐ No ☐
6. Do I see criticism as an effort to help me? Yes ☐ No ☐
7. Would I spend time with customers if it didn't mean money to me? Yes ☐ No ☐
8. Do I know and understand my own weaknesses? Yes ☐ No ☐
9. Do I do anything about them? Yes ☐ No ☐
10. Do I like most people I meet? Yes ☐ No ☐
11. Do I sometimes seek out an appraisal of my work? Yes ☐ No ☐
12. Do I look forward to sales meetings as a chance to learn something that will help me? Yes ☐ No ☐
13. Do I feel my customer's problems affect me? Yes ☐ No ☐
14. Do I believe that selling and service go together? Yes ☐ No ☐

**REPRINTS FOR YOUR SALESMEN** . . . this is a condensed version. Each lesson is available in an expanded form, in a 4-page brochure, size 8½x11, printed in 2 colors on white glossy paper and is 3-hole punched to fit any standard 3-ring binder. Each subject in this expanded version is fully and completely developed in comprehensive detail and includes a self-examination quiz for Salesmen. Prices are as follows:

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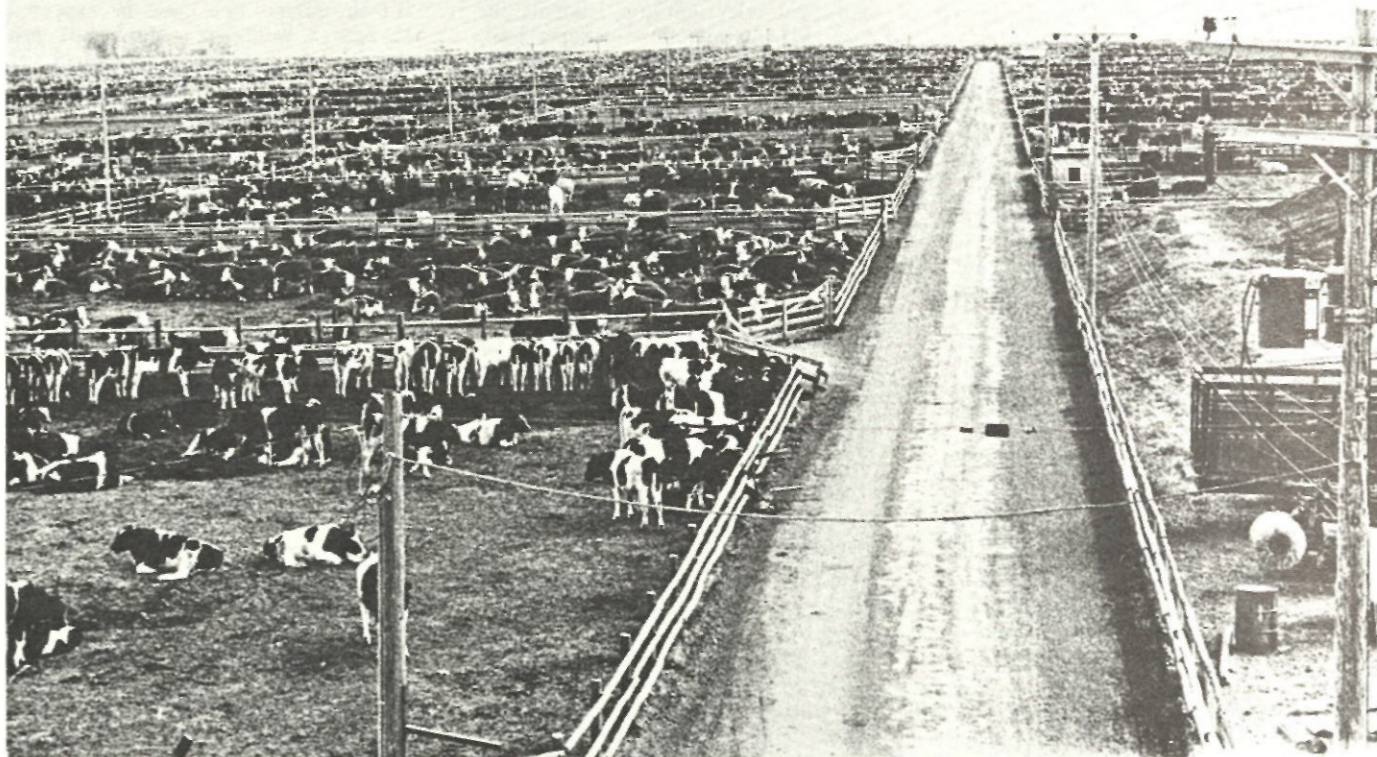
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| 3. Get Acquainted With Your Company  | 8. How To Set Up An Interview       |
| 4. You're On Stage                   | 9. Relaxing Between Rounds          |
| 5. You Can't Fire Without Ammunition | 10. The Competition                 |
|                                      | 11. Taking A Risk                   |
|                                      | 12. Playing The Short Game          |

