

## EDITOR'S PROFILE of this issue

*from a historical perspective ...*

with Paul Wesling, SF Bay Area Council GRID editor (2004-2014)

### NOVEMBER, 1960:

Cover: Bill Hewlett and Dave Packard appear on the cover, with a photo of the entrance to the new HP building in Stanford's Industrial Park. A photo of the new building is on p. 28.

- p. 6: in the editorial, Pete Lacy talks about a program in Long Island high schools intended to excite teachers and students about science (today: STEM). Topics of talks include "Can a Woman Pursue a Scientific Career?" and "How an Engineer Works".
- p. 12: Long discussion of past month's panel on "Experiences of Recent Visitors to the Soviet Union": reactions from Dave Packard, Irmgard Flugge-Lotz and Bernie Widrow of Stanford, plus Roy Amara of SRI and Fred Kurzweil of IBM. Women in USSR work, while American women are full-time homemakers, and even drive their own cars.
- p. 18: Fred Terman told the NEC attendees in Chicago that if the Midwest continued to "plod along" in electronics it will become the "peon group" of the industry. "If you plod along doing hard, unexciting work and making a living, the East Coast and particularly the West Coast electronics industries will have all the fun and most of the growth. ... You do not know how to make use of the 'egghead' type. As a result, you don't even fight over the masters and doctors candidates being produced by your own universities, let alone by universities in the rest of the county."
- p. 20: Mechanical Engineering Prof. John Arnold of Stanford (and one that I had for a class at Stanford, and remember well) spoke on engineers-turned-managers and gave five important management actions. He also is in charge of a program at the Graduate School of Business.
- p. 22: The Professional Group on Product Engineering and Production (predecessor to today's Electronics Packaging Society, of which I've been an officer) profiles its meeting on "Theory and Practice of Impurity Concentration and Control in Silicon Mono Crystals" which has come a long way since Czochralski's techniques. Shown is a photo of Bud Eldon (future IEEE president) with the meeting's speaker and attendees. This work was critical to the transistor and IC business in what became Silicon Valley.
- p. 28: Eugene Kleiner, one of the "traitorous eight" that founded Fairchild, is appointed manager of administration and research services. He went on to found Kleiner Perkins (with Tom Perkins), one of the big venture capital firms in the Valley.
- p. 28: Gene Amdahl, who was a key contributor to the IBM 704, rejoins IBM Research. He later developed computer architectures at IBM's offices in Menlo Park, and went on to found Amdahl Corporation, maker of computer systems that were plug-compatible with the IBM 360 (where I worked for 7 years). A photo of Gene is on p. 30.
- p. 36: There is a long list of IRE members who have recently moved to the SF Bay Area, showing the continuing influx of talent into what becomes Silicon Valley. Dave Hodges comes to UC-Berkeley's EE department (I worked with him to establish the IEEE Trans on Semiconductor Manufacturing).



Archive of available SF Bay Area GRID Magazines is at this location:

[https://ethw.org/IEEE\\_San\\_Francisco\\_Bay\\_Area\\_Council\\_History](https://ethw.org/IEEE_San_Francisco_Bay_Area_Council_History)

At time of scanning, the bound volumes are held by Paul Wesling. January, 2021 Contact p.wesling@ieee.org

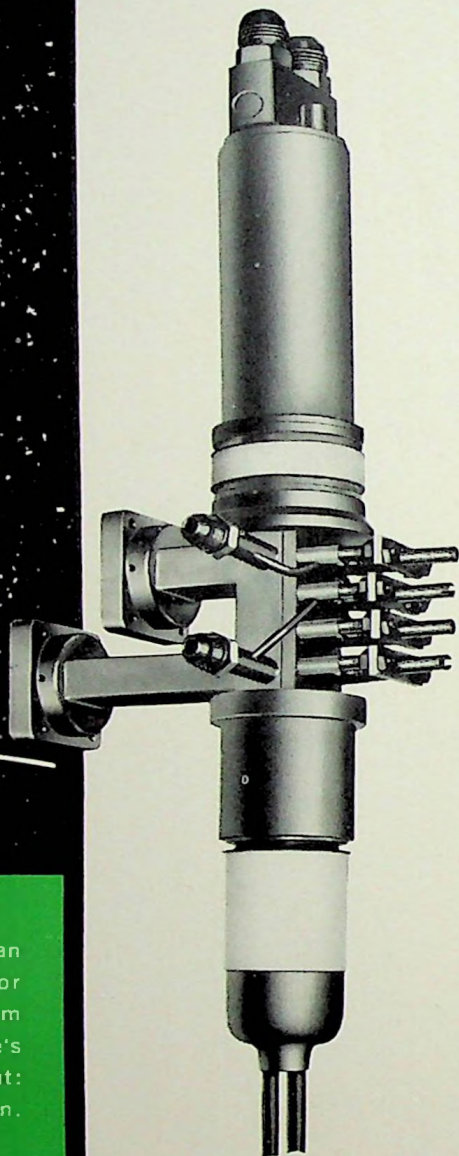
# *Grid*

November 1960



for  
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systems

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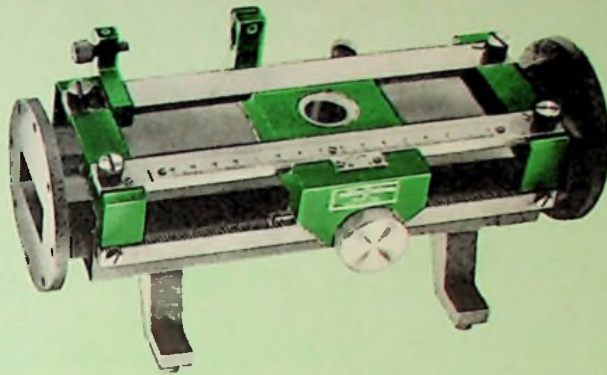
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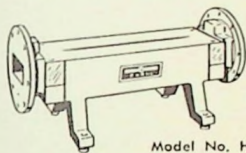
# Interchangeable SLOTTED SECTIONS

convenient and positive

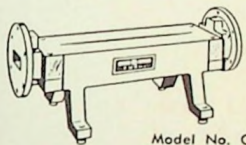


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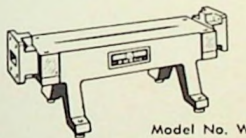
## INTERCHANGEABLE WAVEGUIDE SECTIONS



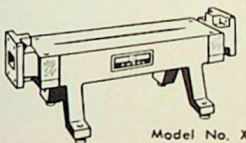
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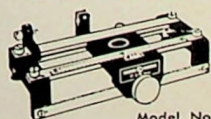


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# Grid

## November 1960

Published monthly except July and August by the San Francisco Section, Institute of Radio Engineers

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### cover

Twenty years of diligence as a member of the Peninsula electronic family has led Hewlett-Packard Co. to the position of world's largest maker of electronic measuring equipment. Also to completion of its current \$4.5-million

building program on a 50-acre Stanford Industrial Park hilltop site. In the cover picture, founders W. R. Hewlett and David Packard appear with the new front entrance, a facade embellished with a special topical mosaic.

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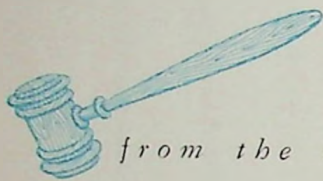
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*from the chairs*

#### LOOKING AT LONG ISLAND



*Pete Lacy*

Although Stan Kaisal and I meet on IRE committees several times each month, the hours are taken up entirely with administrative affairs. So I will take the liberty of using this space to continue a discussion of the matter taken up last month: contact with the young people of this area at the junior high school and high school level to provide increased incentive to study the many basic and new ingredients of electronics.

Probably some new approaches will be generated in the San Francisco Section to accomplish this "coupling," but I will only report on the formal aspects of a plan under way in another section.

This is the program carried out by the student affairs committee of the Long Island Section. It has been in operation since 1956 and has developed formal programs aimed at the teachers as well as the students. For the teachers, there has been developed a state-approved course for which in-service-training credit is given. The student program consists of a lecture bureau making available speakers and topics; and a group of IRE high-school representatives, whose function is to act as liaison with the schools.

The objectives of this program are given by Gus Kroyer in the February 1960 *Pulse*.

"All of this effort is an attempt to provide a means by which the substantial L.I. scientific community of graduate engineers, scientists, mathematicians, etc., can make its experience available to the teachers and students of the area. In so doing, it is hoped that both teacher and student might be stimulated, thus making science more meaningful to the student.

"No attempt is made to sell the student on a particular career, but rather, the talks with their demonstrations, slides, movies, and so forth, are meant to provide him with a fresh view of the world he is preparing to enter. With broader experience, the student's selection of a career may be a little easier and less due to factors of chance. One might hope that the nation's welfare is served by the stimulation of talented youngsters.

"While this program is unique among professional organizations, its purpose

is shared, to some degree, by a number of other groups. Among these are the Junior Engineering and Technical Society (JETS), the Science Explorer Scout Program of the Boy Scouts of America, the Joe Berg Foundation, and various programs sponsored by industrial organizations throughout the country (usually Big Brother Systems). Each of these programs attempts to meet a specific need in its own locale, and the methods chosen are as numerous as the programs. While the IRE does not sponsor individual student groups, it has made known its willingness to help other organizations by providing speakers at meetings, or by occasionally furnishing consultation on specific problems which have arisen in the course of a project."

During this current school year their lecture series for the teachers includes 16 lectures divided into the categories of electronics, mathematics, physics, and mechanics. There are 19 student lectures available covering both technical and vocational guidance topics. Some of the latter are: "Can a Woman Pursue a Scientific Career?," "Careers in Technical Writing and Art," and "How an Engineer Works." The technical topics cover space vehicles, radio astronomy, computers, physics, and engineering specialties.

This is certainly a major undertaking for an IRE section and deserves the highest of praise. Long Island also will have the new Graduate School of the Brooklyn Polytechnic Institute opening early next year. This was accomplished by the Institute under the leadership of Dr. Ernst Weber, former IRE president.

Many of the same objectives have been accomplished in the Bay Area. Here the efforts have grown over a long period of time with close cooperation between schools, industry, and the scientific community. Probably the greatest contribution that the IRE membership could make would be to examine the present situation to see how the current programs can be aided by more volunteer assistance. Certainly there also must be new, rapidly growing areas where effective aid has not been established.

*Pete Lacy*

—PETER D. LACY, SECRETARY, SFS



## ENGINEER'S BIRD GUIDE

Litton has designed and developed an airborne computer that can perform 250,000 additions per second in a complete package less than 7 cubic feet in volume. This *general-purpose* data processor incorporates an advanced combination core and drum memory, high-speed switching circuits, and esoteric logic organization that features dual instruction registers and interlaced operand and instruction access cycles.

Litton airborne systems currently in production for manned aircraft are for the Grumman A2F, W2F, WF2, and the Lockheed F-104 and P3V.

Engineers experienced in logic design, circuit design, computer programming and disciplines related to computer systems, guidance and control systems, and tactical data systems will find positions of absorbing interest in our R&D and manufacturing facilities in Los Angeles suburbs. A laboratory for research and development in advanced communications is maintained in Waltham, Massachusetts. If you can make significant contributions in any of these areas, write to Mr. Don Colvin, Research and Engineering Staff, Ventura Freeway at Canoga Ave., Woodland Hills, Calif.



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# MEETING CALENDAR

## EAST BAY SUBSECTION

8:00 P.M. • Monday, Nov. 28

"Stanford Two-Mile Electron Linear Accelerator"

Speaker: Omar E. Snyder, research assistant, W. W. Hansen Lab of Physics, Stanford University

Place: Dublin Corral, Dublin, California

Dinner: 7:00 P.M., Dublin Corral

Reservations: Marge Bennett, Hilltop 7-1100, Ext. 84203; or Virginia Cherniak, THornwall 3-2740, Ext. 5434, before Nov. 24 if possible

## PROFESSIONAL GROUPS

### Audio

8:00 P.M. • Wednesday, Dec. 7

(Joint meeting with Audio Engineering Society)

"F-M/F-M Multiplex Stereo"—panel discussion

Moderator: R. S. MacCollister, producer, "Equipment Report" program, KPFA, Berkeley; KPFK, Los Angeles

Panelists: Hal Cox, KAFE-FM and Hal Cox Co.; Ed Davis, KDFC-FM; Erwin Goldsmith, KPFA-FM; R. A. Isberg, Ampex

Place: Monterey Room, Sir Francis Drake Hotel, Powell at Sutter St., San Francisco

Dinner: 6:30 P.M., The Golden Hind, Sir Francis Drake Hotel; Happy Hour, 6:00 P.M., Drake's Tavern

Reservations: Ed Dowling, EMerson 9-7111, Ext. 545, by Dec. 7

### Bio-Medical Electronics

8:00 P.M. • Wednesday, Nov. 16

"The Photoreceptor as a Transducer"

Speaker: Donald Kennedy, assistant professor of biological sciences, Stanford University

Place: Room M-112, Stanford Medical School Building. Room M-112 is located in the courtyard of the wing in the center nearest Hoover Tower. Approach from Palm Drive on Stanford campus, which is the extension of University Avenue, Palo Alto

Dinner: 6:00 P.M., Red Cottage Restaurant, 1706 El Camino, Menlo Park

Reservations: Ken Gardiner, DAvenport 6-6200, Ext. 2659

### Communications Systems

8:00 P.M. • Wednesday, Nov. 23

"Step-Frequency Ionosphere Sounder Techniques"

Speakers: Leonard Seader and Raymond Egan, Granger Associates

Place: Room 126, HP wing, Electronics Research Lab., Stanford University

Dinner: 6:00 P.M., The Red Shack, 4085 El Camino Way, Palo Alto

Reservations: Mrs. Donna Jean Harapat, REgent 9-2344, by November 22

### Electron Devices

8:00 P.M. • Wednesday, Nov. 30

(Joint meeting with PGMTT)

"Low-Noise Traveling-Wave Tubes"

Speaker: Dean Watkins, Watkins-Johnson Co.

"Low-Noise Parametric Amplifiers"

Speaker: Glen Wade, Raytheon Co.

