EDITOR'S PROFILE of this issue

from a historical perspective …

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

May 15, 1962:

Cover: Members see an automated toroidal coil-winding machine at Lenkurt Electric; the meeting itself is described on page 10. This capability was an important advance, since telephone linesets have stringent band-edge requirements in order to be multiplexed onto a microwave signal, which takes precise L and C values for their filters; as part of GTE, this was a large market for both military and commercial use (eg, for the Southern Pacific railroad's system, predecessor to SPRINT). So, another story: While I was at Lenkurt, several of these machines were installed at our plant in Guadalajara, Mexico. The bifilar windings used differing colors of thin enamel-covered wire. The Mexican women running the machines didn't feel the resulting toroids had nice visual symmetry and a good blending of colors, so they changed the winding sequences/placements. Meanwhile, back in San Carlos, us engineers were perplexed at why the lineset band edges were drifting. Turns out our engineered windings were important to performance, and the aesthetic considerations of the operators had to be suppressed for us to get good product.

p. 7: For one last time before the pending merger, a large number of past Section officers came together to discuss the upcoming vote. Here were some of the luminaries in attendance (I would like to have been there):

-- Leonard Fuller, chair in 1928, past Chief Engineer for Federal Telegraph and now retired from UC-Berkeley's EE department. (I mentioned in an earlier issue that I have two of his Lee de Forest audions.)

-- Ralph Heintz, chair in 1932, a ham in the '20's who started Heintz & Kaufman, an RF radio company forced by the RCA monopoly to make its own tubes, from which Eitel and McCullough left to form Eimac in the early '30's.

-- Charlie Litton, chair in 1933, who was a ham at 11 years old and invented many devices, including the glass lathe (for making repeatable, reliable tubes) and the oil vacuum pump, and consulted with Rus and Sig Varian on the klystron.

-- Fred Terman, chair in 1939, who started the communications engineering course at Stanford and got Dave (and Lucile) Packard to return from GE to Stanford for advanced studies (through a donation from Litton), then paired him up with Bill Hewlett to form their own company.

-- Barney Oliver, chair in 1956, who came from Bell Labs to head up HP's labs; conveyed to Bud Eldon (IEEE's 1985 president) that "Bill" (then IRE president) wanted him to start a new IRE Group, which became today's Electronics Packaging Society.

-- Joe Pettit, chair in 1952, who became dean of engineering at Stanford, then president of Georgia Tech.

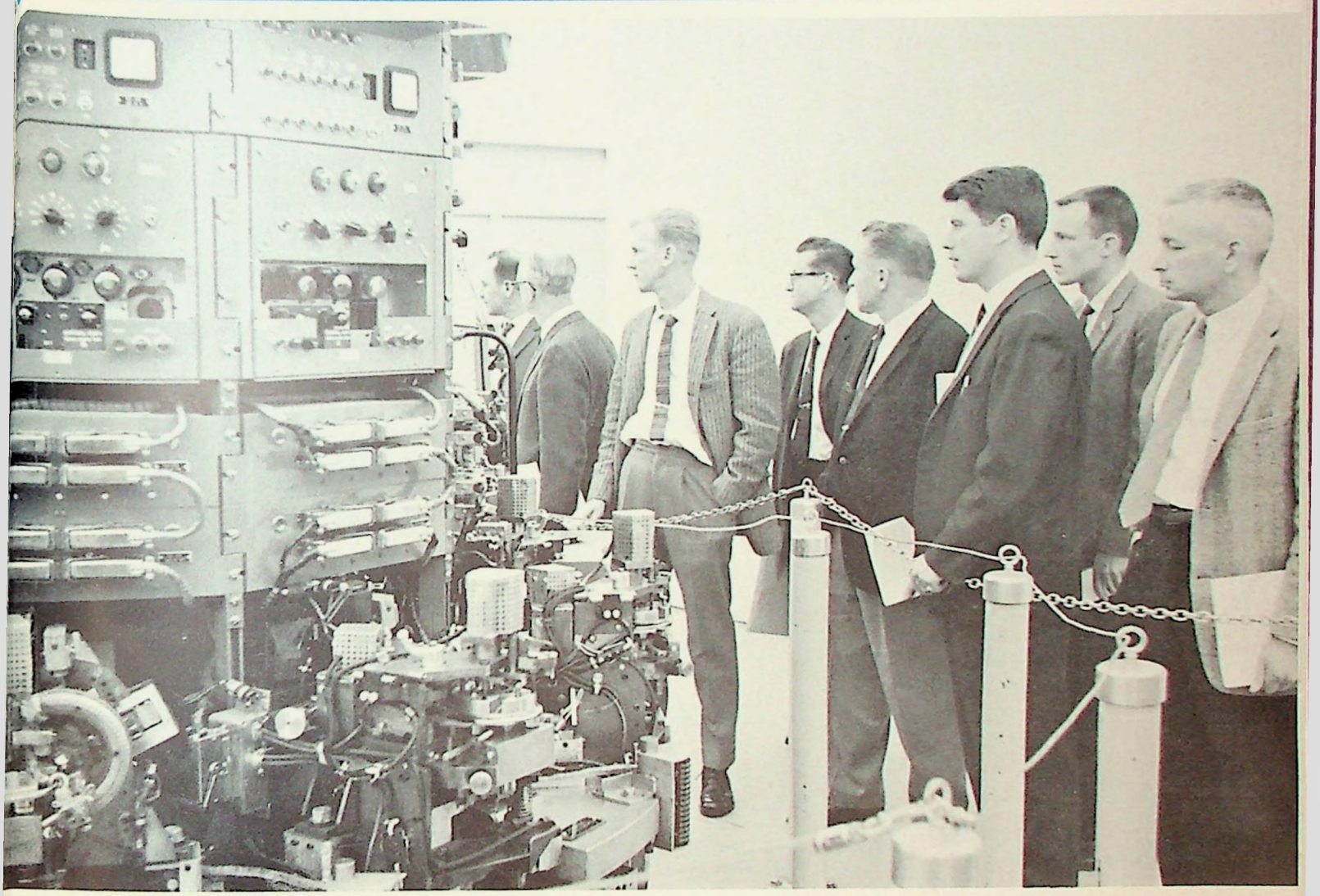
All those serving as Section and Sub-Section chairs are listed on page 8.

p. 10: WESCON will again have a student competition with more than 40 presentations. First prize is the Lee de Forest Award and $1,000; the best presentation gets the Frederick Emmons Terman Award and $300.

SAN FRANCISCO SECTION

Grid

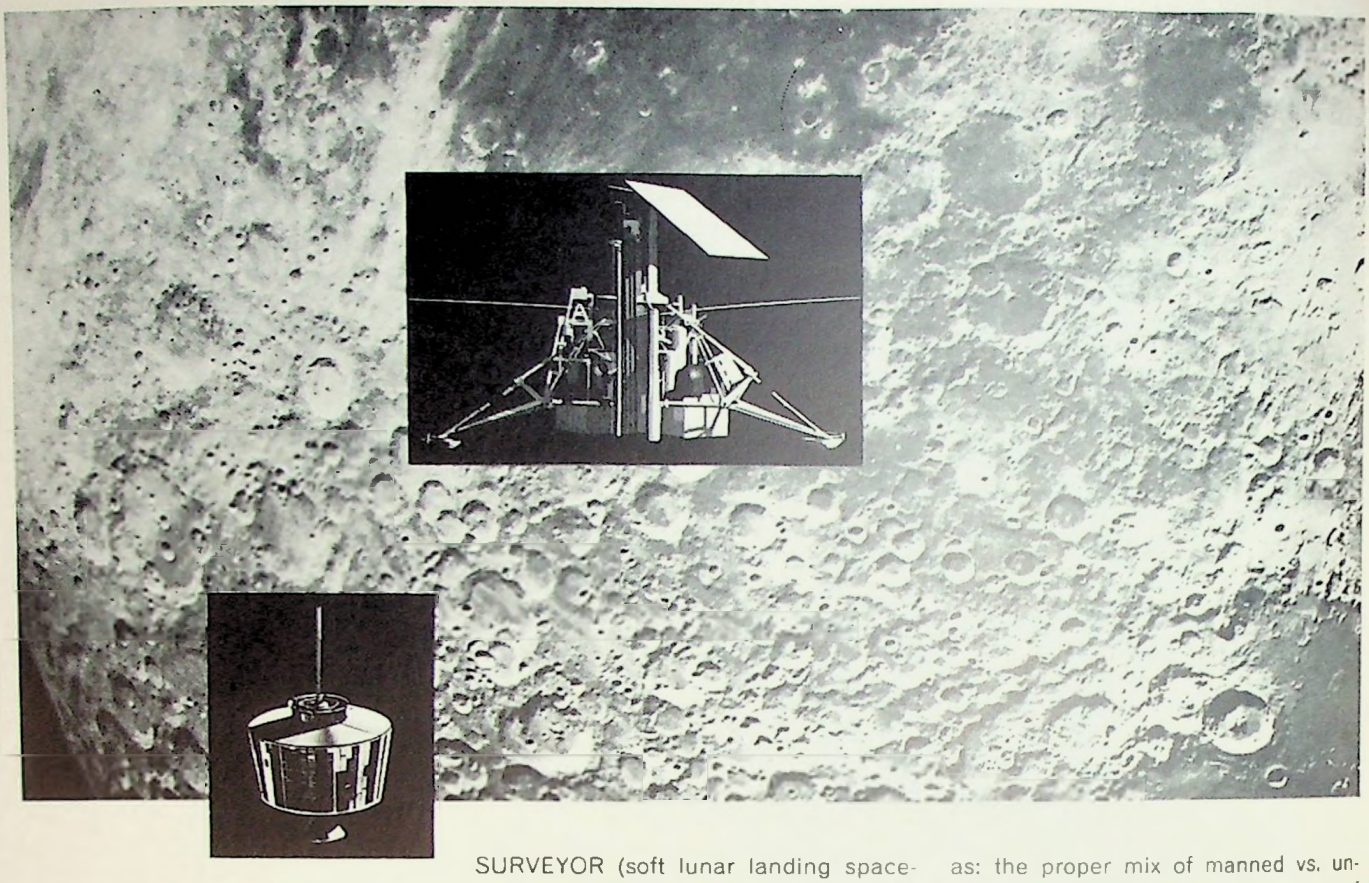
MAY 15, 1962



IREminder

May 15 (Tuesday) PGSET
May 16 (Wednesday) PGRFI
May 22 (Tuesday) PGEC, PGPEP
May 23 (Wednesday) PGI
May 30 (Wednesday) PGED
June 12 (Tuesday) SFS (Annual Meeting)
June 27 (Wednesday) PGI

