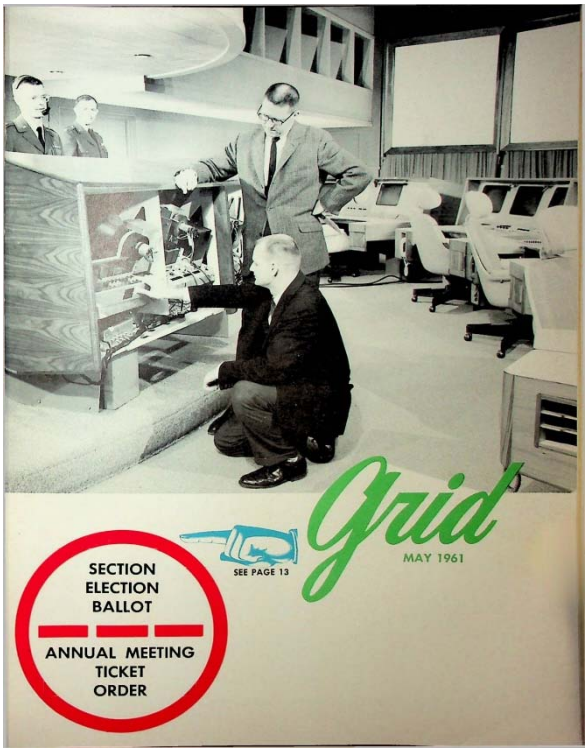
EDITOR'S PROFILE of this issue

from a historical perspective …

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



May, 1961:

Cover: Consoles are being installed and tested at the USAF's Satellite Test Center in Sunnyvale. It coordinates and meshes the launch, tracking, data acquisition and recovery activities for Air Force satellites.

p. 38: Among the engineers accepted as new IRE members is Alan F. Shugart. He had come to IBM's disk drive division in San Jose in 1955, working on the RAMAC, and his team invented the floppy disk. After serving as VP at Memorex, he founded Shugart Associates, then Seagate Technology. He was unsuccessful in electing his dog, Ernest, to the U.S. Congress.

Grid

MAY 1961

SECTION ELECTION BALLOT

ANNUAL MEETING TICKET ORDER

SEE PAGE 13

flexible power for forward scatter

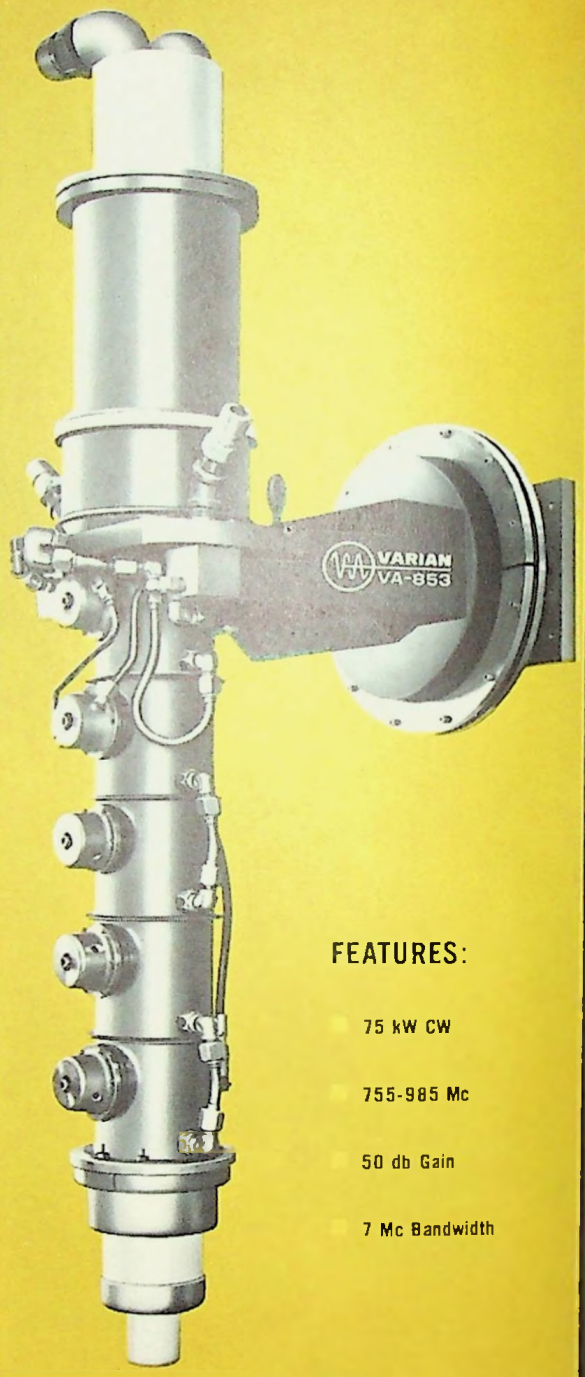
75 kW CW to 10 kW

The Varian VA-853 CW amplifier klystron features an extremely flexible power range at 755 to 985 Mc — from 75 kW to as low as 10 kW. Provides new possibilities in the development of troposcatter systems. Designed to meet USAF specifications for forward scatter tubes.

One power amplifier serves the entire output range. Power can be varied easily by adjustment of the beam voltage. Drives from a 5 W exciter. High gain — 50 db — is provided by five internal cavities. Compactly designed, with input and output couplings preset for flat rf lines. Just tune to desired frequency; no other physical adjustments are necessary.

Noncritical electromagnet provides a self-centering mount; the tube can be removed as a unit, inserted directly — no need for roll-out dollies.

It's very probable Varian power tubes can aid in your design problem. For technical information, write Tube Division.



FEATURES:

- 75 kW CW
- 755-985 Mc
- 50 db Gain
- 7 Mc Bandwidth

VARIAN associates

PALO ALTO 16, CALIFORNIA

BOMAC LABORATORIES, INC.
VARIAN ASSOCIATES OF CANADA, LTD.
S-F-D LABORATORIES, INC.
SEMICON ASSOCIATES, INC.
SEMICON OF CALIFORNIA, INC.
VARIAN A. G. (SWITZERLAND)

Q. WHAT'S THE LATEST ABOUT ARNOLD 6T CORES ON THE COAST?

A. SAME-DAY SHIPMENT OF STANDARD DELTAMAX CORE SIZES!

For West Coast users of cased tape-wound cores, here are potential cost savings and an answer to your inventory problems: *Arnold aluminum-cased, hermetically-sealed Type 6T Cores are now available for immediate shipment from warehouse stocks in our Los Angeles plant.*

An extensive stock of Deltamax 1, 2 and 4-mil cores in the proposed EIA standard sizes (see AIEE Publication 430) is ready for your convenience. Shipment will be made the same day when your order arrives by noon, in quantities from prototype lots up to your regular production requirements.

Use Arnold 6T Cores for improved performance as well as reduced cost. They offer you three important design advantages. *One:* Maximum compactness, comparable to or exceeding that previously offered only by plastic-cased cores. *Two:* Maximum built-in protection against environmental hazards. *Three:* Require no supplementary insulation prior to winding and can be vacuum impregnated after winding.

Arnold 6T cores are guaranteed against 1000-volt breakdown . . . guaranteed to meet most military test specifications for resistance to vibration and shock . . . guaranteed also to meet most military specifications for operating temperatures. The 6T case is extra rigid to protect against strains.

● Let us supply *your* requirements. Full data (Bulletin TC-101A and Supplements) on request.

ADDRESS DEPT. TG-5

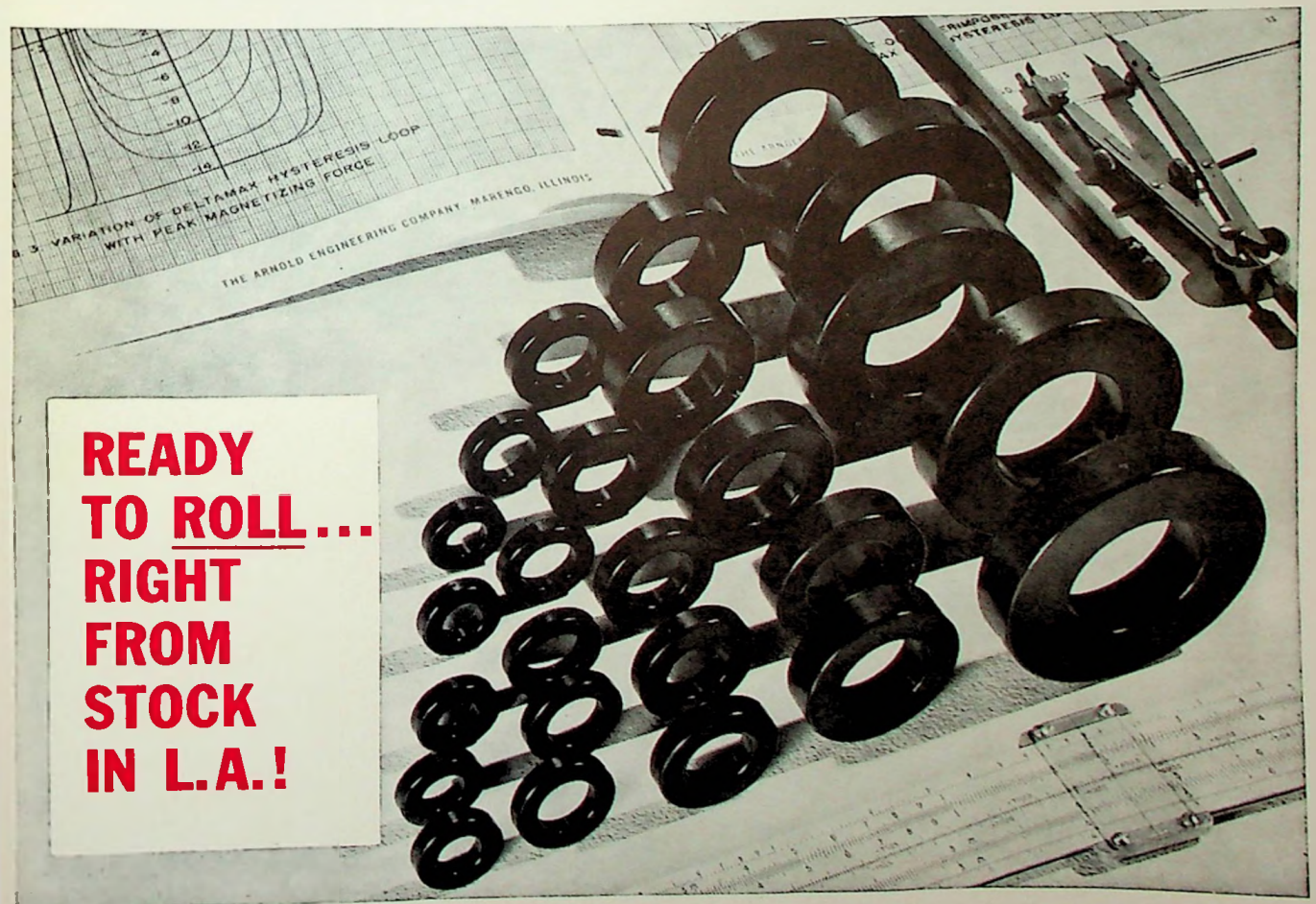
ARNOLD

SPECIALISTS In MAGNETIC MATERIALS

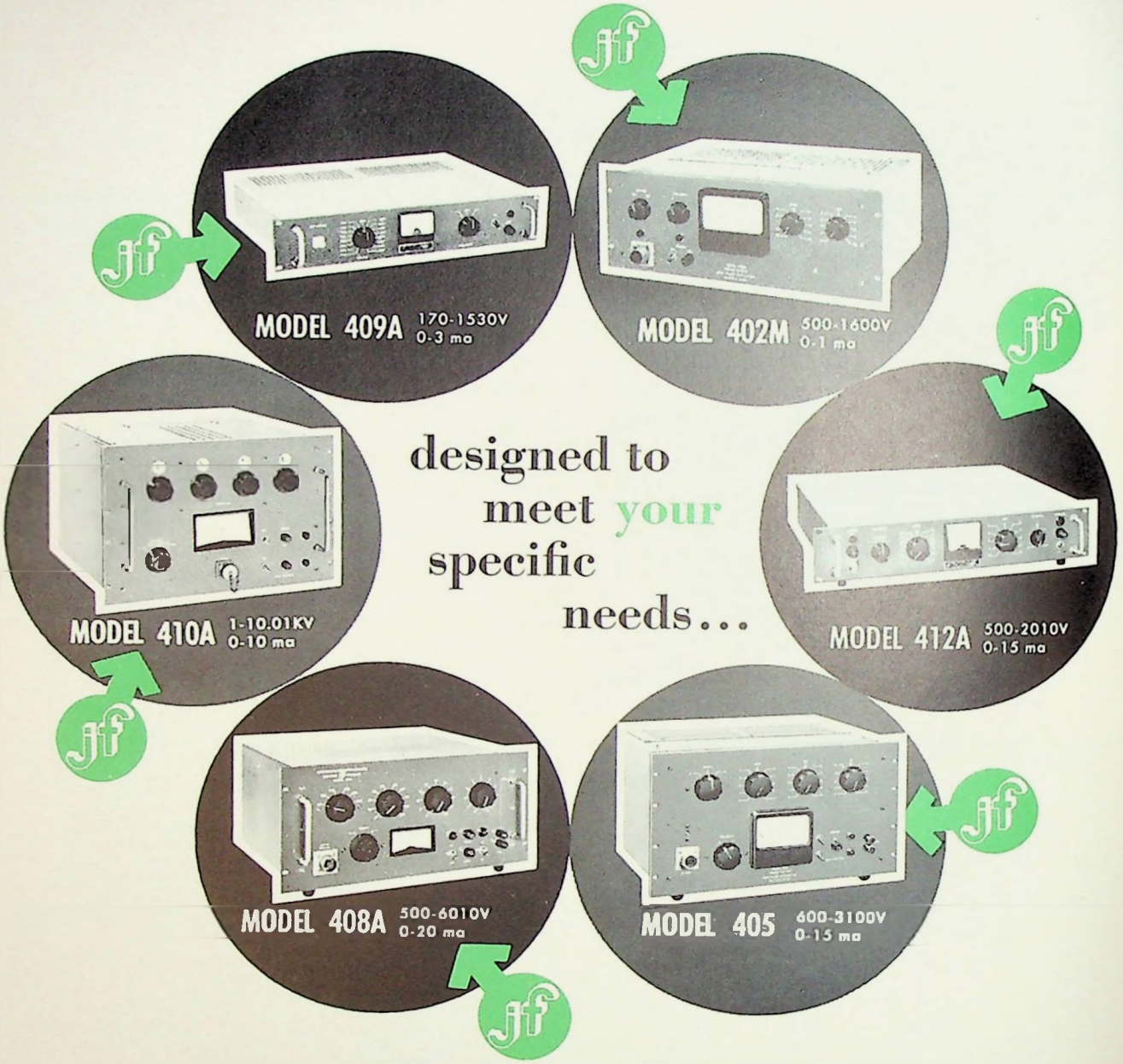
THE ARNOLD ENGINEERING COMPANY
Main Office: MARENGO, Ill.

SAN FRANCISCO, Office: 701 Welch Road, Palo Alto, Calif.
Telephone: DAvenport 6-9302

2421



HIGH VOLTAGE POWER SUPPLIES



designed to meet your specific needs...

JOHN FLUKE precision High Voltage Power Supplies offer complete coverage up to 10 KV. In addition to high calibration accuracy, tight line-load regulation, fine voltage resolution, and excellent long term stability; many other plus features are provided the design engineer. For example: difficulties resulting from corona, jitter, bounce or overshoot are non-existent in jf supplies. The capability of the John Fluke Co. to keep pace with industry demand is evidenced by the fact that most of these instruments have been introduced within the past year.

MODEL	VOLTAGE	CURRENT	REGULATION		STABILITY PER HOUR	MAX. RIPPLE RMS	RESOLUTION	PRICE
			LINE	LOAD				
409A	170-1530V	0-3 ma	0.01%	0.4%	0.02% (Per Day)	0.002%	85V steps	$335.00
402M	500-1600V	0-1 ma	0.03%	0.03%	0.01%	5mv	100mv	$320.00
412A	500-2010V	0-15 ma	0.01%	0.01%	0.005%	5mv	10mv	$455.00
405	600-3100V	0-15 ma	0.01%	0.005%	0.005%	5mv	10mv	$595.00
408A	500-6010V	0-20 ma	0.01%	0.01%	0.005%	5mv	10mv	$695.00
410A	1000-10,010V	0-10 ma	0.01%	0.01%	0.005%	5mv	10mv	$1095.00

All prices quoted, F.O.B., Factory, Seattle. Prices and technical data subject to change without notice.

Designed to power photomultiplier tubes and ionization chambers . . . for research and development of traveling wave tubes and backward wave oscillators.

JOHN FLUKE

MANUFACTURING CO., INC.

P. O. BOX 7161, SEATTLE 33, WASHINGTON

volume 7
number 9

Grid

May 1961

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

contents

PUBLISHER & EDITOR: FRANK HAYLOCK
GENERAL OFFICES: 109 HICKORY LANE, SAN MATEO, CALIF. FIRESIDE 5-1617

POSTMASTER: PLEASE SEND FORM 3579 TO: P. O. BOX 1193, SAN MATEO, CALIFORNIA

OFFICE OF PUBLICATION: 394 PACIFIC AVE., FIFTH FLOOR, SAN FRANCISCO

SUBSCRIPTION: $2.00 (SECTION MEMBERS); $4.00 (NON-MEMBERS) $5.00 (FOREIGN) PER ANNUM.

SECTION MEMBERS: SEND ADDRESS CHANGES TO IRE NATIONAL HEADQUARTERS, 1 EAST 79 STREET, NEW YORK 21, N. Y. OTHERS TO P. O. BOX 1193, SAN MATEO, CALIFORNIA.

SECOND-CLASS POSTAGE PAID AT SAN FRANCISCO, CALIF.

cover

In Sunnyvale, the USAF Satellite Test Center, command post for the Air Force earth satellite programs, was activated in January 1960. An interior view of the control center of the network of technical stations required to operate Discoverer, Midas, and other Air Force programs, appears on the cover.

