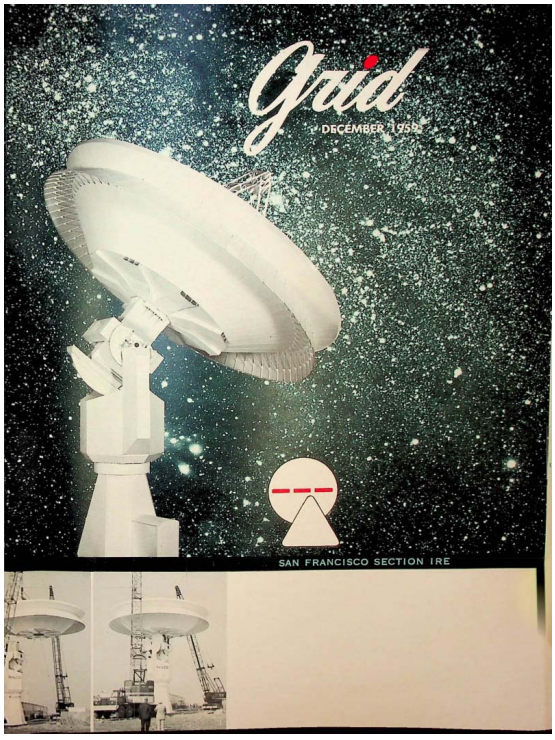
EDITOR'S PROFILE of this issue

from a historical perspective …

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



December, 1959:

Cover: This Philco WDL 3-axis 60-foot dish is one of several built for Lockheed for communications with satellites. More details on page 5.

Page 10: Five of the seven IRE honor awards this year went to present/past SF Section members; one went to Prof. Allen Peterson, my undergrad advisor. Of 76 new IRE Fellows, 8 are from our Section, including Stanford's Prof. John Linvill (one of my instructors) and Prof. David Tuttle (who was the resident faculty member at my freshman house). I got to know his daughter Jacqueline, then in high school. Photos are on page 12.

Page 24: Jay Last of Fairchild (one of Shockley's "traitorous eight") speaks to the Electronic Computers group, describing a 20 Mc (MHz) flipflop made entirely out of silicon and fabricated from a wafer measuring 100 mils (2.5 mm) on a side. The new integrated device is mounted in a TO-9 case. This is likely the first IRE meeting to describe a working IC. By comparison, today's wafers are 300 mm in diameter.

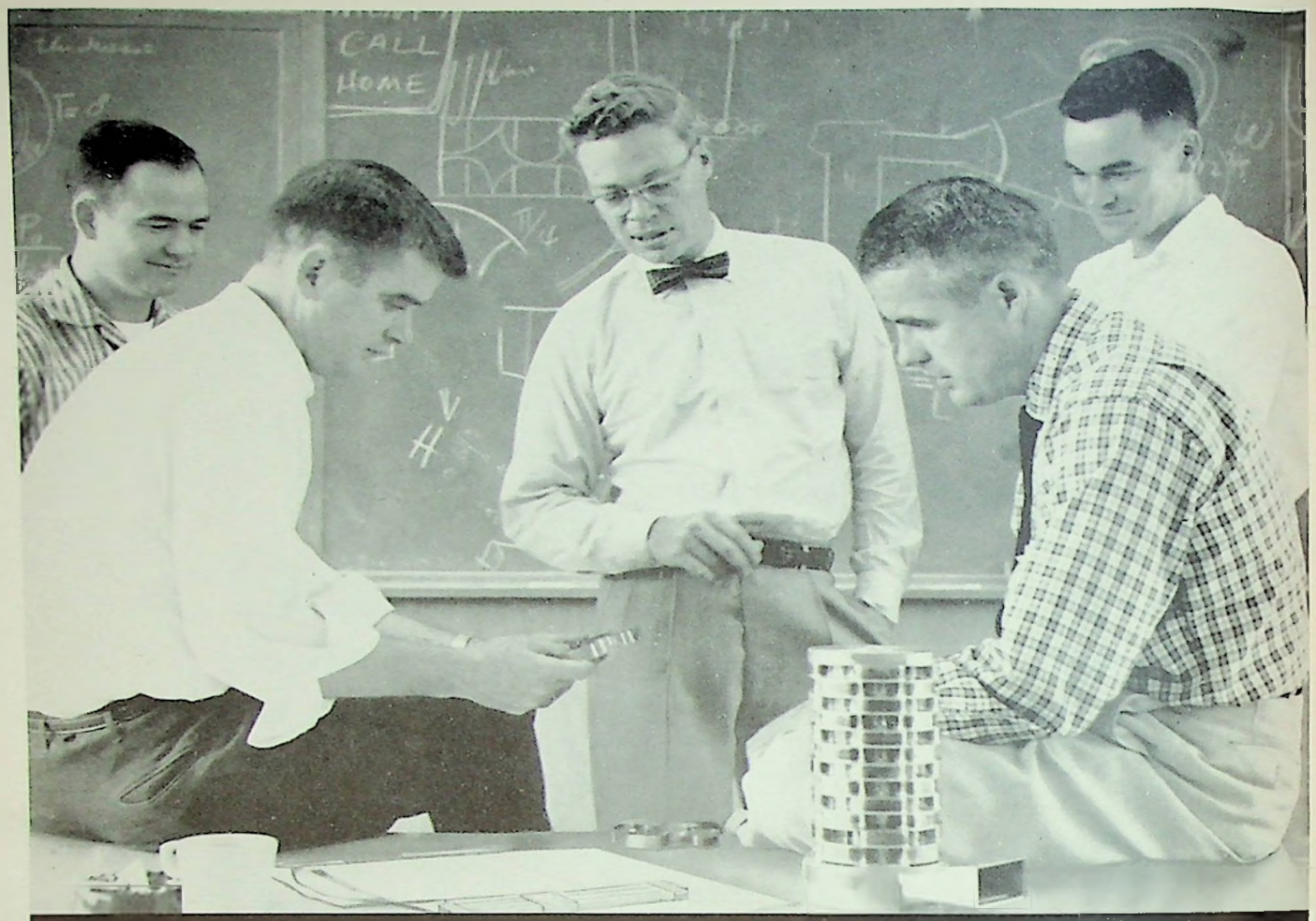
Page 28: The New Almaden Museum is taking shape under the Perham Foundation. Douglas Perham (see November issue, page 12) is president, with Ralph Heintz (founder of Heintz & Kaufman, an early HF radio company and local Ham) as vice president. Leonard Fuller is a director. Leonard is the grandfather of a friend of mine who showed me a box of "goodies" left to him from Fuller's days as Chief Engineer of Federal Telegraph, our first electronics company (started in 1909). Fuller was Stanford's first EE PhD in 1919, and went on to head up UC-Berkeley's engineering school. He offered a large magnet from one of Federal's arc transmitters to Earnest Lawrence to fabricate a 42-inch cyclotron, leading to 6 Nobel prizes by 1960 for UC-B researchers. From that box of goodies we retrieved two Audion vacuum tubes made in about 1913 (see photo of one in my profile of the November issue).

Page 36: Among engineers moving into the Bay Area, David Leeson arrives at Stanford. He became a licensed amateur (Ham) operator in 1952 (now W6NL). In 1968 he founds California Microwave, goes on to be an IEEE Fellow, and raced cars for several years (won two national championships). He's trustee of Stanford's amateur station W6YX, and has several lectures and articles on the history of local technology. Tom Perkins, an EE from MIT, joins the IRE as a new member, working at HP, where he heads up the research department in 1963. He goes on in 1973 to found our first venture capital firm, Kleiner-Perkins, on Sand Hill Road. He served as chairman of Tandem Computers, where I worked for 17 years. He also served as chair of Genentech, the world's first genetic engineering company (funded by his VC firm).

Grid

DECEMBER 1959

SAN FRANCISCO SECTION IRE



A few of Varian's large research team on wave tubes confer on new design features.

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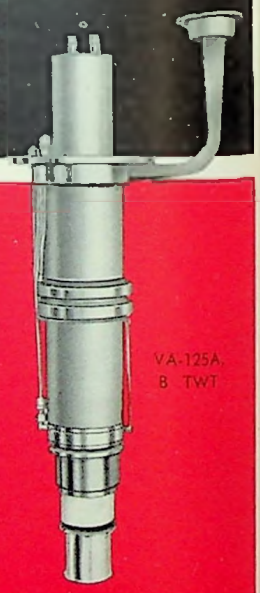

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SAN FRANCISCO SECTION

Grid

VOLUME 6 DECEMBER 1959 NUMBER 4

(Continued on page 8)

IN THIS ISSUE

ABOUT THE COVER

Same Stars, New Wise Men?

At the beginning of Century No. 20.5, men in Palo Alto and around the world are looking into the skies in this new way. For example, Philco engineers in the Western Development Laboratories, calling on the assistance of Moore Dry Dock Co. for the ironwork, produced the three-axis 60-ft antenna shown on the cover. The first of a number of similar units, it was built for Lockheed's missiles and space division.

It stands 80 ft high, weighs more than 130 tons, and is driven in azimuth, declination, and cross elevation by three 90-hp hydraulic motors controlled remotely by servo valves.

Intended for the reception of telemetered data from satellites and destined for one of the world-wide tracking stations, the antenna has a solid aluminum dish-surface accurate to 0.065 in. The dish, counterbalanced with 35 tons of lead, has an aerodynamic wind spoiler, wind-tunnel tested at Cal Tech, mounted on the rear surface. The assembly responds to tracking commands to an accuracy of plus-or-minus 2 milliradians in winds up to 60 mph, maintains mechanical effectiveness up to 140.

So much for the details. In view of the forthcoming season of the year we might express the wish that all channels transmit the message, Peace on Earth, Goodwill toward All Men.

The GRID is published by the San Francisco Section of the Institute of Radio Engineers monthly except for July and August.

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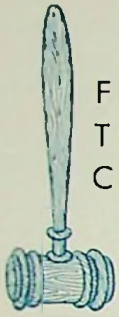

FROM THE CHAIRS

The San Francisco Look

Pete Lacy

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The new constitution of the IRE states "Its objects shall be scientific, literary, and educational. Its aims shall include the advancement of the theory and practice of electronics, radio, allied branches of engineering, and of the related arts and sciences, their application to human needs, and the maintenance of high professional standards among its members. Among the means to this end shall be the holding of meetings for the reading and discussion of professional papers and the publication of papers, discussions, communications, and such other matters as may be appropriate for the fulfillment of its objects."

In furtherance of these objectives, the following local activities are sponsored by the IRE: technical meetings (2 to 3 per week during season), social and general gatherings, the **Grid**, college paper competition, Future Engineers Show for high school students, and WESCON. In addition, the local section of the IRE works with other engineering societies and educational institutions on activities affecting the IRE membership and the electronics industry.

Carrying out this local IRE program requires three ingredients: participation and encouragement of the membership, availability of speakers for meetings, and money. Of the first, little need be said as it is abundant and can be best judged in terms of the second ingredient: availability of speakers.

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The IRE funds are budgeted in the following manner: 20 per cent to subsection and professional group chapters, 22 per cent administrative, 13 per cent courtesy, and 14 per cent external relations. Another item usually taken from these funds is our support of the "San Francisco Engineer," and at the current cost rate, this would add 56 per cent to reach an unseemly total of 125 per cent.