POSTMASTER: RETURN REQUESTED—SUITE 2210, 701 WELCH ROAD, PALO ALTO, CALIFORNIA



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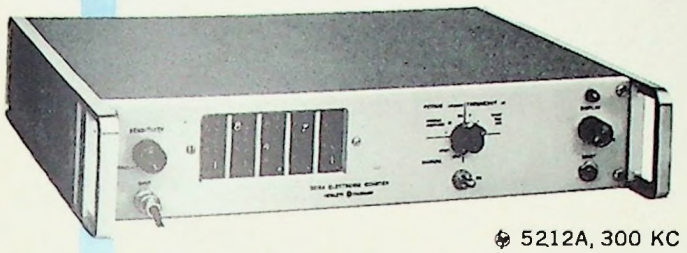
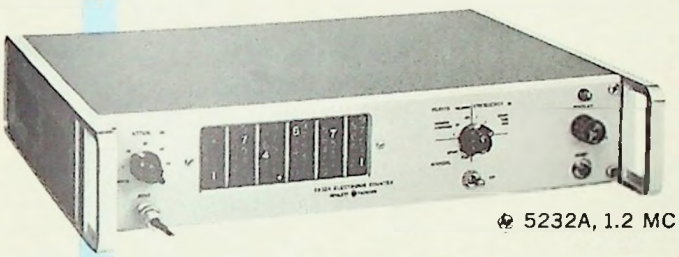


5212A, 300 KC

5512A, 300 KC



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5512A	300 KC, 5 digits Nixie								1,175.00
5232A	1.2 MC, 6 digits columnar	2 cps to 1.2 MC	± 1 μs ± time base accuracy ± trigger error/ periods averaged	2 cps to 1.2 MC			f_1: 100 cps to 1.2 MC (1 v rms into 500 ohms) f_2: same as period		1,300.00
5532A	1.2 MC, 6 digits Nixie								1,550.00

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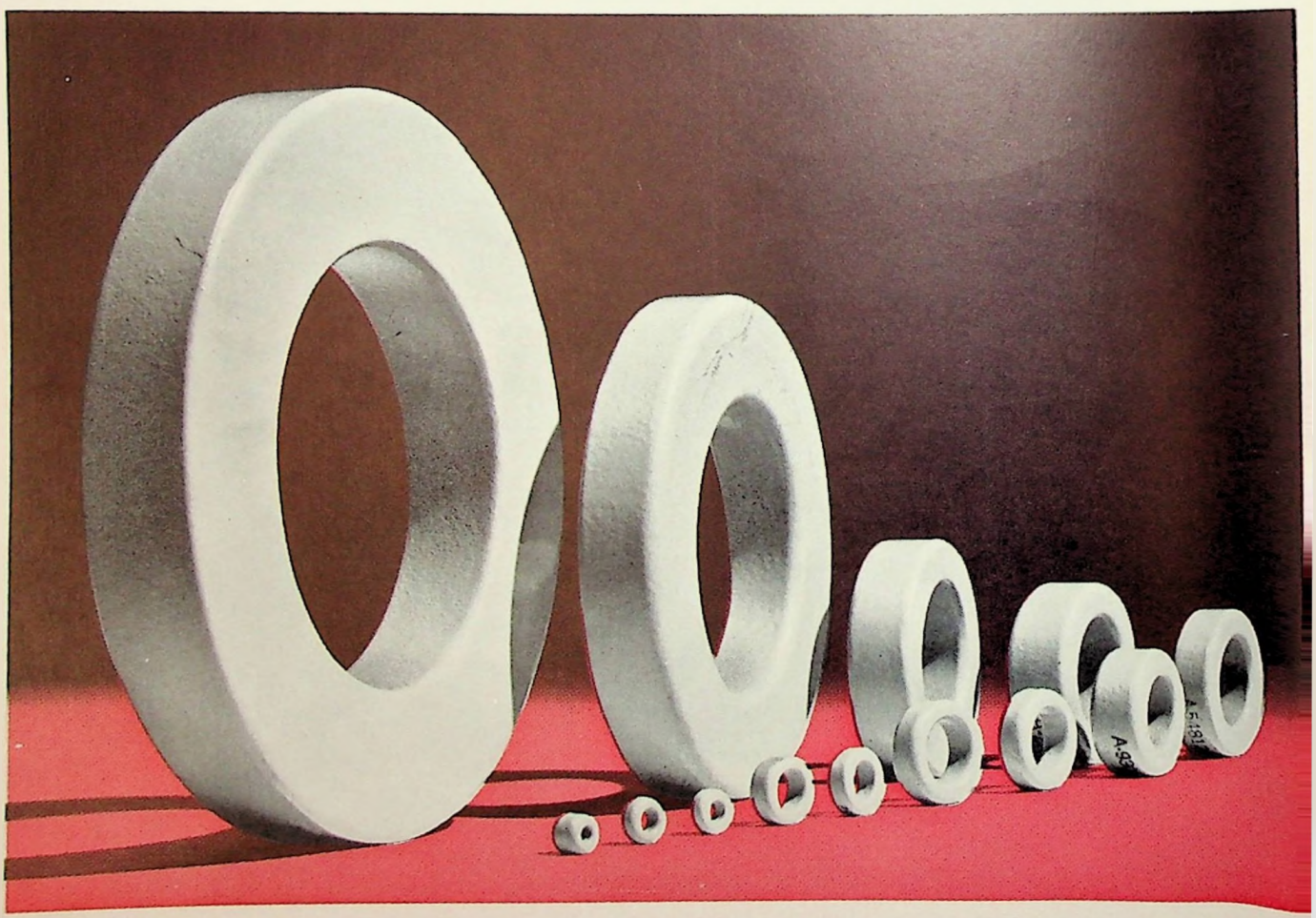

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contents

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cover

In mid-March the PGCS Chapter went to Lenkurt to hear about an advanced military multiplexing system and its possible commercial applications. This meeting is reviewed on a subsequent page. Part of the meeting consisted of a tour through the Lenkurt facilities, and on the cover we see part of the group examining the carousel automatic toroidal coil-winding machine, which produces filter components for the equipment under discussion that evening, as well as other Lenkurt carrier equipment.

The machine winds up to 2100 toroidal coils in an eight-hour shift and does this to an accuracy of one turn—making possible large volume production of high-quality filters. The carousel was designed, developed, and built by Lenkurt engineers, and has been in continuous operation for several years.

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MEETING CALENDAR

SAN FRANCISCO SECTION

Thursday • June 12

Annual Meeting—ladies are most cordially invited
Place: Fremont Hills Country Club, 12893 Viscaino Place, Los Altos Hills
Dinner: 7:30 P.M. (Cocktails: 6:30 P.M.) $6.00
Reservations: Doris Gould, IRE Office, 321-1332

PROFESSIONAL GROUPS

Electron Devices

8:00 P.M. • Wednesday, May 30

"Helium-Neon Gas-Phase Optical Maser"
Speaker: William Earl Bell, manager, experimental physics, Spectra-Physics, Inc.
Place: Room 100, Physics Lecture Hall, Stanford University

Electronic Computers

8:00 P.M. • Tuesday, May 22

"Error-Correcting Codes and a Particular Physical Realization"
Speakers: Dr. Bernard Elspas and William K. English, SRI
Place: Lockheed Auditorium, 3251 Hanover Street, Palo Alto
Dinner: 6:00 P.M., The Red Shack Hofbrau, 4085 El Camino Way, Palo Alto
Reservations: None required

Instrumentation

8:00 P.M. • Wednesday, May 23

Lecture No. 3
"Storage: Processing and Printout"
Speakers: Robert N. Flanders, Dymec, and Paul J. Weber, Ampex
Place: Hewlett-Packard Co., 1501 Page Mill Road, Palo Alto (main lobby)
Meet-the-Speaker Dinner: 6:00 P.M., L'Omelette Restaurant, 4170 El Camino Real, Palo Alto
Reservations: None required

Fremont Hills Country Club, where the annual Section meeting is scheduled to take place in June

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MEETING CALENDAR

Instrumentation — 8:00 P.M. • Wednesday, June 27

Lecture No. 4
"System Programmers and Summary"
Speakers: To be announced
Place: Hewlett-Packard Co., 1501 Page Mill Road, Palo Alto (main lobby)
Meet-the-Speaker Dinner: 6:00 P.M., L'Omelette Restaurant, 4170 El Camino Real, Palo Alto
Reservations: None required

Product Engineering & Production — 8:00 P.M. • Tuesday, May 22

"Brazing Problems in Vacuum Tube Manufacturing"
Discussion and plant tour
Speaker: David K. Davis, metallurgist, Varian Associates
Place: Western Gold & Platinum Co., 525 Harbor Blvd., Belmont

Radio Frequency Interference — 8:00 P.M. • Wednesday, May 16

"Radio Frequency Interference Measurements in the Microwave Spectrum—Power Density and Field Intensity Concepts"
Speaker: Robert Friedman, manager, applications engineering, Polarad Electronics Corp., Long Island City, New York
Place: Lockheed Auditorium, 3251 Hanover Street, Palo Alto
Meet-the-Speaker Dinner: 6:30 P.M., Rickey's Studio Inn, 4219 El Camino Real, Palo Alto
Reservations: Mrs. Pat Hanson, DA 1-2280

Space Electronics & Telemetry — 8:00 P.M. • Tuesday, May 15

Subject and speaker: To be announced
Place: Lockheed Auditorium, 3251 Hanover Street, Palo Alto
Dinner: 6:30 P.M., Camino Bowl, 2025 El Camino Real, Mountain View
Reservations: Cynthia Chaney, DA 6-4350

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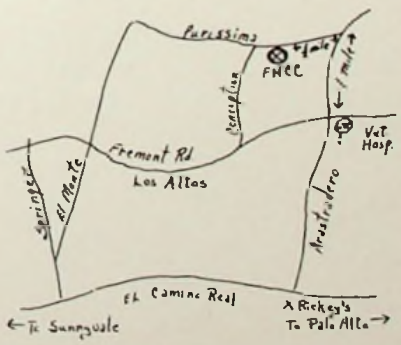
annual meeting

THE PROMISE

Making arrangements for an Annual Section Meeting understandably involves numerous complications, so the identity of the speaker cannot yet be announced. It will, however, be an individual of unusually great and general international interest—one chosen for appeal to members in all areas of our activities and their wives as well.