Personnel are Capt. F. S. McCartney, Air Force, assistant system test controller; Major Keith Smith, Air Force, System test controller; Ned Spitzer, Lockheed, assistant test director; and James Sutherland, Radiation at Stanford, installation engineer.

As the focal point of the satellite complex, the Satellite Test Center provides the direction which coordinates and meshes the launch, tracking, data acquisition, and recovery activities during satellite operations.

Design and installation of the display-systems equipment were performed under contract by Radiation at Stanford—other local contributors being the Vicon Corp., division of Insul-8-Corp., and Dymec, a division of Hewlett-Packard.

Consoles visible contain cctv equipment, communications facilities, and remote controls for audio tape recorders. Large screens permit projection of satellite tracks, maps, weather information, and similar data.

MANUFACTURERS OF:
Microwave Products, Educational, Medical, Laboratory Instruments

For precise quantitative analysis of:

- Dielectric properties of solids and liquids
- Ferromagnetic effects
- Paramagnetic relaxation and resonance effects
- Absorption spectra of gases
- Molecular beam resonance
- Superconductivity phenomena
- Microwave accelerated particles
- Radiometry
- Velocity and phase by interferometry
- Transmission and absorption spectrometry
- Plasma diagnostics

UNIQUE FERRITE ISOLATORS

We use a special ferromagnetic compound in these units. Result: improved unidirectivity.

Typical Specifications

Frequency range: full waveguide bandwidth
Insertion loss: 1.0 db max.
Isolation: 30 db min.
VSWR: 1.15 max.
Overall length: 5⅞"

NEW FERRITE-LOADED CRYSTAL MULTIPLIER

You have long wanted more power at Ultra-microwave* frequencies. These ferrite-loaded harmonic generators deliver 10 db more power at the second harmonic.

Units are available with outputs to 200 KMC/sec.

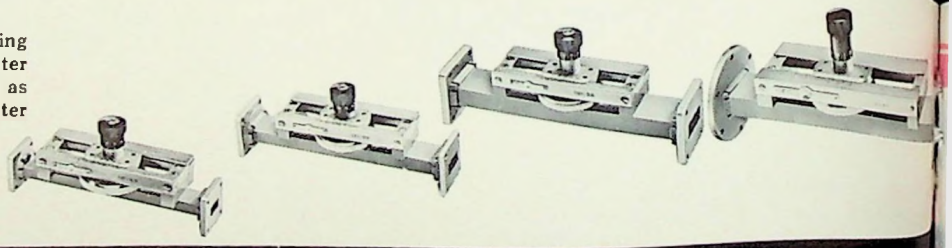
CLICHE' DEPT.

We not only claim "the most complete line" —we have it!

DE MORNAY

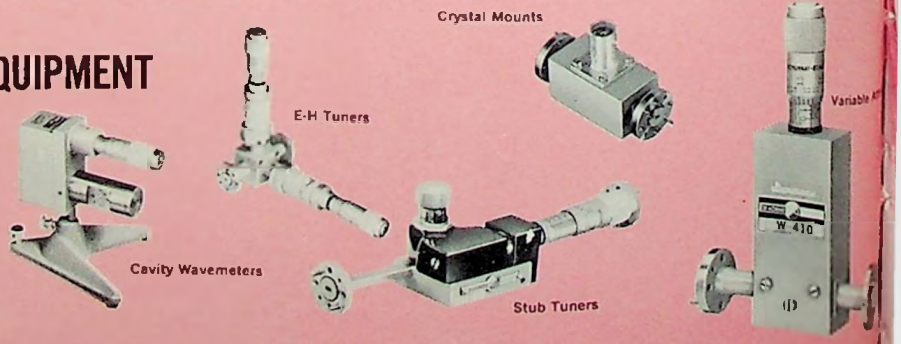
STUB TUNERS

—the finest money can buy, offering precise resettability . . . micrometer depth control . . . VSWR as high as 20/1, as low as 1.02 . . . micrometer readout to .0001".



ULTRAMICROWAVE* EQUIPMENT

This line—the most widely used in America today — has opened new horizons in microwave applications. If you are interested in higher and higher frequencies, get in touch with us—we're now working with frequencies up to 300 KMC/sec.



WHAT IS THE FREQUENCY STANDARD FOR THE U.S.A.?

ANSWER: By act of congress, the U.S. Bureau of Standards determines the primary standard, based on the revolution of the earth. Our unique design, methods, and environmentally controlled calibration procedures enable us to deliver production cavity wavemeters calibrated to an accuracy of 1 x 10^{4}. Transfer of frequency calibration from U.S. Bureau of Standards data is accomplished well within the limits defined.

Exclusive features:

- Hermetically sealed
- Temp. comp. 10^{-5} fMc/°C, −30 to +70°C
- Covers full waveguide bandwidth
- High Q values
- .0001 micrometer resolution

A CHALLENGE TO YOU!

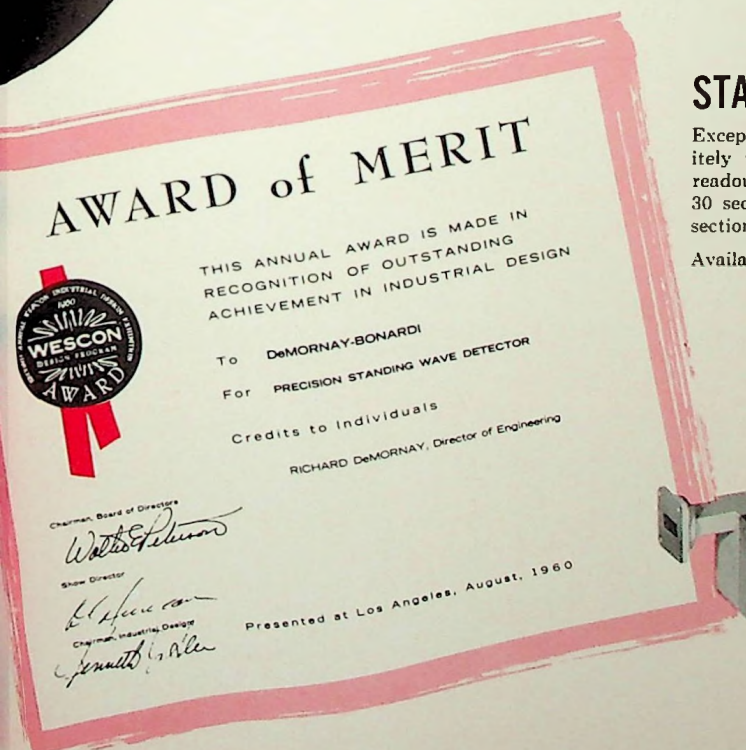
Buy any one of our 1500 stock items. Try it. If it doesn't meet our specifications, the person who verifies this and notifies us will receive a reward of $50.00.

This offer holds good for orders placed until the end of the month following publication of this issue.

BONARDI

OLD! OLD! OLD!

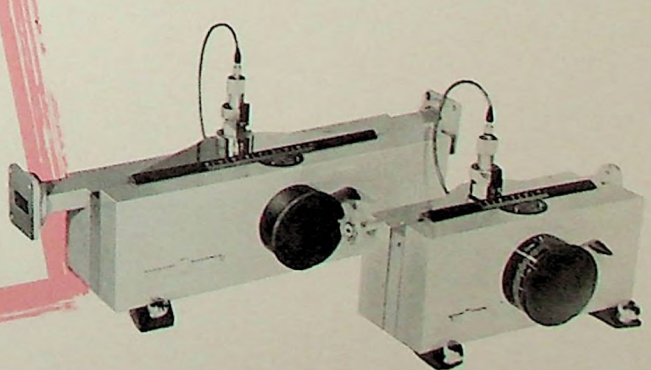
—yes, we're proud to have the oldest name in the business.



STANDING WAVE DETECTORS

Exceptionally accurate . . . patented, gearless, infinitely variable speed drive . . . linear displacement readout to .01 mm . . . direct phase readout . . . only 30 seconds to change to any of 10 other waveguide sections, with perfect alignment.

Available from 5.8 KMC to 300 KMC.



REPORTERS

SAN FRANCISCO SECTION

William Luebke, Eitel-McCullough, San Carlos

EAST BAY SUBSECTION

John Lavrischeff, Lawrence Radiation Laboratory

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

PROFESSIONAL GROUPS

ANTENNAS & PROPAGATION
Tetsu Morita, Stanford Research Institute

AUDIO
Stanley Oleson, Stanford Research Institute

BIO-MEDICAL ELECTRONICS
Harmon H. Woodworth, Stanford Research Institute

BROADCASTING
H. W. Granberry, General Electric Co.

CIRCUIT THEORY
R. C. Kiessling, ITT Laboratories

COMMUNICATIONS SYSTEMS
Kenneth P. Patterson, Sperry Gyroscope Co., Sunnyvale

ELECTRON DEVICES
Richard Borghi, Hansen Microwave Laboratory

ELECTRONIC COMPUTERS
John Boysen, Lockheed MSD

ENGINEERING MANAGEMENT
Leonard M. Jeffers, Sylvania EDL

ENGINEERING WRITING & SPEECH
Douglas Dupen, Associated Techdata, Inc., Palo Alto

INFORMATION THEORY
D. Braverman, Stanford Electronics Laboratories, Stanford

INSTRUMENTATION
Les Burlingame, Lenkurt Electric Co.

MICROWAVE THEORY & TECHNIQUES
Frank Barnett, Hewlett-Packard Co.

MILITARY ELECTRONICS
Jerome J. Dover, Ampex Military Products Co.

PRODUCT ENGINEERING & PRODUCTION
W. Dale Fuller, Lockheed MSD
Olof Landeck, Electro Engineering Works

RADIO FREQUENCY INTERFERENCE
R. G. Davis, Lockheed MSD, Palo Alto

RELIABILITY AND QUALITY CONTROL
Rudy Cazanjian, Sylvania Electronic Systems, Mountain View

SPACE ELECTRONICS & TELEMETRY
Robert D. Baker, Granger Associates

INSTITUTIONS

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

HISTORIAN—**William R. Patton,** Varian Associates, Palo Alto

PRODUCTION STAFF

ASSOCIATE EDITOR—**Mary Haylock**

EDITORIAL ASSISTANTS—
Emma Scarlott, Marjorie Silva

MEETING CALENDAR

SAN FRANCISCO SECTION

6:00 P.M. • Friday, June 15

Annual Dinner Meeting
Speaker: To be announced
Place: Villa Hotel, 4000 S. El Camino Real, San Mateo
Reservations: See page 13 for reservation forms

PROFESSIONAL GROUPS

Antennas & Propagation

8:00 P.M. • Wednesday, June 7

"Interactions of a Plasma with Microwaves—Some Recent Experiments"
Speaker: Prof. R. S. Elliot, U.C.L.A.
Place: Room 101, Physics Lecture Hall, Stanford University
Dinner: 6:30 P.M. (Social Hour 6:00 P.M.), The Red Shack, 4085 El Camino Way, Palo Alto
Reservations: Odette Moore, DA 6-6200, Ext. 2414, by noon June 7

Circuit Theory

8:00 P.M. • Wednesday, June 7

"Parametric Amplifiers: Circuit Theory and Design"
Speaker: Dr. E. S. Kuh, University of California
Place: Conference Room B, Stanford Research Institute, Menlo Park

Electronic Computers

8:00 P.M. • Tuesday, May 23

"Significance of Advanced Programming Techniques to the Computer Engineer"
Speaker: Harry D. Huskey, professor, University of California
Place: Lockheed Auditorium, 3251 Hanover Street, Palo Alto
Dinner: 6:00 P.M., Red Shack, 4085 El Camino Way, Palo Alto
Reservations: Informal, none required

Electron Devices

8:00 P.M. • Thursday, May 18

(Joint meeting with PGMTT)
"The Laser"
Speaker: Dr. T. H. Maiman, director, applied physics laboratory, Quantatron, Inc.
Place: Room 100, Physics Lecture Hall, Stanford University

Engineering Writing & Speech

8:00 P.M. • Tuesday, May 16

"Technically Speaking—the Techniques of Presenting Engineering Ideas Verbally"
Speaker: Richard B. Garretson
Place: Room 3B, Hewlett-Packard Company, 1501 Page Mill Rd., Palo Alto

Information Theory

8:00 P.M. • Thursday, May 18

"Information-Lossless Automata"
Speaker: David A. Huffman, associate professor of electrical engineering, Massachusetts Institute of Technology; visiting associate professor, University of California, Berkeley
Place: Main auditorium, Building 1, Stanford Research Institute, 333 Ravenswood Avenue, Menlo Park

Instrumentation

8:00 P.M. • Thursday, May 18

Annual meeting and plant tour
"Innovations in Test Instrumentation"
Speaker: Clay Rasmussen, manager, instrumentation section, Lenkurt
Place: Lenkurt Electric Co., 1105 Old County Road, San Carlos
Dinner: 6:30 P.M., The Gold Platter, 1000 El Camino Real, San Carlos
Reservations: DA 1-7751

MEETING CALENDAR

Microwave Theory & Techniques 8:00 P.M. • Thursday, May 18
(Joint meeting with PGED, see above)

Microwave Theory & Techniques 8:00 P.M. • Wednesday, May 24
"The S-Band Horn-Reflector Antenna and Maser Receiving Equipment for Project Echo"
Speaker: Dr. R. W. DeGrasse, Microwave Electronics Corp., Palo Alto
Place: Room 101, Physics Lecture Hall, Stanford University

Military Electronics 8:00 P.M. • Tuesday, June 6
"Circuit Design from Refractory Materials"
Speaker: W. Dale Fuller, Lockheed Missiles & Space Division, Palo Alto
Place: Auditorium, Bldg. 202, Lockheed MSD, 3251 Hanover St., Palo Alto
Dinner: 7:00 P.M. (Social Hour 6:30 P.M.), The Red Shack, 4085 El Camino Way, Palo Alto
Reservations: Lou Gado, DA 6-7053
Refreshments will be served at the conclusion of the program in the auditorium

Product Engineering & Production 8:00 P.M. • Tuesday, May 23
"Application of Electron Beams in Electronic Fabrication Processes"
Speaker: D. A. Vance, design specialist, microsystems electronics dept., Lockheed MSD, Palo Alto
Place: Room 100, Physics Lecture Hall, Stanford University

Radio Frequency Interference 8:15 P.M. • Tuesday, May 16
(Joint meeting with PGSET, see below)

Space Electronics & Telemetry 8:15 P.M. • Tuesday, May 16
(Joint meeting with PGRFI)
"RFI Considerations in the Selection and Establishment of Satellite-Tracking Stations"
Speaker: John Kavanough, Philco WDL
Place: Building 202, LMSD, 3251 Hanover Street, Palo Alto
Dinner: 6:30 P.M. (Social Hour 6:00 P.M.), The Old Plantation, 1030 N. San Antonio Road, Los Altos
Reservations: Mrs. Miller, DA 1-4175, before noon, May 16

CHRONOLOGICAL RECAP

May 16—Engineering Writing & Speech, Space Electronics & Telemetry/Radio Frequency Interference
May 18—Electron Devices/Microwave Theory & Techniques, Information Theory, Instrumentation
May 23—Electronic Computers, Product Engineering & Production
May 24—Microwave Theory & Techniques
June 6—Military Electronics
June 7—Antennas & Propagation, Circuit Theory
June 15—San Francisco Section

wescon news

ABOUT LITERATURE

WESCON's anticipated 35,000 visitors will use special "credit cards" to request product literature. As a further step in streamlining the world's second largest technical gathering, an agreement has been worked out with Addressograph-Multigraph Corp. for supplying thousands of embossed plastic "inquiry cards," to be issued to WESCON registrants at three stations within the Cow Palace August 22-25.

The cards, similar to hotel and restaurant charge cards, will be embossed with the name, title, company affiliation, and address of the visitor.

In contrast with the traditional "paper-gathering" forays of past major technical expositions, WESCON engineers and executives can simply present the Inquiry Card to the booth representative of any company or product line in which they are interested.

Exhibitor companies, all of which will be supplied with imprinting machines by WESCON, will quickly record all the name-and-address information on index cards also provided by the management of the show. Companies will then use the index cards for prompt mail service of product and company literature directly to the inquirer.

The service presents several major advantages to exhibitors and visitors alike, Larson pointed out. In the first place, briefcase "tonnage" will be reduced sharply for registrants interested in getting the latest line on develop-

(Continued on page 10)

FAR LEFT
Back around the first of the year, the Chamber of Commerce and the Kiwanis Club of Palo Alto jointly held a luncheon to commend Philco Corporation on their "outstanding accomplishment and contributions in the field of space-age communications." Joseph M. Hertzberg, marketing vice president, seems almost as pleased as Oscar T. Simpson, general manager of the western development laboratories, receiving the physical award from Tully C. Knowles, Chamber president. Onlookers, John Ball, mayor of Palo Alto, and Alexander Bodi, Kiwanis president

LEFT
Jack McCullough and Bill Eitel prepare to raise the first Q RIQAP flag in the Bay Area over the San Carlos Eimac plant. The award was made by Col. B. R. Painter, commanding officer of the western regional office of the U. S. Army Signal Supply Agency. Q means quality; RIQAP means reduced inspection quality-assurance program; and the award means sort of an honor system for the production of Eimac tubes

MORE WESCON

ments of 1180 exhibiting companies.

Chances of loss or misplacement of important materials during the busy four-day show are also eliminated, and exhibitor companies are free of the pressures of supplying their booths with thousands of pieces of printed information daily. Instead, corporate brochures and other materials can be sent directly to interested persons. Waste and duplications should be eliminated, Larson said, along with the time required to register thousands of requests by hand.

wescon news

ABOUT RECRUITING

WESCON again has asked the electronics industry for a "gentlemen's agreement" to restrict personnel recruiting activities.

The "gentlemen's agreement," which resulted in a major de-emphasis on recruiting during the 1960 show in Los Angeles, was renewed in a letter signed by Albert J. Morris, WESCON board chairman, and sent to presidents of exhibiting companies.

