# The COLORADO Engineer


MAY 1965

**What's down under the sea?** Hostile submarines? New food sources? Biological wonders like the archaic coelacanth fish? ¶ In many ways, we know more about the surface of the moon than we do about the sea around us. The sea guards its secrets in darkness, with pressures that crush steel like an eggshell. Radio waves that put us in touch with the stars can penetrate less than 100 feet of its depth. ¶ Westinghouse scientists are helping to unravel the sea's mysteries by perfecting new precision instruments for measuring salinity, acoustics, currents, pressures, sea floor contours. ¶ Westinghouse was the first to develop centralized engine room control for oceanographic ships, a development that will help make hydrographic and oceanographic surveying faster and more accurate than ever before. ¶ New undersea propulsion methods under investigation at Westinghouse involve fuel cells, thermoelectric generators, thermionic converters, cryogenic propellants. Strange words, strange world. ¶ For more data concerning a challenging career at Westinghouse, an equal opportunity employer, see our representative when he visits your campus, or write L. H. Noggle, Westinghouse Educational Center, Pittsburgh, Pa. 15221.

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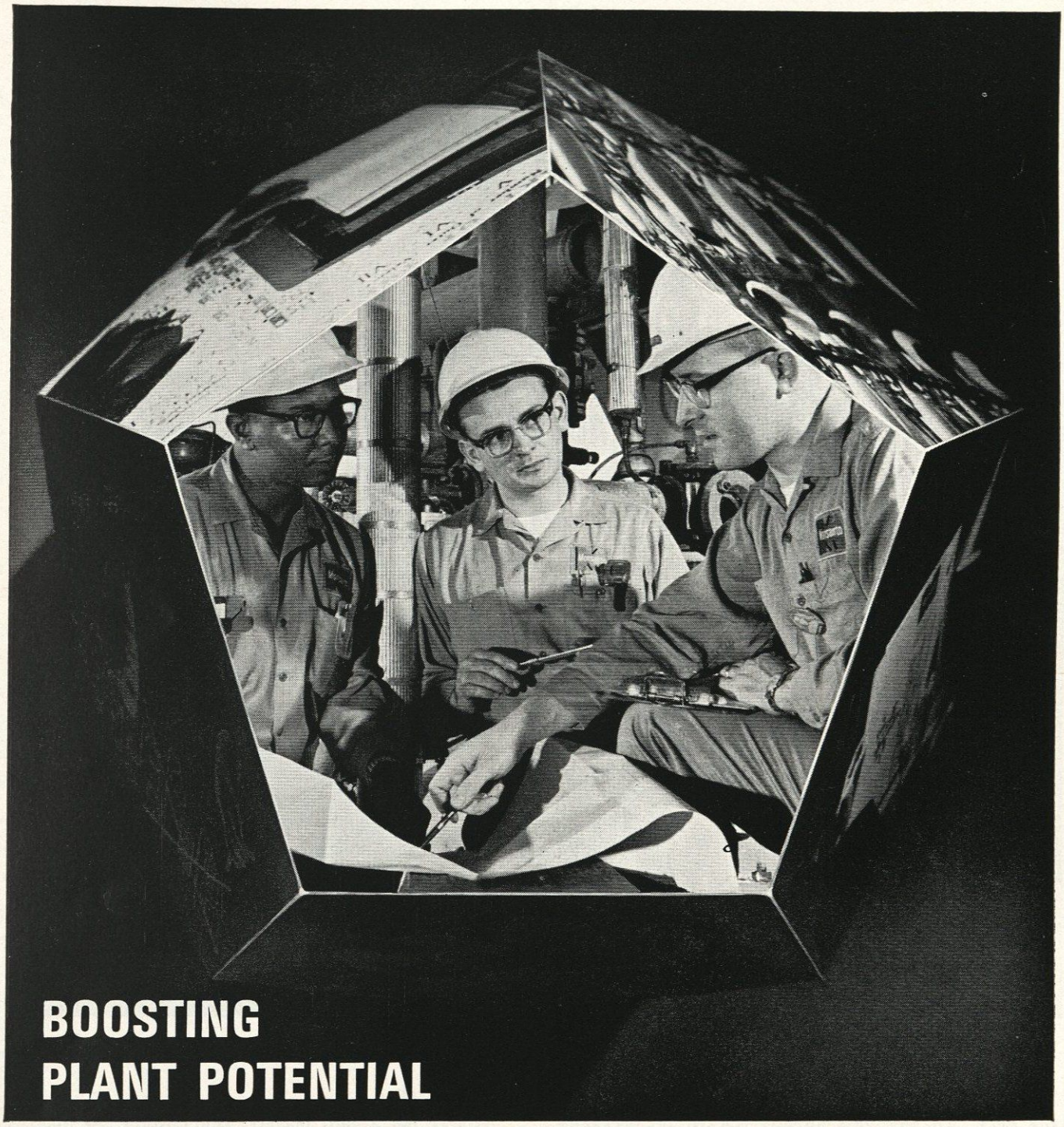


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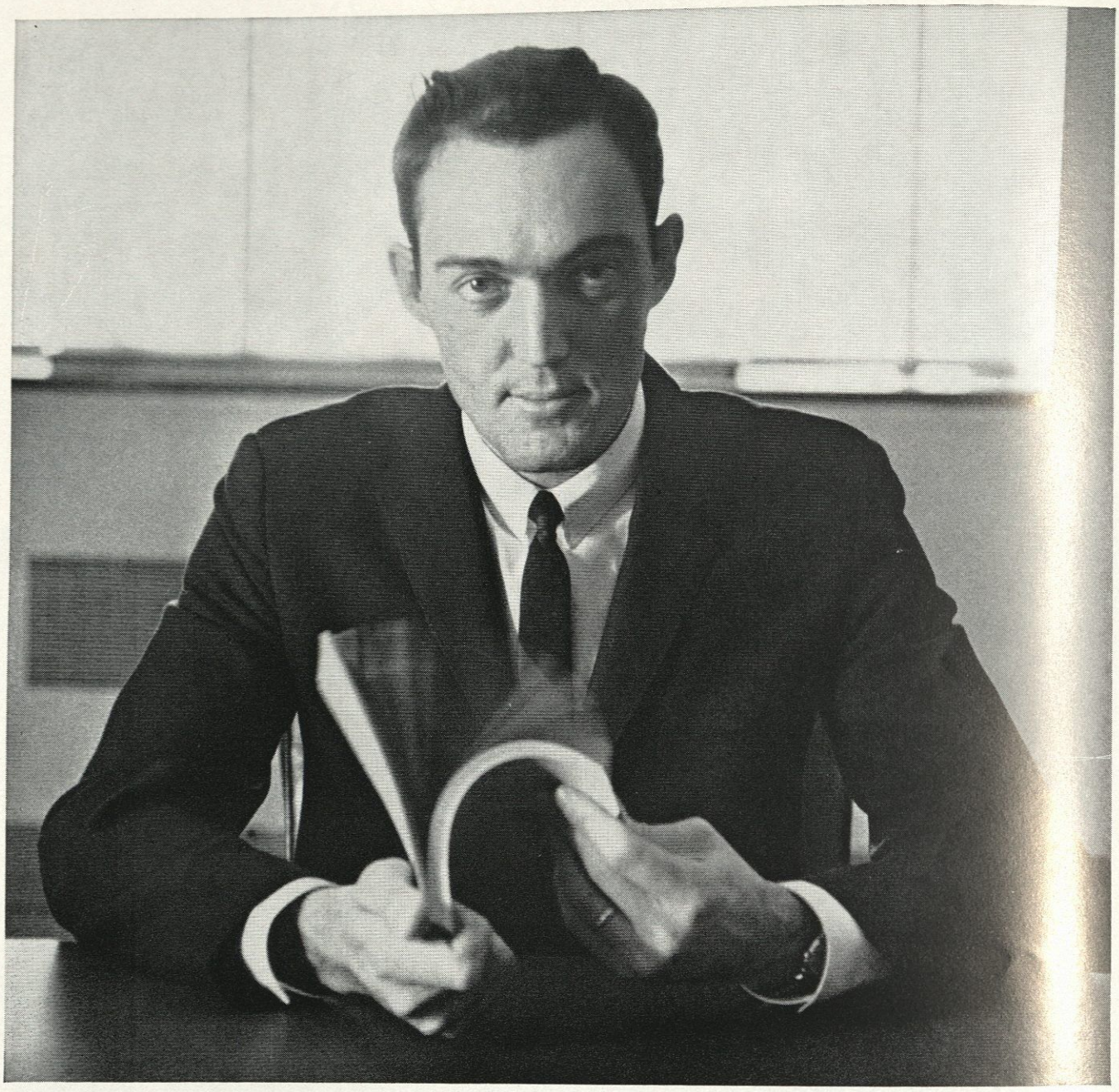

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# The COLORADO Engineer

**COLLEGE OF ENGINEERING • UNIVERSITY OF COLORADO**

**VOLUME SIXTY-ONE • NUMBER 4 • MAY, 1965**


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### FEATURES



### SECTIONS



### COVER

Cover Artist, Jerry Carroll, depicts the theme of E-Days - 1965. Full coverage begins on page 15.


**CIRCULATION: 2000**

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**MEMBER OF**

**ENGINEERING COLLEGE MAGAZINES ASSOCIATED**

Charles Wales,
Wayne State University
Detroit, Michigan
Chairman

# BUT IS IT WRONG?

In the past several months, there has been a great deal of discussion about the Greek system. The *Daily* is filled with letters and articles by various people examining and re-examining the "role" of the social fraternities and sororities on campus. Some of the groups studying the matter have been interested in the discriminatory aspect of Greek life, and of course, the question is not one of whether or not discrimination exists, but rather whether or not it is unhealthy.

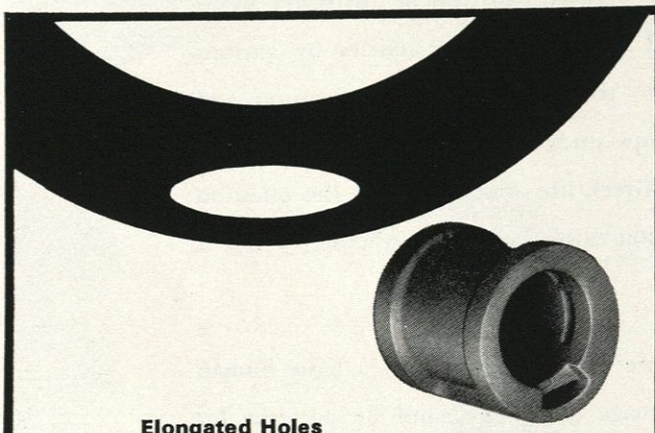
Selectivity of association is little more than a satisfying of a basic human need. The individual has a certain image of himself, and he patterns his actions to fit that self-concept as best he can. This means that he dresses himself in a particular way, and also, that he picks his friends and associates to complement his mind's "picture" of himself. Thus, *de facto* segregation will exist as long as there is a "social" difference among the "races."

In a "fraternal" setting, this social significance becomes even more important. Not only must the individual image be maintained, but now the member is more or less permanently associated with the group, so the image of the group must also be maintained. The various selective procedures used by each house are the only mechanisms by which those who are now members (and therefore not very able to chose the "right" house) can limit their future associates to people who bring with them the desired image. Thus, if freer access to the Greek system is to be initiated, some provision also must be made to allow equally free exit.

If the University administration were to attempt to break down the existing limits to membership in the Greek system without taking into consideration the problems mentioned above, the system would, in all probability, collapse. If the University does feel that social fraternities and sororities constructively contribute to the educational process, the issue of discrimination should be approached cautiously and without the attitude that immediate action is the only answer.

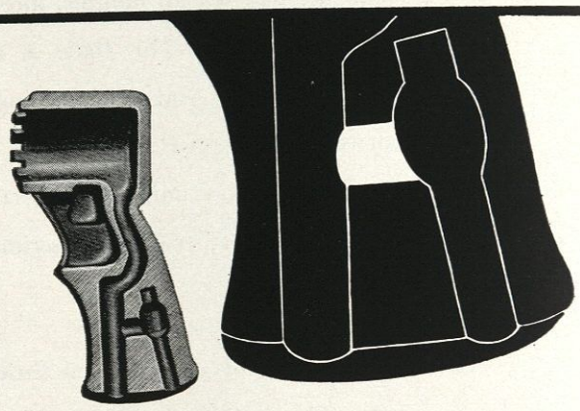
**—Fred E. Love**

# Unusual Shapes Cost Less To Produce When They are Malleable Castings.



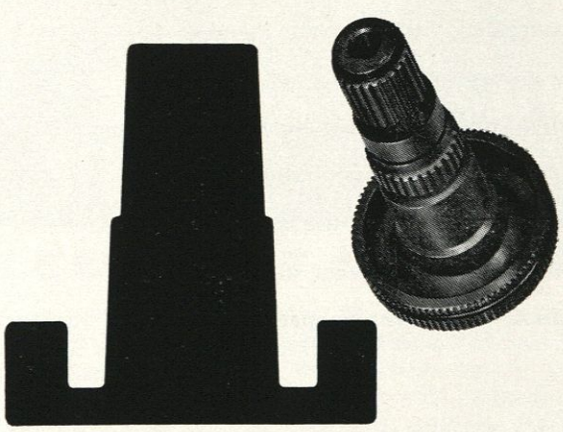
**Elongated Holes**

Round holes? Simple! Odd-shaped holes? Use Malleable! Here's a shape where casting is the only economical solution . . . and only Malleable provides both the strength and easy machinability that are needed. Excellent wear resistance on the inside of this air tool cylinder is achieved by hardening the 53004 pearlitic Malleable up to Rockwell 58C.