The setting for the affair is a particularly happy choice of locations. The Fremont Hills Country Club was just opened in February. It has a most attractive clubhouse idyllically situated within a few minutes of travel from the Palo Alto area.

Details on reservations and the like are in the Calendar above. Your early reservation is not only invited, but urged by those working on plans: Pete Lacy, vice chairman; Hank Schroeder, arrangements; and Jim Warnock, executive secretary.



Hints on reaching Fremont Hills Club

meeting review

RED SWEATER OR BLUE?

One of the rare Section meetings of this and recent technically specialized years was held the last week in April to provide a forum for final thoughts on the AIEE/IRE matter. As a prelude, a ceremony brought together 22 past chairmen of the Section, the East Bay Subsection, and the now-defunct Palo Alto Subsection for the presentation of diplomas and suitably inscribed pieces of pocket hardware as mementos of their services to the Section. This project was organized by Earl Goddard, historical chairman.

Ranking the group in terms of seniority was Leonard Fuller, chairman in 1928. Present also were: Ralph Heintz, Charlie Litton, V. J. Freiermuth, Noel Eldred, Fred Terman, C. J. Penther, Herman Held, Win Wagener, Al Isberg, Al Ogilvie, Walt Naller, John Whinnery, Al Morris, Barney Oliver, Mike Leifer, Vic Corey, Don Dunn, Stan Kaisel, Joe Pettit, John Corl, and Jerry Rosenberg. Mementos will be sent to those unable to be present, a list of whom is appended to this review, complete with indications of their year of servitude.

Thanks in great part to the staunch maintenance by Louis Fein, Palo Alto computer consultant, of a viewpoint that seemed to represent a minority of one, the forum part of the program developed into a spirited and interesting debate. Fein's ideas, set forth in the Letters to the Editor department of the April 15 issue of the **Grid** in a somewhat abridged form, seem to bear chiefly on the wish that a long-term study be undertaken by experts and

(Continued on page 8)

that a full gamut of possible moves ultimately be presented for the members' votes of both societies.

To these points, members present addressed themselves by stating that this merger has, in actuality, been under consideration and discussion for many years on an intermittent basis and that the national officers of IRE and also presumably AIEE are indeed experts as witness the condition of the two societies, as well as the fact that many of the individuals are, in real life, in the managerial echelons of large and successful businesses.

On the absence of a choice for our final vote, Joe Pettit conceded the virtue of Fein's approach in the case of parent dealing with a pre-adolescent child. In his example, the mother, noting the child about to go out into the snow in shirtsleeves, wisely says, "Johnny, would you rather wear your red sweater or your blue one?" In our case, he suggested that the alternatives might be, "Do you wish to merge? Or disband?"

Doubtless, the one point on which general agreement is attainable was the comment that members should be sure to vote when their ballots are received, since a ⅓ vote is necessary, with ⅔ of that figure required for passage. Considering the time and energy that have been expended up to now by officers and committee people, it would be a sad commentary on our concern with professional affairs if the issue failed for lack of participation.—F. H.

San Francisco Section Chairmen

Leonard Fuller	1928	L. E. Reukema	1948
Ralph Heintz	1932	William Hewlett	1950
Charles Litton	1933	R. A. Isberg	1951
A. H. Brally	1935	Allan Ogilvie	1952
V. J. Freiermuth	1937	Walter Naller	1953
Noel Eldred	1938	John R. Whinnery	1954
Frederick Terman	1939	Albert J. Morris	1955
C. J. Penther	1940	Barney Oliver	1956
Leonard J. Black	1941	John McCullough	1957
Herman Held	1942	Meyer Leifer	1958
Karl Spangenberg	1943	Earl Goddard	1959
Winfield Wagener	1944	Victor Corey	1960
David Packard	1945	Donald Dunn	1961
Stanley Kaisel	1962		

Palo Alto Subsection Chairmen

Joseph Pettit	1952	John Granger	1955
O. G. Villard	1953	W. W. Harman	1956
Myrl Stearns	1954	Bruce Whaley	1957
Wayne Abraham	1958		

East Bay Subsection Chairmen

W. W. Salisbury	1954	Charles W. Park	1958
John L. Corl	1955	Ivan C. Lutz	1959
Jerry Rosenberg	1956	Donald Pederson	1960
H. F. Gray, Jr.	1957	A. J. Stripeika	1961
Eugene Aas	1962		

meeting ahead

HELIUM-NEON LASERS

Basic operating principles of the continuous-wave helium-neon optical maser will be discussed by William Earl Bell of Spectra-Physics, Inc., at a PGED meeting scheduled for the end of May. See Calendar, page 6, for time and place. In these devices, population inversion between neon atomic levels is obtained by exchange collisions between excited helium atoms and ground-state neon atoms. Energy for this process is provided by an r-f gaseous discharge. Coherent oscillations occur when the neon atomic system is placed in a high-Q optically resonant structure formed of highly reflecting mirrors.

William E. Bell, PGED speaker

While maser action may occur at a number of wavelengths in the region 1 to 1.4 microns, strongest oscillation occurs at 1.153 micron. Characteristics of several types of resonators, including plane-parallel and confocal, will be discussed. The plane-parallel configuration will give the smallest beam divergence. Applications of continuous-wave gas-phase masers to communication, interferometry, optical measurement, geodesy, and plasma research will be discussed.

Bell has had 17 years of experience as an experimental physicist. He is the author of some 20 scientific papers and the holder of many patents. He has been at the National Research Council of Canada, Chalk River Laboratories, Chalk River, Ontario, where he was a collaborator in a classic measurement of meson lifetime. He has been employed in exploration geophysics by Newmont Exploration Ltd. in Jerome, Arizona.

From 1954 to 1961 he was with the instrument division of Varian Associates. Here he did experimental work in nuclear and electron magnetic resonance and was associated with many of the basic experiments in the field of optical pumping. In 1961 he was one of the founders of Spectra-Physics, Inc., and holds the title of manager, experimental physics.

Robert Flanders, PGI speaker

meeting ahead

PGI SUBSTITUTES

Referring to the notice about the third PGI lecture in the current series (**Grid**, May 1, page 6), a new combination of speakers has been announced. Robert Flanders of Dymec and Paul J. Weber of Ampex. Scope of the lecture remains as described there.

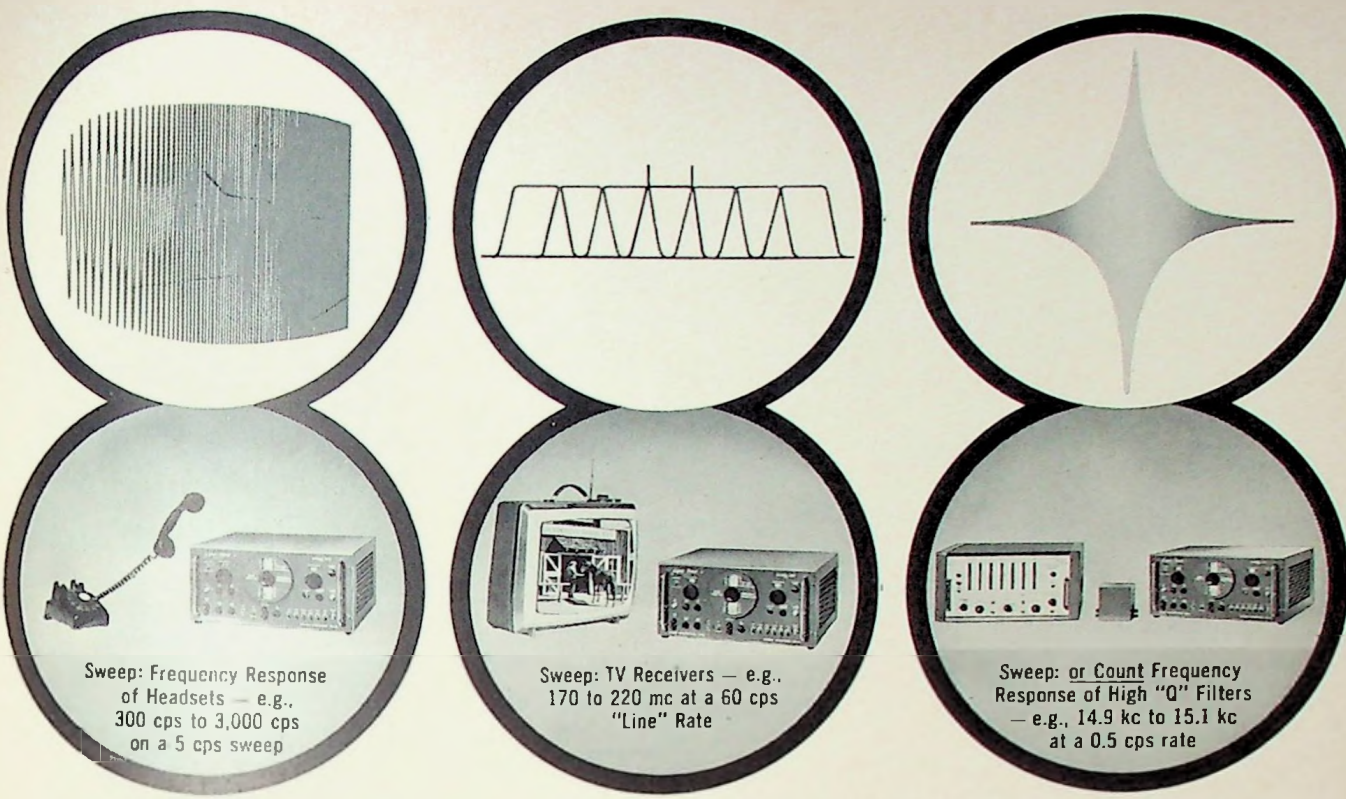
After receiving his BE in engineering at UCLA, Flanders continued at the same college for his graduate studies. He later worked for C. F. Braun Co. for one year as an electrical power designer on instrumentation of refineries, and for F. L. Moseley Co. in Pasadena for six years as manager of digital data-processing systems.

