

*Designing for the optimum in electronic circuitry (see story on page 32)*

# electronics and communications



an age publication

NOVEMBER 1958

1211C  
QEL  
CRC  
EPM

MR F W PREZIOSI  
8 EASTGATE CREES  
SCARBOROUGH ONT

# AROUND THE WORLD *again and again!*

**A** fair idea of the extent to which Stackpole fixed composition resistors are used may be gained from this illustration.

Laid end to end, the total number of these tiny components produced to date by Stackpole would extend many times around the world.

Such acceptance is a tribute, both to the high quality of the resistors and to the dependable, personalized service, that Stackpole puts behind each resistor order.

## CANADIAN STACKPOLE LTD.

550 Evans Ave., Etobicoke  
Toronto 14, Ontario

Type CM-1/32  
( $\frac{1}{2}$  watt)

Made in Canada . . . By  
Canadians . . . In this modern  
21,000 square-foot building.



Type CM-2  
(2 watts)

Type CM-1  
(1 watt)



# STACKPOLE FIXED COMPOSITION RESISTORS

Available for your convenience through leading parts distributors.

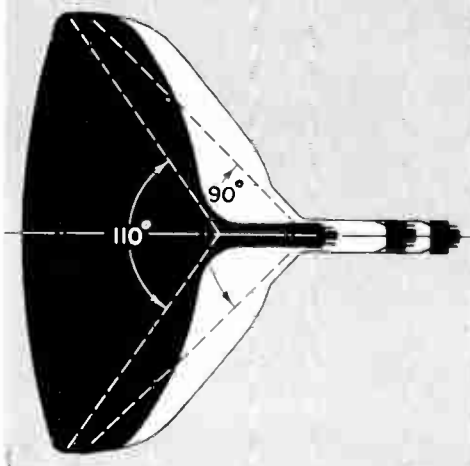
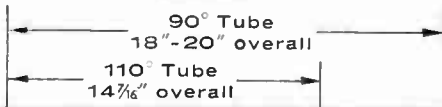


# ⑤ Big Advantages with MARCONI 110° Picture Tubes



## ⑤ advantages

- \* 5½" shorter than the conventional 90° tube, opening new scope for cabinet design.
- \* Available with 90° faceplate allowing for conversion to 110° without retooling the mask.
- \* No ion trap required—you save on the cost of an ion trap and the labour for adjusting it.
- \* Integral glass button base eliminates any possibility of loose base-pin connection.
- \* Small neck allows 110° deflection with only slightly more power than is required for a 90° tube.
- \* Approximately one pound lighter.



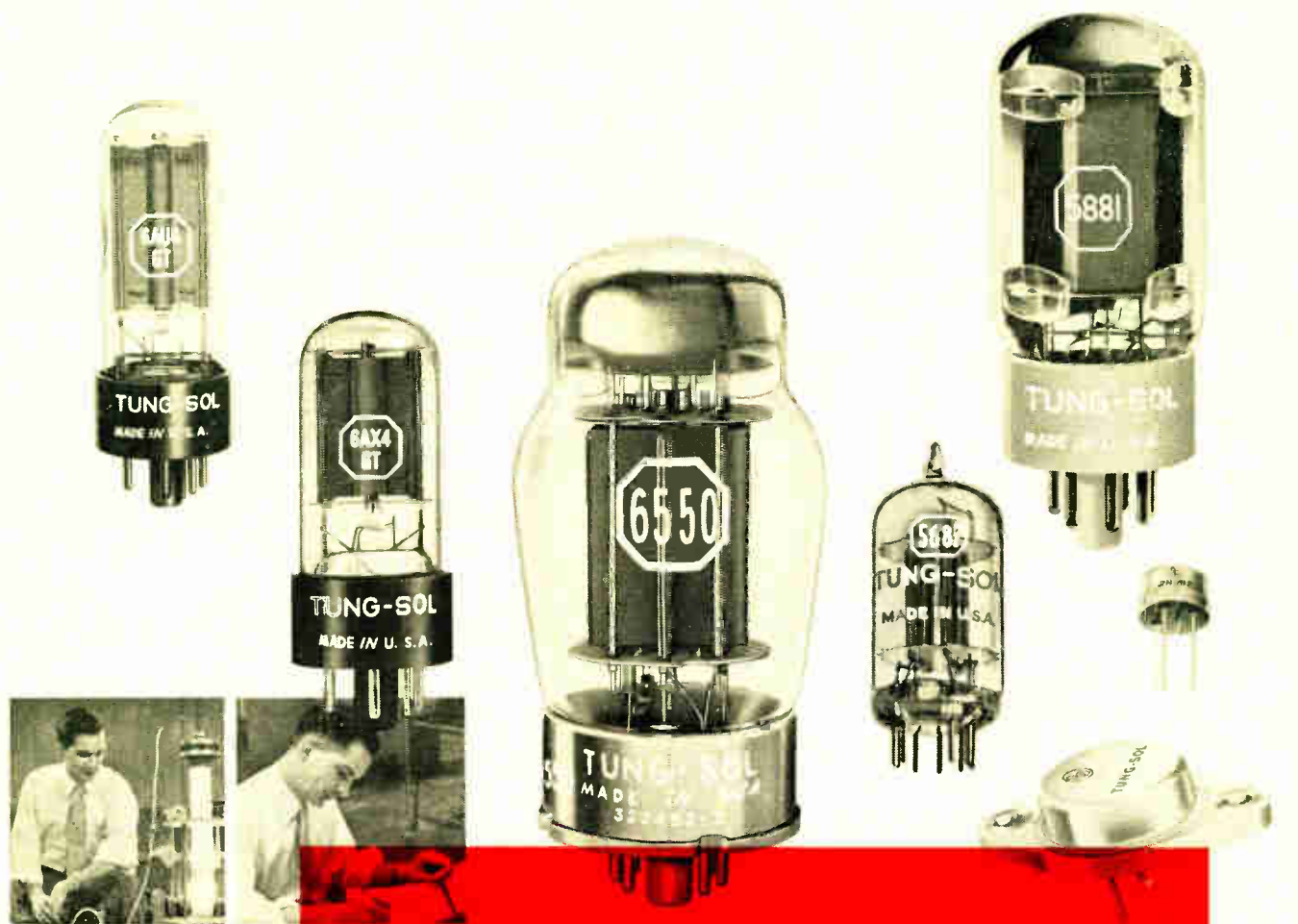
*As always Marconi is ready to supply the industry's latest needs. Marconi 110° tubes are now available from Canadian production to customer's specifications.*

ELECTRONIC TUBE AND COMPONENTS DIVISION

CANADIAN **Marconi** COMPANY

830 BAYVIEW AVENUE, TORONTO, ONTARIO

BRANCHES: Vancouver • Winnipeg • Montreal • Halifax • St. John's, Nfld.



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# Electronics and Communications



an age publication

Canada's pioneer journal in the field of  
electronics and communications engineering

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a new

260



Series III

— with improved sensitivity and added convenience, at a new low price.

For 20 years the famous Simpson 260 has become a by-word in circuit analysis and measurement. Still maintaining its fine reputation for quality and the traditional Simpson care and attention in every detail of design and manufacture — the 260 is now available in a new series to keep up with our changing times. The Series III 260 uses printed circuits for added reliability and ease of service. Increased sensitivities are provided at no sacrifice in reliability; added ranges, and a unique scale layout to improve readability.

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A.C. Volts (5000 ohms/volt). From 2.5 volts to 5000 volts in 6 ranges.

D.C. Resistance 0-2000 ohms to 0-20 megohms in 3 ranges.

Polarity reversing switch, volume level (decibel) and DBM ranges.

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**\$54.50**



The Series III 260 is completely Canadian made — from the famous ruggedized Simpson movement to the precision film type resistors. A wide range of accessories are also available — attractive leather carrying cases—high voltage probes—test leads, etc. Write for further details.

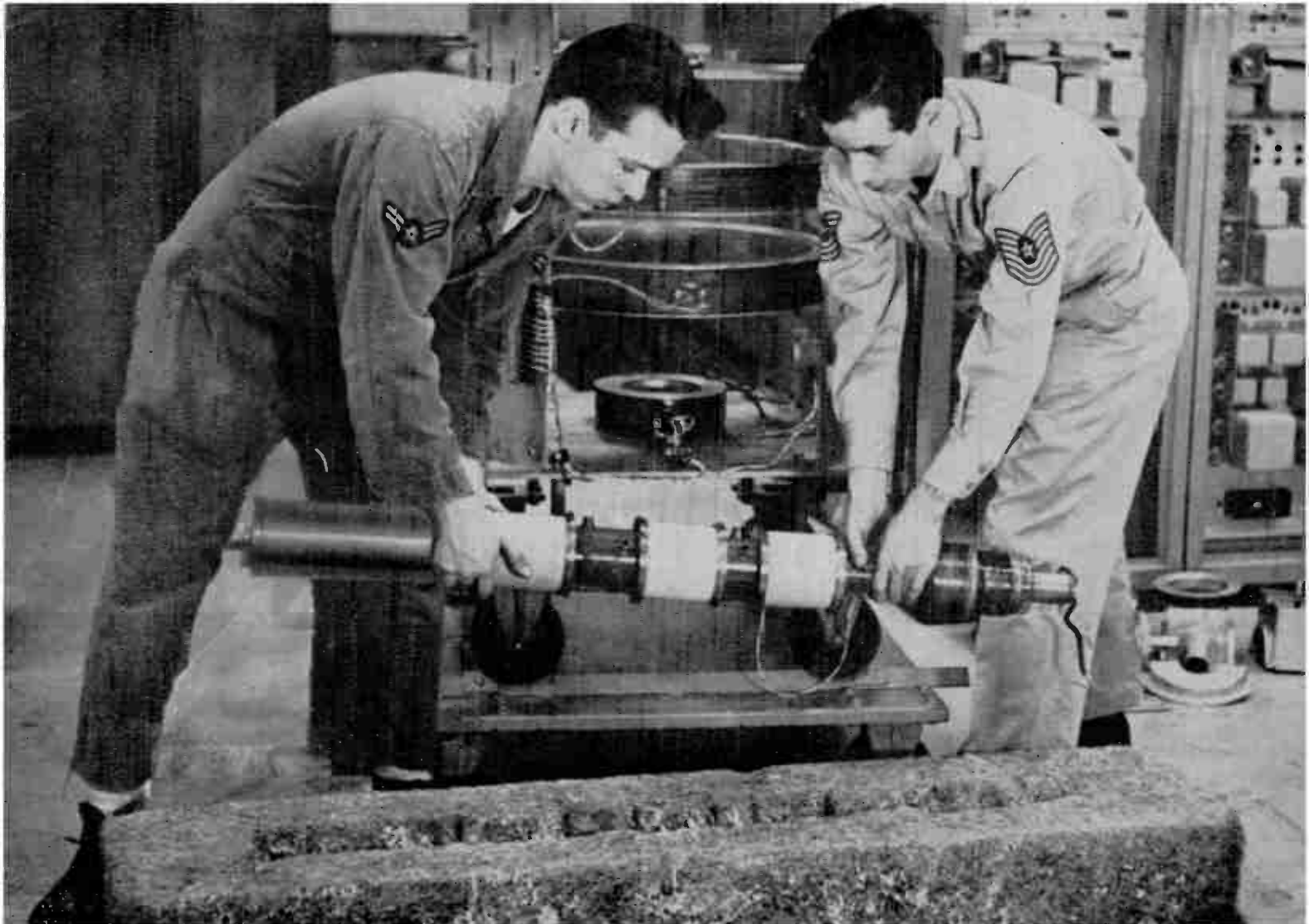
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IN U.S.A.: SIMPSON ELECTRIC COMPANY, 5200 W. KINZIE STREET, CHICAGO 44, ILLINOIS



