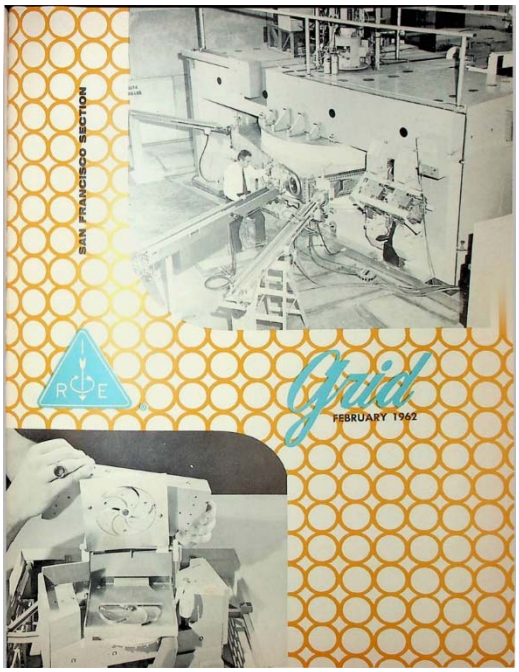
EDITOR'S PROFILE of this issue

from a historical perspective …

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



February, 1962:

Cover: The new 88-inch Cyclotron at UC-Berkeley is now in operation, adding to the capabilities of the 44-inch one constructed with the magnetics from one of Federal Telegraph's surplus 1 MW arc transmitters back in 1932, given to Ernest Lawrence by Leonard Fuller, Stanford's first EE PhD. A photo of the oscillator is shown on page 12.

p. 6: Detailed concerns with combining the IRE with the AIEE are now being discussed. Are there advantages in combining AIEE's power and transmission specialties with IRE's disciplines? Will a single membership renewal and slate of meetings be helpful? IRE members are encouraged to write in.

p. 9: To replace the mimeographed/mailed meeting notices, a second monthly edition of the GRID will be composed and mailed starting this spring; this should help the Groups that meet early in the month.

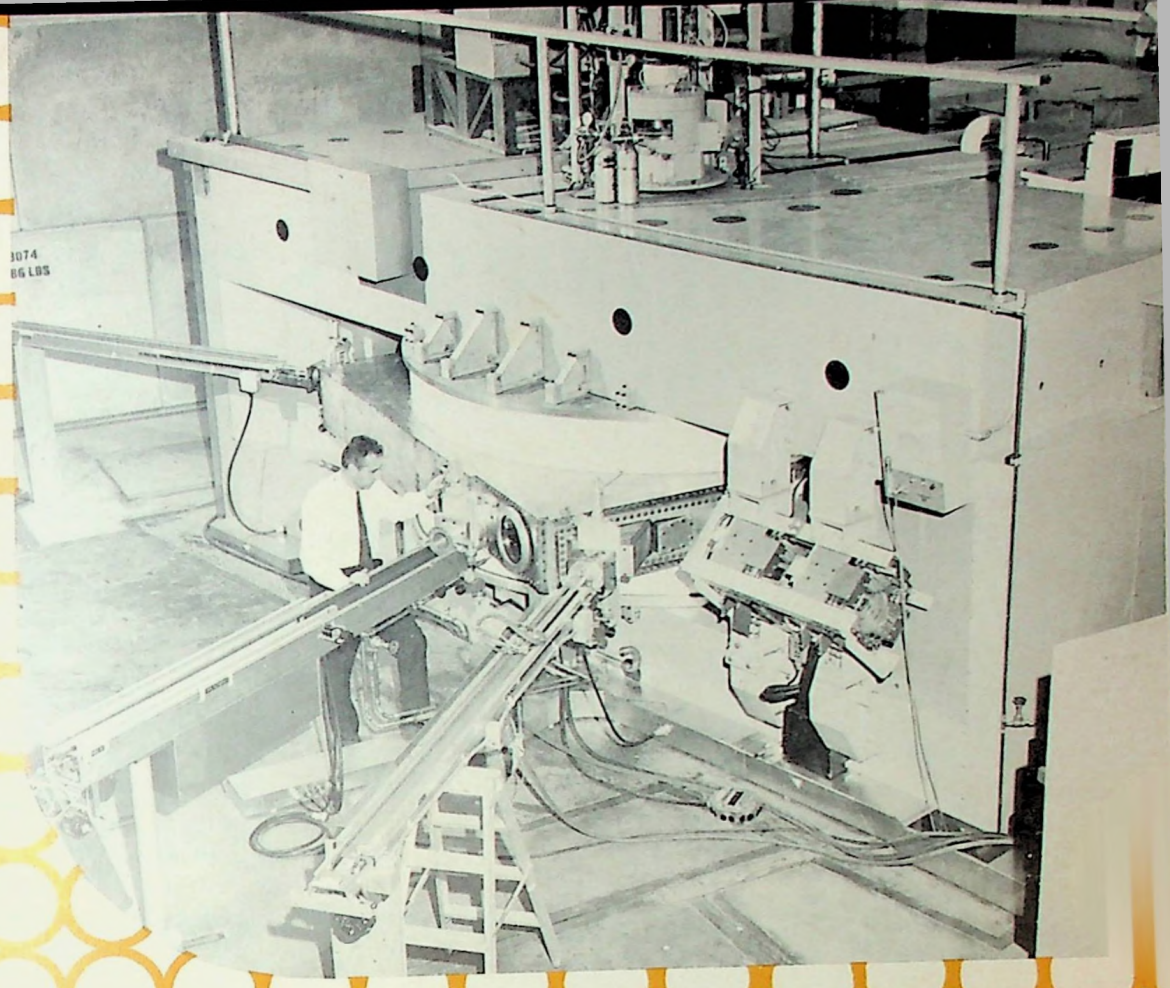
p. 18: Sir Robert Watson-Watt, inventor of radar in the U.K. prior to WW II, visits UC-Berkeley and SRI, and explains at an IRE meeting that radio experiments back in the '30's were considered a waste of money - compared to constructing lighthouses. It was the Tizard committee's approval in 1935 – and the subsequent secret trip to the USA to disclose the details and engage new resources – that brought Stanford and others into the development of higher-frequency (microwave) radar so important to the war effort.

p. 18: Bernie Widrow's adaptive neurons are described in some detail. His setup was shown on the cover of the September 1961 issue of the GRID. He mentions the work that he and Ted Hoff were doing setting electrochemical variable weights for the pseudo-neurons. This is the first mention of Ted, who later joins Intel (as employee #12) and invents (with Stanley Mazor) the first microprocessor (or "universal processor"), the Intel 4004 chipset, in 1969.

p. 30: At the WAEI (Women's Association of the Electronic Industry) meeting, it was pointed out that Varian Associates was started in Menlo Park in 1948 with 6 people (including Dorothy Varian) and $22,000; it's now the largest employer in Palo Alto with 3,300 people. The first Varian building in Stanford's Industrial park opened in 1953 with 35,000 square feet; Varian now has half a million square feet on 65 acres, and is looking for 100 more acres for 5,000 more employees. Varian is the largest maker of klystron tubes, and second-largest microwave tube producer.

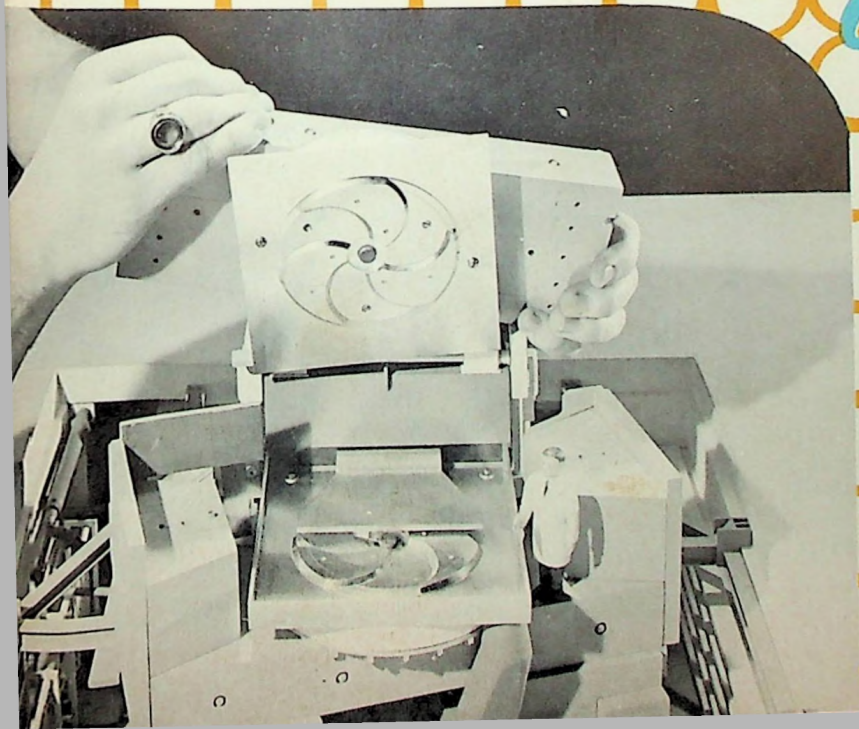
p. 38: A new president is named for Dalmo Victor, in Belmont, as Tim Moseley retires, likely to spend more time on his large black sailboat *BARUNA*. I worked part-time and one summer at Dalmo Victor, as a student. In addition to the TFX fighter electronics that I was working on, it had an extensive machine shop; Tim needed better winches for his boat, so he had them made in the shop. They were called "Barient" winches, named for the black *Baruna* and the competing white *Orient*. They became known as a premium winch. In 1966-68, when I was in charge of training Stanford students as new sailors on SF Bay, we received several Shields-class sailboats donated by Cornelius Shields, the New York financier. The rough Bay conditions (wind, waves, tides) quickly ruined the supplied winches, and Corny Shields agreed to replace them with Barients at his expense.

SAN FRANCISCO SECTION



Grid

FEBRUARY 1962



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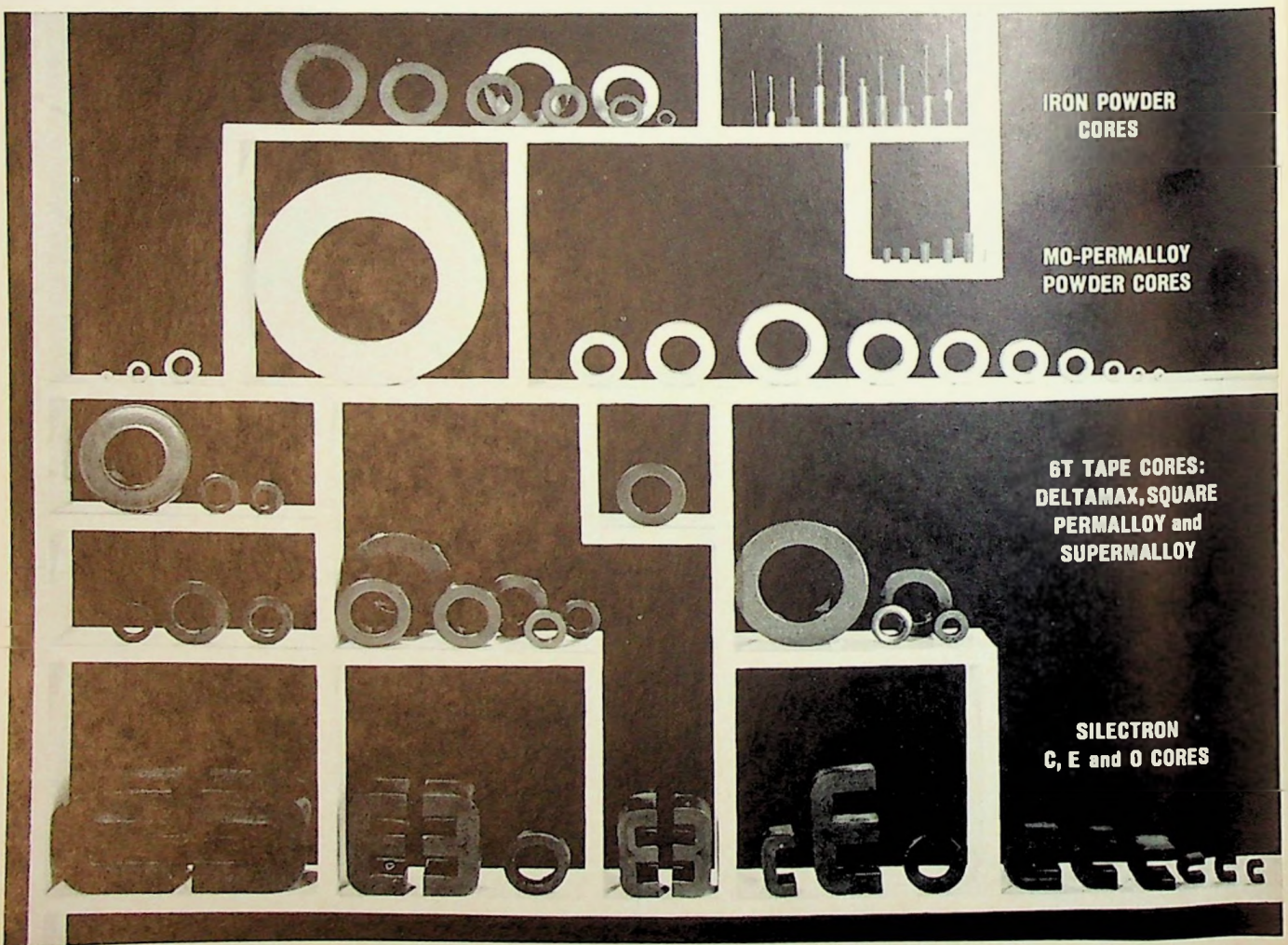

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volume 8
number 6

Grid

February 1962

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contents

cover

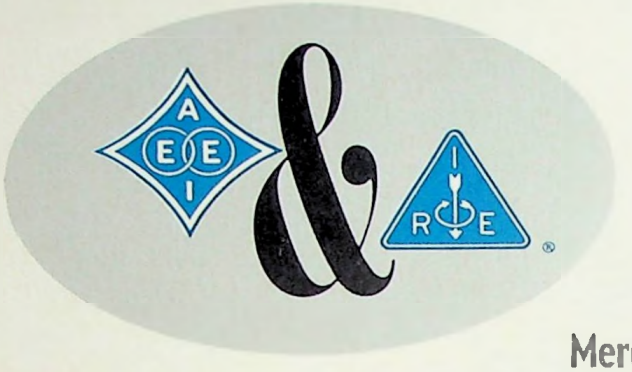
Late news in atom-smashing circles is that the new 88-in. cyclotron in the University of California's Lawrence Radiation Laboratory has been successfully operated. This machine was the subject of a paper presented at the end of October to the East Bay Subsection by Dr. Bob H. Smith, who is in charge of the r-f facilities.