Flanders has been affiliated with Dymec Division of Hewlett-Packard for one year.

After receiving his BSEE degree from Cooper Union Institute of Technology in New York, Weber attended George Washington University, Washington, D. C., for graduate studies.

Weber is presently manager of the training and development department for Ampex Corporation.

Paul J. Weber, PGI speaker



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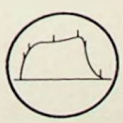
Check Video Bandpass — e.g., 1 kc to 10 mc at 1 cps rate


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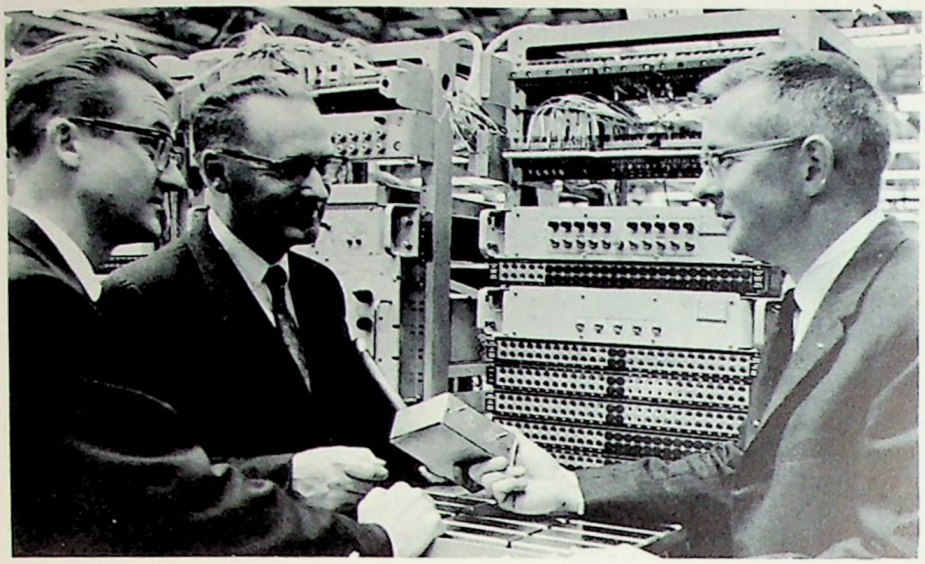

Right to left for a change, speaker Bean at the PGCS Lenkurt tour discusses a carrier component with R. A. Isberg, chairman, and Owen E. Thompson. Grid *reporter*

R. M. T. Young, speaker at the joint PGEM/PGEWS meeting, and Frank Mansur, vice chairman, PGEWS
—Paul Jensen photo

meeting review

CHANNELS FOR DATA

The speaker for the March meeting of the Professional Group on Communications Systems, held at Lenkurt Electric Co., Inc., San Carlos, was Tom Bean, manager of government systems engineering. Bean's topic was, "An Advanced Military Multiplexing System—Can It Be Used for Commercial Applications?" He introduced the AN/FCC-17 multiplexing system of sophisticated and reliable design. It was developed by Lenkurt for the Air Force.

He explained that there are three inherent basic differences between military and commercial multiplexing systems: 1) In the development of commercial systems, the transmission of data constitutes only a small percentage of the total traffic, whereas the AN/FCC-17 will handle 100 per cent loading. 2) Both commercial and military systems are designed to operate from the prime fixed plant, but in the military sense equipment must be designed for much more rugged use, since a fixed plant today may be obsolete tomorrow, and may be transported on a moment's notice by truck, air, or even by a parachute drop. 3) The AN/FCC-17 differs from a commercial system in that it provides an ease of maintenance that is completely basic, since it is operated by personnel with a relatively low level of technical training.

Concluding, Bean stressed that many of the unique electrical features of the military system, with their complementary mechanical advantages and simplified maintenance, can be used effectively and economically on a commercial basis because of the increasing demand for data transmission.

Members were then given a tour of the plant, where they viewed the AN/FCC-17 in various stages of production.

meeting review

WHERE IS IT SLIPPING?

One of the major headaches of management people (both those expecting deliveries under contract and those supplying under contract) is not whether delivery will be on time but rather: just how late?

In a concentrated effort to discover a method of correcting this problem, the Navy office of special projects has been working with pert (Program Evaluation and Review Technique). This is a computerized process whereby two aims are achieved. By plotting estimated progress of all steps and substeps of a project, an estimate can be made of probable project completion. Further, by recording actual progress against estimated progress of all links in a project, work emphasis can be shifted from areas of good progress to areas of excessive slippage.

R. M. T. Young, associated with implementing pert at Lockheed for the Polaris program, explained to the March joint meeting of PGEM and PGEWS some of the processes involved in applying pert.

First, each step in the progress of a planned project is evaluated for a probable completion date derived from a time-distribution curve. This curve is generated by an equation relating the most optimistic, the expected, and the most pessimistic estimates, each appropriately weighted. Then a complex net-

(Continued on page 12)

wescon news

CAREER ENCOURAGEMENT

Wescon's Future Engineers Show will have student representation from throughout the United States, assuming a national character in 1962 for the first time.

According to Gerry Goldenstern, chairman of the event, invitations to participate have been sent through the seven U. S. regional headquarters of the IRE, and to secondary science instructors. Goldenstern and his vice chairman, V. J. Braun, started last fall to plan the event for August of this year, and about 4500 brochures explaining the program were included in a national mailing in January.

Expectation is that nominations of student scientists and engineers will exceed 40. Selection, either by local IRE section or independently through instructors and student science associations, are most often based on work entered in local or regional science fairs.

In Los Angeles, the young participants (along with their instructors) will be guests of Wescon for the exhibit, seminar, and a full program of "Junior Wescon" activity. They will be competing for a total of $2800 in scholarships, including two top awards: the $1000 Lee de Forest award for the best experiment, and the $300 Frederick Emmons Terman Award for the best seminar presentation.

This year's program is the sixth annual Future Engineers Show, and has become an integral part of Wescon's policy of encouraging careers in electronics and the allied scientific arts.

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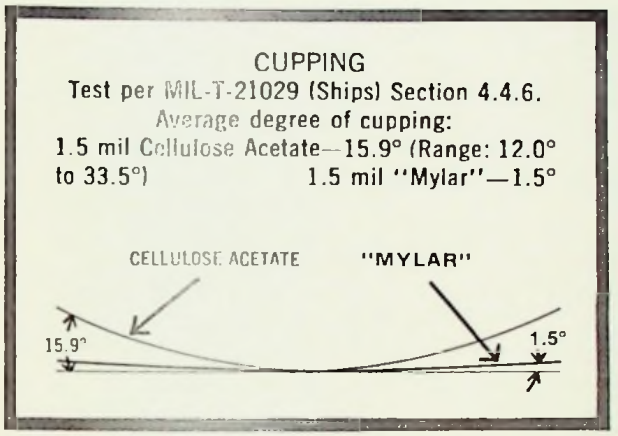

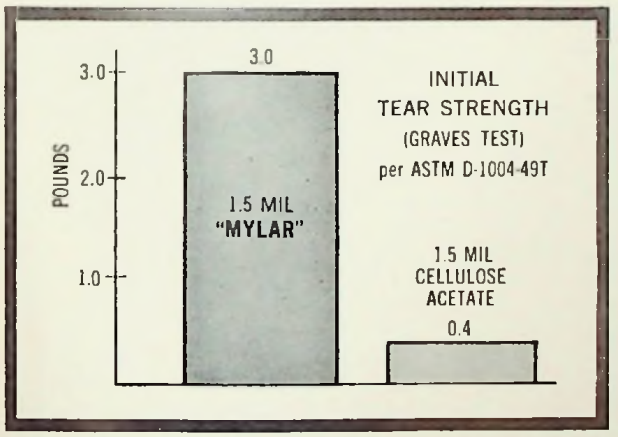

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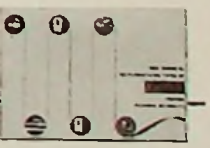

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MORE PERT

work is tabulated and charted, linking each event with every other event upon which it is dependent or which is dependent upon it. From this network a most critical path is discovered: that chain of events whose interdependency is such that the final project completion is most affected by its progress. From this network also comes the estimate of final project completion.

While the project is actually under way, close and accurate records are kept of the progress of each sub-project or link in the network. With computer techniques, these records are compared with the original and all revised estimates. Thus the strong and weak links of the network are discovered. Effort in areas meeting or leading estimates can be shifted to aid in areas in danger of causing the most detrimental delays. These shifts, new estimates, and new records are kept fed to the computer. The pert network then is continually kept up to date, providing new forecasts and indicating directions of corrective action.

In essence, pert performs for an extremely large and complex project what a competent manager performs intuitively in the management of smaller less bewildering projects.

Young pointed out that initial successes of pert have led to the development by other agencies of similar techniques such as pert-II, rmi, rmp, etc. These perform similar services but are, he said, considerably more complex in their organization and operation.

The meeting was opened by the PGEWS secretary, Paul Jensen. The speaker was introduced by the PGEWS vice chairman, Frank Mansur.

—DOUGLAS WM. DUPEN

meeting review

LEAPING THE STANDARDS HURDLE

At the last East Bay Subsection meeting, in late January, Joseph Roizen of Ampex discussed the status of television in Europe. His remarks were based on a year's travel through the video centers there, a journey from which he had at the time just returned.

Joseph Roizen, speaker at the East Bay Subsection meeting

The entire European continent has been tied together in one big network. This feat enabled 250,000,000 people to see the Rome Olympics.

The Europa network was not put together without difficulty. One of the major problems was that there are three basic tv display standards in use today in Europe, all of which are different from the U. S. standards

Country	Lines per Picture	Pictures per Second
U.S.A.	525	60
England	405	50
France	819	50
Remainder	625	50

In addition to the above, standardization of vertical blanking pulses and bandwidth has not been achieved.