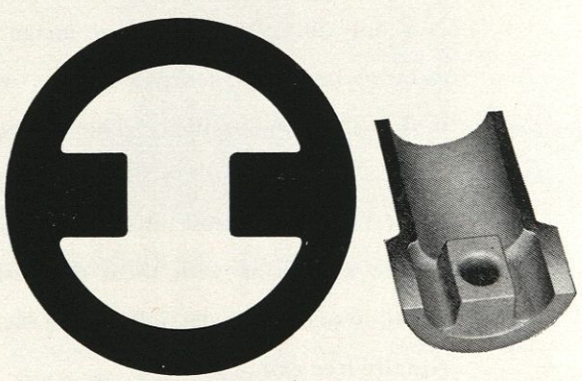
**Blind Holes**

Blind holes present a situation where the only practical manufacturing method is casting. This example shows a cross-section of the handle of a pneumatic impact wrench. Shell coring produces the holes with such accuracy that only a few finish machining operations need be performed.



**Deep Grooves**

Deep grooves are real money-wasters in other forming methods . . . but not in Malleable castings. In this transmission gear, the switch to pearlitic Malleable cut material cost 15% . . . cut machining cost 25%.



**Internal Bosses**

Here is a shape that can cause real problems . . . except when it's cast of Malleable iron. The interior cavity, two bosses and the holes through the bosses are formed with a shell core. This method cuts cost 75% compared to welding several components. The Malleable casting looks better . . . achieves closer tolerances.


There are many ways you can do a better job at less cost with modern Malleable castings. Our new brochure, "Design Criteria for Malleable Iron Castings", tells how.

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Lots of things are going on at Union Carbide. We're producing new alloys to re-surface equipment such as rock-crusher rolls and keep them in action longer. Other new alloys are helping the chemical industry stop costly attacks of acids and corrosives. And we've recently introduced some new silicone rubber compounds with greatly improved resiliency for use by the aerospace and automotive industries.

To keep bringing you these and many other new and improved products, we'll be investing half a billion dollars on new plant construction during the next two years.

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# FLUID AMPLIFIERS

TIM HIRABAYASHI

Fluid amplifiers—are these devices going to put electrical amplifiers out of a job? Not exactly, but they will replace the electrical systems in some instances. Exactly what are these things? Are they something new? And what can they do? These are some of the questions we will attempt to answer.

There are several types of pure fluid amplifiers. Let us take a closer look at a few of these types. The proportional pure fluid amplifier uses a low energy fluid stream to control a fluid stream of higher energy. Essentially a stream of fluid is directed through a wide area (to prevent wall attachment, which is discussed later with the digital pure fluid amplifier) to a splitter. At right angles to this stream, there are two smaller controlling jets near the mouth of the stream. When the controlling jets are not being utilized, the main stream is divided by the splitter into two equal and diverging streams. When the right controlling jet is operating, the momentum change in the main stream due to the control jet causes more fluid to flow out the left outlet duct (fig. 1). The amount flowing out each outlet duct depends on how much sideward momentum the control jets impart to the main stream. Of course if the control jet on the left is utilized, the stream will be deflected to the right and more fluid will flow out of the right outlet duct.

Presently with the proportional pure fluid amplifier, power gains of up to ten are being obtained per stage. There have been problems, though, with insufficient linearity and low signal-to-noise ratios.

The digital pure fluid amplifiers have a construction similar to the proportional pure fluid amplifiers except that there is no wide area through which the fluid passes. As the fluid flows along one side of the "Y" junction, a low-pressure vortex builds up between the stream and the wall near the mouth of the stream. The higher ambient pressure on the other side forces the stream even closer to the

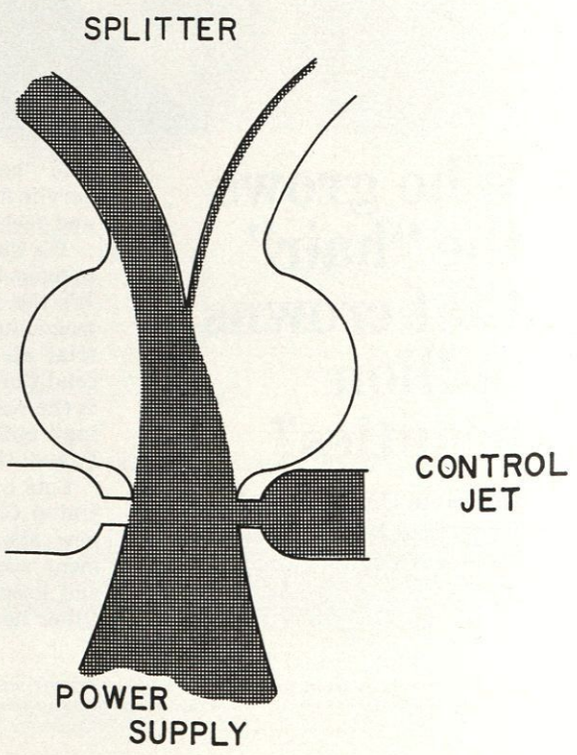


FIG. 1

wall. Thus the stream will remain attached to the one wall with all of the fluid exiting through one duct (fig. 2). The stream will remain there until the controlling jet on that side is applied to dissipate the low-pressure vortex. The transverse pressure gradient will then be reversed, and the stream will attach itself to the opposite wall, even after the controlling jet is removed, switching takes place in 1 to 2 milliseconds for a device with a 0.025 inch input jet nozzle width. Digital pure fluid amplifiers, however, are sensitive to noise or disturbances in the flow. Application of the digital elements has been slowed by the difficulty of connecting several of the devices together.

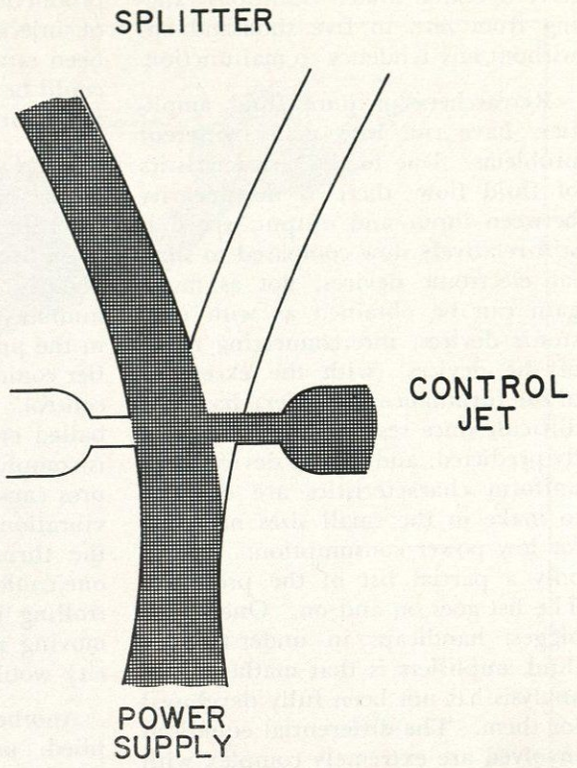


FIG. 2

### Turbulance Amplifier

Another type of fluid amplifier is the turbulance amplifier. It is known that if a stream of low velocity fluid is injected into a stationary field of fluid, the stream will remain laminar for a considerable distance. This stream can then be picked up with an output collector which is in line with the input nozzle (fig. 3a). However, if a controlling jet is directed at right angles to the stream, turbulance will be created and the flow entering the output collector will be considerably reduced (fig. 3b).

The distance between the two tubes can be up to 100 times their diameter. There are commercially available devices with inside diameters of 0.030 inch and separations of about ¾ inch. The turbulance amplifier is one of the few pure fluid amplifiers that can be interconnected easily. It therefore has found practical industrial application sooner than the wall attachment type. The turbulance amplifier also has the advantage of being simple to fabricate and therefore inexpensive to produce. However, it is limited to small flow values and has relatively slow switching speeds of from 7 to 10 milliseconds.

Fluid amplifiers have several advantages over their electronic counterparts. First, they are immune to electromagnetic radiation. Second, these devices have been operated on cryogenic fluids at very low temperatures, and with suitable ceramic base materials, operation at three or four thousand degrees Fahrenheit is possible. In addition, digital amplifiers

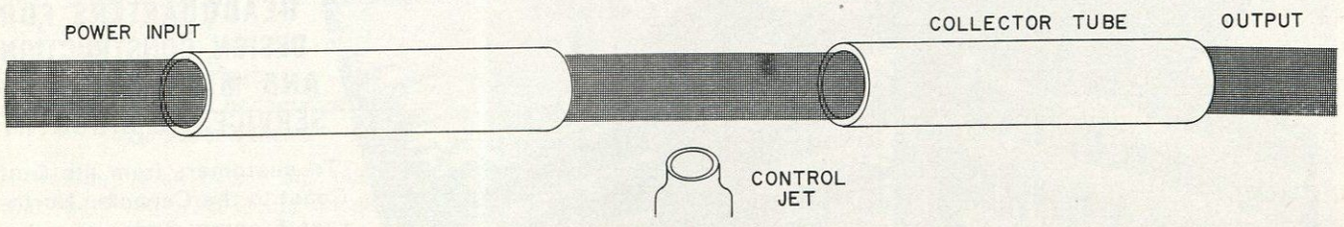


FIG. 3A

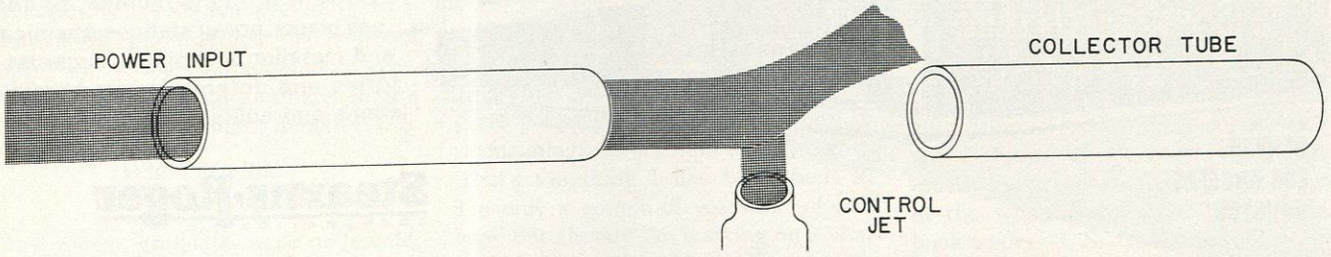


FIG. 3B

have operated under vibrations ranging from zero to five thousand cps without any tendency to malfunction.

Researchers in pure fluid amplifiers have run into many different problems. Due to the characteristics of fluid flow, there is no linearity between input and output; speed is still relatively slow compared to similar electronic devices; not as much gain can be obtained as with electronic devices; interconnecting many of the devices (with the exception of the turbulance amplifier) has been difficult since results cannot be readily predicted; and digital devices with uniform characteristics are difficult to make in the small sizes necessary for low power consumption. This is only a partial list of the problems. The list goes on and on. One of the biggest handicaps in understanding fluid amplifiers is that mathematical analysis has not been fully developed for them. The differential equations involved are extremely complex with some not having unique solutions.

Although the cost now is high due to the necessity of custom building, fluid amplifiers offer tremendous mass production possibilities with the use of injected molded plastics. It has been estimated that the cost per unit could be reduced from several dollars to about ten cents.

Fluid amplifiers lend themselves to many applications. The digital pure fluid amplifier, which operates much like a flip-flop switch, seems ideal for digital computers using the binary number system. The principle used in the proportional pure fluid amplifier could be applied to rocket engine control. The present system of gimballed engines and hydraulic pistons is complicated and susceptible to failures caused by the engine's heat and vibration. By bleeding off some of the thrust produced by the rocket, one could divert it for use in the controlling jets. This system has fewer moving parts and due to its simplicity would be less apt to fail.