Place: Room 100, Physics Lecture Hall, Stanford University

### Electronic Computers

8:00 P.M. • Tuesday, Nov. 15

"Table Look-up and Language Translation"

Speaker: John E. Griffith, IBM, Poughkeepsie, New York

Place: Stanford Village Auditorium, Stanford Research Institute

Dinner: 6:00 P.M., The Red Shack, 4085 El Camino Way, Palo Alto

Reservations: None required

### Electronic Computers

8:00 P.M. • Tuesday, Dec. 13

Details to be announced

### Engineering Management

7:00 P.M. • Thursday, Nov. 17

Computer Executive-Decision Game

Hosts: Ben Lefkowitz and Dr. Clay Perry, Stanford Research Institute

Place: Bldg. 410, Engineering Division, Stanford Research Institute

Reservations: Mrs. Crist, DAvenport 6-6200, Ext. 2403

Participation limited

# MEETING CALENDAR

meeting ahead

## THEORIZING NOISE AWAY

**Engineering Writing & Speech** 8:00 P.M. • Tuesday, Nov. 15  
"Patent Disclosures and Claims"  
Speaker: John F. Lawler, patent attorney, Sylvania Mountain View  
Place: Conference Room 3B, Bldg. 1, Hewlett-Packard Co., 1501 Page Mill Road, Palo Alto

**Instrumentation** 8:00 P.M. • Tuesday, Nov. 22  
"State of the Arts, Instrumentations, Magnetic Recording"  
Speaker: Winfried B. Heinz, chief engineer of instrumentation, Ampex  
Place: Cubberley Auditorium, Stanford University

**Instrumentation** 8:00 P.M. • Tuesday, Dec. 6  
"A Proton Energy Instrument for Satellite Use"  
Speaker: Thomas Fryer, research engineer, NASA, Ames Research Center, Moffett Field  
Place: Cubberley Auditorium, Stanford University

**Microwave Theory & Techniques** 8:00 P.M. • Wednesday, Nov. 30  
(Joint meeting with PGED, see above)

**Military Electronics** 8:00 P.M. • Wednesday, Dec. 7  
Pearl Harbor Anniversary Meeting  
"The Polaris Missile and the Fleet Ballistic Missile Weapon System"  
Speaker: Cmdr. Nicholas Brango, USN, assistant director plans and policy division, Bureau of Weapons representative, LMSD, Sunnyvale  
Place: Bldg. 202, LMSD Auditorium, Palo Alto  
Dinner: 6:00 P.M., The Red Shack, 4085 El Camino Way, Palo Alto  
Reservations: Daystrom-Wiancko, DAvenport 6-7053, by noon, Dec. 5

**Product Engineering & Production** 7:30 P.M. • Tuesday, Nov. 22  
"Design and Fabrication of Magnetic Components" and plant tour  
Speakers: J. Biggerstaff and L. Burkhart, Palo Alto Engineering Co.  
Place: Palo Alto Engineering Co., 620 Page Mill Road, Palo Alto

**Radio Frequency Interference** 8:00 P.M. • Tuesday, Nov. 15  
Organizational meeting  
Place: IRE Section Conference Room, 701 Welch Road, Palo Alto

**Space Electronics & Telemetry** 8:00 P.M. • Tuesday, Nov. 15  
"Space Radiation—Properties, Measurement, and Effects on Design Considerations"  
Speaker: Forrest Mozer, research scientist, nuclear physics department, Lockheed  
Place: Auditorium, Lockheed, 3251 Hanover Street, Palo Alto  
Dinner: 6:30 P.M., The Red Shack, 4085 El Camino Way, Palo Alto  
Reservations: Mrs. J. Miller, DAvenport 1-4175

### CHRONOLOGICAL RECAP

- November 15—Electronic Computers, Engineering Writing & Speech, Radio Frequency Interference, Space Electronics & Telemetry
- November 16—Bio-Medical Electronics
- November 17—Engineering Management
- November 22—Instrumentation, Product Engineering & Production
- November 23—Communications Systems
- November 28—East Bay Subsection
- November 30—Electron Devices/Microwave Theory & Techniques
- December 6—Instrumentation
- December 7—Audio/AES, Military Electronics
- December 13—Electronic Computers

"Low-Noise Traveling-Wave Tubes" is the topic to be treated by Dean A. Watkins at the November episode of the continuing series of PGED/PGMTT meetings. At the same affair, Glen Wade will discuss "Parametric Amplifiers, Masers, Photon Counters, and other Low-Noise Devices." See the Meeting Calendar for additional data.

Watkins' talk will trace the important steps which have brought about the the present low-noise twt and will describe the characteristics of tubes presently available.

The noise performance of various low-noise microwave receiving devices, i.e., masers, parametric amplifiers, and traveling-wave tubes has recently reached the point where further improvement is not needed for most practical applications. Background thermal noise generated outside the receiver, either in the transmission line from the antenna, in the losses of the antenna itself, or in the vicinity of the source now sets the lower limit on sensitivity in most situations.

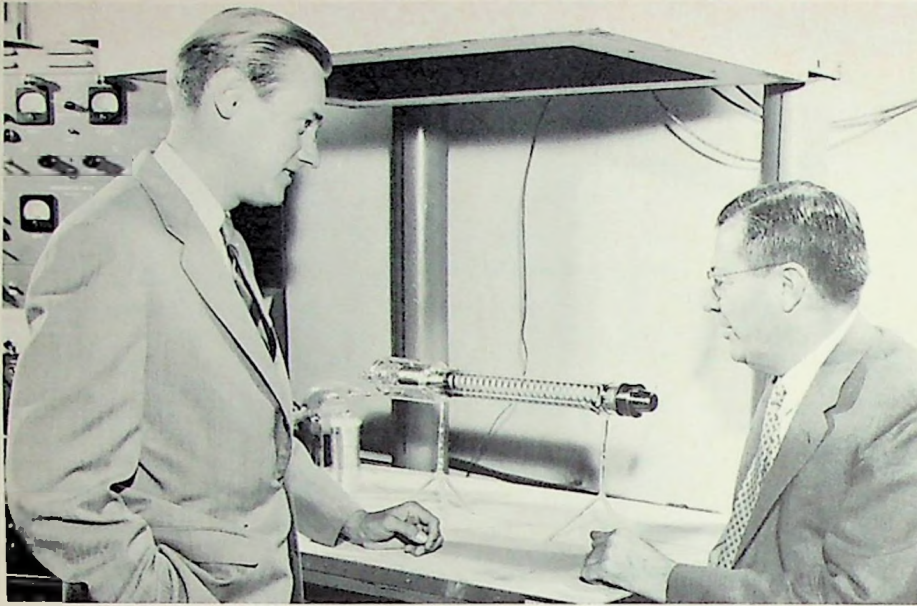
Because of these recent advances in noise performance, the choice of which device to use in a particular application may depend upon performance characteristics other than noise figure, such as gain, bandwidth, stability, life, reliability, size, weight, and power requirements.

Low-noise traveling-wave tubes have now given noise figures ranging from 2 db at 1,000 mc to 4.5 db at 10,000 mc. Tubes approaching these performance figures are now commercially available from at least two suppliers. Further progress appears likely with a noise figure of about 10 db achievable at 100,000 mc in two years.

The steady improvement in these devices since the early work on twt's of Pierce and Field in 1946 has been the direct result of continuous development and refinement of the theory of the small-signal behavior of electron beams. The inventions that have been made in this field are perhaps unusual in that they were the direct result of a new step forward on the theoretical front in each case. Empirical attacks on the problem have been largely unsuccessful by contrast. There are aspects of the noise behavior of electron beams which are still not well understood. It is to be expected that their understanding will finally eliminate the last vestiges of noise contributed by a twt to the signal which it amplifies.

Dean Watkins is president of Watkins-Johnson Company and director of the electron-devices laboratory at Stan-

(Continued on page 10)



Dean Watkins, PGED/PGMTT speaker, and friend discuss a backward-wave oscillator

#### MORE THEORIZING

ford University. His faculty association with Stanford began in the spring of 1953, when he was appointed associate professor of electrical engineering. He was advanced to full professorship in June of 1956.

Previously he was with the research laboratories of the Hughes Aircraft Company, Culver City, where he became head of the microwave tube department. Early in his career he was a design engineer for Collins Radio Company, Cedar Rapids, Iowa. He spent a year during 1948-49 on the staff of Los Alamos Scientific Laboratory. He received his BS from Iowa State College in 1944, his MS from the California Institute of Technology (1947), and his PhD from Stanford (1951).

At the 1957 WESCON in San Francisco (for which he was chairman of the technical program committee), Dr. Watkins was named recipient of the annual Electronic Achievement Award of the



Glen Wade

Seventh Region. Early in 1958 he was named a Fellow of the IRE.

He also received national attention in August of 1957 with the announcement of his invention of the "helitron" tube, an electrostatically focused, wide-range, voltage-tuned oscillator. While a student at Stanford he was co-inventor of the low-noise traveling-wave tube, a development announced in 1952. He is the author of numerous technical publications and of a book, "Topics in Electromagnetic Theory."

The presentation by Glen Wade will discuss the techniques and mechanisms relative to each of the devices listed and will summarize the state of the art in connection with each. In addition, there will be a brief discussion of the type of detector exemplified by photon counters and i-r detectors.

A number of new techniques have been developed recently which give extremely low-noise operation in detecting signals at microwave and higher frequencies. Ten years ago the lowest-noise performance available was from laboratory models of traveling-wave tubes having noise temperatures in the vicinity of 2600 K. At present, several new devices are capable of considerably better noise performance, in some cases better by two or three orders of magnitude.

Glen Wade served in the U. S. Navy in World War II as an electronics technician and later as an electronics officer. He then returned to undergraduate studies at the University of Utah where he received the BS and MS degrees in electrical engineering in 1948 and 1949, respectively.

After working at the Naval Research

Laboratory in Washington, D. C., he returned to graduate studies at Stanford University where he was first a Sperry Fellow and then an RCA Fellow in electronics. He obtained the PhD degree from Stanford in 1954 and then was employed as a research associate by the General Electric microwave laboratory at Stanford. Until recently he was an associate professor of electrical engineering at Stanford and a senior staff member of the Stanford electronics laboratories. He has also served as a consultant for the Zenith Radio Corporation, Philco Corporation, and Diamond Ordnance Fuze Laboratory. Early in 1960 he joined the Raytheon Company, Spencer laboratory, as associate director of engineering for general research.

Wade received an Eta Kappa Nu Award in the "Outstanding Young Electrical Engineer" competition in 1955. He is a member of IRE, the American Physical Society, Phi Kappa Phi, Tau Beta Pi, Eta Kappa Nu, and Sigma Xi.

#### meeting ahead

##### LOOKING AT THE FROG

Immediately if not sooner (Nov. 16) the Professional Group on Bio-Medical Electronics will be meeting to consider the subject of "The Photoreceptor as a Transducer." See the Calendar for details.

Dr. Donald Kennedy, assistant professor of biological sciences at Stanford, the speaker of the evening, received his PhD at Harvard. His thesis was titled, "The Study of the Frog Electroretinogram."

He has published numerous articles on the visual systems of various animals including tadpoles, frogs, alligators, and crayfish. His discussion will be a consideration on the light-receptor systems, found in various animals, as transducers.

A panel of electronic engineers will discuss the biological transducers and consider them with non-biological systems and appearances.

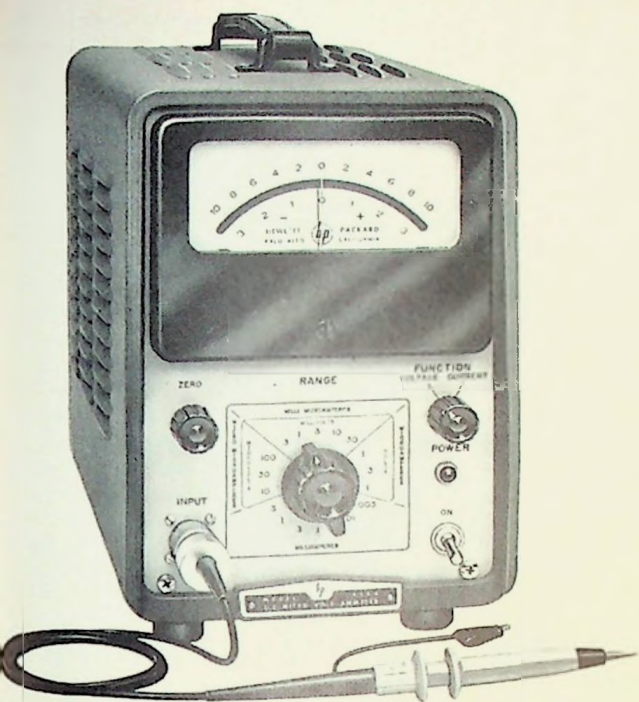
#### meeting ahead

##### OUTGUESSING THE SUN

If there were no disturbing effects on the ionosphere, propagation prediction would be a relatively simple procedure, involving only the season and the time of day. Solar flares and the frequently attendant corpuscular emission play havoc with normal radio communications as well as upsetting all the classical rules for predicting optimum frequencies.

Leonard Seader and Raymond Egan will discuss frequency selection problems and the system techniques for solution of these problems at the No-

(Continued on page 12)



READ DIRECTLY

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CROSS-CURTAIN COMMENTARY

A very interesting panel discussion on Russia was featured at the October meeting of the San Francisco Section at Stanford on the 24th. David Packard of Hewlett-Packard moderated, and panel members included Irmgard Flügge-Lotz, Gerald L. Pearson and Bernard Widrow, all of Stanford; Roy Amara of SRI; and Fred Kurzweil of IBM, San Jose. Pearson had visited Russia as a side trip after attending an international semiconductor conference in Prague, while the other four panelists had attended the First International Conference on Automatic Control in Moscow.

It is worth noting that the panel agreed that Russian scientific conferences are capably run and have no direct political overtones. Mrs. Flügge-Lotz observed that although papers were reviewed well in advance, pre-prints were not available until shortly before the conference. Fifteen minutes were allotted to each speaker, but translation requirements (Russian and English) cut this time in half. Discussion and comment seemed to be pre-arranged and sometimes not completely germane, which put speakers on their mettle. Mrs. Flügge-Lotz recommended that scientists presenting papers at such conferences should be very well prepared to discuss their work.