U. S. Air Force personnel remove 25,137 hour klystron from advanced Pole Vault base. Department of Defense Photograph.

## Eimac Klystrons Going Strong

*after 25,000 Hours in Pole Vault Tropo-Scatter Service*

After 25,137 hours on the air, and still in perfect operating condition, this Eimac 3K50,000LF UHF klystron has been acquired through the cooperation of the U.S. Air Force and Canadian Marconi, Ltd. This klystron was one of the original tubes installed in Project Pole Vault, the first tropo-scatter communications line ever established. The tube is just one of a number of Eimac klystrons that have exceeded 25,000 hours of reliable on-the-air time in this system. Eimac klystrons are used as final amplifiers in the Pole Vault 10 kilowatt transmitters that handle multiple-channel voice and teletype communications. Experience with this first system in our early warning defense network confirmed klystron-powered tropospheric scatter as an outstandingly dependable system of long distance communication.

The exceptional performance of these tubes under the difficult logistical and environmental conditions of the far north is indicative of the reliability and conservative rating of performance-proved Eimac external-cavity klystrons. Eimac amplifier klystrons are now being used extensively for tropo-scatter communications throughout the United States, Canada and other regions of the world. Eimac klystrons for communications and pulse applications are now available covering frequencies from VHF to SHF and to multi-megawatt output powers.

For further information, write for a copy of the 24-page booklet "Klystron Facts Case Five."

### **EITEL-McCULLOUGH, INC.**

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*The World's Largest Manufacturer of Transmitting Tubes*

*Canadian Representative:*

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Vacuum Switches

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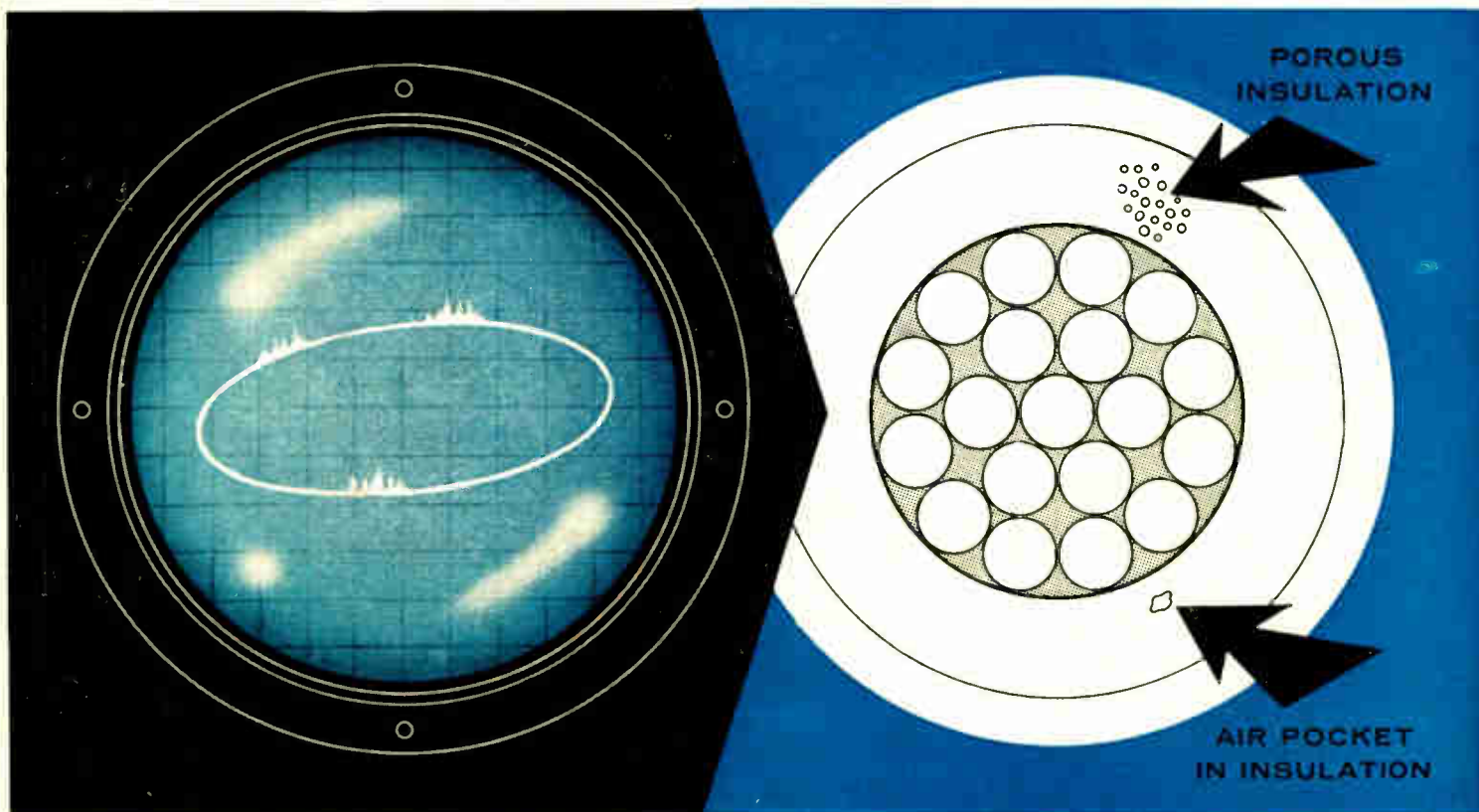


# Northern Electric's

## **CORONA LEVEL**

### safeguards cable quality

# Testing



Corona level testing of Northern Electric's rubber and plastic insulated cable rated at 5,000 volts and higher now gives an added assurance of quality.

Although all Northern cables are designed and manufactured with utmost care, voids may still occur in the insulation. When these voids occur in high voltage cables they may ionize and result in premature failure.

Tests normally specified seldom detect such voids, but Corona Level tests are extremely sensitive to their presence. In Corona Level testing a high A.C. voltage is applied to the cable and an oscilloscope graphically indicates the radio frequency voltages resulting from ionization of voids under this stress.

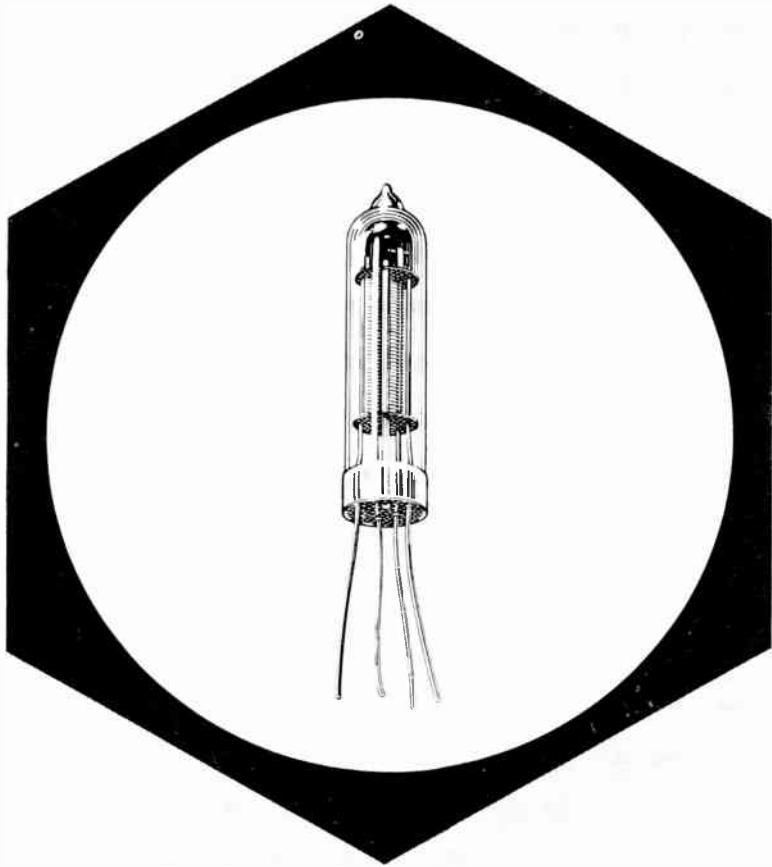
Why risk the possibility of having cable failure because of voids. Northern's rubber and polyethylene Corona Level testing ensures corona-free cables.

## *Northern Electric*

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SERVES YOU BEST

3058-5





**The Philips 6977 is a sub-miniature vacuum indicator triode** with a fluorescent anode, designed for applications in computers and business machines as an improved replacement for indicator lamps. In transistorized circuits the tube's high impedance and small signal requirements do not load the transistor circuit. Flying leads make it suitable for use with printed wiring. Philips 6977 triode has a life of 20 thousand hours. Overall dimensions are 2.6" x 0.22" including leads. Dimensions of fluorescent region are 0.4" x 0.22".