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# AGRICULTURAL ENGINEERING



## *For Those Who Like a Breath of Fresh Air*

By James Johnson

You smell it before you see it. Then you take a turn at the tower, whip down the road, and there stretching out to the horizon you can see cattle.

The Monfort Greeley Feedlot covers four hundred acres. They hold around one hundred thousand cattle, and over a million bushels of corn are stored to be used as feed there.

Monfort buys cattle weighing 600 to 800 pounds, feeds them for about one hundred forty-five days, and sells them. They will weigh about 1200 pounds when finally sent to the Monfort Packing plant, where they are killed.

The carcasses are dressed, and butchered on an assembly line. Then the cuts are frozen at minus three hundred and fifty

*Monfort's main feedlot, just north of Greeley. This facility covers 400 acres and houses up to 100,000 head of the finest prime beef. Although automated to the fullest degree, cowboys are used as an integral part of the workcrew for many purposes.*

degrees, using a method developed by the firm. The meat, ninety three percent of it top grade, is distributed throughout the world.

The Feedlot employs four veterinarians and a crew of aides to spot, diagnose, and tend sick cattle. There is a "hospital" and "ambulances", of course.

Eating, the basis of the business, is a carefully controlled process. Lights shine on the lots at night, so that the cattle can see to eat. A computer monitors, and keeps track of consumption for the different pens.

Feed is a mixture of corn which is cooked and flanked at the lot, corn ensilage, sugar beet pulp, alfalfa, and a protein supplement prepared by nutritionists. Monfort contracts out, and then harvests most of the ensilage, and alfalfa. Corn is shuttled from the eastern plains on ninety 100 ton railroad cars.

The feed mixture and ration is developed for each pen on a daily basis. A punch card prescribes the amounts of each ingredient, and activates an automatic hopper system which dumps it into a truck. Then, since the hopper is not all that accurate, the truck is weighed, the actual amount of feed is

punched out of new data cards, and the information is run back into the computer so that it can make necessary corrections in feed proportions. Monfort leases its computer time.

Movements of the trucks are monitored at important areas with close circuit television.

The whole feedlot is built on a grade, so that liquid waste drains down into a collecting reservoir, from which it is dumped, for use as liquid fertilizer. Solid wastes are cleaned three times a year, and presently is sold to farmers for fertilizer. Monfort is experimenting with baking and refining the waste into a product which could be burned as a fuel.

That is the green revolution happening in America.

For the next decade the United States will be the only one of the world's five major food producing regions which will produce significant agricultural surpluses.

Monfort gets bigger. The farm gets bigger. Somewhere along the line the small farmer disappears.

The future lies with the Magnuscrubber Waterless peach peeling machine. Or with an ultrafiltration/reverse osmosis cottage cheese plant, capable of processing three hundred thousand pounds of cheese a day. Or a study of non-Newtonian fluid behavior, to give viscosity and sensory correlations for cream soups, or jello. Or in the cultivation of bacteria strains which derive high quality protein from crude oil, or Mesquite brush. The future lies in a new micro-crystalline cellulose product for less fattening cheese cake.