The Europa network solves this lack of standardization by re-recording the program in the new system at system boundaries using a monitor on the old system and a camera on the new system. This same method would have to be used in any USA-Europe television link in the future.

In Europe, most tv is run by the State. This has a great effect on the content, for example: Germany specializes in cultural programming while France features adult shows.

European tv is not backward by any means. Most stations Roizen visited had the latest and best monitors, recorders, and other equipment available.

In Rome, during the Olympics, there were at least 50 video tape recorders in use storing and preparing the various programs.

Roizen illustrated his talk with a number of slides, taken in various parts of Europe, illustrating the technical level and programming in existence. He then showed other slides of Europe that were of general interest.

During dinner, prior to the meeting, Mrs. Roizen entertained the assembly with a number of her more interesting experiences while in Europe with her husband.

J. B. WRIGHT

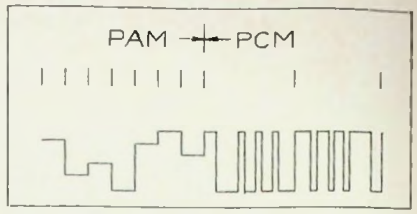
meeting review

DOUBLE DATA-LINK CODING

At the March meeting of PGSET, pacm was described by Warren F. Link of Aeronutronic division, Ford Motor Co. The term pacm stands for Pulse Amplitude (and pulse) Code Modulation.

Aeronutronic was given a study contract in 1957 to look into the problem areas in telemetry systems. This study included: 1) user requirements, 2) R-F spectrum and its crowding, and 3) standardized telemetry-system requirements.

Data rate required by users was investigated. The relation between percentage of total space vehicles and data-rate capacity transmitted for each vehicle was examined. One point on the curve shows that 90 per cent of the vehicles could be accommodated by a bit rate of 1 mc or less. The curve is very flat in this area and is asymptotic to the 100 per cent line.



Described at the PGSET meeting, pacm system employs pam for low-accuracy data with pcm for information requiring high accuracy

User data-accuracy requirements were also investigated. The accuracies most generally requested were 0.1 and 2 per cent with 1, 10, 20, 5 per cent, etc., requested less frequently.

There were few if any requests for accuracies between 0.1 and 1 per cent, an order of magnitude of difference. Such separation suggests that a single coding method may not be used efficiently. A pcm code is most suitable for the high-accuracy data but may not be necessary for the 2-per-cent data.

A common comparison was also made between f-m/f-m, pcm/f-m, pdm/f-m, and pam/f-m by relating transmitter power and receiver bandwidth for given data errors. The pam/f-m system was found to be far superior in the 1-2 per cent data error range. The four modulation methods were compared for susceptibility to an adjacent band and pam/f-m was the least affected while f-m/f-m made the poorest showing. When using the correct combinations of accuracies for the pcm/f-m and pam/f-m, the two signals can be interlaced (time multiplexed) with optimum conditions for both. The combination produces a string of pam channels followed by pcm channels and thus the term pacm. A pam data sample is about one fourth a pcm data-sample period.

Aeronutronic has completed a pacm system for evaluation by the services. The equipment can operate as all pam or pcm or the combination pacm, at data rates of 8,000 to 800,000 bits per second. The pcm words are 6 to 12 bits in length with provision for 64-bit words while the pam samples can be 1 to 6 bits long with an overall frame length of 2048 bits. In addition to the word and frame generator, the laboratory setup includes an s-band transmitter and receiver, detectors, readouts, and pcm magnetic-tape recorder.

(Continued on page 14)

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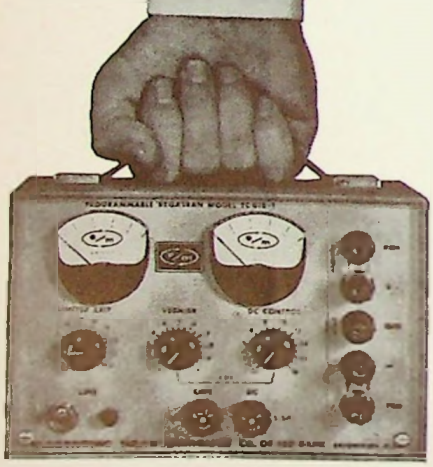

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MORE PACM

An example of a typical data-transmission requirement would be as follows. Data group 1: Subcommutate 250 channels with a 2-cps bandwidth and 0.1 per cent accuracy; data group 2: Subcommutate 100 channels with a 10-cps bandwidth and 0.1 per cent accuracy; data group 3: Commutate 25 channels with a 200-cps bandwidth and and accuracy of 2 per cent; data group 4: Supercommutate 5 channels with a 2000-cps bandwidth and 2 per cent accuracy.

The foregoing could be accomplished with a simple pacm format with 100 primary channels, an equivalent bit rate of 400,000 bits per second, a receiver bandwidth of 500 kc and a 13-db s/n in the i-f section. The same data would require 3 to 5 present-day f-m/f-m data systems.

The pacm system has advantages over others in its transmitter-power-vs-bandwidth function, its low susceptibility to adjacent r-f channels, its standardizing the use of two suitable coding methods into one system, and the fact that it is essentially a digital system.

—JOSEPH W. BARKLEY, JR.

meeting review

FIVE KEYS TO TESTING

The February meeting of PGPEP featured a talk by Eric B. Edberg, manager of reliability and quality assurance for Varian Associates. Edberg discussed "Testing Versus the State of the Art" as related to today's ever-increasing technical requirements.

He pointed out that as late as the mid-thirties it was an easy task for the FCC to allocate the frequency spectrum since nobody wanted the frequencies above 20 megacycles anyway. By contrast, today frequencies almost up to that of light are being sought.

During the period following the Korean War, often called the air age, a weapons system had a reasonably long

(Continued on page 16)

Eric B. Edberg, PGPEP speaker
—Harmon Traver photo

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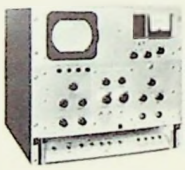

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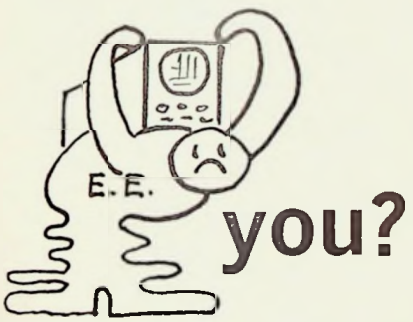

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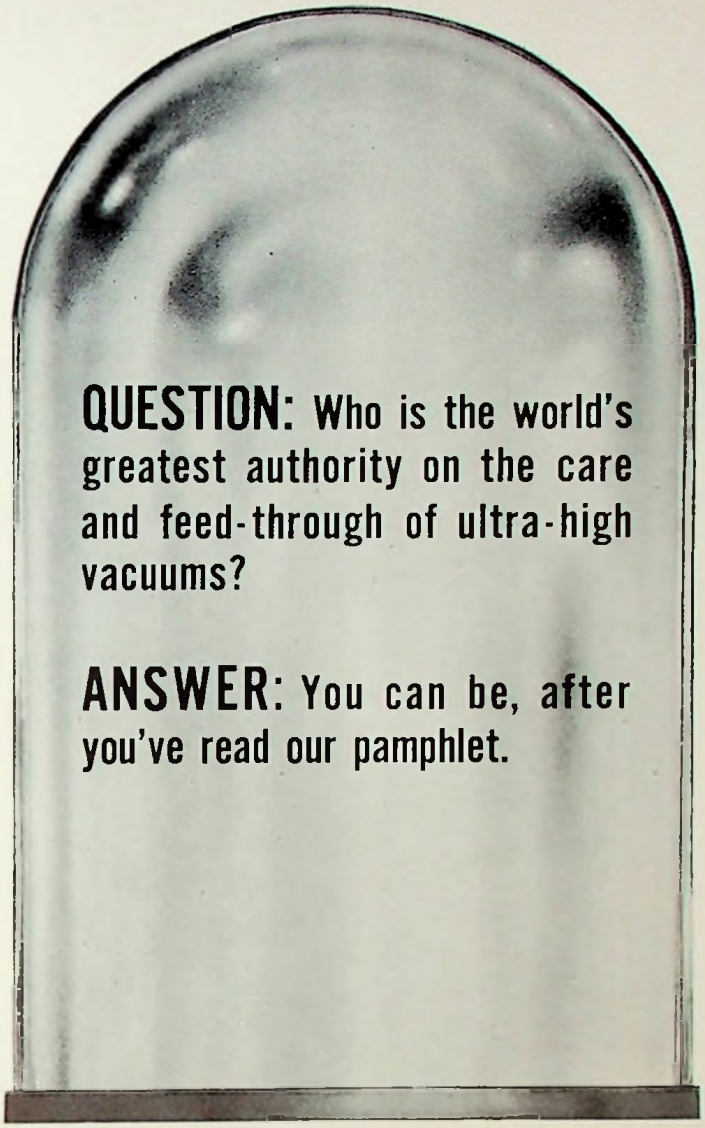

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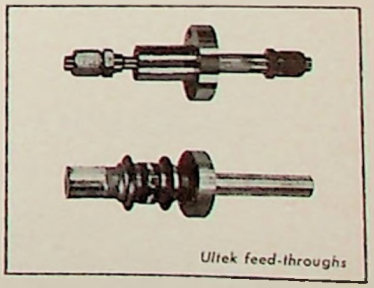
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MORE TESTING

life of perhaps ten years. The cycle of new equipment from conception to manufacture covered a period of five years or more. In the present missile or space age, telescoping of the time scale has become a tactical as well as contractual obligation. Expanding the state of the art for ever more complex systems requires circuitry to perform new functions under stringent environments of shock, vibration, and temperature with demonstrated high reliability. This presents the prime contractor with a truly herculean task. Part of this task is passed on to sub-system or component manufacturers such as Varian.

An Example

One such component is the microwave tube, which requires special care in its design, manufacture, and usage, if its full potential is to be realized. Specifications demand continually higher output, higher efficiency, better noise figures, and greater bandwidths, all under more difficult environments, at less size and weight and with longer life and reliability. These requirements are both reasonable, and proper and point out the direction to be taken in extending the state of the art.