Another idea, which is being applied, uses the digital pure fluid amplifier as a liquid-level sensor. One of the control jets is connected to a tube which has its open end at the desired level. When the level is below the tube, air is aspirated into the tube and the flow is directed to the output feeding the tank. When the level of the liquid covers the end of the tube, the flow of liquid is switched back to the duct leading to the bypass tank.

Once the problems of mathematical analysis and quality mass production are solved, more fluid amplifiers will find their way into use.

## ABOUT THE AUTHOR

Timothy Hirabayashi is a Senior in Mechanical Engineering from Bethesda, Maryland. He is a member of Pi Tau Sigma, ASME, and Alpha Phi Omega.


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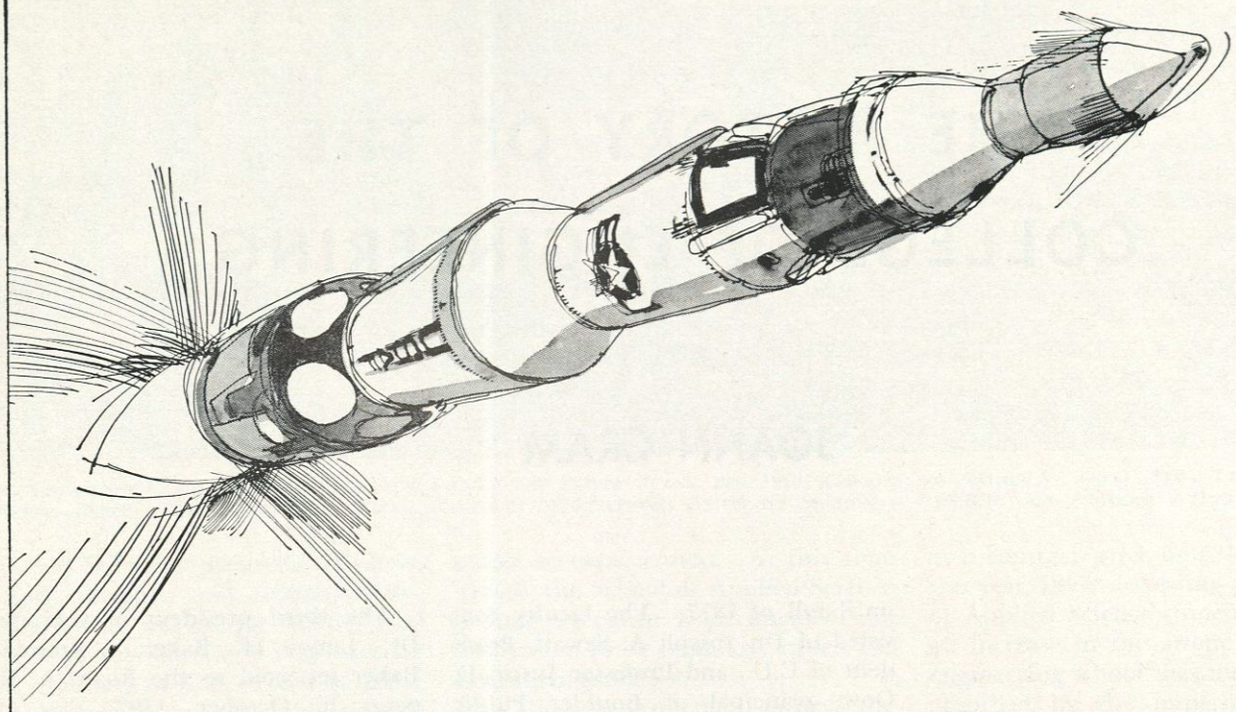


**College graduates do key work right away on the Aerospace Team.**
**Lt. Gregory Risch, aeronautical engineer from Notre Dame, varsity swimmer, missile test expert, tells how you can be part of it.**

(Lt. Risch, B.S. '62, did extensive undergraduate work in aerodynamics, helping to construct one of the country's largest and most successful smoke tunnels. He has played an important part in the operations of the test range at Cape Kennedy.)

**What's the best way to become an Air Force officer?**

I wouldn't want to call any one way the "best" way. We count on getting top-quality officers from all our sources. First, there's the Air Force Academy. I received my commission through Air Force ROTC. Many colleges and universities will soon be providing two-year AFROTC programs that you can apply for during your sophomore year. Then, for the college graduate, there's Air Force Officer Training School—OTS.

**Who's eligible for Air Force OTS?**

Any college graduate, male or female, or a college student within 210 days of graduation, is eligible to apply. Who the Air Force will take depends on what the particular needs are at the time. Those with scientific or engineering degrees can usually count on receiving the first openings.

**Does the Air Force have jobs for nonscience majors?**

There are quite a few jobs in nontechnical fields such as administration and personnel. And it is not essential that prospective pilots or navigators have backgrounds in the sciences. However, since the Air Force is one of the world's leading technological organizations, a keen regard for science is important.

**What sort of work do young Air Force officers do?**

Important work. An Air Force career gives young people the opportunity to do meaningful work right from the start. That's the thing I like best about it. I'm only a couple of years out of college, but already I'm working on a vital project in an area that really interests me. In other words, I'm getting to *use* the things I studied in college. My education is paying off, both for me and for the United States.

**What are the possibilities for advancement?**

They're plenty good. The Air Force believes in giving its young officers all the responsibility they can handle. That's not only good for you, it's good for the Air Force. It gets the best-qualified people into the top jobs where they can contribute most to our defense effort.

**How long am I committed to serve?**

Four years from the time you receive your commission. If you go on to flight school, four years from the time you're awarded your pilot or navigator wings.

**Where can I find out more?**

If there's an Air Force ROTC unit on your campus, see the Professor of Aerospace Studies. If not, contact the nearest Air Force recruiting office. It's listed in the white pages of the telephone book under "U.S. Government".

**United States Air Force.**

## BOOK REVIEW

# THE HISTORY OF THE COLLEGE OF ENGINEERING

JOANN CRAM

This month, we are reviewing a book that is still being written! It is a history of our own College of Engineering, and it doesn't have a title yet. *You,* dear Reader, are hereby invited by Mr. Mandel and Mrs. Shipley (the co-authors) to submit a title to them by August 1 for the book reviewed below. The best suggestion will earn a free copy of the final work. Need some ideas? Here are a few titles from histories other colleges have written. (I really think *we* can do better!) *The Story of Purdue Engineering* (from Purdue, obviously), *Dress her in White and Gold* (from Georgia Tech, not so obviously), and *Man of Ingenuity from beneath the Orange Tower* (University of Texas). Good Luck and Happy Titling!

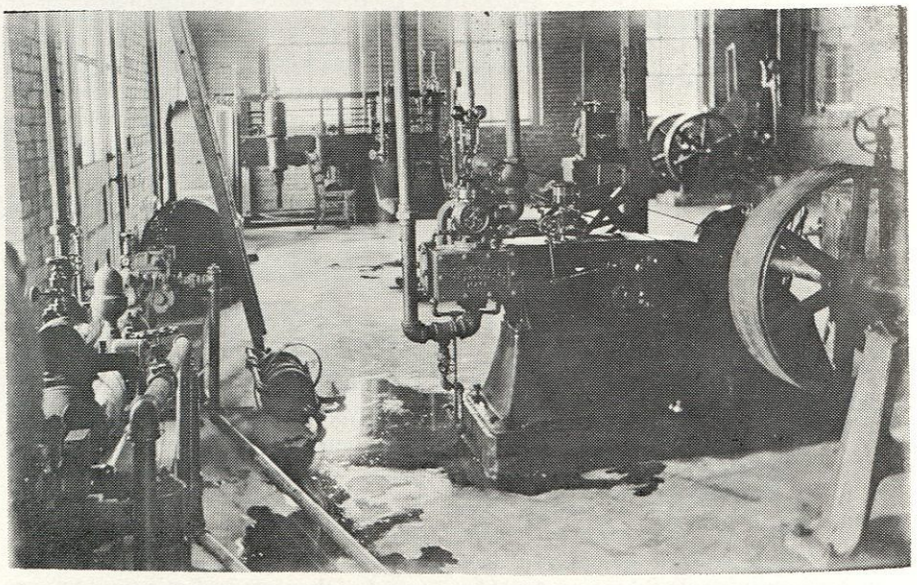
Although the University of Colorado existed on paper from 1861, the cornerstone of Main, the first building, wasn't laid until September, 1875, and the first class, fifteen, didn't meet until fall of 1877. The faculty consisted of Dr. Joseph A. Sewall, President of C.U., and Professor Justin E. Dow, principal of Boulder Public Schools. The following fall, the College of Arts and Sciences was established, and in 1882, this sole College in the University graduated six. "To outward appearances the College was a naked, ill-constructed building situated in a barren waste, removed from any sidewalk by nearly a mile of mud, surrounded by pasture, pig pens, chicken coops . . . a barn, a horse shed, and a wire fence to keep out the black bull that ruled the 12th street region as late as 1889."

This resumé exemplifies Chapter 1, which is the early history of the University. Chapter two finds the beginnings of the College of Engineering.

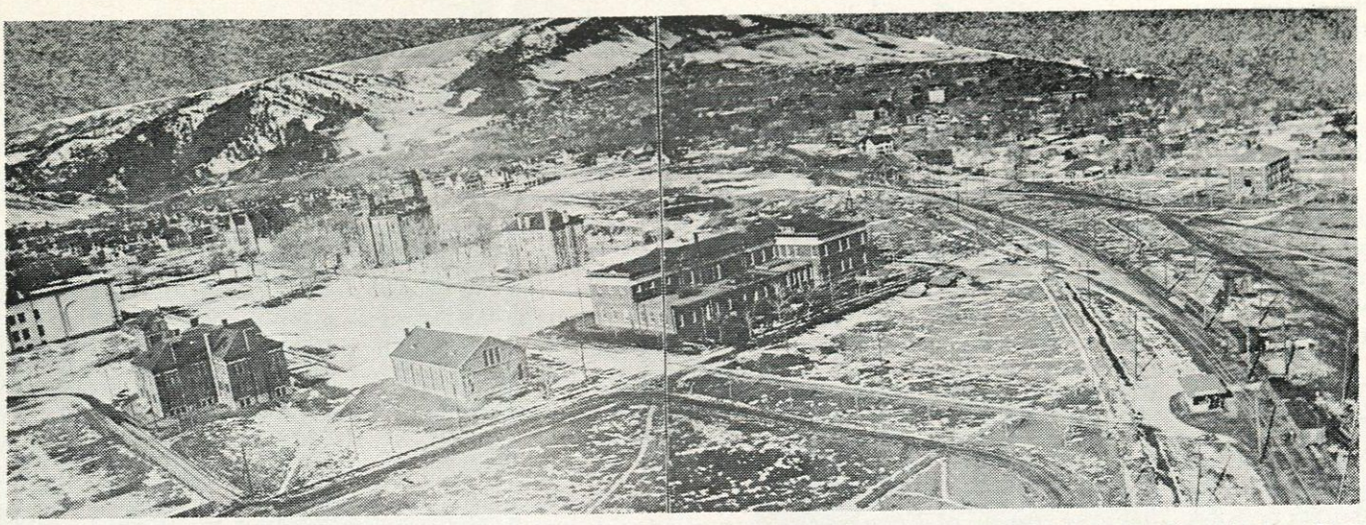
The third president of C.U. was Dr. James H. Baker. "President Baker reported to the Board of Regents in October, 1892, that the growing needs of Colorado and the future of the university demanded a department which already existed in most state universities. I refer to a Scientific (Technological) School. By the addition of one special professor, work in civil and electrical engineering can be begun at once. In due time, we shall aim at mechanical engineering as well as civil and electrical. The courses will be four years in length, and the college standard of admission will be required. We believe this school will become an important department in the University."