Yet people starve in this nation. Fourteen BILLION pounds of fluid cheese whey, which could be used for protein supplementation, is thrown away every year, to become a large source of stream pollution. Daily, acres of topsoil are blown or washed away. Irrigation dams have emptied rivers, and wells drain away vital water tables. Irrigated lands are gradually being turned, in many places, into salinated deserts. The standard of living in rural areas remains far below that of urban and suburban America.

The damaging effects of agriculture on a natural environment can and are being significantly reduced. New techniques for better use of limited water supplies, such as partial irrigation, stubble planting, and dry land farming are coming into more general use. New insecticides are safer, and less of a danger to a non-insect bystander. Farmers lobby for tougher erosion control bills. Hybrid crops, and mutant strains have and will substantially increase the yields, range, and productivity of various crops. Unfortunately the more such specialized crops are used extensively, the more susceptible we are to massive blight.

The green revolution is a direct result of the technological revolution in the developed world, and the population explosion. Increasing the efficiency of capturing the energy of the sun which is trapped by plants, and making it suitable for human consumption is essentially an engineering and scientific problem. The engineers and the scientists have provided solutions, for the near future. But a farmer with all the fertilizer, equipment, plant strains, and knowledge available can only produce so much in the way of food. A given acre of land can only produce a limited amount of food with foreseeable technology.

To change that limitation will require a greater understanding of the processes of energy conversion and matter than we now possess. It will be a power for mankind unmatched in history. To be master of ones environment has been the centuries-long dream of mankind. It is a dream which must come of age very soon, or else our environment will master us. Sooner or later the population rise will stop. The birth rate can fall. Or, if we fail in that dream, the death rate will rise, somehow, to equal the birth rate.



*Editor's note: Jim is a freshman in the College of Engineering, with plans for majoring in civil engineering. He is also interested in going into medicine at some future date. His outside interests include: mountain climbing, skiing, and watching girls (naturally). He is also an avid student of man's future.*

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# YOGA

## *A Contorted Approach to Intelligence?*

By Sheila Wall

Emotional stability. Peace of mind. How much would any of us give to have these? A very old philosophical and physical teaching promises just those things. The teaching is yoga. "Yoga?" you might exclaim, "you mean that nutty fringe stuff where gurus stare at their navels for hours?" Yoga has gotten quite a reputation in this country for being something strange that ordinary people don't indulge in. However, the average American would probably lead a far more satisfying and peaceful life if he learned to discipline his body and his mind. In America, we pamper ourselves extensively. We eat far too much and a lot of people are in danger of becoming overweight. We have talked ourselves into believing that drugs, smoking, and liquor are relaxants that are necessary because of our hectic pace of life. Through body and mind discipline, many Americans could perhaps lead a naturally relaxed life. Yoga may help you achieve this.

Yoga began in India as a philosophy of withdrawal and has its roots in the history of that nation. About 3,000 B.C. India was inhabited by dark-skinned aboriginal peoples. These peoples, at first believed by archaeologists to be primitive, established the well organized cities of Harappa and Mohenjodaro in what is now West Pakistan. They were called Dravidians and were conquered by the Aryans, an Indo-European ethnic group that had its origins in Central Asia.<sup>1</sup> The word "Aryan" is a name that was attached to these people. Early historians thought that Aryans were extremely advanced and were an intellectual people. This may have been so, but the word Aryan was misinterpreted by many, including Adolf Hitler, who thought it meant racial purity. The Aryans evidently extinguished the Dravidian culture. Literature—the first of the Indo-European peoples—originated with the Aryans in the *Vedas*. The *Vedas* are epic poems which deal with the mythology of the pastoral Aryans. These people gradually began to question the nature of life and man. A great development in Indian literature is seen in the *Upanishads*, which deal with philosophical answers to question of life and the nature of man. The *Upanishads* are a collection of conversations between teacher and student somewhat like the *Dialogues of Plato*. They were written by various authors mostly between the 10th and the 6th century B.C. The *Upanishads* are concerned with the salvation of the soul and it is here that yoga as a philosophy had its beginnings. The concept of Brahman (not, in this case, the name of the highest priestly caste) and Atman is expounded. Brahman signifies the cosmic reality underlying the phenomenal world<sup>2</sup>—it is the world soul. It is the whole of life's essence and the intellect of the universe. Contrasting, Atman is the individual soul or consciousness.