This means supplementing IRE fund support from other sources. The matter of IRE participation was carefully considered during the recent reorganization of the "Engineer." Howard Hansen, IRE representative on the board of directors, will watch this situation carefully with emphasis on the importance of reaching a self-supporting status like that of the **Grid**.

The present financial picture is quite satisfactory even though the current budget expenses may exceed the predicted income when the amount from the WESCON fund becomes available this month. Then some trimming of expenses may have to be accomplished as well as a readjustment of expense loads on the three finance sources. Thus, the operation over current fiscal year ending June 30, 1960, is expected to break even and not require use of the current reserves which amount to approximately 30 per cent of a year's operating expense.

The November 23 meeting of the Section executive committee approved an interim operating plan for administration including the following: overall policy determined by executive committee, operating committee to administer policy plans, and program planning by the professional groups committee. The policy matters that will be laid down by EXCOM include: budget, programming, publications, and awards. These policies will be determined at the beginning of the year and reviewed at the middle and end of the year.

Pete Lacy

—P. D. Lacy, treasurer, SFS

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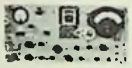

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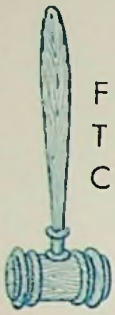

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Hugh Gray (Photography) Hugh Gray Co., San Francisco

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D. J. Angelakos, Cory Hall, University of California, Berkeley 4

MEETING CALENDAR

PROFESSIONAL GROUPS

Communications Systems — 8:15 P.M. • Wednesday, Jan. 27

"Propagational Variations Affecting Scatter Communications"
Speaker: Dr. H. Kummer, Hughes Aircraft Company, Culver City, Calif.
Place: Stanford University (details later)

Electronic Computers — 8:00 P.M. • Tuesday, Dec. 15

"Circuit Philosophy and Design for the New ILLIAC Computer"
Speaker: Dr. Wolfgang J. Poppelbaum, Digital Computer Laboratory, University of Illinois, Urbana, Ill.
Place: Stanford Village Auditorium, Stanford Research Institute, 333 Ravenswood Avenue, Menlo Park
Dinner: Informal Meet-the-Speaker, 6:00 P.M.; Hal's Restaurant, 4085 El Camino Way, Palo Alto
(No reservation required)

Engineering Writing & Speech — 8:00 P.M. • Tuesday, Jan. 19

"A New Approach to the News"
Speaker: Norman Tipton of "Electronic News" magazine
Place: WESCON office, 60 West 41st Avenue, San Mateo
Dinner: Villa Chartier, 4060 South El Camino Real, San Mateo
(No reservation necessary; ask for PGEWS table)

Military Electronics — 8:00 P.M. • Tuesday, Jan. 5

Classified (SECRET)
"ARDC Command Presentation"
Speaker: Col. Carlo Tosti, special assistant to Lt. Gen. B. Schriever
Place: Cubberley Auditorium, Stanford University, Palo Alto
Security clearance forms: Mrs. Jennings, WHitecliff 8-1434

Military Electronics — 8:00 P.M. • Thursday, Jan. 7

Unclassified
"ARDC Command Presentation"
Speaker: Col. Carlo Tosti, special assistant to Lt. Gen. B. Schriever
Place: Auditorium, Santa Clara University

Space Electronics & Telemetry — 7:30 P.M. • Tuesday, Dec. 15

A popular exposition of a topic relating to space exploration
Speaker: Dr. Walter La Berge, director of systems engineering, Philco Western Development Laboratories, Palo Alto
Dinner: Villa Chartier, 4060 South El Camino Real, San Mateo
Reservations: Jolene Bradfield, REgent 9-4321, Extension 26632, on or before December 11
(Traditional December family meeting—includes musical program)

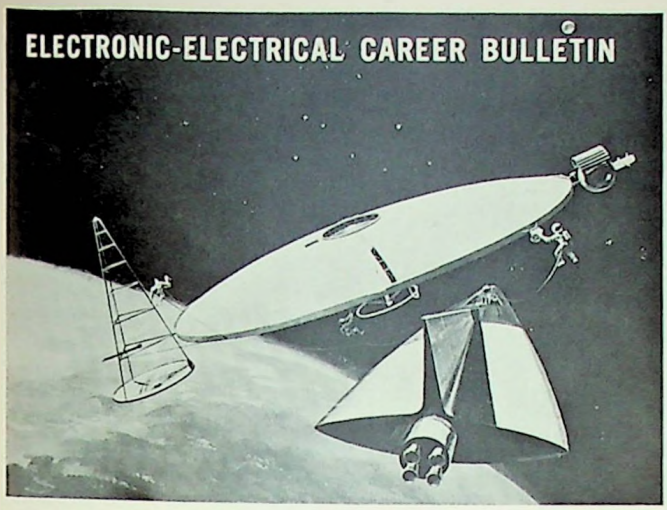
Space Electronics & Telemetry — • Tuesday, Jan. 19

Details to be announced

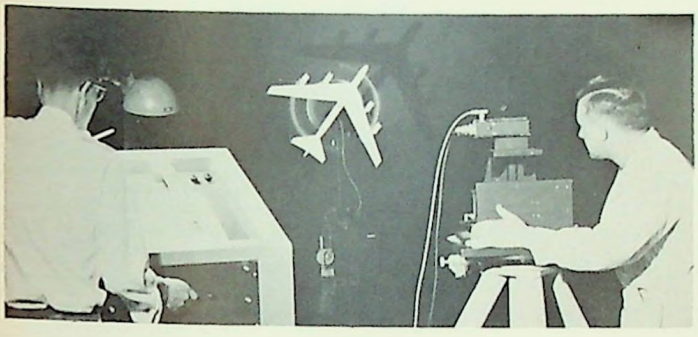
PGRQC, PGPT, and PGMIL plan a series of four joint meetings on microminiaturization in February.

CHRONOLOGICAL RECAP

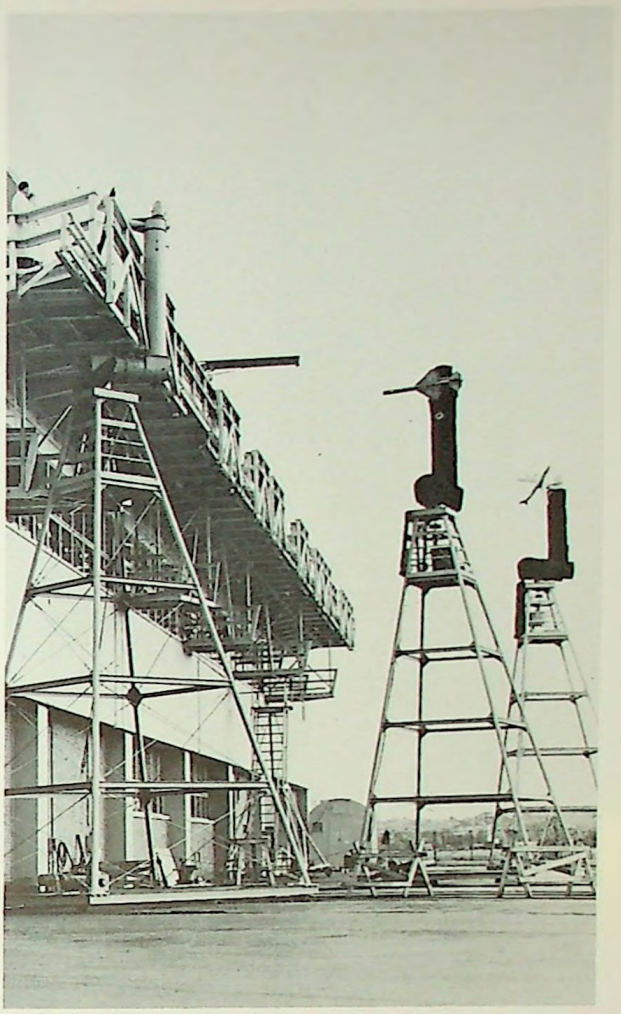
December 15—Electronic Computers, Space Electronics & Telemetry
January 5—Military Electronics
January 7—Military Electronics
January 19—Engineering Writing & Speech, Space Electronics & Telemetry
January 27—Communications Systems



MARS VEHICLE. Drawing, based on Boeing study, of space vehicle designed for launching from orbiting platform for reconnaissance flight to Mars and return. Lunar, orbital and interplanetary system studies, and expanding programs such as the advanced Minuteman solid-propellant ICBM, are typical of challenging, long-range assignments Boeing offers electronic-electrical engineers.



DARK TUNNEL. View in 100-foot dark tunnel, part of extensive Boeing infrared research and development facilities. Boeing investigations include use of infrared, visible and ultra-violet techniques for use in communication, navigation, detection and guidance at altitudes above tropopause. IR systems, inertial navigation, electrical power systems for satellites, shockwave radiation and refraction and irdome heating are other areas of assignments open at Boeing.



ANTENNA PATTERN RANGE, with movable towers capable of handling models up to 1000 pounds. Boeing has openings in ECM antenna development, and in gas, solid and liquid dielectric research, as well as large-aperture antennas for ASMs, orbital vehicles and airborne warning systems. Other openings are available in instrumentation, missile guidance and control.

SEATTLE area, boating capital of U.S., offers world-famous recreational facilities. Fresh and salt water boating and fishing are only one hour from dramatic snow-capped mountains renowned for six-months-a-year skiing. Mild year-round climate. Excellent schools and universities, cultural activities, modern housing and shopping centers. Wonderful Western living for the whole family!

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MEETING AHEAD

ARDC Plans

The Air Research and Development Command will send Col. Carlo R. Tosti to the Bay Area for two presentations available to IRE members. Col. Tosti will speak on the present status of Air Force development programs, where the Air Force is going and what the R&D plans are for the future.

The ARDC presentation is scheduled for January 5 and 7. On January 5 the presentation is classified SECRET and will be at 8 P.M., Cubberley Auditorium, Stanford University. Clearance forms must be secured from the ARDC liaison office, 1176 Los Altos Avenue, Los Altos. An unclassified presentation will be given January 7 at the Santa Clara University Auditorium. Students and wives are cordially invited to attend the latter.

Colonel Carlo Tosti is a native of Buffalo, New York, and attended grammar school and high school there. He graduated from the Virginia Military Institute in 1942, receiving a BSEE. In 1946, he was graduated with a master's degree in engineering administration from Stanford University.

From his entrance into the service in 1942 to 1950, Colonel Tosti worked as a design and development officer in the fields of aircraft engines and guided missiles. From 1950 to 1954, he was assigned to Air Force Headquarters and was associated with coordination of the over-all Air Force research and development program.

Since August of 1954, Colonel Tosti has been assigned to the Headquarters of the Air Research and Development Command. He is special assistant to Lt. Gen. B. Schriever.

MEETING AHEAD

Speedy Illiac

A meeting having more than usual potential importance to computer people has been scheduled for December by PGEC. See the Calendar, page 8, for other details. Dr. Wolfgang J. Poppelbaum of the University of Illinois will describe one of the very few asynchronous machines, also one of the country's most rapid computers — the ILLIAC.