Accompanying the letter was a four-page printed folder, which sets forth WESCON's position on recruiting and suggests some "guidelines" for insuring the success of company social events at the show.

In the booklet, the WESCON board reviews the almost-unanimous cooperation of exhibitors in eliminating overt recruiting at the 1960 show, and concludes that "it remains apparent that aggressive recruiting of technical personnel has no place in a forum of scientific professionals . . . we again ask participants to join in a 'gentlemen's agreement' to eliminate this practice . . ."

In discussing exhibitor social events at WESCON, the booklet recognizes that "entertainment is a natural convention function" and offers some suggestions for insuring success of parties and receptions. Included are notes on methods of invitation, space requirements, timing, and general planning of WESCON parties.

In his letter to electronics executives, Morris congratulated them on individual policies under which "no responsible organization takes advantage of the WESCON 'population' to launch personnel recruiting efforts."

wescon news

ABOUT EXHIBITORS

With 1180 booth spaces diagrammed for the Cow Palace and auxiliary buildings, WESCON will offer its largest exhibition of electronic products ever when the trade show and associated technical convention are held August 22-25 in San Francisco. Manager Don Larson reports the accomplishment of a successful space pattern allocating booths to all companies on the waiting list—as well as satisfying the requirements of veteran exhibitors under the new set of show rules.

In recent years WESCON has operated under severe floor space restrictions, as many new and some growing companies have sought to display their wares. Using the large new Sports Arena and an adjacent tented area in Los Angeles last August, WESCON was able to provide only 987 booths—leaving a waiting list of almost 200 applicants unsatisfied.

meeting ahead

INSTRUMENTATION AT WORK

Professional Group on Instrumentation members will hear about and see cost-saving new Lenkurt Electric production test equipment at their May 18 meeting in San Carlos. Guest speaker will be Lenkurt instrumentation development manager Clay Rasmussen, whose subject is "Innovations in Test Instrumentation." See the Calendar for other details.

Lenkurt is a leading developer and manufacturer in a highly competitive field—voice and data telecommunications systems.

After dinner and their annual business meeting, the group will tour Lenkurt's development engineering and standards lab quarters (where Standards Lab Manager Les Burlingame will be host) and conclude with a visit to the factory to watch the new test equipment work.

Before joining Lenkurt in January 1960, Rasmussen had his own engineering development and services company. Prior to that, he had been with Beckman Instruments as a project leader, and as an engineer in both production and development.

meeting ahead

THE LIGHT TOUCH

Practical realization of the laser (light amplification by stimulated emission of radiation) has made possible the generation of very-high-intensity coherent light beams, with nearly perfect collimation. The basic principles of operation, recent experimental results, and potential applications will be discussed at a joint PGED/PGMTT meeting on May 18. See the Calendar for details.

Dr. T. H. Maiman, the speaker, is director of the applied-physics laboratory at Quantatron Inc. He has spent five years with the Hughes research laboratories conducting cylotron resonance studies in gases and solids, leading to the development of a cylotron resonance harmonic generator. He was responsible for development of a filled-cavity internal-magnet liquid-helium maser, also first liquid nitrogen and dry ice cooled masers. His experiments in optical pumping of solids culminated in development of the first optical maser (laser).

For a year he was with Lockheed Aircraft studying ionization problems and measurements in connection with guided missiles.

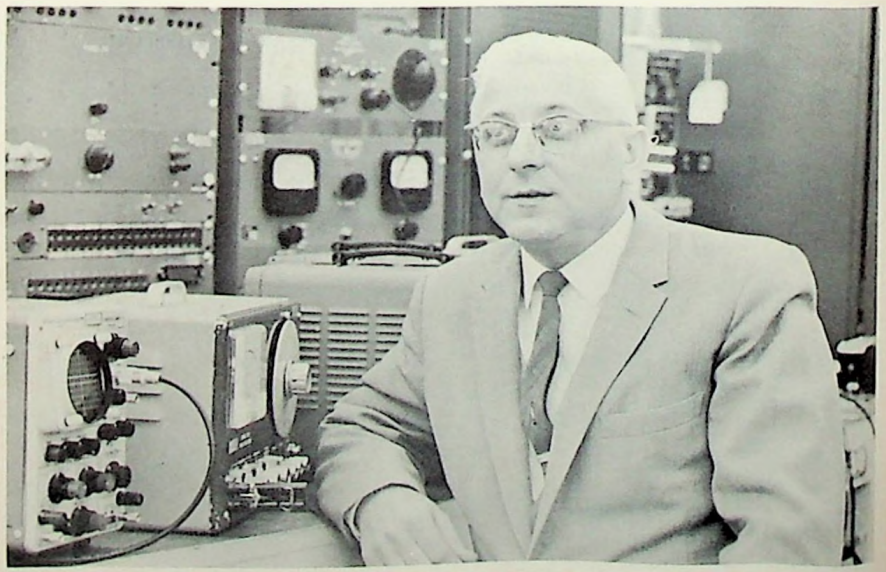
He is a member of the American Physical Society, Sigma Xi, Sigma Pi Sigma, Sigma Tau, and Pi Mu Epsilon and has had publications in areas of microwave and optical spectroscopy, masers, and lasers.

meeting ahead

STRADDLING AUTOMATA

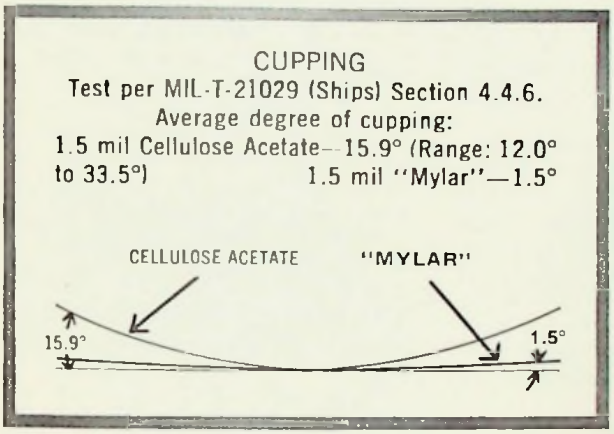
The newly organized San Francisco Chapter of the Professional Group on Information Theory will hold its first meeting on May 18. The speaker will be Professor David A. Huffman, asso-

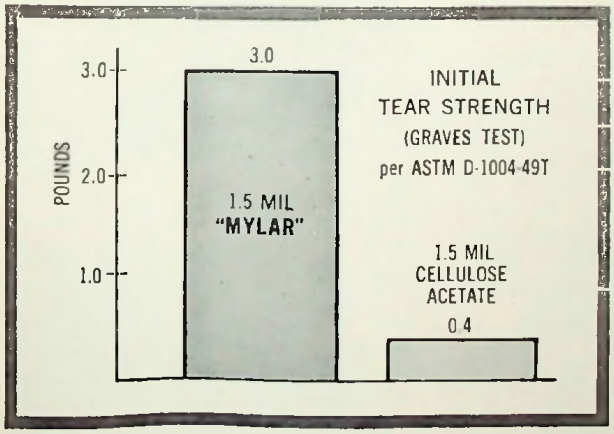
(Continued on page 12)



Clay Rasmussen, Lenkurt, May PGI speaker

GUARD AGAINST SIGNAL DROPOUTS WITH RELIABLE TAPES OF MYLAR®



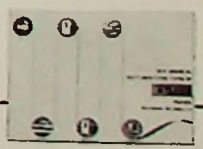


Signal dropouts can make the data from critical tests completely useless. That's why the reliability of your magnetic tape base is so important. Tapes of Mylar*, because they're dimensionally stable, resist cupping which may cause signal dropouts from loss of contact with the recording or playback heads. They also resist swelling and shrinking which can cause track displacement.

Tapes of "Mylar" also resist stretching and breaking from sudden stops and starts, edge nicks, and are unaffected by humid storage and aging. They have 7 times the initial tear strength of ordinary plastic tapes!

The tremendous cost of gathering data demands reliability. Get it with tapes of "Mylar". Send coupon for free booklet of comparative test data and judge for yourself. Du Pont Company, Film Department, Wilmington 98, Del.

*Du Pont's registered trademark for its polyester film.



DU PONT
REG. U.S. PAT. OFF.
Better Things for Better Living . . . through Chemistry

DU PONT MYLAR® POLYESTER FILM

E. I. du Pont de Nemours & Co. (Inc.)
Film Department, Room #13, Wilmington 98, Delaware

Please send free, 12-page booklet of comparative test data to help me evaluate magnetic-tape reliability.

Name_____ Position_____

Company_____

Address_____

City_____ Zone____ State_____

ciate professor of electrical engineering, Massachusetts Institute of Technology and visiting associate professor of electrical engineering, University of California, Berkeley. Also, consult the Calendar.

Professor Huffman will discuss certain classes of automata (logical machines) from the point of view of information conservation. His subject thus straddles the boundary between information theory and switching theory.

An answer will be given to the problem of finding the most general information-preserving transformation that can be performed by a finite-state logical machine. The design of a machine to accomplish the inverse transformation (decoding) will be considered. Several special cases of interest will be discussed in terms of canonical network torms. Finally some unsolved problems in this area will be described.

This talk should be of considerable interest to people in both the information-theory and computer fields.

Professor Huffman received the Doctor of Science in Electrical Engineering from Massachusetts Institute of Technology in 1953. Since 1953, he has been a member of the faculty of the department of electrical engineering at MIT and has been actively engaged in research in switching theory.

meeting ahead

LOW-NOISE ECHO

The PGMTT Chapter is having a meeting May 24. Details in the Calendar. The subject will be "The S-Band Horn-Reflector Antenna and Maser Receiving Equipment for Project Echo." The speaker is Dr. R. W. DeGrasse, senior engineer at Microwave Electronics Corporation of Palo Alto.

The ultra-low-noise receiving equipment developed at BTL for Project Echo consisted of a 28-foot horn-reflector antenna with az-el mount followed by a low-noise traveling-wave maser and associated equipment. Overall system noise temperatures of 17K for the antenna pointed vertically to about 150K for the antenna on the horizon were obtained at the operating frequency of 2390 mc. Various aspects of the design of the antenna and traveling-wave maser will be discussed. Some thoughts on possible trends in future design of antennas and masers for such ultra-low-noise receivers also will be discussed.

R. W. DeGrasse

meeting ahead

TRIPLE-BARRELED PLASMA

When PGAP convenes in early June, R. S. Elliott will discuss "Interactions of a Plasma With Microwaves: Some Recent Experiments." Consult the Calendar for details.

The radiation pattern of a microwave horn covered by a plasma layer has been recorded and will be presented. Theoretical predictions of serious side-lobe difficulties have been confirmed.

In the presence of a transverse d-c magnetic field, a plasma can exhibit a triple resonance phenomenon. This has been observed in a waveguide experiment, and suggestions will be given for its utilization in diagnostics.

Static electric fields show promise for diverting plasmas from antenna apertures and a preliminary experiment which gave hopeful results will be described.

Plasmas can be used as variable directional couplers and some experimental findings with devices of this type will be discussed.

After receiving a bachelor's degree in English literature at Columbia, Elliott transferred to engineering, and was granted a BS in electrical engineering in 1943. There followed three war years during which time he worked on the proximity fuze, radar, and the early Bumblebee missile at the Applied Physics Laboratory. With war's end, Elliott returned to graduate school, obtaining

Robert S. Elliott

W. Dale Fuller will speak on Circuit Design from Refractory Materials, at the June meeting of the Professional Group on Military Electronics

the MS in 1947 and the PhD in 1952, both from Illinois. During this period he also served as assistant professor and was baptized into the antenna profession via summer employment at Sperry and North American.

Upon completion of the PhD, Elliott served a year of active duty in the Navy during the Korean war, being associated with a missile program undertaken by the Naval Ordnance Laboratory. Three years of employment at Hughes followed, during which time he was principally engaged in research on surface wave antennas.

In 1956 Elliott left Hughes to participate in the formation of Rantec Corporation, serving as its first vice president and technical director. In 1958 Elliott returned to his first love—teaching—and is now professor of engineering at UCLA. He offers a four-semester graduate sequence in electromagnetic theory and its applications, and shares with Professor Hershberger the responsibility of directing a plasma research program.

Elliott is a member of Sigma Xi, Tau Beta Pi, and a Fellow of the IRE. He is married, the father of four evenly divided children, and lives in Woodland Hills, California.

meeting ahead

PARAMETRIC-AMPLIFIER DESIGN

The San Francisco chapter of PGCT will hear a talk by Dr. E. S. Kuh of the University of California on "Parametric Amplifiers: Circuit Theory and Design" at its June meeting. See the Calendar.

Parametric amplifiers have long been used in certain types of mechanical systems. The development of new components has made possible new applications of the parametric principle in electronic amplifiers.

(Continued on page 16)

Announcing:

THE ELECTION, THE ANNUAL MEETING

As the San Francisco Section year starts drawing near to its official close, two culminating events appear. First, the election of a new slate of officers for 1961-62; and second, the annual Section meeting at which these officers are installed, at which newly elected Fellows are presented to the Section, and at which other awards are made.

Your participation in these two events is an important part of the really full-scale functioning of the Section.

Therefore, why not make plans now to join your colleagues on June 15 in the one Section activity designed to include items of interest for all members as well as their wives. The principal speaker of the evening is being chosen on that basis and details will be announced later.

Starting at 6:00 P.M., the cocktail hour will last until 7:30 when a buffet supper will be served. The location will be the Pacifica Room and the Terrace Bar of the Villa Hotel in San Mateo, and the cost is $5.00. Use the order blank below.

And don't forget to vote!

Immediately below is your ballot for the 1961-1962 officers of the San Francisco Section IRE. Thumbnail sketches of the candidates will be found overleaf. Please fill *your* ballot out immediately and mail it—no postage required.

VOTE!

GO!

San Francisco Section

BALLOT 1961-1962

- ☐ Chairman, S. F. Kaisel
- ☐ Vice Chairman, P. D. Lacy
- ☐ Secretary, Charles Susskind
- ☐ Treasurer, Jerre Noe
- ☐ Treasurer, Alan T. Waterman

] VOTE FOR ONE

- ☐ Section-WESCON Director, Meyer J. Leifer

San Francisco Section

ANNUAL MEETING

TICKET ORDER

Please reserve_____places for me at the Annual Meeting June 15 at $5.00 each.

☐ Check enclosed ☐ Check being sent ☐ Will pay at door

name _____

company _____

address _____

telephone number _____

S. F. Kaisel
—for Chairman

President and technical director, Microwave Electronics Corp., Palo Alto. Senior Member IRE. Washington University, BSEE; Stanford, MA and PhD. Litton Industries, 1955-1958; Stanford ERL and ML, research associate; RCA, research engineer; Washington University, instructor; Harvard, special research associate; and USAF, technical observer.

Peter D. Lacy
—for Vice Chairman

Vice president and director of engineering, Wiltron Co., Palo Alto. Senior Member IRE. University of Florida, BSEE 1942; Stanford, MS 1947, PhD 1952. Stanford ML, research assistant and Sperry Gyroscope Fellow; Varian Associates, consultant; Hewlett-Packard Co., member of advanced development staff; Navy, radar countermeasures officer, member of technical mission to Japan.

Charles Süsskind
—for Secretary

Associate professor, electrical engineering department, University of California. Senior Member IRE. CalTech, BSEE 1948; Yale, MEng 1949, PhD 1951. Stanford, research associate and lecturer ML, assistant to director; University of California, 1955; USAF, radar specialist. Author, "Dictionary of Style," SF Press; Clerk-Maxwell Premium paper, British IRE, 1952. British IRE, APS, ASEE, History of Science Society, Society for the History of Technology, Sigma Xi, Tau Beta Pi.

Jerre Noe
—for Treasurer

Director, engineering sciences division, Stanford Research Institute. Senior Member IRE. University of California, BSEE 1943; Stanford, PhD 1948. Hewlett-Packard, 1946-1948; Harvard radio research lab at Cambridge, 1943-1945. Sigma Xi, Eta Kappa Nu, Tau Beta Pi.

Alan T. Waterman
—for Treasurer

Associate professor of electrical engineering, Stanford University; associate director, systems-techniques laboratory; consultant. Senior Member IRE. Princeton University, AB physics; California Institute of Technology, BS meteorology; Harvard University, AM and PhD in engineering sciences and applied physics. American Airlines, meteorologist. American Meteorological Society, American Association for the Advancement of Science, Sigma Xi, American Physical Society.

Meyer Leifer
—for Section-
WESCON Director

Chief engineer, Ampex Instrumentation Products Co., Redwood City. Fellow IRE. Brooklyn College, BS mathematics 1933; Columbia University, AM physics 1935; New York University, postgraduate work. Sylvania Mountain View, general manager microwave-device operations; Sylvania EDL, engineering manager and assistant director; Sylvania Bayside physics lab, manager of systems and circuits. Sigma Xi, Pi Mu Epsilon, Sigma Pi Sigma, and RESA.

FIRST CLASS MAIL
Permit No. 112
Palo Alto, California

BUSINESS REPLY MAIL
NO POSTAGE REQUIRED IF MAILED IN UNITED STATES

San Francisco Section IRE

Suite 110
701 Welch Road
Palo Alto, California

FIRST CLASS MAIL
Permit No. 112
Palo Alto, California

BUSINESS REPLY MAIL
NO POSTAGE REQUIRED IF MAILED IN UNITED STATES

San Francisco Section IRE

Suite 110
701 Welch Road
Palo Alto, California

VOTE

GO!

Raymond Justice of Granger Associates, speaker on Log-Periodic Antennas at the May 10 meeting of the Professional Group on Antennas & Propagation

MORE CIRCUIT THEORY

The talk will start with a review of the analysis of linear circuits containing a single periodically varying capacitance.