This gives an idea of the complexity of Indian philosophy which contains yoga. Yoga means, from Latin, "to yoke." This is apt, for in doing yoga a student unites his soul (Atman) with the world soul (Brahman) and thereby achieves the peace of God.



Yoga, then, is a philosophy that is steeped in what Westerners would call mysticism. However, despite a long complex history, Yoga is a quite practical way for the average person interested in self-improvement to better his life and reduce frustration. For the beginner, yoga can be divided into two broad areas. One is Hatha Yoga or the physical exercises and the other is Raja Yoga, which was literally the yoga of kings. Raja Yoga deals with the mental aspects and includes meditation. However, when learning yoga, one does not separate the two. Without the idea of mind control and concentration the exercises of Hatha Yoga become ordinary calisthenics.

How is Yoga different from calisthenics? The main difference is that Western exercise is more like a punishment than a pleasure as anyone who has puffed his way through 100 push-ups knows. For a person on a diet, ordinary exercise tends to be disastrous rather than helpful for it instills a ferocious hunger. The exerciser finds himself gorging the equivalent of the calories he has just burned up to stave the pangs of hunger after a vigorous jogging and sit-up session. Yoga gives one energy rather than taking it away. It tends to be relaxing and pleasurable, and gives drive and energy that one never knew one had before. Sound like it promises a lot? It does, but for a faithful student, Yoga fulfills every one of these promises. Another advantage of yoga is that desire for food vanishes. Gaining weight becomes a problem of the past. This is because the body has attained equilibrium, and tends to balance at a certain healthy weight that is right for the individual. Along with this weight equilibrium comes a health equilibrium. With yoga, one remains almost religiously healthy, rarely if ever catching colds or the flu. Dr. Franklyn Thorpe in *Yoga For Today* reported that he had been practicing Hatha Yoga for forty minutes a day for ten years. He said, "During this period, I have rarely had a cold and no disease of any kind."<sup>4</sup>

Many people feel that yoga is primarily concerned with meditation. One concentrates on the exercise and in effect brings the whole consciousness into play: Slowness in movement is essential in the exercising. The student concentrates on the particular muscle being stretched and visualizes it as

becoming gradually more supple. True meditation involves, at first, merely sitting quietly on the floor or in a chair and trying to attain peace of mind and complete mental stillness. One focuses on a pleasant activity or something that is especially relaxing. Eventually you get to the point where distractions from your body and mind are cut to a minimum and you can concentrate fully on the peaceful scene you have established within yourself. There are further mind exercises that you can practice—such as imagining all the muscles in your body as being non-existent. You are, in effect, totally immobilized by your mind. How can you help but relax!

Now, would you like to try a little yoga? One of the important first steps that differentiates yoga from calisthenics is breath control, or pranayama. The yogis believe that only when you can control your breath, you can then begin to control your mind. As an example, listen to your breathing as you read this. It is probably erratic and unevenly spaced. Doctors tell us that we utilize only  $\frac{1}{4}$  of our lung space. The rest is filled with stale air. Take a breath and expel it, then without further breathing, try to blow air from your mouth. You'll find, if you are a typical shallow breather that there's still a lot of air left to expel.

Okay, having done the preliminaries, let's get on with pranayama. The first exercise is rhythmic breathing. Place a finger on your wrist and time your pulse. Expel the breath to the same count and rhythm. Do this while lying flat out in a quiet room. After a while, you'll get the feeling of being rhythm and in harmony with your whole body.

The diaphragmic breath helps to relax the body and calm the nerves. Lie flat out with knees pulled up. Expand your stomach with air. Then, pull your stomach in. This forces air into your lower lungs. Gradually, by pushing your diaphragm up further, you can visualize air in your middle and upper lungs also. This exercise will increase the capacity of your lungs.