It is also the subject of the cover, where the view of the entire machine includes Dr. Elmer Kelly, physicist in charge. A view of a scale model reveals the configuration of the spiral ridges, a special feature of the new machine. And, a review of the paper appears on page 12.

The new cyclotron, which was built at a cost of some $4,850,000 of AEC funds, has been under construction since May 1956. It will allow scientists to work in previously inaccessible intermediate-energy ranges, permitting new experiments on the atomic nucleus.

section officers

Should



Merge?

"Yes!" says L. V. Berkner, outgoing national president of IRE, and many others.

"No!" says Clarence Radius, Cal Poly; Herb Heller, Cleveland Section News; and many others.

remarks from the chair

Implications of the proposed merger of IRE and AIEE and how it will affect publications, professional groups, conventions, vitality, size, and organization are obviously complex and not fully foreseeable until the final constitution and bylaws are available for study. Early acceptance of the general idea is now being tempered by deeper considerations of the detailed problems involved. Fears of dilution of publications, professional groups and conventions have been expressed. Herb Heller says there is growing realization by some members that "size, beyond a point, is not beneficial," and that achieving size for its own sake may compound the problems of organization, vitality, and conventions. Should the power and transmission specialties of AIEE become concerns of IRE? Clarence Radius points out that, "a 10^{10} dollar industry certainly can support a society wholly devoted to its own problems." IRE has indeed become just that. The question is, in the unforeseeable future, how close together will the fields of interest of IRE and AIEE grow and what benefits will merger and the elimination of dual memberships and meetings bring the members? Only the members of both groups can themselves decide this, and their full discussion will at least have the safety of numbers, each crystal ball being possibly as clouded as that of any national committee of either group. Therefore full and immediate discussion is vitally important to the future of IRE.

Your Operating Committee has approved the idea of merger in principle, contingent upon the development of details. Your Executive Committee voted 8 to 8 in a test vote on January 29, with your Chairman casting a favoring vote to break the tie.

The situation is highly volatile and it is important that Section members express their opinions to the **Grid** no later than February 25, in order for them to be reflected in the March issue and as a guide to the Operating and Executive Committees. Address your cards or letters to "Merger, The **Grid**, P.O. Box 966, Station A, San Mateo, Calif.

Stanley F. Kaisel

—STANLEY F. KAISEL
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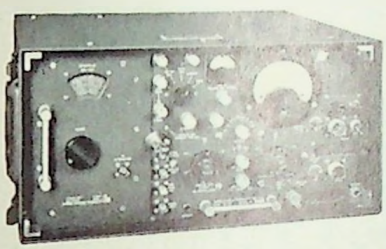

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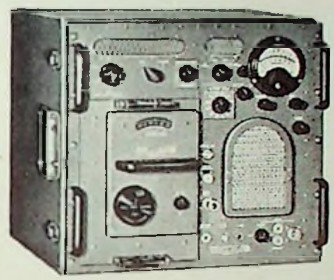

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MEETING CALENDAR

EAST BAY SUBSECTION — 7:00 P.M. • Wednesday, Feb. 21
(Joint with PGRQC—see below)

PROFESSIONAL GROUPS

Antennas & Propagation — 8:00 P.M. • Wednesday, Feb. 21
(Tutorial series on millimeter waves—joint with PGED and PGMTT)
Lecture No. 2
"Millimeter Propagation"
Speaker: Prof. A. Straiton, director of electrical engineering research lab, University of Texas
Place: Room 101, Physics Lecture Hall, Stanford University

Antennas & Propagation — 8:00 P.M. • Wednesday, Feb. 28
Lecture No. 3
"Millimeter Transmission-Line and Antenna Design"
Speaker: Alan J. Simmons, Technical Research Group Inc., Somerville, Massachusetts
Place: Room 100, Physics Lecture Hall, Stanford University

Antennas & Propagation — 8:00 P.M. • Wednesday, Mar. 7
Lecture No. 4
"New Techniques for the Generation of Millimeter and Sub-Millimeter Radiation"
Speaker: Paul Coleman, University of Illinois
Place: Room 101, Physics Lecture Hall, Stanford University

Audio — 8:00 P.M. • Monday, Mar. 5
"Speech Analysis & Perception"
Speaker: Dr. Dorothy A. Huntington, speech and hearing department, Stanford University
Place: Conference Room B, Stanford Research Institute
Dinner: 6:30 P.M. (Cocktails 6:00 P.M.), Ramor Oaks, 3435 El Camino Real, Atherton
Reservations: Herb Ragle, EM 9-7111, Ext. 596

Electron Devices — 8:00 P.M. • Wednesday, Feb. 21, 28, March 7
(Tutorial series on millimeter waves—joint with PGAP and PGMTT, see above)

Electronic Computers — 8:00 P.M. • Monday, Feb. 19*
"Proposed University of California Computing System Including Remote Terminals"
Speaker: Professor Harry D. Huskey, electrical engineering department, University of California
Place: Main Auditorium, Stanford Research Institute, Menlo Park
(Enter main entrance of new building)
Dinner: 6:00 P.M., Red Shack Hofbrau, 4085 El Camino Way, Palo Alto
Reservations: None required
*Third Monday this month only

Electronic Computers — 9:00 A.M. • Monday, Feb. 26
(Joint with AIEE West Coast Subcommittee on Solid-State Devices and IRE national PGED)
Third Annual Symposium on the Applications of Magnetic and Dielectric Solids
Place: Stanford Research Institute, Menlo Park
Registration: 9:00 A.M. (no fee)
Chairman: Donal Meier, National Cash Register, Hawthorne, Calif.
Program: Dr. Floyd B. Humphrey, California Institute of Technology, Pasadena

Engineering Management — 8:00 P.M. • Wednesday, Mar. 21
(Joint meeting with PGEWS, see top of page 9)

Engineering Writing & Speech — 8:00 P.M. • Tuesday, Feb. 20
"Making Visual Aids Effective"
Speakers: Arch Cassingham and Ralph Simms, Sylvania RSL
Place: Auditorium, Sylvania EDL, 123 N. Whisman Road, Mountain View
Dinner: 6:00 P.M., The Red Shack Hofbrau, 4085 El Camino Way, Palo Alto
Reservations: James Weldon, 968-6211, Ext. 2344

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MEETING CALENDAR

Engineering Writing & Speech 8:00 P.M. • Wednesday, Mar. 21
(Joint meeting with PGEM)
"PERT (Program Evaluation Reporting Technique), a New and Valuable Management Tool"
Speaker: R. M. T. Young, senior staff specialist, Polaris missile systems project control, Lockheed Missiles and Space Co.
Place: Lockheed Auditorium, 3251 Hanover Street, Palo Alto
Dinner: 6:30 P.M., L'Omelette Restaurant, 4170 El Camino Real, Palo Alto
Reservations: Doris Gould, IRE Section Office, DA 1-1332, by Mar. 20

Microwave Theory & Techniques
8:00 P.M. • Wednesday, Feb. 21, 28, March 7
(Tutorial series on millimeter waves—joint with PGAP and PGED, see above)

Military Electronics 7:30 P.M. • Tuesday, Mar. 6
"Operation of Air Force Satellite Control Test"
Speaker: M. Tolson, requirement evaluation and integration section, Satellite Test Center, Sunnyvale
Place: Lockheed Auditorium, 3251 Hanover Street, Palo Alto
Dinner: 6:00 P.M., Red Shack Hofbrau, 4085 El Camino Way, Palo Alto
Reservations: None required

Product Engineering & Production 8:00 P.M. • Tuesday, Feb. 20
Lecture and plant tour
"Testing Versus the State of the Art"
Speaker: Eric Edberg, manager, reliability and quality assurance, vacuum tube division, Varian Associates
Place: Varian Associates, 611 Hansen Way, Palo Alto

Reliability & Quality Control 7:00 P.M. • Wednesday, Feb. 21
(Dinner meeting—joint with EBSS)
"Automation to Eliminate Human Effects on Reliability"
Speaker: L. J. Paddison, Sandia Corporation, Albuquerque, New Mexico
Place: The Red Shack Hofbrau, 4085 El Camino Way, Palo Alto
Dinner: Broiled chicken—$3.00 including tax and tip
Reservations: DA 1-1332 by Monday, Feb. 19

Space Electronics & Telemetry 8:00 P.M. • Tuesday, Feb. 20
"Some New Approaches to Vehicle and Ground Station Antennas for Space Communications"
Speakers: P. D. Kennedy and R. F. Trainer, Lockheed
Place: Lockheed Auditorium, 3251 Hanover Street, Palo Alto
Meet-the-Speaker Dinner: 6:30 P.M., Camino Bowl, 2025 El Camino Real, Mountain View
Reservations: Cynthia Chaney, DA 6-4350

CHRONOLOGICAL RECAP

February 19—Electronic Computers
February 20—Engineering Writing & Speech, Product Engineering & Production, Space Electronics & Telemetry
February 21—Antennas & Propagation/Electron Devices/Microwave Theory & Techniques, Reliability & Quality Control/East Bay Subsection
February 26—Electronic Computers/AIEE/Electron Devices
February 28—Antennas & Propagation/Electron Devices/Microwave Theory & Techniques
March 5—Audio
March 6—Military Electronics
March 7—Antennas & Propagation/Electron Devices/Microwave Theory & Techniques
March 21—Engineering Writing & Speech/Engineering Management

lectures ahead

THREE ON MILLIMETER WAVES

Propagation, transmission-line, and new-generation-method aspects of millimeter waves will be covered by lectures Numbers 2, 3, and 4 of the joint PGAP/PGED/PGMTT series during the latter part of February and in early March. See particulars in the Calendar, page 8.

Lecture No. 2, on propagation, features A. W. Straiton of the University of Texas. Straiton spends half time as a professor of electrical engineering and half as director of the electrical engineering research laboratory.

The millimeter-wavelength portion of the radio spectrum has great potential as a region into which radio- and radar-systems application may be extended. Propagation characteristics of these radio waves do, however, impose stringent limitations on the practical uses of these wavelengths. The most unique of these features is the absorption of these wavelengths by oxygen and water vapor in the atmosphere. Other features which affect the possible applications are absorption and scattering by rain and other types of precipitation; fluctuations due to atmospheric inhomogeneities; background radiation from the atmosphere and from the sun; and reflection from land, water, and buildings.

Recent measurements have provided considerable information on all of these characteristics. In this paper, these experimental results are described and compared with those predicted by theoretical consideration. The potential

(Continued on page 10)

publications note

CHANGES COMING

As agreed at the Excom meeting of January 29, the increasing activities of the Section have already generated the need for expanded and at the same time simplified internal communications. Accordingly, plans are presently being made to replace the individual mimeographed meeting notice program with a second edition of the **Grid** each month.

This will do a great deal toward equalizing the elapsed time between **Grid** mailing dates and meeting dates and be especially helpful to those groups whose meetings take place in the early parts of the month.

It will also expand the coverage of professional group activities from the smaller confines of the group itself to the total membership of the Section.

Watch for this development in the near future and be prepared for the disappearance of individual notices in all but emergency situations.

Alan J. Simmons

Paul D. Coleman

MORE MILLIMETER WAVES

uses of the millimeter spectrum are evaluated in terms of the conditions imposed by the propagation characteristics.

Straiton, a Fellow of the Institute, has degrees of BSEE, MA, and PhD in physics, all from the University of Texas. He has been on the faculty of the Texas College of Arts and Industries and has been employed; directly by Southwestern Bell Telephone Co., Bell Telephone Laboratories, and the Central Power and Light Co., and as a consultant by Texas Co. and Douglas Aircraft Co. He has been active in many aspects of IRE and URSI work and holds memberships in Sigma Xi, Tau Beta Pi, and Eta Kappa Nu.

Lecture No. 3

For the third lecture, Alan J. Simmons of TRG, Inc., will consider antennas and transmission lines for the millimeter waves.

The outstanding design problem in antennas is that of holding tolerances to the necessary small fraction of a wavelength. The extension of conventional antennas such as parabolic reflectors with simple feeds, Cassegrain feeds, conical scanned feeds, and monopulse feeds into the millimeter region will be discussed with examples of antennas that have actually been built and a consideration of the tolerance problems encountered. The use of dielectric lenses will also be discussed.

Unconventional antennas (such as the Purcell array, Fresnel zone plate, and leaky-wave antennas) as well as techniques that have been used for building conventional slot arrays in the millimeter wave region will be described.

The major problem with millimeter-wave transmission lines is the high loss encountered with conventional waveguides. Various methods that have been used or suggested for circumventing this difficulty will be described. These include: the use of oversize waveguide, the use of the $TE_{0,1}$ mode in circular waveguide, the use of H-guide, the dielectric image line, and quasi-optical waveguides such as the beam mode. Some of the problems associated with these special transmission lines—for instance, mode launching and maintenance of mode purity—will be discussed. Some of the problems involved in the design of microwave components for some of these unconventional waveguides will be briefly mentioned.

Simmons is a Senior Member of IRE. He received his PhD in EE from the University of Maryland following an MS in EE from MIT and a BS in physics and chemistry from Harvard. He has been affiliated with the U.S. Naval Research Laboratory and the MIT research laboratory of electronics. He is a member of Sigma Xi and Phi Kappa Phi.

Lecture No. 4

"New Techniques for the Generation of Millimeter and Sub-Millimeter Radiation" will be the title of the March lecture given by Paul D. Coleman of the University of Illinois. Some general observations on present classical and quantum electronics approaches to the submillimeter wave problem will be discussed, along with brief remarks on the general problem encountered.

A more detailed summary of Cerenkov radiation research in the ultramicrowave group at Illinois in both scaler and tensor media (plasmas and ferrites) will be presented.

Also recent novel electron-beam couplers presently under study at Illinois will be described. These include Fabry-Perot resonators, electron-beam pumping of a maser, and deceleration radiators.