Assessment of the success or failure of any program requires quantitative measurements under actual usage conditions. As a program progresses, specifications which started as estimates become better delineated as factual data becomes available. However, reluctance to tighten specifications is certainly not so great as the reluctance to loosen them, but even this often happens. Another source of confusion in specifications comes from the amazing number referenced in government procurements. In this regard, Edberg stated that there are some 25,000 such specifications in existence, many of which may be in effect on any one contract by reference or sub-reference. The need to provide for fast feedback of revised specification conditions and values is one of the hurdles that must be surmounted in our present-day time-compressed programs to prevent delays and waste of money.

It is only after conditions are known that the instrumentation needed for the test program can be specified. While in many cases much of the equipment needed is available, many times we are concerned with the measurement of parameters new to the industry.

One of the measurements required for microwave oscillators is the measurement of a-m and f-m sidebands. In the a-m measurements it is necessary to measure sidebands more than 120 db down from the carrier in 100 cps bandwidths in the region of 1 kc to 100 kc from the carrier containing 1-kw power. Since the tubes operate in the 5- to 10-gc range, short-term stabilities of 1 part in 10^{-11} are involved. These same measurements must be made at several frequencies and as a function of several other operating parameters. In addition, further measurements of the same type must be made under conditions of vibration, temperature, and sometimes shock.

The combination of variables require such a large number of point-by-point measurement that both the tube and technician probably would be worn out before the tests were completed. This means that instrumentation must have a degree of semi-automation and present quantitative data that is plotted automatically. Several years of research and development were required to produce satisfactory models. Because of sensitivity of the equipment used to make, not only the a-m and f-m measurements, but also noise output, a severe problem of r-f interference had to be solved.

Economic Aspects

The total cost of one of these systems is in the neighborhood of $40,000, but it does make it possible to fulfill specification commitments and serve as a tool in providing measurements during design and development phases. Since

(Continued on page 18)

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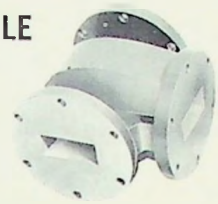

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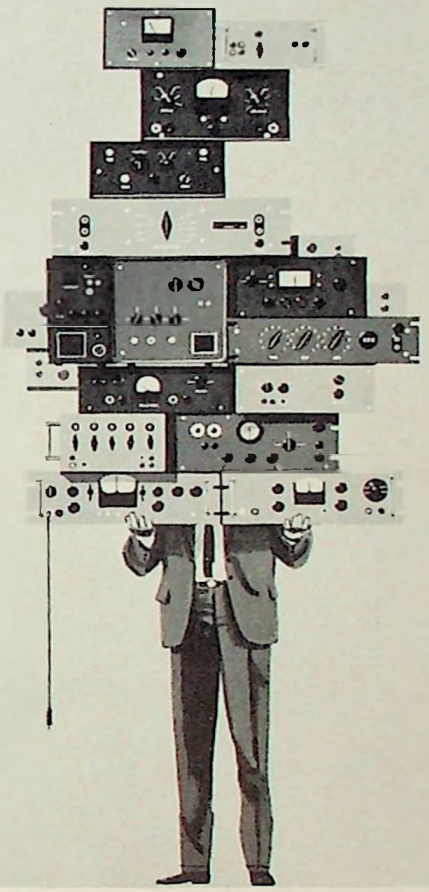

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MORE TESTING

up to one-half of the labor cost of a microwave tube is directly attributable to the testing activity, labor-saving instrumentation is a good investment.

The high-acquisition cost dictates that an effective program of test-equipment maintenance and calibration must be provided if down time is to be kept to a minimum. The validity of measurements must be assured by a completely documented calibration program. Transfer standards of a higher degree of accuracy than the equipment being checked should be used for the actual calibrations. Such transfer standards should be rigidly controlled and calibrated in a standards laboratory against secondary standards that are periodically checked against primary standards directly traceable to the National Bureau of Standards.

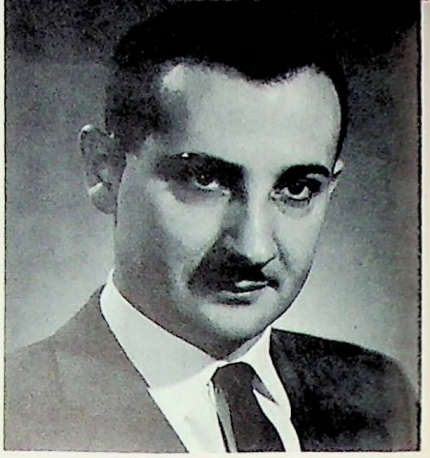
Another important aspect of testing is the environmental laboratory. Where only a short time ago environments involving vibration, shock, centrifugal acceleration, altitude, humidity, and temperature were imposed merely to assure that components could withstand the environment without destruction, it is now necessary for the component to operate with only a small degree of degradation in performance while subjected to such environments. Since the tests are operating tests it becomes necessary to provide a well-equipped laboratory with properly trained personnel.

In summarizing his talk, Edberg stated we would more closely fill our present needs in testing if: 1) We encouraged and accomplished rapid feedback in specifications between contractor and supplier; 2) We attempted to provide versatile programmed semi-automatic test equipment before the fact for at least those types of measurements needed in all tube programs; 3) We made best use of our instrumentation by assuring its continual calibration accuracy; 4) We provided an environmental facility in keeping with the times; and 5) We manned the facilities with well-trained high-caliber people.

Edberg has been with Varian since 1950. Prior to being named manager of reliability and quality assurance he was chief test engineer. From 1945 to 1950 he was with Sperry Gyroscope's klystron application and test group. From 1940-1945 he was on active duty with the USNR in radar work. He received his technical education at CCNY.

A plant tour of the microwave tube production and test areas followed Edberg's talk. A number of the test systems were observed in operation on tubes from a few milliwatts up to several megawatts of output power.

—HARMON R. TRAVER



H. M. Semarne, PGEC speaker

meeting review

MICROPROGRAMMING AND ITS MODIFICATIONS

Dr. H. M. Semarne, Los Angeles consultant, spoke on microprogramming before the March PGEC meeting. He began his talk with a historical review of microprogramming. He went on to discuss some of the advantages and practical applications that resulted from using a microprogrammed system.

Semarne pointed out that microprogramming is a vital form of programming as well as a design concept. Microcommands, as building-block components of machine instructions, enable the programmer to express himself through highly versatile composites of individual logic operations. The instruction list of a computer has a given degree of abstraction with respect to the machine logic. The programmer can supplement this list by higher-level commands controlled by sequences of microcommands. These sequences, or microprograms, supply stored — rather than wired—logic.

At the design stage, stored logic set up by microprograms can be assumed for most conventional hardware-implemented instructions of a computer. Satisfactory results can be achieved by a further modification of microprogramming in which much of the logic is stored as pre-selected generic groups of microcommands.

Semarne is a consultant on computer applications, information-system planning, and computer-user training programs. He has been a research associate at the Foundation for Advanced Research, and an instructor in mathematics and computer programming techniques at the University of California, Los Angeles Extension.

Semarne has a doctorate in linguistics from the University of Paris, and a BS and an MS in chemistry and mathematics from the University of California at Los Angeles, where he has a PhD thesis in mathematics in progress.

—W. H. DAVIDOW

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Outputs: 100KC ±0.1 V, 100KC ref, Sin 0.1 V, Sq Wv.

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Flange and Order No.	Band	Waveguide Type (RG/U)	Flange Type	Material	Reference No.	Price
UG-344/U	C	50	Cover	Brass	MIL-F-3922/6	$2.10
UG-441/U	C	106	Cover	Aluminum	MIL-F-3922/11	2.20
UG-343A/U	C	50	Choke	Brass	MS90048	3.25
UG-343B/U	C	50	Choke	Brass	MIL-F-3922/30	3.25
UG-440A/U	C	106	Choke	Aluminum	MS90048	3.50
UG-440B/U	C	106	Choke	Aluminum	MIL-F-3922/36	3.50
C-72B	C	50	Milledback	Brass	——	2.50
C-72A	C	106	Milledback	Aluminum	——	2.75
UG-39/U	X	52	Cover	Brass	MIL-F-3922/1	.75
UG-135/U	X	67	Cover	Aluminum	MIL-F-3922/4	.85
UG-40A/U	X	52	Choke	Brass	MS90048	1.30
UG-40B/U	X	52	Choke	Brass	MIL-F-3922/36	1.30
UG-136A/U	X	67	Choke	Aluminum	MS90058	1.40
UG-136B/U	X	67	Choke	Aluminum	MIL-F-3922/27	1.40
X-72B	X	52	Milledback	Brass	——	1.10
X-72A	X	67	Milledback	Aluminum	——	1.15
UG-419/U	P	91	Cover	Brass	MIL-F-3922/10	.95
P-70A	P	91 Alum	Cover	Aluminum	——	1.10
UG-541/U	P	91	Choke	Brass	MS90062	1.60
UG-541A/U	P	91	Choke	Brass	MIL-F-3922/13	1.60
P-71A	P	91 Alum	Choke	Aluminum	——	1.75
P-72B	P	91	Milledback	Brass	——	1.25
P-72A	P	91 Alum	Milledback	Aluminum	——	1.35

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Construction is under way on this $250,000 facility in Mountain View for Datamec Corp., manufacturer of computer magnetic-tape equipment. The 15,000-sq-ft plant and office building at 345 Middlefield Rd. is to be ready July 15

grid swings

IT IS REPORTED:

A new end station with three-foot-thick concrete walls where nuclear targets can be bombarded by billion-volt electrons will go under construction this summer on the **Stanford University** campus.

It will be an addition to the high energy physics laboratory, one of the W. W. Hansen Laboratories of Physics. Support for the $650,000 project comes largely from the Office of Naval Research. Spencer and Lee of San Francisco are the architects. Completion of the new end station is expected some time in the spring of 1963.

Moore Associates recently announced the election of **Melvin J. Gardner, William G. Hoover,** and **Roger W. Sant** to the Board of Directors. Hoover is technical director of Granger Associates and maintains an association with Stanford as lecturer in electrical engineering.