The formula for power gain of a parametric amplifier will be obtained in terms of the variable capacitance and appropriate impedances of an arbitrary embedding network. It will be followed by a study of maximum gain-bandwidth products for both inverting and non-inverting type circuits. Finally, synthesis procedures for broadband amplifiers will be given.

education

WHAT TO DO THIS SUMMER

Thirty classes will be presented by Engineering and Sciences Extension, University of California, during the summer of 1961 beginning in June. Courses in mathematics, the sciences, and various branches of engineering will be offered on the University of California campus in Berkeley, the San Francisco Extension Center, and in Sunnyvale, Menlo Park, and San Leandro. The following courses may be of special interest to electrical and radio engineers:

Analysis of Transistor Circuits X 430-ABC taught by Thomas R. Nisbet, Sunnyvale High School, begins June 19.

Principles of Electronic Measurement 853AB, offered by Roger Dorr, Sunnyvale High School, beginning June 13.

Introduction to the Theory of a Complex Variable XB 185 begins June 9, Stanford Research Institute, Menlo Park. Dr. Julius J. Brandstatter teaches.

For complete scheduling of all summer classes and for further information, please contact Engineering and Sciences Extension, 2451 Bancroft Way, Berkeley 4, California.

meeting review

ION AGE: NOT YET HERE

No spectacular and demonstrable effect coupled with the manipulation of negative or positive ions in your home air-conditioning plant can be looked for immediately, in the view of the speakers at the mid-April meeting of the Professional Group on Bio-Medical Electronics.

An animated motion-picture presentation briefed the 60 or so present on the origins of ionized atmospheric particles and illustrated the manner in which they join together in molecular rafts containing a half-dozen or so molecules to form what are referred to as small ions as well as the manner in which the charges concentrate on particulate material to produce what are referred to as the intermediate ions. Large ions are also charges on particulate matter but of such a large size as to have no profound bio-medical influence.

Following the film, Paul Andriese and other staff members from the department of bacteriology at the University of California contributed general comments and specific discussion relating to a running fire of questions from the audience. By and large, it appears that the group has found no reproducible biological effect of either positive or negative ions at normal concentrations. An excess of positive ions seems to have inherently bad effects, while an excess of negative ions offsets this effect.

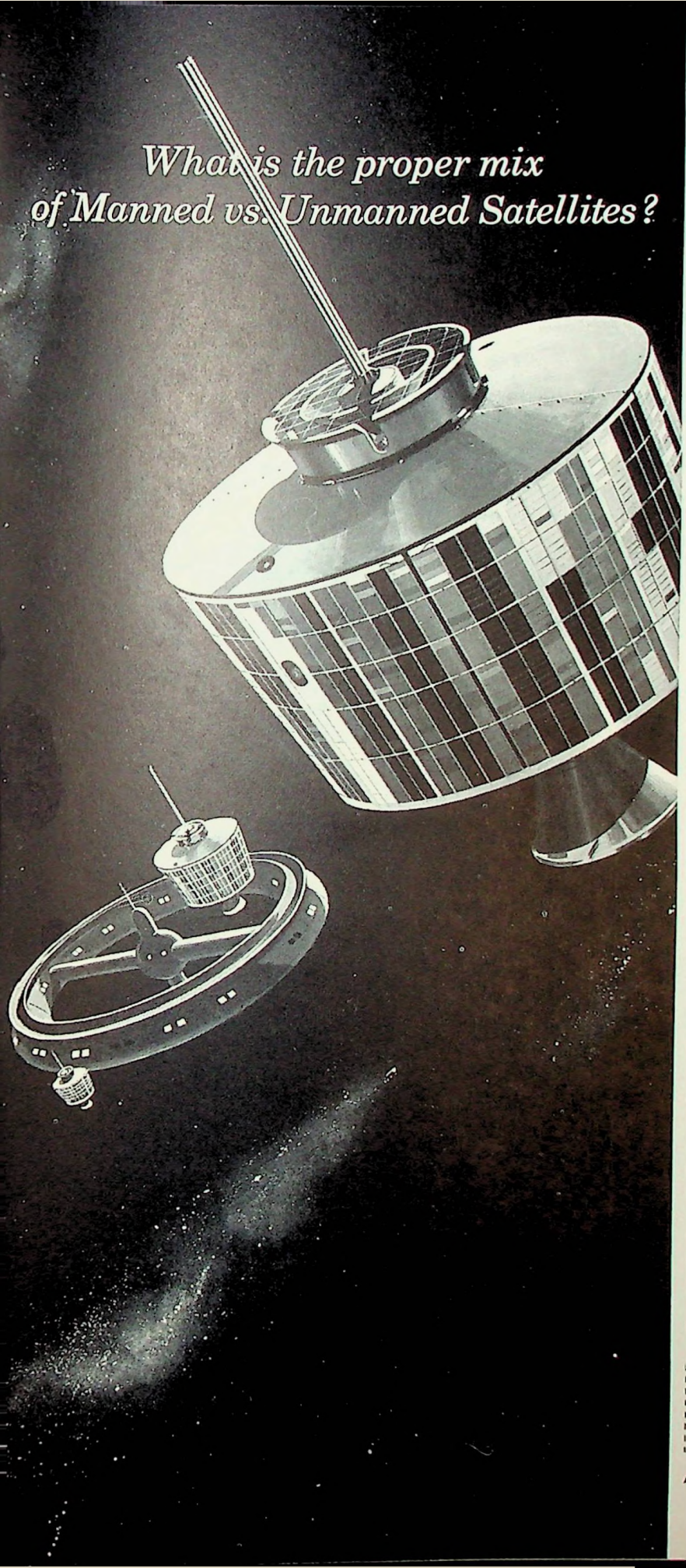
For example, fresh air has an excess of negative ions while furnaces of either gas or electric types tend to concentrate positive ions, in part because the higher mobility of negative ions causes a selective loss of them in ducts and other parts of the heating or air-conditioning system.

Generally, it is difficult to build up a high concentration of negative ions, but where this has been done, it has been found less irritating than a corresponding high concentration of positive ions. At the same time, it appears clear that reactions differ widely from person to person, and more generalized statistical data seems to be needed before great strides can be taken in application.

From a physiological point of view, the presence of positive ions inhibits the ciliary action which serves normally to clear the tracheal mucosa of external particles. On the other hand, negative ions accelerate this action. The positive ions also appear to whiten the tissue of the tracheal mucosa and increase its susceptibility to trauma.

Two case histories were cited, one at the University Bevatron and the

(Continued on page 18)



opportunities for

systems analysts

Hughes Aerospace Engineering Division has openings for Systems Analysts to consider and analyze a wide spectrum of basic problems such as:

What are the requirements for manned space flight?

Justify choice of systems considering trade-off of choice in terms of cost effectiveness.

Automatic target recognition requirements for high speed strike reconnaissance systems or unmanned satellites.

IR systems requirements for ballistic missile defense.

Optimum signal processing techniques for inter-planetary telecommunications

Maintenance and logistic requirements for weapon systems.

The positions involved with the solution of these basic and critical questions present opportunities for the optimum application of the technical and analytical background of graduate physicists and engineers with both systems and specialized experience.

If you are interested in helping to solve these questions and are a graduate physicis or engineer with a minimum of three years experience in weapon systems analysis, operations analysis, IR, physics of space, signal processing or communication theory, we invite your inquiry. For immediate consideration, please airmail your resume to: **Mr. Robert A. Martin,** Supervisor, Scientific Employment, Hughes Aerospace Engineering Division, Culver City 37, California.

We promise you a reply within one week

HUGHES

HUGHES AIRCRAFT COMPANY

AEROSPACE ENGINEERING DIVISION

other in nuclear submarines. At the Bevatron, during a shutdown period, workers found it nauseating to enter a certain area where measurements indicated that radiation was not high. Members of the bacteriology department went to this area and made measurements which revealed large excesses of positive ions.

In the other case, nuclear submarines provide a problem, not from the nuclear power plant, but from the large number of fluorescent indicators on board. These effect a predominance of positive ions which are routinely dispelled by the introduction of negative ions.

—GEORGE SPELVIN

meeting review

DATA UNLIMITED

Robert L. Sink, associate director of the data lab division of Consolidated Electrodynamics Corp., Pasadena, Calif., opened the discussion at the late February meeting of PGI with some pertinent remarks as to the need for "Large-scale Data Handling Concepts." He said in part:

Many interesting and important programs require automatic systems for data gathering, processing, display, and storage. A satellite is a fine example. The sheer volume of the data that must be handled has resulted in the design and construction of data-handling systems which are capable of making measurements at a higher rate and with greater accuracy than would have been considered desirable or possible a few years ago.

Large-scale systems are based upon time division multiplexing methods using analog-to-digital converters to achieve resolution, accuracy, and storage capability in an advantageous fashion.

Raymond Fox, University of California Lawrence Radiation Laboratory, speaking on the subject of The Plasma Diode at the April joint meeting of the East Bay Subsection and the Professional Group on Electron Devices

Pulse-code modulation (PCM) methods of data handling have been used at bit rates up to about 500,000 per second. The total information transmitted can be used either for a few high-frequency channels or a large number of low-frequency channels in rather arbitrary fashion. System resolution can be exchanged for system speed.

Pulse-code modulation methods have attracted major support because of the capability of achieving high resolution, because of efficiency and reliability in transmission and storage, and because the data is in a form that can be conveniently selected and introduced into a computer by data-handling equipment. Noise pickup, amplifier drift, and switching errors cause an error in the analog accuracy equal to 10 microvolts of equivalent signal.

Current programs are turning towards reduction of the number of amplifiers in a complete system requiring the use of switches operating at low levels.

There are 16 different data-gathering systems. The high-level voltage range is 1 to 10 volts with 5 volts predominant. The low-level is 5 to 50 millivolts with 20 the most popular. The bit rate is 300,000 to 500,000 bits per second with 384,000 most popular. Ten to 1,000 frames per second can be used; 120 is the most popular. Four groups of 32 channels each with the above characteristics, using two electronic switches per electronic group allowed Douglas Aircraft to make a wideband differential amplifier in a volume of 0.4 cu ft.

In some of the applications, only 5 per cent of the total information is actually used. This has led to a logical elimination of the groups of data which are not pertinent. This is important when you consider that in a satellite run from solar batteries, it is necessary to husband energy used and good judgment must be applied to the selection of data fed to the equipment.

Sink ended his talk with the statement that there exists knowledge far beyond any known demands. This means the data men can do almost any job demanded of them. Slides and pictures of equipment were used in the discussion.

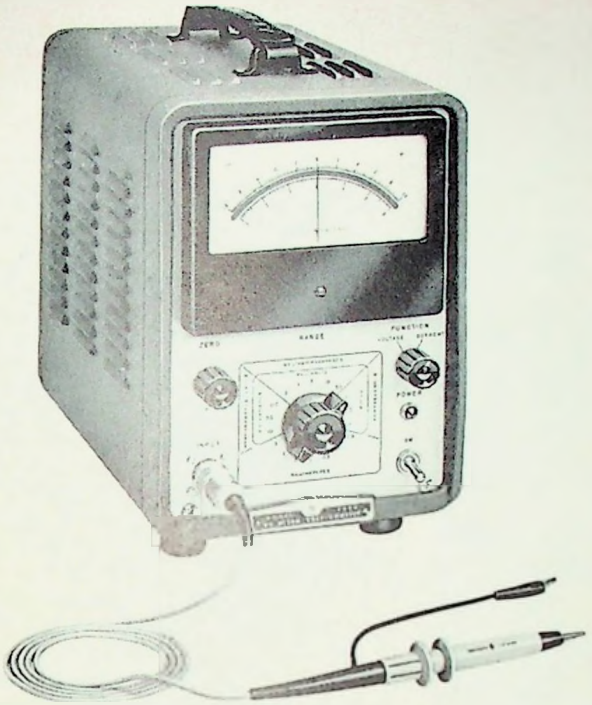
—LESLIE G. BURLINGAME

meeting review

UNCERTAIN PLASMAS

Early in February, Dr. Oscar Buneman of Stanford University spoke to the San Francisco Chapter of PGAP. The talk was the first in a series of

(Continued on page 20)



READ DIRECTLY

1 μμa

and

1 μv

10 times previous accuracy, drift less than ±4 μv per day, noise less than 0.2 μv!

hp 425A Microvolt-Ammeter

Now make these difficult measurements quickly, easily

Engineering — minute dc potentials, difference voltages, nulls; resistances from milliohms to 10 megmegohms (with external dc source). Also use with Esterline-Angus, other recorders

Physics, Chemistry — grid, photomultiplier circuits, vacuum ion levels, thermocouple potentials, voltaic currents in chemicals

Medicine, Biology — voltages in living cells, plants, seeds, nerve voltages

Use of a photoelectric chopper instead of a mechanical vibrator, insuring low noise and drift. Protection against 1,000 volt momentary overloads. Probe minimizing thermocouple and triboelectric effects. Heavy ac filtering.

Above are but a few of the reasons why the hp 425A does the work of complex equipment arrays faster, more simply and with 10 times previous accuracy.

In addition to extremely small voltages and currents, Model 425A measures resistances from milliohms to 10 megmegohms, in conjunction with an external constant current.

Get complete details today from your hp representative, or write direct.

SPECIFICATIONS

MICROVOLT-AMPLIFIER

Voltages: Pos. and neg. 10 μv to 1 v end scale. 11 ranges, 1-3-10 sequence.

Current: Pos. and neg. 10 μμa to 3 ma end scale. 18 ranges, 1-3-10 sequence.

Input Impedance: 1 megohm on voltage ranges, 1 megohm to 0.33 ohms on current ranges.

Accuracy: ±3% of end scale.

AMPLIFIER:

AC Rejection: At least 3 db at 0.2 cps, 50 db at 50 cps and approx. 60 db or more above 60 cps.

Gain: 100,000 maximum

Output: 0 to 1 v, adjustable

Output Impedance: Depends on setting of output potentiometer; 10 ohms max.

PRICE: hp 425A, $500.00 (cabinet);
hp 425AR, $505.00 (rack mount).

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

HEWLETT-PACKARD COMPANY

1071A PAGE MILL ROAD · PALO ALTO, CALIFORNIA, U.S.A.
CABLE "HEWPACK" · DAVENPORT 6-7000
FIELD REPRESENTATIVES IN ALL PRINCIPAL AREAS

2114

CONTACT OUR ENGINEERING REPRESENTATIVES, NEELY ENTERPRISES, FOR INFORMATION—Los Angeles, 3939 Lankershim Blvd., North H'wd., TR 7-0721; San Carlos, 501 Laurel St., LY 1-2626; Sacramento, 1317 Fifteenth St., GI 2-8901; San Diego, 1055 Shafter St., AC 3-8106; Phoenix, 641 E. Missouri Ave., CR 4-5431; Tucson, 232 So. Tucson Blvd., MA 3-2564; Albuquerque, 6501 Lomas Blvd., N.E., AL 5-5586; Las Cruces, 114 S. Water St., JA 6-2486.

MORE PLASMAS

three tutorial lectures on plasmas. The subject for Buneman's talk was "Plasma: A Propagating Medium and a Source of Radiation."

A plasma is defined as an assembly of free ions and electrons such that the number density of the ions equals the number density of the electrons. Plasmas exist in the interplanetary gas, in the laboratory during voltage breakdown, and in thermonuclear reactions.

The definitions of plasmas is somewhat contradictory for electrons and ions are never really independent of one another. The long-range (collective) coulomb interactions always exist between charged particles. Particles are said to collide when the proximity of one particle appreciably deflects the second (of the order of 10 degrees or more).

There followed a discussion of the properties of totally ionized plasmas as they appear in the laboratory, in space, and in thermonuclear reactions. The significant properties of a plasma are: (1) particle density, (2) particle temperature, (3) mean free path, (4) Debye length, (5) collision frequency, and (6) plasma frequency.

The significance of each of these properties was demonstrated with a simple example. Buneman considered a uniform plasma perturbed by a one-dimensional electron distribution. The speaker noted that this system is a perfectly linear oscillator, where the plasma frequency equals the oscillator frequency, and is a measure of collective interactions. The departure from statistical equilibrium leads to negative damping of these oscillations, the enhancement of noise, and radiation.

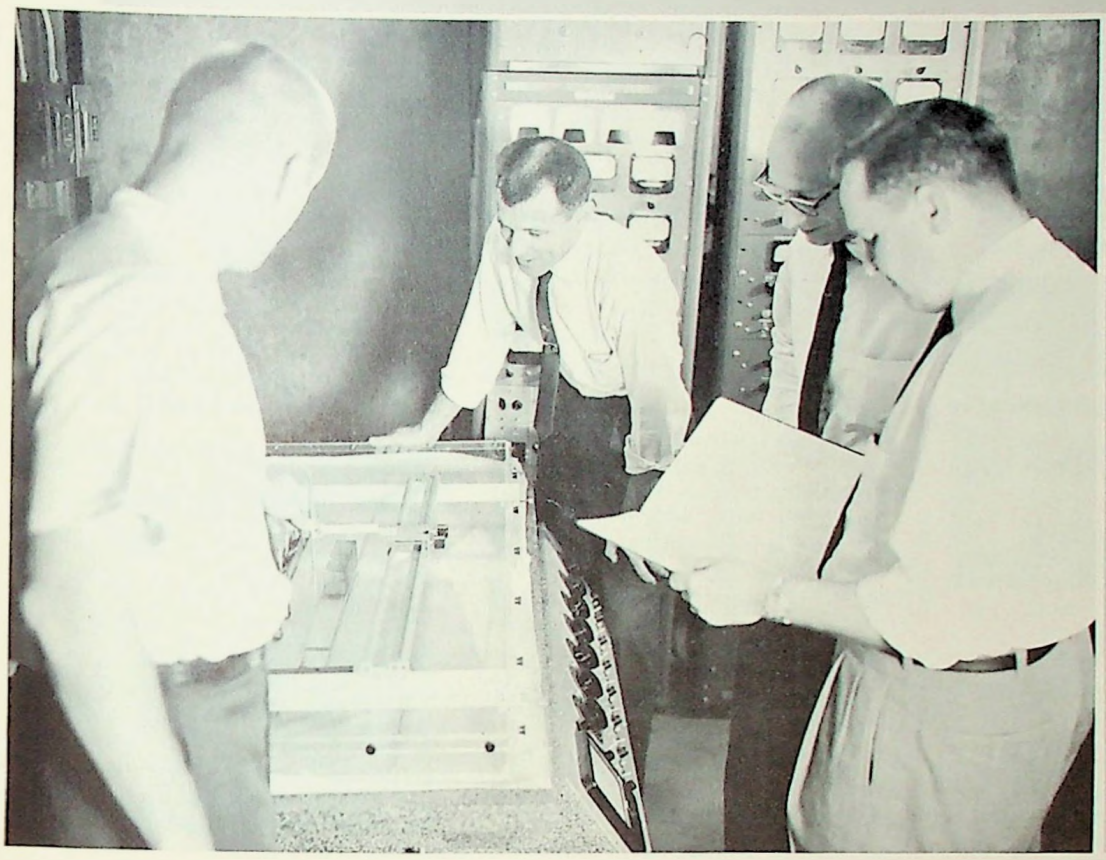
Boltzmann's Kinetic Theory techniques in conjunction with Maxwell's Electromagnetic Equations have been applied to derive the spectral law for plasma fluctuations and the equations governing propagation through a plasma in magnetic fields. The expressions for the refractive index of a plasma were then noted. These expressions demonstrate the interesting cut-off characteristics of plasmas as a propagating medium.