*Rogers wide range of quality tubes are finding more and more applications in all types of professional equipment. For greater reliability and lower maintenance costs, specify Rogers tubes.*

# ROGERS

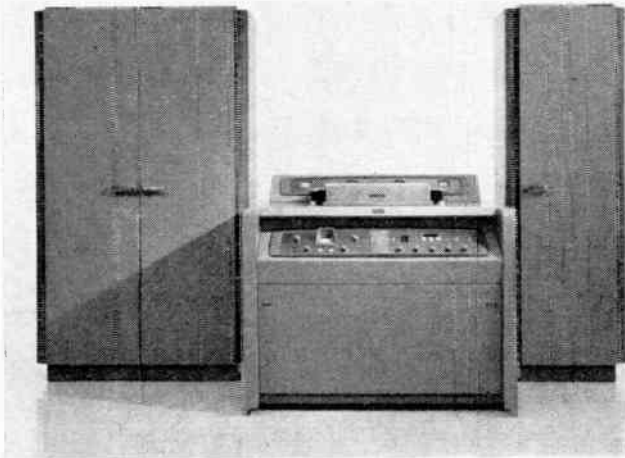
*electronic tubes & components*

A DIVISION OF PHILIPS ELECTRONICS INDUSTRIES LTD.  
116 VANDERHOOF AVENUE, TORONTO, ONTARIO / BRANCHES: MONTREAL, WINNIPEG, VANCOUVER  
★ Rogers Electronic Tubes are sold through Canada's Independent Electronic Parts Distributors

# AMPEX

*World Leader in Precision Magnetic Tape Recording Instruments*

Ampex Tape Recorders are in service throughout the world in television and radio stations, and in professional sound recording studios . . . wherever finest quality is required.



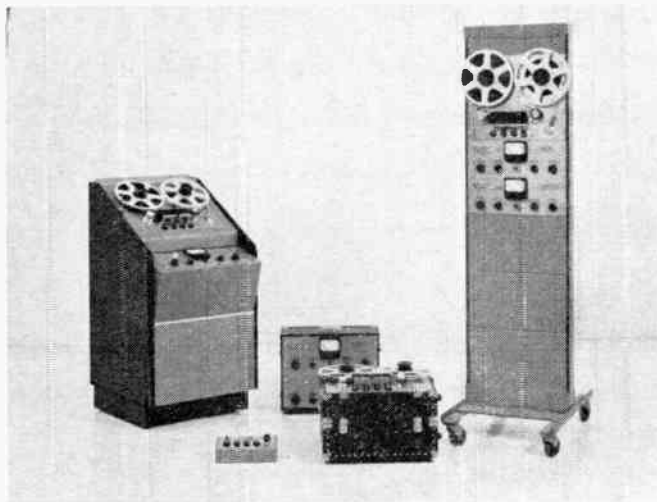
**VR-1000** Videotape\* Recorder

First commercially available Videotape Recorder. Magnetically records what the TV camera "sees." in either black and white or color. Playbacks look "live."



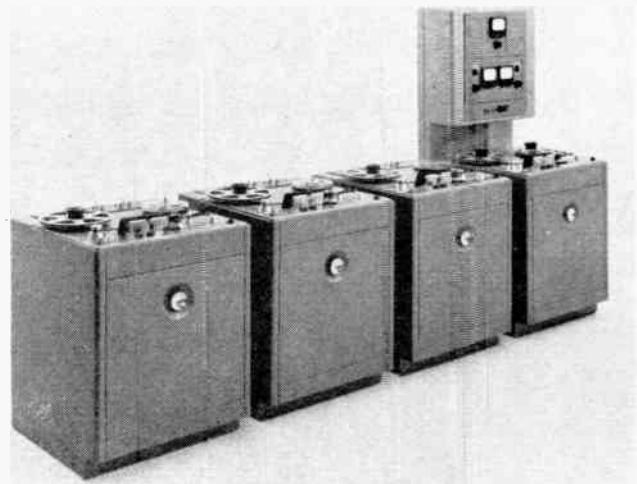
**MODEL 300** Magnetic Tape Recorder

Standard of the professional recording industry, it consistently delivers the finest in audio reproduction. Available in as many as 8 channels, in console and rack mounting.



**MODEL 351** Magnetic Tape Recorder

First choice of the broadcasting industry. Features printed circuits and miniature tubes. Available in console, rack and portable models, with one or two channels. Sold by dealers.



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High speed duplication, with superb fidelity, of recorded master tapes. Makes up to 10 copies at one time. Available with one, two or four channel heads.

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AMERICAN  
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\*TM Ampex Corporation



# EIA Report

By Basil Jackson, A.R.Ae.S., Tech. M.C.A.I.

## Active Engineering Committees

During the past month nearly twenty meetings have been held by various divisions and committees of EIA. Of these nearly half have been engineering meetings.

The Receiver Engineering Sub-Committee on Safety and CSA met and later made its report to a full meeting of the Receiver Engineering Committee. Earlier in the month, the Components Engineering Committee had met to discuss matters of interest to component manufacturers.

From the Electronics Division, the Instrumentation and Data Handling Committee met recently. The terms of reference were defined and it was agreed that the main scope of action of the committee was the promotion of electronic instrumentation and data handling equipment in both the commercial and military fields.

An outline, given by each company representative present, of his company's activities in the instrumentation and data handling fields, revealed that a diversified and wide range of systems and equipment was covered. It was quite evident that the Canadian industry was well able to manufacture, install and operate analog and digital computers, high-speed communication links, input and output devices, and the associated equipment.

## New Chairman of Government Liaison Committee

W. H. Jeffery, immediate past president of EIA, has been appointed chairman of the Government Liaison Committee. A. L. Stopps, past vice-president and past chairman of the Components Division, is a new member of this committee. Some important meetings between high ranking Government officials and this committee have taken place recently.

## First Progress Report On TV Servicing Course

The Ryerson Institute of Technology in Toronto has told the EIA office that good progress is being made by the twenty practicing television technicians who are enrolled in the first industry-sponsored television servicing night school course. "Interest and attendance in the new course are excellent", said a Ryerson spokesman recently, "and steady progress is being made in both the theoretical and bench work."

Further progress reports on this sixteen-week course, sponsored by EIA of Canada, will be made from time to time in this report. Graduates of the course will be awarded industry-recognized certificates of proficiency.

## Stereocasting

In the United States a national stereophonic radio committee to develop standards for the broadcast of stereophonic sound has been formed. Dr. W. R. G. Baker, of EIA of the United States, is general chairman of the new group, which will be formed within the structure of EIA of United States. For further news about progress in stereocasting see the "CRTPE NEWSLETTER" on page 12.

## U.S. Government's Financial Aid To Research

A report recently published by EIA of United States shows that the U.S. Government financed 61% of the total research and development costs of the "Electronic-Electrical Systems, Parts Industry" and 43% of the "Telecommunications and Broadcasting Industry". These figures are for 1956, the latest available.

Compiled by the U.S. Bureau of Labor Statistics on behalf of the National Science Foundation, the report shows a total of \$669.6 millions spent on applied R and D for Electronics-Electrical Systems, Parts Industry and \$137 millions for Telecommunications and Broadcasting. As a comparison, \$260.7 millions were spent on applied R and D for Aircraft and Associated Parts, and \$182.1 millions on Machinery (including computers).

The report defines the term "applied research" as including projects "directed to discovery of new scientific knowledge which has specific commercial objectives". In contrast, basic research is defined as including projects "which represent original investigations for the advancement of scientific knowledge and which do not have specific commercial objectives, but may occur in fields of present or potential use". Development is defined as "technical activity concerned with non-routine problems which are encountered in translating research findings or other general scientific knowledge into products or processes. It does not include routine technical services to customers". Also, the report defines electronics in applied R and D as "electronic systems and components, whether for wire or wireless telephone and telegraph of all kinds, radio and television transmitting and receiving, object detection, industrial controls, business machines, or other applications".

The total cost of R and D expenditures, (both applied and basic) for Electronic-Electrical Systems, Parts Industry amounted to \$1,173.4 millions for 1956 (57.9% more than in 1953) and for Telecommunications and Broadcasting the figure was \$171.1 millions (51.4% increase over 1953).

# Newsletter

Canadian Radio Technical Planning Board

## WHO'S WHO IN THE PLANNING BOARD

### No. 8 — Canadian Electrical Association

Plans for the formation of an electrical association in Canada resulted from a meeting held in Toronto, Ontario, on September 17, 1891, at which the "Canadian Electrical Association" was organized.

The Association was incorporated by Letters Patent under Dominion Charter on March 30, 1922. It has steadily progressed from a small beginning until it is now a very important electrical organization. Its purposes and objects are to advance, in the public service, the art and science of the generation, transmission and distribution of electricity and to stimulate and promote the greater use of electricity for all purposes; to foster and encourage research by its members and the study, discussion and interchange of information on all subjects related to these objects; to assist in maintaining high standards of service and ethical business practices; and to develop and maintain cordial relations among its members, with kindred associations and with the public.

### 14th Annual Meeting

Plans are now well advanced for the 14th Annual Meeting of the Planning Board to be held at the Chateau Laurier Hotel, Ottawa on Thursday, December 11, commencing at 10:00 a.m. The agenda will include the president's annual report and consideration of the revised Constitution and By-laws. The new Constitution is the result of much thought by the Executive Committee over the past year in an effort to up-date the CRTPB organization and procedure.

At the annual meeting reports will be given by the chairmen of the various committees and of the West Coast Panel. The committees consist of Television, Broadcast, Microwave, Fixed Land and Maritime Mobile, Tropospheric Scatter, Aeronautical and Amortization.

### DOT Buys ILS Localizers

The Department of Transport has purchased fifty Instrument Landing System localizers for airports across Canada, it was announced recently. The installations, costing \$1,000,000, are being made in line with the policy of the Department to modernize Canadian airways with the latest aids. The purpose of the localizers is to align aircraft on the landing approach with the airport runways. Other equipment then brings the aircraft down at the correct angle to the ground.