The report that the conference's keynote speaker had stated that automatic control is best used in a "rationally organized society" elicited the comment from another panelist that the Russians have two important reasons for their effort in this field: (1) it will help them increase productivity; and (2) it will help them catch up with and perhaps surpass the U.S.

In the field of automatic control the panelists stated that the Russians are strong in the areas of non-linear systems, optimally designed systems, and self-adaptive systems, but that they appear to lag in the field of large digital computers. There seems to be some shortage of good experimentalists although they have a good practical approach to many problems. For example, many industrial plants have pilot plant-facilities which are used by staff members of the research institutes.

Each of the research institutes is assigned an area of research, with very little overlapping, so that there is little competition in research. Technology is as regimented as everything else, but academicians occasionally slip off into related but more interesting problems.

Product development is done in the factories; quality control is not too good, partly as a result of the fact that

since there is no unemployment, marginal workers are retained.

Many of our instruments are copied with only minor modifications, and the Russians apparently used published U.S. material to help them develop solar cells for the Sputniks.

Finally, in response to a question about the Russian opinion of our science and technology, Pearson quoted a Russian visitor to this country "we in Russia consider Bell Telephone Laboratory the best in the world, and here I am."

Aside from technical matters, the panelists stated that the Russian people are very friendly in their attitude but that they seem convinced that their socialist system is the best for them. The younger people are eager to practice their "American" brand of English, which they must study for six years in school.

Since nearly all Russian women work, they are amazed that not only are most American women full-time home makers but that they have cars of their own. Widrow caused some astonishment when he mentioned to a group of Russian people that he planned getting an extra car just for his wife's use. Packard, who toured Russia with a group of businessmen, described a new housing development of apartments for 25,000 people which was to have parking facilities for only 400 automobiles. This same shortage of cars was mutely in evidence in a series of color slides shown by Pearson, in which many busy, but nearly autoless streets were shown.

Although they are nearly new, many Russian buildings have the appearance of age, the result of severe "corner-cutting" during construction. Their own version of urban renewal had produced

(Continued on page 14)

meeting ahead

MULTI-EARED MATTERS

As a pre-Christmas presentation, the Professional Group Chapter on Audio will present early in December (see Calendar) a panel discussion on F-M/F-M Multiplex Stereo which will feature a number of the more knowledgeable audio technologists in the area. Of particular interest should be the demonstration which has been planned. It will present some of the off-the-air recorded stereo tapes made for consideration by the FCC.

MORE SUN

vember PGCS meeting. See the Meeting Calendar, page 8. They will also describe a step-frequency ionospheric

meeting ahead

STARRING POLARIS

Marking the anniversary of Pearl Harbor Day, the December meeting of PGMIL will feature a series of the latest 16-mm sound films of the Polaris missile. The paper of the evening (see the Calendar for further information) will trace the history of this weapon and the U. S. Naval Fleet Ballistic Missile weapons system from its origin to the latest operational tests, the integration of this system into the U. S. total deterrent force, and some prognostications.

sounder which offers a great potential for reducing radio communication circuit outage to a minimum during ionospheric disturbances and other circuit dropouts.



Leonard Seader



Raymond Egan

# TEXAS INSTRUMENTS NEWS

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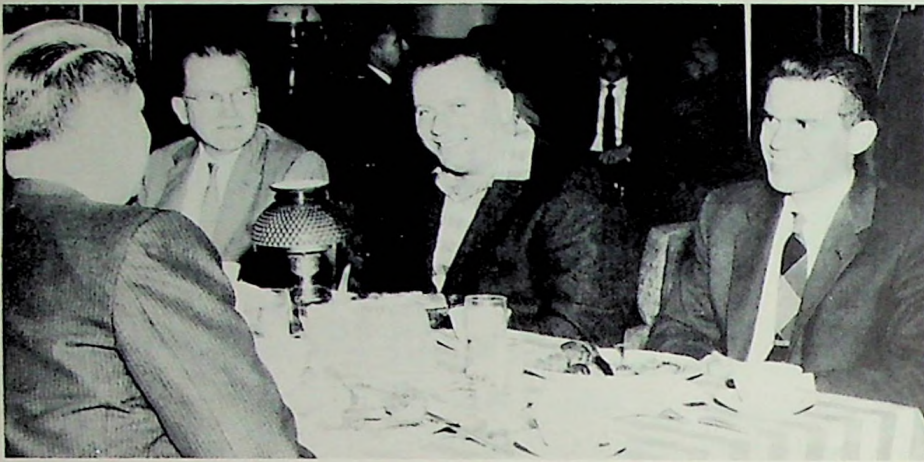
*Design Now* with the new TI Type CG $\frac{1}{4}$ , and telephone for immediate delivery of 1-999 units.\*

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TI type number	wattage rating	MIL designation	standard resistance ranges	max. recommended voltage
CG $\frac{1}{4}$	$\frac{1}{4}$ w	RN60B	24.9 $\Omega$ to 82.5k	350 v

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*Dr. Joseph F. Hull, with back to camera; Harold A. Wheeler; Dr. Harold I. Ewen; and Dr. E. M. T. Jones dine together preceding the PGED/PGMTT October meeting*

#### MORE RUSSIA

streets lined with new apartment houses, bordered in the rear by slum areas, which visitors are usually not allowed to see.

Almost every one of the panelists had a "strange" experience. Amara's camera disappeared at a banquet with only a vague explanation, but the assurance that it would be returned next morning. It was, without comment, but also without evidence of tampering. After Pearson's briefcase was left behind in Moscow, it was delivered to him next day with a peculiar explanation about having to recall a flight that was hundreds of miles toward a destination in the opposite direction.

The Russian eagerness to please caused difficulties of some magnitude when they tried to make available a menu of considerable variety and still feed 750 people during a short luncheon recess at the conference.

—W. R. LUEBKE

#### *meeting review*

##### **COSMIC CONSIDERATIONS**

The first of three meetings sponsored by the PGED and PGMTT and relating in some way to low-noise amplification was held at Stanford on October 13. The speaker, Dr. Harold I. Ewen, discussed "Tube Trends for the Space Age" in which he forecast low-noise receiving and high-power transmitting-tube requirements for interplanetary and outer-space investigations.

Investigations outside the solar system have so far employed only radiometric techniques, i.e., those detecting energy emitted by various natural radio sources. The primary need here is for low-noise amplifiers. Low-noise traveling-wave tubes, masers, and parametric amplifiers have proved themselves in this application. Where relatively narrow-band operation is desired, masers have provided the lowest noise tem-

peratures. For the study of broadband radio sources, however, such as radio stars, the low-noise broadband traveling-wave tube has provided equivalent performance in a more convenient system.

Thus masers may be reserved for such narrow-band tasks as investigation of OH, H<sub>2</sub>, and NH<sub>3</sub> lines and in applications such as the determination of the astronomical unit. Numerous radiometric applications, both outside and inside the solar system, plus the increased activity in this area indicate an increasing market for low-noise amplifiers both narrow and broad band.

One interesting recent radiometric discovery is of an active halo surrounding the Galaxy. Similar radiation has been observed from the planet Jupiter. It is possible that studies of "local" phenomena within the solar system may lead to better understanding of the larger-scale phenomena occurring about the Galaxy. Within the solar system we need not depend only on the natural radiation from the sun and planets. Radar astronomy and space probes offer the possibility of obtaining much additional information.

Successful radar astronomy requires three basic ingredients; sufficient power and sensitivity in transmitting and receiving equipment respectively, and suitable antennas. In terms of those factors under our control, the power returned from a given object will be directly proportional to the product of the square of the frequency, the average transmitted power, and the square of the antenna area. In addition to these factors it is desirable to pick frequencies where both cosmic noise and the absorption of the earth's atmosphere are low. The region about 10 kmc is a good choice; it is a relatively high frequency, it lies well below the water vapor absorptive peak occurring in the earth's atmosphere at about 22 kmc,

and is well into the relatively low-noise blackbody-radiation region of the cosmic background. Consideration of available and proposed steerable antennas also favors the X-band region; these antennas yielding the maximum frequency-area product. Running through an example using Venus as a target, a signal-to-noise ratio of about 19 db would be expected with a transmitted power of 20 kw c-w at X-band. To obtain the same result with 500 mc, as was used with the Milstone antenna, would require 8 megawatts c-w.

The question of compatibility of tubes for planetary and conventional radars is important since it clearly affects the size of the market for a given type. The high average powers desirable for planetary observations can be equally effective in improving conventional radar by using frequency or phase-modulated signals. This principle has been demonstrated with "Chirp" radars where high resolution has been maintained with increased sensitivity obtained through higher average power.

Communication with space probes from earth and from point to point in space, were briefly considered. For earth-to-space-probe communication, 10 kmc again appears to be a good choice. For communication within space where the earth's atmosphere will not interfere it is sometimes assumed that millimeter or even higher frequencies may be used. While this appears possible, it may be that the dimensional accuracy required for such high-frequency antennas will limit their size, leaving an opportunity again for the X-band frequencies which would always have the additional advantage of providing possible earth communication.

The question period following this very interesting talk was unfortunately very brief because of Ewen's jet-age commitment at the airport.

—RICHARD P. BORGH

#### *meeting review*

##### **FOUR FOR STANDARDS**

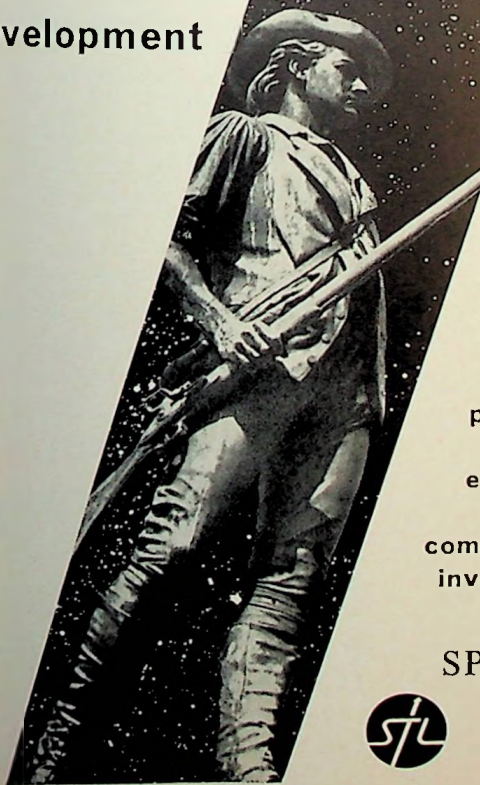
When the Professional Group Chapter on Instrumentation met early in October at Stanford, four speakers covered the topic, "Progress in the Development of Electronic Standards." Their presentations were moderated by Chuck Miller from Varian Associates. The speakers were Cecil Sheehan of Ampex Corp., Tom Whittemore of Philco Corp., Les Burlingame of Lenkurt Electric Co., and Phil Hand of Hewlett-Packard.

Sheehan began by describing operations of the standards laboratory at Ampex. Standards covered include those of length, temperature, mass, surface, and color; and all are tied in with NBS standards through a well defined cali-

*(Continued on page 16)*

# Minuteman

...Another  
major  
USAF weapon  
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development



Minuteman, a three-stage solid propellant intercontinental missile, is moving through its early development and test programs on or ahead of the time schedule originally set for it. This advanced ICBM, the fourth in a family of four Air Force ballistic missiles, is designed to be fired automatically from underground silos or mobile launchers. Minuteman will be constantly at "ready" giving America an almost instantaneous retaliatory capability for defense • The Minuteman concept developed early in 1957 when Space Technology Laboratories conducted a study of the characteristics of second-generation missiles to satisfy the requirements of the Air Force Ballistic Missile Division. STL provides over-all systems engineering and technical direction for Minuteman as it has for the Atlas, Titan, and Thor programs. The application of compatible components, systems, and experience developed through the years is bringing Minuteman closer to the threshold of operational capability • Among the industrial organizations developing Minuteman are such major contractors as: Boeing Airplane Company for weapon system integration; assembly and test; Thiokol Chemical Corp., Aerojet General Corp., and Hercules Powder Company for engines; Autonetics, a Division of North American Aviation for guidance; and Avco Corp. for re-entry vehicle.

To assure continued growth in these and related space programs, STL is already projecting state-of-the-art advances five and ten years ahead. Outstanding scientists and engineers with unusual capabilities in propulsion, electronics, thermodynamics, aerodynamics, structures, astrophysics, computer technology, and other related fields and disciplines are invited to investigate positions at STL. Please send resumes to:

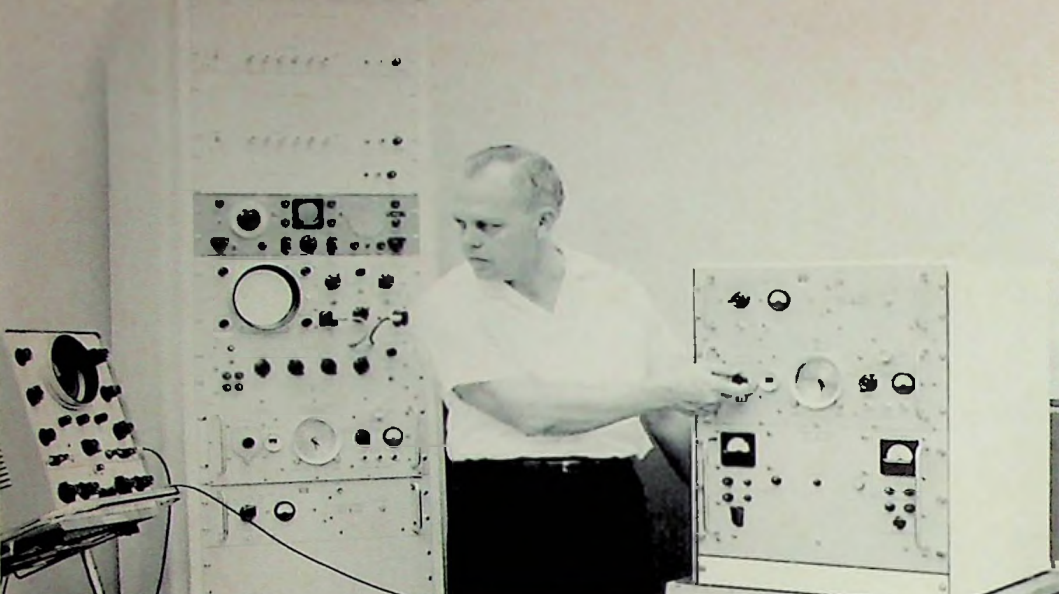
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Here the Hewlett-Packard Company frequency standard appears (large rack) as -hp- engineer Dan Lansdon checks out company's new primary frequency and time standard

**MORE STANDARDS**  
 bration procedure. As an example, Ampex has 41 sets of gage blocks which are calibrated each six months against NBS-calibrated sets—comparison being made to a few millionths of an inch. Sheehan posted a chart which showed the flow of calibrations from NBS to the operational level.