If you're feeling all dragged out now and tired, this breathing exercise may help. Stand straight and throw back your shoulders. Inhale as deeply as possible. Then, slowly, bend backwards while holding the breath. When you're back as far as possible, slowly come forward and bend from the waist. Remain in this position until you can no longer hold the breath. Rise to a standing position and expel the air. If you feel dizzy at first, try taking in a little less air—and don't hold it too long. One more thing on any breathing exercise; try as much as possible to breathe through the nose. The nose purifies and warms any air being taken in.

Now, let's start some physical exercises. While doing these, it is best to do the rhythmic breath. Perform each exercise slowly and try to establish an idea of your mind, controlling your muscles.

**NECK ROLL**—This can be done sitting up in a chair. Slowly rotate your head in a complete circle. Do this about five times in one direction and five times in the other. If you notice a grinding or grating sound, it is the grating of a calcium deposit that has built up in the bones, as a result of having held your head in primarily one position. This exercise helps make the neck muscles more supple. It sometimes helps in relieving tension headaches.

**THE ROLL-BACKS**—This is not really an Indian yoga exercise but rather something that American yogis thought up to help their stiff American students get into shape. First, sit with your legs crossed and grab your toes with your hands (all of this should be done barefoot, and in loose clothing). Then, just roll back, imagining your spine to be supple and smooth. Attempt to touch your toes to the floor over your head. Do about 10-15 of these before beginning any yoga session.

**FORWARD BEND**—One of the primary reasons that elderly people tend to have a shuffling gait and are hunched over is because their spine and leg muscles are stiff. This exercise is one which will help prevent that. Sit on the floor with legs extended. Bend from the waist and try to grab your toes with your hands. Eventually when the muscles become more supple, you should be able to touch your nose to your knee. Remember to do this slowly, especially if you're out of shape. Give your muscles a chance to break in to this gradually. There are variations to this exercise which can be found in any book on yoga.

**THE PLOUGH**—This begins somewhat like the roll-backs. Sit, with legs extended and roll back. Attempt to touch your toes with legs extended to the floor over your head, keep knees straight. You should be able to feel the pull in your back and legs. If, at first, you aren't able to touch the floor with your toes, attempt to come as close as possible. If you keep practicing this, eventually the lower back will become supple enough to allow your toes to touch the floor. This is an excellent posture for stimulating the brain because it increases the flow of blood to that area.

**REVERSE POSTURE, SHOULDER-STAND HEADSTAND**—The reverse posture and shoulder-stand are preliminary exercises designed to prepare the neck for the headstand. The headstand, incidentally, is one of the most important exercises in yoga. The headstand improves circulation especially to the brain which will increase mental clarity. It also helps reverse the process of slumping our bodies undergo as they age.

The reverse posture is best begun from a plough position. With hands supporting back, slowly raise legs. Keep working on this until it can be comfortably maintained for 1-2 minutes or more. When the reverse posture becomes easy, gradually slide your hands up your back until they are supporting your upper back. The body should be extended and completely straight. The chin will be naturally forced into the base of your neck. Work on this until holding it for 2 minutes becomes easy. This helps strengthen your neck and prepare it for supporting your body when you do the headstand. The headstand can be done with varying amounts of support from your arms. They can form a cradle for your head or form a tripod for increased balance. In doing it, if you roll over and cannot maintain the position, it might be beneficial to do it close to a wall so it can provide support. When you are getting into the position, do it by placing arms and head in the desired posture and walking your legs into closer to your body. Gradually bring the legs up close to the chest and slowly, without sudden movements, extend the legs over the head. Don't be discouraged if this doesn't come easily at first.

**CORPSE POSE**—is a relaxation exercise done after the program exercise. Stretch out, close your eyes and concentrate on relaxing tense muscles. Try to think of pleasant thoughts. The whole purpose is relaxation, so concentrate on thinking of anything that will help reduce the tension in your life. Some useful mental exercises are imagining yourself floating in clouds or bathed in a pleasing color. You'll be surprised because 15-20 minutes of this following an exercise program helps refresh you like sleep.