ELECTION NEWS

PGEC Readjusts

With the transfer to the East of Arthur Critchlow, vice chairman of the PGEC, a postcard election was held in November. Dr. Richard I. Tanaka, secretary-treasurer, was elected to the vacated vice-chairman spot and Gardiner L. Tucker was elected secretary-treasurer.

Carlo R. Tosti

Tucker is presently resident manager of the IBM Research Laboratories in San Jose. He received the AB degree in physics and mathematics in 1947 and the PhD in physics in 1952, from Columbia University. Tucker has been with IBM since 1952. Until 1954, he was a research physicist at the IBM Watson Labs in New York City. From 1954 to 1957, he was manager of semiconductor and transistor research at the research laboratories in Poughkeepsie, N. Y. From 1957 to 1959, he was manager of the IBM research planning staff. In July, 1959, he moved to the San Jose laboratories.

Gardiner L. Tucker

EXCOM

Microminutes

A thumbnail sketch of the proceedings of the San Francisco Section executive committee meeting of November 23 follows:

Kudos. Actual awards and Fellow elections are reported elsewhere in this issue. They were reported by Don Harris and a unanimous motion of commendation was adopted for the work of the committee: Don Harris, Bill Eitel, and John V. N. Granger.

Modus operandi. Following a report by Vice Chairman Don Dunn, the section reorganization plan with its new operating-committee base was accepted as the way of life pending detailed codification in a new set of by-laws. A committee to study and propose the latter was appointed: Pete Lacy, Bill Edson, and Al Morris.

Dichotomy. The recently merged arrangements and public relations committee was re-split into separate entities.

Exchequer. A tentative budget was advanced, discussed, and accepted—to be presented for final approval in detailed form by Treasurer Lacy.

Amanuensis. Grace Pacak was introduced as the new IRE executive secretary and head of the San Mateo office. A current report on the Section service status in the office was given by Secretary Stan Kaisel.

INSTITUTE AWARDS

Honors to Many

National IRE esteem has been directed toward a large number of members of the San Francisco Section in the annual announcement of Institute awards and Fellow elections. Out of the eight IRE honor awards normally made during the year, five went to present or past members of the Section or nominees of the Section's awards committee, and one—The Vladimir K. Zworykin Television Prize — was not awarded this year. Out of 76 members raised to Fellow grade, eight were in the San Francisco Section. In addition, the newly elected Seventh Region director is a Section member.

Fellows are as follows: Paul W. Crapuchettes, Litton Industries, San Carlos, (for contributions to microwave tube development); R. A. Helliwell, Stanford University, (ionospheric radio propagation); J. G. Linvill, Stanford, (network theory and transistor circuits); Theodore Moreno, Varian Associates, (microwave electronics); T. H. Morrin, Stanford Research Institute, (administration of research in electronics); Walter T. Selsted, Ampex Corp., (magnetic recording); D. F. Tuttle, Jr., Stanford, (network theory education); and V. H. Rumsey, University of California, (antenna theory and practice).

In the awards category, the Browder J. Thompson Memorial Prize Award was made to J. W. Gewartowski for his paper, "Velocity and Current Distributions in the Spent Beam of the Backward-Wave Oscillator," published in the Oc-

(Continued on page 12)

How a 150 watt triode 25 years ago led to super power klystrons today

In 1934, two radio amateurs, unhappy with existing final amplifier tubes, formed a company to make their own. Their first tube, the Eimac 150T, established a new standard of electron tube performance and reliability.

Other important Eimac tube developments were:

150T—The first Eimac tube in 1934, was designed primarily for the amateur and established Eimac tube characteristics for the future—clean, hard vacuums, simplified design, lower driving power, high mutual conductance and superior overload capability.

450T—Only two years later practically every major airline was using Eimac tubes. The 450T fulfilled the critical needs of aviation and was first choice in ground-to-air communications.

3X2500A3—By the time Major Armstrong had won his battle for FM, Eimac internal anode triodes were in nearly every experimental FM broadcast station. In 1945 the external anode triode 3X2500A3 was introduced and used in the world's most powerful FM transmitter.

304T—In 1940 Eimac introduced multi-unit triodes—which operate efficiently up to 200mc, and as high as 10 times rated voltage. The 304T, four triodes in one, is still acclaimed as a top linear amplifier tube.

VT 127—In 1939, Eimac 100T triodes powered the first Navy radar, prototype of the first radar to see action in the Pacific. Eimac's 15E met the higher frequency operation needs of airborne radar and made possible 26,000 Navy radar sets. Many of the renowned VT series tubes were other Eimac contributions.

4-125A Family (5 tubes)—In 1945 Eimac introduced the 4-125A, first radial-beam tetrode. Today, Eimac's five internal anode tetrodes are famous for low driving power requirements, low grid emission, low gridplate capacitances, minimized neutralization requirements and dependable VHF performance.

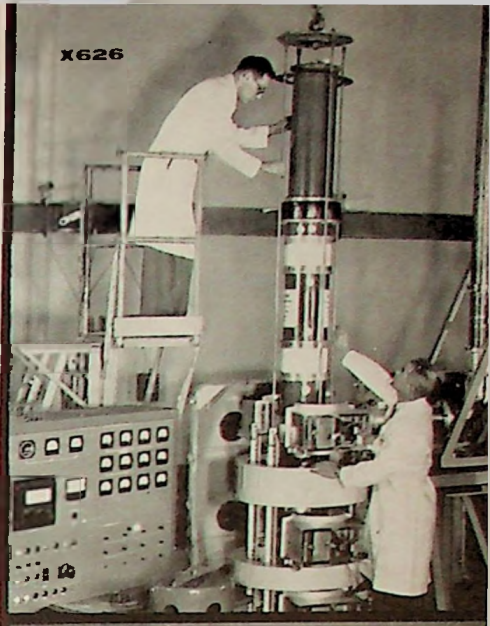
4X150A—Compact, rugged external anode radial-beam tetrodes were introduced by Eimac in 1946. The 4X500A and 4X150A led to smaller, high power, high frequency equipment and coaxial cable circuits.

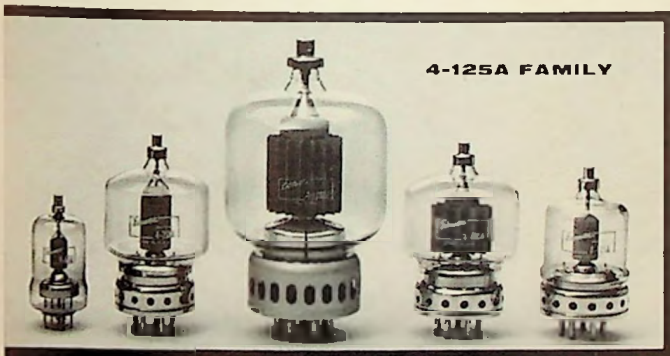
Amplifier Klystron—Eimac saw the shortcomings of grid tubes for UHF in 1948, started developing amplifier klystrons. Today Eimac klystrons are the most widely used tubes in tropospheric communications.

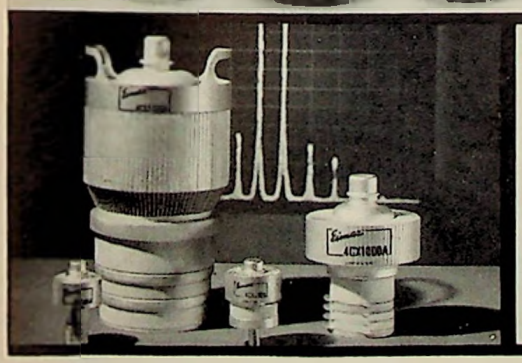
4CX300A, 4CX250B, 4CX1000A, 4CX5000A—Today, over 40 Eimac tubes feature ceramic envelopes. More compact than glass, these advanced tubes can withstand thermal and physical shock never before possible.

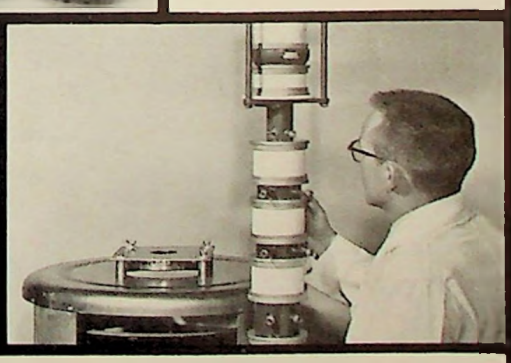
X626—Super power, 1.25 megawatts of long-pulse power, at UHF is now available with the Eimac X626. This tube powered the record 56,000,000 mile radar contact with Venus.

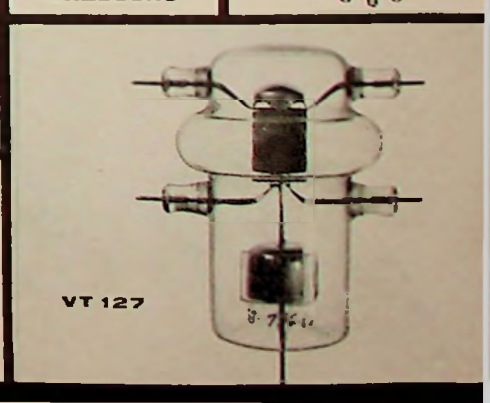
TWT—Now, microwave in the form of ceramic traveling wave tubes and reflex klystrons. Eimac is engaged in the development and manufacture of new electron devices to propagate the uncrowded spectrum at Super High Frequencies and above.











The dependable tubes of yesteryear have not been forgotten. They are constantly improved. Most of the oldtimers on review here are still available and many are replacements for originals that have finally given in after years and years of service.

Eimac **EITEL-McCULLOUGH, INC.,** San Carlos, California

Paul W. Crapuchettes

R. A. Helliwell

J. G. Linvill

MORE AWARDS

tober 1958 "Transactions of PGED." Now a member of the Northern New Jersey Section, he did the work on which the paper was based while at Stanford and was an SFS nominee.

The W. R. G. Baker Award went to E. J. Nalos for his paper, "A Hybrid Type Traveling-Wave Tube for High-Power Pulsed Amplification," in the July 1958 "Transactions of PGED." This work was done at the General Electric Microwave Laboratory in Palo Alto. Nalos is now a resident of Zurich, Switzerland.

The Founders Award was given to Haraden Pratt, a native San Franciscan and an SFS nominee. The Harry Diamond Memorial Award winner was K. A. Norton of the National Bureau of Standards in Boulder, Colo., another non-member Section nominee. The remaining IRE honor is the Seventh Region Achievement Award, previously announced during WESCON, and presented to Dr. Allen M. Peterson of Stanford University and Stanford Research Institute.

In the annual elections, which made Dr. R. L. McFarlan, consultant of Chestnut Hill, Mass., president for 1960; C. W. Carnahan of Varian Associates became Seventh Region Director.

Theodore Moreno

MEETING REVIEW

Visitor From Japan

On November 24, the Professional Group on Electronic Computers was honored to have as speaker the inventor

(Continued on page 14)

V. H. Rumsey

T. H. Morrin

Walter T. Selsted

D. F. Tuttle, Jr.

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Estrada Fanjul, right, greets the speakers for the October PGPT meeting: Tom Smith, Sidney Simon, and Gene Dodge

MORE JAPAN

of the parametron, Professor Eiichi Goto from the University of Tokyo, Tokyo, Japan.