So in the fall of 1893, the School of

*Editor's Note: The authors of the history of the College of Engineering would like the aid of the Students, Faculty, and Alumni in obtaining facts, anecdotes, and photographs for use in the book. If you know of any material which would be of interest, or if you would like more information, please contact Prof. Siegfried Mandel, Ketchum 128, University of Colorado, Boulder, Colorado, 80304.*



STEAM POWER LAB IN OLD ENGINEERING III — ABOUT 1910

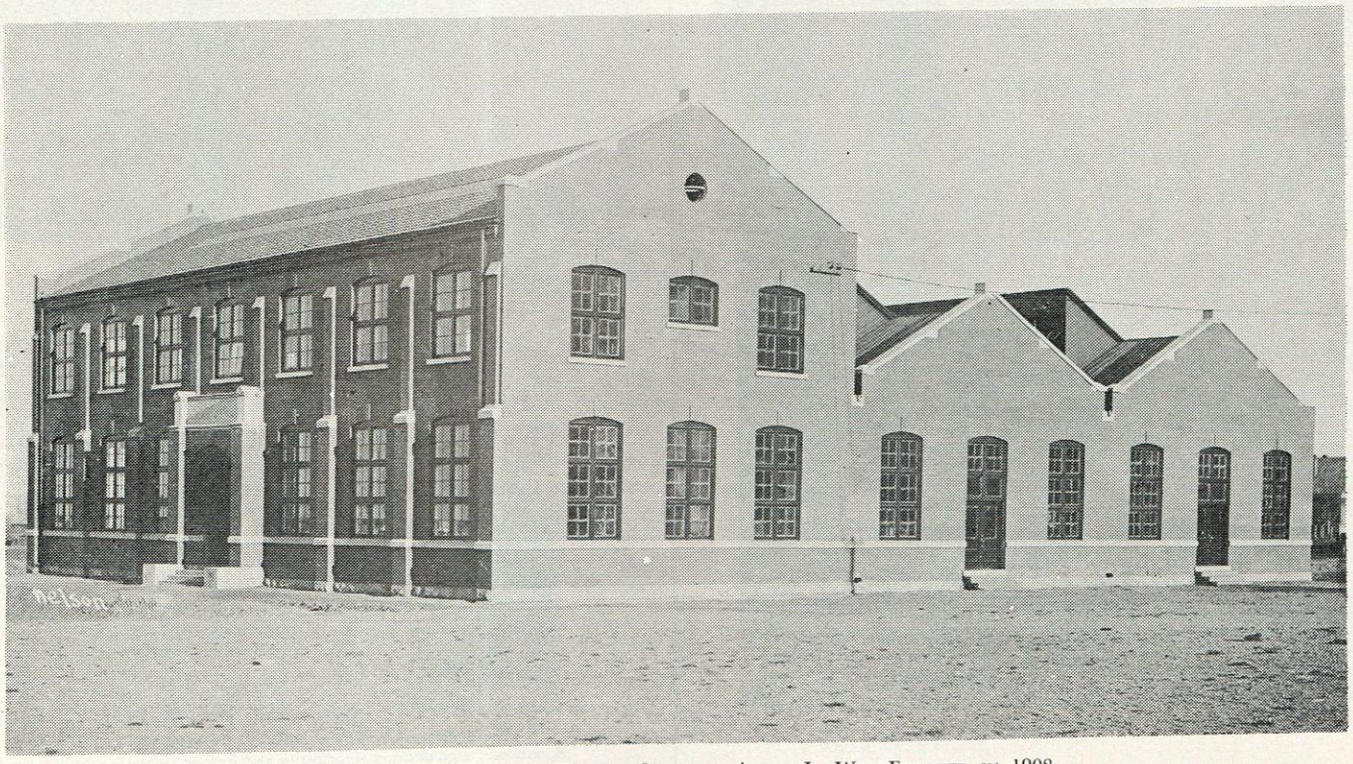


THE UNIVERSITY CAMPUS AS SEEN FROM THE TOP OF THE POWER PLANT, FEB. 1910 (COURTESY OF ARTHUR W. GILL). FROM LEFT TO RIGHT: LIBRARY, EKELEY, HALE, OLD MAIN, GYM, WOODBURY, ENGINEERING, UNIVERSITY STATION — C.&S.R.R., AND UNIVERSITY HOSPITAL.

Applied Sciences appeared. It's only faculty member and, consequently, acting Dean was Major Henry Fulton, a 40 year-old Civil War veteran and graduate of C.U.—Class of 1891. "There was erected on the eastern edge of the campus a brick structure with a tin roof which, with the schedule of courses in the catalogue, represented all there was of the School of Applied Science. Courses . . . leading to the bachelor degree in civil and electrical engineering were opened to an entering class of one student: Fred W. Whiteside, who was also to be its first graduate. The next year four students enrolled, the next year nine, and the success of the engineering school seemed assured. At this time (1895) the School of Applied Science became a separate Department of the University, to be popularly called the Engineering School."

By the turn of the century, the School of Applied Science boasted an inventory of very nearly $20,000, including an engineering building which also housed the campus heating plant. "This one-story brick structure was at first known among the uninitiated as the repair shop but was honored among engineers. . . . When the athletic spirit on the campus clamored for a gym, one was built much to the indignation of the engineers, as an annex to the repair shop—at a contract price of $2100.00. But the year 1897, according to a School of Applied Science student, saw such an increase in the attendance of the engineering school that the annex was absorbed by the imperialistic engineers, who drove the athletes from their position and occupied the conquered ground with their lathes and benches. The work done in this shop furnished the mechanical engineering training required for electrical engineering students and was the first step toward a mechanical engineering department."

"At this time the building, which occupied ground where Norlin Library now stands, was remodelled and



YES, ONCE IT WAS NEW. HUNTER SHORTLY AFTER IT WAS FINISHED IN 1908

the second story added, providing sufficient space for several years for shops, labs, lecture, and drawing rooms until, by 1902, it was too small to accomodate the 120 students by then enrolled."

The above excepts typify the School before World War I. Enrollment and faculty kept increasing, lab facilities improved steadily, and among it all was an extraordinary *esprit de corps*. The "Oil Can Society" is an example. "Flourishing a coat of arms bearing a shield inscribed with an oil can and the legend, Down with Friction, and taking as its motto, Let the Slide Rule, the society dedicated itself to the proposition that the cause of lubricy shall lack no champion, and that friction shall not go unopposed. The brotherhood, who boasted that they met in the oil shack, equipped with all the modern conveniences such as gas heat, tin roof, and oiled earth floor, could be heard chanting, 'My slide rule, my pied rule, O frictionless divide rule, and welcomed to membership students who committed qualifying boners in class—the crew, for example, who flooded the boilers while testing the power plant, or the student who invented the 2½" x 4" circle, or the one who marked his measurement 1' 12"."

World War One saw the College expanding laboratories for practical equipment training. Thirty two temporary instructors were appointed and the curriculum speeded up to complete four years work in two. But at the same time, the war brought the college up to date with the latest advances in engineering practice.

During this time, the dean of the College was Milo S. Ketchum, under whose leadership the College prospered. Dean Evans took over after the war and struggled with increasing enrollment and consequently crowded conditions. But the College grew in the face of disadvantages.

In 1920, the first Engineers' Days were established. Familiar faculty names appeared at CU such as Charles Hutchinson and Frank Eastom.

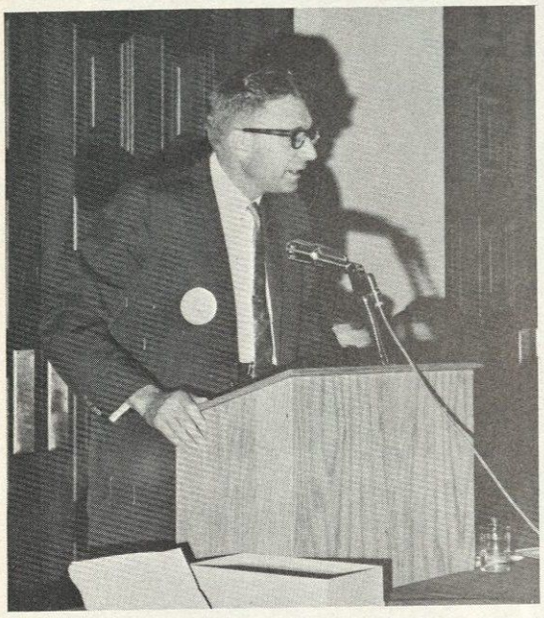
World War II had an even more profound effect on the College than World War I. Hundreds of Navy men were trained here. The importance of research was realized and the establishment of the Engineering Experiment Station, which was "to train men in methods of scientific research and to turn out professional engineers competent in the planning, design, construction, or operation of engineering projects."

And so the book continues. Details of faculty and curriculum changes are noted, as well as favorite anecdotes. Individual department histories are given right up to the present day, and the development is presented in a highly interesting and organized manner. This book is scheduled for release in conjunction with the dedication of the new Engineering Center. Then it will be obvious to all that the College of Engineering has had a very dynamic history and no intention of slowing down.

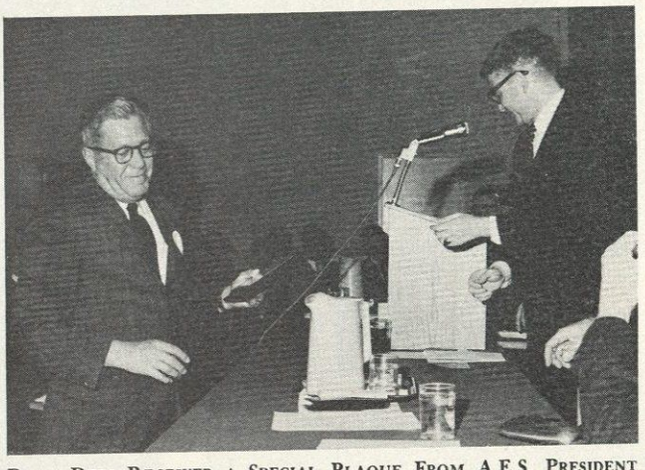
## ANSWERS TO MAY PUZZLES

1) 20 acres
2) 18,538.77 sq. ft.
3) They are in alphabetical order
4) 7752341/667334
5) 1:05 5/11

# E-DAYS— 1965

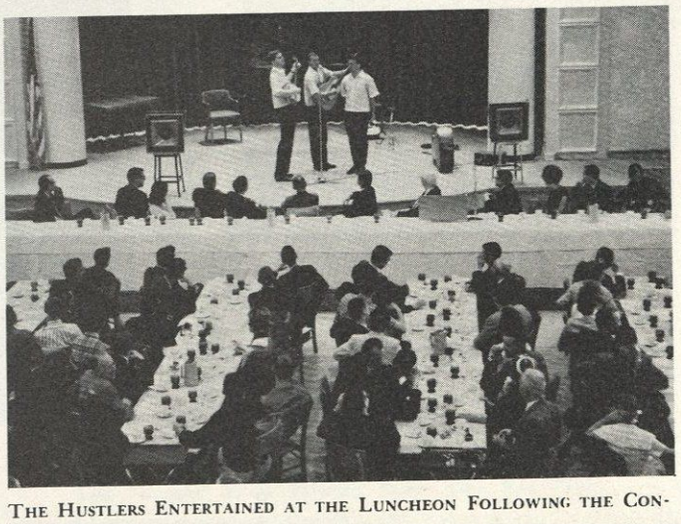


Above: Dr. J. E. Stepanek, Keynote Speaker at the Convocation, Described the Role That the Engineer Must Play in the World Today.



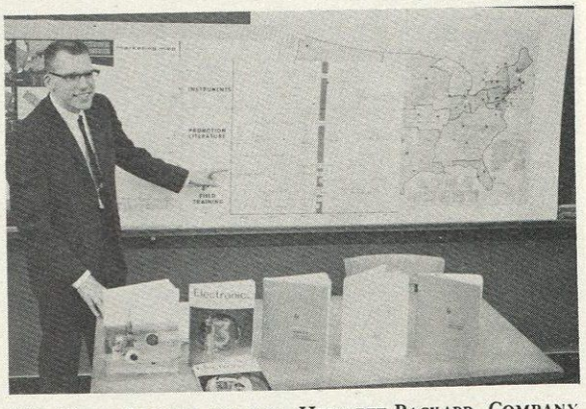
Dean Dedi Received a Special Plaque From A.E.S. President Marshall Silver Thanking Him for His Unending Support.

Below: The A.E.S. Faculty Appreciation Award Went to Dean Timmerhaus in Recognition of His Many Contributions to the College of Engineering.



The Hustlers Entertained at the Luncheon Following the Convocation.

Al Sanders Was Named "Outstanding Senior Engineer" by the Colorado Engineering Council.



Mr. Milo Pitcher of the Hewlett-Packard Company Spoke on "Technical Marketing" at the Seminar Sponsored by I.E.E.E.

# THE E-DAYS BALL

THE CANDIDATES FOR E-DAYS QUEEN WERE (FROM LEFT TO RIGHT) SHEILA AGGELER, VALERIE BARROWS, LINDA ETTER, JUDY KULP, AND SHIRLEY NUSS.

DEAN PETERS THEN HAD THE DELIGHTFUL TASK OF CROWNING MISS LINDA ETTER AS QUEEN OF THE 1965 E-DAYS.

PROF. JOHN C. ("TREACHEROUS") TWOMBLY WAS AWARDED THE "PURPLE SCREW" AFTER WINNING THE "MEANEST PROFESSOR" CONTEST. OTHER NOMINEES WERE: PROF. WILLIAM G. ("GASHOUSE") GOTTENBERG—M.E.; R. BEN ("KILLER") KRIEGH—A. MATH.; PROF. DONALD G. ("LUCIFER") LEITCH—C.E.; PROF. C. FORBES ("DIVERGING") DEWEY—AERO.; AND PROF. J. J. SCHELDORE—CH.E., WHO RAN INCOGNITO AS "J²S."