Yoga has some excellent therapy exercises. Two of these are:

**FOR HEADACHE**—Do this in a semi-dark room. Sit with legs crossed or in a lotus position and keeping back straight do about 10-20 neck rolls in both directions. Then do one exercise which will force blood to your head while at the same time relaxing your neck muscles. This could be the shoulder stand or the plough. Finish up with the corpse pose. The whole key is relaxing neck muscle tension.

**FOR SORE THROAT**—The Lion Posture is extremely beneficial at the earliest stages of a cold and sore throat. Sitting in a crossed-leg posture lean head back, drop jaw and extend tongue downward. Sounds grotesque? It doesn't look too cute, so you might try doing this one in private. Hold it for 20 seconds to one minute. Do it about every 10 minutes until sore throat disappears. It sometimes helps to alternate this with the headstand. These exercises must be done when a cold first starts or else they don't help very much. Also, don't encourage your cold by eating a lot of heavy, starchy foods. The best thing perhaps is to drink a lot of water and cut food to a minimum.

Yoga supposedly has some three million different postures. Obviously, not even a small part of these can be described here. If you are interested in a regular program of yoga, one of the better books describing beginner-to-advanced workouts is Jess Stearns, *Yoga, Youth and Reincarnation*. Or perhaps you may decide that taking a few lessons will help start you off correctly. Yoga can be learned from a book effectively if one takes into account the importance of control and positive thought in performing the exercises. Starting a daily program of yoga may introduce you to a life with less tension and more peace-of-mind, as well as more self-confidence.



*Editor's note: Sheila is a sophomore majoring in psychology-premed, and is a veteran writer for the ENGINEER. Her interests include hiking, skiing, sports car racing, philosophy, and advanced biology.*

## Research opportunities in highway engineering

### The Asphalt Institute suggests projects in five vital areas

Phenomenal advances in roadbuilding techniques during the past decade have made it clear that continued highway research is essential.

Here are five important areas of highway design and construction that America's roadbuilders need to know more about:

**1. Rational pavement thickness design and materials evaluation.** Research is needed in areas of Asphalt rheology, behavior mechanisms of individual and combined layers of pavement structure, stage construction and pavement strengthening by Asphalt overlays.

Traffic evaluation, essential for thickness design, requires improved procedures for predicting future amounts and loads.

Evaluation of climatic effects on the performance of the pavement structure also is an important area for research.

**2. Materials specifications and construction quality-control.** Needed are more scientific methods of writing specifications, particularly acceptance and rejection criteria. Additionally, faster methods for quality-control tests at construction sites are needed.

**3. Drainage of pavement structures.** More should be known about the need for sub-surface drainage of Asphalt pavement structures. Limited information indicates that untreated granular bases often accumulate moisture rather than facilitate drainage. Also, indications are that Full-Depth Asphalt bases resting directly on impermeable subgrades may not require sub-surface drainage.

**4. Compaction and thickness measurements of pavements.** The recent use of much thicker lifts in Asphalt pavement construction suggests the need for new studies to develop and refine rapid techniques for measuring compaction and layer thickness.

**5. Conservation and beneficiation of aggregates.** More study is needed on beneficiation of lower-quality base-course aggregates by mixing them with Asphalt.

