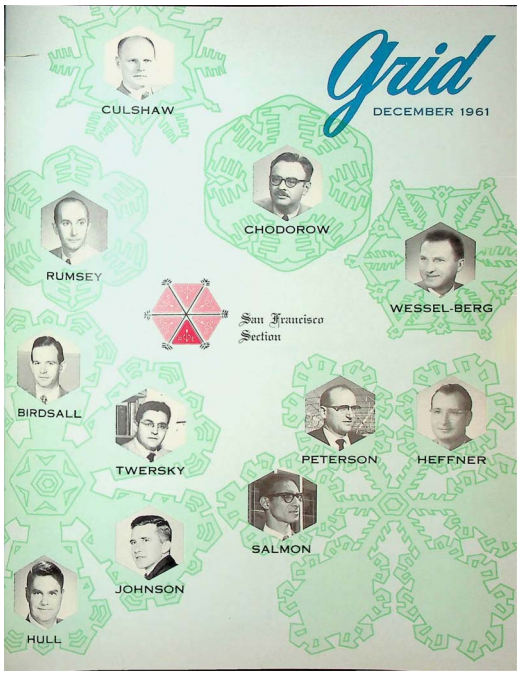
EDITOR'S PROFILE of this issue

from a historical perspective …

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



December, 1961:

Cover: Celebrating IRE award-winners. Of the six awards that IRE gives, four of the five USA recipients are in the Bay Area. Also profiled are seven new IRE Fellows.

p. 7: The editorial points out that the SF Section of the IRE started with 50 members in 1916. It started growing rapidly from 1955 onwards. The IRE itself will be 50 years old in 1962, with 100,000 members. And we get the first rumblings of a possible merger between the IRE and the AIEE – what then becomes the IEEE. On page 14 is a photo of the heads of IRE and AIEE talking about first steps toward consolidation of the two societies.

p. 9: A summary of J. Presper Eckert's talk on the past, present and future of computers. He introduced various metrics for evaluating cost and performance.

p. 10: David Steinberg, purchasing manager of Lenkurt Electric, in Belmont, was on a panel discussing cost-reduction methods. He felt that the responsibility belonged to the development engineers. My first job (in 1968) was at Lenkurt, and I would sometimes visit David's office for advice and counsel. I was one of the component test/specification engineers. We made microwave relay systems for multiplexed telephone lines; the Southern Pacific railroad built a network down California's Central Valley, following their tracks, so they could avoid the high phone tariffs charged by AT&T for their WATS lines. This later become the Sprint network ("SP" stands for "Southern Pacific").

p. 16: Prof. Arthur Schawlow, who recently joined Stanford, gave a talk about solid-state masers (ie, lasers), and also the new ruby-based laser and how it works, giving coherent optical radiation.

Grid

DECEMBER 1961

CULSHAW

CHODOROW

RUMSEY

WESSEL-BERG

San Francisco Section

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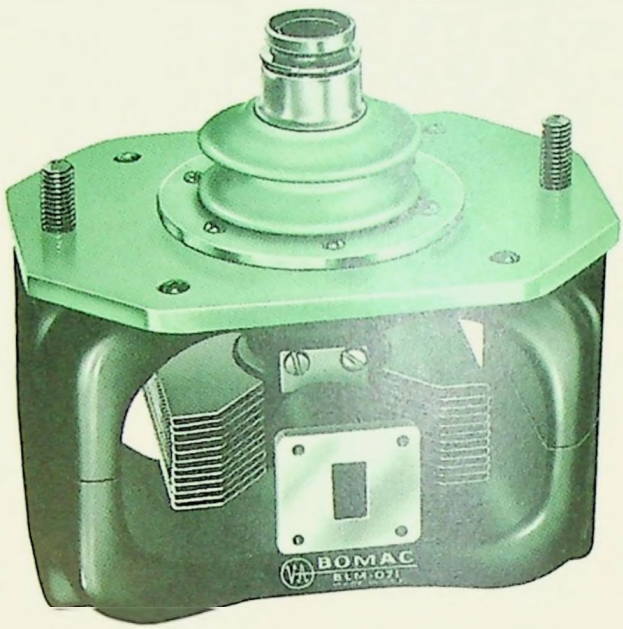
BOMAC K_U BAND MAGNETRONS

Designers of radar equipment will find Bomac Laboratories' new BLM-071 K_U-band pulse magnetron meets exacting requirements for airborne systems: lightweight, rugged, powerful. This newest contribution from Bomac is a fixed-frequency tube (15.9-16.1 kMc) rated at 100 kW peak, at 0.001 duty cycle.

Cathode structure is greatly improved over similar magnetrons. Operable at high ambient temperatures, with input/output terminals permitting pressurization to 30 psia. Special construction minimizes leakage current. High power output and low operating voltage are combined in a compact, ruggedized unit. Long life. Weight: less than 8½ lbs.

The many advantages to Bomac's BLM-071 magnetron make it readily adaptable to navigation, high-altitude mapping, airport surveillance, and similar applications. Write for full technical details.



FEATURES: Frequency 15.9-16.1 kMc.
Peak Power 100 kW.
Normal efficiency 30%.
Duty cycle 0.001 Max.
Pulse width 0.06 to 1.2 usec.

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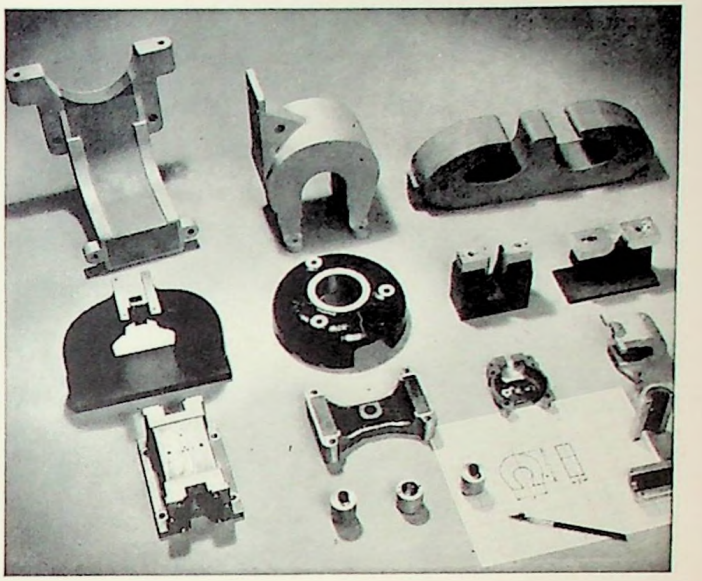
for your PERMANENT MAGNET requirements

Typical group of Arnold permanent magnets, both cast and sintered types.



Typical group of permanent magnet assemblies

ALNICO MAGNETS

Arnold permanent magnets are available in all types of Alnico material, in sizes ranging from large castings weighing over 80 pounds to very small sintered parts weighing less than one gram.

Alnico V can usually be depended upon to deliver the greatest energy product to the magnetic circuit per unit weight of magnet material. It is therefore generally the first choice for a magnetic material except where special physical considerations are paramount.

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Available from Arnold in production quantities, Alnico VIII possesses the highest coercive force of all Alnico grades, as well as a high energy product and a relatively low temperature coefficient. It is especially suited for traveling wave tube focusing applications. Gap flux densities as high as 1000 gausses are attainable in tubular-type straight field focusing magnets. Alnico VIII is also recommended for applications which involve strong demagnetizing fields, or where space considerations dictate the use of a short magnet. *Write for Bulletin PM-119.*

SPECIAL PERMANENT MAGNET MATERIALS

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Arnox III is a molded-type magnet having high coercive force and moderately low residual induction and energy product. Principal uses are for magnetic requirements which are not stringent, and for a relatively short magnet of reasonable cross section. Accurate dimensions and close tolerances can be economically obtained. These magnets can be premagnetized before assembly, and have very high resistance to demagnetization. Slightly better magnetic properties are obtained in the pressing direction than in other directions.

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Arnox V is a ceramic permanent magnet material composed of highly oriented barium ferrite. It has many times the energy product of Arnox III and is comparable in many applications to Alnico V. Because of its high coercive force, its use is recommended in applications where a short magnetic length is desirable, or where extremely high demagnetizing forces may be encountered.

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For more complete information, *write for your copy of "The Magneteer," Vol. 2, No. 1.*

7506-B

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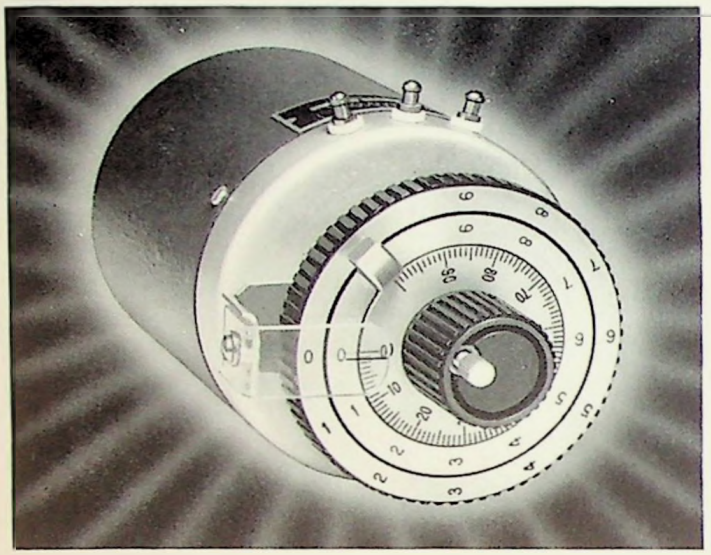

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HIGH RESOLUTION
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LOW COST • LONG LIFE

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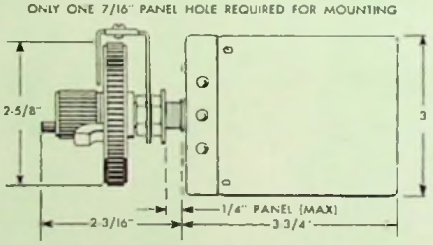
PARTIAL SPECIFICATIONS OF THE MODEL 50A, AS SHOWN



VOLTAGE RATIO: 0.0000 to 1.0000

FULL SCALE ACCURACY: RESISTANCE, ±0.05%; **LINEARITY,** ±0.01%

RESOLUTION, 0.002% or better

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TEMPERATURE COEFFICIENT: 0.002% per degree C

WEIGHT: 16 ounces

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WYO, Denver, Colo., MA3-1458

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Grid

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contents

cover

In this 1962nd season of giving, the technical gifts of the eleven seasonally pictured members of the Section on this month's cover have been acknowledged internationally by various awards and honors of the Institute. For the six awards the IRE gives, four of the five U.S. recipients are in the San Francisco Section: Victor H. Rumsey, University of California, Morris N. Liebmann Award (antennas); William Culshaw, GTE Laboratories, Harry Diamond Award (microwave optics, interferometry); and Marvin Chodorow and Tore Wessel-Berg, Stanford, joint W. R. G. Baker Award (klystron paper).