Of the fifty Instrument Landing System localizers, thirteen will be used to replace obsolete equipment; twenty-two will be used for airports presently not equipped with such facilities and to fit additional runways at some of the busy airports, while fifteen will be used for installations in the future at airports where traffic density and other circumstances justify the cost.

At present there are twenty-six ILS installations in use at twenty Canadian airports.

### Recent CRTPB Meetings

The seventh meeting of the Microwave Task Force on Communication System Parameters took place in Toronto on November 14. The meeting continued with the review and revision of EIA Standard TR-141 "Microwave Relay Systems For Communications" and considered the performance standards for the different pieces of equipment used in a microwave relay system.

### Stereo Broadcasting

In the United States, as in the United Kingdom and in Canada, interest is being shown in the development of stereo broadcasting systems. Six FM stations in the U.S.A. are already using experimental licenses to commence stereocasting, and the FCC has stated that licensing extensions will be granted if the results merit this action.

There are at least three proposed systems. The Crosby system uses two channels of equal bandwidth while the Halstead system has provision for one wide-band and two narrow-band information channels.

RCA has an AM/AM stereo system at the laboratory development stage. In this system each stereo channel is carried by one of the sidebands of the AM carrier signal, while the receiver separates the sidebands into two speakers. In conventional AM receivers the sidebands would not separate so that no stereo effect would be apparent. In Canada at least one private station has experimented with stereo broadcasting and the CBC has planned a series of tests.

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Canadian Radio Technical Planning Board  
200 St. Clair Avenue West, Toronto 7, Ontario

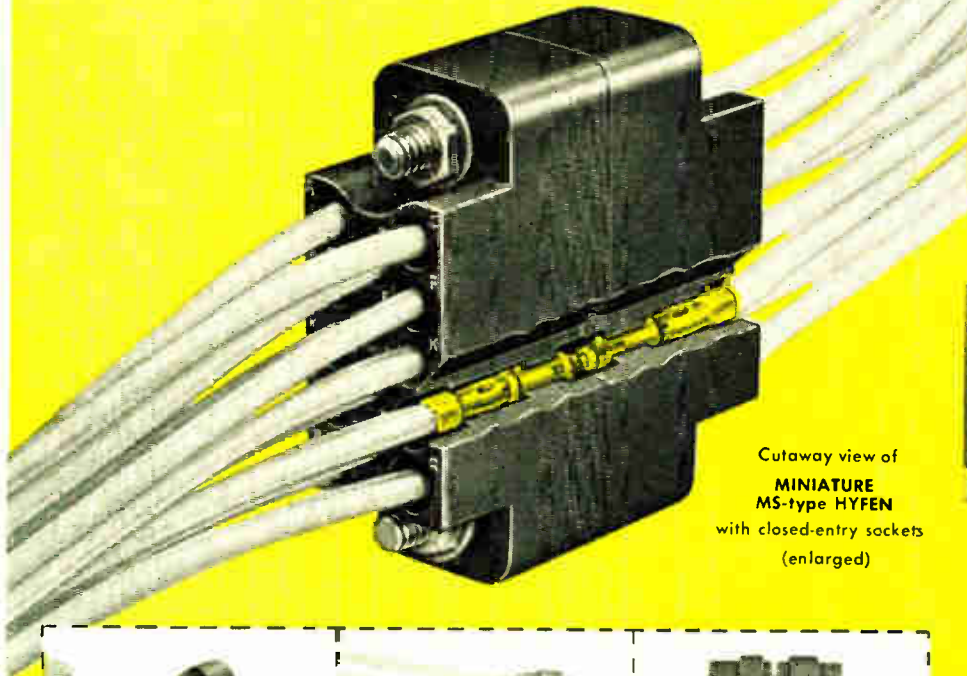
F. H. R. POUNSETT, President; C. J. BRIDGLAND, Vice-President; R. A. HACKBUSCH, General Co-ordinator;  
R. C. POULTER, Director of Public Relations; F. W. RADCLIFFE, Secretary-Treasurer



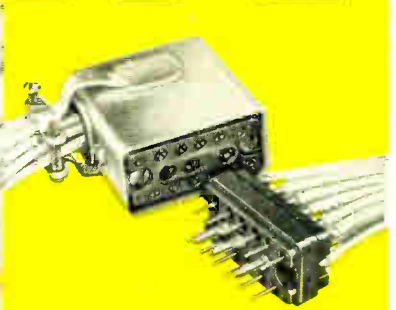
# HYFEN<sup>TM</sup>

## CONNECTORS

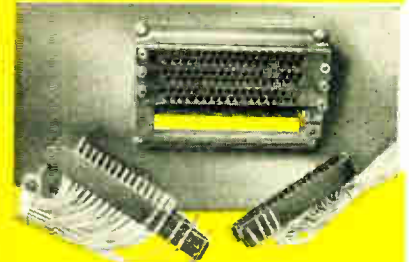
*with crimped, snap-locked contacts*



Cutaway view of  
**MINIATURE  
MS-type HYFEN**  
with closed-entry sockets  
(enlarged)



15 contact, multi-purpose connector. Mates with, or replaces existing solder connectors.



Feed-thru, modular design, multiple insert connector. 35 contact inserts, can be removed from frame for easy contact insertion or removal. 5 or 8 insert frames available.



**CRIMP** pins or sockets on wire

**SNAP-LOCK** contacts into plug or receptacle

**MATE** with HYFEN or equivalent solder types

**SAVE WEIGHT, SPACE, TIME** — Burndy's HYFEN method brings added Reliability and Versatility to the connector field, allowing the design of lighter and more compact equipment... saving space, weight and time. Pins and Sockets can be bench-installed on the wire and can be snap-locked in place even after the Plug and Receptacle have been mounted on the equipment.

Designed to replace or mate with virtually all existing connectors, including AN, MS, and other Miniature types, the HYFEN meets or exceeds MIL specs.

The HYFEN method ends the high rejection rate inherent with the use of solder... especially important in today's continuing trend toward miniaturization.



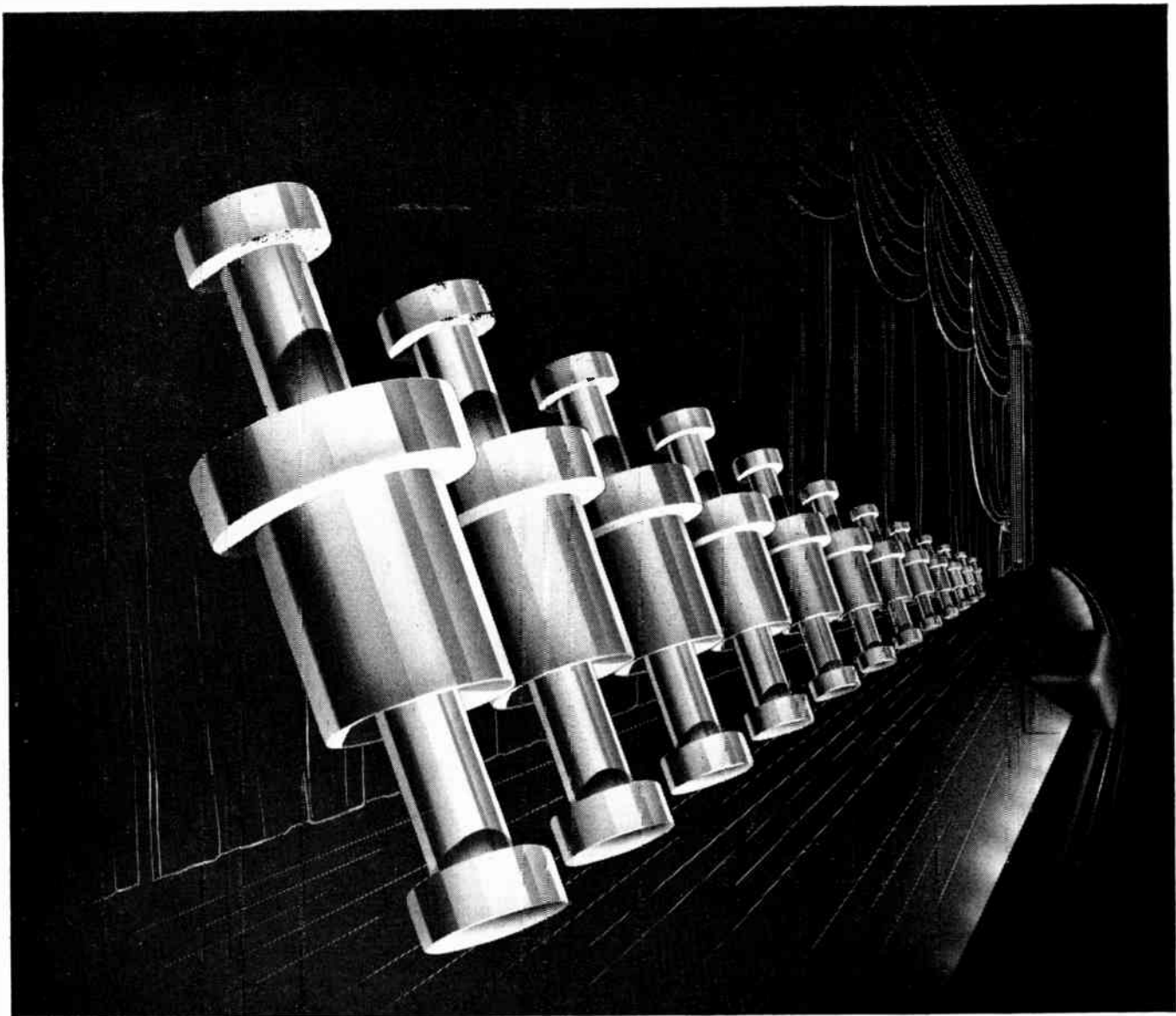
AN-type HYFEN connector, showing HYFEN method adapted to round design.

*HYFEN types illustrated are typical of those already supplied to the Industry by Burndy. HYFEN connectors are engineered to meet specific requirements. For other types and sizes, contact Burndy.*

OMATON DIVISION

# BURNDY

BURNDY CANADA LTD., 1530 Birchmount Road (Metropolitan Toronto), Scarborough, Ont.