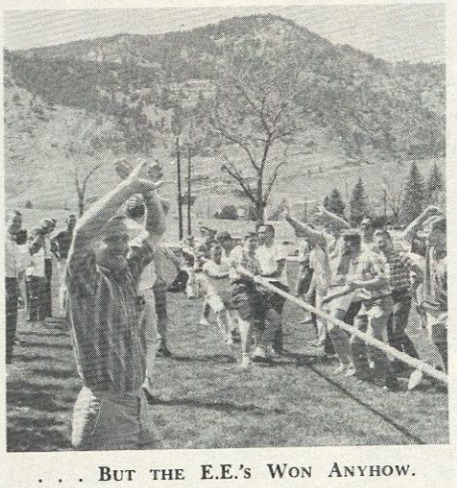
# AND THE PICNIC

Chow Line at the Picnic Saturday Morning. If You Want to Eat, You Got to Wait in Line.

Engine School's Contribution to the Population Explosion.

The Civils Tried. . . .

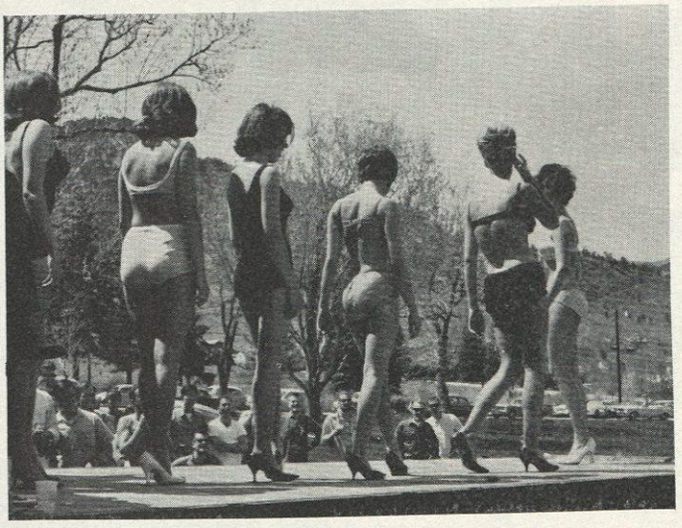
And So Did the Chem E.'s. . . .



. . . But the E.E.'s Won Anyhow.

"Miss Most Perfect Body" Finalists Were (From Left to Right): Georgia Grabow, Joanne Krys, Lois Ann Keithley, Cheryl Ann Clapham, Kathy Shambaugh, and Kathi Grunewald. Miss Cheryl Ann Clapham (Third From the Right) Was Declared the Winner in an Obviously Close Contest.

The "Bodies" Look Perfect From This Side, Too.




BELL TELEPH
SYSTEM

# Sophisticated, work-saving aids help Bell System engineers provide important communications services

As an engineer your future could be important to us. You might be able to contribute to our continuing leadership in the communications field. Therefore, you should know something about us and how we operate.

Bell System engineers deal with modern problems in modern ways. They have at their command the latest in technology and equipment.

An example is how computer programs aid in providing telephone service for new communities.

Engineers at Bell Telephone Laboratories have devised computer programs broad enough in scope so that Bell System operating telephone companies can use them to engineer the required wide variety of telephone plant networks.

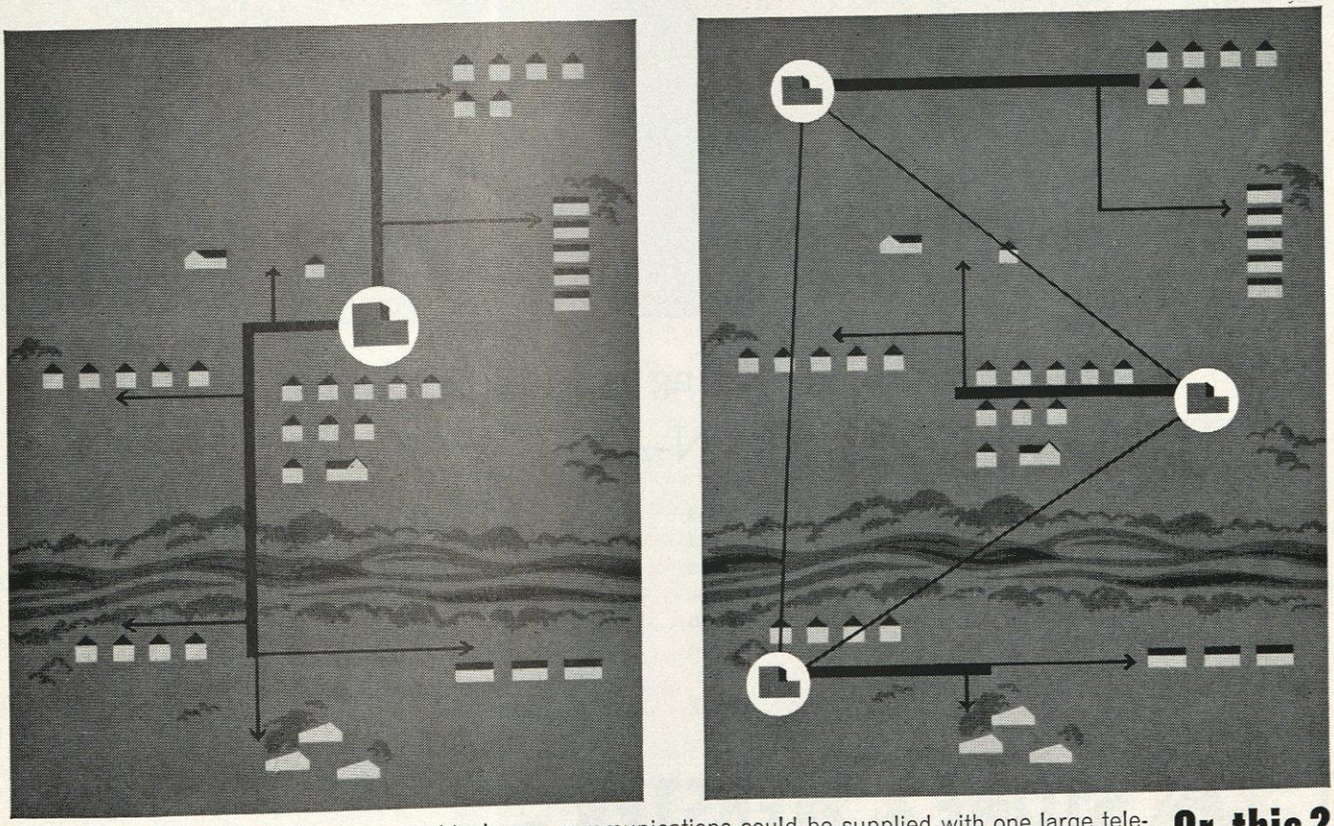
As part of a continuing effort, programs have been designed to analyze communications needs of an area for determining the best plant network layout and switching office location.

In general, the necessary data are collected and the engineer selects a number of alternative plans to be analyzed in detail by a computer. His final decision is based primarily on an analysis of the computer output.

The computer supplies more significant data, and supplies it much faster, than laborious, manual calculation methods. The engineer is thus relieved of dull, time-consuming computation, and he plans facilities with increased confidence—knowing that he is providing efficient and economical communications, tailored for a given area.

You may well find a rewarding career in the Bell System, where people find solutions to exciting problems. The Bell System companies are equal opportunity employers. Arrange for an on-campus interview through your Placement Office, or talk to a local Bell System company.

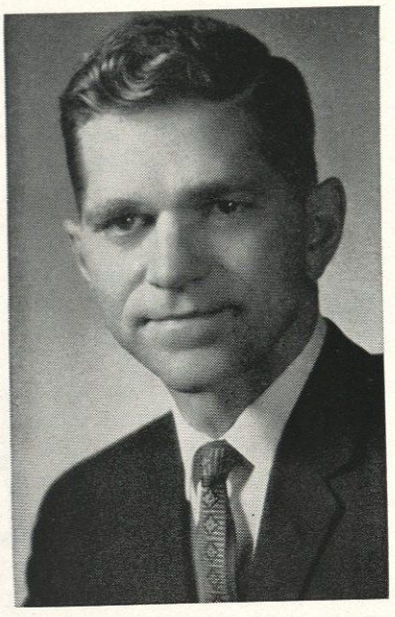
**Bell System**
American Telephone and Telegraph Co. and Associated Companies



**This?** In this hypothetical geographical area, communications could be supplied with one large telephone switching office and a network of cables (left), or with three smaller offices and a different network (right). Many other combinations of offices and cable networks might be possible. This situation, although hypothetical, is typical of the complex telephone engineering problems that are being solved with the aid of computer programs designed at Bell Laboratories. **Or this?**

# DEAN'S COLUMN

## DEAN PETERS



As we approach the end of another school year, our Engineering College recognizes the achievements of its students and faculty by the special awards on "E" Days on April 30 and May 1. I extend my congratulations to all those who received their much-deserved recognition on "E" Days. I also welcome Dr. Joseph Stepanek, our Convocation speaker for "E" Days, back to the University of Colorado. Dr. Stepanek was formerly on our Chemical Engineering faculty, and he has now joined the University on a half-time basis as coordinator of Industry-University activities after spending a number of years in the development of industrial and educational activities in foreign countries.

This has been a good year for our College, with a number of "firsts" that speak well for our future. Our most important "first" is the construction now under way of our new Engineering Center which will provide new facilities for the entire College. Another "first" is the initiation this year of our new undergraduate program in engineering design and economic evaluation. We also initiated, with the support of $200,000 from the Charles F. Kettering Foundation, a joint program with the College of Engineering at the University of Illinois for faculty and student development in engineering at our two universities.

For the first time in its history, our College received the top University recognition for excellence in teaching and for excellence in research. Dean Charles A. Hutchinson received the University Development Foundation Award for Excellence in Teaching and Professor Frank S. Barnes was named as the 1965 University Research Lecturer. Dr. Barnes was also named as the Curtis W. McGraw Research Award winner for 1965, representing the top faculty member in engineering research in the United States under the age of 40.

Emphasis has been placed during the past year on the development of a co-ordinated interdisciplinary program for education in the area of systems engineering. The faculty is currently giving serious consideration to some revisions in the undergraduate engineering curriculum, with the possibilities of reducing the total number of hours required for the engineering degree and of providing additional flexibility in the freshman year to permit students in certain fields to take physics in the first semester with a simultaneous change in the chemistry requirements for engineers. There has been a major revision of the Associated Engineering Students during the past year, and I give special thanks to Marshall Silver as President of AES and to Fred Love as Editor of the *COLORADO ENGINEER* for the fine job they have done in helping direct our undergraduate student activities.

I may be somewhat prejudiced, but I think our College should rate first in all types of activities. This includes general University affairs as well as academic matters. In 1964 the student-faculty team race in the slalom at the CU Winter Carnival was won by the Dean of Arts and Sciences and one of his students. Since the College of Engineering should be the best in everything, I talked to AES President, Marshall Silver, to see what could be done about correcting this situation. As a result, Bruce Klimoski, who is a freshman chemical engineer, and your Dean teamed up for the race this year. I am pleased to report that your College of Engineering now rates in its normal top place in student-faculty slalom team standings, as well as in academic quality.

This is your College. We are not satisfied with being second best in anything. It may take a lot of hard work but we, as engineers, are ready for this. The results are worth the effort. I am proud of our College, our Students, and our Faculty. I sincerely hope that each of you shares with me this feeling of pride in our College of Engineering.

Max S. Peters

DEAN

**The Colorado Engineer is the engineering journal of the University of Colorado, published four times a year. Most of the work of chasing down the material and of putting the magazine together is managed by the students. In this, the final issue for the year, we would like you to**

# MEET

# *The* COLORADO *Engineer* STAFF

### FRED LOVE

Fred has been Editor of the *Colorado Engineer* the past year that's why his blurb is first). Some of his more outstanding accomplishments this year have been writing an anti-AES editorial, plagiarizing dirty jokes, and last but not least, selecting himself as his successor. Fred's other outside activities are A.I.Ch.E., Tau Beta Pi, Sigma Tau, Alpha Chi Sigma, Control Board, Dean's Council, and the Engineering Development Foundation. After one more year of this kind of "study," he will, with luck, graduate with one degree in chemical engineering and another in marketing.

### MARK SHERIDAN

Mark is a graduating fifth-year student. That's all that really matters, but it doesn't take up enough space. He might be described as a joiner; as extra-curricular activities he has devoted considerable time to FAC, Rocky Mtn. Surf Club and F.I.O. (Federation of Intercollegiate Organizations). Also, he has diligently served on an ad-hoc "movement" to get softer toilet paper for University restrooms.

After graduation this August, he hopes to contract hay fever long enough to take the draft physical. If successful, he will possibly R. F. his way into a job as a chemical engineer.