Seven new Fellows from SFS appear in the 1961 list: Charles K. Birdsall, University of California (twts); Hubert Heffner, Stanford (bwos, parametric amplifiers); Joseph F. Hull, Litton (crossed-field microwave devices), H. Richard Johnson, Watkins-Johnson (voltage-tuned microwave oscillators); Allen M. Peterson, Stanford & SRI (propagation), Vincent Salmon, SRI (acoustics); and Victor Twersky, Sylvania (electromagnetic scattering).

Note to distant readers: Significant quantities of snow actually last fell in San Francisco February 5, 1887.

MEETING CALENDAR

PROFESSIONAL GROUPS

Antennas & Propagation — 8:00 P.M. • Wednesday, Jan. 10

"Backward-Wave Antennas"
Speaker: Paul E. Mayes, University of Illinois; currently on sabbatical leave at University of California, Berkeley
Place: Room 277, Cory Hall, University of California
Dinner: 6:15 P.M., Faculty Club
Reservations: Sandra Torrey, DA 1-3300, Ext. 392

Broadcasting — 8:00 P.M. • Tuesday, Jan. 9

"Experience with American Klystrons in Recent European UHF Transmission Systems"
Speaker: George Badger
Place: Eitel-McCullough, Inc., San Carlos
Dinner: 6:30 (Cocktails 6:00 P.M.) Ed's Chuck Wagon, 1360 El Camino, Belmont
Reservations: None required

Bio-Medical Electronics — 7:30 P.M. • Wednesday, Dec. 20

(Joint meeting with PGRQC, see below)

Electronic Computers — 8:00 P.M. • Tuesday, Dec. 19

"Recent Developments in Computer Organization in Europe"
Speaker: Dr. Cuthbert C. Hurd, IBM research and engineering
Place: Lockheed Auditorium, 3251 Hanover Street, Palo Alto
Dinner: 6:00 P.M., The Red Shack, 4085 El Camino Way, Palo Alto
Reservations: None required

Information Theory — 8:00 P.M. • Thursday, Jan. 25

"Project West Ford"
Speaker: Dr. Robert M. Lerner, Lincoln Laboratory
Place: Conference Room B, Stanford Research Institute
Dinner: 6:00 P.M., Old Plantation, San Antonio Road near El Camino Real
Reservations: Mrs. Beryl Lelo, DA 6-6200, Ext. 2944 by noon, January 25

Reliability & Quality Control — 7:30 P.M. • Wednesday, Dec. 20

(Joint meeting with PGBME, see above)
Dinner meeting—ladies invited
"ESP, LSD, & the Nature of Man"
Speaker: Dr. W. W. Harman, Stanford University
Place: Villa Lafayette Restaurant, 1140 Castro St., Mountain View
Dinner: 7:30 P.M. Attendance limited
Reservations: Miss H. Bueschell, DA 1-0390 ($3.50 per person)

CHRONOLOGICAL RECAP

December 19—Electronic Computers
December 20—Reliability & Quality Control/Bio-Medical Electronics
January 9—Broadcasting
January 10—Antennas & Propagation
January 25—Information Theory

Grid reporters

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PGAP: RAYMOND D. EGAN, RADIO-SCIENCE LABORATORY, STANFORD UNIVERSITY
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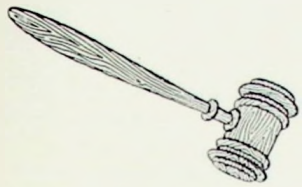
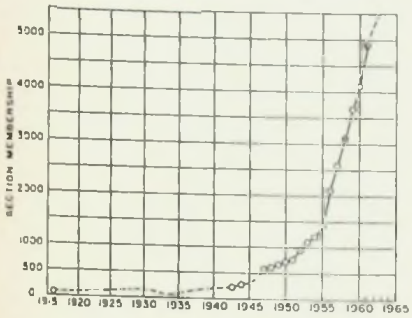


from the chairs

THE RED CARPET



The San Francisco Section was organized in 1916 with approximately 50 members, and grew slowly but steadily through 1955 when the rate of growth increased considerably. Despite the rapid increase in Section size during the past few years there is still a large potential of qualified non-members in the Bay area who are missing the many services and benefits of the IRE. The Section in turn is not receiving the advantage of their participation in its diversified activities.

As the IRE approaches its 50th Anniversary in May of 1962, and the membership nears 100,000, President Lloyd Berkner is particularly desirous of seeing that the advantages of IRE membership are brought to the attention of all qualified engineers and scientists independently of the possible merger of AIEE and IRE.

To accomplish this, each Section member should consider himself a part of the Membership Committee; contact one prospective member, tell him about the benefits he has derived from IRE membership, show him this copy of the **Grid** to illustrate the numerous Section activities in which he can participate, encourage him to apply for membership and attend some of the meetings. There are numerous engineers who need only this simple encouragement to join the Section. Others find that the reference forms are an insurmountable hurdle and although well qualified, procrastinate in having the forms completed. Suggestions for handling this problem are now contained in the supplementary information sheet available with application forms from company representatives or from the Section office in Palo Alto.

Frank Inami of LRL is acting this year as Membership vice chairman, responsible for the East Bay area, in order to more adequately handle the growing geographic spread of members. An increased number of company membership representatives is planned and their names will be listed in a future issue of the **Grid.**

Suggestions for increasing the effectiveness of the Membership Committee are always welcome, particularly as the technical community continues to expand.

Fred J. MacKenzie

—FRED J. MAC KENZIE
CHAIRMAN, MEMBERSHIP

Fred MacKenzie

Prof. Paul E. Mayes, speaker at the PGAP January meeting

meeting ahead

BACKWARD-WAVE ANTENNAS

Paul E. Mayes, associate professor of electrical engineering, University of Illinois, on sabbatical leave at the University of California, will speak to PGAP during January. His topic will be as above and the details of the meeting are listed in the Calendar, page 6.

It is well known that the propagation characteristics of electromagnetic waveguides can be altered by placing periodic discontinuities in the guide. The principal effect of periodicity in the waveguide structure is to introduce "stopbands" in the frequency spectrum. In the stop-bands the propagation constant is complex-valued and the guide will no longer effectively transmit electromagnetic waves. These stop-bands can be explained in terms of the coupling of forward and backward waves on the periodic structure. Waveguide filters can be devised by making use of the stop-bands of periodically loaded closed waveguides.

Recently, applications have also been made of stop-band characteristics in periodic open waveguides. The results indicate that excellent antennas can be devised in this way. Measurements made with bifilar helical and zig-zag wires show the transition from pass-band to stop-band characteristics as a function of frequency. The pass-band character of the lower frequencies is demonstrated by the ability to establish standing waves of predictable guide-wavelength by placing a short ciruit on one end of the structure. At higher frequencies the fields on the structure decay very rapidly as evidence of the complex propagation constant which is typical of the stop-band. Radiation patterns measured at frequencies inside the stop-band are very smooth, free of side lobes, and unidirectional with high front-to-back ratio. The radiation is in the direction toward the feed-point which agrees with the concept of coupling between the forward and backward waves on the structure.

Investigations of the backward-wave antennas were prompted by the search for better understanding of frequency-independent antennas. It now follows that the backward-wave helix and zig-zag are made frequency independent by applying a linear taper to the periodic structure. The resulting frequency-independent antennas are the conical logarithmic spiral and the logarithmically periodic zig-zag. Similar results have also been obtained with other periodic structures. Thus the operation of a periodic structure as a backward-wave antenna can be used to judge the quality of frequency-independent performance of its logarithmically periodic counterpart. This is an important aid to frequency-independent antenna design since logarithmically periodic geometry in itself is no guarantee of frequency-independent performance.

meeting ahead

ESP, LSD & THE NATURE OF MAN

Ladies are invited to the December joint dinner meeting of the PGRQC and PGBME, so for this reason the usual fare of technical papers has been abandoned in favor of a general-interest topic. See the Calendar for data.

Man's nature and ESP have long been of general interest to people everywhere but LSD is a relatively new cocktail-hour topic. The speaker, Dr. W. W. Harman, has been interested for some years in investigations of man's inner experience through the use of LSD and similar chemical mind-manifesting agents. Harman is a professor of electrical engineering at Stanford University but has also conducted a graduate seminar on The Human Potentiality for a number of years.

Studies of philosophy, theology, psychology, and psychiatry seem in the past to have led to vastly different pictures of man's inner nature. This may be due in part to different and partially hidden basic premises inherent in their approaches. Recent developments in various fields suggest the possibility of hidden constraints in the scientific method as commonly understood. Studies of such areas of human experience as are symbolized by the letters ESP and LSD seem likely to shed important light on man's nature and perhaps will help explain the discrepancies between the models of the psychologists and those of the philosophers. In particular, responsible observation of man's inner being through the use of LSD tends to reveal the nature of man in a new and fascinating light.

Officers serving the Professional Group on Bio-Medical Electronics for 1961-1962 include the following:

Chairman: Keith F. Killam, Jr., Stanford University.

Vice Chairman: Kenneth Gardiner, Stanford Research Institute.

Secretary-Treasurer: William Halpern, Beckman Instruments, Spinco Division, Palo Alto.

Keith F. Killam, Jr., chairman, PGBME

Kenneth Gardiner, vice chairman, PGBME

Barnard

Isaacs

Tanaka

committee appointments

SPRING JOINT COMPUTER CONFERENCE

Executive and committee responsibilities for the 1962 Spring Joint Computer Conference and Exhibition in San Francisco next May 1-3 have been announced. The technical program and exhibits will be at the Fairmont Hotel. Sponsorship of the national meeting is by the American Federation of Information Processing Societies, representing IRE, AIEE, and ACM.

General chairman is George A. Barnard of Philco western development laboratories, Palo Alto; vice chairman is Dr. Hewitt D. Crane of Stanford Research Institute; and secretary-treasurer is Robert A. Isaacs of Philco western development laboratories. Heading the technical program is Dr. Richard I. Tanaka of Lockheed Missiles & Space Co., Palo Alto; program vice chairman is Dr. Robert C. Minnick of Stanford Research Institute; and associate chairmen for special sessions are John E. Sherman of Lockheed Missiles & Space Co. and R. J. Andrews of International Business Machines, San Jose.

Commerce & Services

Exhibits chairman is John W. Ball of Pacific Telephone Co., Sacramento; arrangements chairman is R. George Glaser of McKinsey & Co., San Francisco; and vice chairman of arrangements is Ray Smith of Smith-Corona Marchant, Oakland; printing and mailing are being handled by William O. Hamlin, chairman, and Ransford Johnston, vice chairman, both of Fairchild Semiconductor, Mountain View; publications chairman is Earl T. Lincoln who is being assisted by John J. McNulty, vice chairman, both of IBM, San Jose; chairman and vice chairman of the registration committee are Don E. Eliezer and Leo Rinsler, both of IBM, San Jose; Norman S. Jones of Friden, Inc., San Leandro, is chairman of the public relations committee and R. Dale Painter of Fairchild Semiconductor is vice chairman.