Goto designed and built the first parametron computer, PC-1, at the University of Tokyo. A second computer, PC-2, is nearing completion at the university. This parametron computer uses a 6-mc pump frequency at an effective clock rate of 100-kc. This machine, with a 200,000-bit memory, claims an addition time of 14 microseconds and a multiplication time of 300 microseconds.

All the computers now in production in Japan use the parametron device. The parametron is a non-linear inductor in a resonant circuit. The resonant circuit oscillates at a frequency half that of the exciting or pump frequency. Phase of the oscillation determines whether the bit is a 1 or 0. The logic which determines the phase of oscillation is of the majority type; that is, the phase of the majority of inputs determines the phase of oscillations.

Another topic of Goto's talk was work with Esaki tunnel diodes. (Dr. Leo Esaki of Sony Corporation in Japan invented the tunnel diode). Goto has developed a circuit using tunnel diode pairs (two tunnel diodes in series) which is logically similar to the parametron, the difference being that the parametrons are controlled by the phase of a-c inputs and the tunnel diode pairs are controlled by the polarity of d-c inputs. Here, again, majority logic is employed. As soon as sufficient quantities of tunnel diodes can be produced, Goto is going to build a computer with a speed of 30-mc. With further improvements, he and his associates are seeking to develop one with speeds of 100-mc.

—J. A. Boysen

MEETING REVIEW

Saving the Surface

The October meeting of PGPT was attended by some 30 people who heard Gene Dodge, Sidney Simon, and Tom Smith discuss various production finishes. First, Gene Dodge, president of Tepco Co., discussed cleaning techniques for various types of metals and the attributes of various plating methods. In addition he covered the available finishes for aluminum such as anodizing, colored anodizing, and corrosion-resistent finishes of the Iridite type. He also discussed special types of coating for the electronic industry such as the gold-over-silver system and the rhodium-over-silver system for components which much carry r-f currents. Electroless plating techniques such as the Kanigen process were discussed. Methods for plating on aluminum using zincate process or the electroless Ni process were also covered.

Sidney Simon, chief chemist, Rhino Tech Co. and Technical Coating Corp., then discussed various attributes of paints as protective coating. Both speakers mentioned the fact that plating finishes and paint finishes are competitive with one another as a means for protecting base metals, and in spite of some friendly rivalry both speakers ended up agreeing that each system has its place.

Simon pointed out some of the less common finishes such as temperature-indicating paints, protective coatings for printed circuits, and protective coatings for metals at high temperature. He further discussed the basic types of film formers and the attributes of each type. He then followed with a discussion of the basic types of pigments and the

(Continued on page 16)

NEW, direct-reading, transistorized

302A WAVE ANALYZER

Quick summary:

Covers 20 cps to 50 KC. Completely transistorized, no warm-up period. Ac powered, 3 watts consumption, hum free; or may be battery operated 18 or 28 v. Very sharp acceptance circuits; new operating ease without tedious lineup. Extremely compact, light weight.

SPECIFICATIONS

Frequency Range: 20 cps to 50 KC

Voltage Range: 10 μv to 300 v, 15 ranges

Warm-up Time: None

Voltage Accuracy: ± 5% of full scale

Residual Mod. & Hum: More than 75 db down

Intermediate Freq. Rejection: At least 75 db rejection

Selectivity: ± 3.5 cycle b.w., at least 3 db down
± 25 cycle b.w., at least 50 db down
± 70 cycle b.w., at least 80 db down

Input Impedance: 100,000 ohms on 4 most sensitive ranges; 1 megohm on others

Selected Frequency Output: 1 v open circuit. Response ± 1 db full range

B.F.O. Output: 1 v open circuit; output level control. Freq. response ± 1 db, full range. Output impedance approx. 600 ohms.

Auto. Freq. Control: ± 100 cycles holdin minimum

Price: $1,475.00 (cabinet); $1,460.00 (rack mount)

Data subject to change without notice.
Prices f.o.b. factory

Engineers have already termed the compact, transistorized hp 302A the most significant advance in wave analyzers in 10 years. Without time-consuming delay for warmup or calibration, the 302A instantly separates an input into its fundamental, harmonics and intermodulation products so that each may be examined individually. An AFC simplifies finding and holding a signal despite very sharp acceptance circuits.

Model 302A is highly useful in telemetering, carrier and vibration system work as well as audio applications. Ask your hp representative for a demonstration and specifications.

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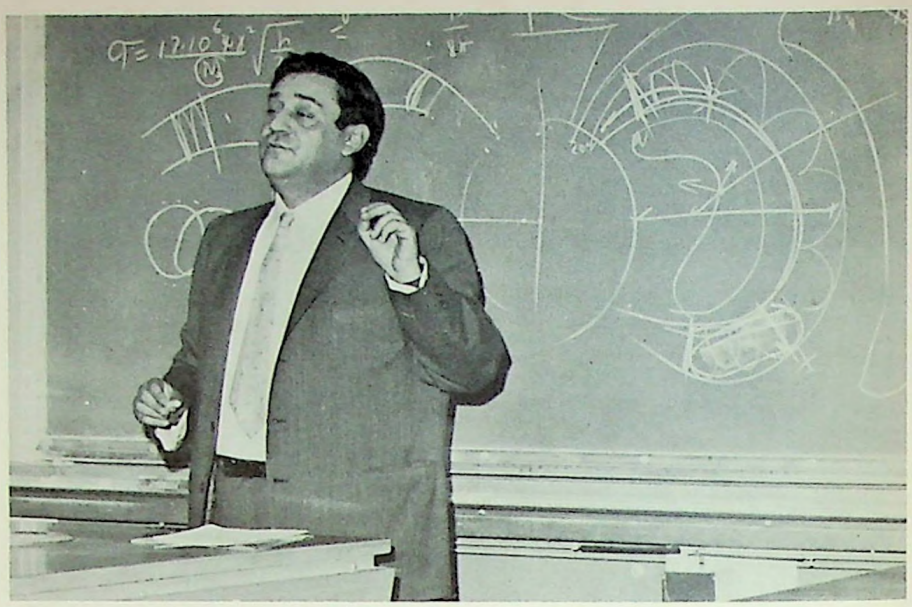
hp 302A easily measures small signals on noisy circuits



N. C. Christofilos might seem to be asking for a diminuendo from the violin section except for the flute music on the blackboard which indicates that he is speaking about the Argus experiment at the November PGAP/PGSET meeting

MORE SURFACE

uses and the effects of solvents and additives in paints.

The final speaker of the evening was Tom Smith, chief chemist, Doidge-Koren Co. He introduced a movie which showed the steps involved in the development of the Doidge-Koren Co. water-soluble-paint resin.

A lively 45 minutes of discussion followed. Considerable interest was shown in both plating processes and recent developments of paint technology.

—*George F. Reyling*

MEETING REVIEW

The Argus Experiment

The "Argus" experiment, a study of man-made radiation in space, was described to about one hundred scientific and technical attendees at a recent meeting by N. C. Christofilos, the man who first proposed the experiment. The talk, presented at Stanford University on November 10, was sponsored jointly by the Professional Groups on Antennas & Propagation and on Space Electronics & Telemetry.

Christofilos, who is now affiliated with the Lawrence Radiation Laboratory of the University of California, first outlined the events leading up to general scientific appreciation of the importance and feasibility of the Argus experiment. As originally proposed, artificially created relativistic electrons were to be released in the upper atmosphere, where they would be trapped by the "magnetic bottle" and "magnetic mirror" properties of the earth's magnetic field. Thus, by using vast regions of space for a laboratory, it was proposed by Christofilos that it would be possible to study important geophysical phenomena (such as aurorae, the properties of the ionosphere, the geometry of the earth's magnetic field, and the density and other characteristics of the outer regions of the earth's atmosphere), as well as certain atomic and nuclear phenomena related to particle accelerators and the study of controlled nuclear fusion.

In the first paper on the Argus experiment, Christofilos proposed that a small A-bomb be exploded at great height to provide the relativistic electrons. From theoretical considerations it appeared that one kiloton bomb would produce a sufficient number of particles to form a shell of radiation around the earth of sufficient intensity to be measured by satellite-borne counters. The artificial radiation belt was expected to endure for many days.

It is interesting that these proposals were made some months prior to the discovery by Van Allen of the natural radiation that is trapped in the earth's outer atmosphere by the magnetic field. With the discovery of the Van Allen belts, however, added emphasis was given to the importance of a controlled man-made experiment, and only four months after the decision was made that such an experiment should be undertaken, actual tests got under way.

Three A-bombs were carried aloft by high altitude rockets on August 27, August 30, and September 6, 1958. The rockets were fired from on board a ship, the Norton Sound, in the South Atlantic. A U. S. satellite, Explorer IV, was instrumented to measure the artificially

(Continued on page 18)

MORE ARGUS

created radiation shell. Other high-altitude rockets were fired to measure the radiation belts. A world-wide network of tracking and measuring stations was set up to record various effects of the artificial radiation including the man-made auroral displays created both at the launching point and at the magnetic conjugate point near the Azores Islands.

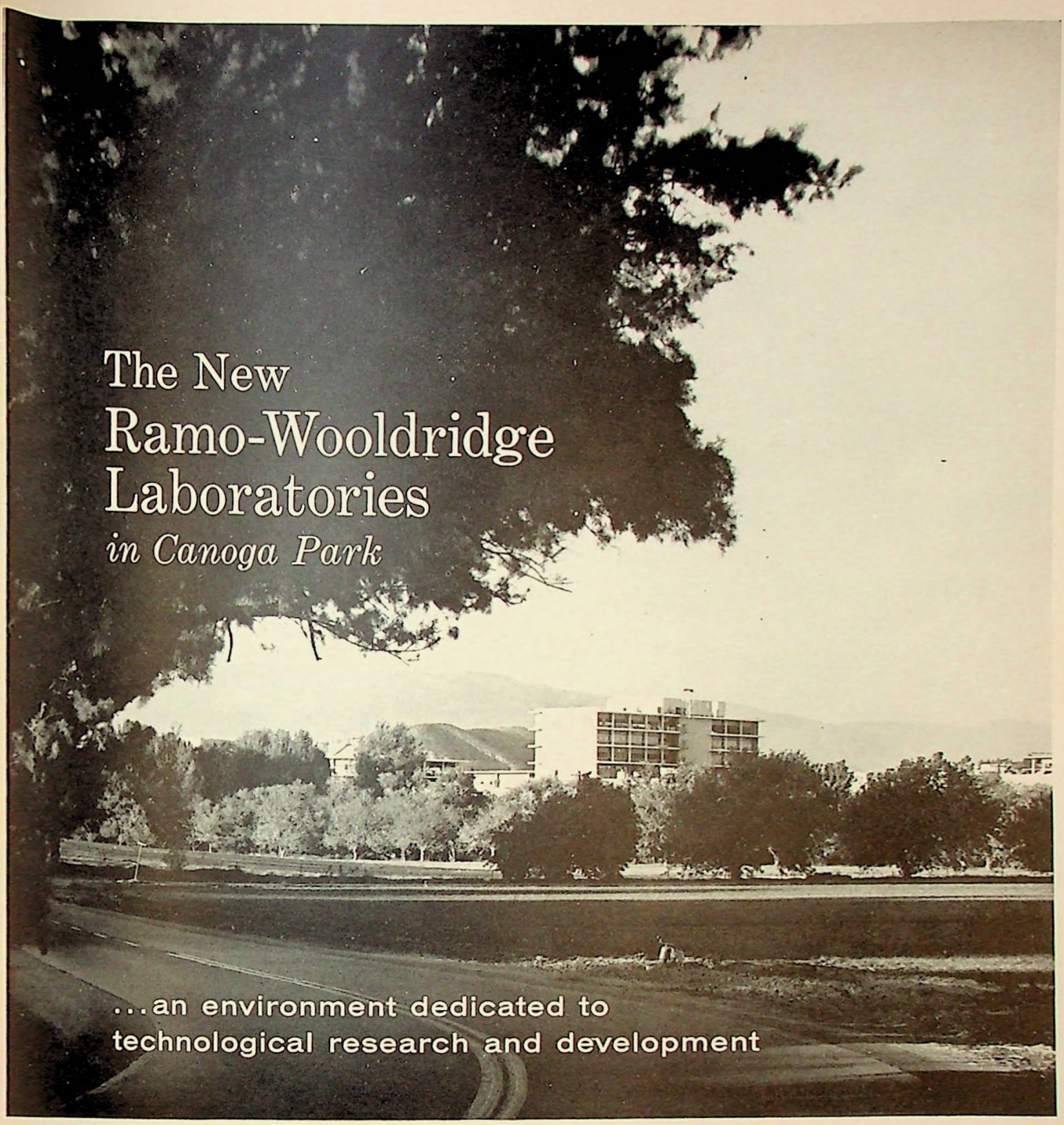
Dr. Herbert York, then chief scientist of the Advanced Research Projects Agency, was responsible for coordinating the vast effort involved in conducting these extensive experiments only four months after the initial decision was made. The radio and radar measurements of the man-made aurora, as well as other electromagnetic measurements, were under the direction of Dr. A. M. Peterson of the Stanford Research Institute. Dozens of other scientists were also involved.