Speaking next, Whittemore pointed out that Philco uses WWV of Beltsville, Md., as a basis of comparison for their frequency standard. Checks made of the Philco standard indicate it agrees with WWV within about 2 parts in 100,000,000.

He pointed out that the latest thinking in regard to frequency stability is to use a low-frequency broadcast which is not subject to the Doppler variations of the WWV frequencies. Correspondingly, checks made against WWVL (20 kc from Boulder, Colo.) and NBA (16 kc from the Canal Zone) show agreement of approximately 1 part in 1,000,000,000. Checks at the lower frequencies have the further advantage that they can be made over a much shorter period of time than those of the WWV frequencies, due to greater stability.

Discussing the Lenkurt standards laboratory, Burlingame said that it maintains NBS calibrated standards of voltage, resistance, capacitance, inductance, microwave attenuation, power, and reflection coefficient, as well as r-f micro-potentiometers, and r-f voltmeters. Standard capacitors, resistors, etc calibrated by NBS are used to calibrate secondary standards used by various instrument laboratories of the company to calibrate working units.

Due to the need for working materials harder at increasing frequencies, it is desirable to know the Q of capacitors and coils. Capacitors and inductors

are sent to NBS for calibration not only of capacitance and inductance but also of Q (NBS is not too well equipped to make Q measurements, but they are improving their ranges). Calibrated capacitors and inductors are used to calibrate carefully selected equipment so that engineering knowledge of materials and factory handling of production materials is constantly improving.

Frequency stability at Lenkurt is about 2 parts in 100,000,000.

Concluding the presentation, Phil Hand mentioned the fact that Hewlett-Packard makes equipment to measure l-f, h-f, and microwave parameters over the frequency range from d-c to 40 kmc. Their frequency standard is held to a few parts in 10,000,000,000. Hand talked about two specific problems giving trouble at the moment. The first is r-f voltage standards. He can get accurate voltage determinations from NBS at one volt, but the problem is how to get fractions and multiples of this value. A second problem is the type N connector. Hand is a member of the NBS committee considering, among others, the GR and Woods (English) for the answer to this problem.

—LES BURLINGAME

*meeting review*

**TOOLING THROUGH THE REPORT**

The local chapter of the Professional Group on Engineering Writing & Speech has inaugurated its season of meetings with a tour of the facilities of W. A. Palmer Films, Inc., in San Francisco. Ten were present for this very interesting October meeting and field trip.

Messrs. Terry Brickley and W. A. Palmer described some of the principal problems that are encountered in the production of industrial and techni-

(Continued on page 18)

**HR-92 X-Y  
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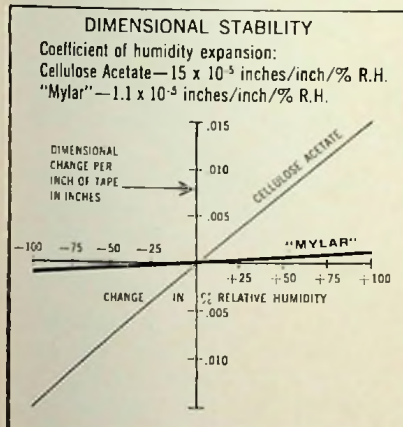
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CHART NO. 1

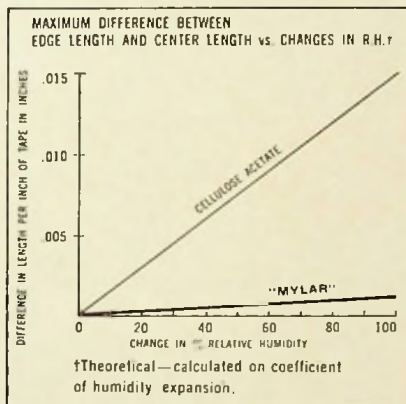


## Less signal dropout.

Chart 1 shows that dimensional change in "Mylar" with humidity change is negligible compared to acetate. This exceptional stability prevents tape shrinking, swelling or cupping that could result in shifting of

tracks or loss of contact with the recording or playback head. Possibility of signal dropout or garbled or weak signals are minimized and reliability of recorded data is assured.

CHART NO. 2



## Fewer garbled signals.

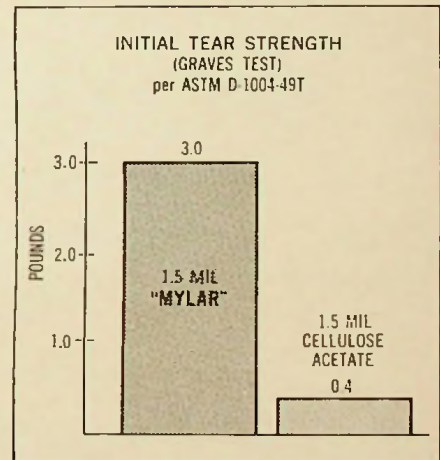
If magnetic tape picks up or loses moisture unequally across the tape width there will be a difference in length between the edges and center. Chart 2 compares this effect for "Mylar" and cellulose acetate tapes. Because "Mylar" is virtually non-hygroscopic there is no dimensional difference between edges and center to cause poor registration of timing across adjacent tracks on the tape.

## Less tape breakage.

Since most breaks start as edge nicks,

the high initial tear strength of "Mylar" reduces chance of breakage and subsequent failure to record critical information. Chart 3 compares initial tear strength of "Mylar" and acetate. In addition, "Mylar" has the highest tensile strength of any instrumentation tape base. And "Mylar" does not lose its toughness with age, repeated playbacks or storage because it has no plasticizer to dry out.

CHART NO. 3



The superiority of "Mylar" can make an important contribution to reliability of your magnetic tape system. Ask your magnetic tape supplier to recommend the specific tape of "Mylar" for your needs.



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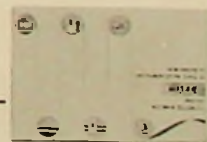
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Terry Brickley addresses the PGEWS October plant tour of Palmer Films

#### MORE FILMS

cal films, and showed how motion picture technical services can be employed. Members of Palmer Films' technical staff were on hand to conduct the tour throughout their facilities and to answer questions.

Brickley, for 15 years a film writer and audio-visual consultant, spoke first, on the topic, "Motion Pictures as Another Tool for the Engineering Writer." He observed that motion pictures are being frequently used as the media for progress and technical reports to Government contracting agencies by defense industries.

As in other phases of technical publication, he noted, often there is little time to prepare for the production of films, and seldom is there the chance to make elaborate studio setups. Thus,

the report-film producer must use film shot in the laboratory and mock-ups instead of actual operations. Animation is especially effective in supplying information where film of actual operations is not available.

Brickley described a technique which is especially suitable for report films, which he referred to as "live camera." This method is similar to the production of live television programs, hence the name. It entails the use of usually two, sometimes three cameras which, along with sound-recording equipment, are run continuously throughout each sequence.

The presentation is done by someone associated with the project being reported on. It is often unrehearsed, takes the form of a lecture or panel discussion. Props such as models, actual

*(Continued on page 20)*

#### opinion

##### ELECTRONIC PEONAGE

Dr. Frederick E. Terman, vice president and provost of Stanford University, told attendees at the NEC that if the



Frederick E. Terman

Midwest continued to "plod along" in electronics, it will become the "peon group" of the industry. "If you plod along doing hard, unexciting work and making a living, the East Coast and particularly the West Coast electronics industries will have all of the fun and most of the growth."

Indicating the background for this situation, Terman pointed out that the state of California produces more men with advanced degrees in electronics each year than do all the institutions in the states of Illinois, Indiana, Michigan, Minnesota, and Iowa put together. "By and large," he said to the Chicago gathering, "you do not know how to make use of the 'egghead' type. As a result you don't even fight over the masters and doctors candidates being produced by your own universities, let alone by universities in the rest of the country."

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An **ELECTRONICS SECTION CHIEF**—should have EE degree and six years experience in development of high reliability VHF and UHF receivers and amplifiers, both tube and transistorized types. Areas of activity will include i-f amplifier units, distributed amplifiers, lin-log amplifiers, afc units and mixer/amplifier combinations. Experience in utilizing tunnel diodes and parametric amplifiers is desirable. We also need:

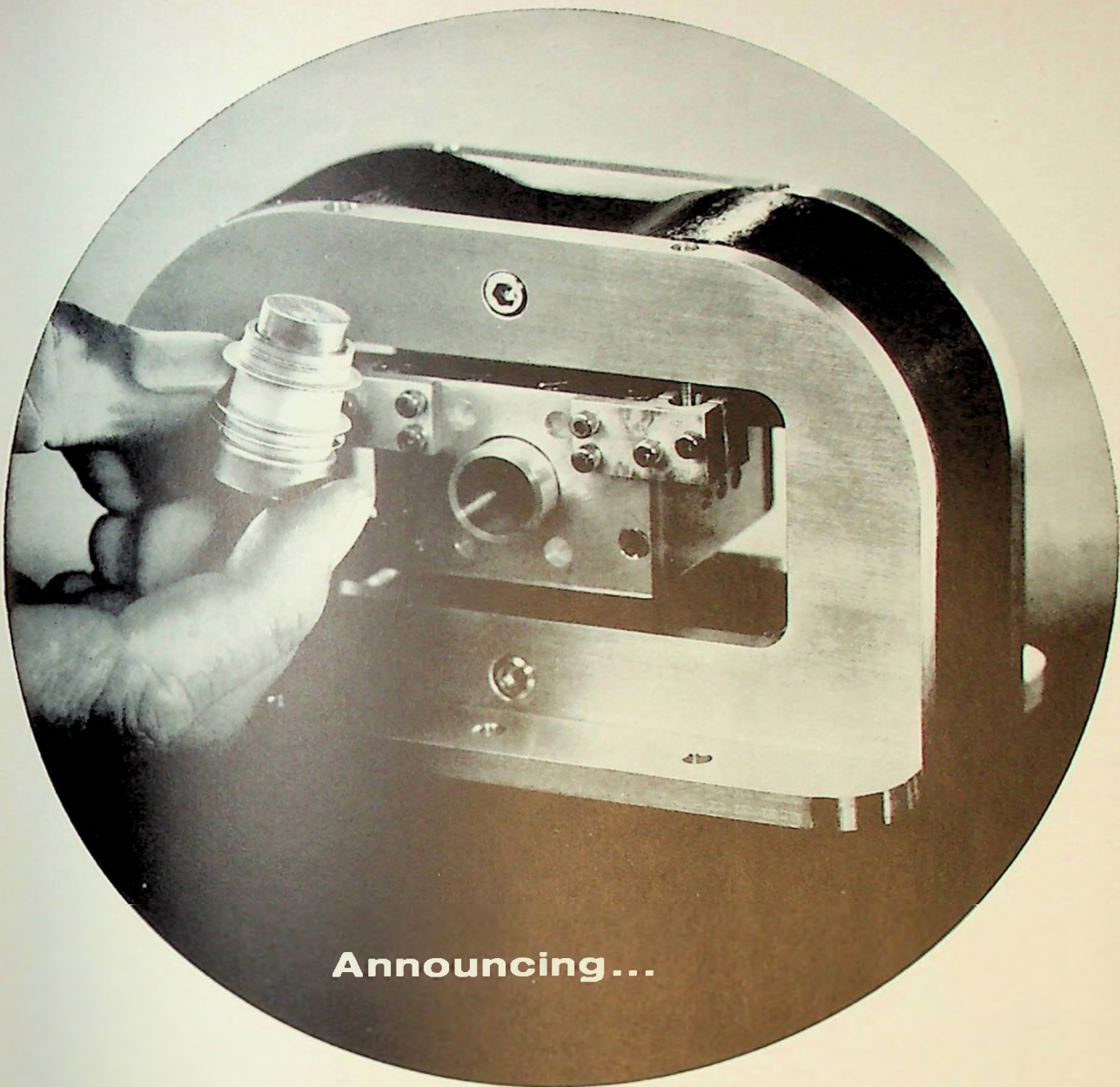
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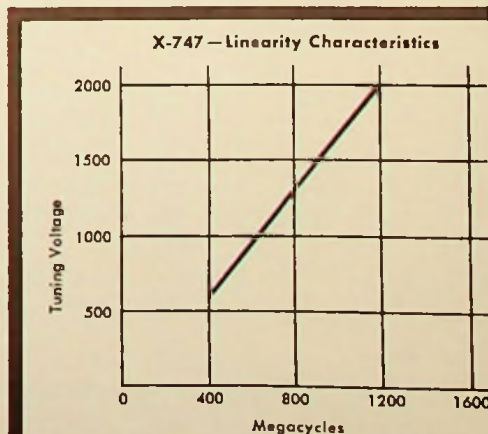
Take a look at the world's most advanced voltage-tunable magnetron: Eimac's new X-747, shown here with its magnet and cavity. This new tube can be tuned over the exceptional range of 400-1200 megacycles—a range approached by no other electronically tunable device. And it's extremely linear! Nominal output power of the X-747 is 100 milliwatts.

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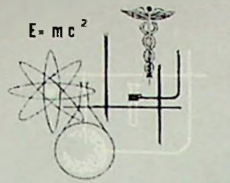
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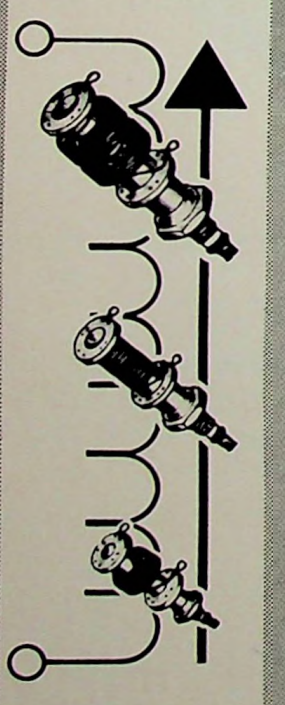
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equipment if it is small, or inserts of charts, drawings, or scenes, are often used. The speakers are encouraged to use notes if they are needed.