Social Affairs

Planning a social program for women in San Francisco in connection with the conference will be a committee headed by Miss Margaret G. Conley, chairman, and Miss Ann Nemi, vice chairman, both with IBM in San Francisco.

meeting review

O-R, SIMULATION, & ANT HILLS

The first PGEC meeting of the current season was held at the Lockheed auditorium on September 26. As usual, the meeting was preceded by a "meet-the-speaker" dinner at the Red Shack on El Camino Real.

H. D. Crane of Stanford Research Institute, chairman of the PGEC Chapter for the coming year, introduced the other new officers including Arthur Anderson of IBM Corporation, vice chairman and program chairman; and Louis Lauler of Lockheed Missiles and Space Co., secretary-treasurer.

Arthur Anderson then introduced the speaker, Dr. Ernest Koenigsberg, director of operations research at C-E-I-R, Inc., of San Francisco. Koenigsberg received his PhD in theoretical physics from Iowa State University in 1953 and has worked in the operations research field for the past several years.

Koenigsberg's topic for the evening was the role of computers in operations research, hereafter called o-r. He began his talk with some definitions of the o-r vocabulary, including such terms as simulation, management or war games, linear programming, game theory, etc. He then proceeded to discuss a particular example of the application of o-r in the plywood industry. The overall approach was to state the problem of production planning into such a form that the techniques of linear programming are applicable. The method of solution of the resulting problem was the simplex method.

The limitations of this simplex method and linear programming were then pointed out as well as some of the recent new developments in the field, including integer programming techniques and the decomposition principle. After a short discussion and comparison of some particular computer programs for operations research, Koenigsberg concluded his talk with a general discussion of simulation.

After a short break for refreshments, the discussion of simulation continued, including possible simulation of the action of the President or other government officials, and the use of ant hills for simulation experiments. These two topics were discussed separately.

—DONALD L. EPLEY

meeting review

THE HIGH COST OF PAPER

One of the fathers of computers spoke at the October meeting of the PGEC local group. J. Presper Eckert, Jr., presently a vice president of Remington Rand, but only a few years ago the chief engineer of one of the first computer projects, spoke about the past, present, and future of computers. After reminiscing briefly on his personal experiences at the University of Pennsylvania and the Eniac project, Eckert traced the development of computers up to the present and speculated on possible future developments.

He discussed a rule-of-thumb figure of merit used in the development of Univac I, the solid-state version of Uni-

(Continued on page 10)

Hewett D. Crane, chairman, PGEC

Arthur G. Anderson, vice chairman, PGEC

Panel on value analysis and cost reduction at October PGPEP meeting: seated, Steinberg, McMahon, Day, Brown: standing, Thomas E. Scatchard, program chairman

Harmon R. Traver photo

MORE ECKERT

vac, Lorc, and smaller machines developed by Remington Rand. The figure of merit of any proposed change was defined as the ratio of the percentage increase in performance of the computer to the percentage increase in cost of the computer. The various factors such as relative cost of memory and speed, deadlines for freezing designs, etc., which must be considered in choosing a figure of merit, were pointed out. Some examples of figures of merit were given: Univac I, 5; solid state Univac, 8; Lorc, 3-4; and the smaller machines 12-15.

Eckert also proposed a scale for measuring the capability of machines or other "calculators." Assigning the figure 1 to a man and 10 to a man with a desk calculator, the following figures were given for the Remington Rand computers: 10^5 for Univac I, and 10^7 for Lorc. Eckert then suggested that using the logarithm of these figures would provide a more meaningful scale. He speculated that a critical point on this scale was in sight since foreseeable techniques probably will produce a figure of about 10^{10} or 10 on the logarithm scale.

In order to pass this point on the scale, Eckert held that new system organizations would be required. One possibility along this line, the perceptron approach, was mentioned. The disadvantage of this approach, the extremely large number of elements required, was pointed out and it was suggested that perhaps a compromise using some of the perceptron principles and extremely fast elements would be a practical solution.

Other important problems were also discussed by Eckert. Some of these are the builders' problems of constructing computers which are more easily programmed and which may use indirect input-output equipment, the newer areas of application of computers such as character recognition, teaching, collecting data for medical research, and finally, a very practical problem often overlooked by both computer users and builders: the high cost of paper! In smaller computer installations whose rental costs are not extremely high, the cost of producing the copies of data including carbon paper, middle-man costs, etc., can approach the rental cost of the machine itself. Certainly, both builders and users should show concern over this possibility.

Concerning the relationship between computer builders and users, Eckert made another interesting comment. His experience with both groups indicated that only 1 hour of users' time is spent in developing methods for applying a computer to his particular problems for every 1000 hours of builders' development time. Yet, the ratio of computer operation time to computer development time indicates the opposite should be the case. One is certainly left with the impression that the users are at the low end of their "capacity scale." The increase of this figure will undoubtedly require advancements in both programming methods and computer-system organizations.

—DONALD L. EPLEY

meeting review

DOES COST EQUAL WORTH?

A very successful and highly informative meeting of PGPEP was held at the Beckman Instruments Spinco Division Palo Alto plant in late October. A panel discussion on value analysis and cost reduction was followed by a tour of the Spinco Division research and production facilities.

Participants in the panel discussion were Arthur W. Brown, manager of purchase for IBM; Walter Day, purchasing manager for the Berkeley Division of Beckman Instruments; N. J. McMahon, director of supply for United Air Lines; and David Steinberg, manager of purchases and material for Lenkurt Electric Co.

Brown emphasized the need for purchasing to "get on board" early in the development stage. He stressed cooperation between purchasing, engineering, and the vendor. The principle of "use cents—save dollars" is followed in making an estimate of the purchased-parts cost before any quotations are requested. Any increase in quotations of over 10 per cent or $500 is carefully reviewed. The performance of the buyer and the entire purchasing function is measured by how well the original estimates are met. Since 80 per cent of the costs at IBM are for purchased parts, the results achieved are very important and resulted in a saving of $11,000,000 last year.

Case History

Day explained that Beckman has been using value analysis for about five years. They encourage participation by everyone in the plant on their own materials including service functions such as maintenance. For instance, by working with the vendor it has been possible to make a minor change in a diode so it could replace ten previously used diodes. The savings in the first year amounted to $65,000. This rose to $100,000 in the following years as additional applications were found for the revised part.

McMahon stated that United Air Lines buys some $30,000,000 in replacement parts for use in the maintenance of aircraft in San Francisco. Two value analysts work with their fifty inventory planners and an identification section in reviewing common parts. Within a few months after the start of the program they were saving five times their salaries by specifying the best part for each use—taking into account cost, quality, and requirements for the part.

Steinberg maintained that value analysis was an engineering function.

(Continued on page 12)

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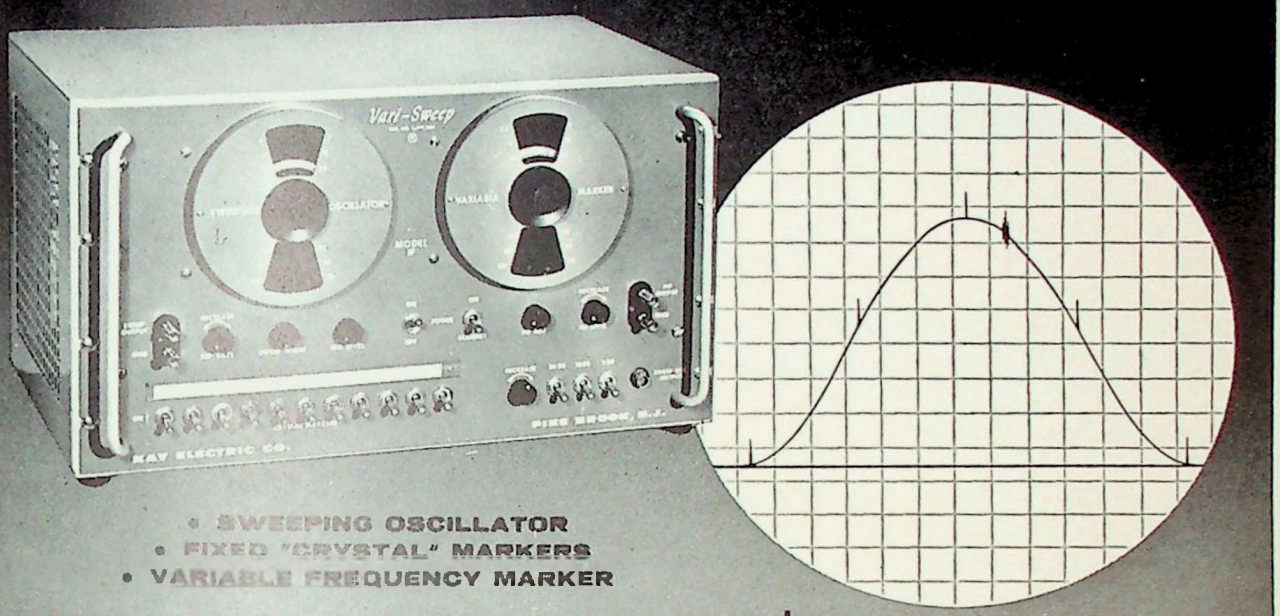

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Zero Reference: True zero line during retrace.

Attenuators: Switched 20, 10 and 3 db: variable 6 db.

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Variable Marker: "Birdie pip" marker continuously variable from 2 to 135 mc in 6 overlapping bands. Direct-reading frequency dial accurate to within ±1.0%.

Marker Output: Approx. 5 V peak. **Sweep Output:** Approx. 7 V peak.

10-145 MC VARI-SWEEP MODEL RADAR

Same as Model IF in a different frequency range.

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Frequency Range (CW or Sweeping Operation): 2-220 mc, 10 bands. Direct-reading dial.

Sweep Width: Continuously variable to maximum of at least 30 mc (above 50 mc) or 60% of center frequency (below 50 mc).

Sweep Rate: Variable, 10 to 40 cps; line lock.

RF Output: 1.0 V rms (metered) into nom. 70 ohms (50 ohms upon request). AGC'd to ±0.5 db over widest sweep and tuning range.

Attenuators: Switched 20, 20, 10, 6 and 3 db, plus continuously variable 6 db.

Price: $795.00 f.o.b. factory. $875.00 f.a.s. N.Y.

KAY *Vari-Marker* MODEL H

VARIABLE MARKER: (CW or "Birdie pip").

Frequency Range: 1.7 to 230 mc in ten overlapping bands.

RF Level: 1.0 V rms into 70 or 50 ohms, metered.

Flatness: ±0.5 db, AGC'd.

Attenuators: Switched 20, 10, 6, 3 db, continuous 6 db.

Frequency Dial: Direct reading, accurate to ±1%.

Marker Amplitude: Variable to 5.0 volts peak.

HARMONIC MARKER: (Picket-fence pip or CW).

Intervals: Switched 250 kc, 500 kc, 2.5 mc, 5.0 mc, other frequencies can be specified.