There are over 50 Cambion® standard solder terminals, each available with varied shank lengths. Ordinarily finished with silver plating, they can also have tin-lead or tin-zinc electroplating, hot tin coating, bright-alloy or cadmium plating, 24K gold plating or finishing. All materials meet military specifications.

## Precision performance all down the line!

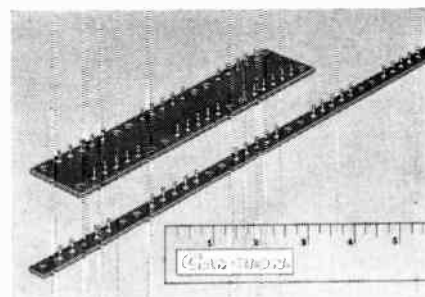
Always precision-machined from quality brass — always electroplated to guaranteed proper thicknesses — always in stock when you order them — Cambion solder terminals have the *guaranteed* precision you need.

Produced to extremely close tolerances, Cambion solder terminals are quality controlled throughout their entire manufacture. Cambion engineers continually check and recheck the coatings for adhesion, continually inspect cross-sections to guarantee uniform thickness. This is microscopic precision on mammoth scale — means your orders are filled immediately — no matter *how* big they are.

Precision manufacture guaranteeing precision performance — the standard is high for the entire Cambion line of electronic components, including capacitors, swagers, hardware, insulated terminals, coils, and coil forms. For samples, specifications, and prices write

to Cambridge Thermionic of Canada Limited, 2425 Grand Boulevard, Montreal 28, P. Q. Canadian Representative: Samuel C. Hooker (Canada) Limited, 4126 Bathurst St., Downsview, Ontario.

Cambion standard and custom all-set terminal boards are produced on Cambion-designed swaging machines and tooled to insure smooth finish without cracking. Paper, nylon, cloth, or glass laminates are bonded with phenolic, epoxy, melamine, or silicone resins, then lacquered, varnished, or coated. Now available: ceramic and miniature all-set boards.



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**CAMBION®**

Makers of guaranteed electronic components, custom or standard



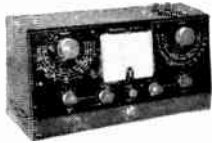




# CANADA'S FINEST ELECTRONIC TEST EQUIPMENT!

in kit form at budget prices

## "Q" METER KIT MODEL QM-1



\$53.95

Tests components at normal operating frequencies — 150 kc to 18 mc. Wide range of inductance, capacitance, and Q, covers all values likely to be encountered. All indications read directly on meter. Full frequency range on four bands. Voltage regulated and transformer-operated power supply. Special test coil provided for calibration purposes.

## IMPEDANCE BRIDGE KIT MODEL 1B-2A

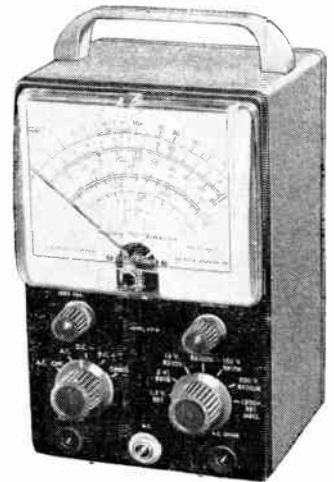


\$69.95

Gives rapid and accurate measurement of resistance, capacitance and inductance, as well as dissipation factors of condensers and storage factors of inductors. A center scale one hundred ua meter provides for null indications. Features a built-in power supply, 1,000 cycle phase shift generator, and a vacuum tube detector. Can be connected to external generator for measurements at frequencies other than 1 kc.

## VTVM KIT MODEL V-7A \$35.95

- Quickly and easily assembled.
- Large, easy-to-read 4½" 200 ua meter.
- 1% precision resistors for high accuracy.
- Etched circuit board assures extreme circuit stability.



## LABORATORY GENERATOR KIT MODEL LG-1

Designed for laboratory and development work as well as for general service. Accurately calibrated 200 microampere panel meter reads output voltage in microvolts or percent modulation. Frequency range from 100 kc to 30 mc, on fundamentals, divided into five calibrated bands. Maximum output in excess of 100,000 microvolts. Modulation variable from 0 to 50%, at frequency of 400 cycles internally. Can be modulated externally with an audio frequency of 60 to 10,000 CPS.



\$57.95



## "EXTRA DUTY" 5" OSCILLOSCOPE MODEL O-12 \$79.95

- Laboratory quality, at much lower than usual price.
- Sweep range 10 — 500,000 CPS, push-pull output.
- Printed circuit boards for faster, easier assembly and assured stability.
- Automatic sync circuit with self-limiting cathode follower.

## PROFESSIONAL OSCILLOSCOPE KIT MODEL OP-1 \$217.95

Features DC coupled amplifiers and DC coupled CR tube un-blanking. Triggered sweep circuit operates on either internal or external signals and may be either AC or DC coupled. Polarity of triggering signal may also be selected, and any point on waveform for start of sweep. Prewired terminal boards provided for all critical circuits. Power supply is transformer-operated using silicon diode rectifiers.



# DAYSTROM LIMITED

Distributors of Heathkits in Canada

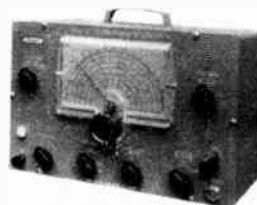
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Wired

Test Instruments



**Model SWG-58 SWEEP GENERATOR Model MHG-48 MARKER GENERATOR**

For alignment of TV, FM and VHF receivers. Frequency Range: 3 Mc to 260 Mc in 2 bands. Sweep deviation: 0 to 12 Mc. Sweep Method: vibrating capacitor, sinusoidal. Amplitude Variation less than 3 Db at 12 Mc deviation. Output Impedance: 75 ohms, unbalanced Output Voltage: 100,000 microvolts, variable. Horizontal Phasing Voltage: adjustable Blanking Control: Ample Output for all TV alignment. 4 tube compliment. AC, 115 V., 50/60 cycles, 35 watts, approx. Size 8 x 12 x 15 inches. Wt. 15 lbs.

**SWG-58 \$97.95**

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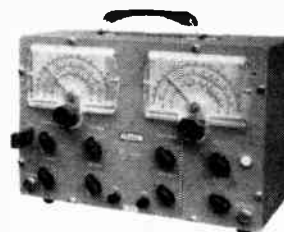
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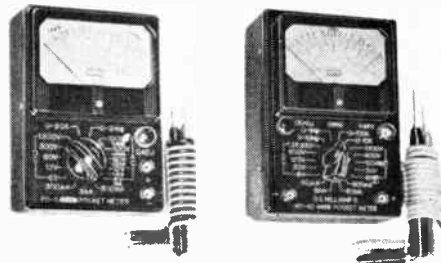
SPECIFICATION: AC Volts - 0: 6: 12: 60: 300: 1200 at 2,000 ohms per volt. DC Volts - 0: 6: 12: 60: 300: 1200 at 2,000 ohms per Volt. DC Current - 0 - 0.3 Ma - 3 Ma - 300 Ma. Decibels - -20 to 46 Db. Capacity - 0 - 0.1 Mf. Inductance - 0-1000 H. Resistance - 0-20,000 ohms: 0-2 Megohms. Size: 5-1/4" x 3-3/4" x 1-1/4". Wt. 18 ozs.

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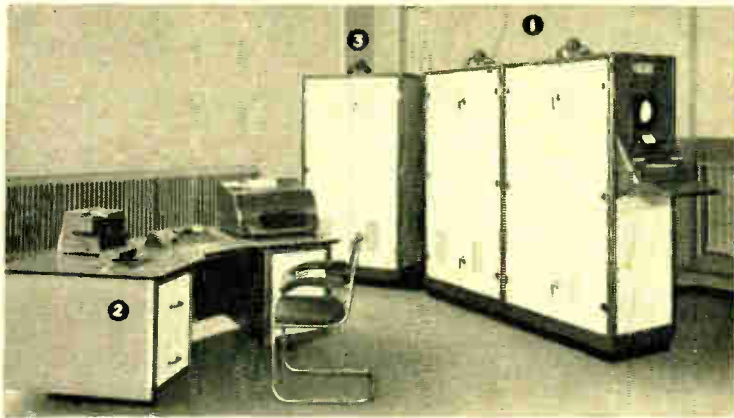
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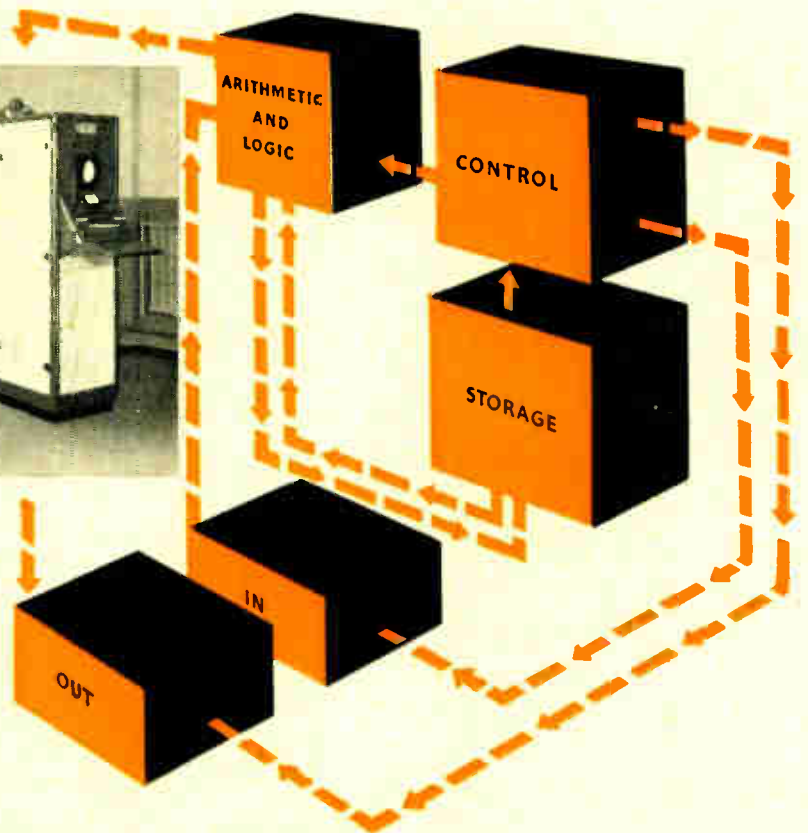