The results of the tests can be considered very successful, from several points of view. First of all, most of the expected phenomena took place, such as: (1) the formation of visual and radar aurorae at the bomb site and at the magnetic conjugate point in the Azores; (2) the production of a shell of radiation which completely circled the globe within an hour; and (3) the stability of the shell, which lasted many days. But of even greater significance is the fact that the precise intensities, decay times, and shell stabilities could not be predicted, and only from the results of the experiment is it possible to reach important new conclusions about the earth's outer atmosphere and the behavior of relativistic particles trapped therein.

Christofilos concluded his very interesting presentation by predicting how such experiments might be conducted in the future without the use of bombs, but by employing satellite-borne devices to release "tracer" radiation which would then be tracked to study the characteristics of radiation in space.

Christofilos, while he was born in Boston, Mass., spent his youth in Athens, Greece. He is a graduate in electrical engineering, but his background in theoretical nuclear physics is self-taught. While still in Greece he discovered the principle of strong focusing, an important phenomenon in the new particle accelerators. He came to the U. S. in 1953, and for the next three years was associated with the Brookhaven National Research Institute. Since 1956 he has been at the University of California, where he is working on various problems associated with controlled nuclear fusion.

(Continued on page 20)



The new Ramo-Wooldridge Laboratories in Canoga Park, California, will provide an excellent environment for scientists and engineers engaged in technological research and development. Because of the high degree of scientific and engineering effort involved in Ramo-Wooldridge programs, technically trained people are assigned a more dominant role in the management of the organization than is customary.

The ninety-acre landscaped site, with modern buildings grouped around a central mall, contributes to the academic environment necessary for creative work. The new Laboratories will be the West Coast headquarters of Thompson Ramo Wooldridge Inc. as well as house the Ramo-Wooldridge division of TRW.

The Ramo-Wooldridge Laboratories are engaged in the broad fields of electronic systems technology, computers, and data processing. Outstanding opportunities exist for scientists and engineers.

For specific information on current openings write to Mr. D. L. Pyke.

THE RAMO-WOOLDRIDGE LABORATORIES

8433 FALLBROOK AVENUE, CANOGA PARK, CALIFORNIA

MORE ARGUS

Soon after Sputnik I, he became interested in the possibility of a controlled high-altitude radiation test, since it would involve some of the phenomena he had studied with relation to particle accelerators and controlled fusion.

—Von R. Eshleman

MEETING REVIEW

Moffett Field Day

The PGMIL was privileged to visit a portion of the NASA Ames Research Center at Moffett Field for their opening meeting of the 1959-60 season. Maurice D. White and Robert M. Barnett, Ames Research engineers, outlined some of the NASA efforts in the area of simulation of air and space flights.

One simulator was devoted to the Eggers-Long M-1 controlled re-entry configuration studies. This simulator has complete instrumentation for pilot control for re-entry bodies. Another simulator was an adaptation of the Air Force F151 fixed aerial gunnery device for visual simulation of space problems.

All Ames simulators feed into a half-million-dollar 280-amplifier analog computer through a multiplicity of interconnecting equipment.

A part of the evening session was devoted to viewing the XV-3 and X-14 research aircraft and to viewing military electronic packaging of the F-102 and F-106 fighters. The F-102 is used at Ames, with computer feedback, on adaptive autopilot studies. The F-106 computer is being used on a sample data systems study.

—Otis R. Hill

MEETING REVIEW

Keeping Them Flying

For a joint November meeting, approximately 35 members of PGPT and PGRQC assembled in the lobby of the United Air Lines maintenance base for a tour of the electrical maintenance section, arranged by W. G. Haynes. Here the group met guides, C. L. Deeming, D. D. Quante, F. C. Foley, H. Heap, K. Moe, T. Ellison, L. Sebold, and S. Wagner, who were drawn from the engineering and supervisory staff of the section.

The first impression of those who made the tour was the tremendous size of this operation—one of several located at major airports across the country. The guides explained the various sections which test communication equipment, radar, automatic pilots, and various specialized gear such as the transponders used by radar ground control for aircraft identification.

Several of the sections in the area had arranged interesting exhibits covering various phases of their specialties. One of these exhibits was an operating test setup showing the performance of the weather radar units used by United.

The problems of establishing and maintaining standards and the system of keeping track of the maintenance history of each individual unit in the airway system were described to interested parties by various guides. One feature of the solution of the problems of aircraft maintenance was the replacement in each aircraft of all units requiring test and overhaul with tested and certified units from stock. Each of these units is carefully tested—first as a unit after overhaul and repair, and finally when assembled in the aircraft.

—George F. Reyling

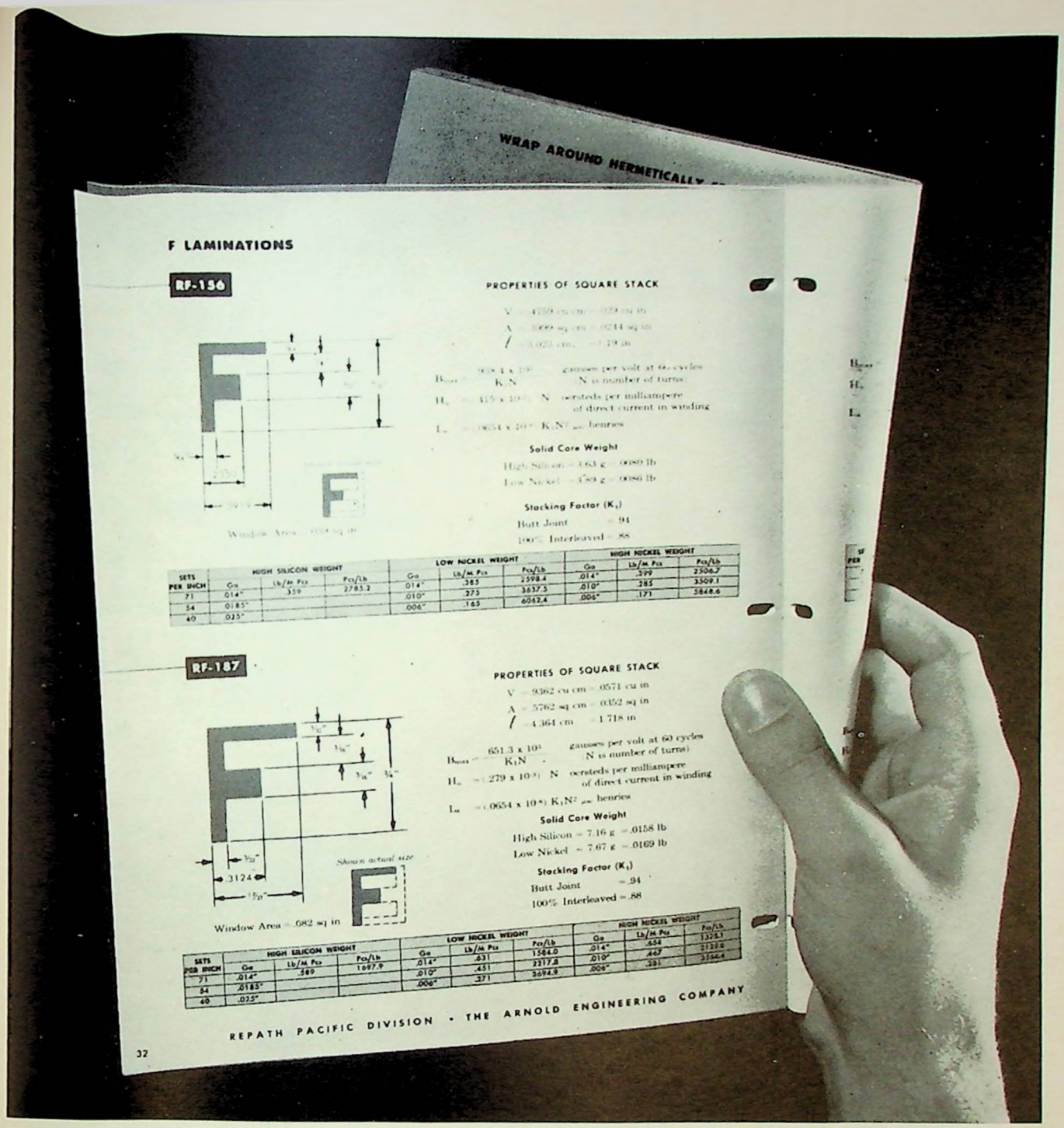
MEETING REVIEW

Historical Parameters

Glen Wade presented a comprehensive talk on devices using parametric amplification at the November PGED meeting. He pointed out the history, theory, similarities, limitations and the state-of-the-art of the various devices employing parametric amplification. These devices in recent years have be-

(Continued on page 22)

United Air Lines was host to this gathering of PGPT/PGRQC tourists at the joint November meeting



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MORE PARAMETERS

come increasingly important because of their very low noise figures.

In all cases the parametric buildup of oscillation or the reinforcement of modulation can be described by a general differential equation of the Hill-Mathieu type where the coefficient of the linear term is a time-varying parameter from which the energy is derived.

Almost one hundred years ago Lord Rayleigh, according to the author, suggested an electrical adaptation of this principal. He pictured a closed resonant circuit with which amplification could be obtained by changing the distance between capacitor plates periodically at twice the resonant frequency. Thus, for parametric amplification two things were required: one, a source of energy and two, a method of transmission of the energy.