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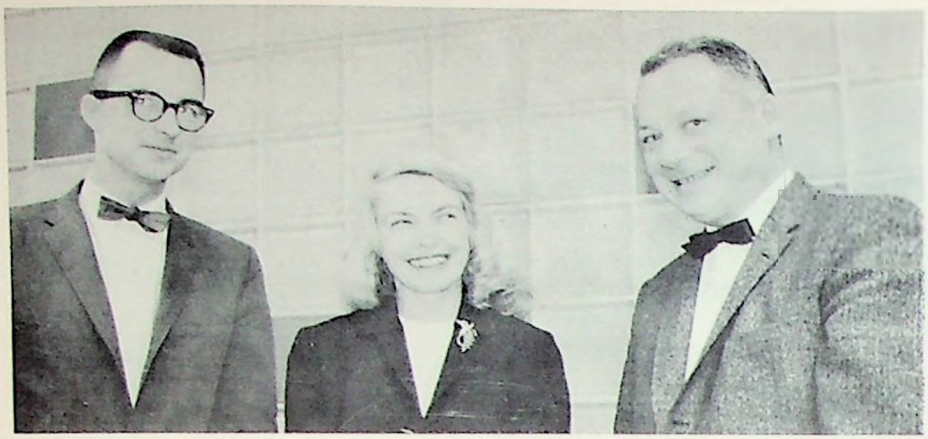

Jim Weldon, Sylvania, chairman, PGEWS, with Virginia Whipple, speaker at November 21 meeting; and S. J. Reisman, both Lockheed

MORE COST

While every assistance in supplying information should be provided by purchasing, nothing should be done to relieve the development engineer of his responsibility for controlling costs by specifying the proper part. He did not believe in another person or group re-specifying the parts for cost reduction after the engineer had finished his job. The engineer himself should use value-analysis principles in seeing that each part bears a cost in relation to its value to the entire product. With regard to cost reduction he felt more attention should be devoted to operational costs and optimum inventory levels.

From the large attendance at the meeting and the questions asked of the various panel members following their formal presentation, it was evident that there is keen interest in value analysis and cost reduction.

During the plant tour the PGPEP members and their guests were able to see some of the biochemical and medical equipment being produced by the Spinco Division. One of the items was a centrifuge capable of operating at 70,000 rpm.

—HARMON R. TRAVER

meeting review

CODIFYING COLD COPY

In 1957, S. J. Reisman and Homer Shaw sat down at Lockheed research publications to plan and begin a house technical-publications style guide. Next January, the Macmillan Company will publicly offer a permanent hard-cover edition of the result for national distribution. The story of this gestation was the topic of a presentation by Virginia Whipple to the November meeting of PGEWS held at the Sylvania MVO auditorium in Mountain View. Mrs. Whipple, a senior publications engineer at Lockheed Missiles and Space Co. was one of many contributors to this exhaustive, comprehensive publications handbook.

Mrs. Whipple justified the existence of style guides in general by citing the conditions at Lockheed which engendered the initial efforts to produce their guide. Contrary perhaps to what one might at first think, the esthetic values of consistency of style between and within individual publications and of upgrading compositional quality are but secondary results of the establishment of a style guide. The primary advantage of conformity to a style guide, at least to industrial institutions, is the production of acceptable publications much more rapidly and at greatly reduced cost.

Every publication passes through the hands of at least a writer, an editor, a typist, a proofreader, and a page-layout man. Larger publications may require the services of several of each of these. A company producing many publications concurrently must therefore maintain a quite large staff, and each member of which has a hand in some phase requiring attention to consistency to arbitrary standards. If an individual set of rules for such processes as abbreviation, capitalization, page numbering, paragraphing, referencing, and footnoting must be established for each publication, and if these differ, countless hours are lost in debate, back-referral, corrections, changes, and general confusion.

A typist too often is heard to say, "But that's the way we indented the last proposal"; a proofreader repeatedly must return to an editor to ask whether or not to spell out single-digit numerals on this particular report, the layout man must each time double check for individual policy in page numbering, the editor must return for clarification of writer intent in paragraph subordination. A style guide establishing rigidly consistent standards to be followed in all publications obviates all these time-consuming difficulties.

Lockheed's style guide, as it will be published by Macmillan under the tentative title "Style Manual for Technical Writers," provides guidance in several areas of technical publications. First it provides a guide for the establishment of a technical-publications organization, its personnel, its functions, its operating procedures. Then a large section points out how technical reports, technical proposals, and technical manuals differ. The contents, elements, and organization of a technical report are enumerated. The audiences, types, methods of generation, and format of technical proposals are discussed. The purposes and responsibilities of technical manuals are shown in relation to imposed specifications.

This exposition is followed by chapters on a recommended typographical procedure concerning such details as organization, presentation, page numbering, headings, typing, etc. Included here are 19 pages providing rules for typists and guides for writers on the method of arranging and presenting mathematical equations.

Next, sections on acceptable usage present universally recognized rules covering such compositional procedures as spelling, sentence structure, punctuation, compounding, and abbreviating. An extensive list of standard abbreviations is included. The book concludes with several sample pages, an annotated bibliography and a list of editorial and proofreading marks.

Mrs. Whipple pointed out that one unique feature of this style guide, in contrast to most others, is that it is aimed peculiarly to "cold-type" publications. These are publications meant to be reproduced from typewritten (like this paragraph) or hand-lettered pages rather than by a "hot-type" process from hand- or linotype-set metal forms (like normal Grid text). Currently, industry is spending billions of dollars annually on cold-type publications.

A question-and-answer period followed, responded to by both Mrs. Whipple and Reisman. The meeting was conducted and the speaker introduced by Chairman Jim Weldon.

—DOUGLAS WM. DUPEN

meeting review

REDUNDANCY AT FREMONT

The first meeting of the season for PGRQC was held in mid-October with a total of 19 people, excluding FAA personnel, in attendance.

All instrument flights between airports are under the direction of the Federal Aivation Agency which assigns routes and altitudes and monitors all

(Continued on page 14)

Project Surveyor engineering openings

Hughes Space Systems Division has immediate openings for Electronic Engineers, Mechanical Engineers, Physicists and Aeronautical Engineers to work on Project Surveyor—a spacecraft which will soft land on the moon. Once there, Surveyor instruments will perform a variety of scientific tests: drills will pierce and analyze the moon's surface; high quality television pictures will be transmitted to earth; other instruments will measure the moon's magnetic and radiation characteristics. ■ To accomplish this step into space, Project Surveyor requires the talents of imaginative junior and senior engineers and scientists to augment its outstanding staff. Experience is preferred but not required. A few of the openings include:

control engineers

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

circuit designers

Involves analysis and synthesis of systems for: telemetering and command circuits for space vehicles, high efficiency power supplies for airborne and space electronic systems, space command, space television, guidance and control systems, and others.

systems analysts

To consider basic problems such as: the requirements of manned space flight; automatic target recognition requirements for unmanned satellites or high speed strike reconnaissance systems; IR systems requirements for ballistic missile defense.

infrared

Includes systems analysis and preliminary design in infrared activities involving: satellite detection and identification; air-to-air missiles; AICBM, infrared range measurement; air-to-air detection cryogenics and others.

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Search radars located at Paso Robles, Half Moon Bay, and Sacramento transmit video information by microwave link to the Oakland air-route traffic-control center (now located at Fremont), where traffic-control personnel plot the progress of all flights. The present location of the control center was selected in order to reduce the effects of nuclear fallout. Portions of the building have been specially constructed to reduce the radiation effects by a factor of 1/1000 from that in an unprotected area.

Much of the equipment being used is continually being replaced by newer, improved-performance equipment. The usual ppi scope presentation requires semi-darkness for viewing. It is being replaced by a high-brilliancy "television" presentation which can be viewed in normal room light. This new presentation uses a high-resolution horizontal raster but maintains the ppi picture. An airline map about each radar site can be superimposed on the actual radar scanned picture to show the true geographical position of any plane with relation to prescribed airlanes.

Specially constructed recorders document all FAA voice traffic control conversation for file.

Because of the importance of the function performed by the control center, all electronic equipment is duplexed. For each unit, there is a second unit ready to take over the function of the other. When a failure occurs, an alarm is actuated and the function of the failed unit is transferred to the other unit either manually or automatically. The failed unit is removed, repaired, and then replaced in the rack.

—ROGER MC DONALD

meeting review

OVER THE CAPACITOR & INTO THE WOODWORK

In mid-October the PGA, together with AES and SMPTE, met at the KGO studios in San Francisco to hear an address by Michael Rettinger, a well-known consultant in acoustics who has been with the RCA engineering department in Hollywood for 25 years. Rettinger spoke on two subjects, a newly developed unidirectional capacitor microphone and some acoustical considerations in the design of a sound studio.

The microphone discussed by Rettinger utilizes a metallic-coated Mylar film of small diameter as the sensing element. Air passages leading to the cavity in the rear of the microphone alter the phase characteristics of the sound wave presented to the diaphragm in such a way that the microphone acquires frequency-dependent sound directional characteristics.

Addition of a lightweight tubular array to the front of the microphone renders the unit even more directional to sound. The tubular array consists of varying lengths of ¼-inch-diameter tubes, each filled with resistive material to reduce resonances. The maximum length of the tubular array can be from 18 to 60 inches, depending on the degree of directionality desired. However, sound attenuation increases both with increasing tube lengths and with increasing frequency. Electrical power for the capacitor bias voltage and the miniature cathode-follower tube is supplied by several mercury cells and small high-voltage batteries all enclosed in the lower portion of the fork supporting the microphone.

Rettinger drew from his experience to illustrate some practical applications in which the highly directional characteristics of the microphone had proved most useful. In one particular instance, use of the microphone made possible the film and sound recording of a principal actor ice skating in a small rink while supporting members of the cast in the same scene roller skated on the wooden floor surrounding the ice without being heard.

Studio Considerations

Speaking on sound-studio design, Rettinger emphasized with words and charts the following considerations: (a) the relation of the recording-room reverberation characteristics to those of the reproducing-room reverberation characteristics, (b) the amount of sound isolation required for the studio, and (c) the type of recordings that are to be made in the studio.

The reverberation time in a given room is a function of frequency. A basic goal in studio internal design is to obtain sound characteristics such that the reverberation time can be increased or reduced to meet the needs of a particular recording without changing the reverberation characteristic of the room. Since high-frequency sound is more easily absorbed than low-frequency sound by such room contents as rugs, drapes, seats, and people, it is necessary to provide a means of dispersing and/or absorbing low-frequency sound. One successful means of accomplishing this is the use of curved plywood panels or multiple splays or baffles placed at appropriate positions in the room.

Rettinger illustrated in detail some sound isolation provisions he designed into a number of studios constructed adjacent to each other. These required a high degree of sound isolation so that recordings of different scenes could be made simultaneously in all rooms.

In the question and answer session that followed, numerous queries were directed at details of the microphone construction and also upon electronic reverberation instruments that have recently been marketed. Rettinger indicated a clear preference for the reverberation room over any of the electronic reverberation devices.