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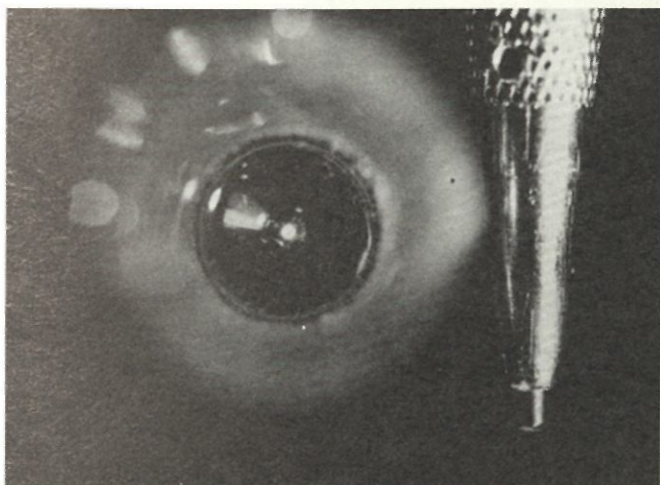
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Continued from page 6

C.P. Snow quite correctly, I believe, sees the technology-humanity cultural gap as a significant factor of our present dilemma (*The Two Cultures*). Technologists have failed to grasp societal needs while nontechnical-intellectuals have failed to grasp the potential and possibilities offered by technological innovation. Unfortunately, technologists have often been associated with highly conspicuous projects of questionable value.

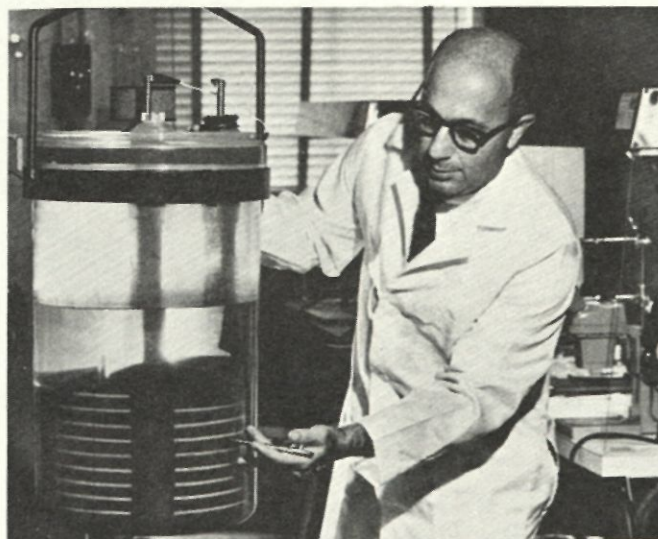
Much needs to be done. Technologists can, if they wish, play a significant role in reordering national and world priorities to create a more "livable world." Rather than advocating snowmobiles and 500 horsepower super sex symbols, engineers can express a concern for the environment, a concern that may lead them to discover that much can be improved by not building many unnecessary playthings. With half the world malnourished and uneducated, little should need to be said for goals. The problem is how to encourage developed nations, such as ours, to commit even one percent of our gross national product as recommended by the United Nations to bettering the condition of mankind. In the process of sharing the task of world development, it would not be surprising that we would learn more of ourselves and thus concurrently enrich our own lives. The Peace Corps was a valiant attempt — unfortunately it has been both politicized and under-funded. An attempt at a multinational level could undoubtedly do much to raise not only our own hopes but the hopes of all mankind.

## WHAT'S NEW




The tiny white circle in the above photo is the inner region of a new miniaturized waveguide gas laser. This region, roughly one half the thickness of the mechanical pencil lead at right, serves to channel laser light in much the same way that water is guided through a water pipe. Miniature gas lasers may someday be used in future mass communications systems.

© Bell Laboratories



DOUBLE LIFE EXPECTANCY — that is the promise of this new lead-acid battery whose performance actually improves during the greater part of its life. Developed at Bell Labs, the battery is cylindrical in shape and has a plastic case. One of the battery's inventors, D. O. Fader, is pointing at a round grid made of pure lead — a major factor in the battery's anticipated 20-year lifetime. The batteries will be used by Bell System telephone companies as a source of reserve emergency power.