Long & Associates, Inc., has announced a recent move to larger quarters at 505 Middlefield Road, Redwood City. The new quarters, a residence built in 1889, makes the "House of Long & Associates, Inc." the oldest electronic representative house in captivity

Alan F. Culbertson has been elected vice president—engineering of **Lenkurt Electric Co., Inc.** Culbertson has been director of engineering at Lenkurt since December, 1959, and will continue under the new title to handle his former responsibilities. He joined Lenkurt in 1952 after six years with American Telephone & Telegraph Company.

Culbertson *Buchmiller*

The appointment of **Lyle D. Buchmiller** as senior research engineer at **Microwave Electronics Corp.** has been announced. For the past 12 years Buchmiller has been a research associate at the Stanford University electronics laboratory.

George L. Matthaei of **Stanford Research Institute** will receive this year's Microwave Prize at the 1962 National Symposium of PGMTT. The award is for Matthaei's paper, "A Study of the Optimum Design of Wide-Band Parametric Ampliers and Up-Converters," which appeared in the January, 1961, issue of the PGMTT Transactions.

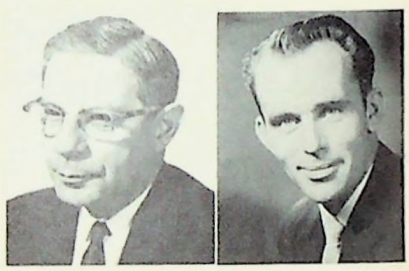
Reconix, Inc., has been formed by **Peter D. Strum,** president, and **John B. Pettegrew** and **Maurice G. Chernin,** vice presidents, to specialize in electronic receiving systems, instrumentation, antennas, and ecm equipment. The firm's laboratories and manufacturing facilities are located in a new 6,000-sq-ft building in the Kavanaugh Industrial Park, Menlo Park.

Edwin R. Gamson, general manager of **Ampex Corporation's** Computer Products Company in Culver City, has been elected corporation vice president.

Varian Associates has announced organizational changes designed to consolidate and strengthen the company's instrument, radiation and vacuum products divisions.

The former instrument and equipment group structure has been divided into two parts. **Emery Rogers,** vice president, instrument division, will report directly to President H. Myrl Stearns. **Louis Malter,** who has just been elected a vice president of the company, will assume responsibility for the vacuum products and radiation divisions and will also report to Stearns. **Howard Patterson,** who has been serving as vice president, instrument and equipment group, will become a consultant for Varian.

Malter come to Varian in 1958 as director of research. Before joining Varian, he held posts at Radio Corporation of America and the Naval Research Laboratory.



Malter *Swanson*

William C. Swanson has been appointed district manager of engineering and marketing for Northern California by the **Physical Sciences Corporation,** Pasqdena, an affiliate of Packard Bell Electronics. Swanson's office is located in Mountain View.

Straube Associates have recently been appointed representatives for **Radio Condenser Company,** subsidiary of TRW Electronics Inc., Camden, New Jersey.

Three additions to the senior engineering staff have been announced by **Granger Associates: Walter E. Ferrell,** design and development; **Edward A. Sutherland,** product and standards engineering; **James W. Fitzgibbons,** mechanical development and production design of multi-couplers; and **Merdin C. Criddle,** senior field engineer.

(Continued on page 22)

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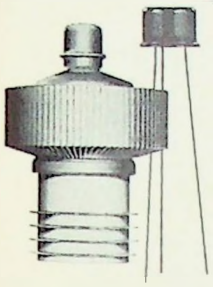

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MORE SWINGS

Microwave Electronics Corp has announced the appointment of **Everett A. Malcolm** as materials manager. Malcolm will assume responsibility for sources, traffic, inventory, and control of all purchased materials.

Donald A. Ashford has rejoined **Lenkurt Electric Co., Inc.,** as a senior staff engineer in product planning. First associated with Lenkurt Electric in 1958, Ashford left in August, 1959.

Christopher Karabats has been appointed to the newly created position of manager of production control and parts fabrication of the tube division at **Varian Associates.**

Prior to joining Varian, Karabats was manufacturing manager at General Electric Co. in Palo Alto.

D. E. Merrill has joined **Microwave Electronics Corp.** as personnel manager. Prior to assuming his new position he was personnel manager of Dymec, a division of Hewlett-Packard Co., and acted as personnel coordinator for all divisions of the Palo Alto plant.

E. Kenneth Peterson has been named manager of advanced development at **Lenkurt Electric Co., Inc.,** San Carlos, where he has been a member of the product planning staff since joining the company in August, 1960.

Geoffrey Ball recently joined the technical staff of **ITT Federal Laboratories** in Palo Alto and will be involved in pattern recognition studies.

Peterson

Ball

IRE MEETINGS SUMMARY

May 22-24 — **National Microwave Theory and Techniques Symposium.** NBS, Boulder Labs, Boulder, Colorado. No exhibits. Program: Robert W. Beatty, NBS Lab, Boulder, Colorado. Digest: $3, order from M. C. Thompson, NBS, Boulder.

May 23-25 — **National Telemetering Conference.** Sheraton Park Hotel, Washington, D. C. Exhibits: Leon A. King, Jansky & Bailey Co., Shirley Highway and Edsall Rd., Alexandria, Va. Program: D. G. Mazur, Goddard Space Flight Center, Greenbelt, Md. Proceedings: $3.50 members, $5.50 non-members, order from IRE Headquarters.

May 24-26—**Seventh Region Conference.** Olympic Hotel, Seattle, Washington. Exhibits: Century 21 Fairgrounds. Program: T. G. Dolby, 3220 99th N.E., Bellevue, Washington.

June 18-19—**Chicago Spring Conference on Broadcast & TV Receivers.** O'Hare Inn, Chicago, Ill. Exhibits: John H. Landeck, Admiral Corp., 3800 W. Cortland, Chicago, Ill. Program: Al Cotsworth, Zenith Radio Corp., 6001 W. Dickens Ave., Chicago 39, Ill. Proceedings: PGBTR Transactions, July, 1962.

NON-IRE LOCAL EVENTS

May 17 — Northern California Section, **American Society of Lubrication Engineers.** "Present-Day Lubrication Research in Europe," by R. G. Larsen, Shell Development Co. Spenger's Fish Grotto, Berkeley. Dinner: 7 p-m (social hour 6 p-m), no reservations required.

May 21—**Women's Association of the Electronic Industry.** Caravan Inn, 4375 El Camino Real, Mountain View. Dinner: 7:00 p-m (social hour, 6:00 p-m). Speaker: Miss Barbara J. Short, NASA, Ames Research Center, Moffett Field. Miss Short, one of the designers of the capsule configuration for Project Mercury, will discuss the function of the Ames facility. Pictures will be shown.

May 27-June 2—**University of California Extension,** fifth annual leadership laboratory in human relations and supervisory skills. Ojai Valley Inn, Ojai. Information: University of California Engineering and Physical Sciences Extension, UCLA, Los Angeles 24.

May 28-30—First Annual Convention of the **American Association for Contamination Control.** Jack Tar Hotel, San Francisco. Registration and exhibits: Donald M. Petersen, Central Vacuum Corporation, 3008 E. Olympic Blvd., Los Angeles 23, California.

PAPERS CALLS

May 15 — 800-word abstracts, ten copies, and biography of author for 9th National Symposium on Reliability and Quality Control (San Francisco; Jan. 22-24, 1963). Send to: Leslie W. Ball, Boeing Co., P.O. Box 3707, Seattle 24, Washington.

June 1—50-word abstracts for 15th Annual Conference on Engineering in Medicine & Biology (Chicago, Nov. 4-7). Send to: Program Committee, P.O. Box 1475, Evanston, Ill.

June 1—350-word summary, subject title and short biographical note for 2nd Canadian IRE Symposium on Communications (Montreal, Quebec, Nov. 16-17). Send to: Allan B. Oxley, Chairman Technical Program, P.O. Box 802, Station B, Montreal, Quebec, Canada.

June 11—400- to 500-word abstracts in triplicate and 50-word summaries for NEREM (Boston, Nov. 5-7). Send to: I. Goldstein, Raytheon Co., Box 555, Hartwell Road, Bedford, Mass.

June 15—1000-word summary, four copies, for Spaceborne Computer Engineering Conference (Anaheim, Calif., Oct. 30-31). Send to: R. A. Kudlich, chairman, Program Committee, AC Spark Plug Division, General Motors Corp., 950 North Sepulveda Blvd., El Segundo, Calif.

June 15 — 500-word abstract and brief professional record of author, five copies, for Ninth East Coast Conference on Aerospace and Navigational Electronics (Baltimore, Oct. 22-24). Send to: William C. Bergard, chairman, Technical Program Committee, Adv. Res. Dept., Bendix Radio, Towson 4, Maryland.

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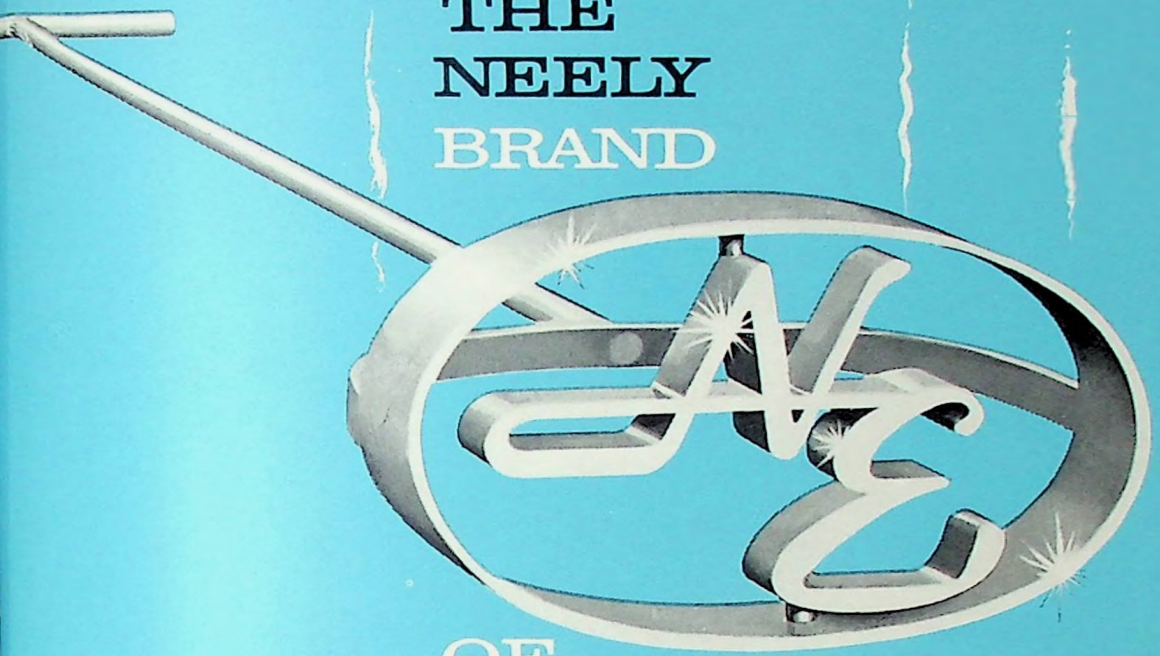