—S. OLESON

P. E. Haggerty, president-elect of the Institute, and Warren H. Chase, president, AIEE, during conference on first steps toward consolidation of the two societies, Target date for plan to take effect, after membership approval, is Jan. 1, 1963

meeting review

PERTURBED SPREAD

At a November meeting, a presentation on the theory and design of the sandwich-wire antenna introduced by W. Rotman and N. Karas was made to the local PGAP chapter by George

(Continued on page 16)

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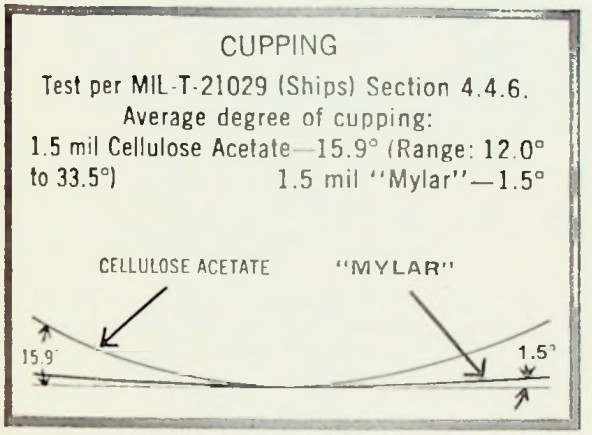

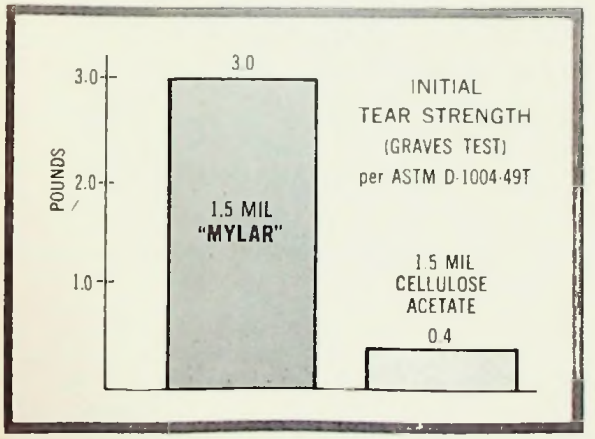

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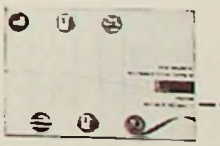

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MORE ANTENNAS

J. Koloboff of Dalmo Victor.

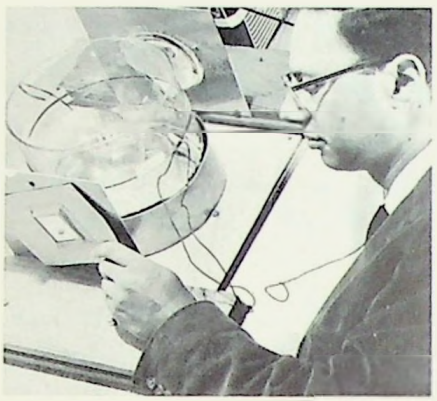
The configuration of this antenna is basically that of a three-wire line with a perturbed, or modulated, center conductor. Radiation from the structure is due to the unbalanced current component of the modulated center conductor, with the power radiated by each perturbation being proportional to the square of the amplitude of the perturbation. Hence, control of the amplitude distribution along the radiating aperture is available to the designer. Control of the phase distribution is available by proper relative location of the perturbations in terms of wavelengths along the transmission medium. Because of the dielectric support of the center conductor, wavelength in the transmission medium is smaller than in free space.

Utilizing control of the phase and amplitude distribution along the antenna aperture, the speaker described design procedures for the synthesis of pencil-beam and shaped-beam radiation patterns from this type of antenna. To avoid bidirectional radiation from the basic three-wire line, it is backed by a conducting plate separated ¼ wavelength from the aperture. The speaker presented results of experimental work on pencil-beam and shaped-beam antennas operating at x-band frequencies. Use of matching stubs located at center-conductor modulation points was presented as a means of reducing the reflection from the perturbations. Without matching stubs it is possible, at some frequencies in the operating band, for the reflections to combine in-phase to produce a large vswr on the order of 4:1. By proper design of the matching mechanisms, vswr as low as 1.7:1 can be achieved over a band from 8.5 to 9.6 gc.

Level of cross-polarized radiated field measured on the experimental antennas is on the order of −15 db. Efficiency of the experimental antennas is about 85 per cent. The sandwich-wire antenna appears well suited for applications requiring a lightweight flush-mounted microwave antenna.

Koloboff received his BSEE and MSEE degrees from the University of California in 1957 and 1959, respectively. At the present time he is a microwave design engineer with Dalmo Victor and is enrolled in the University of California extension courses.

—C. E. PHILLIPS



Arnold Bloom, speaker at the October PGSET meeting

meeting review

LIGHT AT WORK

In mid October PGSET met to consider recently explored physical phenomena having potential applications in space electronics. Gathering at the Lockheed research division auditorium, the group heard Dr. Arnold Bloom, director of theoretical research of Spectra-Physics Corp., Mountain View, discuss a number of his specialties with particular emphasis on optical pumping and laser development. Bloom is also a specialist in nuclear and ferro-magnetic resonance, and other associated effects, and has published twelve papers in these fields.

He described several experiments which may have potential application as narrow-band optical detectors.

One of these experiments demonstrated that optical radiation may be used to pump the metastable population of the discharge to a higher energy level which permits a return to the minimum energy state and subsequent excitation back to the metastable level, thus increasing the conductivity of the discharge. A helium discharge operating in this manner may be used to detect 20.5 micron radiation with a bandwidth of 0.1 A.

Another gaseous-discharge experiment demonstrated that light, modulated at the Larmor frequency of the magnetic dipoles, may be used to generate a precessing moment in these dipoles when they are aligned by an external magnetic field.

The meeting was preceded by a meet-the-speaker dinner at the Camino Bowl in Mountain View, and about thirty attended the meeting.

The transfer of chairman Robert Morgan to Los Angeles has necessitated a new election in PGSET with the following results:

Chairman: Jack C. Baker, Philco

Vice Chairman: Donald E. Willoughby, Philco

Secretary-Treasurer: Stephen E. Bederka, Lockheed

—D. E. WILLOUGHBY

meeting review

COLORFUL COHERENCE

A joint meeting of PGMTT and PGED at Stanford in early November heard about the latest developments in the fast-growing field of optical masers. The speaker was Dr. Arthur L. Schawlow, who has recently been appointed professor of physics at Stanford. His pioneering work in the field of his talk was done at the Bell Telephone Labs.

When an atom undergoes a transition from a higher- to a lower-energy state, a quantum of electro-magnetic radiation is emitted. If this emission is properly controlled in a suitably chosen gaseous or solid body, coherent amplification or generation of electromagnetic energy can be obtained. At microwave frequencies this principle has been successfully applied for some years, and is emboded in the familiar microwave maser. The possibility of extending this technique to the infrared and optical frequency ranges is particularly significant because of the failure of conventional amplifiers and oscillators at these frequencies.

A solid-state optical maser has been successfully operated using ruby, i.e. alumina doped with chromium. This material has a broad absorption band in the green part of the spectrum. If the ruby is illuminated with light anywhere in this range, fluorescence occurs at several sharp lines in the red. This fluorescence is one of the conditions necessary for maser operation. It is also necessary to have the optical equivalent of a cavity resonator tuned to the wavelength of the chosen flu-

(Continued on page 18)

Jack C. Baker, chairman, PGSET

Donald E. Willoughby, vice chairman, PGSET

Stephen E. Bederka, sec'y-treasurer, PGSET

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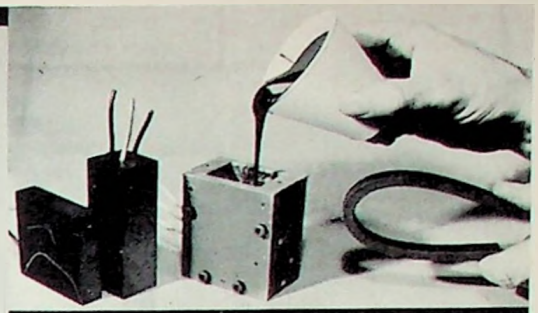

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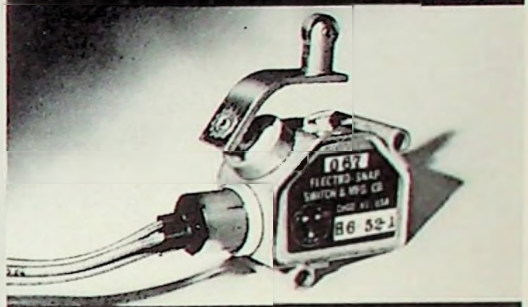

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orescent line. This is accomplished by grinding the ends of a ruby rod optically flat and parallel and metallizing them so as to make an interferometer of the Fabry-Perot type.

White light can be used to pump a maser of this type. When the intensity of the pump is low, only ordinary fluorescence is observed. This is due to spontaneous emission and is incoherent. When the pump power is increased past a certain critical threshold (of the order of a few hundred watts), stimulated emission predominates over spontaneous emission and maser action begins. A beam emerges from the end of the ruby rod having a line width an order of magnitude narrower than for spontaneous emission. The beam also has phase coherence, making it possible to focus it into an extremely small spot.

This type of maser can only be operated on a pulsed basis because of heat dissipation problems. However, peak powers of several kilowatts can be achieved, and the average power density in a focused spot can be made high enough to vaporize any solid material. The best efficiencies achieved are of the order of ½ per cent.

Optical masers can also be made using a mixture of helium and neon gases excited by means of an electrical discharge. C-W operation is possible in this case, a few milliwatts of output being obtained with 50 watts of pump power. Line widths of less than 10 kc and beam-spread angles less than one minute of arc have been reported for this type of maser.

Educated at the University of Toronto, Schawlow received a PhD in 1949. From then until 1951 he did research on microwave spectroscopy at Columbia University, and it was there that he was first associated with Professor C. H. Townes. For the next ten years he was in the physical research department of Bell Telephone Laboratories, where he conducted investigations on molecular quadruple resonance superconductivity and optical spectra of solids. In 1960 he was a visiting associate professor at Columbia University with Professor Townes.

—E. F. BARNETT

At November PGMIL meeting, Maj. Herman Teifeld, speaker; Walter Prise, chairman; and Charles Antony, program chairman

meeting review

AFSC ON DISPLAY

The Professional Group on Military Electronics held a regular November meeting at the Lockheed Palo Alto auditorium, preceded by a speaker's dinner at the Red Shack Restaurant. The speaker for the evening was Major Herman H. Teifeld and the subject, Air Force Systems Command.

Teifeld spoke on the organization and function of the AFSC. He told of the several high-level studies conducted during and after World War II which prompted the establishment of the Air Research and Development Command in 1950. He also mentioned the recent reorganization of that command in 1961 into the present Air Force Systems Command.

With the aid of some clippings from the cutting-room floor, the speaker took the group on a pictorial tour of the various AFSC organizations throughout the world. After he had launched various and sundry rocket planes and missiles, he described how AFSC maintains a $2 billion physical plant, employing approximately 77,000 people, and has or will contract for $7 billion of R&D services and equipment this fiscal year —a good portion of which directly affects this PGMIL.