The principal problem confronting the plasma physicist today is that of the stability of finite plasma configurations. The boundary of finite plasma configurations is usually a magnetic field. The most stable plasmas are those in which the confining magnetic field is self-induced.

Buneman concluded his talk by showing a slide demonstrating two stream instabilities. The two streams are formed by an electron beam moving through a collection of static ions. The possibility of stable plasma confinement is uncertain.

(Continued on page 22)

Are you a Microwave Tube Engineer?



"The emphasis of the company in the past has been production-oriented, backed up by a fine development and techniques organization. This emphasis will continue in the future, but a shift of orientation is taking place to include a continually larger stress on R & D."

This quote is taken from a recent magazine article written about Huggins Labs. Already, approximately 20% of the yearly company expenditures is allotted to Research and Development.

If you would like to become a part of this growing group, and participate in such stimulating areas as:

periodic permanent magnet focusing projects high power TWT research
low-noise TWT development electrostatic focusing projects . . .

and share in the benefits of those already enjoying:

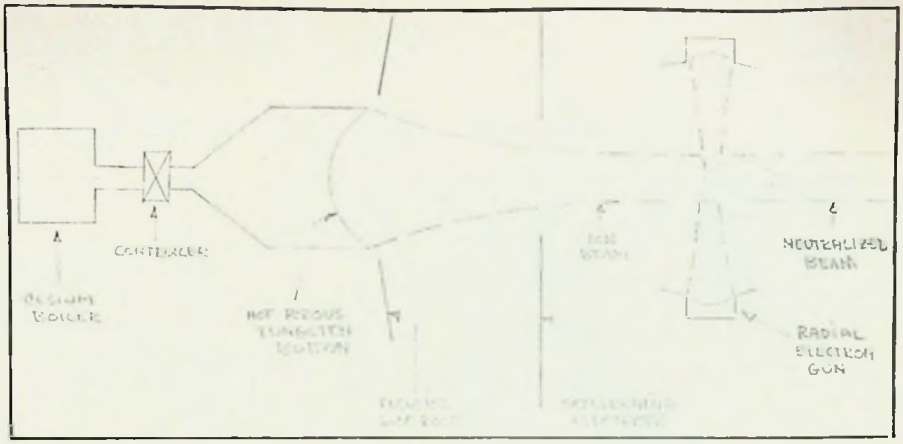
company profit sharing stock purchase opportunity education tuition refund plan
affiliation with a team, some of whom have been associated with the TWT since its infancy, then:

CALL COLLECT OR SEND RESUME TO: R. A. HUGGINS OR W. S. FLOYD

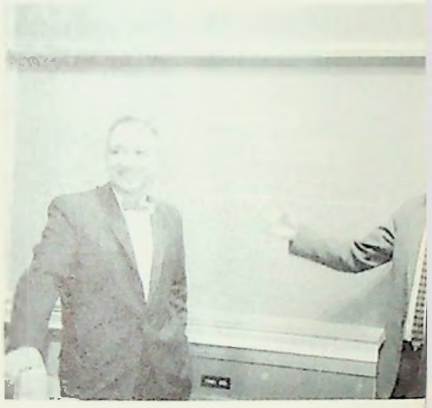
HUGGINS manufacture development engineering design research LABORATORIES

HUGGINS LABORATORIES, INC.

999 East Arques Avenue Sunnyvale, California Regent 6-9330



Above, a schematic view of the solid-beam ion engine discussed at the March meeting of PGED by George R. Brewer of Hughes, shown below with John Shaw and Joseph Hull



meeting review

PLANNING A LONG TRIP?

One of the most attractive means for propelling vehicles through space consists of the use of convergent ion guns similar in many respects to the electron guns commonly used in high-power linear-beam microwave tubes. Support for this statement was provided by George R. Brewer of Hughes Research Labs in a very interesting talk given at the March meeting of PGED at Stanford.

Brewer began with a general picture of propulsion requirements covering topics such as payload, acceleration, and the comparison of chemical and electrical propulsion systems. This was followed by a description of ion-gun components, and problems in design and their solution. An estimate of future scientific and business activity closed the talk.

Probably the most significant term used in the discussion and comparison of space engines is "specific impulse." This is defined simply as the exit velocity divided by the gravitational constant. For long missions, such as to Mars or Venus, a higher specific impulse means significant increases in payload. The specific impulse of electrical propulsion systems is 10 to 20 times that of chemical engines. The magnitude of the thrust available from ion engines is, however, very small; they cannot be used to get off the ground. In moving from orbit to orbit, their integrated effect is large, hence their use for relatively long trips. Using a Mars trip as an example, assuming typical values for various constants and starting from a 300-mile orbit about the earth with a 9000-pound vehicle, the payload delivered to Mars is 500 pounds in 250 days by the chemical engine and 4000 pounds in 400 days by the ion engine. This is a rather startling advantage for the ion engine.

Getting back down to earth and current problems, the basic engine components are shown in the accompanying figure. Cesium vapor is fed by the controller to the back of a hot (1100 to 1200 C) porous tungsten cathode button. After passing through the button it is accelerated in a Pierce type gun. After passing through the accelerating electrode hole, the beam is neutralized by a stream of electrons injected radially by a second Pierce type gun, before being ejected from the ship. In passing through the hot button, the Cesium is

(Continued on page 24)

MORE PLASMAS

Buneman was born in Milan and went to high school in Hamburg. He received his BS, MS, and PhD degrees at Manchester University, England. Buneman was senior principal scientific officer at the British Atomic Energy Research Establishment at Harwell. For the past ten years he has been a lecturer in applied mathematics at Cambridge University, England. Professor Buneman is currently a member of the plasma dynamics area of electronics at Stanford University.

He has had extensive research experience with significant contributions to the understanding of magnetrons, ion optics, reactor design, and nuclear instrumentation.

—H. GUTHART

Titles

alone are not a true measure of an engineer's strength

Big wheel? Little wheel?

A sign on a desk or an office door can't tell you. In industry many of the most valuable engineers don't have impressive titles. Yet, they're heavyweight engineers—thinking, planning, carrying out, developing, designing, analyzing. Their value lies, not in governing, but in doing. Other engineers, equally as capable, serve best by stimulating and leading engineers. Both kinds are vitally necessary because without them you fail to accomplish your goals and you fail to grow.

Fortunately, we have the best of both at RCA West Coast. And we're looking for more good ones:

Advanced Systems Engineers, Development and Design Engineers, and Project Engineers with experience in these areas: Electronic Countermeasures, Data Processing and Computer Systems, and Missile Ground Support Systems.

So, whether you have an impressive title or not, a very bright future can be yours at RCA West Coast. How bright depends on you. Check our very illuminating box at right.

RCA
WEST COAST
Call collect or write:
Mr. T. M. Ripley
EMpire 4-6485
8500 Balboa Blvd.
Dept. 261-E
Van Nuys, California

RADIO CORPORATION OF AMERICA
WEST COAST MISSILE AND SURFACE RADAR DIVISION

The name you know is the place to grow!

All qualified applicants considered, regardless of race, creed, color, or national origin.

MORE PROPULSION

99 per cent ionized. Cesium is used because it is easily ionized and provides the desired specific impulse at a reasonable accelerating voltage. Current densities of 5 to 10 ma per cm^2 can be obtained from these cathodes. The surface physics of these buttons presents a critical problem area.

Design and experimental work at Hughes on guns similar to that shown in the figure, have produced some gratifying results. An important aid in the design was the use of an electrolytic tank with current injection to simulate space charge. This tank, used in conjunction with an analog computer, was developed by Brewer and his associates over the past few years and has been very useful in the design of high-perveance electron guns. As in the case of electron guns, space-charge forces are found to be significant. Also the electrolytic tank is useful in minimizing anode interception, which, in the case of ion guns, leads to serious erosion. Erosion caused by interception of the ion beam on the accelerating electrodes results primarily from poor gun design and initial tangential velocity of the Cesium ions.

Another problem, not appearing in electron-gun design, is that of electron exchange between ions which have been partially accelerated and the few neutral atoms. This exchange increases with increasing voltage. The result is a stationary ion in the electrode space. Fortunately, it has been found that most of these do proceed through the beam aperture. Shaping of the focus electrodes also serves to reduce interception further.

Initial experiments have been concerned primarily with the interception and neutralization problems. The interception has been reduced to values approached by electron guns (anode current/cathode current $= 2 \times 10^{-4}$) and is adequate for first-generation engines. Current thinking requires that the beam on leaving the accelerating electrode aperture be neutralized in detail. Neutralization was checked by noting the beam spread with the neutralizer on and off. The reduction in beam spread due to space charge with the radial electron beam off checks with expected results indicating that the neutralizer works well.

New tests are currently in preparation for a larger hollow-beam gun. As with electron guns, the desire for higher perveance persists. This gun will be tested in a large vacuum chamber having the rather remarkable pumping speed of 200,000 liters per sec while maintaining a vacuum of 10^{-8} mm Hg.

Flight tests are being planned by NASA for the Fall of 1962. The purpose will of course be to check the engine under actual operating conditions.

Immediate future possibilities for ion engine use in addition to the long range need for an interplanetary drive, includes the control of communications and other satellites in attitude and orientation.

Business aspects for the guns themselves are modest, perhaps a few million dollars per year. Of the current $84 million space propulsion program, about 3 million is devoted to ion propulsion. The major future costs will probably be incurred in connection with other components of the vehicle such as guidance equipment, etc. with the engine itself remaining secondary, cost-wise.

—R. BORGHI

meeting review

WIFE-TEST EQUIPMENT

In mid-March, members and guests of the PGA and the AES listened to a stimulating talk presented by Joseph B. Craig and George L. Augspurger, both of J. B. Lansing Sound Inc. in Los Angeles. The subject, "A Two-way Professional-Quality Speaker System Using Six to Eight Cubic Foot Enclosures" concerned the philosophy, the design, and

(Continued on page 26)

NEW TEKTRONIX 5-INCH WAVEFORM MONITOR

for Television Broadcasters

Rack-Mount Model Type RM527 • Portable Model Type 527

In a rack or console, this new Tektronix Waveform Monitor *adapts* easily to your control applications.

For example, in addition to conventional two LINE and two FIELD displays, you can choose from three calibrated time-base rates—at 0.125 H/CM, at 0.025 H/CM with 5X Magnifier, and at 0.005 H/CM with 25X Magnifier—which eliminates the need for time markers.

You can use the dual inputs differentially.

And you can observe bright displays at 4-kv accelerating potential over a full 7-centimeter by 10-centimeter viewing area.

Adaptable and versatile, this new Waveform Monitor also features:

- backporch dc restoration, with no color-burst distortion,
- sensitivity from 0.25 volt minimum to 1.6 volts maximum for 140 IRE units,
- response flat from zero to 5 megacycles, ±1 db, or new IRE Roll-off,
- amplitude linearity within 1% over full 7-cm of vertical deflection,
- internal voltage calibrator at 0.714 or 1.00 volt, ±1%, with long-term accuracy,
- field-shift pushbutton control,
- electronically-regulated power supplies.

The Rack-Mount Model is 5¼" high, 16¾" wide, 16" deep, weighs 30 pounds.

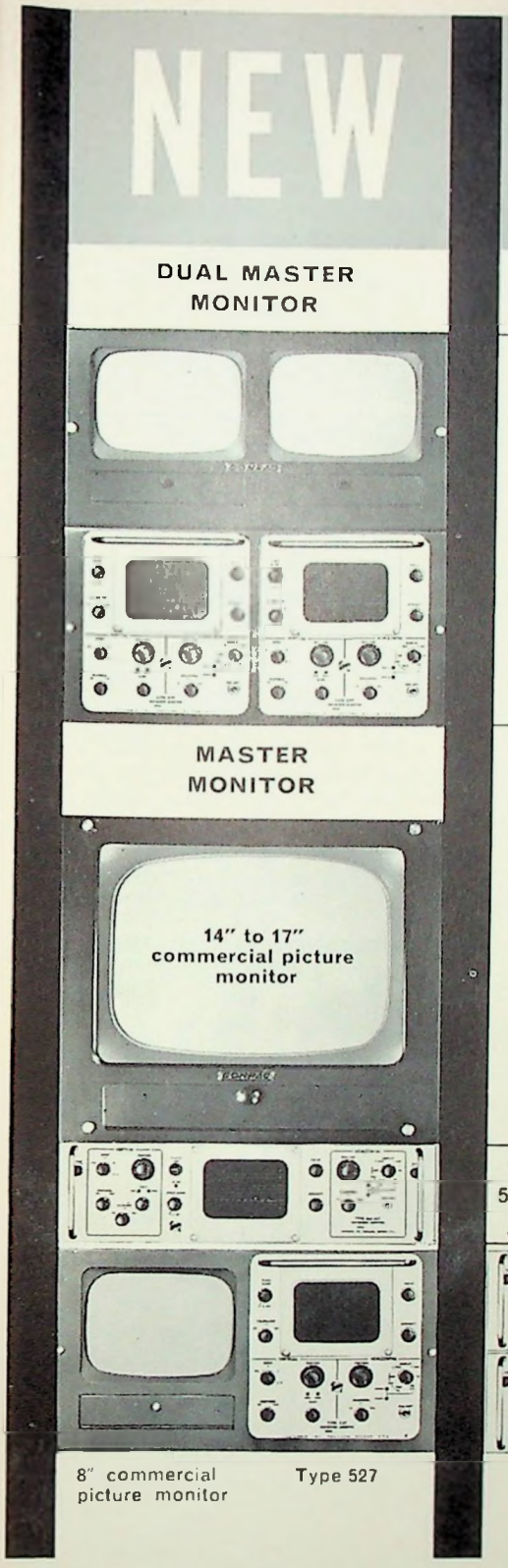
Type RM527 . . . . . **$1075**

The Portable Model is 9¾" high, 8¼" wide, 16¾" deep, weighs 27 pounds.

Type 527 . . . . . **$1000 ***

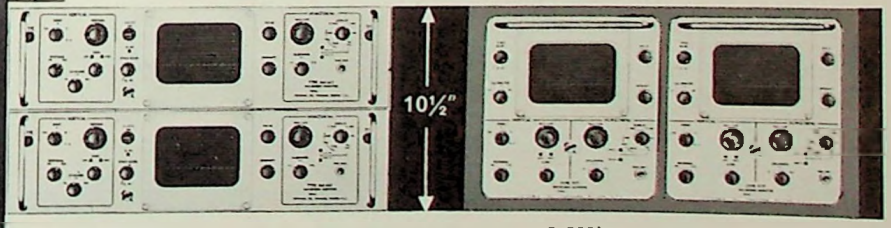
(prices f.o.b. factory)

*Field case pictured is available at additional cost.



8" commercial picture monitor

Type 527



2-RM527's slide mounted

2-527's cradle mounted

For a demonstration of the all-around adaptability, operating convenience and dependability of either model of this new video waveform monitor, call your Tektronix Field Engineer.

Tektronix, Inc.

PALO ALTO FIELD OFFICE

3944 Fabian Way • Palo Alto, California • DAvenport 6-8500

TEKTRONIX FIELD OFFICES: Albuquerque, N. Mex. • Atlanta, Ga. • Baltimore (Towson), Md. • Boston (Lexington), Mass. • Buffalo, N.Y. • Chicago (Park Ridge), Ill. • Cleveland, Ohio • Dallas, Texas • Dayton, Ohio • Denver, Colo. • Detroit (Lathrup Village), Mich. • Endicott (Endwell), N.Y. • Greensboro, N.C. • Houston, Texas • Indianapolis, Ind. • Kansas City (Mission), Kan. • Los Angeles, Calif. Area (East Los Angeles, Encino, West Los Angeles) • Minneapolis, Minn. • Montreal, Quebec, Canada • New York City, Area (Alpertson, L.I., N.Y. • Stamford, Conn. • Union, N.J.) • Orlando, Fla. • Philadelphia, Pa. • Phoenix (Scottsdale), Ariz. • Poughkeepsie, N.Y. • San Diego, Calif. • San Francisco (Palo Alto), Calif. • St. Petersburg, Fla. • Syracuse, N.Y. • Toronto (Willowdale), Ont., Canada • Washington, D.C. (Annandale, Va.).

TEKTRONIX ENGINEERING REPRESENTATIVES: Hawthorne Electronics, Portland, Oregon • Seattle, Washington. Tektronix is represented in twenty overseas countries by qualified engineering organizations. In Europe please write Tektronix Inc., Victoria Ave., St. Sampsons, Guernsey C.I., for the address of the Tektronix Representative in your country.

SEE THE TYPE 527 AT BOOTH 28B, N.A.B. SHOW

the performance connected with the JBL S7 speaker system, a new product development at the J. B. Lansing Co. The JBL S7 system consists of a Model LE15A 15-in. low-frequency loudspeaker, a Model LE85 high-frequency driver, a Model HL91 high-frequency horn and dispersion lens assembly, and a Model LX5 crossover network. Also available is the Model JBL C50 enclosure specifically designed for the JBL S7 speaker system.