Paul D. Coleman received the BA degree from Susquehanna University, Selinsgrove, Pennsylvania, in 1940; the MS degree in physics from Pennsylvania State University, University Park, in 1942; and the PhD degree in physics from MIT in 1951.

He has been employed as a physicist with the U.S. Signal Corps and subsequently the U.S. Air Force at Wright Air Development Center and at the

(Continued on page 12)

among the students

NEW BRANCH

A new student branch of IRE was chartered at San Francisco State College on January 9 with Stanley F. Kaisel, Section chairman, Robert A. Craig, chairman, education and student relations committee, and James D. Warnock, executive secretary of the Section, officiating.

Kaisel, Owens, and Zilka at the SF State installation ceremony

Receiving the charter from Kaisel were William Owens, president of the Engineering Society and Professor Thomas J. Zilka, head of the engineering department. Kaisel also presented a scroll to Fred Nase, outgoing president of the student engineering society, in recognition of his leadership.

Professor Rene B. Marxheimer, enthusiastic and dedicated IRE faculty representative at S. F. State, played a major role in formation of the student branch.

Student branches within the Section area are now also active at University of Santa Clara; Stanford; U. S. Naval Postgraduate School, Monterey; Heald Engineering College, S. F.; U. C., Berkeley; and San Jose State, according to Craig. He has urged that each PG send a list of speakers in their field to the faculty advisors to increase mutual interest and participation. A list of advisors can be obtained from the Section office.

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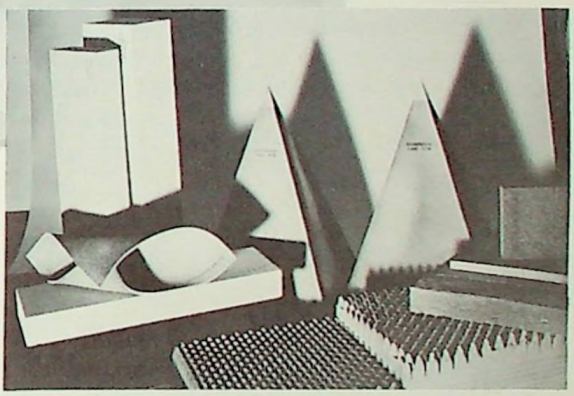

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Cambridge Air Research Center. He was later a research associate in physics in the research laboratory of electronics at MIT.

In 1951 he became an associate professor in electrical engineering at the University of Illinois and is presently a professor on the graduate electrical-engineering staff. In 1959 Coleman became a member of the board of technological counselors of FXR, Inc., and was later elected chairman. He is a member of Sigma Xi, the American Physical Society, and Pi Mu Epsilon.

meeting ahead

STATE-OF-ART & TESTING

Eric Edberg of Varian will discuss the problems of correctly simulating end-use conditions in the testing of new products when PGPEP meets this month. See Calendar for date, etc. Too often, specifications and requirements in a telescoped research and development program defy usage of established test procedures.

The discussion will include a picture of Varian's approach to the testing of small lots of high-quality products and a tour of its facilities to help illustrate this approach.

meeting ahead

FAR-OUT ANTENNAS

Members and guests of PGSET will be gathering shortly to consider new ideas in antennas for both ends of the ground-space link. See the Calendar for details.

Since most satellites and space vehicles built so far have not been stabilized, the antennas of their communication systems have been required to be omnidirectional. However, the day seems to be coming when larger, higher-gain antennas will be used. Such antennas will be subject to unique requirements, the most notable of which is the need to package the antenna in a small volume during vehicle launching. Various techniques for doing this have been investigated, and examples of mechanically erected and pressure-erected antennas are described in the paper.

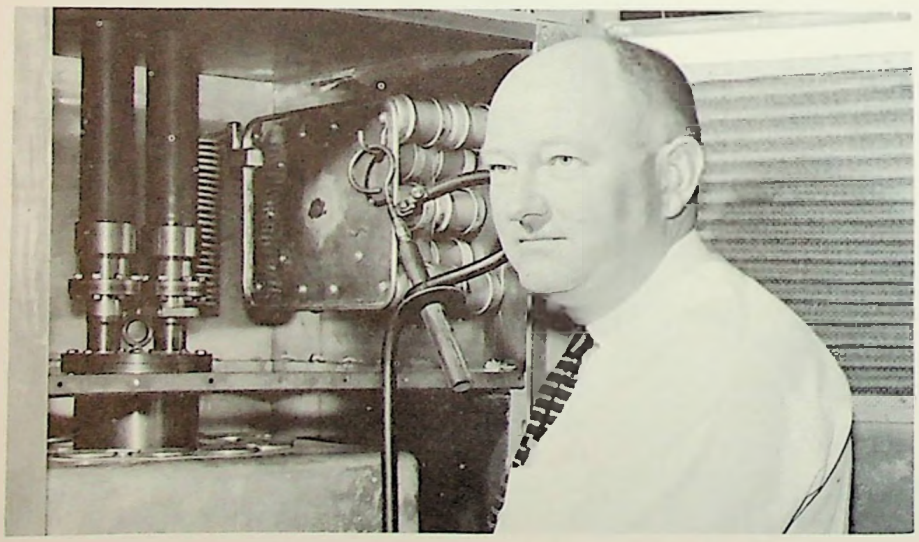
The mechanical-erection techniques are relatively straightforward, but are advantageous only for small antennas or when the antenna shape is compatible with the shape of the vehicle. The pressure-erection techniques, however, are more flexible in that much larger unfurled-to-furled size ratios are possible.

Ground-station requirements of recent space exploration projects for larger and more accurate antennas have resulted in the construction of a number of enormous parabolic-reflector antennas, each costing many millions of dollars. The high cost of such antennas is due to the difficulty of maintaining reflector accuracy as the huge structure is tilted and as wind forces and temperature changes distort the surface. Because of cost limitations and these engineering problems, the size limit for a movable-reflector antenna has been estimated to be approximately 800 feet in diameter.

The Lockheed Missiles & Space Company has set out to develop a more economical and practical solution to the problem of building large, accurate antennas. This solution takes the form of a spherical-reflector antenna for which the main structure, the reflector, is firmly mounted on the ground and only the feed is moved to change the beam angle. While this concept is still in the research and development stage, it is expected to find applications in radar systems, satellite-communication systems, and systems for data reception from deep-space exploration probes.

Peter D. Kennedy, one of the evening's speakers, is responsible for studies of propagation problems, communications systems, tracking systems, and antenna feasibility. He was previously employed by the Ohio State University research foundation and received his PhD, MS, and BS degrees in electrical engineering from Ohio State University, Purdue University, and the Newark College of Engineering, respectively. Kennedy is a senior member of the Institute.

The second speaker, Robert F. Trainer, is head of the antennas and propagation section in electromagnetics research at the Lockheed Missiles & Space Company. Trainer has been with Lockheed for the past four years. He was formerly employed by Stanford Research Institute and the applied physics laboratory at Johns Hopkins University. He received his BS in electrical engineering from George Washington University, and is a member of IRE.



Bob H. Smith, speaker at the East Bay Subsection meeting, with the oscillator unit of the new 88-in cyclotron

meeting review

SHORT CUTS FOR PARTICLES

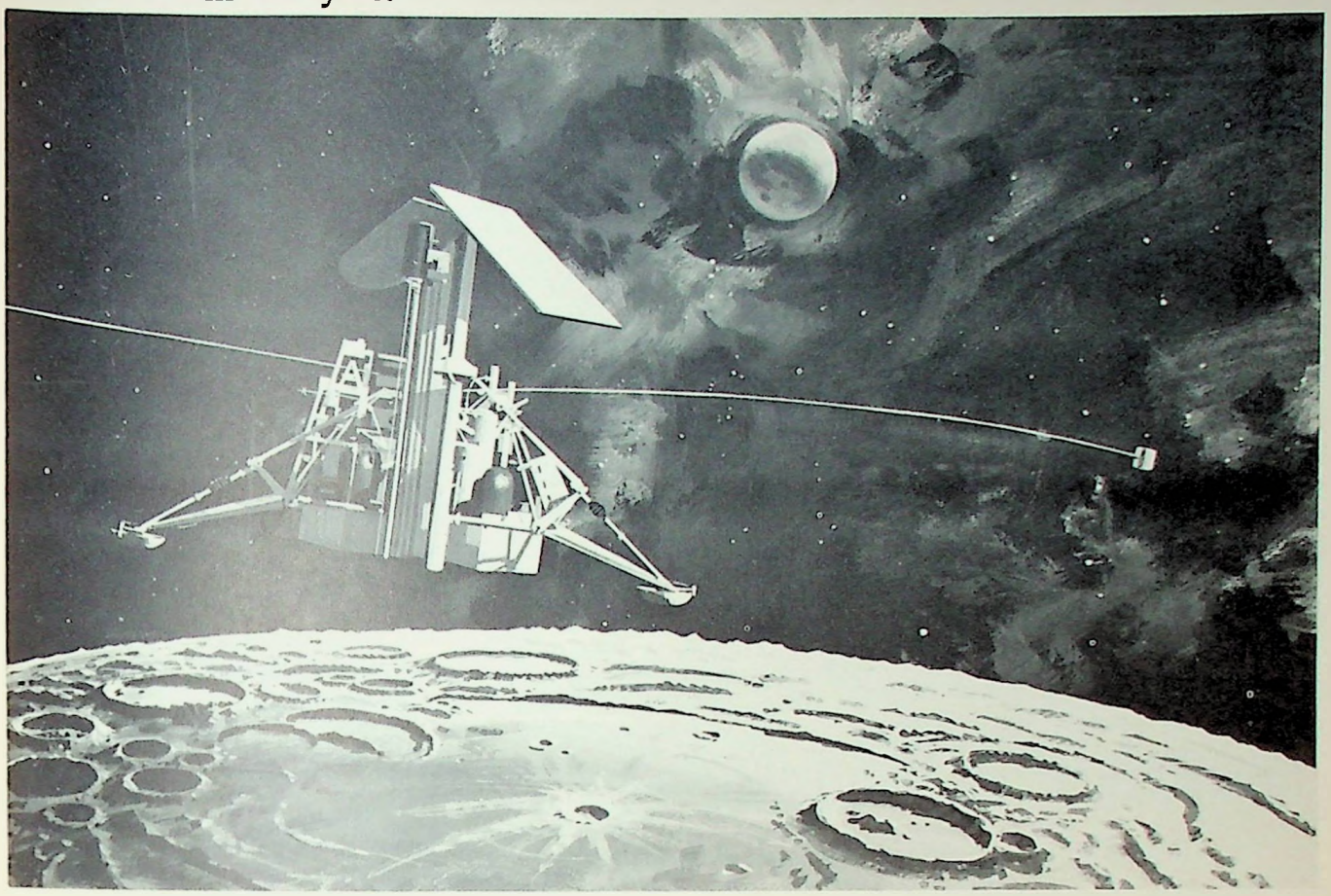
Dr. Bob H. Smith of the University of California, Lawrence Radiation Laboratory, discussed the new 88-in. spiral-ridge cyclotron at the regular October meeting of the East Bay Subsection. The meeting was held in the auditorium of the Radiation Laboratory following a pre-meeting dinner at Spenger's restaurant in Berkeley. Following the lecture, there was a tour of the cyclotron.

The paper discussed briefly the types of research performed in physics at low, medium, and high bombarding energies. Three areas of investigation, suitable for the 88-in. cyclotron, for which experiments are under preparation at present, were then discussed. These consisted of, 1) investigation of the potential wells of nucleii, 2) investigation of the surface structure of nucleii, and 3) investigation of the nucleon distribution within the interior of nucleii.

Next, the paper discussed the theory of ordinary cyclotrons and showed that their energy is limited by the relativistic mass increase of the accelerated particles and the requirements of beam focusing. In ordinary cyclotrons, the focusing force is a result of the cross product of the beam current and radial component of magnetic field. The latter is a result of the magnetic field lines bowing outward. Since the magnetic field is axially symmetric, and the curl of B is zero in a current-free region, it follows that the magnetic field must

(Continued on page 14)

Problem for you:



Soft land this vehicle on the moon

This spacecraft is SURVEYOR, one of the many important projects now under way at Hughes. It will "soft" land on the moon sometime in 1963. Its mission: to pierce and analyze the moon's surface; to transmit back to earth high quality television pictures; and to measure the moon's magnetic and radiation characteristics. To accomplish these demanding objectives. Project Surveyor requires the talents of many imaginative junior and senior engineers and physicists to augment its outstanding staff. A degree from an accredited university and U.S. citizenship are required. Experience in Aerospace Vehicles is preferred but not necessary. A few of the openings include:

CONTROLS ENGINEERS. Concerns airborne computers and other controls related areas for: missiles and space vehicles, satellites, radar tracking, control circuitry, control systems, control techniques, transistorized equalization networks and control servomechanisms.

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MORE CYCLOTRON

decrease with increasing radius. This requires that the frequency for cyclotron resonance decrease with increasing radius, and limits the radius to which particles can be accelerated.

In 1938 L. H. Thomas showed that these two difficulties could be eliminated by allowing the field to vary azimuthally in a suitable way. In Thomas' proposal, the magnetic-field lines bow on the sides or edges of hills in the structure of the pole tips, producing an azimuthal component of field. An axial force directed toward the median plane results from the cross product of this field component and the particle velocity. At the larger radii, the orbit becomes somewhat triangular in shape as a result of the smaller radius of curvature resulting from the high field of the hills and the longer radius of curvature over the valleys. Compared with a circular orbit, the particle takes a short-cut across the valleys which is just sufficient to permit a constant orbit time.

The necessary experimental work on Thomas' cyclotron was delayed by World War II, and the events which followed, until 1950 when two electron models were built and studied in Berkeley. The results obtained from these machines verified Thomas' original work.

In 1955, D. W. Kerst showed that if the hills were spiraled, even stronger focusing would be obtained. This meant that the ratio of the magnetic field on the hills to that in the valleys would be smaller. For a peak field limited by pole-tip saturation, the average field would be higher. Thus, less magnet steel would be required to produce a spiral-ridge cyclotron of a given energy than for the corresponding Thomas cyclotron.

The 88-in. cyclotron is one of six spiral-ridge cyclotrons being built in the United States at the present time. It will produce a variable-energy external beam. To achieve this, the magnetic field and the r-f frequency are variable. To accommodate particles of different relativistic mass increase, there is a set of 17 independent pole-face windings. These are powered by water-cooled magnetic-amplifier-type power supplies.