The advantage of "live camera" technique lies in the direct eye contact that the performer has with his audience; each member of the audience, when the film is showed, feels that the speaker is directing the presentation to him. In this respect it can be even more effective than a live talk before a large group, where the speaker must direct (and therefore diffuse) his speech to a large area.

Brickley cited the example of one of evangelist Billy Graham's appearances at which a large overflow audience watched him, via closed-circuit television, from another auditorium. Graham gained a greater response from the t-v audience than from the live audience.

The tour of Palmer Films' studios and laboratories showed them to be an exceptionally well-equipped films facility, with equipment needed to produce all types of 16-mm films. Coffee and doughnuts were served following the tour.

—JAMES WELDON

## meeting review

### HOW TO BE CREATIVE THOUGH MANAGERIAL

In October the PGEM met to consider the question: "Can Managers Remain Creative?" Professor John Arnold, Stanford University, gave one of his outstanding talks on the subject. His subject was of great importance to "engineers turned managers" who have been assailed by doubts as to their contributions to the profession. Professor Arnold pointed out that of course managers **can** remain creative and good managers **do** remain creative. He suggested that managers are creative through the exercise of their management responsibilities.

Specifically, he pointed to the following significant management actions which help to promote creativity in others: 1. Recognition, 2. Stimulation, 3. Encouragement, 4. Environment, and 5. Rewards.

Finally, Professor Arnold pointed out that engineering management has a responsibility to understand the emotional and intellectual factors which favor a creative climate and then to meet the needs for personal growth which help to maintain creative output.

Professor John Arnold has a nationwide reputation in creative engineering and comprehensive design. These subjects are highlighted in a special two-week summer course for men in industry which was started at MIT and is now



John E. Arnold

carried on at Stanford University where he has been a professor of mechanical engineering since 1957.

In addition to his work in mechanical engineering, he is in charge of a program in the Stanford Graduate School of Business in the management of research and development activities. He is a consultant to many major corporations and departments of the United States Government on creativity and the management of creative personnel.

—L. M. JEFFERS

*meeting review*

**NEW EQUIPMENT CLINIC**

Early in October, the Audio Engineering Society and our Professional Group on Audio held a joint meeting to inform each other about the new professional product line of Ampex Corp. The engineers responsible for the development of this new product line introduced a new stereo 2-track tape recorder, Model PR 10-2; a stereo 2-channel 4-station mixer, Model MX-10; and the integral speaker-amplifier, Model SA-10.

*(Continued on page 22)*



*This is the new Ampex professional recorder Model PR-10, one of the machines under discussion by AES/PGA*



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## MORE AUDIO

George Rehkla, manager of the mechanical development section, outlined new mechanical features of the tape-recorder transport system including the use of eddy-current clutches, new capstan and speed-change assemblies, a remote control box, and a self-threading tape mechanism. Charles Wilkins, senior electronics engineer, described novel and simplified features of the tape-recorder and tape-reproduce amplifiers, including plug-in equalizers for frequency compensation, nuvistor pre-amplifiers, and solid-state rectifiers. John Bennett, electronics engineer, in discussing the circuit design of the stereo MX-10 mixer, emphasized its ability to accommodate a wide dynamic range of input-signal levels.

After each of these speakers had held forth approximately 20 to 30 minutes, all made themselves available to answer questions from the group. Following this, there was a demonstration of the equipment which elicited further questions.

—ED DOWLING AND S. OLESON

## meeting review

### GROWING CRYSTALS

Growing crystals was the subject of the October meeting of the Professional Group on Product Engineering and Production at Knaptic Electrophysics, Inc. The meeting was attended by an enthusiastic group from a broad variety of fields ranging from components manufacturing to systems. The topic was "Theory and Practice of Impurity Concentration and Control in Silicon Mono Crystals" and the meeting, which included a plant tour and demonstration, was held at Knaptic's Facilities at Industrial Avenue in Palo Alto.

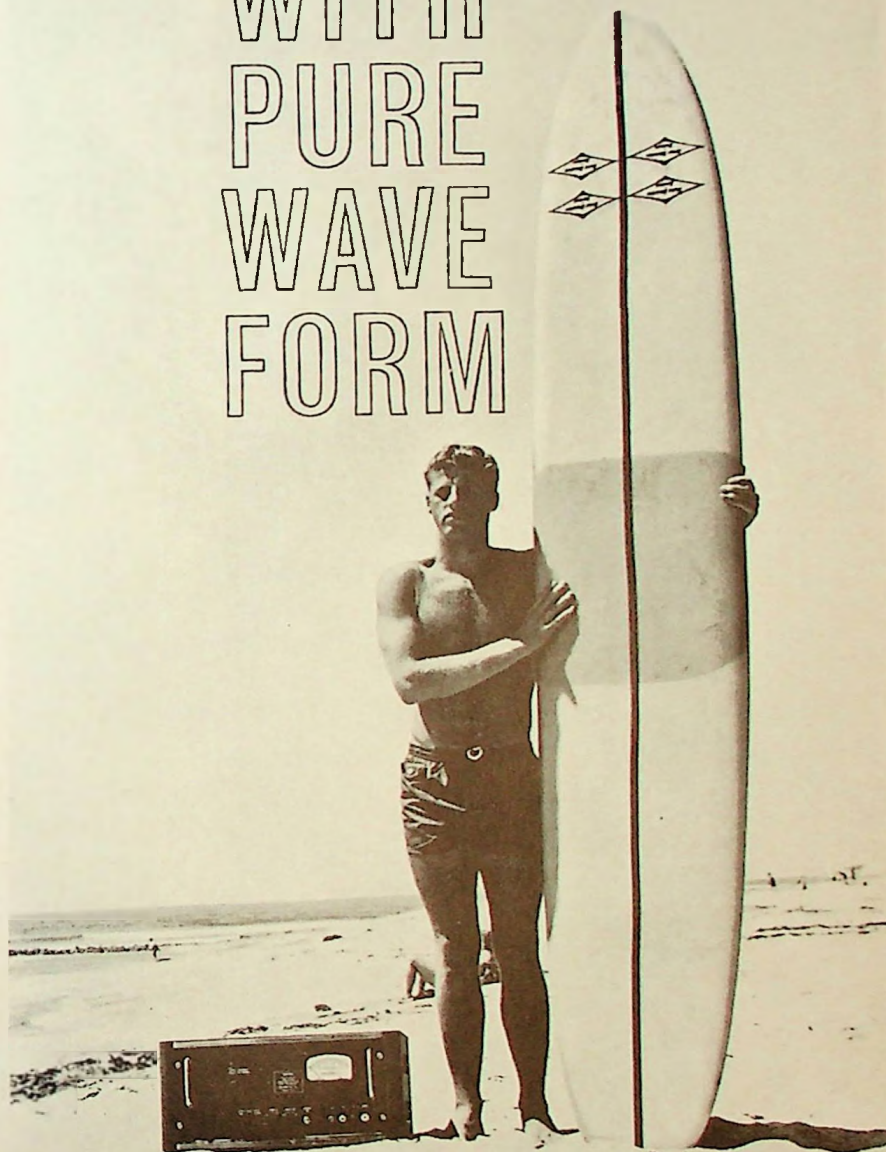
Bob Yeaman, vice president of manufacturing, said that the company was formed in December, 1957, by Dr. Knaptic for the sole purpose of growing single crystals for manufacturing of transistors and diodes. The company, which has about 100 employees and is housed in the 30,000-square-foot building, operates on three shifts, five days per week. Interestingly enough, the yield from the graveyard shift is just as good and sometimes even better than the other two shifts, which is quite contrary to the general condition in industries. The explanation to this is that the operators are left more undisturbed to do their job.

The main speaker, Horst Kramer of Knaptic, came to the United States from Germany via Canada where he received his BS degree in physics in 1959 at Columbia. After his graduation, he came to Palo Alto to start working on his masters degree at Stanford. In the



Messrs. Yeaman, Kromer, Eldon, Kramer, and Fuller were part of the crowd at the Knapic field trip staged by PGPEP

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meantime, he gained employment at Knapic.

Kramer said that it took eight months after the plant had started before it was really rolling. The many variables in growing crystals make the task a matter of tight control. Knapic is a job shop and grows crystals to customer orders. Their market is world wide.

By graphical means, Kramer demonstrated the effect of impurity concentration on the characteristic of a crystal. Impurity is only one phase of the control. Such matters as radial spread, and control of variations along the axis are among the different variables to control. Various means of performing this control were described.

The addition of impurities makes resistivity of desired value. However, the crystal rejects dope that is intended to go into the crystal. In addition, oxygen will act as a donor of impurities which furthermore complicates the complete control of growing silicon mono crystals.

After Kramer's presentation, a plant tour followed. The first crystal was grown by Czochralski as far back as 1918 and the equipment at Knapic's plant certainly indicates that we have come a long way since the days of Czochralski. Among the departments visited was the clean room, where the charges are prepared to grow crystals to meet customer's specifications. The work orders and routing slips certainly verify the fact that Knapic has a wide spread of customers.

The department that created the greatest interest was the growing department, where the growers and associated control equipment were thoroughly pursued by all participants in the meeting. The cutting operation, using diamond cutters, was combined with the test and classification department where we could see the final crystals. Apparently, there is no limit to

(Continued on page 24)



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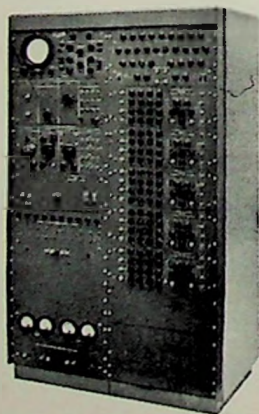
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## MORE CRYSTALS

the size that can be grown as we saw crystals as large as four inches in diameter.

The meeting was concluded by an interesting question-and-answer period, followed by refreshments.

—OLOF LANDECK

## meeting review

### COURIER TALK

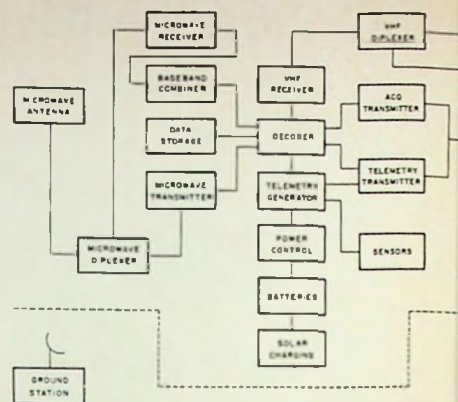
Members and guests attending the joint October Meeting of the PGSET and PGRQC were enthusiastic in their comments and questions concerning the Courier Satellite communications system described by G. O. Moore, satellite programs manager of Philco WDL. Mr. Moore supplemented his talk with a short movie and color slides of the Courier satellite developed by Philco and described the system operation. He also pointed out that the success of the program was brought about by cooperation between design and development engineers and the reliability and quality-control sections.

The 500-pound "Courier" satellite which appeared on last month's **Grid** cover, will girdle the earth nearly 14 times daily and is designed to pick up messages at one point and deliver them to another.

Different from its recent predecessors, the Department of Defense's Courier is not intended for navigation purposes or scientific measurements, nor is it on a reconnaissance patrol in space. It is out there expressly to test its ability to relay messages for communications between ground stations.

Its capacity is estimated to be equivalent to 3,725,000 words a day — enough to fill around 513 solid pages of newspaper information without ads or pictures in the standard 8-column size.

The satellite system was conceived by the U. S. Army Signal Research and Development Laboratory at Fort Mon-



Simplified block diagram of the Courier satellite

mouth, N.J., under direction of the Advanced Research Projects Agency of the U. S. Department of Defense in Washington, D.C.

The payload of the Courier system, the satellite itself, was designed and developed in Palo Alto at the Western Development Laboratories of Philco Corporation in accordance with specifications by the directing agencies. It is one of several satellite programs for government agencies which Philco now has under way but it is considered the most advanced space vehicle ever developed by Philco.

Ground complexes were provided by the International Telephone and Telegraph Company's ITT Laboratories at Nutley, N.J. while tracking antennas were provided by Radiation, Inc. of Melbourne, Florida.

Courier was blasted into space by a Thor-Able-Star vehicle launched by the U.S. Air Force.

The satellite is expected to orbit the earth every 110 minutes for a prolonged period of time at an altitude averaging 600 miles from the earth's surface. It will be in view of each ground station for varying periods up to 15 minutes. During this time, it will

(Continued on page 26)

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## Life In The Solar System

At Stanford University we are assembling a small research team to design and evaluate a number of advanced instruments to detect forms of life, familiar or exotic, that may have evolved beyond the earth (See Science, Aug. 12, 1960, p. 393). This long-range program is supported by the National Aeronautics and Space Administration.

To complement a strong capability in microbiology and biochemistry we require a research associate in instrumentation. His function would be the collaborative design, procurement, construction and maintenance of advanced instruments with special emphasis on optical techniques (e.g. UV spectrometry and microscopy; interferometry; light piping) and electronic links (e.g. digitalized television; signal analysis) to telemetry.

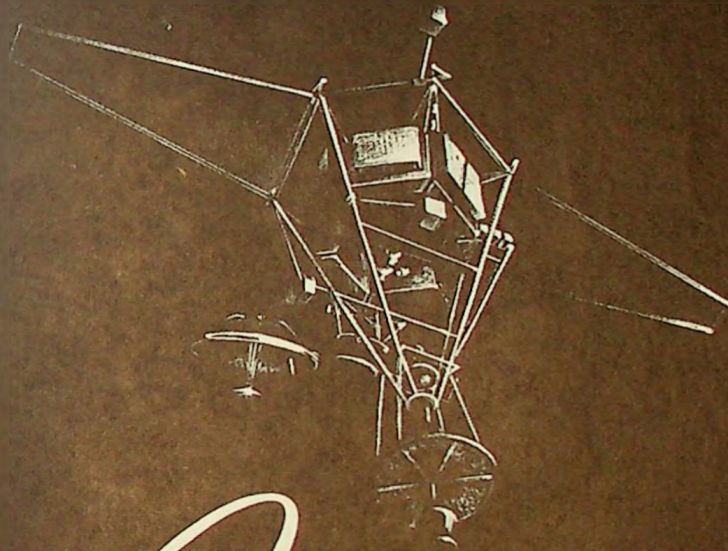
We are therefore looking for a physicist or engineer with an unusual breadth of scientific knowledge, imagination, energy, enthusiasm and practical talent who enjoys working in a very small talented group and with his own hands.