The command headquarters is at Andrews AF Base, Washington, D.C. It maintains six field divisions: ballistic systems and space systems, Inglewood, Calif.; aeronautical systems, Dayton, Ohio; electronic systems, Bedford, Mass.; foreign technology, Dayton, Ohio; and aerospace medical, Brooks AF Base, Texas. It also maintains seven R&D centers—Rome Air Development and Lincoln Laboratory operate as subordinate units under the electronic systems division. The following operate directly under headquarters: air proving ground and missile test, Fla.; missile development and special weapons, New Mexico; Arnold Engineering Development, Tenn., and flight test, Calif.

In addition, the command operates such organizations as the armed forces technical information agency and the network of contract management regions, which are responsible for the administrative monitoring of all Air Force contracts. The command sponsors R&D in areas of basic and applied research as well as systems development. Essentially, the AFSC develops weapons systems for delivery, on a timely basis, to the operational commands: Strategic Air Command, Tactical Air Command, and Air Defense Command.

Following the major's talk, Charles Antony, program chairman, discussed the December social function which replaces the usual monthly meeting. The dinner, with entertainment by the Peninsula Players, was scheduled for December 7.

—JOE WETTSTEIN

meeting review

NEW AUDIO INSTRUMENTATION

David Cochran, research and development engineer at Hewlett-Packard Co., spoke to members and guests of both the IRE/PGA and the AES at the beginning of November when a meeting was held at SRI. His interesting talk encompassed technical details of two newly developed instruments at Hewlett-Packard: a battery-operated transistorized audio oscillator and a low-distortion transistorized wave analyzer.

The transistor oscillator, basically an r-c oscillator incorporated into a bridge circuit, utilizes a variable resistance to vary the frequency of oscillation. Cochran illustrated how the four principal problems of stability, absolute amplitude control, resolution, and the bridge-impedance variation over the frequency range were handled. The variable resistance element, a wire-wound card type, permits 0.05 per cent resolution at one end of the scale and 0.5 at the other end. Exponential spiral cams attached to the shaft convert the resistance scale from hyperbolic to logarithmic. The oscillator unit features such specifications as a frequency stability of ± 0.02 per cent over 50 hours and 0.01 per cent per degree C, an amplitude stability of ± 0.1 per cent, and an amplitude variation of 3 per cent over the entire frequency range of 5 cps to 500 kc. Harmonic frequency distortion is approximately 43-50 db below the fundamental.

Cochran, in discussing the wave analyzer, pointed out some explicit examples of the way in which a wave analyzer of even low distortion characteristics may contaminate, with harmonics, a signal being analyzed and how overloading an analyzer input stage can lead to the same result.

The new transistorized wave ana-

(Continued on page 20)

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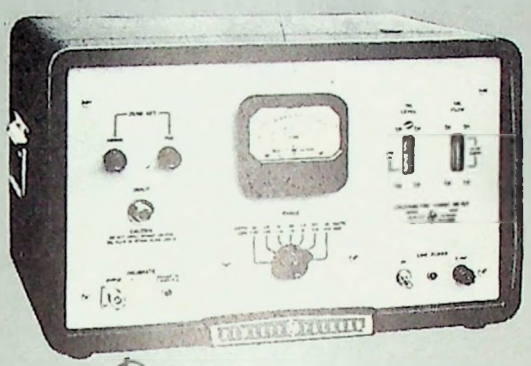

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Direct reading in watts, DBW
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Compact, self-contained
Internal 1% calibrator

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The hp 434A is a self-contained, high-precision instrument, yet it operates with only two simple front-panel controls—range switch and zero set. No other adjustments are needed to measure power at any frequency, dc to 12.4 GC. And the compact 434A requires no thermistor, barretter, external terminations or plumbing of any kind! Thus it is ideally suited for use by non-technical personnel to measure AM power, pulsed power, cw, video and dc power. An internal calibrator ensures that the 434A operates always at peak performance.

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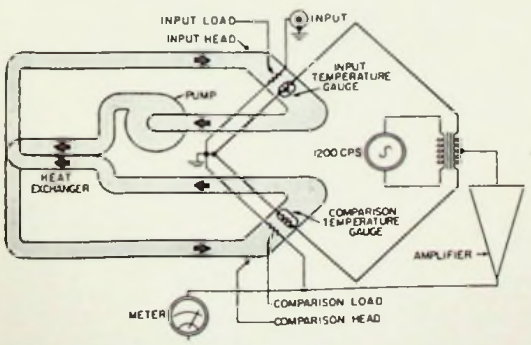

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7174

Ralph A. Brown, chairman, PGA

Stanley J. Oleson, vice chairman, PGA

MORE AUDIO

lyzer, a heterodyne type, has a dynamic range of 150 db, a frequency response of 10 cps to 50 kc, a residual modulation and hum voltage approximately 75 db below the principal signal, and a bandwidth of 1.5 cps (flat top) or 70 cps at 80 db below the signal peak.

Novel features presented by the new analyzer are: a linearly calibrated tuning control with fine tuning adjustable in 10-cps increments over the entire frequency range from 10 cps to 50 kc, automatic frequency control lock-in to aid in the narrow bandwidth tracking, and balance controls which are accessible only by screwdriver since the necessity of balancing has been reduced to a much less frequent chore than has been the case with many previous similar types of narrow-band heterodyne analyzers.

After answering numerous questions from the audience, Cochran adjourned with his listeners for refreshments and informal discussions.

—S. OLESON

meeting review

L + R, MEET L – R

Robert Greisinger, chief engineer of Sargent-Rayment, provided members of the IRE/PGA and AES with a very informative insight into the principles of f-m stereo multiplexing during the mid-September meeting. After outlining the f-m stereo system specifications set forth by the FCC, Greisinger discussed in logical detail the general design of functional circuitry comprising the f-m stereo receiver including a number of variations adopted by different manufacturers.

In stereo f-m broadcast transmission the signals from two microphones are mixed to produce in-phase sum (L + R) and out-of-phase (L – R) difference signals. The L + R signal, delayed slightly to keep it in phase, frequency modulates the main carrier signal in the lower 15-kc bandwidth region. The difference signal is transmitted as amplitude modulation of a suppressed subcarrier centered at 38 kc and using the bandwidth area from 23 to 53 kc. This subcarrier is suppressed to less than 1 per cent modulation. A 19-kc pilot or synchronization carrier spaced in the middle of an 8-kc "dead band" modulates the main carrier between 8 and 10 per cent. The sum of the sidebands resulting from amplitude modulation of the 38-kc subcarrier can cause a peak deviation of the main carrier of 45 per cent when only the left or right signals are present. The (L + R) and the (L – R) signals are each capable of modulating the main channel 90 per cent.

For normal monophonic f-m operation only the main channel and a subchannel (SCA, limited to less than 10 per cent modulation) is used. The difference in volume to a monophonic listener as opposed to a stereophonic listener is less than 1 db.

The Receiver

In receiver circuitry the stereo f-m tuner is similar to the monophonic f-m tuner through the limiter and detector stages. Beyond the detector stage a monophonic f-m tuner passes the signal through a de-emphasis network into an audio amplifier. Stereo signal separation is accomplished by passing the output of the detector into filter, demodulator, and matrix networks where the difference signal is separated from its carrier frequency and the sum and difference signals are combined to provide two audio channels. Although de-emphasis networks may be placed either before or after the matrix, better signal separation is obtained if the de-emphasis circuits are placed after the matrix network.

Greisinger, with the aid of an oscilloscope, illustrated many of his circuit explanations by showing waveforms in various portions of a typical f-m stereo tuner circuit. Upon conclusion of the presentation members of the audience adjourned for refreshments and informal discussions with the speaker.

In the San Francisco Chapter of PGA, officers are as follows:

Chairman: Ralph Brown, Lenkurt
Vice Chairman: Stanley Oleson, SRI
Secretary-Treasurer: to be announced.

—S. OLESON

meeting review

FEEDBACK: A TRIPLE CHOICE

Professor Leonard S. Schwartz, of the New York University Department of Electrical Engineering, addressed a meeting of the PGIT early in November. His talk was a survey of the results of analyses of various kinds of feedback communication systems. The meeting was held in the auditorium of the Lockheed research laboratories in Palo Alto, with an audience of 40 present.

The speaker prefaced his address with the remark that the basic ideas of feedback communications first appeared in two patents by Van Duuren in 1937-8, and were incorporated in an RCA system in 1939. One of these basic ideas is that of dual-threshold decision, whereby the receiver binary-decision equipment assigns each received binary digit to one of the three categories, one, zero, or doubtful, depending on the level of the received pulse relative to two decision thresholds.

For example, in a binary pulse-amplitude modulation system, pulses received above threshold T_2 would be regarded as ones, pulses below threshold T_1 as zeros, while pulses falling into the "null zone" between T_1 and T_2 would be considered doubtful (i.e., as erased digits). A channel using this scheme can be regarded as a binary erasure-plus-error channel. If the two thresholds are set sufficiently far apart, the channel approaches the idealized binary erasure channel, where only erasures, but no errors occur. A single-error-detecting code (simple parity-check code) may be used to correct one erased digit per block on a one-way channel of this sort. With more complicated parity-check codes it is possible to do correction of both erasures and errors up to a certain point (depending on the code complexity and redundancy).

Two-Way Systems

Dual-threshold (or "null-zone") detection finds its principal application, however, in two-way communication systems where a return link (feedback link) may be used to permit the receiver to request repeats of portions of the received message. Actually there are two basic schemes of this general sort.

In the first type, called decision feedback, it is the receiver which decides when to request a repeat. In the second type, called information feedback, the received information is sent back to the transmitter over the return link, where it is compared with the original data. Here the transmitter effectively looks over the shoulder of the receiver

(Continued on page 22)

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IT IS REPORTED:

Warnock

James D. Warnock, former publicity manager of the San Francisco Chamber of Commerce, becomes executive secretary of the San Francisco Section, IRE, effective December 1. In this new post he will function as business and advertising manager of the **Grid**, with headquarters at the IRE Section Office in Palo Alto.

Opto-Electronic Devices, Inc., a recently-formed corporation, has announced a December 15 completion date for a 10,000 square-foot plant being built in Mountain View.

Principals of the new firm are; Frank **A. Litz**, president, **Robert L. Katz**, vice president and director of business affairs, and **Wm. B. Hugle**, vice president and director of R&D.

National Research Corporation has announced the establishment of a western district office for its research division in Palo Alto. The company has appointed **Rick W. Diehl** to serve as western district manager.

The appointment of **Beardsley Graham** of Palo Alto, an executive of the Missiles and Space Co. of Lockheed Aircraft Co. of Lockheed Aircraft Corp., to the presidency of **Spindletop Research Incorporated** was announced recently at Lexington, Ky. Graham is resigning as manager of satellite research planning after having been associated with Lockheed and its Missiles and Space subsidiary at Sunnyvale and Palo Alto for the past five years.

Previously he was an assistant director of Stanford Research Institute, Menlo Park, and manager of SRI's Mountain States Division at Phoenix, Ariz. He has also held a succession of responsible research and development positions with Bendix Aviation Corp. of Detroit, Lewyt Corp. of Brooklyn, National Broadcasting Co. in Hollywood and New York and Pacific Telephone & Telegraph Co. in San Francisco, and was an early member of the Section publications board.