While the 88-in. cyclotron was designed primarily to accelerate deuterons to a maximum energy of 60 mev, it also accelerates protons to 60 mev, neon to 150 mev, oxygen to 185 mev, and carbon to 160 mev.

The r-f system is one of the self-excited type, with regulated frequency. The resonator operates in the quarter-wave TEM mode and tunes from 5.5 mc to 17 mc by a variation of the inductance of the dee stem with a set of movable panels. The design problems associated with the resonator were described.

The oscillator tube is an RCA Type 6949. It is powered by a 456-kw power supply with a silicon rectifier. A hard-tube modulator is included so that dee-voltage regulation may be used. The modulator serves as a high-speed switch for protection during sparking.

—GEORGE SPELVIN

G. W. Rollosson, EBSS speaker

meeting review

MMZ MARCHES ON

Dr. G. W. Rollosson opened his talk before the November EBSS meeting by pointing out that Sandia Corporation was trying to advance the state of the art of microminiaturization—that is, trying to make a quantum jump in the field rather than duplicate previous work. Rollosson then asked the question, "Why microminiaturize?"

His reasons:

To save space and weight. This reason points out Sandia's primary interest in microcircuitry—telemetry circuitry. As systems undergoing test get smaller, there is less space and available weight for telemetry packages, thus a natural application for microcircuitry.

To increase reliability. This effect remains one of the major problems in microcircuitry.

To decrease cost. This is always a worthwhile goal, one not yet achieved in this field, but something to look forward to in the future.

To decrease transit time. Transit time is important in high-speed computers whose speed is limited by the time required for information to move about in the computer circuitry.

Some of the problems encountered in microminiaturization are:

Interconnection of component parts. As components get smaller—thin-film vacuum deposited systems, for example—it becomes harder to tie them together by conventional methods, such as solder, etc.

Power dissipation. As packages become denser, 1/100 of the power used in conventional packages would be sufficient to melt the circuit block. Reduction of applied power in proportion to the reduction of size would work but then noise becomes a problem.

Reliability

Reliability is a major bugaboo in microcircuitry. Sandia's conception is as follows:

Eliminate interconnection problems by building everything at once. This can be done by depositing all circuit components, including active components, onto a substrate simultaneously. This is quite difficult. Resistors and capacitors are easy but depositing inductances and active components is difficult. One approach has been to use the active material as a substrate and deposit the passive components on top. A common effort along this line is 20 to 50 components and the modules must still be interconnected. It would be desirable to deposit 6 to 10 thousand components all at once.

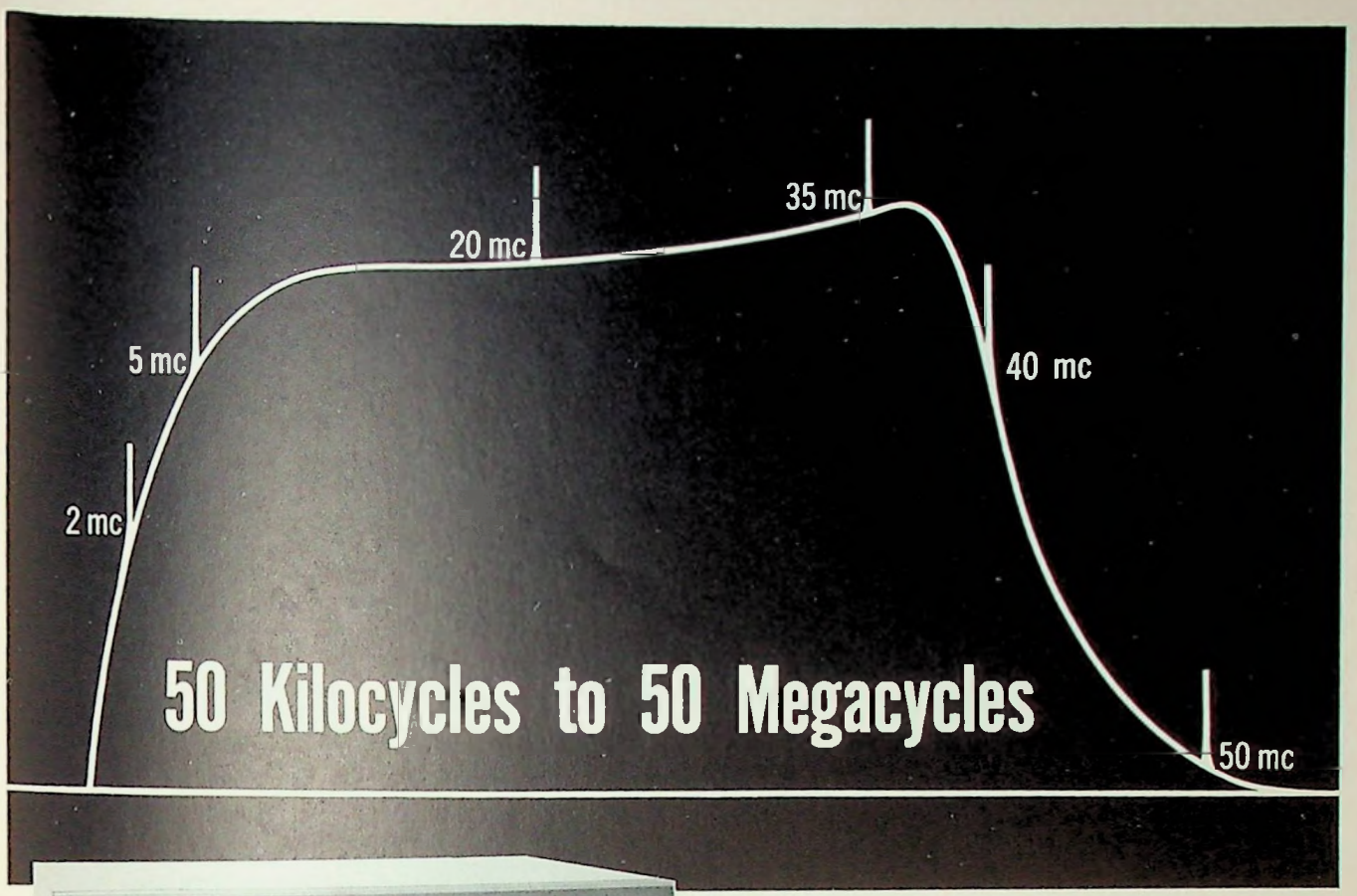
Solve power dissipation problem by using pulse circuitry (small average power) and by designing active components that require no standby power.

Increase overall reliability by using self-organizing (or adaptive) systems. A self-organizing system is a system that can, through interaction with its environment, adapt itself or modify its behaviors in such a way that it ultimately attains a static or dynamic state of equilibrium with that environment. It is not possible to build a microminiature system containing 10,000 components and achieve 100 per cent reliability. It is possible to build such a system with 80 per cent of the components good (the rest open or shorted). Therefore, what is needed is a system that can ignore its faults and continue to operate until, say 50 per cent of the parts have failed. Such is a self-organizing system.

Programs at Sandia

Active Components: Semiconductor films have been investigated. For example, germanium can be deposited on germanium. Investigations also include depositing single-crystal silicon-carbide

(Continued on page 16)



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thin films using graphite as a substrate. The problem here is heating the substrate from underneath. As the silicon-carbide film grows, the temperature falls off and the result is a polycrystal film rather than a single-crystal film. If the temperature is increased to continue single crystal growth, the substrate melts.

A solar furnace is presently being used to heat the surface of the deposit —a promising method. The use of electron beams and optical lasers is also being studied.

Another approach is to ignore semiconductors and use dielectric films (tunnel-emission devices). There has been some success with aluminum and gold on a glass slide with silicon monoxide as a dielectric. One model, which exhibited a typical dip, had a 15-angstrom layer of aluminum oxide, 60 angstroms of silicon monoxide, then gold—this produced 75 angstroms of dielectric between two conductors.

Other active components investigated include a fiber switch two-state device consisting of aluminum powder held together with ambroid cement, and semiconductor spheres forming point contacts and having diode characteristics.

The fiber switch seemed to open and close as evidenced by the following characteristics: open resistance, 20 megohms; closed resistance, 100 ohms; make voltage, 50 volts; break current, 20 milliamperes; and make-break time, 1 microsecond. It has one problem—it is self-destroying!

Work at Sandia with passive components has mostly been a learning process. They have deposited a 0.3-inch thin film single-stage amplifier on an RCA substrate using resistors only. Since they are difficult to deposit, the easiest way to work with inductors is not to use them!

The classic substrate is a 1 by 3 in. glass slide, although work has also been done with quartz and sapphire and plastics are also being tried. The major problem is finding a material that is smooth, refractory, and able to withstand a high vacuum.

Interconnections or the integration of efforts has taken the classic form of masking and evaporation. Preferred is topological mapping, using shadow coatings and evaporating material from an angle. Model studies have demonstrated the feasibility of this method.

Work has also been done with electron-beam and laser-beam machining of holes and paths.

Adaptive Systems Efforts

A computer program has been set up on an IBM 704 to simulate a reflex arm. This program has shown evidence of self organization. The computer program is continuing on a CDC 1604 and the arm is being duplicated with a hardware model.

In order to describe the hardware models, Rollosson first gave consideration to the brain. The parts in an actual brain include neurons or nerve cells, synapses, dendrides, and axons. This system has been simplified to include only neurons and synapses.

Neurons have the properties of: Accepting inputs and supplying outputs, firing periodically even when no input has been received, providing an output when the sum of the inputs is greater than the threshold, and enhancing presynaptic conductors because of firing.

Properties of the Sandia neuron model are as follows: a fixed firing threshold, an internal value that increases linearly with time, and a condition such that inputs add momentarily to the internal value and the internal value drops to zero when fired.

A synapse acts to change the inputs to the neuron. In the hardware model, it attenuates, in the computer it amplifies the signal. It may be thought of as a variable-gain amplifier.

Each time a pulse through a particular synapse fires the neuron, the gain factor of the synapse is increased. This is enhancement of memory because the next pulse through that particular synapse is more apt to fire the neuron.

Gain factor is continually decreasing with time. This is forgetfulness; if no pulse comes through a synapse for some time, the next pulse is not likely to fire the neuron.

Neurons and synapses have been built with the desired characteristics and Sandia shops are now fabricating enough to duplicate the computer program.

The computer-program "brain" contains 64 neurons and their associated synapses. The interconnections between neurons were made by a computer using a table of random numbers since the neuron interconnections in an actual brain are random. The only criterion for interconnection was that the general trend is from input to output. The input neurons are limited to one input and the output neurons are limited to one output. All other neurons have from zero to 8 outputs biased to the high side and no restrictions on the number of inputs except no self connections.

The internal action of the brain is as follows:

Neuron firing value is 32 and neuron value increases one each cycle and decreases to zero when fired. Synaptic value varies from one to eight and increases one each time it fires its neuron. The value decreases 1/128 each time it does not fire its neuron.

Inputs to the arm from the brain go to action (muscle) cells. An input pulse increases the value of the action cell to 64. Each cycle, the value of the action cell is decreased by two if no pulse

(Continued on page 18)

Part of the PGMIL audience during the December social gathering

meeting review

STRICTLY SOCIAL

Members of PGMIL got together for a social gathering, ladies night, and dinner at the Red Shack Restaurant in Palo Alto on December 7, the 20th Anniversary of Pearl Harbor. Presence of ladies provided an unusual atmosphere for this meeting.

Friendly hour at the private bar preceded the dinner. Guests were greeted and introduced by PGMIL Chairman Walter Prise.

After the dinner, Charles Antony, program chairman for the group, introduced Peninsula Players, an organization of amateur entertainers. They presented a show that lasted over an hour. The group, composed of employees of local industrial firms, surprised the assembly with their many talents.

Judging from the reaction of guests, this attempt to bring together members and their ladies for a friendly social gathering may be considered a success.

Said Gaspard de Coriolis: *"A particle which is subject to no forces in a rotating coordinate system experiences a radial acceleration and a tangential acceleration."*

It was around 1840 that Coriolis discovered what has since become known as the Coriolis Effect. He noticed objects above the earth tend to rotate relative to the earth's rotation...to the right in the northern hemisphere, to the left in the southern.

The Coriolis Effect is in force in outer space, too. If a space vehicle is rotated in order to establish artificial gravity, the necessarily short radius of the rotation causes a Coriolis force. This creates orientation problems for a human occupant. To eliminate this difficulty, a scientist at Lockheed Missiles & Space Company conceived the idea of connecting the vehicle to an auxiliary fuel tank by a half-mile-long cable. Thus, if the whole system is then rotated at a reduced speed around its center of mass gravity, the longer radius greatly minimizes the Coriolis force. Right now—on the drawing boards at Lockheed—is an enormously advanced space vehicle system which utilizes this concept, in addition to many others.

Fortunately, natural laws are about the only restrictions which circumscribe scientists and engineers at Lockheed Missiles & Space Company. The climate in Sunnyvale and Palo Alto, on the San Francisco Peninsula, is close to perfection. The creative atmosphere—the opportunity to work on such important projects as the DISCOVERER and MIDAS satellites, the POLARIS FBM, or even more advanced concepts such as the space system cited above—is the dream of the creative engineer.

Why not investigate future possibilities at Lockheed? Write Research and Development Staff, Dept. M-11A, 962 West El Camino Real, Sunnyvale, Calif. U.S. citizenship or existing Department of Defense industrial security clearance required. An Equal Opportunity Employer.

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is received. Outputs from the arm to the brain come from "ligaments" and "cartilages."

The ligament value equals the sum of the action cells and its previous value. The ligament value drops to zero when the ligament is fired. The ligament has a variable threshold value that starts at 1024, increases by 16 each time it is fired (fatigue) and decreases by two each time it is not fired (recovery). The cartilage has a fixed firing threshold. Its value is a function of the position and speed of the arm and is weak at the center position, strong at the sides, and strong for a quick motion.

Position of the arm is indicated by the difference in the number of firings of ligaments on both sides.

When the computer was turned on, the arm moved over to one side and then stabilized. Examination of the interior of the brain showed that the shortest paths had taken over. By "taken over" is meant that the synaptic values stay at 7 or 8 and the neurons fire more frequently.