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Payload Size	Approximately 51 in. diam.
Satellite Spin Rate	Approximately 40 r.p.m.
Orbit Altitude	Approximately 600 Nautical Miles
Speed of Satellite	Approximately 14,400 mph
Primary Power Supply	Nickel Cadmium Batteries 12 Amp. Hour—28 Volt
Charging Supply	19,152 Solar Cells—Average Charging Rate 1.8 Amperes
Total Power Consumption	
Standby	10 Watts
Active	225 Watts
Tracking Method	Beacon in Satellite — Auto-Track — Antenna on Ground
Commanding Method	Active—21 Selected Commands Via VHF and Microwave
Data Storage Method	Five Tape Recorders
Storage Capacity	4 Digital and 1 Analog Fifteen Megabits NRZ Tele Type at 55 Kilobits/Sec. or 30 cps —50 kc Analog Equivalent
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Four Microwave Receivers	VHF N.F. 12 db Transistorized F-M
VHF Transmitters	Two Telemetry 1.5 Watts Output F-M—Dev. $\pm 6$ kc Two Acquisition 50 Milliwatts Output Unmodulated
Two VHF Receivers	Command NF—6 db Transistorized Unmodulated
Telemetry	7 IRIG Commutated Channels—35 Parameters
Two Ground Stations	Puerto Rico and Ft. Monmouth, N.J.

—R. D. BAKER

### meeting review

#### PATTERN PROBLEMS

Hans J. Bremmerman of the U.C. math department spoke to the local chapter of the Professional Group on Electronic Computers on October 25 at the LMSD Auditorium in Palo Alto. His subject was Self-Adaptive Systems.

The topic of self-adaptive or self-organizing systems is a challenging area of how the mind works. Dr. Bremmerman spoke on the technique of behaviorisms of a human and how they might be simulated at the input-output level or the neuron level.

In the area of input-output simula-

tion, problem solving has been demonstrated by Newell, Shaw, and Simon, the Sentential Calculus Machine, and the Geometry Machine. In pattern recognition very little success has been attained. In game theory the game of chess is always of interest. This is an example of a completely determined problem but of astronomical size.

Bremmerman's approach to the pattern-recognition problem is that of a learning process. He states that biological evolution is an example of an external learning process and he is presently developing a model of evolution that, if successful, will assist in pattern recognition.

—J. A. BOYSEN

### meeting review

#### ANGELS, BIRDS, AND RADAR

A bout with the dentist laid low the first speaker of the San Francisco Chapter of PGAP, Dr. Myron G. H. Ligda of Stanford Research Institute. In his place, his able co-worker, Dr. Roland Nagle, carried on and spoke on "Meteorological Factors in the Refraction of Microwave Energy." Nagle was introduced by the new PGAP chairman, Dr. Richard Honey.

Radar observation has been affected by storms and other atmospheric conditions. This has been turned from a handicap to useful purpose by the radar meteorologist. Radar is thus useful as a weather-information tool. It also aids in determining the intricate relationship between the dynamic composition of the weather and electromagnetic propagation. Eventually this should aid in designing radar that can locate distant objects further away and in greater detail.

The effect of temperature, pressure, and water-vapor content on the index of refraction was initially described. Most curious and interesting of all radar echoes are those received from clear sky. Echoes of this type have been tagged by the picturesque designation of "angels." Birds, hot air thermals, haze layers, temperature inversion and fronts between air masses can, under suitable conditions, cause angels. Another interesting phenomenon described and illustrated was echoes from lightning strokes. Strokes fifty or sixty miles in length are commonly seen on the radar scope.

A movie on anomalous maritime echo from picket ships stationed 350 miles off the California coast closed the talk. Examples of second- and third-trip echoes from as far as 850 miles out were illustrated.

After the formal talk a question-and-answer period ensued.

—T. MORITA

november 1960

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*See Schedule Below for Times and Places*

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Monday, November 28—11 a.m. to 9 p.m.—Hotel Eldorado (Room 105 and 165), Freeway U. S. 40E at Canterbury Road.

### OAKLAND

Tuesday, November 29—1 p.m. to 9 p.m.—London House Chuck Wagon, 34 Jack London Square, Oakland

### PALO ALTO

Wednesday, Thursday, Nov. 30, Dec. 1—11 a.m. to 10 p.m. Rickey's Studio Inn, 4219 El Camino Real



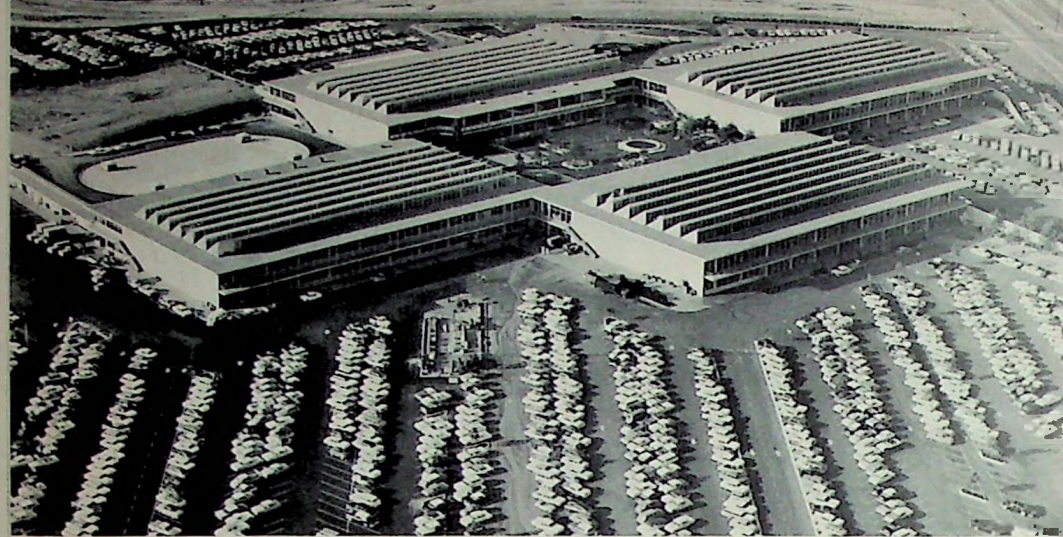
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Situated on a low hilltop in Stanford Industrial Park, Hewlett-Packard Company's new \$4.5 million plant is among the most modern facilities in the electronics industry. This aerial view, looking southwest, shows the plant's four principal buildings, its enclosed patio and 2,000-car parking area. The plant, which employs about 2,300 persons, is located on a 50-acre site overlooking Palo Alto and the lower San Francisco Bay

grid swings

#### IT IS REPORTED

Eugene Kleiner has been appointed manager of administration and research services for Fairchild Semiconductor Corporation's research and development center at 844 Charleston Road, Palo Alto. Formerly, Kleiner was manager of manufacturing engineering at Fairchild's transistor plant in Mountain View. In October 1957 Kleiner and

seven others organized and founded Fairchild Semiconductor Corporation.

The election of John P. Day as vice president for engineering of Granger Associates has been announced. Since 1958 Day has been consulting scientist in the electronic research and develop-



Day

Ballard

ment program at Lockheed missiles and space division. He is a past chairman of the San Diego Section and has been a member of the Seventh Region Committee of the Institute. He is a member of SMPTE.

Advancement of John W. Ballard to the post of manager of applications engineering at Granger Associates has been announced. Ballard has been on the applications-engineering staff at Granger Associates since last winter. Ballard attended Dartmouth College with a Holloway Naval Scholarship. He received his AB cum laude and an MS in electrical engineering and business administration in 1956.

Dr. G. M. Amdahl has rejoined International Business Machines Corp. as special assistant to the vice president of research and engineering. Amdahl, a senior staff engineer at Poughkeepsie

(Continued on page 30)

## Quan-Tech Laboratories

BOONTON, NEW JERSEY

### CONSTANT CURRENT SUPPLY

#### Model 151 SPECIFICATIONS

**OUTPUT:** 0.5 to 500 ma. DC in three ranges; 0.5 to 5 ma., 5 to 50 ma., and 50 to 500 ma. Maximum terminal voltage is adjustable from 0.5 to 20 volts DC.

**REGULATION:** 0.25%, 0 to 20 volts load.  
0.25%, 105 to 125 volts AC line.

Range	Ripple	AC Impedance
0.5 to 5 ma	1.5 $\mu$ a	1 Meg./50 mmfd.
5 to 50 ma	15 $\mu$ a	400 K/0.02 mfd.
50 to 500 ma.	50 $\mu$ a	10 K/0.05 mfd.

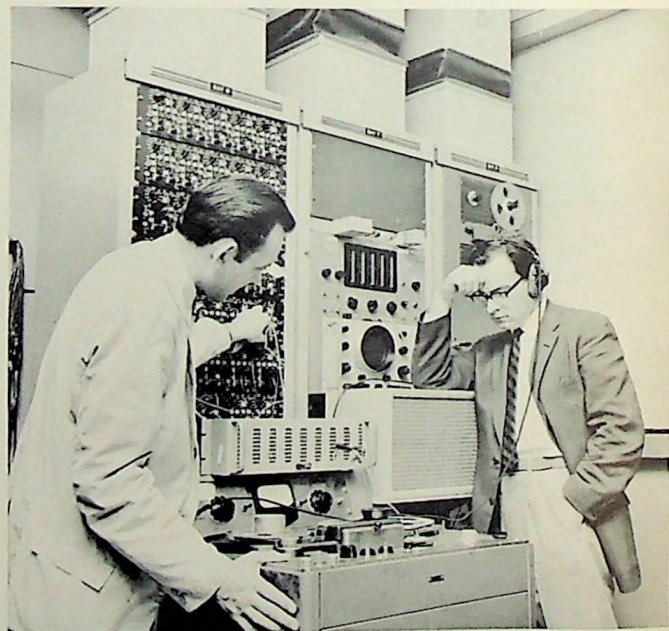
**POWER INPUT:** 105-125 volts, 50-60 cycles, 35 watts.

**DIMENSIONS:** Height — 8 $\frac{1}{4}$ " , Width — 5" , Depth — 7 $\frac{3}{4}$ " (overall).  
Weight — 7 $\frac{3}{4}$  pounds; Shipping weight — 10 lbs.

**PRICE:** \$275.00 F.O.B. Boonton, N. J.

## HUGH GRAY COMPANY

ELECTRONIC MANUFACTURER'S REPRESENTATIVE  
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Bell Telephone Laboratories researchers B. F. Logan and Dr. M. R. Schroeder (supervisor of acoustics research at the laboratories) work on development of a "colorless" artificial reverberator for acoustic conversion, with no undesirable side effects, of an ordinary auditorium into the acoustic equivalent of a full-sounding concert hall. Topic was one of those presented at the 60th meeting of the Acoustical Society of America in San Francisco October 20-22 — Dr. Vincent Salmon, SRI, general chairman



## OUTSTANDING PROFESSIONAL OPPORTUNITIES NOW

### Research Director

Physicist, responsible for study, development, and program direction of applications in new field of data handling.

### Electronic Engineers

Project engineer status on design programs involving transistorized electronics and electro-mechanical devices. Transistor design experience, pulse and switching circuits preferred.

### Mechanical Engineers

Experience in design of small electro-mechanical components, project level responsibility. Knowledge of close tolerance design and miniature precision bearings required.

### Methods Engineer

BSEE or IE. Electronic design and 3 years methods engineering experience in instrumentation field desirable. Practical experience in electro-mechanical assemblies, printed circuit board design.

- Additional Engineering Positions Available

TELEPHONE OR WRITE: E. R. Scott to arrange immediate confidential interview

- If immediate interview inconvenient, please send a detailed resume to Personnel Manager. All replies strictly confidential and acknowledged.



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**"VX" Super Refractory**—Wesgo ceramics with uniquely high resistance to thermal shock, ideal for use in furnace brazing, available in boats, slabs, special brazing fixtures.

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**Precious metals**—high purity platinum, gold, silver and alloys of these metals in many forms to meet your need.

*Wesgo—long the standard of the vacuum tube industry,  
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6752

# WESGO

## New Product of the Month



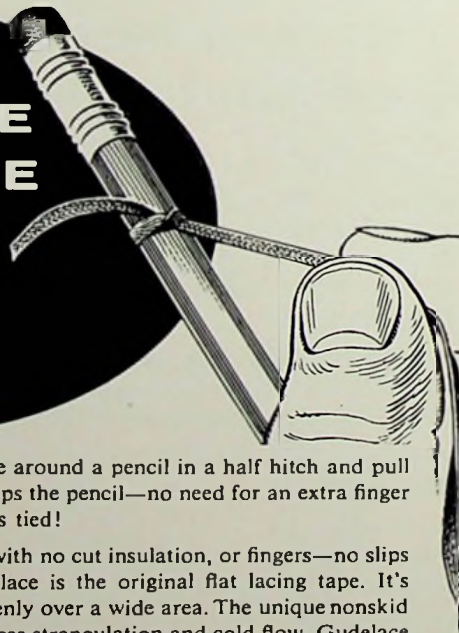
## Perkin 5-AMP Power Supply is Transient-Free

Transistor-ruining transients are completely eliminated by a new Perkin solid state power supply with a regulated DC output of 0-36 volts at 5 amps.

Excellent for laboratory testing of transistorized loads, Model MTR036-5A has a specially designed regulation circuit with its own instantaneously acting transistors. Reliable magnetic amplifiers provide static regulation.

Dynamic line regulation is 15mv; maximum RMS ripple, 2mv; maximum dynamic impedance: 50 milli-ohms. The unit is short circuit proof, has no fuses, and features automatic current limiting. This unit is typical of a complete line with ratings up to 100a. Detailed information is available from PERKIN ELECTRONICS CORP., 345 KANSAS ST., EL SEGUNDO, CALIF. Represented by: Cerruti Associates, P.O. Box 509, Redwood City, Calif., Phone EMerson 9-3354.