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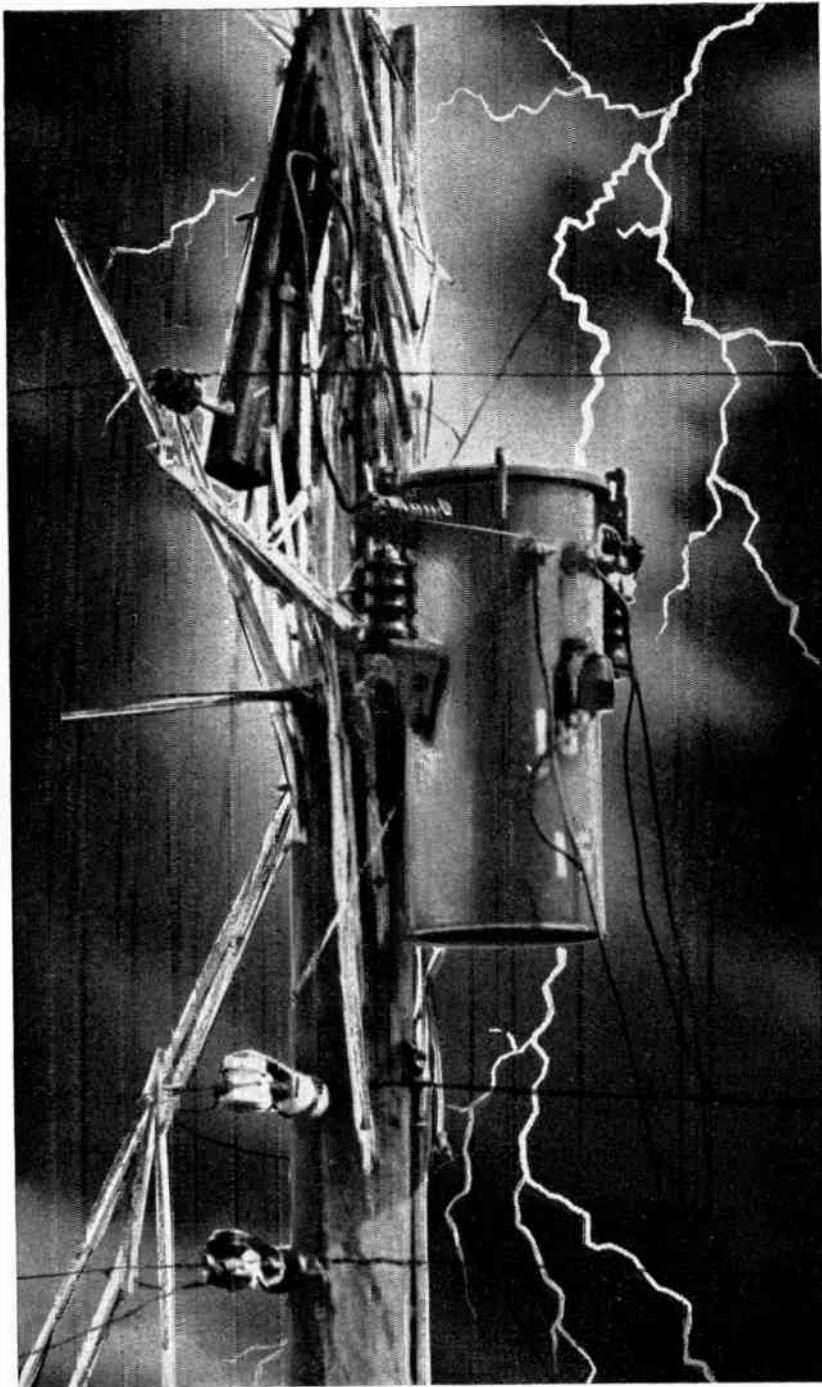
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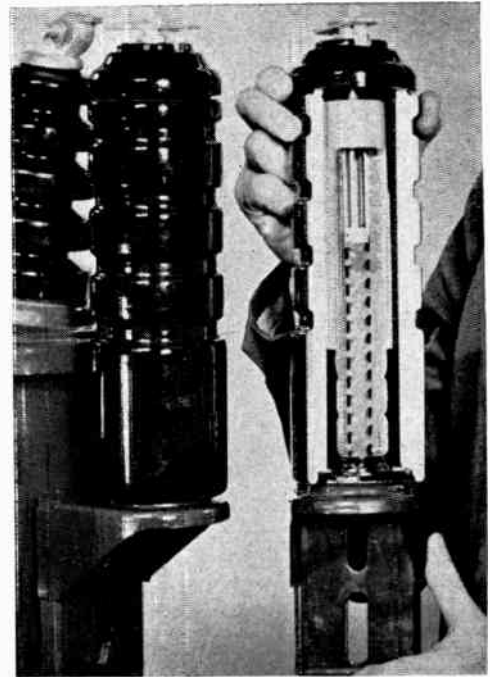


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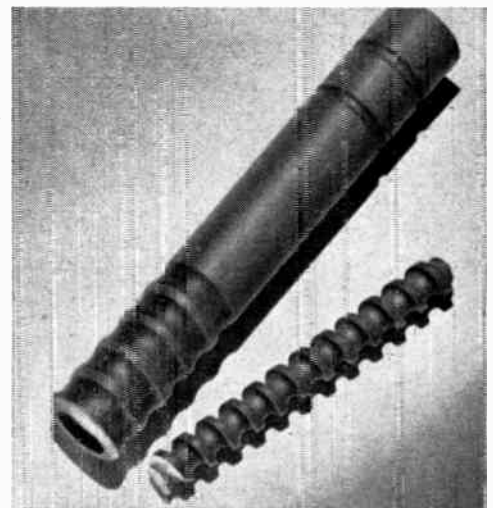
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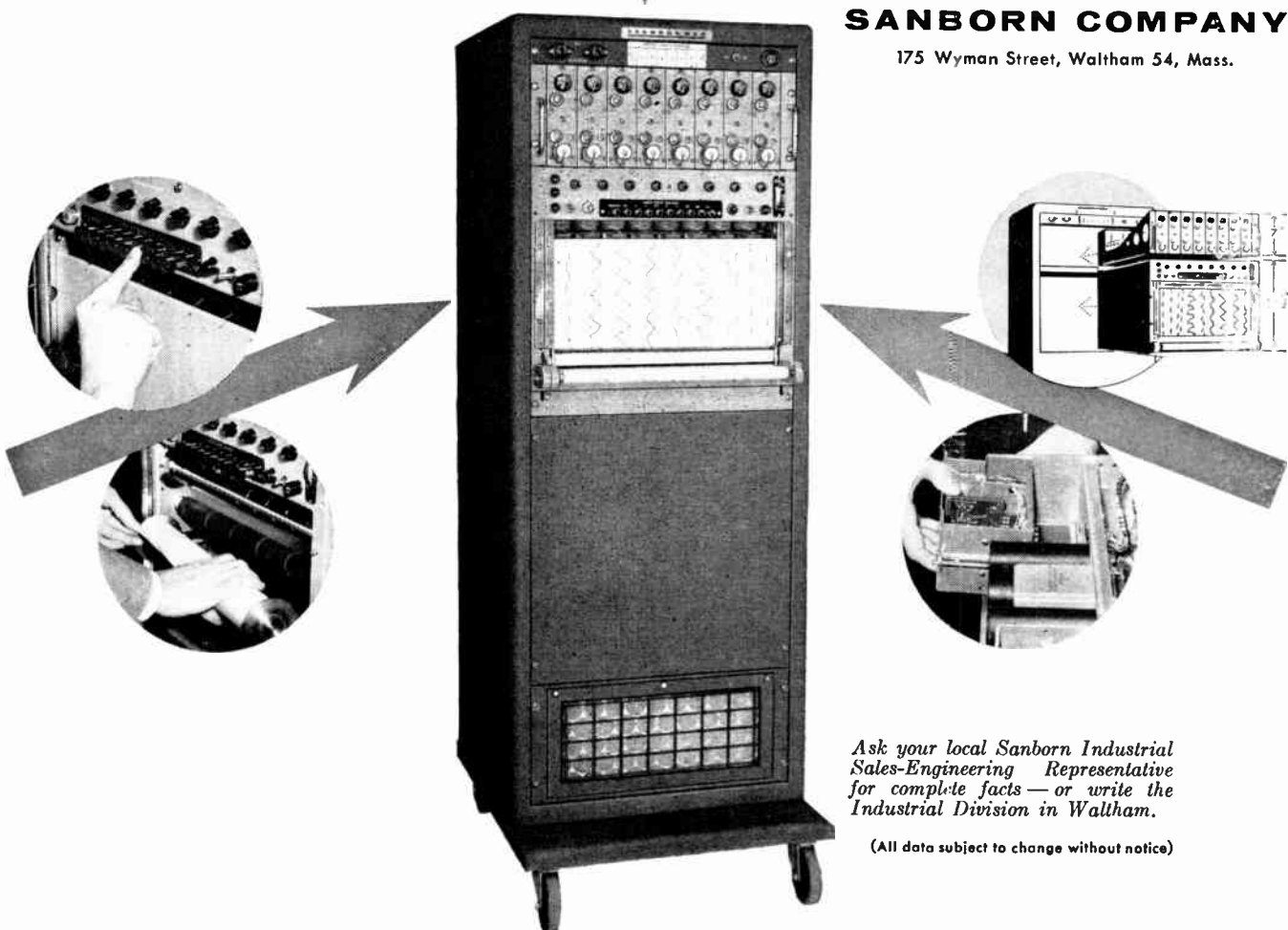
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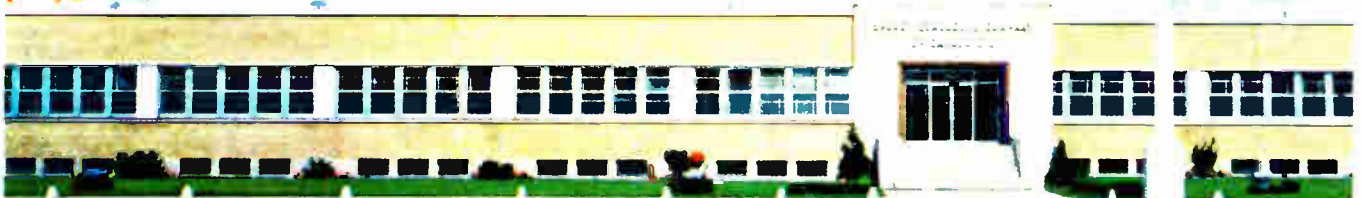
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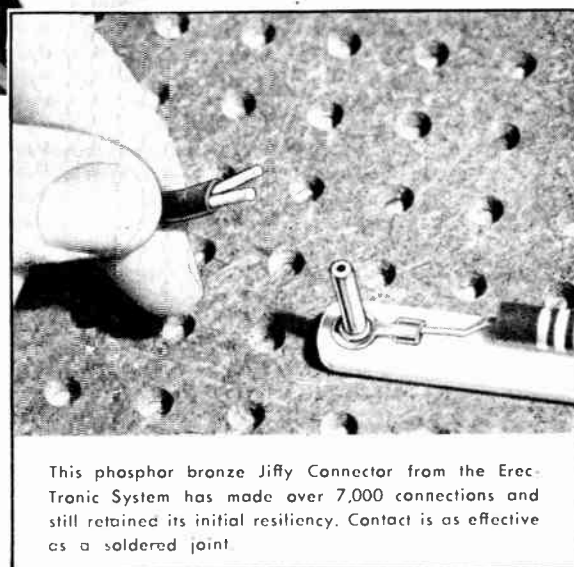
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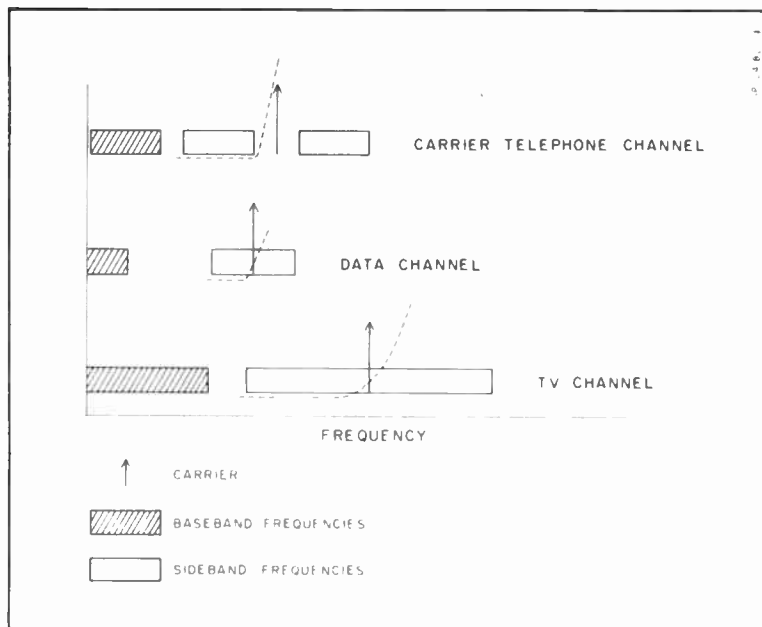
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Figure 1. The selection of the transmitted frequency band by the modulator output filter (dotted lines) is shown for a single sideband carrier telephone channel, a vestigial sideband data channel, and a vestigial sideband for a television channel.