Graham *Phelps*

John M. Phelps, captain, USN (Ret.), has joined **Granger Associates, Inc.**, Palo Alto, as assistant to the president. Phelps' last active duty assignment was as director of research and development of the Defense Communications Agency. In his new position, he will assist President **John V. N. Granger** in planning and organizational development activities.

Watkins-Johnson Co. has announced four appointments to the technical staff: **Donald C. Hunceker** will take a management part in the production of high-power traveling-wave tubes, **Rowland W. Haegele** will lead production engineering of low-noise tubes, **James A. Long** will work on the development of traveling-wave tubes for use in satellite communication systems, and **Richard E. Pospisil** will join Watkins-Johnson's R&D team in the systems division.

Max P. Forrer has been appointed manager of the applied physics group at **Kane Engineering Laboratories.** Forrer joined Kane early in 1961 from General Electric's Microwave Lab.

(Continued on page 24)

MORE FEEDBACK

and decides where to repeat the message. In many cases the return link may be assumed to be virtually error-free without seriously changing the results of performance analyses. This is true, for example, with decision feedback where the data rate (and hence the required bandwidth) of the return link may be much lower than that of the forward channel, thus permitting a higher signal-to-noise ratio.

The repeated information received in a decision-feedback system may be used in several different ways at the receiver. In non-cumulative decision-feedback systems, the receiver entirely discards message blocks in which errors (or erasures) have been detected, and waits until an ostensibly error-free copy has been received. In cumulative decision feedback, the receiver attempts to construct a correct version of the received message from all of the copies it has received. This may be done digitally or by means of (analog) signal integration. Schwartz showed a number of computed curves which compared these three techniques in terms of their error rate versus transmission time per bit. These curves showed that cumulative decision feedback was best at least for very low error rates.

An amusing example of information feedback was used to illustrate the manner of operation of such systems where the transmitter is effectively "looking over the receiver's shoulder." Here the transmitter was attempting to send the message, "GONE WITH THE WIND," in the face of numerous errors on both the forward and feedback channels. A special symbol θ, is used by the transmitter to tell the receiver to erase the preceding letter. The sequences of transmitted and received symbols looked as follows:

T.: G O N θ N E θ θ θ E sp W I W I . .
R.: G O P θ N O T θ θ E sp W θ W I . .

Comparative analyses of information feedback and decision feedback showed that at very low signal-noise ratios information feedback can actually increase the error probability. However, for high signal-noise ratios information feedback appears to be better than decision feedback.

Finally, Professor Schwartz compared the behavior of (1) unidirectional transmission, (2) so-called "simple" feedback systems, and (3) long-code "fail-safe" feedback systems[1] under three different kinds of noise conditions, (a) constant noise, (b) slowly varying noise, and (c) rapidly varying or burst noise. Unidirectional transmission is suitable only under constant noise conditions. "Simple" feedback systems perform well under both constant noise and slowly varying noise. But only the "fail-safe" systems are effective under rapidly changing, or burst-noise conditions. An MIT system using Bose-Chaudhuri error-detection codes was cited as an example of a long-code "fail-safe" type.

Another interesting example mentioned was the AGAGS air-traffis control system which combines features of both decision feedback and information feedback in the same system.

Reference:

[1]J. J. Metzner and K. C. Morgan, "Reliable Fail-Safe Binary Communication," IRE WESCON Record, Vol. IV, part 5, p. 192, 1960.

—BERNARD ELSPAS

Said J. Stefan and L. Boltzmann: *"The total radiation from a black body is proportional to the fourth power of the absolute temperature of the black body."*

Radiation is usually associated with high temperatures. Yet very cold bodies emit a radiation which can be highly significant in missile and space applications. The problem faced by infrared scientists, trying to detect variations in radiation from low temperature atmospheres, can be likened to detecting a one-foot cube of ice from a distance of five miles.

Lockheed Missiles & Space Company scientists are deeply engaged in studying the problems of infrared emission from the earth and its atmosphere, as seen from orbital altitudes. Although the earth resembles a black body at 300° Kelvin, the emission from its atmosphere, under some circumstances, is much colder. To make measurements under these circumstances, Lockheed has evolved radiometric equipment with one of the most sensitive detection systems yet conceived.

Scientists and engineers must also take careful measurements of a potential employer. Lockheed Missiles & Space Company in Sunnyvale and Palo Alto, California, on the beautiful San Francisco Peninsula, invites this close scrutiny. As Systems Manager for the DISCOVERER and MIDAS satellites and the POLARIS FBM, Lockheed preeminence in Missiles and Space creates positions in many disciplines for outstanding engineers and scientists.

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New GTEL research center under construction in Palo Alto

Construction of a major research center in Palo Alto for **General Telephone and Electronics Laboratories, Inc.** officially got under way recently with a ceremony at which Lt. General **James D. O'Connell,** vice president, poured concrete for the new building. The main structure, of steel frame and laminated wood, has been designed around a circular spine that provides room for storage, wiring, and ducts to serve the laboratories on each side. The offices are placed on the outer perimeter of the ring so that each one has a view of the surrounding country.

Hewlett-Packard Company has announced: the formation of a Canadian sales company to handle the sale of Hewlett-Packard products in Canada; plans to establish an oscilloscope manufacturing plant in Colorado Springs, Colorado; an agreement on plans whereby **Harrison Laboratories, Inc.,** Berkeley, New Jersey, would become a wholly owned subsidiary of Hewlett-Packard; the formation of two new divisions, the advanced research and development division managed by **Paul E. Stoft**, and the frequency and time division managed by **Alan S. Bagley.**

Chartz *Leifer*

Bay Area members of the eight-man Wescon board of directors include **John A. Chartz,** Dalmo Victor, and **Meyer Leifer,** Ampex Instrumentation Products, both newly elected to membership, and **John V. N. Granger,** Granger Associates, and **Calvin K. Townsend,** Jennings Radio Manufacturing, both two-year veterans.

The late **Sigurd F. Varian** willed an estimated $500,000 to a foundation he created to carry on his charitable works. A chief beneficiary of the foundation will be a tiny hospital in Puerto Vallarta, the Mexican town where he made his home during the last three years of his life.

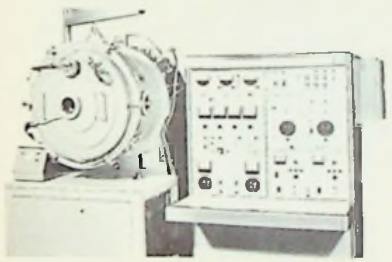
(Continued on page 28)

student affairs

NEW BRANCH

New York headquarters of the Institute has announced approval by the executive committee of a petition to establish an IRE Student Branch at San Francisco State College. Professor Rene B. Marxheimer is the IRE Representative. The Student Branch officers are: Chairman, Fred Nase; vice chairman, Krishna S. Narendra; and secretary-treasurer, Wilson Chu.

new product capsule advertisement



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Scientific Engineering Laboratories, Inc., P.O. Box 607, Woodland, Calif.

—Dave Harbaugh in the *Grid*

"There's your trouble, a weak 6BA6"

Jesse R. Lien, general manager of Sylvania's Mountain View operations, discusses new microwave bistatic Doppler radar equipment for motion-sensitive security applications with George Byrne, who developed concept of the system; and Roger G. Battie, head of security-systems section, RSL

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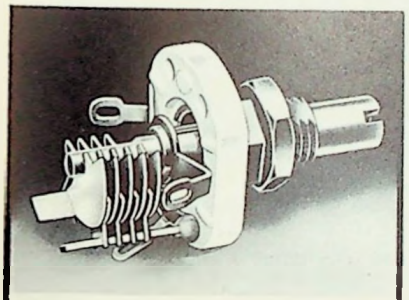

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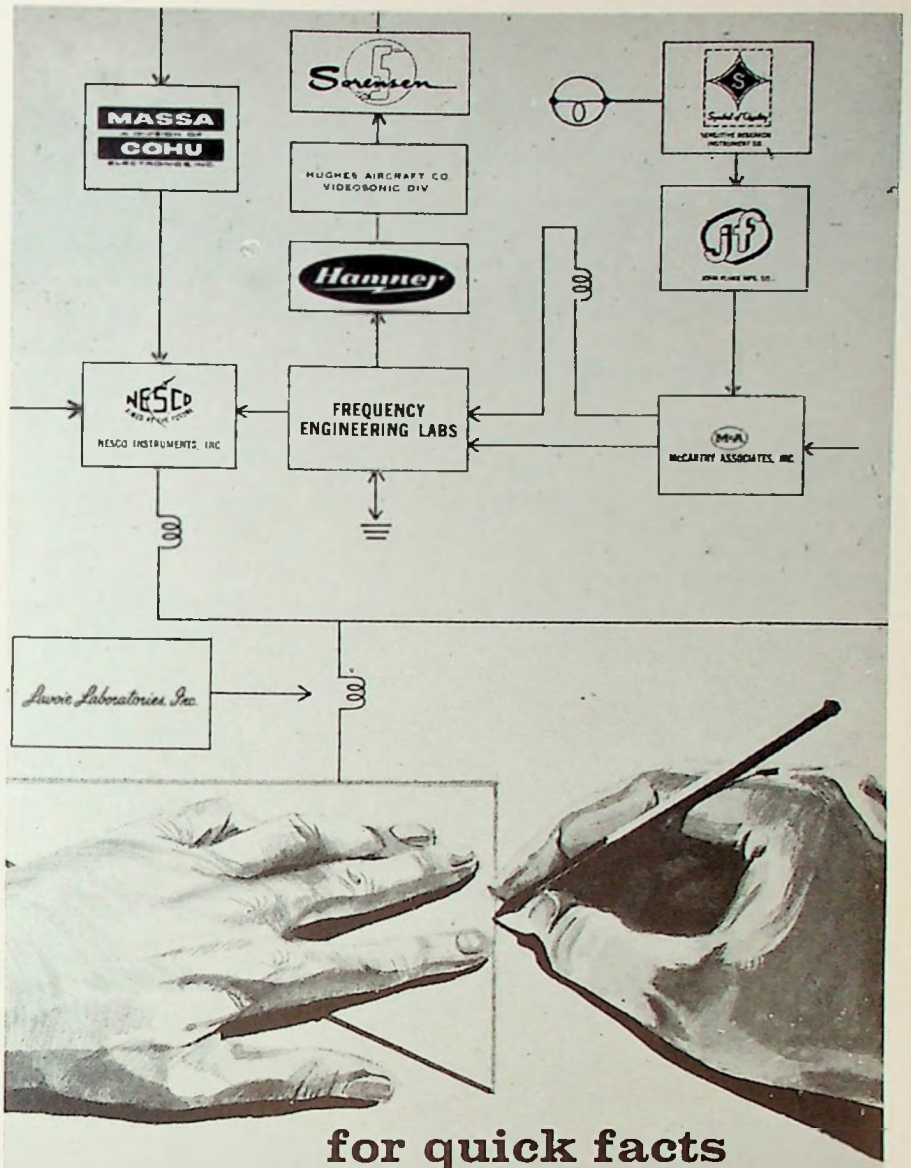

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Carter *Silveira*

MORE SWINGS

Carco Electronics, founded during the summer, is presently operating its new Menlo Park plant, a 12,000-square-foot facility, housing administrative, engineering, and production operations.