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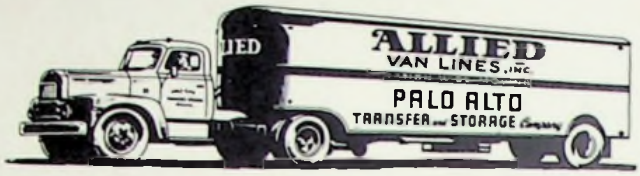

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the section

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

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A. S. Bauer
L. E. Black
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R. Y. Chao
M. A. Clark
E. P. Cleary
R. W. Colpitts
W. J. Crawford
E. D. Crockett
L. F. Crowder
G. E. Delore
J. W. Dymecki
V. W. Edleman
T. S. Edwards
J. R. Flanagon
Bernard E. Gardiner
Gregory E. Gates
R. D. Gray
R. E. Hagerott
P. H. Haley
R. A. Hall
G. L. Heiter
T. E. Helderman
L. G. Holmes
D. S. John
M. H. Johnson
B. W. Jordan, Jr.
W. K. Jung
B. G. Kay
J. L. Kersey, Jr.
R. U. Laine
R. E. Lee
B. A. Lerpold
J. S. MacDougall
R. J. Maltby
W. J. Marsh
W. E. Mitchell
B. M. Nauss
H. H. P. Olszanski
M. C. O'Shea, Jr.
W. S. Perry, Jr.
A. F. Rashid
D. K. Rathbun
T. M. Reeder
J. B. Russell
W. C. Schaefer
R. D. Stowell
C. F. Ramstedt
W. Shahbaz
A. T. Torson
R. C. Turke

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

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E. K. Bachelder
J. D. Bardis
J. P. Bartelme
J. D. Baum
B. J. Benedict
J. R. Cavin
D. R. Crounse
T. P. Daly
B. W. Dorsch
D. W. Doss
J. B. Downey
R. W. Dugan
S. Gee
W. H. Hagerty
E. H. Hale
F. Hale, Jr.
J. C. Kyle, Jr.
S. J. Larson
J. J. Leong
P. A. Lindfors
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S. N. Newton
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N. Podbielski
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I. Radpour
C. L. Rudd
A. E. Schinn
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V. G. Suth
W. A. Tate
J. A. Thieson
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L. S. Upton
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R. C. Walton
E. W. Yeagle
V. N. Zachariah

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

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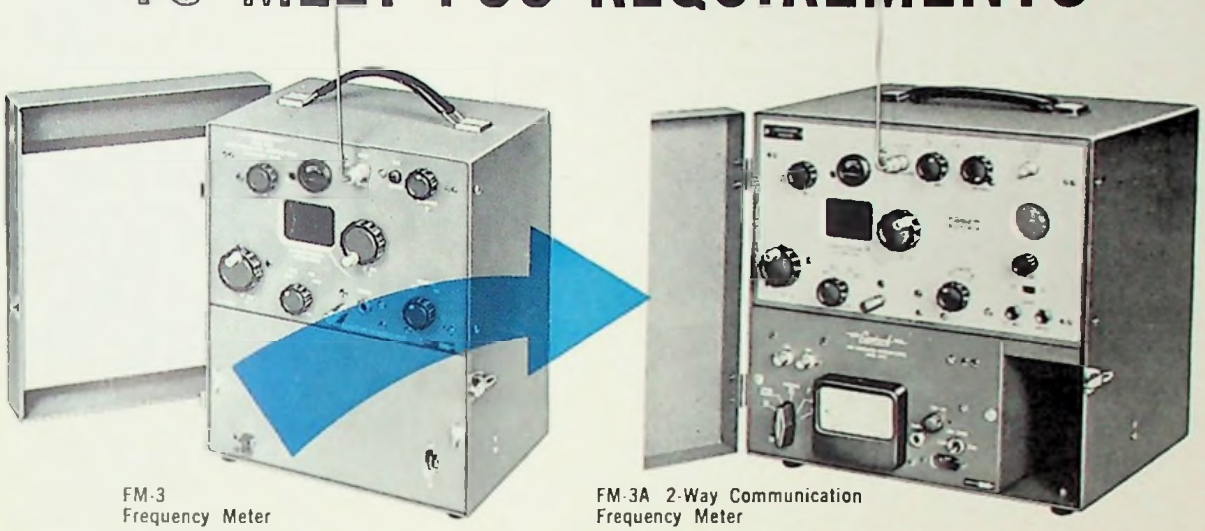
YOUR GERTSCH FM-3 FREQUENCY METER CONVERTED TO MEET FCC REQUIREMENTS



FM-3
Frequency Meter

FM-3A 2-Way Communication
Frequency Meter

— factory conversion provides direct reading of all allocated channels in the 150-170 mc band

All Gertsch Model FM-3 frequency meters can now be factory-converted to measure and generate *all* assigned channels in both 150-170 mc, and 450-510 mc bands.... with ±.0003% (3 ppm) accuracy. Instrument features a single 1-mc crystal which is easily standardized against WWV.

Converted units can also be operated as standard FM-3 instruments through 20 to 1,000 mc, at .001% accuracy.

Conversion includes: an all transistorized converter module, a new front panel and carrying case, and a built-in amplifier (with speaker). Also, a front-panel jack allows input of external audio signals, such as those from a Gertsch Model DM-3 deviation meter. Space for a DM-3 is provided in the case.

Compact size — only 13½" W x 11½" D x 13¾" high.

New Gertsch frequency meters are also available in both battery operated and AC power supply units. New meters incorporate same features as converted instruments.

Send for literature on FM-3A series.

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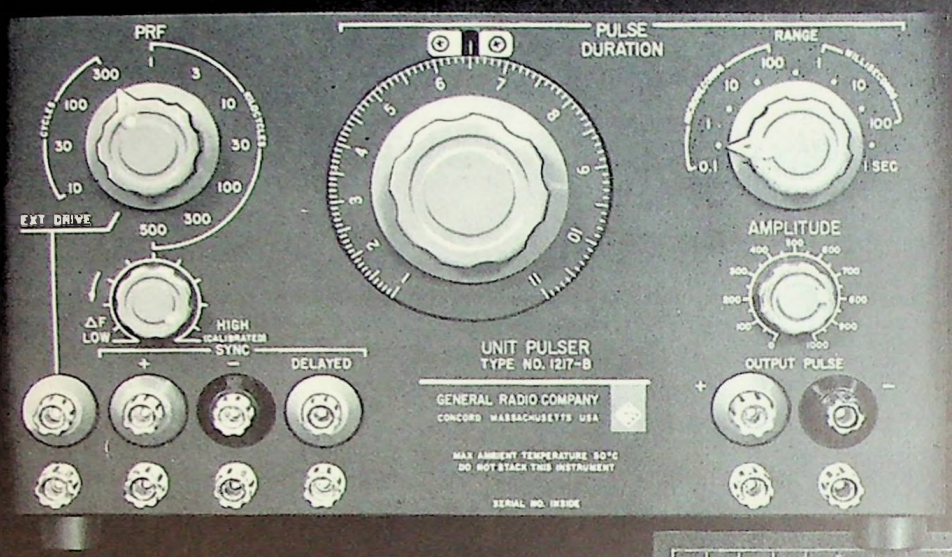
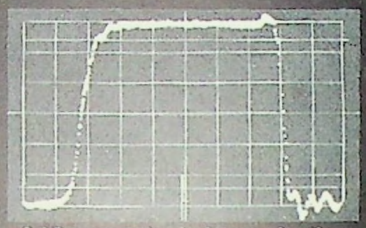
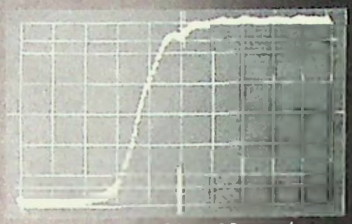


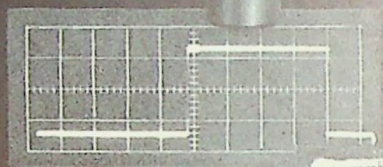
NEW Package of Pulses



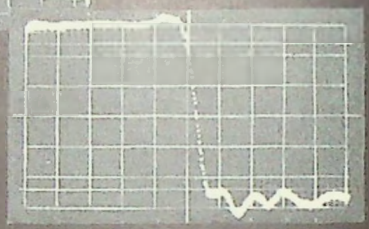
0.12-μ sec pulse in 1-nsec rise time sampling system; 20 nsec/cm.



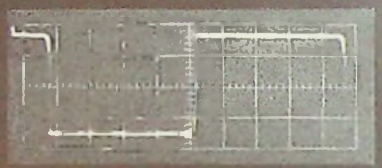
Positive transition, 10 nsec/cm.



2-volt, 5-μsec pulse; 50-ohm termination.



Negative transition, 10 nsec/cm.



2-volt, 0.5-μsec pulse; 50-ohm termination; 0.1 μ sec per division.

This new instrument, which replaces the widely accepted Type 1217-A model, gives you an increased PRF range, better rise and fall times, more output power, and increased pulse-duration range at *no increase in price*. Using both transistors and tubes in optimum circuit design, the Type 1217-B Unit Pulser is a low-priced pulse source with the characteristics you want.

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Improved rise and fall times — less than 15ns into 50Ω load.

Increased pulse duration range — 50ns to 1sec; accuracy, ±5%.

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Ease of external triggering — requires only 0.25v rms driving signal through the complete range to 1 Mc.

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