## Vestigial sidebands in high-speed data transmission

Described in the following article are some of the important characteristics of vestigial sideband transmission and some of the problems involved in high-speed data transmission.

High-speed data transmission devices are needed to provide controls in industry as well as to control the flight of aircraft for safety and national defense. A number of pilot systems have been developed which transmit binary information at rates up to 1650 bits (binary digits per second). One system which has recently been inaugurated is the SAGE system that was designed for operation at 1300 or 1600 bits. The SAGE system employs vestigial-sideband methods for transmission of information over telephone channels. An important consideration in high-speed data transmission is the band-width over which data is to be sent. One of the most commonly available facilities is the carrier telephone channel. The frequency bandwidth varies somewhat between carrier systems for terminal-to-terminal operation, and some degradation is experienced when tandem connections are made. Although modern carrier systems provide bandwidths of up to 3000 cycles, on the average, the bandwidth of all carrier channels in use is in the order of 2500 cycles.

While the theoretical information capacity (bits) is quite high, in the present state of the art the information capacity of a channel (in bits) is considered to be approximately equal to the bandwidth. However, the presence of noise and the manner in which the available bandwidth is utilized also restricts the rate at which information may be transmitted.

For example, it is possible to use a number of separate v-f telegraph circuits each operating at a rate of 74 bits. Using the nominal 170-cycle spacing, approximately 15 v-f carrier telegraph channels could be operated in a 2500-cycle band with a combined bit rate of about 1100. Among the factors which contribute to the reduction in theoretical information rate are the guard bands necessary between adjacent telegraph channels and the use of double sideband transmission.

As with carrier telephone systems, more effective

*This article is reprinted through the courtesy of Lenkurt Electric Co. of Canada Ltd., North Burnaby, Vancouver, B.C., and appeared originally in the Lenkurt Demodulator.*



utilization of the available bandwidth would result from the use of single sideband transmission where amplitude modulation is employed. In a frequency division multiplex carrier system, single sideband methods can be employed because the frequencies below about 200 cycles are not important to the interpretation of speech sounds. Thus a modulator output filter can be designed to select only one sideband for transmission.

However, unlike voice transmission, it is necessary with data and telephotography to transmit the lower frequencies adjacent to the data-channel carrier frequency in order to retain the form of the information pulse. Since this need imposes excessively severe design requirements on the modulator output filter, single sideband techniques are not used in practical data systems. Instead, both sidebands and the data channel carrier may be transmitted as is done in 60- and 100-speed v-f carrier telegraph systems. A disadvantage to the use of both sidebands is the frequency spectrum required for the transmission of information.

Rather than to completely lose the frequency spectrum advantage of single sideband operation, one complete sideband and a portion of the other may be transmitted. The partial sideband is called a *vestigial sideband*, and devices which use this method are commonly referred to as vestigial sideband systems. Vestigial sideband transmission has been used for a number of years in telephotography, and more recently this technique has been applied to the SAGE high-speed data system.

### Characteristics of vestigial signals

With this technique, amplitude modulation is employed, and at the output of the modulator the carrier plus the upper and lower sidebands are present. The modulator output filter is designed to pass one sideband and to have a roll-off such that the sum of the amplitudes of corresponding frequencies above and below the carrier add to the pulse amplitude. This is done to preserve the low frequency components.

A side effect from filtering out part of one sideband is the introduction of a spurious signal component. This signal component is called the *Quadrature Component* because it is  $90^\circ$  out of phase with the principal signal. The phase shift is caused by the impedance char-

acteristic of the modulator output filter in the roll-off region.

Addition of the quadrature component with the main signal causes distortion of the modulation envelope of the amplitude-modulated wave. The distorting effect of the quadrature component is dependent upon the modulation index, which is a function of the ratio of the amplitudes of the carrier and modulating signals.

To reduce the effect of the quadrature component in practical systems which use envelope detection, the spacing (off) signal is not made zero, but is often between 30 and 40 per cent of the marking (on) signal amplitude.

For transmission over a telephone channel, the carrier frequency of a vestigial-sideband data system must lie within the channel bandwidth.

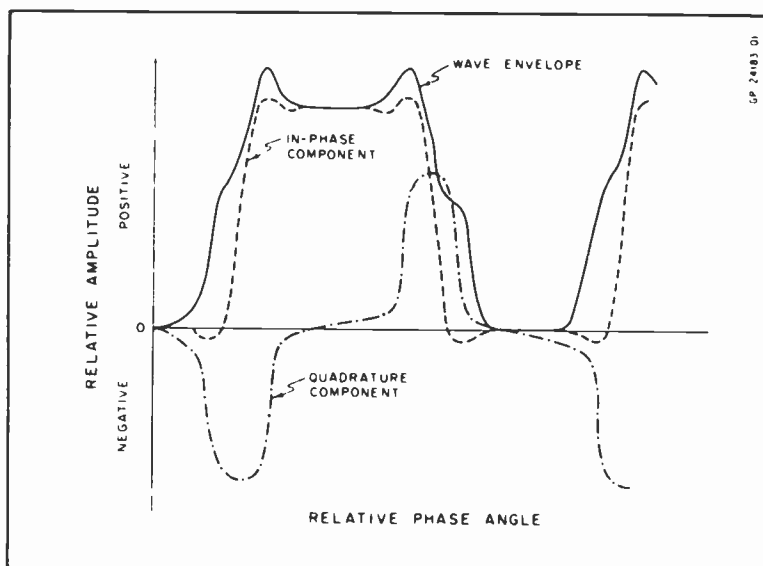
Because of non-linearities experienced in modulators, modulation products result which lie in the band of the original data-pulse frequencies (baseband signal), as well as in the upper portion of the band. The extraneous signals in the low end of the band can be avoided if the carrier is positioned so that the major portion of the two signals do not coincide. Severe interference would be obtained if the carrier were placed too low in the channel. In most broadband vestigial systems, the complete lower sideband plus only a portion of the higher is used to avoid the high order modulation products which fall in the upper portion of the channel. The presence of modulation products places additional restrictions on the bandwidth and therefore the information capacity of a channel.

### Level equalization

Different signal amplitudes convey the marking, spacing and timing indications in systems that employ amplitude modulation. In standard double-sideband telegraph circuits, mark and space are usually determined by the presence or absence of signal at the receiver. However for vestigial sideband systems, the marking and spacing conditions are normally represented by two discrete signal levels. This imposes a penalty in the degree to which rapid level variations may be permitted to occur on a vestigial sideband system as compared to a system that transmits both sidebands.