An attempt was made to determine if the system could reorganize itself when portions were permanently or temporarily disrupted. First, a path was "killed." A competing path took over as expected. A path was next "drugged." A competing path took over temporarily but the shorter path revived and resumed control.

—J. B. WRIGHT

meeting review

ON THE IMPORTANCE OF LIGHTHOUSES

Sir Robert Watson-Watt displays great optimism and hope for scientific achievement in this era of strong government support of science. His experiences carry back into times when this support was certainly not popular and established, but required strong individual conviction and enduring perseverance.

Sir Robert, the inventor of radar and distinguished British radio scientist, spent two days in the Bay Area in late November. He visited and discussed many projects at Stanford University and Stanford Research Institute, particularly in the area of radio propagation. Many current investigations may be related to studies originated by Sir Robert three or four decades ago.

On November 29, Sir Robert addressed a joint Section and Engineering Management chapter meeting at the University of California. It was Sir Robert's first return to the Berkeley campus since 1942 when he visited in connection with a wartime scientific mission. The evening commenced with a dinner and informal discussion at the faculty club. At the meeting, Sir Robert was introduced by Professor Sam Silver, director of the space sciences laboratory.

Starting in a time when radio was far more closely allied to carrier pigeons than the sophisticated scientific complexes of today, Sir Robert began work in the British government service in World War I that was to culminate much later in the method of radar, and lay the foundations for the electronic support of space exploration. The barriers that were to impede this work were formidable, equipment development could be tackled only after strong battle with bureaucratic officials and entrenched scientific and engineering interests. There were widespread feelings that radio experiments were a tenuous fad that could only lead to later embarrassment if carried out and would certainly impede in a small way important projects like building lighthouses.

An important benchmark in radar history was the approval by the Tizard committee, with confirming support at the cabinet level, of a strong radar-development effort in the early months of 1935. The approval was a victory by default since it was gained only in the absence of a plan for a truly offensive type of weapon like a death ray. Sir Robert went on to gain the attention and support of Churchill and his scientific advisor, Professor Lindeman, at a meeting in June, 1936.

This alignment, whether for or against radar, has become a point of widespread discussion since the publication of the book "Science and Government" by Sir Charles P. Snow in the spring of 1961. Sir Charles proposes that if Churchill had come to power in Britain earlier than he did, radar development would have been curtailed and the Battle of Britain lost by the lack of radar. In the discussion after the meeting, Sir Robert discussed his experiences and understandings that do not support this hypothesis of Snow's.

Sir Robert, with brimming optimism, encourages the scientist of today to fight for support and understanding of his most boldly conceived projects. He also feels that science should and will gain greater stature in the cultural realm of philosophy, art, and history.

—PETE LACY

Sir Robert Watson-Watt and Stan Kaisel at the November Section/PGEM meeting

—L. M. Jeffers photo

meeting review

ELECTROPLATED NERVES

The November meeting of PGEC was attended by approximately forty persons to hear Professor Bernard Widrow of Stanford University speak on "Associative Storage and Retrieval of Digital Information in Networks of Adaptive 'Neurons'."

The artificial neuron that Widrow considered is the usual one: each input is multiplied by a variable positive or negative weight; the weighted inputs are summed and then applied to a threshold device. Some of this equipment was illustrated on the September **Grid** cover. His arrays of neurons are similar to the more widely-known Perceptron of Rosenblatt.

Widrow described a number of experiments he has performed on the recognition of patterns on a 4 by 4 retina and followed this by an entertaining demonstration of such an experiment.

Widrow described a very interesting electrochemical variable weight which he and Ted Hoff have developed. In series with each input is a pencil lead which is immersed in a small copper-acid plating bath. Each pencil lead is physically, but not electrically attached to a copper supporting wire, which is the electroplating anode.

Rather than vary potentiometers to train arrays of artificial neurons, Widrow applies a direct current of one polarity or the other to each plating bath. The deposition or removal of copper from each pencil lead changes

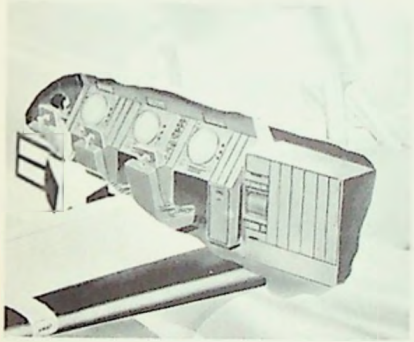
(Continued on page 20)

ADVANCED AIR DEFENSE SYSTEMS WITH FIRST-DAY CAPABILITY

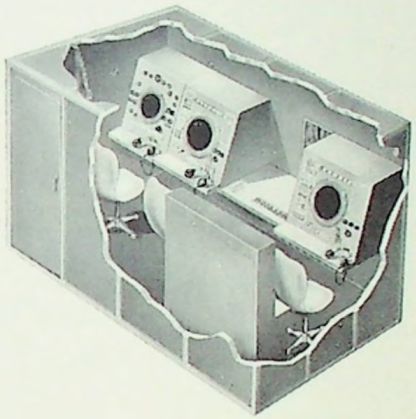
The needs of today's air defense systems pose a problem that would have seemed insoluble ten short years ago. The problem of furnishing mixed-weapons command and control, with first-day capability, in a system that is portable to any place in the world.

Here is how that problem has been solved through creative engineering utilizing a decade of industry progress in tactical data systems.

Systems already delivered by Litton to the military, or in the advanced state of development and production, include: Airborne Tactical Data Systems (AN/ASQ-54, AN/ASA-27) for the U.S. Navy, the Marine Corps Tactical Data System (AN/TYQ-1, AN/TYQ-2) for the U.S. Marine Corps, and the AN/FSG-1 Retrofit Improvement System (OA-3063/FSG-1 (V)) for the U.S. Army.



The first of these, the Airborne Tactical Data Systems, provides a capability for the mission of Airborne Early Warning and Control (AEW & C) in defense of large land masses, attack carrier task groups and other naval units. Both the AN/ASQ-54, installed in a land-based AEW & C aircraft, and the AN/ASA-27, installed in a carrier-based AEW & C aircraft, furnish early warning data on enemy raids to surface elements of an air defense network and provide airborne control of interceptors.



The second of these systems, the Marine Corps Tactical Data System (MTDS), features capabilities for continuous and effective control of Combat Air Operations during an amphibious assault. Facilities are available for control of aircraft on missions such as close air support, reconnaissance, and interdiction and for air defense with mixed weapons, both ship-based and shore-based surface-to-air missiles and interceptors. An integral air traffic control system assists in initial and continuous identification of friendly aircraft.

The third, the AN/FSG-1 Retrofit Improvement System, significantly increases the counter-countermeasures capability of the AN/FSG-1 Missile Master System deployed within the Continental United

States to furnish surface-to-air missile battery coordination in the defense of large cities and industrial areas.

Through the successful design, development and manufacture of systems for air defense missions, Litton has demonstrated its capability to proceed with even further advanced data systems. Such systems are now under conception and development at Litton.

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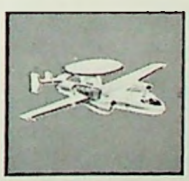

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Group at the January PGEM meeting included John Church and Ralph Jones, speaker, both of Booz, Allen, & Hamilton; W. D. McGuigan, chairman; and L. B. Johnson, vice chairman

—L. M. Jeffers photo

MORE NEURONS

its electrical resistance and correspondingly the weight associated with each input. The weighted sum of the inputs is determined by the application of alternating current in order to prevent the application of the sense signal from doing any plating.

—ROBERT C. MINNICK

meeting review

ON THE HORNS OF A MATRIX

Ralph W. Jones, partner, Booz, Allen, & Hamilton, talked to the PGEM Chapter in January about problems familiar to many people in industry who are faced with an organization combining functional and project groups. His talk was titled, Matrix Organization Control Problems.

He described the combination organization as one having several vertical lines of control stemming from functional department heads, intercepted by several project lines of control stemming from different project managers. He showed how this forms a matrix, and he pointed out how an individual working on a specific job finds himself at the intersection of two lines of authority.

Jones reminded us how an organization can start simply enough, with department heads in charge of engineering, manufacturing, sales and finance. Then he showed how the growth of an organization leads to simultaneous demands on it to produce a variety of hot projects where each project manager is fighting for priority.

This frequently leads to a relationship in which the functional heads are responsible for the who and the how, and the program managers are responsible for what and when.

Jones talked about an apparent tendency of military customers to examine the organizational structures of prospective contractors and to make judgments as to which organization may be more favorable for a given job. He suggested that this tendency might force all contractors to a common pattern, whereas it has certainly not been clearly established that any one organization pattern is best suited to all situations.

The many excellent points raised by Jones led to a lively discussion with the audience, for each member felt that Jones was discussing his own company. The meeting adjourned to a secluded conference room several miles away on El Camino where a rump session was held and all problems were settled.

—L. M. JEFFERS

meeting review

HOW TO PLEASE CRITICS

Dr. Vincent Salmon delivered an extremely interesting and informative talk on architectural acoustics to members and guests of the IRE/PGA and AES in December. He divided the subject of room acoustics into two categories: exterior and interior acoustics. Exterior acoustics involves sound-isolation techniques while interior acoustics involves reverberation techniques and other quantitative measures that correlate with subjective listening considerations.

Effective isolation of a room from exterior sound is, as a rule of thumb, linearly proportional to the amount of mass used in the construction material. Most exceptions to this rule require extremely detailed supervision over actual construction procedures. An effective common type of sound isolation barrier is exemplified by the staggered stud wall construction. A layer of felt is generally interposed between the two sets of studs. A case in which any wall can become transsonant, or transparent to sound, occurs when flexural vibrations of the wall are in phase with the incident sound wave.

Salmon also admonished his listeners not to neglect isolation of sound from such sources as ventilating ducts and plumbing facilities. Noise from ventilating ducts can be lessened by the proper design and insertion of sound traps. Plumbing noise can be virtually eliminated by acoustically decoupling the plumbing fasteners from the wall and using specially designed noiseless valves.

Interior acoustics design is strongly based on subjective evaluations of engineers, musicians, and critics. Therefore, before designing a room, one

(Continued on page 22)


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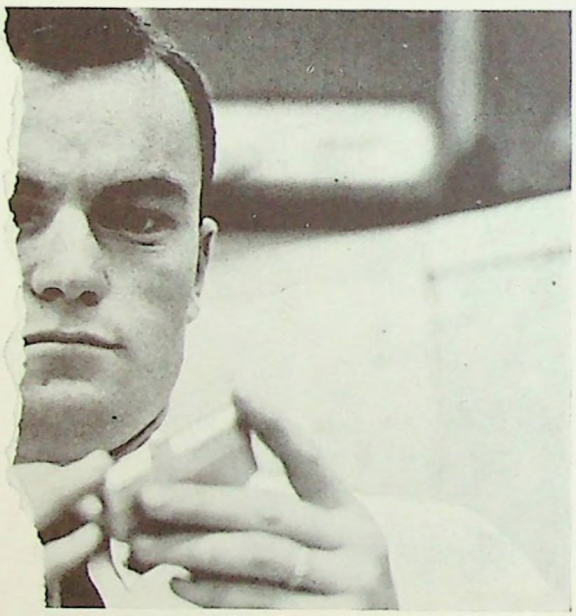

should ask, "For what purpose or emphasis is the room to be used?" (i.e. speech or music) and further, "What type of speech or music?" Even if these questions are answered properly there are still difficulties both in deciding what acoustical characteristics are most significant and in describing these acoustical characteristics in quantitative terms.

Historically, the reverberation characteristics of a room have been used to describe the listening qualities of a room. Since reverberation time is a function of frequency, much effort has been directed at obtaining a proper balance between the reverberation time of rooms at various sound frequencies. This is sometimes accomplished by providing the room with baffles to obtain diffuse sound at low frequencies and with sound absorptive patches to absorb sound at high frequencies. In practice, a room should be designed with a planned irregularity to avoid standing waves and flutter echoes.

Newer Considerations

Other factors more recently used to describe the acoustic qualities of a room are its liveness, definition or clarity, diffusion, and reverberation irregularity. Liveness is related to the ratio of the reverberant sound to the direct sound. Definition or clarity is defined as the ratio of the time integral of the sound pressure squared over 50 milliseconds to the total time integral of the pressure squared. The important aspect of diffusion is that the reverberant sound should not appear to a listener as having arrived from a definite direction. Reverberation irregularity refers to the variation in the sound pressure level at a given point in the room as a function of frequency.

An additional important acoustical factor is the Haas or the precedence effect which stems from the fact that if two sounds are heard in succession, a listener's attention will be directed to the first sound even if it is less loud than the second. The delay time between the direct sound and the first reflected sound should be less than 30 milliseconds.

Salmon gave an account of a very recent attempt to correlate the measurable acoustic properties of music halls with the subjective judgments of musicians and critics. The three most important correlates in order of importance were found to be acoustical intimacy as defined by the relative arrival times of the direct and first reflected sound, liveness as defined by the ratio of the reverberation time at high frequencies to the reverberation time at mid-frequencies, and warmth as defined by

(Continued on page 26)

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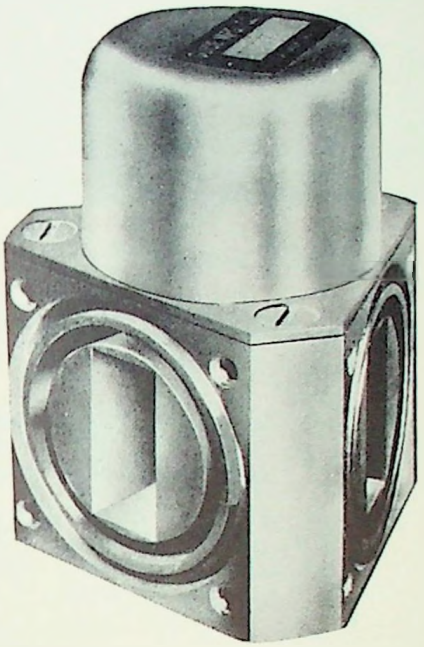

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8011A	0-500V	±0.05%	10 mv	50 uv	TEMP. CONTROLLED ZENER DIODE

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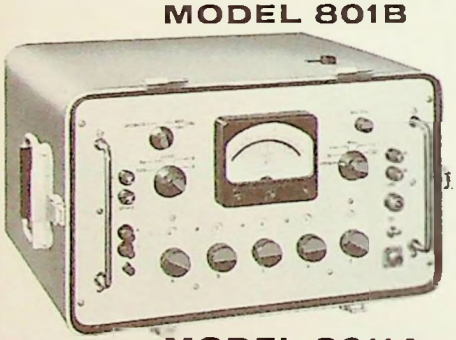

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Rack Model—
19"wide x 7" high x 14" deep

WEIGHT:
Cabinet Model—
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Rack Model—
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PRICE:
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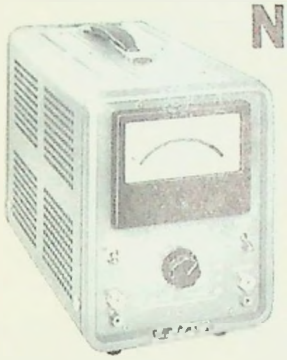

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Input Impedance:	DC—Infinite at null. AC—1 megohm shunted by 25 uufd.
Reference:	Standard cell, zener reference optional at additional cost.
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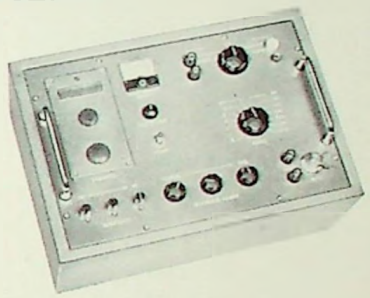

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MORE ACOUSTICS

the ratio of the reverberation time at low frequencies to the reverberation time at mid-frequencies.