### MARSHALL SILVER

Marshall Silver, this years Assistant Editor, is a senior Civil Engineer. He is also President of the Associated Engineering Students. His other activities include Tau Beta Pi, Sigma Tau, Chi Epsilon, and Senior class Council. For his student activities and accomplishments Marshall has been named to *Who's Who Among Students in American Colleges and Universities* and he has been selected as a University Pacesetter. After graduation Marshall will not stray from the academic environment. He has accepted an assistantship at the University of California at Berkeley where he will work for a Ph.D. degree in Soil Mechanics.

### DICK LUBINSKI

Dick Lubinski is a senior majoring in EE. This past year he has served as president of the IEEE Student Branch as well as attempting to serve as features editor of the "Engineer." He has also been a member of the A.E.S. Control Board, Publicity Chairman of E-Days for '64', and has served on the dean's committee. His most important job is taking care of his wife, Nancy, who is expecting their first in November.

### PAUL BUGG

Paul Bugg, Sections Editor, is a Junior majoring in Economics. Paul is planning to attend summer school in order to avoid any serious work this year. He hopes that the financial gains thus foregone will be regained by diligent application (chuckle) next year. In his spare moments, Paul likes to read, dream, sleep, swim, ski, and study, in that order.

### MARILYN ALGYER

An occasional visitor to the Engineering Office was the Assistant Business Manager, Marilyn Algyer, a senior majoring in Sociology. More often she was glimpsed trying to reform her juvenile delinquents in her capacity as Assistant Probation Officer, attempting to balance the books of the Soc. Honorary Alpha Kappa Delta, working on P.W.C.A. Projects or perhaps studying; she admits her job as one of the rare females among a host of males was the most enjoyable though.

### KATHY O'DONOGHUE

Kathy came to Boulder from Aurora, Colorado. As a sophomore in Chemical Engineering, she serves as secretary of A. I. Ch. E. and secretary-treasurer of S.W.E. This year she has labored in the Circulation Department as Circulation Manager, and in the "Nobody Else Will Do It" Depart-

ment doing things that nobody else will do (like cleaning the back room of the office). For kicks, Kathy water-skis, swims, skateboards, and flies, hoping someday to get her private pilot's license. She is also a "happy hasher" in Nichols Hall. To the inevitable question, "Why are YOU in Chemical Engineering?" she replies "I've got a crush on Dr. Johnson."

### GARY MAUTH

Gary Mauth, a senior in EE, has served on the staff this year as Colorado Industries writer. He also served this year as president of Tau Beta Pi and treasurer of the CU Student Branch of IEEE. He was also on AES Control Board and was one of the three finalists for Outstanding Senior Engineer. He was also an active member of Eta Kappa Nu and Sigma Tau.

### BRUCE DUNN

For the small amount of work he does, Bruce probably has his name appear in more places in the "ENGINEER" than anyone else. Although he does write some sections, the reason he came to be on the staff is that he could do the illustrations better than Fred Love could. Bruce is a combined M.E. and business student, making him the only M.E. around the office. However, his great feeling of superiority carries him through the ridicule of the Chemical Engineers. Other than his duties on the staff of the "ENGINEER," Bruce is a member of some honoraries, all the appropriate professional societies, and the Men's Marching Band.

### JO ANN CRAM

Jo Ann Cram, Book Review Editor, is a Senior majoring in Applied Math. She is a member of Sigma Tau, Mortar Board, Superior Student Program, Society of Women Engineers, Society for Industrial and Applied Mathematics, holds the Tau Beta Pi badge, and was an officer of AES for 1964-65. Next year Jo Ann will attend graduate school here at "Dear old C.U." in the department of Astro-Geophysics. Plans for the summer include one medium-sized wedding.

### CHUCK HANSEN

Chuck Hansen is a senior majoring in Aerospace Engineering and Business. He has been associated with the Colorado Engineer for the past four years. He is a member of Sigma Tau Engineering Honorary and the Arnold Air Society. He intends to accept a commission in the Air Force upon graduation and eventually return to CU for graduate study. Among his interests are folksinging and skiing.

### SANDY PYLE

Sandy Pyle, Office Manager for this year, is a senior in aeronautical engineering. This past year she has been President of the Society of Women Engineers, Treasurer of AIAA, and chairman for the Seniors Committee for E-Days. This fall she hopes to enter graduate school in Aero E. after a nice long summer vacation playing golf and enjoying herself.

### CHERYL VAN HOOSE

At the beginning of the school year, Cheryl Van Hoose had great aspirations to major in journalism. Although flunking her first two Freshman English themes did much to dampen her enthusiasm, her major is still journalism. Cheryl found her work of proofreading interesting even though she had occasional difficulty in understanding the workings of such things as parameters and color T.V. circuits. She is a native of Denver and a member of Alpha Gamma Delta.

### JEFF GRAZI

Jeff Grazi, a graduate of North High School in Denver, is the Colorado Engineer's Photographer this year. Jeff's main activities are Alpha Phi Omega national service fraternity, and C.U. Amateur Radio Club. Jeff is also wing president of Nichols residence hall, member of Men's Residence Halls Association, and an employee of the University Memorial Center. This summer he hopes to return to his electrican's job with Howard Electric.

From Left to Right: First Row — Fred Love, Jody Foss, Kathy O'Donoghue, Marilyn Algyer, Barbara Grieve, JoAnn Cram, Sandy Pyle; Second Row — Ron Kamm, Mark Sheridan, Gary Mauth, Jeff Grazi, Bob Schwab, Paul Bugg, Dick Lubinski, Marsh Silver.

# NEW DEVELOPMENTS AT THE NATIONAL BUREAU OF STANDARDS

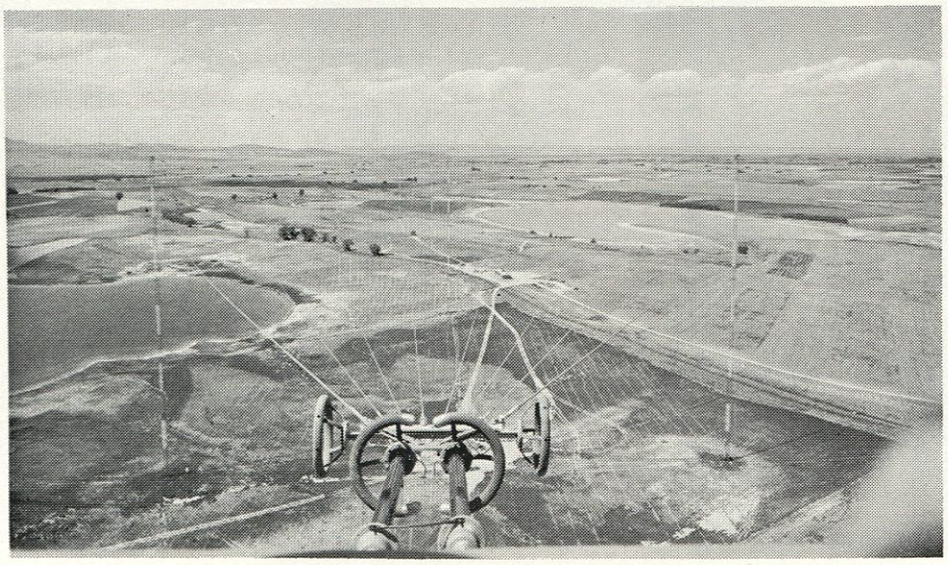
GARY MAUTH

The National Bureau of Standards laboratories, located in Boulder, Colorado, are too vast in their scope and range of technology to be dealt with in an article of this nature. However, the NBS Radio Standards Laboratory is an interesting unit and some of its more recent developments in measurement techniques and time standards make interesting and informative reading.

Within the last ten years, the rapid growth of the electronics industry has turned up many new needs for frequency standards and measurement and calibration techniques which have been handled by the Radio Standards Laboratory at Boulder. The laboratory has developed excellent facilities for the measurement of both rf and microwave power as well as strong facilities in other areas of electromagnetic measurement. It has developed a complete electronic calibration center which annually calibrates thousands of standards over frequencies from zero to 100 gigacyles. The laboratory is also heavily involved in studies using quantum physics as a basis for new radio standards; further, it has developed competence in the millimeter wave regions and in plasma physics.

## Frequency Standards

In recent years, the most striking developments have been in the area of frequency standards and their distribution. The Laboratory operates both cesium and ammonia beams with precisions of one part in $10^9$. The newest cesium beam device, which has even greater accuracy than the first models, was adopted as the official U.S. Frequency Standard in 1960. Since its adoption, the accuracy of the cesium beam has been further refined to one part in $10^{11}$ and this is expected to be still further improved by using a new cesium beam which is about three meters long. Side developments have also been carried out using thallium as an alternate frequency standard. The progress in atomic measurement of time at NBS led to the consideration by the General Conference on Weights and Measures of defining the second in atomic instead of astronomical terms. NBS also operates two stations, WWVB and WWVL, which broadcast



VIEW FROM TOP OF ONE OF THE 400 FT. TOWERS SUPPORTING THE ANTENNAS OF THE NEW 20 AND 60 KC TRANSMITTING STATIONS AT FT. COLLINS, COLO. — NBS PHOTO

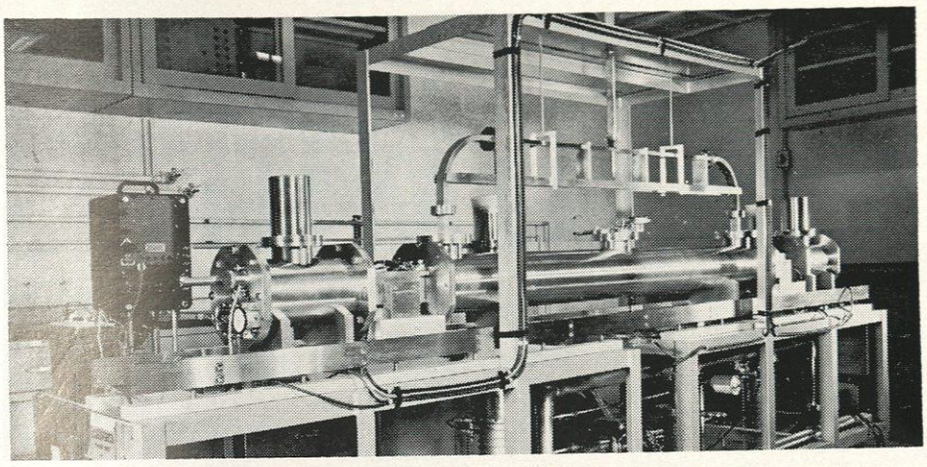
the U.S. Frequency Standard at frequencies of 60 kc and 20 kc, respectively. Broadcasting at these relatively low frequencies reduces the radiated power of the stations, but it provides a much more accurate signal and better stabilities than do higher frequency channels.

### Calibration Standards

With regard to the area of radio frequency standards and calibration measurements, NBS has recently developed a new type of noise power comparator. This device measures noise power from $10^{-18}$ to $10^{-21}$ watts with a precision of at least one percent. This improvement in sensitivity and precision came through the use of a two-channel radiometer developed by the staff, and with refinements, the comparator is expected to eventually achieve a precision of at least 0.02 percent. Also nearing completion at this time is an improved standard for calibrating rf attenuators which promise to provide an accuracy of 0.0001 dB per 10 dB in the near future. This standard is a self-calibrating, high-sensitivity insertion-ratio measuring system. It also has the ability to provide both the insertion phase angle and insertion loss.

### Ultra-High Frequency Measurements

The Radio Standards Laboratory has for some years been doing considerable research in the very high frequency range "including the shorter microwaves up through the millimeter wave region and including the extremely short waves in the nanowave region. They are developing methods of generation, transmitting, and detecting energy in this region. One of the newest programs in microwave physics is the development of an extremely wide-band absolute power standard based upon the pressure exerted by electromagnetic radiation on a perfect reflector. The standard is expected to cover the frequency range from one mm to visible light—ten octaves of the electromagnetic spectrum—in a single unit.



THE NEW CESIUM BEAM FREQUENCY STANDARD

### Plasma Physics

Since the interaction of radio waves and plasmas is a subject of much theoretical and practical interest, NBS has begun a study of radio plasmas with the goal of developing precise measurement techniques and basic data on the fundamental properties of ionized gases. One of the first projects dealt with radio probing a dense, highly magnetized, and bounded plasma. The early theory for this experiment indicated the possibility of accurately determining the internal magnetic field, electron density, and electron temperature of extremely dense plasmas. Analysis, however revealed additional effects not explained by the early theory. Because of this, a detailed solution for bounded plasmas has been developed and is presently being checked.

These are but a few of the many diversified areas in which the Radio Standards Laboratory at Boulder's NBS is doing extensive work. They are also involved in quantum electronics studies, basic theoretical physics work, and many other projects. With the state of the art advancing at the tremendous pace it is today, the work of the RSL can be expected to continue to become more vitally necessary to the scientific achievement of the United States and the entire free world.