Craig and Augspurger introduced the audience to some of the basic practical design considerations underlying the development of the low- or medium-efficiency speaker systems which utilize box enclosures. The heart of the JBL system is the Model JBL LE15A 15-in. low-frequency loudspeaker which is said to deliver exceptional bass response without distortion in enclosures as small as 6 cu ft. The loudspeaker cone resonance is about 20 cps in free air and about 40-45 cps in an enclosure. The speaker has a 19½-lb magnetic circuit which produces a magnetic flux of over 500,000 Maxwells. The LE15A specifications on power capacity state that the most powerful high fidelity amplifiers available may be used without danger of overload.

The JBL LE85, a wideband high-frequency driver, can be coupled to the HL91 horn-lens assembly, which is designed to maintain approximately the same sound distribution at 10,000 cps as at 1500 cps. The LX5, a specially designed crossover network, provides a smooth integration of the low-frequency sound characteristics of the LE15A with the high-frequency sound characteristics of the LE85, the cross-over frequency being at 500 cps.

Following the presentation, interested members of the audience queried the speakers on several details of loudspeaker system design, on methods of measuring speaker power capability, and on the merits of other types of loudspeakers such as the electrostatic type or the Ionovac.

—S. OLESON

meeting review

TRAFFIC PROBLEMS IN THE PLASMA

The third and final tutorial lecture sponsored by the San Francisco Chapter of PGAP was held in early March at Stanford University. Guest lecturer was Dr. Charles Cook, manager of the molecular physics section of Stanford Research Institute. Cook spoke on the collision cross sections and collision frequencies of partially ionized gases.

The speaker emphasized that microscopic and macroscopic calculations of plasma characteristics are necessary in studies concerning the ionosphere either to substantiate experimental measurements of propagation constants or to furnish those that are otherwise unavailable. Also emphasized was the fact that a basic understanding and description of microscopic plasma phenomena is necessary adequately to understand and caluculate the macroscopic plasma characteristics.

Cook first described two experiments for measuring collision cross section. One experiment consisted of crossing a beam of electrons with a beam of neutral particles and measuring the residual current due to the interaction of electrons and neutral particles. This current measurement allows the calculation of a collision cross section which is a function of plasma current, electron number density, neutral particle number density, collision frequencies, and collision volume.

The second experiment consisted of measuring the current density due to electron scattering over the solid angle about an interaction of electrons and neutral particles. This measurement of current per unit solid angle allows the calculation of a differential scattering cross section useful both in obtaining the collision cross section and the collision frequency of the interaction.

(Continued on page 28)

A cross-section of disciplines directed toward **S**pace **T**echnology **L**eadership

The technical staff at Space Technology Laboratories is the free world's most experienced group devoted exclusively to advances in the civilian and military applications of space technology. • Among STL's strengths is a versatile capability created by a cross-section of the scientific and engineering disciplines. This enables the technical staff to anticipate and solve new problems in every area of space technology from fundamental research to complex hardware design and fabrication. • Today, STL's growth and diversification are opening up exceptional opportunities for outstanding scientists and engineers. Their talents and training will bring strength to, and gain strength from, an organization devoted to a single purpose: constant advancement of the state-of-the-art in the exploration and understanding of space. • STL invites the outstanding scientist and engineer to investigate the dynamics of a career in this atmosphere of Space Technology Leadership. Resumes and inquiries will receive meticulous attention.

SPACE TECHNOLOGY LABORATORIES, INC. P.O. BOX 95005P, LOS ANGELES 45, CALIFORNIA

a subsidiary of Thompson Ramo Wooldridge Inc.

Los Angeles • Santa Maria • Edwards Rocket Base • Cheyenne STL Cape Canaveral • Manchester, England • Singapore • Hawaii

MORE PLASMA COLLISION

The macroscopic collision cross section and collision frequency of a heterogeneous plasma was described to result from the microscopic behavior of interactions between the constituents of the plasma. This allows individual studies of unique interactions of a given type between two or more plasma constituents to be extended so as to describe macroscopic properties of the plasma as a whole.

Basic formulas were presented for the conductivity of a slightly ionized plasma in an isotropic region. Howered a complex "collision frequency" ever, in these formulas, Cook considered a complex "collision frequency" parameter in the dissipative term of the equation of motion. Conductivity was then expressed as a function of the usual three "frequency" parameters, including the averaged collision frequency; this microscopic parameter was obtained from integrating over the electron-velocity distribution. The formulas for conductivity presented by Cook differ to some degree from those presented in the basic literature derived by assuming only a real "collision frequency" parameter.

The lecture was concluded with a presentation of results from studies relating to the collision frequencies and the collision cross sections of the ionosphere as a whole as well as of the constituents comparing the ionosphere.

The collision frequencies were graphically represented as a function of altitude and temperature. Through the use of transparent graphical overlays, these frequencies were compared for the heterogeneous plasma of the ionosphere and for the individual plasma constituents of the ionosphere. These results indicate substantial correspondence in collision frequencies in the plasma as a whole to those of the individual chemical constituents which dominate the structure of the ionosphere at the altitudes and temperatures surveyed.

The collision cross section N_2, O_2, and O as measured by several investigators were compared over a range of energy levels. Of these, the N_2 results compared most favorably.

A native of Nebraska, Cook graduated from the University of Nebraska in 1948 with a BS degree in electrical engineering. He received his PhD degree in physics and mathematics there in 1953. Before joining the staff of SRI, Cook was a research associate at the University of Nebraska. He was employed by the State of Nebraska department of roads and irrigation.

At SRI, Cook is engaged in studies of low energy atomic, ionic, and electronic impact phenomena.

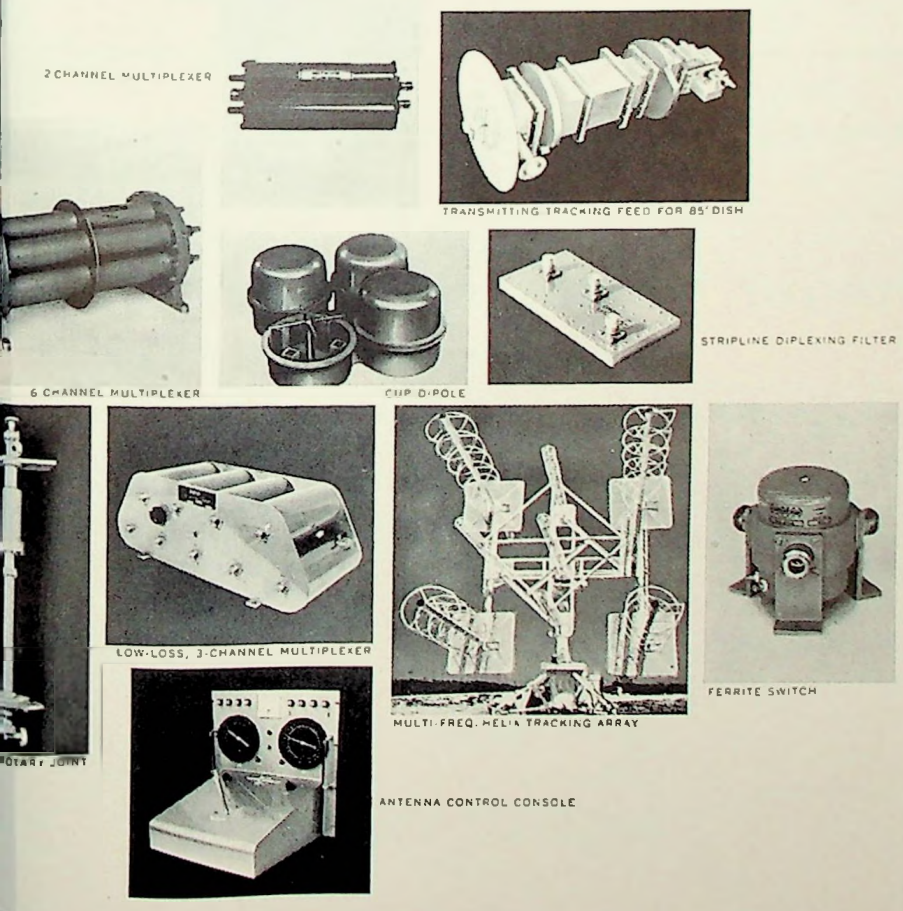
—JAMES A. MARTIN

...with components by Rantec

Over the past years, Rantec has concentrated a major part of its research and development efforts in the design and development of components and subsystems for telemetry. Rantec is now able to offer the design engineer near complete systems in today's 225-300 Mc and tomorrow's 1700-2300 Mc bands. Here are components of amazing adaptability for the design of Rantec-reliable telemetry systems.

FOR THE 225-300 MC SYSTEM *Antennas and arrays, for manual tracking and simultaneous lobing... Helical arrays... dipole diversity reception arrays or feeds for large reflectors... these antennas have been used successfully in DISCOVERER, EXPLORER, PIONEER and ECHO projects... Antenna pedestals and servo mounts Telemetry multiplexers... units which combine two to six transmitters into one antenna... long term, hermetically sealed for outer space environment. Units are used in TITAN, POLARIS, MERCURY, DISCOVERER, SUBROC, X-15 and other projects*

FOR THE 1700-2300 MC SYSTEM *Simultaneous lobing and electronic conical scanning antennas... Horn arrays and slot arrays Feeds for 6' to 85' diameter reflectors... used around the world Filters... coaxial and stripline... designed for rugged ground and space environments... Multiplexers... two to ten channel applications Hybrid assemblies... to be used with simultaneous lobing systems to permit tracking by providing sum and difference channel outputs Dual channel rotary joints... Control and display panels... Y-circulators... broad-band, compact... for use with parametric amplifiers... Coaxial isolators... ferrite switches*



Complete specifications for each component and subsystem are available. Rantec engineers will be happy to work with your telemetry team in the application of these components to the total system.

Rantec Corporation, Calabasas, California

rantec

LETTERS TO THE EDITOR

Palo Alto, Calif.

To the Editor

Dear Sir:

Messrs. McCullough and Siegman have performed a real service for members of the San Francisco Section of the IRE in compiling their comprehensive report on engineering unity (**Grid,** March 1961, p. 12). They have lucidly summarized both the complexity of the many problems involved and the diversity of viewpoints regarding their relative importance and their possible solutions.

As a member of both the AIEE and the NSPE as well as the IRE, however, I think that paragraph (4) under "The AIEE's Functional Plan" (op. cit., p. 28) deserves further comment and clarification. The statement that "the AIEE does not think that all engineers should necesarily be registered and it therefore is urging that NSPE drop its present registration requirement . . ." is misleading and not quite correct.

In reference B of the cited report Walter J. Barrett (AIEE President, 1957-58) stated that in formulating the Functional Plan the AIEE's Board of Directors voted ". . . to approach NSPE with the **suggestion** that its membership be opened, **for a period of years,** to unregistered engineers holding suitable grades in [appropriate] technical societies . . ." He added further that this suggestion was intended only as an interim measure by which NSPE might put itself in a much stronger position to carry out the responsibilities proposed for it by the Functional Plan.[1].

In commenting on registration in the same reference, Mr. Barrett said, "AIEE has, for many years, recommended to its members that they take steps to register as professional engineers. The board of directors believes that this is an essential step in the full development of the practicing engineer, **whether he be a consultant or employed in industry**. We urge **all** young engineers to register in their states as early in their careers as possible."

The statement in the cited paragraph that "NSPE's reaction to this [suggestion] is not yet apparent" indicated a lack of understanding of the unique "grass roots" nature of the NSPE. Unlike the typical technical society, in which a member has little voice in its affairs beyond electing a slate of representatives, and in which all sections are bound by the policies of the national society, every state society in the NSPE has full autonomy in matters of local concern with respect to the national society. So does every chapter with respect to its state society. Thus, although dropping the registration requirement for membership in the NSPE at the national level would require an amendment to its constitution, that does not preclude individual state societies or chapters from admitting members on a different basis at the respective local levels.

The NSPE polled its membership in 1957 and again in 1960 and an overall opinion regarding the registration requirement. Both times the majority of the respondents favored continuing it. Interest was shown, however, in admitting unregistered engineers, according to various other qualifications and with limited voting rights, at various levels of the organization, reflecting a desire of the respondents to extend the membership of the NSPE in any reasonable way to assist in implementation of the Functional Plan.[2,3]

The NSPE board of directors has therefore adopted and maintained the recommendations "that membership requirements at the national level remain unchanged at this time," but "that the several state societies seek ways and means of admitting qualified persons to membership, and take such steps as

(Continued on page 31)

grid returns

LETTERS TO THE EDITOR

Palo Alto, Calif.

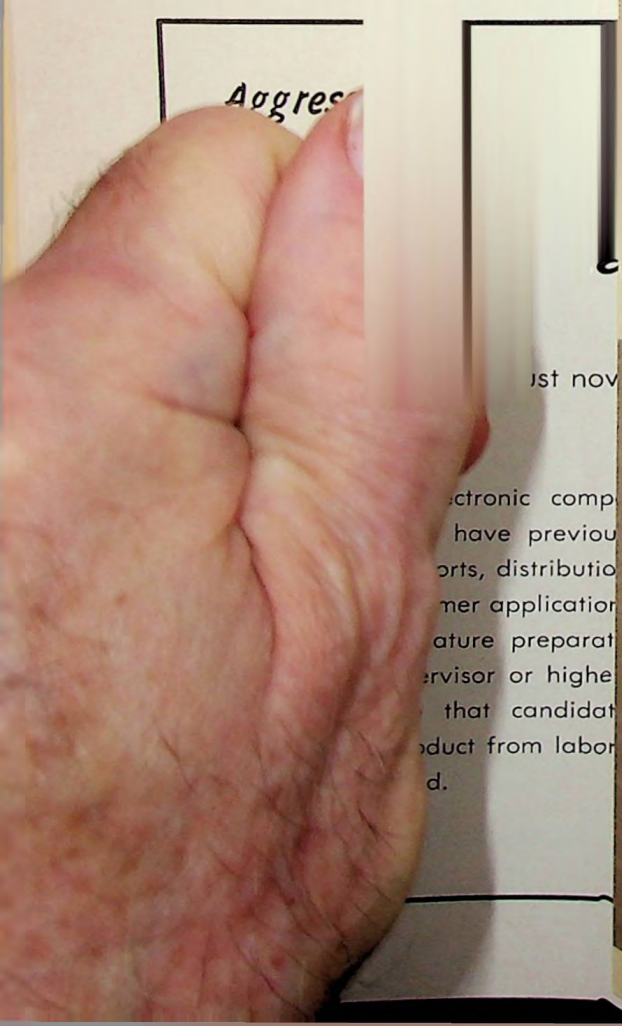
To the Editor

Dear Sir:

Messrs. McCullough and Siegman have performed a real service for members of the San Francisco Section of the IRE in compiling their comprehensive report on engineering unity (**Grid,** March 1961, p. 12). They have lucidly summarized both the complexity of the many problems involved and the diversity of viewpoints regarding their relative importance and their possible solutions.

As a member of both the AIEE and the NSPE as well as the IRE, however, I think that paragraph (4) under "The AIEE's Functional Plan" (op. cit., p. 28) deserves further comment and clarification. The statement that "the AIEE does not think that all engineers should necesarily be registered and it therefore is urging that NSPE drop its present registration requirement . . ." is misleading and not quite correct.

In reference B of the cited report Walter J. Barrett (AIEE President, 1957-58) stated that in formulating the Functional Plan the AIEE's Board of Directors voted ". . . to approach NSPE



may be necessary in their respective states to attain this objective."[1]

In response to the latter recommendation, some state societies in the NSPE have made provisions for membership (at the state and chapter levels only) for suitably qualified unregistered engineers.

In other states, including California, the matter is still under study, and is reviewed from time to time in compliance with NSPE's Policy 45, which reads (in part): "The NSPE will continue to work for unity through a vigorous and continuing program of active cooperation with all other engineering societies in those programs having professional objectives on the national, state, and local levels, without prejudice as to the origin of the program."

Very truly yours,
Keith W. Henderson

N.B.: Emphasis in above quotations added.

References:

1. Walter J. Barrett, "The Functional Plan," ELECTRICAL ENGINEERING, February 1958, p. 119.
2. NSPE—Report of Committee on Improved Professional Activities to the Board of Directors, June 11-14, 1958. (Also published in AMERICAN ENGINEER, July 1958, p. 31.)
3. NSPE, "Results of Poll on Organization of the Engineering Profession," AMERICAN ENGINEER, June, 1960, p. 43.
4. NSPE—Report of the Intersociety Relations Committee to the Board of Directors, October 23-25, 1958.

Corning, New York

To the Editor
Dear Sir:

I enjoy your publication very much and find it is an excellent means of keeping up with the activities of my many friends in the S. F. area.

John L. Sheldon

The Grid now has 125 paid subscribers outside the Section area, many of whom are former SFS members exiled (temporarily, we trust) to other ports of the world. Remind us to tell you about gift subscriptions when the Christmas season is more imminent.—Ed.

"The year 1960 has been a climatic year for United States missile and space programs. American industry achieved several notable 'firsts' which went a long way toward restoring our national prestige in these areas . . ."

—From a memo to editors and writers from Lockheed Aircraft Corp.

Sunnyvale best by government test?

Founder-director-officers of Electromagnetic Technology Corporation are: Ryan, Proctor, Edson, and Morris

grid swings

IT IS REPORTED

A new electronics firm to be known as **Electromagnetic Technology Corporation** has commenced operation as a research, development, and engineering organization with headquarters in Stanford Industrial Park at 1375 California Avenue, Palo Alto. Founders are: Dr. **Alden H. Ryan,** president; Dr. **William A. Edson,** vice president and director of research; **Fred W. Morris, Jr.,** executive vice president; and **Edward K. Proctor, Jr.** in association with **Edward O. Boshell** of New York.

Ryan was formerly manager of the General Electric microwave laboratory at Stanford and previously an associate superintendent of the Naval Research Laboratory. Edson, one of the nation's outstanding authorities on microwave technology and circuit theory, recently resigned from the General Electric Company. He was formerly professor and director of the school of electrical engineering at the Georgia Institute of Technology. He is distinguished as a technical author and has been honored as a Fellow of the Institute. Morris, an authority in the fields of electronic warfare and strategic communication systems, has been active since World War II as an electronic engineering and management consultant to industry and the government. He was formerly an assistant professor of electrical engineering at the University of Southern California. In recent years he has been at SRI.