It was claimed that when measurements for these three factors were combined and weighted properly together with a number of other factors such as clarity, diffusion, loudness of reverberant sound, etc., extremely good correlation was obtained with subjective judgments. However, as Salmon pointed out, the full significance of the developed relationships awaits the actual application of the resulting acoustic design procedure to music-hall construction and, again, the subjective evaluations of musicians and critics. Persons interested in the work above are referred to a book by Beranek entitled "Acoustics of Halls for Music" soon to be published by Wiley & Co.

—STANLEY OLESON

meeting review

WORD FROM EUROPE

Recent Developments in Computer Organization in Europe was the topic for the December meeting of PGEC. The speaker was Dr. Cuthbert C. Hurd, special assistant to the vice president for research and engineering, at International Business Machines Corporation. Following an initial introduction to the present day computer consisting of input, output, store, and arithmetic and logic, Hurd proceeded to a discussion of some of the recent changes being considered in Europe. Older machines were hampered by the limitations of a fixed repertoire, the execution of one instruction at a time, and the requirement of two or more memory references per instruction.

Microprogramming originated in Europe with Vanderpoel, Van Wijngaarden, Zuse and a number of others, using machines which had minimum cost, and was used largely to save money; Wilkes and Stringer in 1953 came to the conclusion that this was the rational way to build a machine, giving the program originator the maximum control over the machine. Microprogramming uses minimum fixed control hardware and gives detailed switching instructions. It does, however, run into the problem that users insist on simple instructions—this, in the past, has sounded the death knell for microprogram approaches.

Push-down store concepts are also active in Europe among such people as Samelson and Bauer. The use of such devices, of course, cuts down the number of required main memory references and decreases computation time by keeping likely information in the store. Methods of programming this type machine were discussed. The push-down store eliminates the multiple references to memory, is useful for program simplification, and allows one to leave a program trail in complicated problems.

Multiprogramming adds the strain of not knowing memory requirements—it requires the use of automatic fast- and slow-memory allocation. In the Atlas, such automatic memory allocation and multiprogramming are used. Memory here is organized in terms of 512 word pages, assigned by program or by executive program. A key is developed, during usage, to get a usage ratio for each page; this page is then stored in high or low speed memory to optimize machine speed over all pages used.

—ARTHUR G. ANDERSON

meeting review

ESP AND ALCOHOL

In late December a joint meeting of PGRQC and PGBME was attended by 110 members and guests, and their ladies. After dinner, attendees were afforded the pleasure of hearing a most interesting lecture delivered by Dr. W. W. Harman, professor of electrical engineering at Stanford University. The subject of Harman's paper was "ESP, LSD, and the Nature of Man."

In introducing his topic, the speaker

(Continued on page 28)

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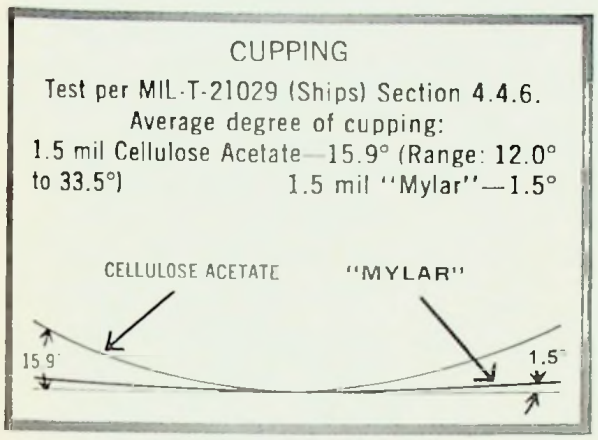

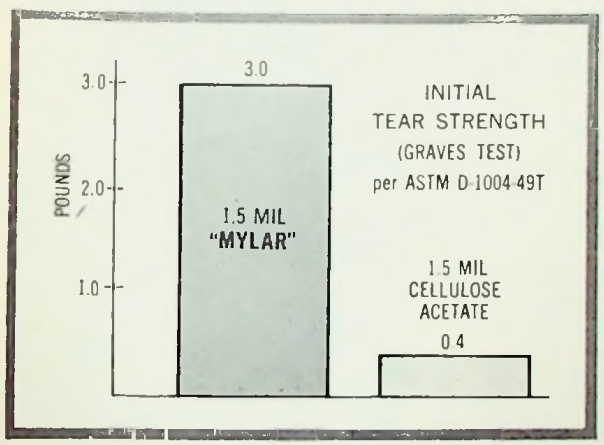

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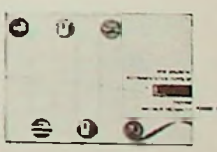

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MORE ESP

presented a brief history of the concept of extrasensory perception and its development. Harman also related the events which led to his own interest in the subject and motivated his formal participation in associated studies. As explained, LSD (lysergic acid diethylamide) is an experimental drug used to stimulate latent traits of extrasensory perception. The group with which Harman is currently associated has utilized the drug in treating selected individuals for alcoholism and other varieties of sickness which are psychological in nature.

An interesting highlight of the discussion centered around the experiences associated with treatment and the results obtained. As an example, Harman pointed out that in some cases a cure for alcoholism was immediate and complete.

After the lecture, questions were invited from the floor. The interest of the audience was greatly evidenced by the high degree of participation during this phase of the evening's activities. During the question-and-answer period, Harman emphasized the fact that the use of LSD as a means of treatment is necessarily limited, and is only administered to an individual when careful analysis indicates that it would be beneficial.

meeting review

HAD GUNS, WOULD DISCUSS

A regular meeting of the PGED was held at the Stanford Physics Lecture Hall on December 6, preceded by a speaker's dinner at the Red Shack restaurant. Speakers for the evening were Dr. Kenneth Harker, microwave development laboratory, Stanford University, and Dr. Kurt Amboss, research and advanced development group, Sylvania Electric Products, Mountain View.

Harker's talk was concerned with the problem of designing electrodes for a space-charge-limited electron gun whose important properties (perveance, convergence, cathode - current -density variation, etc.) have been specified in advance. Harker's method is suitable for axially symmetric guns, either in the presence or in the absence of impressed magnetic fields; the boundaries of the flow may be either straight lines or curvilinear. In order to use this technique, full information concerning the flow parameters must be known, either explicitly, or from a set of ordinary differential equations.

In brief, Harker's method permits one to calculate a particular solution of Laplace's equation in the charge-free region adjacent to the flow boundaries, using analytical procedures; no analog, such as an electrolytic tank, is needed. The solution converges to the specified potential and electric field variations along the flow boundaries. Having obtained the solution, one may sketch equipotential surfaces; these are then the proper shapes for electrodes which will actually produce the desired gun properties.

Amboss discussed a mathematical procedure for calculating the effects produced by certain types of perturbations in a Pierce-type spherical-flow gun. About half the talk dealt with the problem of the anode hole, i. e., how the presence of the hole affects the perveance, current density uniformity both at the cathode and in the ejected beam, the radial variation of potential across the beam in the vicinity of the anode, and the focal length of the anode lens. Other imperfections in an otherwise ideal gun, such as mechanical misalignments, were briefly mentioned.

The analytical technique consists of deriving the flow parameters from an action-function equation discussed in the past by K. Spangenberg, P. T. Kirstein, and others. The action function, W, is written as the sum of an unperturbed function, W_0, from which all parameters of the ideal flow are calculable, and a first-order perturbed function, W_1, which may be used to estimate the effects of small gun imperfections. Excellent agreement between theory and experiment was claimed for a gun having a micro-perveance slightly over 3.

After an extensive question period, the chairman, Dr. Jules Needle, adjourned the meeting for informal discussions and refreshments.

—WILLIAM E. WATERS

meeting review

ALL ON TAPE

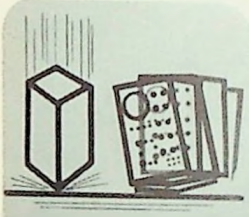
Space communication and inter-classroom communication were juxtaposed in a PGCS meeting that brought 45 attendees to the Cal campus early in December.

Professor Lester E. Reukema of the University described the present state of space communications development, especially between Earth and its manmade satellites. He also described the nature of other planets where life might conceivably exist and the means that are presently being used to evaluate radiation arriving at the Earth from outer space.

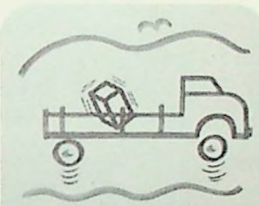
This was a very interesting lecture; it was recorded on magnetic tape as part of the San Francisco Section's historical file of outstanding speakers and topics. It is available to anyone who wishes to borrow it.

Ken Winslow and his staff of the Uni-

(Continued on page 30)



SHOCK



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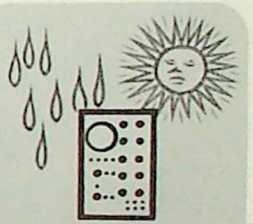

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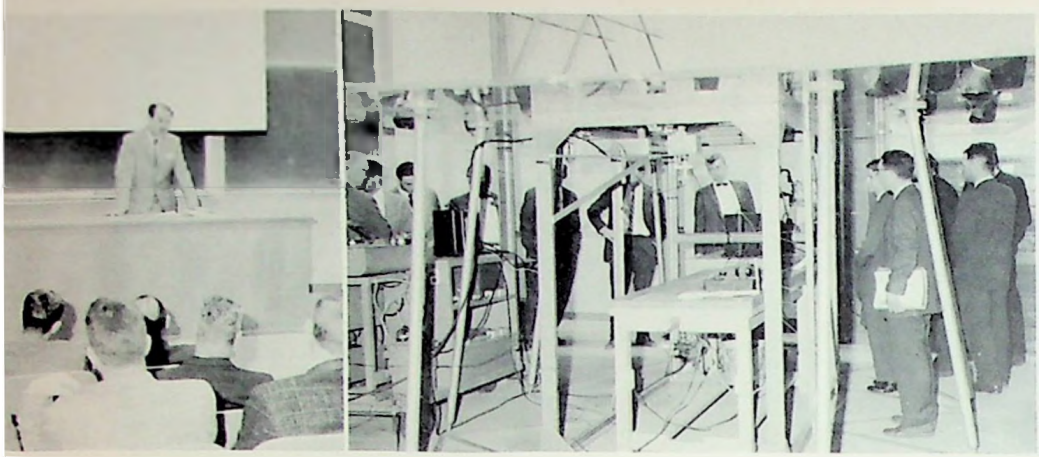


Paul E. Mayes, left, speaking before the January PGAP gathering; and, right, the group inspects echo area instrumentation during the following tour of UC laboratory facilities

MORE PGCS

versity television office demonstrated and described the Marconi 4½-in. image-orthicon camera and the Ampex video tape recorder that is being used to televise University of California lectures. Following the demonstrations, the group had a tour of the video tape recording facilities and the new mobile unit being constructed for televising classes at the University.

—R. A. ISBERG

meeting review

IT AIN'T NECESSARILY FREQUENCY INDEPENDENT

At the January PGAP San Francisco Chapter Meeting, which was held at Cory Hall, University of California, Paul E. Mayes discussed the subject of backward-wave antennas in general and the logarithmically periodic frequency-independant class of antennas in particular.

John Damonte, vice chairman and program chairman, presided at the meeting and announced the subject matter, speaker, and schedule for this year's tutorial series on millimeter waves. This series will be held during February and March at the Stanford Research Institute. See the Calendar, page 8.

Mayes, who is an associate professor of electrical engineering at the University of Illinois presently on sabbatical leave at the University of California, first presented the following four principles:

1. A logarithmically-periodic geometry does not guarantee frequency independent performance.
2. Formation of a unidirectional beam toward the feed point of the antenna and rapid decay of currents is due to interaction of forward and backward waves along the structure.
3. Narrow-band antennas can be designed on the basis of coupling of the feeder wave to a backward space wave.
4. By applying a linear taper to backward wave antennas, frequency independent behavior results.

The speaker then presented the development of periodic and logarithmically periodic structures. He then discussed the properties of these types of antennas on the basis of forward and backward waves and the relation of directional properties of the radiated wave to the space harmonic phase constant.

Mayes discussed the interaction of forward and backward waves that causes the rapid decay of currents in the inactive regions of the antenna.

The interested reader is referred to the following articles for detailed information on the subject.

1. P. E. Mayes, G. A. Deschamps, W. T. Patton "Backward-Wave Radiation from Periodic Structures and Application to the Design of Frequency Independent Antennas," Proceedings of the IRE, Vol. 49, No. 5, p. 962, May, 1961.
2. J. W. Greiser, P. E. Mayes "Vertically-Polarized Log-Periodic Zig-Zag Antennas," Proceedings of the National Electronics Conference—1961, Vol. 17.

—C. E. PHILLIPS

the distaff side

WAEI TAKES A WALK

In January, more than 100 members and guests of the Women's Association of the Electronic Industry met for an excellent dinner in the new Varian Cafeteria and a subsequent plant tour.