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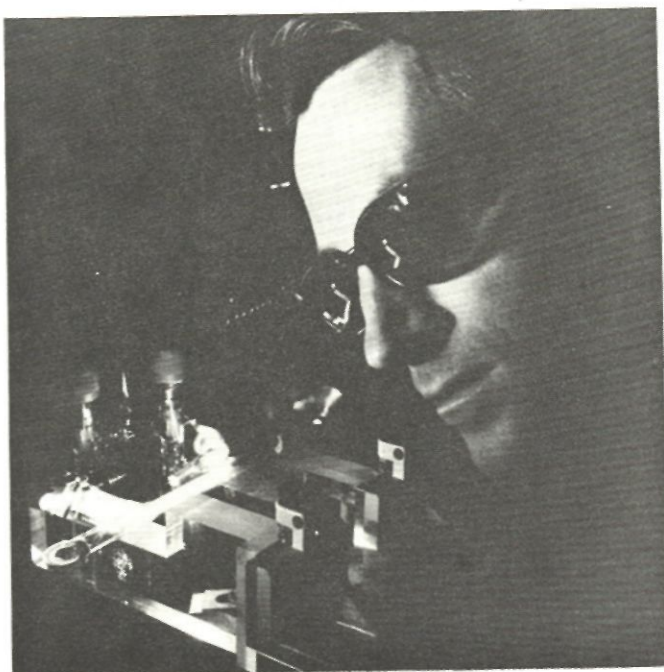
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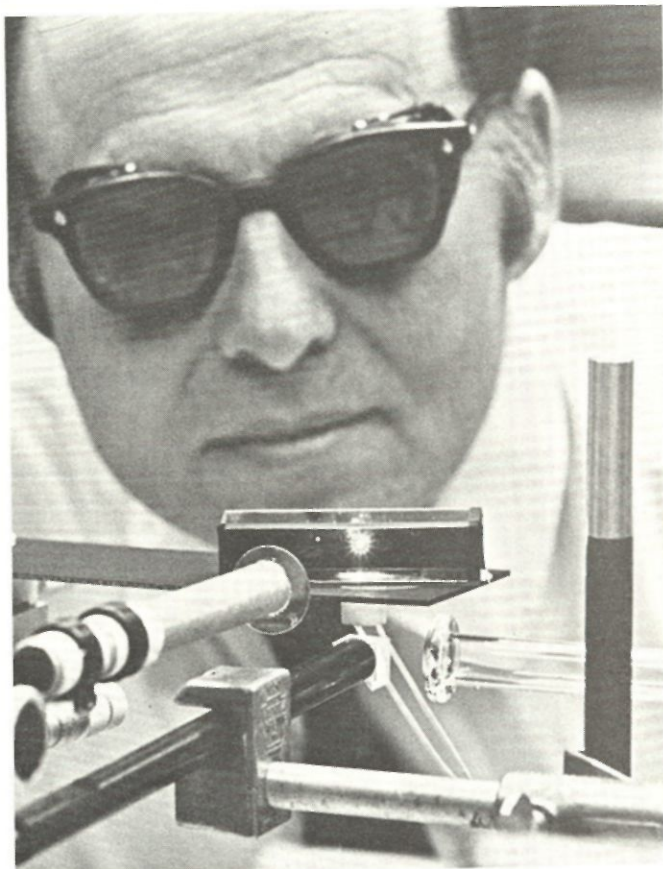
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# WHAT'S NEW



IT'S A GAS — BTL scientist Peter Smith is shown demonstrating a new miniaturized waveguide gas laser. The fine line of laser light in glass tubing (at left) is passing through a waveguide configuration with a diameter of about 20 thousandths of an inch. Someday such lasers could be used in communications systems that use light to carry large numbers of voice, picture, and data signals.

 Bell Laboratories



LIFTING BY LASER. A tiny glass particle being held aloft by the light energy of a laser is inspected by Dr. Arthur Ashkin of Bell Laboratories. The experiment demonstrates optical levitation for the first time and is expected to provide new techniques for studying optical communications by manipulating small particles without using mechanical support.

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That's why, at General Electric, we judge innovations more by the impact they'll have on people's lives than by their sheer technical wizardry.

Maybe that's a standard you should apply to the work you'll be doing. Whether or not you ever work at General Electric.

Because, as our engineers will tell you, it's not so much what you do that counts. It's what it means.

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