Carco Electronics, with an authorized capitalization of $1,365,000, is headed by **John M. Carter,** former president and general manager of California Technical Industries, a division of Textron, Inc. Carter, who is president, is on electronics engineer from the University of Maryland and holds a master's degree in electrical engineering from Johns Hopkins University.

Kenneth Silveira, is assistant chief engineer. A graduate of the University of Hawaii in electrical engineering, he was project supervisor for the flight simulation engineering group at CTI.

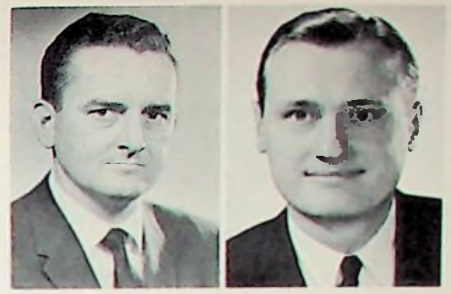
About People

Carl H. Becker has been named director of research, and **Karl E. Sterne** has been named sales manager of **Precision Instrument Company; William P. Hopkins** has been appointed personnel manager at **Rheem Semiconductor Corporation; Paul F. Radue** has joined **Lynch Communications Systems Inc.** as an applications engineer in the marketing division; **Phillip D'Elia** has been appointed manager of a new special products department at **Kaar Engineering Corporation; Edward C. Buurma** has been appointed western regional manager for marketing of the government and industrial group at **Philco Corporation; C. T. Sah** has been named to head the physics section and **Phillip Ferguson** has been appointed head of the device development section at the **Fairchild Semiconductor** research and develop-

Becker *Sterne*

Magida *Cronin*

Heller *Disman*



Wyand *Watkins*

ment laboratory; **Hewlett-Packard Company** has announced the election of **Robert L. Garner** to its Board of Directors; recent appointments at **Advanced Technology Laboratories** include those of **John M. Magida** as product manager — industrial instrumentation, **Paul Cronin**, manager of product engineering — industrial instrumentation, and **Kenneth G. Heller**, manager— aerospace engineering; and **Eitel-McCullough, Inc.** has appointed **Murray I. Disman** manager of microwave tube development, and **David Wyand** product manager of the accessory products division.

Executives of two Palo Alto electronics companies have been elected to two-year terms on the board of trustees of the Western Electronic Education Fund: **W. Frank Cavier**, of **Hewlett-Packard Co.**, and **Dean A. Watkins**, president of **Watkins-Johnson Co.**

(Continued on page 30)

MORE SWINGS

John P. Schoenberg has joined the staff of **Melabs,** Stanford Industrial Park, as manager of its circuits department. Schoenberg goes to Melabs from the research division of Philco Corporation where he was a research group supervisor. Over a twelve year period, his work in the area of electronic design and development has encompassed a wide range of projects with particular emphasis upon solid-state circuitry.

About Representatives

The formation of **Walter Associates,** electronic sales engineers, has been announced by **Charles A. Walter.** The firm represents **Applied Microwave Electronics,** Baltimore, Md., **Eldorado Electronics,** Berkeley, California, **Micro-Tel Corporation,** Baltimore, Md., and **Microwave Technology, Inc.,** Waltham, Massaschusetts.

Recent sales representative appointments include: **J. T. Hill Co.,** San Carlos, for **Drexel Dynamics Corporation,** Horsham, Pennsylvania; **T. Louis Snitzer Co.,** Sunnyvale, for **Behlman-Invar Electronics Corp.,** Santa Monica, and **Rese Engineering, Inc.,** Philadelphia, Penna.; and **Jay Stone & Associates,** Los Altos, for **Applied Research, Inc.,** Port Washington, N.Y.

Two representative firms, **R. L. Pflieger Co.** and **Cerruti Associates,** have merged to form **Cerruti/Pflieger Corp.,** Palo Alto.

R. W. Thompson Associates, Palo Alto, has been appointed to represent **Ace Engineering & Machine Co.,** Huntington Valley, Pennsylvania, and their line of shielded enclosures.

—Alvin Hale in the *Grid*

"Sure, I know it's completely automatic, but why does it keep making resistors instead of capacitors?"

events of interest

IRE MEETINGS SUMMARY

Jan. 9-11—**8th National Symposium on Reliability and Quality Control.** Statler Hilton Hotel, Washington, D.C. No exhibits. Program: E. F. Jahr, IBM Corp., Dept. 351, Owego, N.Y.

Feb. 7-9—**3rd National Winter Convention on Military Electronics.** Ambassador Hotel, Los Angeles, Calif. IRE Business Office, 1435 La Cienega Blvd., Los Angeles 35, Calif.

NON-IRE LOCAL EVENTS

Dec. 16—Broadcast over **KPFA** (94.1 mc) Berkeley, 2:45 p.m. Equipment report: The Ampex Fineline 1200 Stereo Tape Recorder by R. S. MacCollister.

Jan. 18—**Northern California Section of the American Society of Lubrication Engineers.** Chlorinated Silicone Oils and Greases by Robert B. Stewart, Dow Corning Corp. Spenger's Fish Grotto, Berkeley, Calif. Dinner: 7:00 p.m. (social hour 6:00 p.m.), no reservation required.

IRE PAPERS CALLS

Immediate—500-word summaries for the National Symposium on Radio Frequency Interference (June 28-29; San Francisco). Send to: R. G. Davis, Technical Program Chairman, Dept. 58-25, Lockheed Missiles & Space Co., P. O. Box 504, Sunnyvale, California.

Theme for the conference will be "Design—the Answer to RFI." The development of this theme will, it is hoped, serve the following purposes: Establish some requirements for interference-free design at the circuit, equipment, and system levels; bring attention to the importance of freedom from interference as a design criterion; bring new applications in communication and control to the attention of active workers in the field; bring attention to new components and material and encourage their use in eliminating interference; and help in making the results of current efforts in interference-prediction and data collection more useful.

This is the first symposium of its kind in this area, and contributed papers are encouraged to insure full development of the theme.

Officers who have been elected to serve the San Francisco Section Professional Group chapter on Radio Frequency Interference for 1961-1962 are as follows:

Chairman: Peter F. Spencer, Filtron Company, Inc.
Vice Chairman: Robert J. Lathrop, Cook Engineering Company.
Secretary-Treasurer: Richard G. Davis, Lockheed Missiles & Space Co.

Dec. 20—500-word abstracts in triplicate for the Bay Area Symposium on Reliability and Quality Control (Monterey; May 4-5, 1962). Send to: Mr. Frank B. Durand, 553 Connemara Way, Sunnyvale, California.

Jan. 1—300-word abstracts in duplicate, for the 1962 PGHFE International Congress (Long Beach; May 3-4). Send to: John W. Senders, Technical Program Committee Chairman, Minneapolis-Honeywell Regulator Co., 2600 Ridgeway Road, Minneapolis 40, Minn.

Jan. 5—200-word abstracts for the Polytechnic Institute of Brooklyn Symposium on the Mathematical Theory of Automata (April 24-26; New York, N.Y.). Send to: Symposium Committee, Polytechnic Institute of Brooklyn, 55 Johnson St., Brooklyn 1, N.Y.

Jan. 15—500- to 1000-word abstracts for the International Symposium on Information Theory (Brussels, Belgium; Sept. 3-7, 1962). Send to: Dr. F. L. Stumpers, Philips Research Laboratories, Eindhoven, Netherlands.

Feb. 1—750-word abstracts and biographical sketch of author in triplicate for the 6th National Convention on Military Electronics (Washington, D.C.; June 25-27, 1962). Send to: John J. Slattery, Martin Co., Baltimore 3, Md.

Peter Spencer, chairman, PGRFI

Robert Lathrop, vice chairman, PGRFI

Richard G. Davis, sec'y-treasurer, PGRFI

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PHOENIX, 641 E. Missouri Ave. • Phone: CR 4-5431 • TWX: PX 483
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the section

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(Continued on page 38)

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SQUARE WAVES
and PULSES

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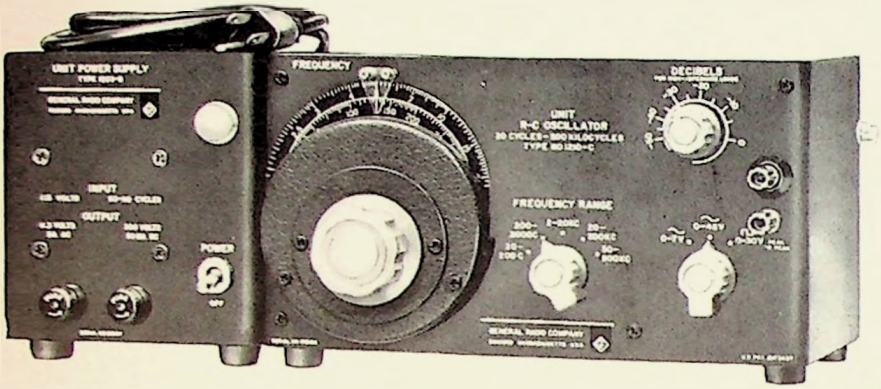

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- Wide Frequency Range: 20 cps to 500 kc in 5 ranges, either sine or square waves. Calibration accuracy: ±3%
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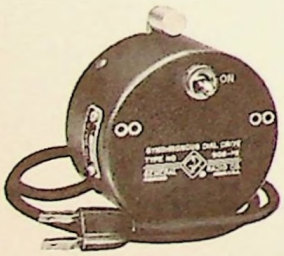
(for loads of 10 KΩ and higher). Maximum open-circuit output is 45v. Output constant within ±1 db from 200c to 150 kc; distortion less than 5% from 200c to 200 kc; hum down 50 db.

Square Waves
0 to 30v peak to peak; rise time about ⅓ μsec; overshoot approximately 1%, hum down 60 db.



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Type 1217-A Unit Pulser, $250

requires Unit Power Supply, $50

- **Repetition Rate:** 30 cps, 60 cps; 100 cps to 100 kc in X1, X2, and X5 steps; with external drive (1210-C Oscillator or equivalent), continuous from 15 cps to 100 kc. (minimum external drive is 10v to 10 kc, 25v to 100 kc)
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- **Pulse Shape:** Rise time 0.05 μsec; decay time 0.15 μsec. Pulse top is flat to within 5% of maximum value.
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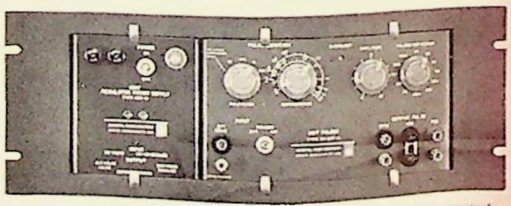

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