WAEI President Mary Fraser, of IBM, presided at the brief business meeting. Plans for the annual Bosses Night in early February were announced by Kathie Kaufman of Ferro Magnetics. Prospective members were urged to contact Rita Baumgardner at Jennings Radio, CH 3-2321, Ext. 253.

Theodore Moreno, vice president and manager of the tube division at Varian traced the history of the company, from its beginning in 1948 with 6 people and a capital of $22,000 to its present family of 3,300—making Varian the largest employer in Palo Alto. The first building on the Stanford Industrial Park site, opened in 1953, had 35,000 sq ft. At present, a dozen buildings encompass more than ½ million sq ft, and with the completion of present construction, the 65 acre tract will be well utilized with nearly 1 million sq ft. Varian is presently looking for another 100 acres—expecting another 5,000 employees and needing 10 parking spaces for every 14 people.

Moreno described the various divisions of the company before the ladies were escorted, in small groups, by 18 tour guides to cover about a quarter of a million sq ft (or approximately half) of the area now in use.

Varian was founded with the klystron tube and this was its first product. Now the company is the world's largest manufacturer of klystron tubes, and the second largest of microwave tubes. On the tour, members and guests of WAEI saw klystrons as small as your thumb and as large as 12 ft long, weighing nearly a ton. There are as many applications as there are models, principally in the military, with prices ranging from $100 to $50,000.

In the instrument and equipment division, the group followed various production stages of nuclear-magnetic-resonance spectrometers, and the new epr spectrometer, capable of identifying substances that previously defied chemical identification and analysis.

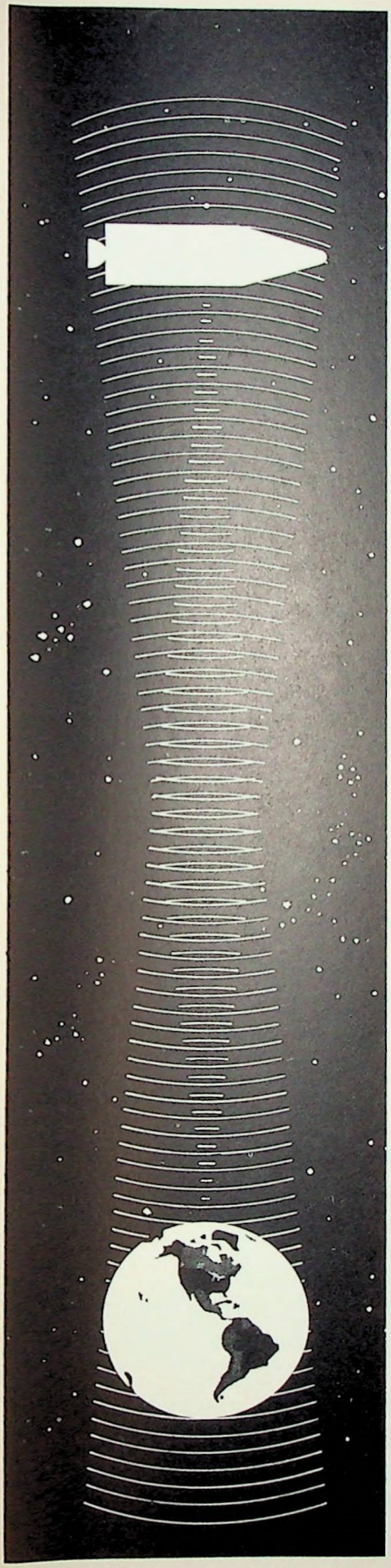
Although no roller skates were provided, Varian's hospitality did extend to refreshments in the homey atmosphere of one of the older cafeterias following the extensive tour.

—MARY HAYLOCK

committee work

THE MEETING QUESTION

Don Harris of Stanford Research Institute has been appointed chairman of the Committee on Policy for Frequency and Control of Technical Meetings in the San Francisco Section. Tasks will include not only formulating a policy toward the proliferating professional group meetings of the Section, but also an approach toward the sponsorship of national meetings and symposia. Any thoughts you may have on the subject will doubtless be gratefully received.



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Walter Noller, president; Bock Lee, chief engineer; and Joseph Landells, manager of marketing at Noller Control Systems Inc. execute conventional maneuvers relating to their company's Richmond groundbreaking. Architect's concept of the completed structure is at right

grid swings

IT IS REPORTED

Ground has been broken and construction is under way in the new Richmond, California, Galvin Industrial Park on a 15,000-sq-ft headquarters for **Noller Control Systems Inc.** The new building, to be completed in April, stands on a triangular plot of 2.62 acres at 1250 Standard Avenue, Richmond.

Noller Control Systems, headed by **Walter E. Noller,** president, is engaged in the engineering and production of supervisory-control, telemetering, and alarm systems. Noller is presently located at 1153 Ocean Avenue, Oakland, with a force of 50.

The new building, which will accommodate a force of approximately 100, devotes about 6,000 sq ft to business and engineering offices with the balance housing laboratories and manufacturing facilities.

Jack D. Rowley has joined **Pulse Engineering Inc.** as manager of quality assurance. Rowley was previously associated with Melabs in Palo Alto as quality-assurance manager.

Edward M. Smith has joined **Insul-8-Corp.** as sales manager of a new division developing and manufacturing proprietary items for industrial applications.

The new division was formed with the acquisition of Sterling Manufacturing Co. of Belmont.

Sylvania Electric Products Inc. announced plans for a 77,000-sq-ft addition to its reconnaissance systems laboratory in Mountain View.

The new two-story addition is expected to be ready for occupancy this summer. It will be erected behind and connected with the present 56,000-sq-ft laboratory facility on the company's 39-acre site, and will house laboratory areas and offices for staff and engineering work.

Ralph E. Rippere has been appointed senior research scientist in chemistry at **General Electric's** computer laboratory.

Ault Associates, Menlo Park, have been named as representatives for **Servonic Instruments,** Costa Mesa, Calif.

Straube Associates have recently been appointed representatives for the electra products division of **Western Gear Corp.,** Pasadena.

U. S. Capacitor Corporation announces the appointment of **Nickerson-Gray and Associates,** Palo Alto, as sales representatives.

Realignment of **Ampex Corporation's** nationwide field organization, including

(Continued on page 34)

Blake

Roberts

MORE SWINGS

appointment of seven new regional managers, has been announced. **Charles H. Wirth,** former manager of the data-products international marketing department, becomes northwestern regional manager responsible for all company product lines. Previously district managers were responsible for individual product lines.

John J. Blake has joined **Microwave Electronics Corp.** as manager of contracts administration. Most recently he was manager of marketing planning and contracts administration for Ampex's Northern California operations. Previously Blake was sales representative for Burroughs Corp. in this area.

William Roberts of **ITT Federal Laboratories** was recently promoted to senior engineer, associated with the speech-research program, and **Paul Heinzinger** has been promoted to senior engineer in the field of pattern-recognition techniques.

The **Bogen-Presto** Division of The Siegler Corporation, Paramus, N.J., has appointed **Heaton-Marco Associates,** San Francisco, as factory sales representatives for all Bogen products.

Walter H. Kohl, Fellow of the IRE, author and lecturer in the field of materials and techniques for electron devices, has established a consulting practice in Los Altos. Kohl will continue to serve as staff consultant to the microwave device division of **Sylvania Electric Products Inc.** at Mountain View, where he was employed full-time during the past three years.

The appointment of **C. R. Zimmer** as manager of the newly established equipment conversion department at the reconnaissance systems laboratory of **Sylvania Electric Products Inc.** has been announced. In his new position, Zimmer is responsible for the conversion of developmental models of elec-

(Continued on page 36)

Zimmer *McCole*

MORE SWINGS

tronic equipment into pre-production prototypes. Zimmer joined Sylvania in 1934 and in 1950 became manufacturing superintendent of the company's electronic defense laboratories in Mountain View, a position he has held until his present appointment.

John F. McCole has joined the applications engineering staff of **Watkins-Johnson Co.** here, to be engaged in customer liaison.

McCole came from Dallas, Texas, where he was with Sylvania Electric Products, Inc.

Egan *Schiffman*

The appointment of **Raymond D. Egan** of Stanford University to the newly-created post of manager of systems research at **Granger Associates** here has been announced. Egan has been a consultant to Granger Associates since 1958, while on the staff of Stanford's radio science laboratory.

Other additions to Granger's staff: **Bernard M. Schiffman** and **Willis E. Moore** have been assigned to development and design in the antenna department; **Wayne A. Downie** is engaged in new product development in the aviation products department; and **Hobart W. Acker** is production manager.

(Continued on page 38)

Acker *Loebner*

MORE SWINGS

HP Associates, new electronic research affiliate of Hewlett-Packard Company, today announced the appointment of **Egon E. Loebner** as manager of optoelectronics.

Loebner was, for the past six years, on the technical staff of RCA Laboratories in Princeton, New Jersey.

Additions to the supervisory staff at **Precision Instrument Company** include:

W. K. Donnell, who has been named materials manager. Previously he was with Lockheed Missiles and Space Company at Sunnyvale, and earlier was production control manager of Fairchild Semiconductor Corporation.

J. L. Lambert, who has been named production supervisor, manufacturing operations.

J. A. Dykmans, who has been appointed supervisor, manufacturing engineering.

Appointment of **Nelson M. Blachman** as a senior scientist of **Sylvania Electric Products Inc.** has been announced. Blachman joined Sylvania in 1954. In his new capacity, he is one of eight persons within GT&E to hold the senior scientist position which was established in 1960 for scientists with international reputations as authorities in their fields.

In 1947, Blachman joined the theory group of the accelerator project at the Brookhaven National Laboratory, and from 1951 to 1954 was a staff member of the mathematical sciences division of the Office of Naval Research, Washington, D.C.

William F. Gates has been named president of **Dalmo Victor Company.** Gates, who has been a vice president of Dalmo Victor, succeeds **T. I. Moseley** as president. Moseley, the founder of Dalmo Victor, will continue with the company and also will work directly with the home office of Textron on various projects. Gates has been associated with Dalmo Victor since 1944, when he joined the company as a research engineer. He was named vice president and chief engineer in 1948, and in 1961 became vice president of the products division.

Bill Gates, Dalmo Victor, looked on as Mrs. Moseley installed 40-year pin on T. I. Moseley lapel in recent ceremony

IRE MEETINGS SUMMARY

Feb. 14-16—**International Solid-State Circuits Conference.** Sheraton Hotel and University of Pennsylvania, Philadelphia, Penna. No exhibits. Program: R. B. Adler, Room C-237, MIT Lincoln Laboratory, Lexington, Mass. Digest: $5, order from H. G. Sparks, Moore School of EE, University of Pennsylvania, Philadelphia 4, Penna.

Feb. 27, Mar. 6—**Molecular Electronics,** two-part tutorial lecture in Cleveland Section annual technical symposium. Registration: Cleveland Section IRE, c/o Grace Electronics, 5148 East Sprague Road, Cleveland 41, Ohio.

Mar. 1-3—**8th Scintillation and Semiconductor Counter Conference.** Shoreham Hotel, Washington, D.C. Exhibits. Program: Dr. George A. Morton, RCA Laboratories, Princeton, N.J.

Mar. 13—**Parametric Amplifiers, Masers, and Lasers,** tutorial lecture in Cleveland Section annual technical symposium. Registration: Cleveland Section IRE, c/o Grace Electronics, 5148 East Sprague Road, Cleveland 41, Ohio.

Mar. 26-29—**IRE International Convention.** Coliseum and Waldorf Astoria Hotel, New York, N.Y. Exhibits: W. C. Copp, IRE Adv. Dept., 72 W. 45 St., New York 36, N.Y. Program: Dr. D. B. Sinclair, chairman 1962 technical program committee, 1 East 79 St., New York 21, N.Y. Convention records: order from IRE Headquarters.

NON-IRE LOCAL EVENTS

Feb. 19-21—**Institute of Aerospace Sciences,** National Symposium on Tracking and Command of Aerospace Vehicles. Jack Tar Hotel, San Francisco. Technical Sessions will include Operational Plans for Missiles and Spacecraft, Requirements and Specifications for Tracking and Command Functions, Equipment and Facilities for Aerospace Tracking and Command, and Advanced Techniques and New Developments.

Luncheon speaker will be Thomas F. Dixon, NASA; banquet speaker, Brigadier General Powell, deputy commander, aerospace systems. Willis M. Hawkins, Lockheed, is general manager of the symposium; Rick Davis, program chairman; and Frank Mansur, administrative chairman. For information call Frank Mansur, Lockheed, DA 4-3311, ext. 45614.

Feb. 21—Santa Clara Valley Subsection **AIEE** and Lockheed Missiles and Space Co., Annual Engineers Banquet. Santa Clara Valley Fairgrounds, San Jose. Speakers: Joe Walker, X-15 pilot; Thomas F. Dixon, NASA. Theme: Travel to the Moon. Each engineer is invited to bring a student as a guest. Tickets available from society representatives.

Feb. 23—Northern California Section, **American Society of Lubrication Engineers.** "Fire Resistant Hydraulic Fluids" by Samuel P. Polack. London House, Jack London Square, Oakland, Calif. Dinner 7 p-m (social hour, 6 p-m). No reservation required.

Mar. 1-3—The division of engineering at **San Jose State College** Open House. Information: Shel Kulick, San Jose State College, San Jose.

Mar. 13—**American Society for Quality Control,** San Francisco Bay Area Section. "What SQC Has Done in Application in Weights and Measures Enforcement" by Robert McKennan, Bureau of Weights and Measures. Del Webb Towne House, San Francisco. Reservations: Arthur Brown, Friden, Inc., San Leandro, NE 8-0700.

Mar. 14—Santa Clara Valley Subsection **AIEE.** "The High Power Klystron" by Dr. Armand Staprans, Varian Associates. 8 p-m, Lockheed Auditorium, Stanford Industrial Park.

Mar. 27—American Society for Quality Control, San Francisco Bay Area Section, and Stanford University, **Maintainability Seminar.** 9 a.m., Stanford University. Registration ($10 includes luncheon and transactions): Jack D. Crowley, 641 San Miguel Ave., Sunnyvale.