**GUDELACE  
TAKES THE  
SLIPS  
OUT OF  
LACING**



Try this simple test. Tie a piece of Gudelace around a pencil in a half hitch and pull one end. Gudelace's flat, nonskid surface grips the pencil—no need for an extra finger to hold Gudelace in place while the knot is tied!

Gudelace makes lacing easier and faster, with no cut insulation, or fingers—no slips or rejects—and that's *real* economy. Gudelace is the original flat lacing tape. It's engineered to *stay* flat, distributing stress evenly over a wide area. The unique nonskid surface eliminates the too-tight pull that causes strangulation and cold flow. Gudelace is made of sturdy nylon mesh, combined with special microcrystalline wax, for outstanding strength, toughness, and stability.

Write for a free sample and test it yourself. See how Gudelace takes the slips—and the problems—out of lacing.

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West Coast Office  
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Los Angeles 7, Calif.

Executive Offices  
12 South 12th Street  
Philadelphia 7, Pa.

## MORE SWINGS



*Amdahl*

*Walker*

from 1952 to 1955, is presently located at San Jose research laboratory. In his previous assignment with IBM, he was instrumental in the development of the 704 computer. He comes to IBM from the Aeronutronics Division of Ford Motor Co. where he was manager of equipment engineering. Earlier he was a member of the senior staff of Thompson-Ramo-Wooldridge, Inc. He is a member of the American Physical Society, Sigma Tau, Sigma Pi Sigma, and Sigma Xi.

**Robert M. Walker** has joined the research laboratory to undertake advanced work in systems science. Walker comes to the San Jose installation from IBM's Watson Laboratory in New York City where his most recent assignment was as manager of reliability research. Walker is a member of APS and AAS.

**A. J. Johnson**, vice president of the development and engineering division of **Shell Development Company's** Emeryville research center will become vice president in the company's head office in New York, about the first of the year. When this transfer becomes effective, **T. W. Evans**, vice president-research, will become vice president and general manager of the Emeryville Research Center.

**Konrad H. Benford** has been appointed manager of field engineering for **Eldorado Electronics**, Berkeley.

Benford, who will provide liaison between Eldorado and customers with special systems requirements, served from 1953 to 1957 as director of the instrument laboratory at the Enrico Fermi Institute for Nuclear Studies.



*Benford*

*Sweo*

**MORE SWINGS**

Appointment of **Arthur P. Notthoff, Jr.**, to the position of manager of engineering of the electronic systems division of **Dalmo Victor Company** has been announced. He joined the firm in 1949 as a research engineer after receiving a master's degree in electrical engineering from Massachusetts Institute of Technology.

**Edwin A. Sweo** has been appointed manager of the servo engineering department. He will fill the vacancy created by the appointment of Notthoff. Sweo joined Dalmo Victor in 1956 as a member of the Stanford-Dalmo-Victor Honors Cooperative Program, under which full-salaried Dalmo Victor engineers take part-time classes at Stanford University working toward advanced degrees. His new position represents the first appointment to managerial status of a Dalmo Victor participant in the Honors Program.

An eastern office of the application engineering department of Dalmo Victor Company has been established in Baltimore, Maryland, headed by **Michael Lichtenstein**. He joined Dalmo Victor in 1948 as a research electronics engineer, and has served in engineering, purchasing, and technical sales.

**Willard H. Fenn**, graduate with BS and MS degrees in electrical engineering from the University of California, has been appointed vice president in charge of West Coast operations of **FXR, Inc.** Headquarters will be in Venice, Calif.



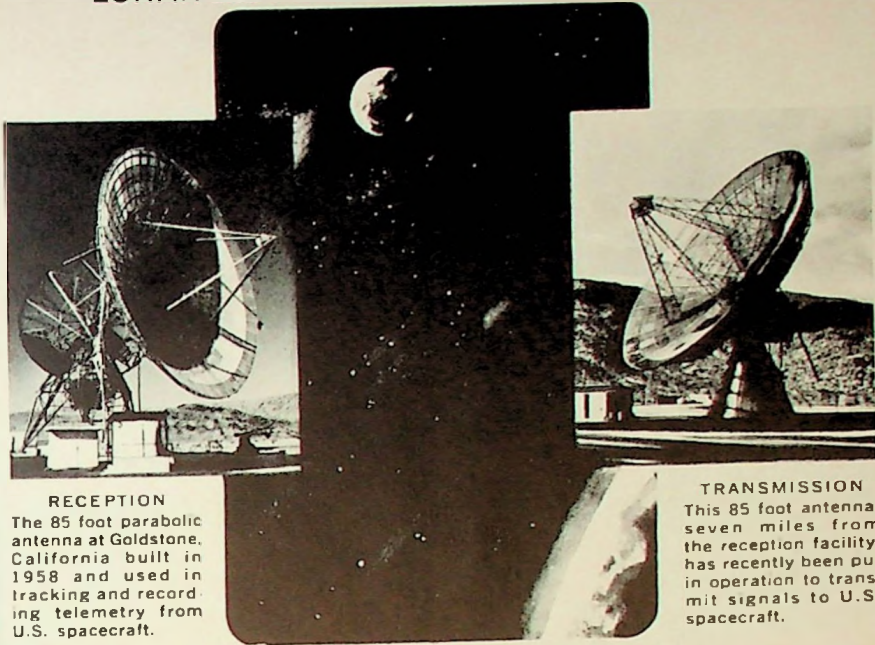
*Fenn*

*Farlow*

**Clayton C. Farlow** has been named manager of research and development of the **Delcon Corporation**, Palo Alto. He was formerly engineer-in-charge at Sylvania electronic defense laboratories in Mountain View.

**Lane Upton**, a project engineer, has been named to the newly created post of manager of contract development. Prior to joining Delcon, Upton was a project engineer for Kaar Engineering Corp., Palo Alto, where he was in charge of design for radio communication equipment, navigational aids equipment and government contract work.

**LUNAR and PLANETARY COMMUNICATION**



**RECEPTION**  
The 85 foot parabolic antenna at Goldstone, California built in 1958 and used in tracking and recording telemetry from U.S. spacecraft.

**TRANSMISSION**  
This 85 foot antenna, seven miles from the reception facility, has recently been put in operation to transmit signals to U.S. spacecraft.

**SENIOR RESEARCH SPECIALISTS**

New opportunities involving advanced research and development projects are now open at JPL in the Laboratory's Telecommunications Division for engineers and scientists capable of assuming a high level of technical responsibility.

**SOME SPECIFIC OPENINGS IMMEDIATELY AVAILABLE**

**Communication Specialists**  
Execution of RF tracking and communication system projects.

**Radio Research Engineers**  
Design of advanced RF transmitter/receiver equipment.

**Antenna Specialists**  
Analysis, design and evaluation of giant Antenna Structures and Servo Systems.

**Research Scientists**  
Digital data and control system analysis and synthesis.

**Mathematicians or Communication System Analysts**  
Analog and Digital system analysis. Noise, coding, information theory. Linear and non-linear filter theory.

Several openings also exist for supervisors of Research and Advanced Development Projects performed by industry for JPL.



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**SEND COMPLETE QUALIFICATION RESUME NOW FOR IMMEDIATE CONSIDERATION**

**Applied Technology, Inc.**, Palo Alto, has appointed **John B. Pettegrew** to the newly created post of engineering marketing manager. Pettegrew, since 1958 chief engineer at Menlo Park Engineering, will coordinate ATI's customer liaison program.

**Frank G. Marble**, formerly vice president and general manager of Boonton Radio Corp., a subsidiary of Hewlett-Packard, has joined **Systron-Donner Corp.** as assistant to the president. Marble is a graduate of Mississippi State College and Massachusetts Insti-


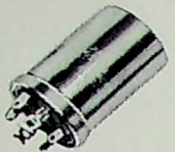

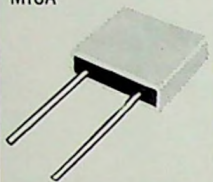

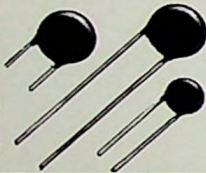
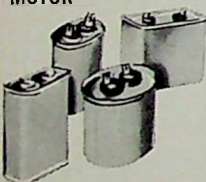
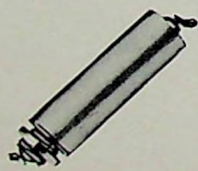
tute of Technology. After 13 years of engineering experience with Philco Cor-  
*(Continued on page 32)*



*Pettegrew*

*Marble*



 <p><b>Consistently Dependable Capacitors</b></p>	<p><b>ELECTROLYTIC</b></p> 
<p><b>FILM DIELECTRIC</b></p> 	<p><b>MICA</b></p> 
<p><b>ENERGY STORAGE</b></p> 	<p><b>CERAMIC</b></p> 
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C-D high reliability capacitors are most widely accepted for critical electronic applications because they are consistently the best. Technical data available. Write to Cornell-Dubilier Electric Corporation, 4144 Glencoe Avenue, Venice, Calif.

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## Wanted!

### Sr. Electronics Engineer

High-speed research and instrumentation cameras and meteorological instruments are the activities of our instrument division. A versatile man with a BS or MS in either electrical engineering or physics, a good grasp of circuitry and systems, an analytical approach, and the ability to take responsible, decisive action, will find an interesting and unusual career in this division.

Beckman & Whitley is a well established concern in both of these fields as well as in missile components.

It will be this man's primary task to see that the latest concepts and techniques of electronics are kept constantly applied to the camera and meteorological activity. For this, he must have a wide range of technical interests and 5 years of electronic instrumentation design or development.

If you are interested please forward resume or call the Personnel Department at LYtell 1-8241.

*Beckman & Whitley*

San Carlos, California

**MORE SWINGS**  
 poration, Bell Telephone, and Pratt and Whitney Aircraft, he spent 3 years as sales manager of Kay Electric Company and from there he went to Boonton Radio.

**Watkins-Johnson Co.**, has filled two key positions on its administrative staff with **Stuart G. Whittelsey, Jr.** as administrative director and **W. LeMar Talbot** as contracts manager.

The new administrative director came from Litton Industries, Dayton, Ohio, and San Carlos, Calif. He is a graduate of Stanford University and has an MBA degree from the Harvard Graduate School of Business. Talbot was formerly administrative services manager for Melabs, Palo Alto, for several years.



Whittelsey

Rubenson

**J. Norman Nelson** has joined the technical staff of **Watkins-Johnson Co.**, Palo Alto, to be primarily concerned with the development of medium-power traveling-wave amplifiers.

Nelson spent the past three years with the Radio Corporation of America at Harrison, N. J., where he was responsible for the design and development of low-noise and medium-power traveling-wave tubes. He is a graduate of Massachusetts Institute of Technology and had additional postgraduate studies at Rutgers University.

Activation of a new division for the development and manufacture of electronic systems and sub-systems has also been announced. **Joseph G. Rubenson**, formerly technical manager of the multi-million dollar AN/GLR-4 system program at the Mountain View operations of Sylvania Electronic Systems Division.

**Dr. Benjamin Epstein** is now a full-time consultant in statistics. Epstein has been professor of mathematics at Wayne State University and visiting professor of statistics at Stanford University. He received his BS and MS degrees from MIT in 1937-38 and his PhD from the University of Illinois in 1941.

Epstein is a member of the American Mathematical Society, Mathematical Association of America, Institute of Management Sciences, Operations Research Society of America, Biometrics Society,

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Servo Motors, Tachometers
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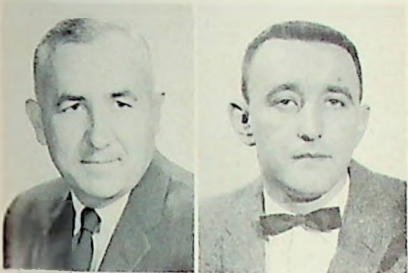
### ★ 130 NORTH B STREET

San Mateo, California  
 Diamond 2-7057

**MORE SWINGS**

and Sigma Xi.

He is a Fellow of AAAS, the Institute of Mathematical Statistics, American Statistical Association, and the American Society for Quality Control.



Epstein

Walter

Menlo Park Engineering has appointed Charles Walter as sales manager. Walter, a graduate of the University of California, Berkeley, was manager of applications engineering for Granger Associates of Palo Alto for the past 18 months. Prior to that time he was sales manager of Sierra Electronic Corp. for five years. Walter is an associate member of AIEE.

Personnel in the electronic defense laboratories of Sylvania Electric Products Inc. have made the following shifts: Jack K. Carlyle, formerly head of the systems synthesis section, has been named manager of the missile and space department; Robert R. Fossum, previously head of the signal analysis section, has been named manager of the advanced analysis department; Alfred E. Halteman will direct the systems analysis department; James M. Harley, formerly head of the systems studies and evaluations sections, has been appointed manager of the tactical electronic warfare department; and John W. Harper has been appointed to head the analyzer section.

*grid returns*

**LETTER TO THE EDITOR**

Dear Sir:  
Would you be so kind as to explain for my benefit and that of several of my mystified colleagues the rather obscure mathematics which appears on page 14 of your October issue.

Yours very truly,  
George Spelvin

Our typographer has been queried on this subject and says it's all Greek to him. Here's what Reporter Barnett had in mind in his original Meeting Review.—Ed.

The angular precession frequency is  $2\pi\nu = \omega = \gamma H$  where H is the field strength and  $\gamma$  is the gyromagnetic ratio of the electron. For an electron in free space,  $\gamma/2\pi = 2.80$  mc/sec oersted.

**BALLANTINE'S MODEL 305A VOLTMETER**

measures peak, or peak to peak

**PULSES**

as short as **0.5  $\mu$ s**

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**AT PULSE RATES AS LOW AS 5 pps  
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**Complex Waveforms**

having fundamental of 5 cps to 500 kc with harmonics to 2 mc.