The appointment of **Terence Furey** to the position of manager, audio product for **Ampex International S.A.,** has been announced. Furey was former sales manager, consumer products, for Electro-Voice of Buchanan, Michigan.

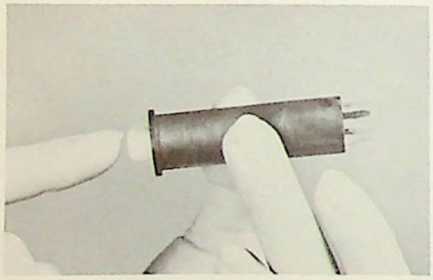
Myron C. Pogue has been appointed manager of planning for the western development laboratories of **Philco Corporation.** A native of Salem, Oregon, Pogue received his AB in speech from the Willamette University, Salem, Ore. He also did advanced work at Boston University in philosophy and graduated from the University of Pittsburgh School of Business. Prior to joining Philco he was manager of market research for Eitel-McCullough.

Appointment of Dr. **Rudolph G. E. Hutter** as chief engineer, microwave device operations of the electronic tube division of **Sylvania Electric Products Inc.,** has been announced. In his new position, Hutter will be responsible for research, development and engineering activities of microwave device operations in Mountain View and at Williamsport, Pa., as well as for technical coordination with Palo Alto and Bayside, N. Y., laboratories.

(Continued on page 34)

new product capsule advertisement

ILLUMINATED INDICATOR SWITCH



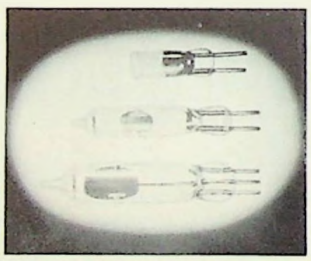
A push-button switch has been developed to provide the most compact, lowest-cost, unitized indicator switch available in the industry. It takes Sylvania indicator lamps of 4, 6, 10, 12, 16, 24, 28, and 48 volt sizes. A change in circuits merely requires a change in lamps. Using the long-life Sylvania indicator lamps rated at 5,000 hours life, maintenance costs are sharply reduced.

The construction of the switch incorporates four contacts for separate indicating and load circuits and it is rated at 5 amp capacity at 250 volts. The spring-loaded mechanism has a one-million-index life. The switch is a single-pole-double-throw switch with wiping contacts.

Sylvania Lighting Products, 60 Boston St., Salem, Mass.

new product capsule advertisement

LEAD-SULFIDE PHOTOCELLS



New development in the semiconductor field have enabled Cetron to offer a complete line of lead sulfide infrared cells.

These subminiature all-glass hermetically sealed cells are environmentally stable, with pins for socket mount or flexible leads.

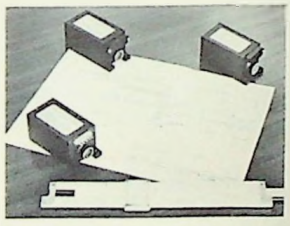
They are now being used, or are adaptable for use, in such equipment as electronic computers, sound projectors, temperature measuring devices, infrared communications apparatus, missile guidance systems, fire detectors, and solar temperature computers.

The line of cells includes a broad range of stock sizes, broken down into several sensitivity ratings.

Cetron Electronic Corporation, 715 Hamilton St., Geneva, Illinois.

new product capsule advertisement

SEQUENCE TIMING SWITCHES



A new series of all-solid-state sequence-timing switches designed for space probe and re-entry applications is now available. Designated Series 7000, these digital switches feature accuracy to 0.3% and initial timing periods adjustable from 0 to 30 seconds. They are capable of operation under high spurious line peaks and in wide ambient temperature ranges.

Miniaturized packages provide complete circuitry for up to three distinct time sequences per unit in less than 10.6 cu in. weighing only 13 ounces. Power requirement is 1.5 watts maximum from 28 v d-c; the switch is automatically reset by the application of vehicle power.

James K. Story, Transducers and Systems, Donner Scientific Co., Concord, California.

Fairchild Mt. View plant as it will appear with present addition

MORE SWINGS

Construction of a 40,000 sq ft addition to the transistor manufacturing and headquarters facility of **Fairchild Semiconductor Corporation** is scheduled for completion in the fall. The new addition will bring Fairchild's total office and manufacturing space at 545 Whisman Road to 108,000 sq ft.

J. Murray Hall has joined the engineering department of **Lenkurt Electric Co.**, as an electrical engineer assigned to the firm's new microwave products project group. Hall previously had been with Canadian Westinghouse Co., Ltd., at Hamilton, Ontario, for eight years. He received his BE in electrical engineering from the University of Saskatchewan, Canada.

Rear Admiral **Thomas G. Wallace**, USN-retired, has joined the advanced development section of **Admiral Corporation** in Palo Alto. Prior to retiring, he was supervising inspector of naval material for the central district of the United States with headquarters in Chicago. Prior to being called to active duty in 1941 he was director of industrial engineering and sales for the Southern California Gas Company.

Charles F. Earley has been appointed assistant commercial manager in the advanced systems development division laboratory of **International Business Machines Corp.**, San Jose. He goes to that new assignment from the general products division development laboratory. Earley joined IBM in 1948 in New York City. He came to San Jose five years ago as product planning manager in the general products division development laboratory.

The **Heli-Coil Corporation** of Danbury, Conn., represented by **Premmco Inc.**, has acquired the Dodge expansion insert, a push-in type of female thread insert for strong threads in plastics and die castings. Premmco Inc. also announces representation for Components Engineering and Manufacturing Co. producing fasteners.

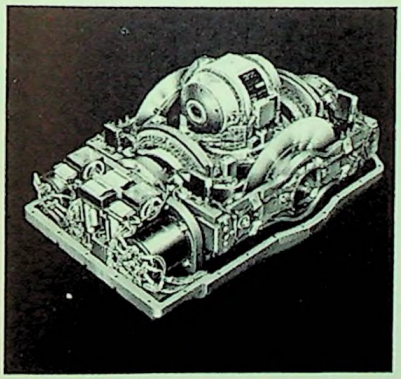
Claire Bell, former general manager of Howell Instruments Inc., Fort Worth, Texas, has joined **Varian Associates** as manager of instrument product engineering. **John F. Moran** has been appointed as manager of high-resolution nmr product engineering. Moran joined Varian in 1952 as a junior engineer.

Headed by **George Quist**, former president of Mandrel Industries, Inc., a new firm devoted exclusively to ordnance technology, has begun operations in Santa Clara. Principals of the firm, called **Explosive Technology**, are Quist, Dr. **Normal R. Zabel**, and **Frank B. Burkdoll. Zabel** was formerly associated with the Poulter Laboratories of Stanford Re

(Continued on page 36)

LITTON ADVANCED INERTIAL PLATFORM FEATURES TWO UNIQUE, FLOATED TWO-DEGREE-OF-FREEDOM GYROSCOPES

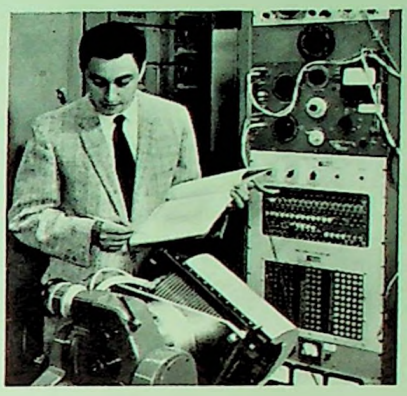
The use of two floated two-degree-of-freedom gyros simplifies the inertial platform, provides higher accuracy and reduced size and weight. Selecting two two-degree-of-freedom gyros as compared to three single-degree-of-freedom gyros was done to increase the accuracy by taking advantage of the larger available space per gyro and to eliminate the undesirable rectification drift inherent in the single-degree-of-freedom gyro platform. It also provided for tighter packaging and simplified design, which contributes to the total platform accuracy, yet permits considerable reduction in size and weight.



To achieve the development of the Litton platform, consideration had to be given to entire new concepts in inertial components, design, packaging, production and testing techniques. Litton developed a unique two-degree-of-freedom gyro measuring three inches in diameter, four inches in length, and weighing only two pounds, that provides a random drift rate capability of less than 0.01 degrees per hour. The two gyroscopes used are packaged in a "dumbbell" configuration which is retained in a four-axis gimbal mechanism. This permits unrestricted angular maneuverability of the vehicle without incurring platform gimbal-lock.

Another Litton developed component contributing to the design of the platform is a miniature accelerometer featuring a pendulous torque-balance mechanism. The accelerometer functions by means of external electronic integrating circuitry, thus eliminating the complexity and larger size of internal integrating devices. The use of nonintegrating accelerometers contributes to the compactness and light weight of the platform. The accelerometer measures only 1.00 x 1.135 x 1.80 inches and weighs 7 ounces.

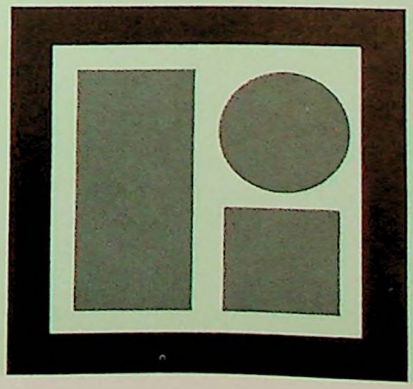
Three identical orthogonally mounted accelerometers are used. The accelerometers, through stabilization signals received from the gyroscopes acting on the platform servos, provide simultaneous measurement of vehicle acceleration along three axes.



If you're in the inertial or electronic field, it may be that a few of these points have sparked your imagination; it may be that Litton is the place for you to contribute your ideas to advanced projects. Advances in the state-of-the-art in all our areas of interest are lining up chairs of responsibility for the engineer capable of contribution. For the engineer who wants more engineering, less paper work. For the engineer with plans . . . who wants to see a job through from concept to product.

Our product is inertial equipment, computers, data processing systems, tactical data systems, displays and advanced communications techniques. If working on these kinds of projects and in this kind of atmosphere interests you, write today to Mr. Donald Krause, Research and Engineering Staff, Litton Systems, Inc., 336 No. Foothill Road, Beverly Hills, California.

LITTON SYSTEMS, INC.
Beverly Hills, California
DIVISION OF LITTON INDUSTRIES



search Institute, and Burkdoll managed the Institute's explosive and propellant test site.

Radiation at Stanford of Palo Alto, a subsidiary of Radiation Incorporated of Melbourne, Florida, has become an associate of the **Stanford Research Institute.** This brings to 144 the number of individuals and companies that have contributed in this way to domestic and overseas technological development.

Accomplishments of the Polaris and Discoverer programs during 1960 have resulted in selection of the **Lockheed** missile and space division as winner of the Dr. Robert Hutchings Goddard Memorial Trophy for 1960. The award is for outstanding achievement in the missile and space field.

Reliability and versatility of the Agena space vehicle brought recognition to the U. S. Air Force satellite programs and **Lockheed Aircraft Corporation** which was awarded the Hoyt S. Vandenberg Trophy for 1960 by the Arnold Air Society at its annual meeting held this year in Detroit. The Vandenberg Trophy is the industrial award made each year to a firm making outstanding contributions "to aerospace power for national security."

James W. Proctor, Jr., formerly sales manager of Diamond National Corporation's wood products division, has been appointed California district manager of Raytheon Company's distributor products division. In his new post, Proctor replaces **Allen W. Merriam, Jr.,** who was recently promoted to western zone manager.

Appointment of **Melvin E. Lowe** as manager of the reconnaissance systems laboratory at the Mountain View operations of **Sylvania Electric Products Inc.** has been announced. Lowe previously served as marketing manager of the division's Waltham (Mass.) laboratories, and manager of the missile systems laboratory, a unit of the Waltham laboratories.

Proctor

Lowe

events of interest

IRE MEETINGS SUMMARY

May 22-24—**1961 National Telemetering Conference.** Sheraton Towers Hotel, Chicago, Ill. Jack Becker, Dept. 32-29, AC Spark Plug Division, General Motors Corp., Milwaukee 1, Wisc.

May 22-24—**5th Global Communications Symposium (GLOBECOM V).** Sherman Hotel, Chicago, Illinois. Donald G. Campbell, ITT Kellogg, 5959 S. Harlem Ave., Chicago, Illinois.

June 12-13—**Third National IRE Symposium on Radio Frequency Interference.** Sheraton Park Hotel, Washington, D. C. W. Gerald James, American Machine & Foundry Co., 1025 No. Royal Street, Alexandria, Virginia.

June 14-15—**5th National Conference on Product Engineering and Production.** Sheraton Hotel, Philadelphia, Pennsylvania. John A. Knoll, RCA Surface Comm. Eng., Location 1-4, Camden, New Jersey.

June 19-20—**Second National Conference on Broadcast and Television Receivers.** O'Hare's Inn, Des Plaines, Illinois. Neil Frihardt, Motorola, Inc., 4545 W. Augusta Blvd., Chicago, Ill.

June 26-28—**Fifth National Convention on Military Electronics (MIL-E-CON 1961).** Shoreham Hotel, Washington, D.C. Charles De Vore, 3224 16th Street, NW, Washington, D.C.

June 28-30—**Joint Automatic Control Conference.** University of Colorado, Boulder, Colorado. Dr. Robert Kramer, Elec. Systems Lab., MIT, Cambridge 39, Massachusetts.

June—**International Conference on Electrical Engineering Education.** Syracuse, New York.

NON-IRE LOCAL EVENTS

May 16—Instrumentation & Controls Division, San Francisco Section, **American Institute of Electrical Engineers:** "Power System Control (Including Load Frequency Control)" by John W. Hoag, chief engineer, control systems, special control division, Minneapolis-Honeywell, Philadelphia, Pennsylvania. 7:30 P.M., Room 4, Crown Zellerbach Bldg., 1 Bush Street, San Francisco, California.

May 23—San Francisco Section, **American Institute of Electrical Engineers** (Joint meeting with ASME): "Inspection Tour—A Look at Modern Communications" by Laurence G. FitzSimmons, chief engineer, Pacific Telephone Company, San Francisco, California. 8:00 P.M., Engineers' Club, 206 Sansome Street, San Francisco. 5:30 Social Hour, 6:30 Dinner—reservations required.

May 26-27—**California Society of Professional Engineers:** Annual Meeting. Casa Munras Hotel, Monterey, Calif.

August 1-3—Fourth Western Regional Meeting of the **American Astronautical Society.** Sheraton-Palace Hotel, San Francisco, California.

IRE PAPERS CALLS

June 1—Five copies of 100-word abstracts and five copies of 500-word summaries, together with author's name, position title, company affiliation, and brief biography, for the Seventh National Communications Symposium (Utica, New York; October 2-4, 1961). Send to: Robert K. Walker, 34 Bolton Road, New Hartford, New York.

June 15—Complete papers or 400- to 500-word abstracts in triplicate, plus 50-word summaries for the 1961 Northeast Electronics Research and Engineering Meeting (NEREM) (Boston, Massachusetts; November 14-16, 1961). Send to: F. K. Willenbrock, Pierce Hall, Harvard University, Cambridge 38, Massachusetts.

July 1—Rough drafts and 500-word abstracts for the International Symposium on Aero-Space Nuclear Propulsion (Las Vegas, Nevada; October 23-26, 1961). Send to: P. M. Uthe, University of California, Lawrence Radiation Laboratory, Box 808, Livermore, California.

July 5—500-word abstracts in triplicate, together with brief professional record of author, for the East Coast Conference on Aerospace and Navigational Electronics (ECCANE) (Baltimore, Maryland; October 23-25, 1961). Send to: William C. Vergara, Advanced Research Department, Bendix Radio, Towson 4, Maryland.