PAPERS CALLS

March 1—200-word abstracts for Second Congress of IFAC on Automatic Control (Basle, Switzerland; Sept. 1963). Send to: Prof. Irving Lefkowitz, chairman AACC applications committee, Case Institute of Technology, 10900 Euclid Ave., Cleveland 6, Ohio.

Mar. 15—500- to 1000-word summaries for the International Conference on Precision Electromagnetic Measurements (Boulder, Colorado; Aug. 14-16). Send to: Dr. George Birnbaum, Hughes Research Laboratory, Malibu, Calif.

Apr. 15—100- to 200-word abstracts, 500- to 1000-word summaries, and indication of technical field of the paper, along with title of paper and name and address of author for Wescon (Los Angeles, Aug. 21-24). Send to: Wescon business office, 1435 La Cienega Blvd., Los Angeles 35, Calif.

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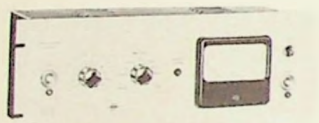

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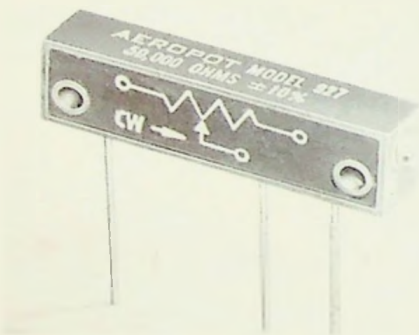
New Model 2409 makes true root-mean-square measurements universally practical for a-c voltages from 2 cps to 200,000 cps. Measurements may be made from 1 mv to 1000 volts in either true rms, average, or peak values.

The 2409 is 0.2-db down at 2 cps and 200,000 cps. Two different meter-damping characteristics afford optimum reading accuracy and speed.

This voltmeter serves as an excellent decade instrument amplifier calibrated for exact 10-db increments of gain. Characteristics valuable to this application are: a response flat within ± 0.2 db from 2 cps to 200,000 cps, distortion less than 0.2 per cent with a 10-v output, input impedance of 10 megohms, output impedance of 50 ohms, and amplification of 60 db.

Available in portable or 7-inch rack-panel versions.

B & K Instruments, Inc., 3044 West 106th Street, Cleveland 11, Ohio.



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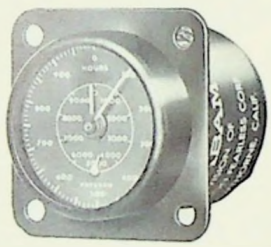
Aeropot 900 Series trimmer potentiometer, designed specifically for printed circuit applications, features a new aluminum-case design that provides maximum heat dissipation. Rating of 3.5 watts at 50C, extends the life expectancy at normal operating levels.

Resistance values range from 20 to 100,000 ohms in 25 turns. Idling feature prevents damage from shift rotation beyond limits. All internal connections are welded and terminals are gold-plated for easy soldering. Compliance with military specification MIL-R-27208A.

Aero Electronics Corp., 1745 W. 134th St., Gardena, Calif.



SUBMINIATURE TIME-TOTALIZER METER

A subminiature time totalizing meter that accurately indicates elapsed operating time of electronic equipment and systems is used to determine reliability, prevent failures, and facilitate maintenance procedures. Meter combines a rugged precise 21-jewel watch movement and a spring-coupled 28-volt d-c torque motor. Weighs approx 2 oz. Has a 1.040-in-diam. face. Available in two operating ranges: 1 hour to 1,000 hours or 10 hours to 10,000 hours.

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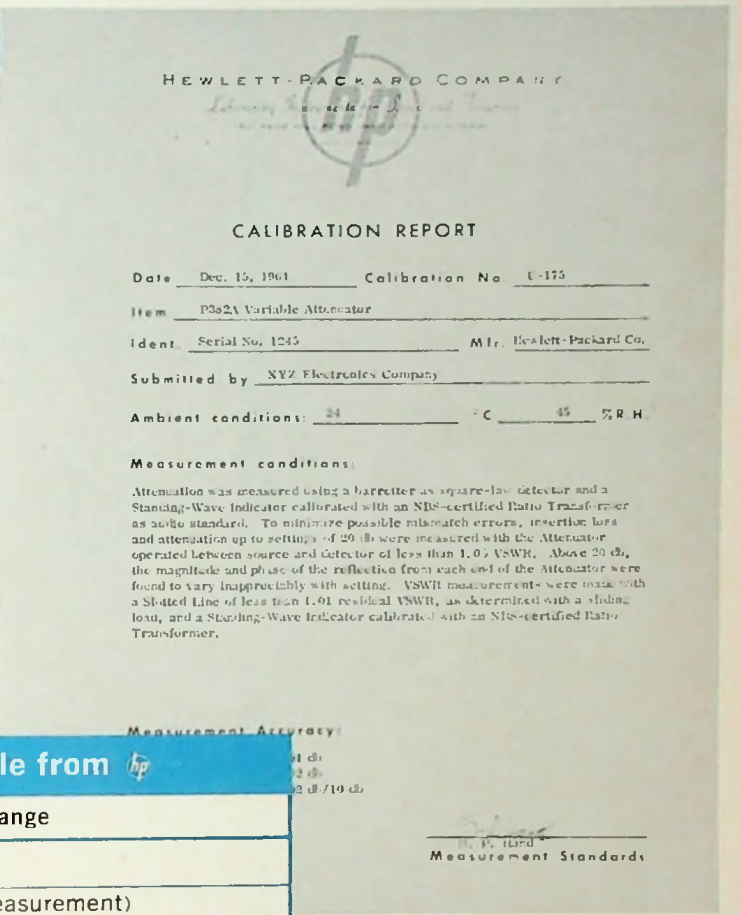
Whether your equipment is manufactured by hp or not, you can have this calibration service, with a concluding report including (1) a complete description of the conditions under which measurements where made (temperature, humidity, test equipment used, etc.), (2) calibration figures (measurements made, accuracy) and (3) demonstration of traceability to the National Bureau of Standards.

This new service is offered in addition to the regular precision calibration service performed by hp on its own instruments . . . calibration which permits Hewlett-Packard to certify performance of hp instruments within published specifications.



HEWLETT-PACKARD COMPANY

CALIBRATION REPORT

Date Dec. 15, 1961 Calibration No 6-175

Item P382A Variable Attenuator

Ident. Serial No. 1245 Mfr. Hewlett-Packard Co.

Submitted by XYZ Electronics Company

Ambient conditions: 24 °C 45 %R.H.

Measurement conditions:

Attenuation was measured using a barretter as square-law detector and a Standing-Wave Indicator calibrated with an NBS-certified Ratio Transformer as audio standard. To minimize possible mismatch errors, insertion loss and attenuation up to settings of 20 db were measured with the Attenuator operated between source and detector of less than 1.05 VSWR. Above 20 db, the magnitude and phase of the reflection from each end of the Attenuator were found to vary inappreciably with setting. VSWR measurements were made with a Slotted Line of less than 1.01 residual VSWR, as determined with a sliding load, and a Standing-Wave Indicator calibrated with an NBS-certified Ratio Transformer.

Measurement Accuracy:

1 db
2 db
2 db/10 db

R. P. Hand
Measurement Standards

Standards measurements available from hp

Measurement	Range
Frequency	0.1 cps to 12.4 GC
DC Voltage	10 μv to 3,000 v (measurement) 10 μv to 1,000 v (generation)
AC Voltage	1 mv to 1,000 v (measurement, 1 cps to 1 GC) Up to 300 v (generation, 20 cps to 1 GC)
DC Current	10 μμa to 30 a (measurement and generation)
AC Current	5 ma to 10 a (measurement, 5 cps to 50 KC) 30 ma to 3 a (generation, 20 cps to 20 KC)
Resistance	0.0001 ohm to 10,000 megohm (dc) 1 ohm to 1 megohm (ac, 1 KC)
Power (dc to 40 GC)	0.1 mw to 600 w
Capacitance (1 KC)	0.1 pf to 1,000 μf
Inductance (1 KC)	0.1 μh to 1,000 h
Attenuation (50 cps to 40 GC)	0 to 120 db (also output attenuators of coaxial signal generators to approximately –90 dbm)
Impedance (50 KC to 40 GC)	L, R, C (50 KC to 50 MC) Z: 2 ohms to 2,000 ohms (50 MC to 500 MC) O: –90 to +90 (50 MC to 500 MC) VSWR: 1.00 to 10 (500 MC to 40 GC)

Information on specific instruments for which standards calibration is available, approximate charges and time requirements are available on request. For complete information contact:

CUSTOMER SERVICE

HEWLETT PACKARD COMPANY
395 Page Mill Road
Palo Alto, California
DAvenport 6-1755

7651

INDEX TO ADVERTISERS

MANUFACTURERS/REP REFERENCE: See opposite page →

MANUFACTURERS INDEX

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Wiltron Co.	O'Halloran Associates
Wincharger Corp. (Zenith Radio Corp.)	Premmco, Inc.

For addresses and telephone numbers of reps listed, see opposite page

the section

MEMBERSHIP

Following are the names of IRE members who have recently entered our area, thereby becoming members of the San Francisco Section:

C. L. Becker
J. Bialek
G. M. Braemser
C. F. Brown
C. Brunetti
F. Cammack
J. W. Cecil
W. S. Chaskin
L. E. Cisne
H. R. Clements
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M. S. Minkel
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P. K. Murakami
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J. E. Pera
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H. D. Rogers, Jr.
C. A. Rypinski, Jr.
A. D. Seltzer
A. Stanchak
L. D. Stevens, Jr.
J. D. Thompson
K. L. Thomson
D. E. Vandenberg

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Robert H. Light
H. D. Rogers, Jr.

Member

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Richard H. Bauhaus
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A. B. Ruff
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Frederick M. Stockham
R. W. Tallon
C. S. Yen

Associate

I. C. De La Rocha
W. R. Hutcherson

---

computer conference

THINGS TO SEE

Exhibit space for the 1962 Spring Joint Computer Conference in San Francisco next May 1 to 3 has been oversubscribed, according to an announcement by John W. Ball, exhibits chairman. There will be 8,866 sq ft of displays in the Grand Ballroom of the Fairmont Hotel for the run of the annual conference sponsored by the American Federation of Information Processing Societies.

Major manufacturing and service companies in the computer field will be represented among the exhibitors, offering a view of equipment, instruments and components lately reaching the market.

Gertsch announces: the CRB line of complex ratio bridges

Ideal for voltage and phase comparison. Measures complex voltage ratios — both in-phase and quadrature — with high accuracy.

These Gertsch CRB instruments are designed for testing 3- or 4-terminal networks, including transformers, synchros, resolvers, gyros, and transducers. The Gertsch line includes:

SOLID STATE BRIDGE — Model CRB-4. Instrument is fully transistorized . . . highly accurate. A self-contained, phase-sensitive null indicator permits rapid measurements. $R_x + R_y$, voltage ratios are read from concentric switch dials. *Battery or line* operation . . . case or rack mounting. Operating frequency range: 380-420 cps. Weight 20 pounds.

COMPLEX RATIO BRIDGE — Models CRB-1B and CRB-2B. In these units, quadrature component reading is indicated either as rectangular coordinate, tan θ, or θ directly in degrees. Useful for measuring angles as small as .001°. Six-place resolution, with high accuracy. Cabinet or rack mounting.

CRB-1B	30-1,000 cps	2.5 f or 200 V max.
CRB-2B	50-3,000 cps	.35 f or 200 V max.

AUTOMATIC COMPLEX RATIO BRIDGE — Model CRB-3. A self-nulling AC bridge with digital readout of both in-phase and quadrature voltage ratios. Excellent for production testing.

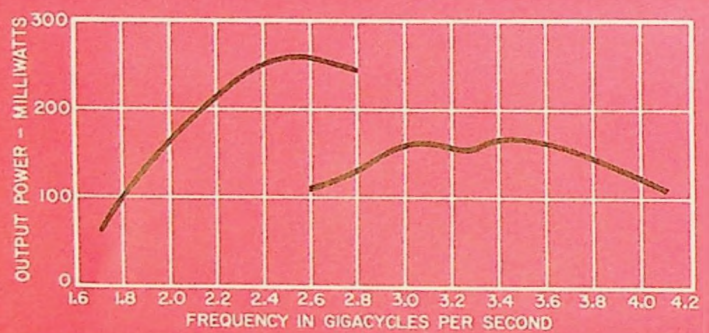
Accuracy of bridge is .002% max. Five-place resolution, with automatic quadrant indication. Unit is self-contained, requiring no external calibration sources, and is equipped for external printer readout.

Complete literature on all units sent on request. Bulletin CRB.

Gertsch

GERTSCH PRODUCTS, Inc.
3211 S. La Cienega Blvd., Los Angeles 16, Calif. • UPton 0-2761 • VErmont 9-2201
Northern California Office: 794 West Olive, Sunnyvale, California, REgent 6-7031

A NEW
High-Performance
MICROWAVE OSCILLATOR



Type 1360-A Microwave Oscillator, $3180
For either bench use or relay rack mounting.

...High output and wide frequency range, coupled with low price, make this oscillator an outstanding value.

- ★ Continuously tunable from 1.7 to 4.1 Gc in two ranges; automatic range switching. Non-contacting tuning plunger.
- ★ ±1% frequency calibration accuracy.
- ★ Separate Δf control (±1 Mc) for fine adjustment.
- ★ Output monitor permits maximum output setting at any frequency and for all load impedances.
- ★ Piston attenuator calibrated in relative db especially useful at low signal levels.

★ **FLEXIBILITY OF MODULATION:**
Internal 1-kc square wave, adjustable ±5%
Internal 1-kc and line-frequency sweeps with trigger output for oscilloscope display of narrow-band responses
External pulse, square wave, and fm

★ **VERSATILE OUTPUT CONNECTOR**
New GR recessed locking type — adapts to all common connector types. Adaptors lock on, yet are readily changed, are trim in appearance, have low vswr.

★ **VARIETY OF ACCESSORIES:**
Including low-cost pulse and square-wave modulators, and a complete line of coaxial elements.

GR Oscillators provide continuous coverage from 0.01 cps to 7.4 Gc

Write for complete information

GENERAL RADIO COMPANY
WEST CONCORD, MASSACHUSETTS

Branch Engineering Office in SAN FRANCISCO
1186 Los Altos Avenue, Los Altos, California
James G. Hussey • Donald M. Vagelaar
Tel: WHitecliff 8-8233