This type of amplification results in a spurious signal which occurs at the difference frequency between the source (now called the pump) and the signal frequencies. This spurious signal (called the idler) is kept within the amplifier by filters in so-called single-channel amplification. In double-channel amplification it is permitted to reach the external circuits.

In the past decade, three approaches to parametric amplification have looked very promising. One is through the use of ferrites which have a voltage-controlled inductance. This, however, at the moment is limited because of the large volume, high demagnetizing field and high pump power required. However, some recent work at Ohio State, for example, with ferromagnetic films has shown good promise at 30 mc—the speaker feels these devices show promise at least to 1000 mc.

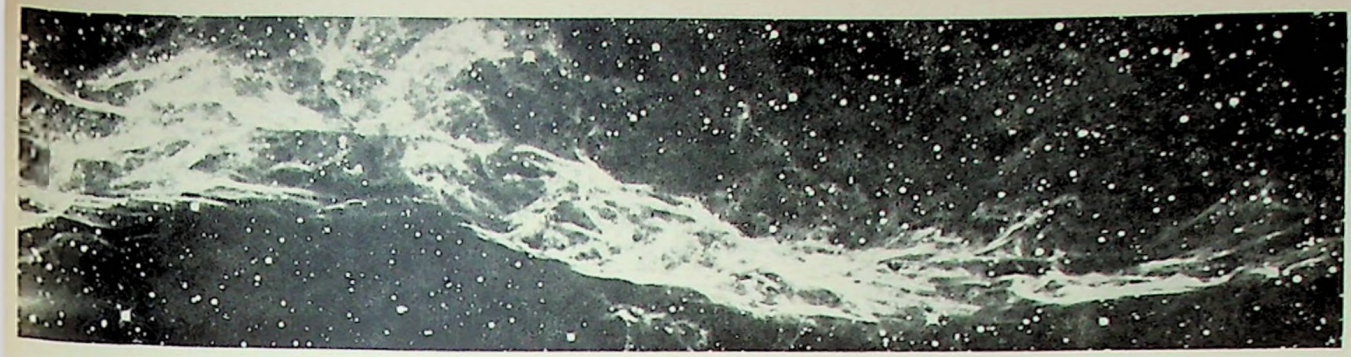
The second approach is through the use of semiconductor diodes in which the capacitance is a voltage-controllable function. Two general types of circuits are presently utilized. In the cavity type one can obtain amplification of the signal frequency or the idler frequency. The device thus acts as a normal amplifier or as a frequency converter. This is the single-channel or regenerative-amplifier approach. In the traveling-wave approach, a transmission line is periodically loaded with semiconductor diodes which must each be pumped in the correct phase. In the cavity type the power-gain equation has a double pole in the denominator which is a direct function of pump power. Normal operation is generally close to this oscillation point, so the pump power level must be critically controlled. The traveling-wave type is much more stable since gain is proportional to the square root

(Continued on page 24)

WESTBURY, NEW YORK—A new ultra-sensitive mass-spectrometer leak detector, with important applications in vacuum technology, has been introduced by the Crosby-Teletronics Corp.

Technical features are:

- **ULTRA SENSITIVITY.** Leak rate sensitivity of 10-13 standard cubic centimeters per second. This rate is 1000 times more sensitive than any other.
- **EXCELLENT SELECTIVITY.** The equipment is sensitive to helium only. Presence of other gases in the equipment cannot give false indications.
- **SIMPLIFIED MAINTENANCE.** All components are readily accessible.
- **SIMPLE AND EFFICIENT CONSTRUCTION.** Both the mass spectrometer and its associated circuitry are of improved design to achieve this greatly advanced sensitivity.
- **INSTALLATION SERVICE.** Every Ultra Sensitive Mass Spectrometer Leak Detector is installed by trained engineers.



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MORE PARAMETERS

of the pump power.

The third type of parametric amplifier uses an electron beam as the energy exchange medium. The electrons are transversely modulated by an input signal after which they rotate at the beam cyclotron frequency. The pump, oscillating at some multiple of the cyclotron frequency (twice in the Zenith diode), parametrically increases the amplitude of transverse electron motion.

This was first demonstrated by Adler of Zenith with a practical device producing double-channel noise figures less than 1 db at 500 mc. These devices are very stable under load and pump variations. In addition, the gain bandwidth product is not a constant (in contrast to the cavity-type semiconductor)—bandwidth remaining essentially constant as the gain is varied.

Wade summarized the present state of noise-figure measurements on parametric devices by recalling that non-refrigerated electron-beam devices have shown double-channel noise figures as low as 43K at 500 mc and 210K at 4000 mc. A refrigerated cavity-type semiconductor device has given a 20-K double-channel noise figure at 6000 mc. At the higher frequencies, a cavity-type semiconductor parametric amplifier has exhibited a double-channel noise figure of 550K.

—Eugene A. Kinaman

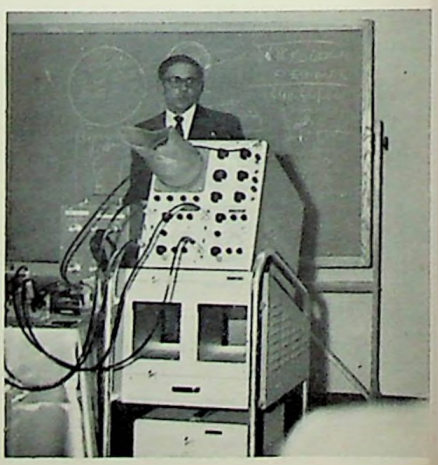
MEETING REVIEW

100-mil Flip-Flop

The Professional Group on Electronic Computers held a regular meeting at Fairchild Semiconductor Corporation in October. Dr. Jay Last, a senior physicist at Fairchild, was the speaker. Last's subject was "Micro-Miniature Circuits." His talk was preceeded by a tour of the manufacturing facilities where silicon-diffused transistors are being made.

Fairchild's new plant on Whisman

(Continued on page 26)



Jay Last

MORE FLIP-FLOP

Road in Mountain View covers 68,000 sq ft and houses complete facilities for crystal growing, device assembly, testing, circuit research, and applications engineering.

Last described what Fairchild has done, is doing now, and is planning to do in the field of micro-miniaturization. As an intermediate step in their program they have built a 20-mc flip-flop entirely out of silicon. The silicon wafer measures 100 mils on a side. This wafer is then mounted in a regular TO-9 case and the necessary leads brought out. Fairchild plans to build other circuits—such as gates and amplifiers—in a similar way.

The advantages which they hope to realize in this program are size, speed, reliability, and low ost.

—J. A. Boysen

MEETING REVIEW

Hunters Pointers

On November 3 the Professional Group on Military Electronics held a regular meeting at the Naval Radiological Defense Laboratory, San Francisco Naval Shipyard, Hunters Point. Ken Sinclair, head of the instruments branch and Harry A. Zagorites gave papers on "Electronics Instrumentation Development for Use with Radiological Research and Defense." Sinclair covered the development of particular items of equipment over the past several years, and Zagorites discussed the application of the electronic instruments in a radiological information-gathering system. Prior to the meeting, dinner was held at the San Francisco Naval Shipyard Officers' Club and about 20 people attended.

—J. J. Dover

GRID RETURNS

Letters to the Editor

Palo Alto

Dear Sir:

This season's PGME meetings have been well received by those 60 to 70 who have attended. The discussions to date have been directed toward the central nervous system. The October meeting was primarily concerned with the systems approach to the central nervous system; while the November meeting dealt with a consideration of its components. Both meetings were rich with comparisons between the physiologic situation and modern computer techniques. We are planning an active spring program beginning with our January meeting. It is probable that this meeting will also be involved with the central nervous system and more spe-

cifically its instrumentation.

The move to the Medical Center has led to the appearance of many new faces, but we were pleased to see most of the old ones wtih us again.

Each meeting has been preceded by a dinner at the Red Cottage in Menlo Park and these too have been well attended.

Our meeting night has appeared to conflict with other local programs so we are considering a change. Those people on our mailing list will be notified directly of any change.

Sincerely,
Noel P. Thompson,
Secretary, PGME

Dear Sir:

I am at a loss to understand your editing. The envelope in which the September issue of the **Grid** arrived was properly addressed to Mrs. Gertrude Taylor Smith, yet on page 29 in the Directory of Officers you list me as Miss Gertrude T. Smith. I can't stop you from using T. instead of Taylor but I do insist on your showing my name correctly as Mrs. I was not born a Smith.

Mrs. Gertrude Taylor Smith

Many things about the publishing field leave us at a loss too, and this question is one of these. How "Mrs." got changed to read "Miss" after being correct on the final galley proof seems to have only one possible answer. Mrs. Smith must have a secret enemy working incognito at the typographers.—Ed.

EVENTS OF INTEREST

Meetings Summary

January 11—**Sixth National Symposium on Reliability & Quality Control.** Statler-Hilton Hotel, Washington, D. C. C. M. Ryerson, Radio Corporation of America, Camden, N. J.

February 3-5—**Institute of Radio Engineers Professional Group on Military Electronics.** Biltmore Hotel, Los Angeles, Calif. Gordon B. Knoob, Motorola, Inc. Military Electronics Division, 1741 Ivar, Hollywood, Calif.

February 3-5—**Western Industrial Isotopes Conference.** San Francisco, Calif. Department of Conferences, University of California Extension, 2451 Bancroft Way, Berkeley, Calif.

February 10-12—**Solid State Circuits Conference.** University of Pennsylvania,

(Continued on page 28)

MORE EVENTS

Philadelphia, Penna. Tudor R. Finch, Bell Telephone Laboratories, Murray Hill, N. J.

February 25-26—**Scintillation Counter Symposium.** Washington, D. C. George A. Morton, RCA Labs, Princeton, N. J.

Papers Calls

December 15—Abstracts of 150-200 words for the annual Electronic Components Conference (May 10-12, Washington, D. C.) Send to: Gilbert B. Devey, Technical Program Chairman, Sprague Electric Company, North Adams, Massachusetts.

December 15—Technical papers on the newest techniques in audio development for the 1960 West Coast Audio Engineering Society Convention at Los Angeles (March). Send to: Walter T. Selsted, Ampex Corporation, 934 Charter Street, Redwood City, Calif.

February 1 — 100-word abstract in triplicate and 500-word summary for PGMTT National Symposium (May 9-11, Coronado Hotel, Coronado, Calif.) Send to: Dr. David B. Medved, Chairman, Technical Program Committee, 1960 PGMTT Symposium, Convair, a Division of General Dynamics, Mail Zone 6-172, P.O. Box 1950, San Diego 12, Calif.

History Moves Forward

Co-chairman Jerry Rosenberg of the Section historical committee reports that actions taken by that body will assist in the task of getting the New Almaden Museum into full operational status. The facility is now organized as a nonprofit foundation with Dougles Perham as president, Ralph Heintz as vice president, Mrs. Douglas Perham as secretary, Austen Warburton as treasurer, and Leonard F. Fuller as director at large.

Two problems have existed in getting the Perham Foundation Museum opened for public use: approval of the building by local authorities, and operating capital. Approval is held up only by the need for two sets of panic-door hardware. Anyone who can contribute such items may contact Paul Giganti, a member of the committee, at Eitel-McCullough, JUno 8-1212.