July 15 — 500-word summaries for the East Lansing Symposium on Engineering Writing and Speech (Michigan State University, East Lansing, Michigan; October 16-17, 1961). Send to: J. D. Chapline, Philco Corp., 3900 Welsh Road, Willow Grove, Pennsylvania.

the section

MEMBERSHIP

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

James A. Ammon
Emmett R. Anderson
Donald G. Benn
Clyde P. Brewer
Edmund J. Burritt
Wilbert H. K. Chang
Lloyd D. Colvin
Richard A. De Kimpe
Joseph C. Demy
William W. Deville
Leonard E. Dighton
Herbert A. Finke
Larry L. Hansen
Hiroshi H. Hara
Ronald S. Hawke
James A. Heskett
Gene R. Hickcox
Cuthbert C. Hurd
Darrell J. Iverson
Kim Tung Jew
Henning B. Johansson
Robert M. Johnson
Frank Klimowski, Jr.
Jay F. Koogle
Peter A. W. Lewis
Wayne V. Mager
John P. Mantey
Philip C. Mazzola
James R. McCaughna
Donald E. McCrary
T. Charles Moore
Manuel R. Moreno
George J. Ponula
Robert H. Pope
Gilbert Schroeder
Roger L. Semple
John F. Skowron
Robert G. Spann
James F. Vize
John J. Vogelzang
Everett M. Watt

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

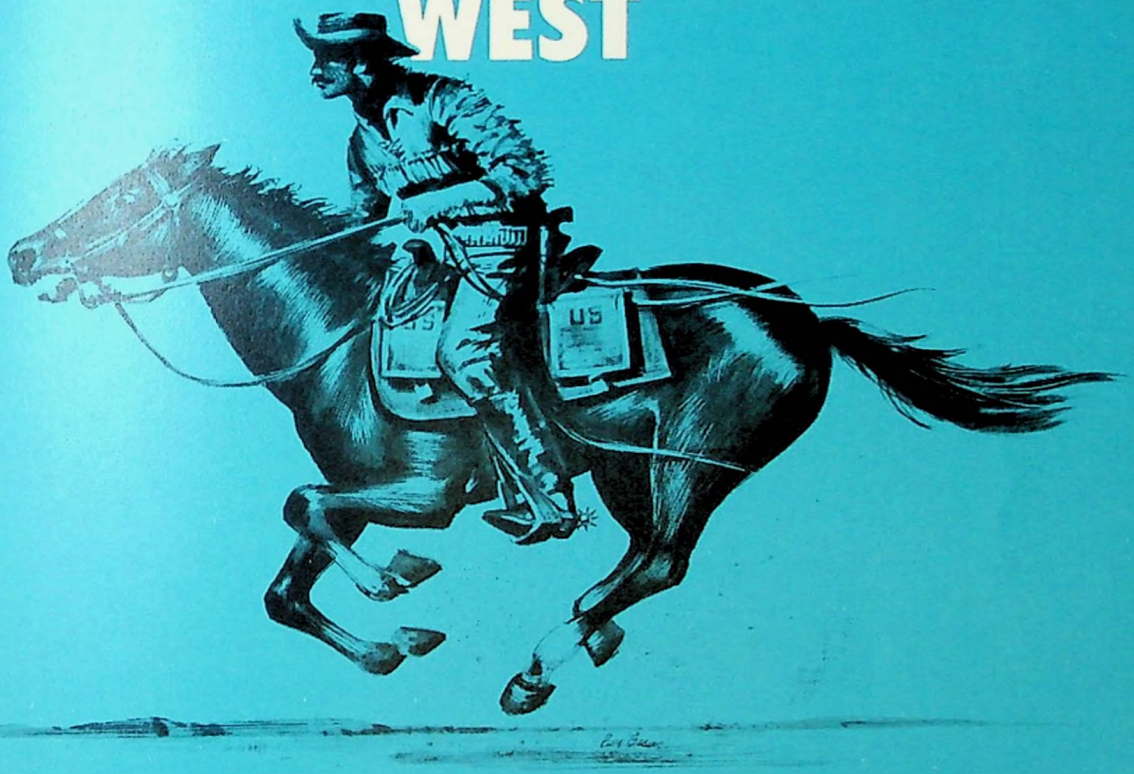
Norman J. Abbod
Ali R. Ahsani
Shuhei Aida
George E. Avery
Orville R. Baker
Godfrey Baumgartner
Barrington O. Bolden
George Brown
Henry J. Brownell
Victor B. Buell
John A. Calvert
James W. Child
Robert A. Crocker
Robert G. Cushman
Colman Daniel
Kenton S. Day
Glenn B. De Bella
Craig A. Denison
Francis P. Diani
James A. Doub
Francis J. Fenech
Douglas L. Finch
Ching-Yao Fong
Minoru Fukada
Otto J. Gentner
Daniel J. Gibbons
Frank M. Goodrich
J. Bruce Gray
Michael Harvey
Thomas L. Humphrey
George Imakawa
Frederick B. Jenne
Ernest C. Jones
John B. King
Gosuke Kinoshita
David Kipping
Richard E. Klokow
Vazhapet Kothandaroman
Huibert Kwakernaak
Donald W. Kyle
Stephen R. Levine
Rudolph Lorenz, Jr.
Chang N. Ly
Marvin D. Marsh
John H. Mason, Jr.
Richard A. McBride
George D. McCready
John H. McCrory
Michael A. McCullough
Peter J. Metz, III
Bruce E. Michaels
Kenneth A. Moe
Charles R. Moore
Roger Muldavin
David H. Paulson
David C. Penning
Melvin W. Pirtle
Elijah Polak
Kanti L. Raniga
Oleg I. Reoutt
Lloyd A. Robinson
Alexander Sadovnikov
Joseph E. Scarbrough
Richard M. Schoepf
Alan F. Shugart
Frederick M. Stockam
Walt Stolte
John E. Swistok
Chiu H. Ting
William K. Wagner
G. Worden Waring
Boyd G. Watkins
Richard W. Watson
Peter B. Whitehead
Howard E. Wolnowsky
Stephen C. Wood
Nusret A. Yazar
Gary W. Yee

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

MEMBER

Henry M. Buhrman
Francis L. Cobb
Vincent J. De Marco
John G. Figueira, Jr.
Druzell D. Foote
Bobby F. Helms
Harold A. Kurth
John J. Magee
George S. Parks, Jr.
Herbert E. Rauch

IN THE NEW WEST



Neely Enterprises serves the Electronic Industry with the complete facilities of eight fully-staffed offices and six factory-authorized Service Departments. For over a quarter of a century Neely has grown with the west, and now serves California, Arizona, Nevada and New Mexico with the products of eight leading manufacturers.

Modern science calls for modern methods. The west's tremendous growth, as a center of the national network of electronic projects, has placed new distribution demands on instrument and technical component manufacturers. Neely Enterprises throughout the years has demonstrated its ability to serve the Western Market.

Your Neely Field Engineer is always alert to keep you up-to-date on the latest electronic developments. Let him show you how to save valuable engineering time, equipment expense and operating costs.

BALDWIN-LIMA-HAMILTON,
E. & I. Division
BOMAC LABORATORIES, INC.
DYMEC,
A Division of Hewlett-Packard Co.
HEWLETT-PACKARD COMPANY
KIN TEL
F. L. MOSELEY CO.
SANBORN COMPANY
VARIAN ASSOCIATES

NEELY
enterprises
ELECTRONIC MANUFACTURERS' REPRESENTATIVES

NORTH HOLLYWOOD
3939 Lankershim Blvd.
Phone: TRiangle 7-0721
TWX: N-HOL 7133

SACRAMENTO
1317 Fifteenth St.
Phone: GI 2-8901
TWX: SC 124

SAN CARLOS
501 Laurel St.
Phone: LY 1-2626
TWX: San Carlos-Belmont Cal 94

SAN DIEGO
1055 Shafter St.
Phone: AC 3-8103
TWX: SD 6315

ALBUQUERQUE
6501 Lomas Blvd., N.E.
Phone: AL 5-5586
TWX: AQ 172

PHOENIX
641 E. Missouri Ave.
Phone: CR 4-5431
TWX: PX 483

LAS CRUCES
114 S. Water St.
Phone: JA 6-2486
TWX: Las Cruces NM 5851

TUCSON
232 S. Tucson Blvd.
Phone: MA 3-2564
TWX: TS 5981

ONE OF NEELY'S EIGHT OFFICES IS LOCATED CONVENIENTLY NEAR YOU . . . FULLY STAFFED TO HELP FILL YOUR ELECTRONIC NEEDS.

MANUFACTURERS INDEX

Manufacturer	Representative
Ace Engineering & Mch. Co.	Premmco, Inc.
Accurate Instrument Co.	Jay Stone & Assoc.
Adage, Inc.	J. T. Hill Co.
Airflow Company	Premmco, Inc.
American Optical Co., Instrument Div.	J. T. Hill Co.
Analab Instrument Corp.	V. T. Rupp Co.
Antenna Systems	T. Louis Snitzer Co.
Antlab, Inc.	Jay Stone & Assoc.
Baldwin-Lima-Hamilton Corp.	Neely Enterprises
Beckman/Berkeley Division	V. T. Rupp Co.
Behlman Engineering Co.	T. Louis Snitzer Co.
Bogart Microwave	Jay Stone & Assoc.
Bomac Laboratories, Inc.	Neely Ent.
Boonton Electronics Corp.	O'Halloran Assoc.
Communications Control Corp.	T. Louis Snitzer Co.
Components Engineering & Mgf. Co.	Premmco
Datafilter Corp.	Jay Stone & Assoc.
Daytronic Corp.	McCarthy Associates
Di-Tran Corp.	McCarthy Associates
DuMont Labs, Tubes & Instruments	J. T. Hill Co.
Dynamics Instrumentation Co.	J. T. Hill Co.
Dymec, Div. Hewlett-Packard Co.	Neely Ent.
E-H Research Laboratories, Inc.	V. T. Rupp Co.
Edgerton, Germeshausen & Grier, Inc.	J. T. Hill Co.
Electromagnetics	O'Halloran Associates
Electronic Associates	O'Halloran Assoc.
Electronic Measurements Co.	O'Halloran Assoc.
Emerson & Cuming	McCarthy Assoc.
John Fluke Mfg. Co.	McCarthy Assoc.
Franklin Electronics, Inc.	T. Louis Snitzer Co.
General Communication	T. Louis Snitzer Co.
Genesys	O'Halloran Assoc.
Glass-Tite Industries	Jay Stone & Assoc.
Hamner Electronics	McCarthy Associates
Hathaway Denver	J. T. Hill Co.
Heli-Coil Corp.	Premmco, Inc.
Hewlett-Packard Company	Neely Enterprises
Huggins Labs., Inc.	O'Halloran Assoc.
Hughes Aircraft Co.	McCarthy Associates
Jerrold Electronics	Instruments for Measurements
Kauke and Co., Inc.	Jay Stone & Assoc.
Keithley Instruments	T. Louis Snitzer Co.
Kepco, Inc.	V. T. Rupp Co.
Kin Tel	Neely Enterprises
Laboratory for Electronics	O'Halloran Assoc.
Lindsay Structures	Premmco, Inc.
Magnetic Amplifiers (Siegler)	O'Halloran Assoc.
Massa Div., Cohu Electronics	McCarthy Assoc.
Menlo Park Engineering	O'Halloran Assoc.
Microwave Associates	T. Louis Snitzer Co.
Microwave Dynamics Corp.	Jay Stone & Assoc.
Microwave Electronics Corp.	Jay Stone & Assoc.
Millivac Instrument Div., Cohu	McCarthy Assoc.
F. L. Moseley Co.	Neely Enterprises
Narda Microwave Corp.	O'Halloran Assoc.
Norwood Unit-American Standard	J. T. Hill Co.
Optimized Devices	O'Halloran Associates
Pacific Electro Magnetics Co.	T. Louis Snitzer Co.
Polarad Electronics	T. Louis Snitzer Co.
Quantech Labs	Jay Stone & Associates
Radiation at Stanford	O'Halloran Assoc.
Sanborn Company	Neely Enterprises
Scientific-Atlanta, Inc.	J. T. Hill Co.
Sensitive Research Instrument	McCarthy Assoc.
Sierra Electronic Corp.	T. Louis Snitzer Co.
Sorensen & Co., Inc.	McCarthy Assoc.
Sperry Microwave Electronics Co.	J. T. Hill Co.
Technibilt Corp.	J. T. Hill Co.
Tel-Instrument Electronics	O'Halloran Associates
Telonic Industries	T. Louis Snitzer Co.
Trygon Electronics, Inc.	T. Louis Snitzer Co.
Varian Associates	Neely Enterprises
Wiancko Engineering Co.	V. T. Rupp Co.
Wilton Co.	O'Halloran Assoc.
Wincharger Corp. (Zenith Radio Corp.)	Premmco, Inc.

INDEX TO ADVERTISERS

New Gertsch Freq Meter

MEASURES AND GENERATES: 20 mc to 1000 mc

ACCURACY: 0.0001%, exceeding FCC requirements 5 times

MODULATION: AM, 30% at 1000 cps; FM, 1 kc at 30 mc
5 kc at 150 mc, or 15 kc at 450 mc max.

This portable instrument in one complete package enables you to measure both frequency and frequency deviations in the maintenance of mobile communications systems.

As optional equipment the FM-7 Frequency Meter can be combined with the new DM-3 Deviation Meter as illustrated. The DM-3 is a dual-range deviation meter with 15 kc and 7.5 kc full scales.

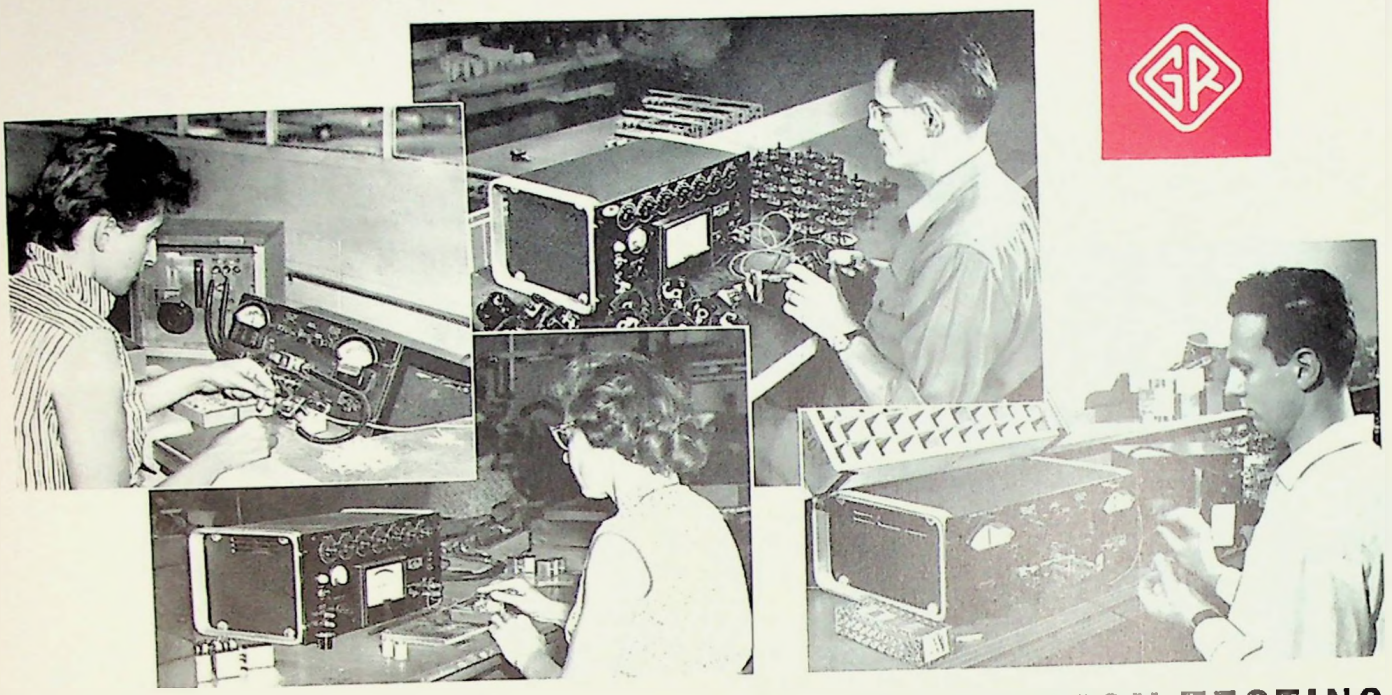
By combining the FM-7 and the DM-3 you get a single instrument capable of measuring and generating carrier frequencies *plus* reading peak modulation deviation.

Write for complete literature.

Gertsch

GERTSCH PRODUCTS, Inc.

3211 South La Cienega Boulevard, Los Angeles 16, California · UPton 0-2761 — VErmont 9-220



SEMI-AUTOMATIC BRIDGES for PRODUCTION TESTING

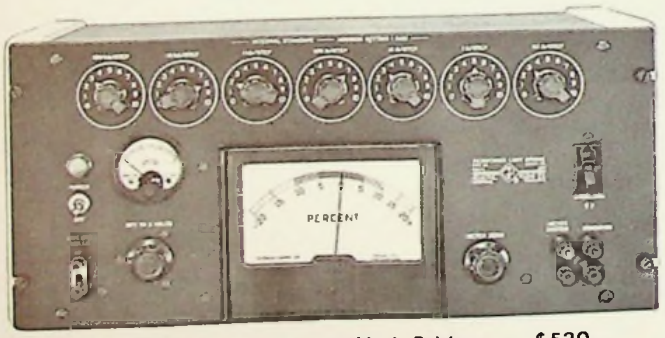
★ Fast . . . Self Balancing . . . Measurements are made as rapidly as components can be connected.

★ Rugged mechanically and electrically for continuous production-line use . . . Built to laboratory-equipment standards.

★ Easy to operate . . . Once set up, no further adjustments are necessary; measuring procedure reduces to simply connecting unknown to Bridge and reading meters.

★ Widely used as basic measuring elements in automatic sorting equipment.

For D-C Resistance Measurements



Type 1652-A Resistance Limit Bridge . . . $520

Large, easily-read meter indicates directly component resistance as a percentage of value of internal standards. No computations, minimum possibility of mistake, saves valuable testing time.

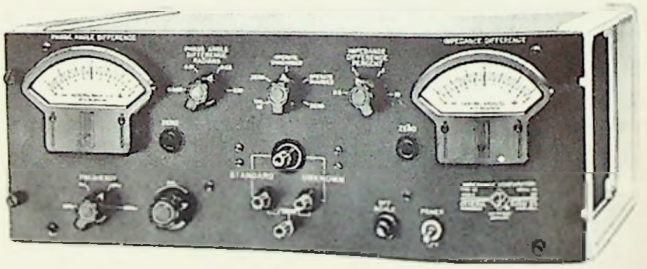
Range: 1 to 1,111,111 ohms with internal resistance standard. 1 ohm to 2 megohms using external standards.

Meter Range: Meter reads from −20% to +20%. ±5% and ±10% scales clearly indicated with color coding.

Accuracy: As a limit bridge, 0.5% or better. For matching resistances, ±0.2%.

Three High-Sensitivity Models providing full-scale ranges of ±2%, ±5%, and ±10% can be supplied on special order.

For R, L, C, and Impedance Measurements



Type 1605-A Impedance Comparator . . . $800

Indicates directly on two panel meters the differences in magnitude and phase angle between an unknown and an external standard. Measures impedance differences as small as 0.01% and phase angle differences of ±0.0001 radian.

Ranges: Impedance and resistance, 2 to 20 MΩ. Capacitance, 40 μμf to 800 μf. Inductance, 20 μh to 10,000h.

Meter Ranges: Impedance Magnitude Difference: ±0.3%, ±1%, ±3%, ±10% full scale. Phase-Angle Difference (in radians): ±0.003, ±0.01, ±0.03, ±0.1 full scale.

Accuracy: 3% of full scale; i.e., for the ±0.3% range, accuracy is ±0.009% of the impedance magnitude being measured.

Internal Oscillator Frequencies: 100c, 1 kc, 10 kc, 100 kc.

Write For Complete Information

GENERAL RADIO COMPANY

WEST CONCORD, MASSACHUSETTS

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

IN CANADA
Toronto
CHerry 6-2171