**Accuracy**

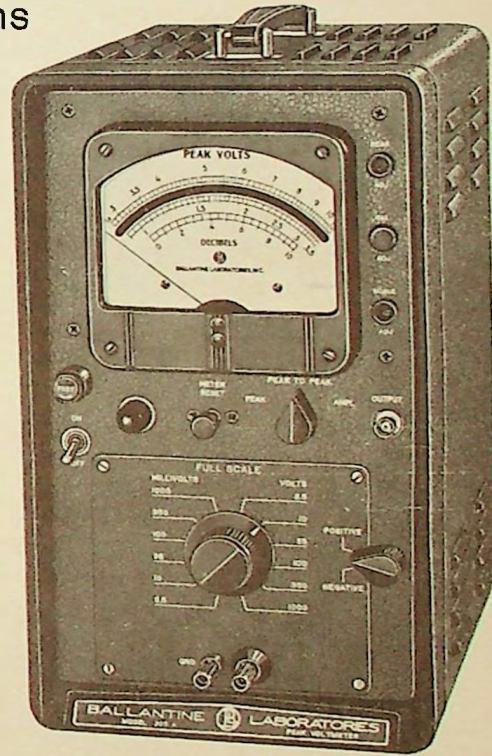
is 2% to 5% OF INDICATED VOLTAGE, depending upon waveform and frequency.

**Scale**

is the usual Ballantine log-voltage and linear db, individually hand-calibrated for optimum precision.

**Input Impedance**

is 2 meg, shunted by 10 pf to 25 pf.



Price: \$395.

THIS "A" MODEL is the result of improvements and new features AFTER 11 YEARS OF MANUFACTURING THE VERY SUCCESSFUL MODEL 305

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# NEW

## HIGH-FREQUENCY CURRENT PROBE



The P6016 AC Current Probe and Type 131 Amplifier constitute a current-detecting system for use with a wide-band oscilloscope. This system provides accurate displays for observation and measurement of current waveforms of low amplitude and fast risetime. Current range is 1 ma to 10 amps. Passband, with a 30-mc oscilloscope, is 50 cps to 17 mc.

Long narrow shape and convenient thumb control make the P6016 easy to use. Just place probe slot over conductor and close slide with thumb—no direct electrical connection is required. Wiping action keeps core surfaces clean. Loading introduced is so light it can almost always be disregarded.

A second system comprises the P6016 with a Passive Termination. Although less versatile, this system provides for observation and measurement of current waveforms at frequencies to 20 mc (with 30-mc oscilloscope) and sensitivity of either 2 or 10 ma/mv (of oscilloscope sensitivity).

PRICES:	P6016 . . . . .	\$ 75
	Type 131 Amplifier . . . . .	160
	Passive Termination . . . . .	15

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Wide-Band

## Micromega Y & T Ferrite Circulators

Compact Configuration with Exceptional Performance

These waveguide and stripline units give you reliable performance under rugged, continuous-duty operation. Designed by highly experienced microwave specialists, they give performance that lives up to their advertised specifications. These versatile units can be converted into microwave switches by replacement of the permanent magnet with electromagnets.

Micromega also has a line of broadband microwave coaxial isolators. Send now for technical data on Micromega's ferrite circulators and/or isolators.

Typical of the line, specifications of the Model CM210 waveguide T-circulator include: frequency range, 6150 to 7550mc; isolation, 20db min.; insertion loss, 0.20db max.; VSWR, 1.15db max.; size, 3" x 3 1/4" x 3 1/4"; connectors mate with UG/50/U.

Typical of the line, specifications of the Model SL250 stripline Y-circulator include: frequency range, 3300-3800mc; isolation, 22db min.; insertion loss, 0.30 max.; VSWR, 1.20 max.; size, 3 1/4" dia. by 1" height; connectors, type N.



**Micromega Corporation**

4134 Del Rey Avenue, Venice, California, EXmont 1-7137

*events of interest*

### IRE MEETINGS SUMMARY

November 20-21 — Conference on Electro-Optical and Radiation Devices. Stanford Research Institute, Menlo Park. A. K. Wing, Jr., ITT Labs, Nutley 10, N.J.

December 1-2 — Eleventh National Conference Professional Group on Vehicular Communications. Sheraton Hotel, Philadelphia. Marion T. Speights, P.O. Box 443, Fort Washington, Pennsylvania. (Local participants include Larry Getgen, Lenkurt Electric Co.; and C. A. Rypinski, Secode Corp.)

December 12-14 — URSI-IRE Fall Meeting. NBS Boulder Labs, Boulder, Colorado. A. H. Shapley, CRPL National Bureau of Standards, Boulder, Colorado.

December 13-15—Eastern Joint Computer Conference. New Yorker Hotel and Manhattan Center, New York. Elmer Kubie, Computer Usage Co., 18 E. 41 Street, New York 17, N.Y. (Local participants include Daphne Innes, Lawrence Radiation Lab; and Lionello Lombardi, University of California.)

### NON-IRE EVENTS

On Saturday, November 26, at 5:00 p.m., KPFA-FM, 94.1 megacycles Berkeley, will broadcast the regular "Equipment Report" program by R. S.

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TRANSFORMERS, FILTERS, POWER SUPPLIES

### Vacuum Tube Products

#### Division

Hughes Aircraft Co.

STORAGE MEMORY TUBES, SPOT WELDERS,  
VACUUM APPARATUS

MacCollister. The subject of this program will be an examination and report on the new Fisher FM-50 F-M Tuner.

November 25-26 — **American Physical Society Meeting.** University of Chicago, Chicago, Illinois.

November 29 — **American Institute of Consulting Engineers Annual Dinner.** Waldorf Astoria Hotel, New York, N.Y.

November 29-December 1 — **Electronic Industries Association Winter Conference.** Fairmont Hotel, San Francisco.

December 5-8 — **American Rocket Society Annual Meeting and Astronautical Exposition.** Shoreham Hotel, Washington, D.C.

#### IRE PAPERS CALLS

**December 1**—Papers for 1961 Western Joint Computer Conference (Los Angeles, May 9-11, 1961). Send to Professor Cornelius Leondes, Department of EE, University of California at Los Angeles, 405 Hilgard Ave., Los Angeles 24, Calif.

**December 12**—500-word summaries for 1961 National Symposium of the Professional Group on Microwave Theory & Techniques (Washington, D.C., May 15-17, 1961). Send to: Gustave Shapiro, Engineering Electronics Section, National Bureau of Standards, Washington 25, D.C.

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Experienced graduate E.E.'s with 3 to 5 years in logic design and transistorized circuit design of digital equipment. Assignments will entail logic and circuit design of buffer storage units and digital peripheral equipment.

## TRANSISTOR POWER SUPPLY ENGINEER

For assignment in specifying power supplies for both large and digital systems; supervising the design of supplies internally or by vendors, and evaluating supplies to determine conformance to specifications. Requires knowledge and design experience in solid state computer power supplies, their specification, and associated transistor circuitry. Requires experienced graduate E. E. or man with formal training and appreciable practical transistor power supply experience.

## TRANSISTOR CIRCUIT ENGINEERS

Seniors & Intermediates

Highly creative positions are available in circuit analysis and design. Duties include: advanced mathematical studies in transistor circuitry, evaluation of transistor circuitry, component studies and keeping abreast of computer circuit advances. Circuit analysis ability and solid understanding of transistor theory essential. E. E. degree required.

## PRODUCT ENGINEERS

Seniors & Intermediates

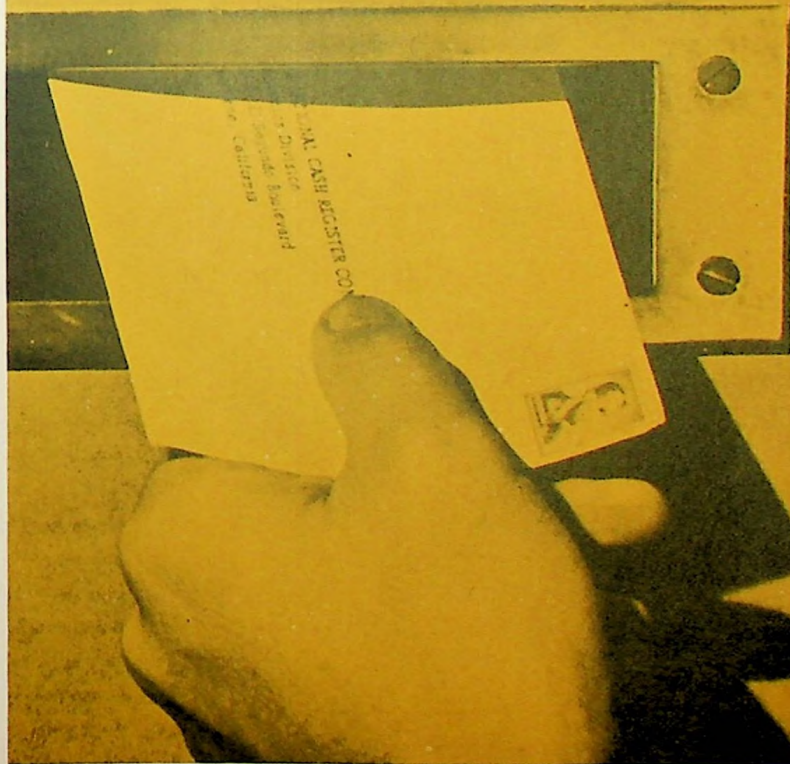
Assignments entail design analysis and technical liaison to develop a producible product; establishment of design requirements from standpoint of cost, product ability and standardization; recommendation of changes for ease of manufacture. Positions require substantial knowledge of manufacturing methods, practices, shop equipment and facilities; solid background in electronic design of digital equipment; E. E. degree.

Confidential interviews can be arranged in Los Angeles or at the Eastern Joint Computer Conference in New York Dec. 13-15. Please send resume now to Norval E. Powell, Personnel Manager.

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## the section

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Richard C. Anderson	John Kettlewell
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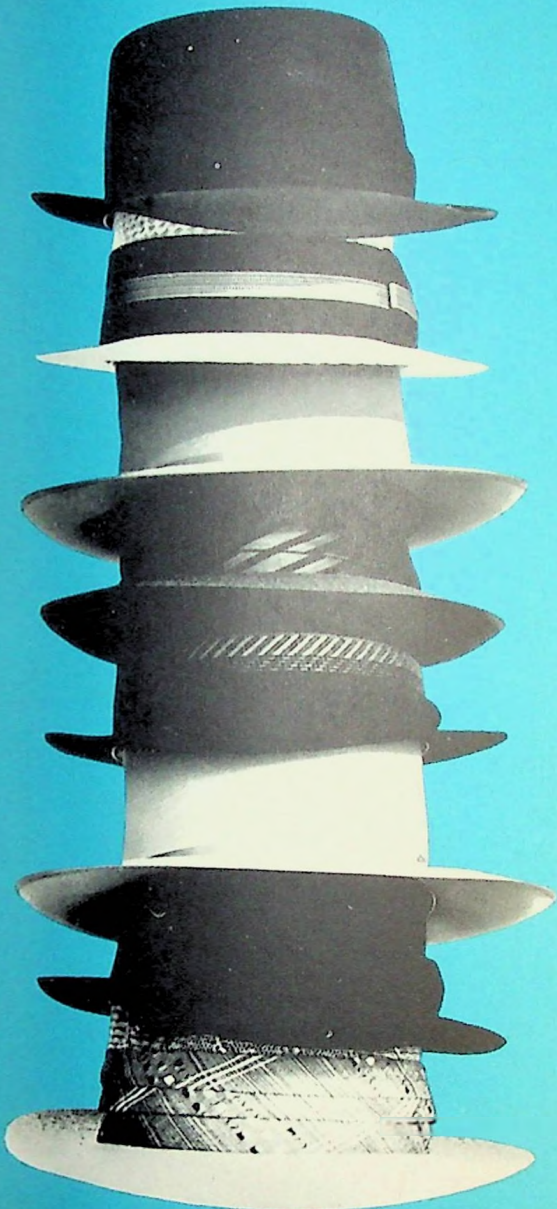
## the recruitment picture PICKING UP

From a condition of unwantedness in July, engineers and scientists found their desirability somewhat enhanced in September. Figures are the result of studies made by Deutsch & Shea, Inc., technical manpower consultants, by measuring the volume of recruitment advertising in 27 newspapers in twenty major market areas and 16 key journals in various technical and scientific fields.

September demand showed a 7.7 increase over the base month of July and 10.1% over the preceding month of August. On technical-journal data only, September was up 7.4% over July, and 12.7% over August.

Following are the names of individuals who have been elected to current membership:

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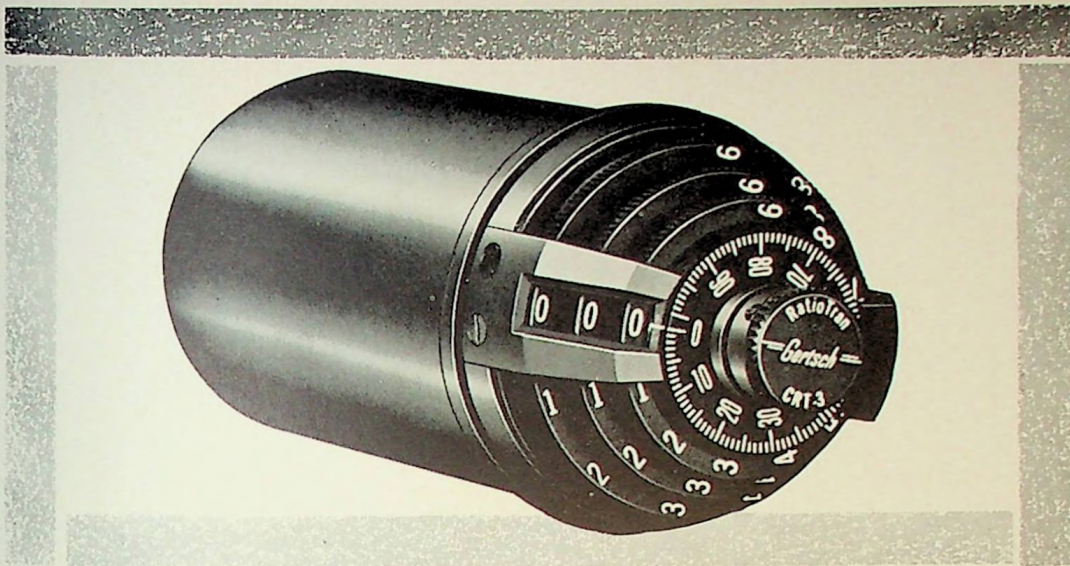
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