Giganti is also active in the organization of a fund-raising drive which will be directed toward the solution of problem number two.

Reprints of the Directory of Officers and Calendar of scheduled meetings for the year are available from the IRE office, 60 West 41 Avenue, San Matea; FIreside 1-3471.

GRID SWINGS

It Is Reported:

Applied Technology, Inc., Palo Alto, has announced the election of Dr. **Oswald G. Villard, Jr.,** Palo Alto, Stanford University professor of electrical engineering, to the board of directors.

Robert R. Johnson has joined the firm as project engineer. Johnson has been a designer of electronic systems for aircraft and missile applications since 1949. During his 10 years in the field, Johnson has been associated with Dalmo Victor Co., Northrop Aircraft Co., and Boeing Airplane Co. Recently he was with Granger Associates in Palo Alto.

Victor R. Witt, formerly of the **IBM** data systems division laboratory in Poughkeepsie, New York, has been promoted to manager of the San Jose IBM product development laboratory. He succeeds **Louis D. Stevens,** who has been promoted to manager of systems engineering at IBM World headquarters in New York City.

Witt *Stevens*

Formation of a new subsidiary in Switzerland for **Varian Associates** is announced. The new company, Varian A.G., will have its main offices at Zug, with a research and applications laboratory at Zurich.

William R. Klauer, who has a BSEE from the University of Santa Clara, has been added to the rapidly expanding Sacramento office of **Neely Enterprises.**

Raymond L. Pole is field engineer at **Premmco, Inc.** Pole, formerly with Westinghouse Electric of Canada, will be

Klauer *Pole*

based in Palo Alto working out of the company's district office in Alameda.

Lewis and Monahan press buttons, firing flashbulbs. Light, picked up across room, actuates curtains, exposing dedication plaque, right

Sylvania Electric Products dedicated a new north wing at the electronic defense laboratories, part of the company's Mountain View operations. The new facility adds 76,000 sq ft, making a total of 140,000 sq ft for the 600-plus employees presently in the laboratory. The dedication featured as principal speakers, Brig. Gen. John C. Monahan, chief of the research and development division of the office of the chief signal officer of the Army Signal Corps, and Robert E. Lewis, president of Sylvania. The laboratory has the sole function of serving the Signal Corps. Other speakers included Samuel A. Ferguson, vice president and general manager of the operations; John W. Anderson, mayor of Mountain View; and Jesse R. Lien, director of the laboratory.

Meeting in Hawaii for their second consecutive year, members of the board of directors of WESCON (Western Electronic Show and Convention) set executive responsibilities for the 1960 trade show and technical convention during their annual business session.

WESCON, which is jointly sponsored by the Western Electronic Manufacturers Association and the Los Angeles and San Francisco Sections representing the Seventh Region of the Institute of Radio Engineers, will be at Los Angeles's new Sports Arena next August 23-26.

Chairman of the board for 1960 will be **Walter E. Peterson,** president of Micro Gee Products, Culver City. **Hugh P. Moore,** chairman of the board of Lerco Electronics, Inc., Burbank, will be chairman of the executive committee.

Convention director for 1960 will be **Bruce S. Angwin,** regional manager of

(Continued on page 32)

MORE SWINGS

the Electronic Components Division, General Electric Co., Los Angeles. Show director will be **Donald C. Duncan,** president of Pacific Electronic Controls Corp.

Also serving on the new board and representing Northern California are **Albert J. Morris,** senior vice president of Levinthal Electronic Products, Inc., Palo Alto; **O. H. Brown,** director of marketing of Eitel-McCullough, Inc., San Carlos; **Calvin K. Townsend,** executive vice president of Jennings Radio Manufacturing Corp., San Jose; and Dr. **John Granger,** president of Granger Assoc.

Don Larson of Los Angeles was reappointed business manager, the post he has held for the past three years.

Robert M. Bennett, Jr., of the IBM Research Laboratory, San Jose, general chairman of the Western Joint Computer Conference, has been joined by **George A. Bernard** of Ampex Corp., Redwood City, vice chairman, and **J. P. Fernandez** of the IBM Product Development Laboratory, San Jose, secretary-treasurer, in announcing the committee chairmanships, as follows:

Chairman of the technical program is **Howard M. Zeidler** of Stanford Research Institute. Program vice chairman is **Jack E. Sherman** of Lockheed Missiles and

(Continued on page 34)

Townsend

Granger

Bennett

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MORE SWINGS

Barnard *Zeidler*

Space Division, Palo Alto. Chairman of exhibits will be **Harry K. Farrar** of Pacific Telephone & Telegraph Co., San Francisco. Heading local arrangements will be **Gene E. Morrison** of Smith-Corona Marchant, Inc., of Oakland. **Robert A. Isaacs** and **Roger Wye** of Philco Corp., Palo Alto, are chairman and vice chairman for printing and mailing.

Public relations will be headed by **Charles Elkind** of Stanford Research Institute. **Norman J. Jones** of Friden, Inc., San Leandro, is public relations vice chairman. **D. D. Willard** and **Earl T. Lincoln** of IBM Product Development Laboratory are chairman and vice chairman of the publications committee. Heading the registration committee is **Harold N. Wells** of General Electric Computer Laboratory, Palo Alto. Women's activities will be arranged by a committee headed by **Mary Fraser** of IBM.

Joint sponsors of the 1960 WJCC, to be held in the Jack Tar Hotel, San Francisco, May 3-5, are the Institute of Radio Engineers, the American Institute of Electrical Engineers, and the Association for Computing Machinery.

At the **University of California,** Dr. **C. K. Birdsall,** a microwave-tube specialist who spent the spring and summer as a visiting professor in Berkeley, has resigned from his position at the General Electric Microwave Laboratory at Stanford to become associate professor. **Georg Bruun,** an expert in circuit theory and communications systems, formerly of the Royal Danish Institute of Technology in Copenhagen, has been appointed acting associate professor. Dr. **Arthur Gill,** who came to this country from Israel in 1950 to earn SB and SM degrees at MIT and a PhD degree at UC, has been appointed assistant professor after serving as associate for two years, during which he worked in the field of information theory. Dr. **R. A. Muller,** whose specialty is the theory of high-frequency tubes, has taken a leave of absence from his position with Siemens and Halske A.G. in Munich to become a visiting professor for one year. Dr. **A. W. Trivelpiece,** who worked on gaseous plasma devices at Caltech and (during the past year) on ferrites at the Institute of Technology in Delft, has been appointed assistant professor.

Membership Status

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

Robert W. Allington
James K. Anderson
Geoffrey H. Ball
Everett F. Basham
Daniel W. Bender
John L. Blake
James L. Boykin
John A. Blickensderfer
M. Michael Brady
Frank D. Brandt
Robert E. Brooks
Robert W. Burger
Robert J. Butwell
Robert N. Carlile
Herbert K. H. Chong
Robert R. Chin
Bent Christensen
Dino R. Ciarlo
Eugene A. Coogan
Bruce V. De Wees
Donald E. Farina
Robert E. Goldman
Paul H. Goodman
Wilborn G. Griffin, Jr.
Donald W. Hanson
Russell E. Hayes
Bas Hoeks
Charles M. Meerschaert
Charles H. Merritt
Armin Miller
Masahiro Omori
Leonard I. Oswald
Stephen T. Paine
Robert S. Pepper
Gerald W. Peterson
John F. Piccolo
John W. Porter
Monroe H. Postman
Herbert E. Rauch
Stewart W. Rawson
Gilbert A. Reeser
Gilbert G. Robinson
Allen L. Rock
Anselm G. Schellenberg
Onni E. Selenius
Sam B. Shankle
Sanford S. Shapiro
Raymond J. Shedko
Philip H. Sheldon
Allen C. Slutman
Grant M. Smith
Kent F. Smith
William D. Smith
Richard M. Staley

(Continued on page 36)

MORE MEMBERSHIP

Robert L. Hymer	Roy P. Stier
John Jacobs, Jr.	Donald S. Swallow
Sanehiko Kakihana	Miroslav Swyryd
Daniel G. Keehn	Tom Tracy
Gunars Kemanis	John L. Turnbull, Jr.
Brian D. King	John A. Tyson
Brenton C. Knudson	William D. Van Patten
David B. Leeson	Donald C. Wallace
Otto Leistiko, Jr.	William B. Weir
Shing Mao	James M. Weldon
Clifford D. Maldonado	Merle L. Wetherell
Boris S. Maximoff	Richard L. Whitely
Bernard J. Maxum	Warren O. Woolsey
James A. Maxwell	Stanley H. Zisk

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

James C. Adams, Jr.	W. Jared Liedigh
Ben L. Allgood	Orval E. Luckey
Everett Alvarez	Bob V. Markevitch
John L. Arnold	Robert C. Mason
Paul V. Borlaug	Stanley E. McCarthy
David L. Boslaugh	Angus R. McKay
Forrest E. Brakeman	Donald L. Nielson
Richard E. Brownlie	Robert J. O'Neill
Donald L. Carpenter	Francois A. Padovani
Richard D. Chapton	Chandrakumar N. Patel
Yi Him C. Co	Thomas J. Perkins
James L. Davis	William H. Pierce
Thomas P. Desmond	Fernando Pradenas
Vernon W. Dixon	Julio C. Rubio
William H. E. Doole	Richard J. Sandretto
Frank B. Durand	Roman Sarda
Louis R. Falce	Jack Silver
Anthony D. Ferrari	Per S. Skullestad
Harold H. Freeland	Frederick J. Styles
Erwin Goldsmith	Dennis M. Talbott
Rosel H. Hyde	Ronald K. Tuttle
Arthur M. Johnston II	Charles P. Van Scoy
Eric A. Jordahl	Joseph E. Wettstein
Ulrich Kaempf	Colin B. Williams
Thomas F. Kessel	Helmut F. Wolf
Erhard K. Kietz	Frank T. Woodall, Jr.
Bhogawandas P. Lathi	Thomas J. Wortman

Following are the names of members who have recently been transferred to a higher grade of membership as noted:

SENIOR MEMBER:

Charles P. Ginsburg Joseph M. Hughes
John F. Moran

MEMBER:

Mason B. Adcock	Donald C. Lincicome
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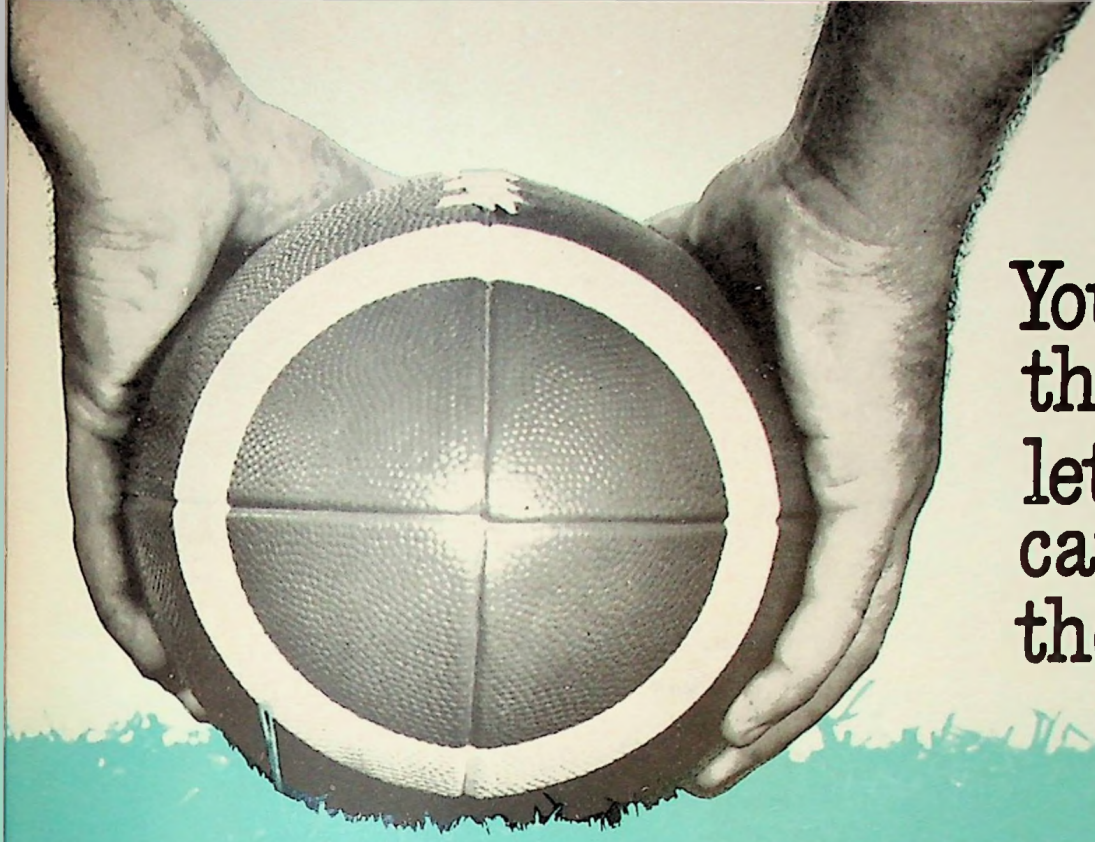
Norman Kaman	Leonard G. Shaw
Leonid J. Karpenko	Kenneth G. Sorenson
James H. Kerins	George J. Tanaka
Edward A. Klein	Lawrence R. Thielen
Larry G. Larson	Carl F. Wasano
Imsang Lee	Jack Wohl

William R. Zangrando

ASSOCIATE:

Allen K. Ream



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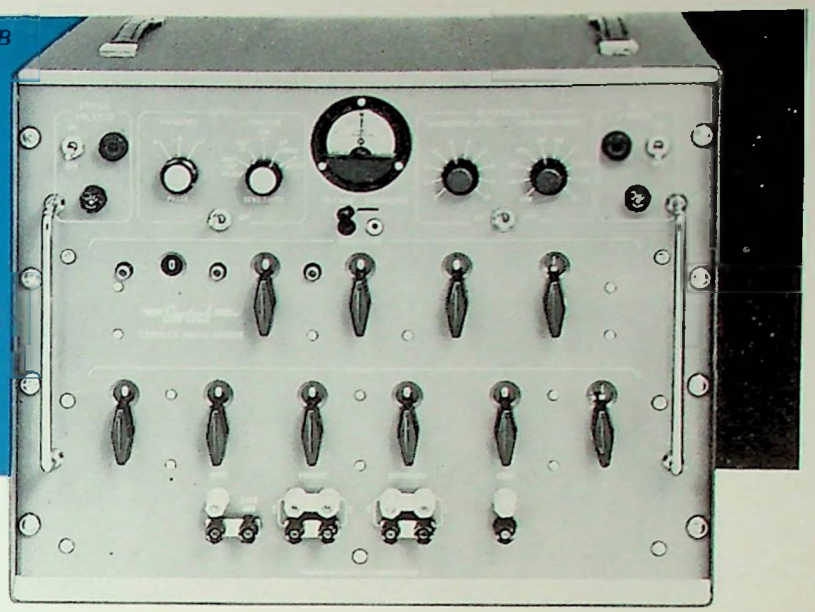
Keithley Instruments	T. Louis Snitzer Co.
Kin Tel	Neely Enterprises
Lamtex Industries	Jack Kaufman
Lawrence Manufacturing Corp.	Premmco, Inc.
Leach Relay Division	Jack Kaufman
LEL, Inc.	White and Company
Levinthal Electronic Nuclear Div.	White and Co.
Levinthal Electronic Equip. Div.	O'Halloran Assoc.
Lindsay Structures	Premmco, Inc.
Manson Laboratories, Inc.	White and Co.
Massa Div., Cohu Electronics	McCarthy Assoc.
Menlo Park Engineering	O'Halloran Assoc.
Millivac Instrument Div., Cohu	McCarthy Assoc.
Narda Microwave Corp.	O'Halloran Assoc.
New London Instrument Co.	Hugh Gray Company
Oregon Electronic Mfg.	White and Company
PCA Electronics, Inc.	Jay Stone & Assoc.
Polarad Electronics	T. Louis Snitzer Co.
Quan-Tech Laboratory	Hugh Gray Company
Radiation Counter Labs	White and Company
Rantec Corp.	O'Halloran Assoc.
Sage Electronics Corp.	Hugh Gray Company
Sanborn Company	Neely Enterprises
Sensitive Research Instrument	McCarthy Assoc.
Sierra Electronic Corp.	T. Louis Snitzer Co.
Sorensen & Co.	McCarthy Assoc.
Technology Instrument	Long & Associates
Telonic Industries	T. Louis Snitzer Co.
Transistron, Div. Van Norman	O'Halloran Assoc.
Universal Electronics	T. Louis Snitzer Co.
Varian Associates	Neely Enterprises
Waltham Electronics Corp.	Hugh Gray Company
Wainschel Engineering	O'Halloran Assoc.
Wincharger Corp. (Zenith Radio Corp.)	Premmco, Inc.
Winchester Electronics	Long & Associates

INDEX TO ADVERTISERS

Model CRB-1B

NEW

Gertsch Complex Ratio Bridge



measures both in-phase and quadrature voltage ratios – with high accuracy

Unique versatility. This instrument cancels quadrature effects, giving a sharp, true null.

In eliminating quadrature voltage, this Gertsch bridge achieves an in-phase ratio accuracy as good as 0.001%. Quadrature voltage ratios are read as rectangular coordinates, tangent of phase-shift angle, or magnitude of phase-shift angle in degrees directly. Harmonics and noise are rejected by use of band-pass filters.

Self-contained phase-sensitive detector gives excellent sensitivity with only 2-volt reference.

Six-place resolution. The magnitude of the transformation ratios of R + jX voltages are readable to 6 places.

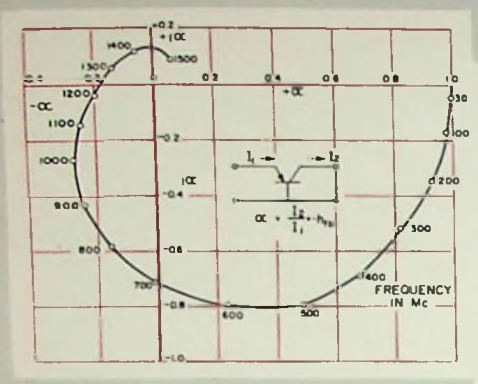
Applications. Unit is used with both 3- or 4-terminal networks such as transformers, synchros, transducers, and resolvers.

Two frequency ranges – 30 to 1000 cps (Model CRB-1B), and 50 to 3000 cps (Model CRB-2B).

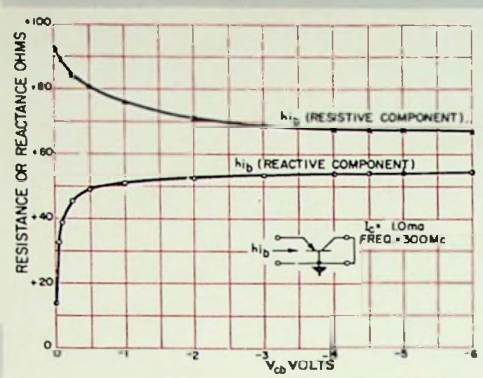
Write for complete data in Bulletin CRB.

Gertsch

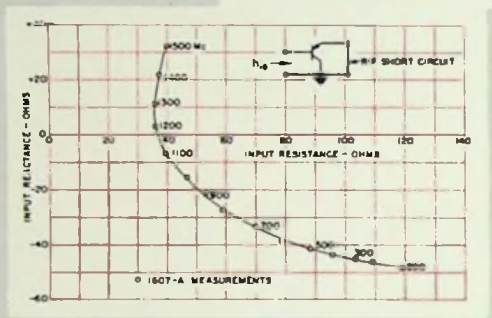
GERTSCH PRODUCTS, Inc., 3211 South La Cienega Boulevard, Los Angeles 16, California / UPton 0-2761 – VErmont 9-2201



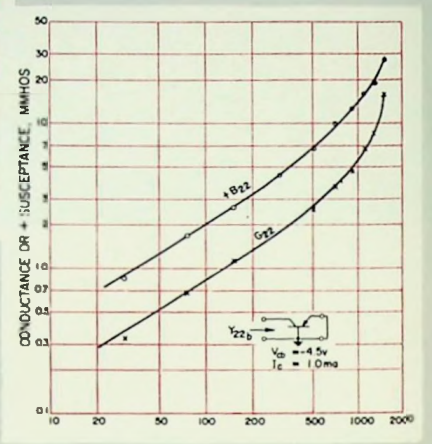
Plot of α, or $-h_{fb}$, versus frequency.



Variation of transistor parameters as a function of collector voltage.



Plot of input reactance versus input resistance



Plot of short-circuit output admittance as a function of frequency

...Some of the Transistor Measurements made with this instrument

Type 1607-A Transfer Function and Immittance Bridge

Frequency Range: 25 to 1500 Mc.

Biasing Provisions: Built-in for use with external d-c sources. Maximum current, 250 ma; maximum voltage, 400 volts.

Price: $1665

★ Measures h_{fb}, h_{fe}, h_{rb}, h_{ib}, h_{ie}, h_{ob}, h_{oe} of transistors directly, *plus* any desired short-circuit or open-circuit input, output, or transfer function of either active or passive networks.

★ Operates with very low r-f levels on unknown — an essential for accurate measurements of transistors and nonlinear devices.

★ The bridge is completely passive — stability of calibration dependent only on permanent physical dimensions.

write for complete information

FUNCTION	RANGE	ACCURACY
Voltage and current ratios (R)	0-30	$2.5\left(1+\sqrt{R}\right)\% + 0.025$
Transimpedance (Z_{21})	0-1500 ohms	$2.5\left(1+\sqrt{\frac{Z_{21}}{50}}\right)\% + 1.25$ ohms
Transadmittance (Y_{21})	0-600 mmhos	$2.5\left(1+\sqrt{\frac{Y_{21}}{20}}\right)\% + 0.5$ mmho
Impedance (Z_{11})	0-1000 ohms	$2.0\left(1+\sqrt{\frac{Z_{11}}{50}}\right)\% + 1.0$ ohm
Admittance (Y_{11})	0-400 mmhos	$2.0\left(1+\sqrt{\frac{Y_{11}}{20}}\right)\% + 0.4$ mmho

GENERAL RADIO COMPANY

WEST CONCORD, MASSACHUSETTS

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