# ALUMNI NEWS

CHUCK HANSEN

### LT. GARY G. VAIR

Lt. Gary G. Vair, BSEE '62, has been awarded the Navy's Commendation Medal for meritorious service while on duty as a Navy officer during the Alaska earthquake in March 1964.

Lt. Vair was assigned as the Utilities Officer at Kodiak Naval Station when the earthquake and tidal waves struck. The tidal waves caused heavy damage to the station's electrical power plant which served several thousand personnel. It was Lieutenant Vair's responsibility to return the station to operation as quickly as possible. Vair directed the work of 175 men who cleaned and repaired the station's electrical equipment. Working around the clock, the men successfully restored the power plant to full operation. Lieutenant Vair was cited for his initiative and professional engineering skill in directing this vital operation.

### CAPT. RICHARD E. PIERSON

Capt. Richard E. Pierson, BSEE '64, recently received the second oak leaf cluster to the U.S. Air Force Air Medal for meritorious achievement in aerial flight over Vietnam. Pierson, an instructor pilot, is now assigned to a military Air Transport Service unit at Scott AFB, Ill.

### WILLIAM A. SELBY

William A. Selby, BSME '54, has been named to head Trane's technical department for foreign affairs. He has been a senior product engineer since July 1963, and prior to that he was a development engineer in the products engineering department. Selby's new duties will include coordination and design of products to be built in overseas plants.

### CMDR. CHARLES W. MALLORY

Cmdr. Charles W. Mallory, BSME '46, director of the nuclear power division of the Bureau of Yards and Docks, has retired after 20 years of Naval service. Upon leaving the the Navy, Mallory will be joining Hiltman Associates, Inc. of Baltimore, Md., as manager of the engineering department.

### GERALD E. MATHIAS

Gerald E. Mathias, BSEE '44, is currently employed as associate manager of the marine and defense section of Westinghouse Electric Co. and also is enrolled in the graduate management program at the New York University.

### NATARAJAN KRISHNAMURTHY

Natarajan Krishnamurthy, MSCE '60, PhD '63, additional Professor of Civil Engineering at the National Institute of Engineering (NIE) at Mysore, India, was elected the first president of the NIE Alumni Assn. He is also editor of the NIE Alumnus. Last summer Krishnamurthy was co-chairman for civil engineering at a seminar on technical education sponsored jointly by the government of India and the United States Agency for International Development.

### JOSEPH S. ALFORD

Joseph S. Alford, BSME '34, has been named 1965 recipient of the Cincinnati Engineer of the Year Award. The award is given annually to a Cincinnatian who has made outstanding contributions to engineering or science, civic affairs, and human welfare.

Mr. Alford, a designing engineer in the Large Jet Engine Department of General Electric, is an internationally recognized authority on gas turbines and mechanical design. He holds 19 patents in the field of aircraft gas turbines and has published many technical papers.

Mr. Alford is a member of the American Society of Mechanical Engineers, the Society of Automotive Engineers, and is an Associate Fellow of the Royal Aeronautical Society.

### FRED DUMLER

Fred Dumler, BSCE '48, has been appointed Vice President of Engineering with the ICS Corporation of Arlington, Texas. ICS does internal pipeline cleaning and coating.

Mr. Dumler previously worked with the Metal Products Division of Armco Steel Corporation. He was with this company for 17 years before assuming his present position with ICS.

### CAPT. SALVATORE F. MARTINO

Capt. Salvatore F. Martino, BSArchE '61, has been decorated with the first oak leaf cluster to the U.S. Air Force Commendation Medal at Langly AFB, Va., for meritorious service as assistant base civil engineer at Templehof Central Airport in Berlin, Germany. Martino is now a navigator with a Tactical Air Command unit at Langly.

# Why become an engineer at Garrett-AiResearch? You'll have to work harder and use more of your knowledge than engineers at most other companies.

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You've worked hard to get a good education. Now you want to put it to work in the best way possible.

You will never be satisfied with run-of-the-mill assignments. You demand exciting, challenging projects.

You not only accept individual responsibility – you insist upon it.

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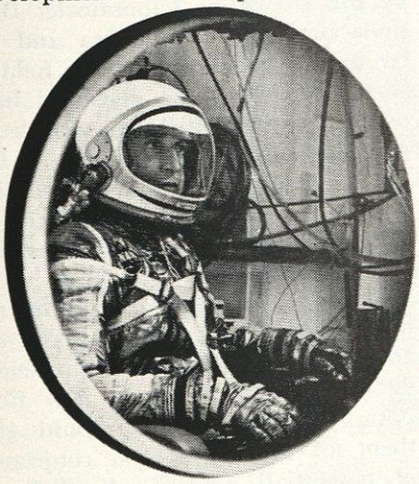
Our business is mainly in sophisticated aerospace systems and subsystems.

Here, research, design, and development lead to production of actual hardware. That means you have the opportunity to start with a customer's problem and see it through to a system that will get the job done.



The product lines at AiResearch, Los Angeles Division, are environmental systems, flight information and controls systems, heat transfer systems, secondary power generator systems for missiles and space, electrical systems, and specialized industrial systems.

In the Phoenix Division there are gas turbines for propulsion and secondary power, valves and control systems, air turbine starters and motors, solar and nuclear power systems.

In each category AiResearch employs three kinds of engineers.

Preliminary design engineers do the analytical and theoretical work, then write proposals.

Design engineers do the layouts; turn an idea into a product.

Developmental engineers are responsible for making hardware out of concepts.

Whichever field fits you best, we can guarantee you this: you can go as far and fast as your talents can carry you. You can make as much money as any engineer in a comparable spot – *anywhere.* And of course, at AiResearch, you'll get all the plus benefits a top company offers.

Our engineering staff is smaller than comparable companies. This spells opportunity. It gives a man who wants to make a mark plenty of elbow room to expand. And while he's doing it he's working with, and learning from, some of the real pros in the field.

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*An equal opportunity employer*

## AiResearch *is* challenge

GARRETT

*Los Angeles • Phoenix*

# THIS TODAY

## BRUCE DUNN

### LIGHTNING TRUCK

This unit shoots arificial lightning for the U.S. Air Force. Called a mobile electrical surge generator, it's used to test the effects of natural lightning. Clark Equipment Company's Trailer Division built the 84-ft-long trailer and special hydraulic erector mechanism. Lightning and Transients Research Institute, Minneapolis, Minn., developed the generator. The trailer's floating suspension lifts the chassis for insertion of horizontal beams to stabilize the unit while operating. The trailer, twice ordinary length, weighs 15 tons, and will carry up to 40 tons. In travel position, the generator rests at full length on the trailer chassis. Raised for operation, it towers nine stories above ground level.


THE AIR FORCE'S MOBILE SURGE GENERATOR.

### FLYING SUB?

A concept of a Navy seaplane which could fly in the air as an aircraft and submerge to cruise under water as a submarine was described recently by a General Dynamics engineer.

The General Dynamics study shows that the submersible seaplane is "feasible, practical and well within the state of the art."

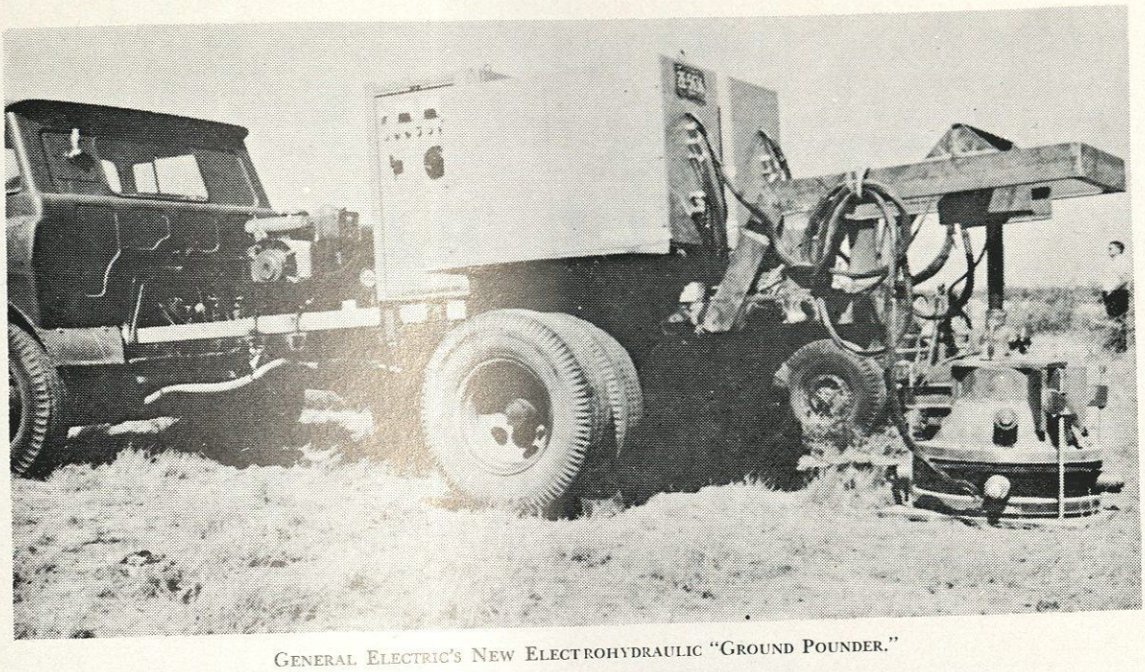
The unique submersible seaplane, called Sub-Plane in the U.S. Navy study project, is a vehicle that would approach its target area with the speed of a water-based aircraft, then dive underwater to pursue its target with the stealth of a submarine.

### TODAY'S NEWSPAPER TODAY—ON THE MOON

An entire daily newspaper could be transmitted to the moon and reproduced from a single 8 by 10 inch film with absolute fidelity and resolution. Such a system could be used for transmission to ships at sea, aircraft, or even that sometimes longed-for desert island. New developments by the Du Mont Laboratories Divisions of Fairchild Camera and Instrument Corporation in the field of fiber optics (minute glass rod light pipes) have opened up completely new methods for highest quality facsimile transmission and reception either on film or on the face of cathode ray tubes similar to television picture tubes.


ARTIST'S CONCEPTION OF A PROPOSED SUB-PLANE.

Our astronauts are not yet on the moon, but if sports enthusiasts are among them, the very light-weight devices possible through new fiber optics shape converters would give them all the details and conjecture of basketball, football, baseball, or



General Electric's New Electrohydraulic "Ground Pounder."

chess. And the female astronaut would keep up with the newest recipes and would have her skirts at the right length when she returned to earth.

## ELECTRICITY— OIL PROSPECTORS GET BANG OUT OF IT

Tremendous electrical exposions on the surface of the earth are now making the search for oil far more efficient and inexpensive.

The Globe Exploration Company, Inc. has devised a system called "DynaPulse" which uses surface-generated seismic energy to define sub-strata conditions. Heart of the system is electrohydraulic equipment developed by General Electric. Large amounts of electrical energy stored in condenser banks is released as a plasma discharge in a transducer which converts the "explosion" into seismic energy.

Precise control of the instant and amount of energy released makes possible the simultaneous use of several field units, thus reducing operating costs. "Dyna-Pulse" units can be truck mounted, or used aboard a barge or boat.

Besides the simplicity and safety of electrohydraulic equipment over gaseous, hydraulic and other methods using chemical explosives or mechanically stored energy, the tremendous pressure and high temperature of the plasma discharge makes an intense explosion rich in high frequencies. Other energy sources used for seismic soundings are often deficient in high frequencies and thus have less revolving power.


A New Way to Recruit. The Beach is Ft. Lauderdale; the Company is Systems Engineering Laboratories, Inc., and Everybody Knows the Time.

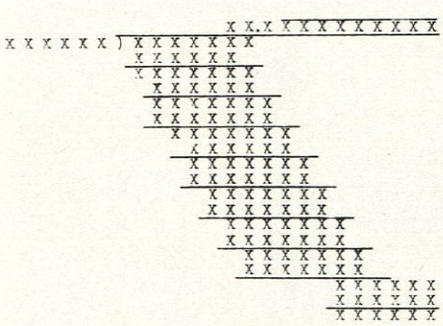
# PUZZLE PAGE

BRUCE DUNN

As this is the last issue of the year, and I wouldn't want to think that you went into a neurotic state trying to solve the puzzles, we have included the answers on page 14 of this issue. But only the answers, no solutions.

1) Actually, you shouldn't have any trouble with puzzles such as the ones in this issue. For example, a farmer agrees to pay $80.00 cash and a fixed amount of bushels of wheat as yearly rental on his farm. This amounted to $7.00 per acre. However, inflation raised the price of wheat from $0.75 to $1.00 a bushel, which effectively raised the rental to $8.00 per acre. How large is the farm?

2) Next is a reconstruction problem.



The only hint to the answer is that the last nine digits in the quotent form a repeating decimal.

3) If you look before you try on this one you should feel ashamed, because it is all too obvious once you see it. You are given the digits in this order: 8-5-4-9-1-7-6-3-2-0. What determined this order?

4) Next is a simple problem in geometry. Simply find the area over which a horse grazes when tied by a rope 100 feet long to a stake on the circumference of a circular lake whose area is one acre!

5) Lastly, we have one for all you people who can tell time. We all know that the hands of a clock are together at 12:00. At what time after that are they together next?

---

References

1) *Louisiana Tech Engineer* — March, 1964

2) *Ibid.* — November, 1964

4) *Drexel Technical Journal* — October, 1964

5) Irving Adler, *MAGIC HOUSE OF NUMBERS,* p55, The New American Library of World Literature, New York. 1957

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## ANSWERS TO MARCH PUZZLES

1) As there are a sufficient number of factors of two, it can be said that a zero will appear every time a factor of five appears, i.e., once in 5, 15, 45, 55, 65 85, 95, 10, 20, 30, 40, 60, 70, 80, 90, and twice in the numbers 25, 50, 75, and 100. This is a total of 24 times, so there are 24 zeros representing placeholders.

2) If you can locate a book that has "rules of thumb" in it, you will find that if the last two digits are divisible by four, so is the number. This is the case here, so the number is divisible by four. It is also divisible by 11 and 9 by virtue of similar rules. Consequently, the number is divisible by their product, which is 396. No stipulation has been made as to the order in which the spaces will be filled, as it is not necessary. From this we can conclude that the probability is 1.

3) This question is answered by considering the distribution of the original $30. The hotel got $25, the men got $3, and the Bellboy got $2.

4) Consider this table:

| Pages | Digits |
|---|---|
| 1 - 9 | 9 |
| 10 - 99 | 180 |
| 100 - 999 | 2700 |
| | 2889 |

Numbering the first 999 pages will use up 2889 digits, leaving 112, to number 28 pages with four digit numbers. $999 + 28 = 1027$, which is the answer.

5) The water level will drop. While the boat carries the bricks, they will displace an amount of water equal to their weight, but they will displace an amount equal only to their volume once they have dropped. Since the bricks sank, they must be more dense than water, therefore the level in the lake will drop.

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# ADVERTISERS' INDEX

# OIL CAN

THE HONORARY SOCIETY OF LUBRICATION ENGINEERING

Lubricity shall lack no champion . . .
Friction shall not thrive unopposed

In this issue, the Chips page is dedicated to presenting the best of the Oil Can over the long history of the College of Engineering. The Oil Can Society was unique among engineering societies. . . . Its purpose was to honor the outstanding blunders of both students and faculty. That is, it was an "RF" society in every sense of the word. There were no meetings, but Oil Can did have a very extensive structure of officers, including Chief Oiler (Jerome S. Marcus—Ch.E. 1917—was one of the guiding lights in that position), Chief Spout Wiper, Matron of Friction Engineering, and many others.

Oil Can first appeared in the Colorado Engineer in May, 1916. The column gradually became more and more concerned with humor, until by World War II, it was devoted entirely to jokes. Shortly after the war, an effort was made to return the section to the reporting of student "boners." However, the size of the College made this impractical, and the jokes returned. Here, though, is proof that our predecessors also made a few rather funny mistakes. —Fred Love

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Harold Worcester invented a new patent foot brake for the large gas engine in the new laboratory. He has only given the brake one trial, so he has not procured much data yet on the efficiency, etc., except that it has required about twenty-five yards of antiseptic gauze to keep the brake in shape after the first trial.

*—May, 1916*

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Thomas Titley was elected to membership when it was learned that he had spent several hours at the simple problem of converting degrees centigrade to radians. *—November, 1916*

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Professor Van Valkenburgh, of the Chemistry department, announced the discovery of a phosphorescent paint, which if applied to the face of a watch would make it possible to tell the time of day at night. Quite a remarkable achievement, no doubt, and one which will bring riches and fame to its inventor. *—June, 1919*

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A principle that should be of great help to efficiency experts has been brought to light by Ed Jones. Prof. Bauer asked him, "What will be the effect if you do not supply enough water to the condenser?" And the answer was, "The water will come out at a higher temperature than the steam enters." In another class Bob Taylor explained the action in an absorber by saying that where the gas is absorbed it leaves an empty space with nothing in it. It is difficult to picture the heights which Mr. Jones and Mr. Taylor will reach when they have left the University.

*—April, 1920*

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The P. Chem class was deeply engrossed in the study of radioactivity and the energy evolved by these substances when Hank Vidal asked, "If radium is disintegrating all the time, is it not possible that the radium now in use is more or less worn out?"

*—January, 1922*

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Watson junior Electrical, kept speaking of real and unreal numbers.

*—March, 1925*

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Our editor (of the *Colorado Engineer*), Al Thomas, is at last a noted member of the society. He has recently made a brilliant discovery. He has found that a switch board makes an admirable writing desk. However, Al has found one difficulty with the new application. The terminals of a certain 220-volt switch don't seem to be able to get along at all with Al's aluminum clip board. In fact, they even went so far as to bite a huge hole in the board when he was trying to write. Al has about decided to get a wooden board, which he has heard is much more congenial with 220-volt terminals. *—January, 1927*

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In Roads and Pavements class, J. E. Cowley, sophomore civil, after expounding to great length in an attempt to answer a question, very nonchalantly asked, "By the way, Professor, just what was the question?"

*—March, 1928*

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Cris Bartlett took hold of two terminals in the A.C. Lab to see if they were hot. They were. *—May, 1928*

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We regret to announce that member Frank Starr sustained slight injuries during some of his most important research. In order to think more clearly, Frank seated himself on one of the numerous belts attached to the machines in the A.C. Lab. He still insists he could have solved the problem he was working on if someone had only waited five more seconds before turning on the power.

*—May, 1928*

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John McKinley, junior chemical, stated in Materials Testing Lab that most specimens got hot when they begin to neck. *—May, 1928*

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As Professor Nelson was explaining how to find the moment of inertia of a washer by subtracting the hole from the total area, Clarence Beitman, junior electrical, said quite seriously, "But the hole hasn't any weight." *—January, 1931*

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A certain sophomore, while half asleep, answered Professor Hutchinson's query, "which way does the sine curve go?" with the appropriate answer, "Yes." *—November, 1938*

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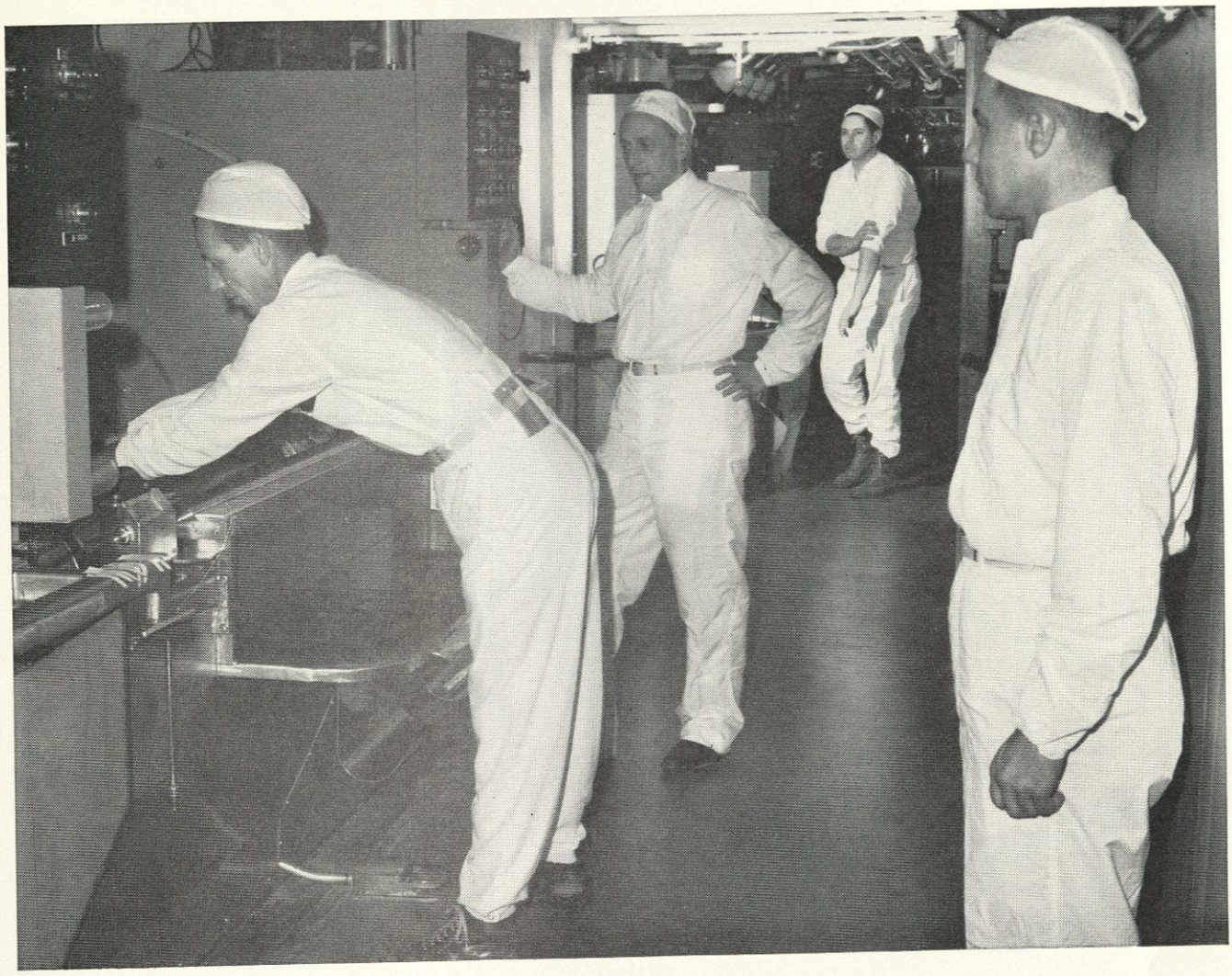

# Art of creating photo-film manufacturing machines taught here

That's sure no professional ad model posing up in the foreground of the picture but a real pro of an engineer looking over his handiwork some six years after drawing the assignment.

The first three years he spent picking the best location for the thing with regard to capital cost, operating cost, and operating convenience. This means he actually put it together in a scant three years, which isn't bad, considering that it amounts to a huge integration of mechanical engineering, electrical engineering, chemical engineering, hydraulic engineering, instrumentation engineering, structural engineering, industrial engineering, and just about every other category of engineering in the catalog of a big college.

Of course, no college teaches men how to design and assemble a complex like that. You learn by doing. Not at every large company can you learn. Come to think of it, *is* there any other company whose production is of a nature and volume that demands such neat and thoroughgoing co-ordination of engineering disciplines?

We happen currently to be seeking not only engineers to create the components and subsystems but those willing to learn how to fit all the pieces together.

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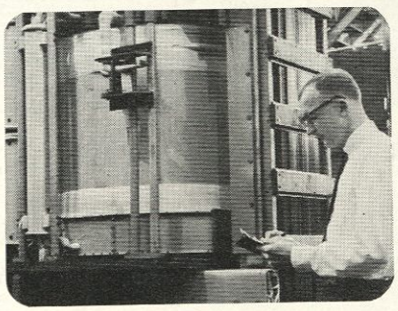
**ELWOOD P. STROUPE, MSChE, PURDUE '62** is a design engineer at the Atomic Power Equipment Department. He has contributed to the design of Dresden 2's reactor—heart of the system. He'll follow it right through installation.



**RONALD F. DESGROSEILLIERS, BSEE, U.S. MILITARY ACADEMY '60** is on the Manufacturing Training Program at G.E.'s Power Transformer Department. Ron is a production foreman helping build massive transformers for Dresden 2.

**WORKING ON THE SALE** of Dresden 2's turbine-generator is William J. Mahoney, BMS, Maine Maritime Academy, '56. After serving four years in the U.S. Navy, Bill joined the Technical Marketing Program to help G.E. meet its customer's needs.

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It takes a big company to handle a massive project like Dresden 2—with research-backed know-how for new designs, manufacturing capabilities to produce next-generation equipment, and in-depth knowledge of customer needs. At G.E., you'll be part of a uniquely decentralized organization with more than one hundred product operations that design, build and sell thousands of products—from transistors to turbines. When a big job requires it, these operations can be tied closely together—like the 57 departments at work on Dresden today. That's one of the reasons why G.E. pioneers in so many areas and is a leader in so many fields. Write us now—or see your placement officer—to define your career area at General Electric. General Electric Co., Section 699-13, Schenectady, N. Y. 12305. (An Equal Opportunity Employer)

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