As an example, if a double sideband system uses a

Figure 2. Distortion of the envelope waveform caused by the quadrature component in vestigial sideband systems is illustrated. The magnitude of this distortion can be minimized by decreasing the modulation index.



marking pulse of 1 volt and a spacing pulse of 0 volts, the receiver will not indicate an error until the marking pulse is reduced to ½ volt when the *slicing level* is set at the intermediate point. The slicing level is the signal amplitude above which the signal is identified as a mark and below which it is identified as a space by the receiver. In this example, the signal level would have to suddenly decrease or increase by 6 db on a voltage basis before an error would be registered.

However, for a vestigial sideband system that uses a marking pulse of 1 volt and a spacing pulse of 0.30 volts, the permissible change in level is reduced to about 3.8 db. This is the ratio of marking voltage to the slicing level  $1/(0.3 + 0.7/2)$ . The tolerance of the vestigial sideband system to sudden changes in level has been reduced by more than one-third of that allowed for a double sideband system.

As the number of signal amplitudes is increased, the allowable changes in level are continually reduced. In the SAGE data system, the relative signal amplitudes are 1, 0.625 and 0.25, respectively for the timing (synchronizing), spacing and marking indications. In this case, the allowable variations in level are restricted to 1.8 db, and any greater variation would cause an error.

Normally some adjustments can be made which will minimize the level changes and, in addition, automatic gain control is available in the SAGE system. Carrier system regulators may be used with this system if the regulator recovery time is sufficiently long.

### Envelope delay

The time required to propagate a single frequency wave from one terminal to another is called *absolute delay*. The difference in absolute delay for different frequencies is called *relative delay*. Absolute delay is of relatively little importance in most telephone and data applications. However, the relative delay (often referred to as envelope delay) between different frequencies of a wave is important. Where significant differences in relative delay exist, the wave envelope of an amplitude modulated wave will be distorted. Equalization across the band is not normally required for low-speed data and voice transmission, but in high-speed vestigial sideband transmission, delay equalization is often necessary.

For an equivalent bit rate, the envelope delay requirements are effectively the same for high-speed data transmission as they are for telephotography. In SAGE circuits, envelope delay should not exceed 500 microseconds ( $\pm 250$  microseconds) between any two frequencies within the frequency range 1000 to 2500

cycles. This is equal to a distortion of  $\pm 0.4$  of a signal element, and is equivalent to a signal-to-noise impairment of about 3 db in signal reception.

A number of the older carrier systems and most of the more recent carrier systems will meet the SAGE requirements over one link. However, much of the envelope delay in a carrier system is caused by the filters. Among the principal contributors are the channel filters, line filters and directional filters. For this reason, the long telephone links and those with a number of filters in the line may have more than the desired delay. Since it is possible that tandem connections of links may be made, the delay of each link should be kept to a minimum. An example of the relative delay in a carrier channel and the manner in which it is equalized is shown in Figure 3.

### Noise

While noise causes interference in telephone circuits, the inherent redundancy of language often permits an understanding of a message in the presence of noise, and if necessary the listener can ask the speaker to repeat the message. Most of the redundancy has been eliminated in the codes designed for data transmission, and often the receiver cannot immediately request a repetition of the message. Therefore, excessive errors cannot be tolerated, and an objective for some high-speed data circuits is 1 error in 100,000 bits.

The effect of noise is to add to or subtract from the signal, and the magnitude of the noise and the relative position of the instantaneous noise signal determines the effect on the signal. In the absence of noise, the ability of a receiver to distinguish among one of a number of signal conditions depends upon the amplitude differences of the signals in a pulse train. The presence of noise may affect the discrimination of the receiver if the instantaneous noise causes the received signal to exceed the slicing level, and errors will occur in the transmitted data. The effects of random noise can be predicted quite well, but the characteristics of impulse noise are not always known. Where impulse noise is present, it is desirable to measure the noise peak and its frequency of occurrence. In this way, the necessary signal-to-noise ratio can be determined.

The signal-to-noise ratio is calculated from the amplitude difference and the slicing level. For example, if a vestigial sideband system uses a marking pulse with an amplitude of 1 volt and a spacing pulse with an amplitude of 0.25 volts, the receiver can discriminate without error only if the instantaneous noise is less than 0.375 volts if the slicing level is set at the intermediate point. In this case, a signal-to-noise ratio of 8.8 db is required, and this is about 3 db more than would be necessary for

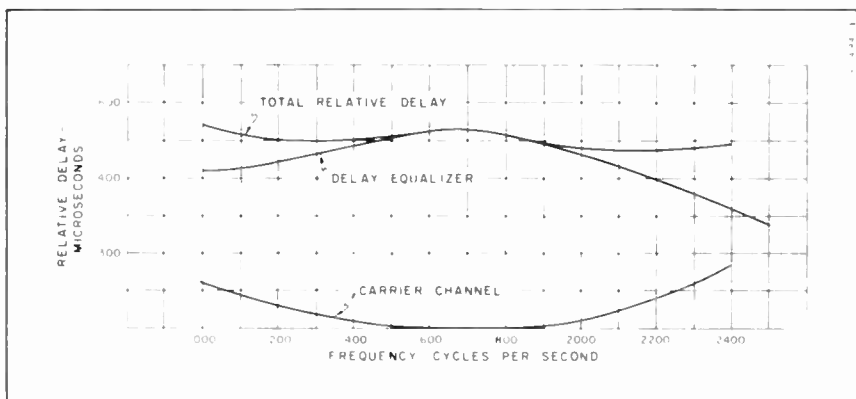
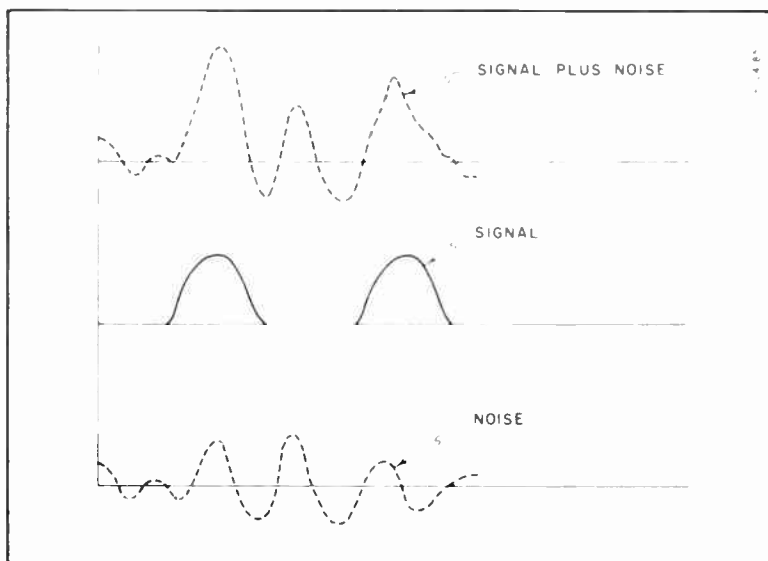


Figure 3. The relative delay characteristics of a typical carrier telephone channel and the effect of delay equalization across the useful portion of the band are shown. Although equalizing increases the total delay, relative delay is reduced considerably.

Figure 4. The effect of noise on a signal is shown graphically. If the noise in a system were as high as illustrated in the figure, errors would result. Usually, the noise adds much less to the signal during a high percentage of the time.



a comparable double sideband system.

For the SAGE system, three different signal amplitudes are used. A starting pulse, spacing pulse and a marking pulse with respective relative amplitudes of 1, 0.625 and 0.25.

In order for the receiver to distinguish between the starting pulse and the spacing pulse without error the instantaneous noise must be less than  $(1-0.625)/2=0.1875$  volts, or about 15 db below the starting pulse. This relationship also applies to the spacing and marking levels. The signal-to-noise ratio is about 9 db greater than that required for the two-level systems and repre-

sents the penalty paid for a three-level vestigial sideband system.

### Conclusion

Vestigial sideband systems may be effectively used in high-speed data transmission, and from a theoretical standpoint the bandwidth of a channel is efficiently used by this technique. However, the sensitivity to level changes, noise and envelope delay makes such systems less "rugged" than some of the other types. For this reason, penalties in the form of signal-to-noise ratio are imposed.

## Scientists to bridge theory/practice gap

One of Canada's industrial research laboratories is launching a program aimed at bridging the gap between scientific theory and actual engineering practice in the design of complex electronic systems.

Dr. J. Rennie Whitehead, Director of Research for RCA Victor Company, Ltd., says the project represents a major new undertaking for his company's fast-growing basic research laboratories in Montreal.

He expects to add several senior scientists, most of them mathematicians and physicists, to carry out the program which he calls "systems analysis." Their work will be directed toward the development of optimum designs of systems in such fields as radio communication, radar, and automatic control.

"Man's advanced theory generally gets a long way ahead of his engineering practice in fields like this one," Dr. Whitehead explains. "Often there may be a gap of five or ten years, or even more.

"By optimum I mean the design that does the job most efficiently at the cheapest possible cost. Surprising as it may seem, a good deal of this can be done mathematically. Nevertheless an experimental program will go along with the theoretical one, for three main reasons. The first is that the theoreticians must work with facts and some of these have to be determined by experiment. Secondly, some problems too difficult or lengthy for mathematical treatment are better solved by simulating the problem experimentally. Thirdly,

new techniques and devices to include in the system must be developed and proved.

"This type of work," Dr. Whitehead continues, "is becoming more and more necessary in our present age, as our technical equipments become more and more complex and expensive. The sophisticated systems which will be needed to meet our defense requirements in the next few years are becoming too enormously expensive to be developed by methods of trial and error, and too radical to be developed by simple evolution from systems now working."

The job of the systems analyst is to bridge the gap between the mathematician and the engineer.

Looking for long-term results in the form of better communication and radar links at lower cost, the RCA Victor research head says he expects to add four or five systems analysts of broad experience within the next year to staff the new Theoretical Group, in the Laboratories' Electronics Division.

Other divisions are concerned with research on microwaves, transistors, and semi-conductor physics. They absorb the energies of no less than 15 professional scientists, mostly physicists, and of a large supporting staff.

All told, eight separate projects are underway in the laboratories at the present time. They include research on transistors of a type matched by few other labs in Canada.



*The Double Cardioid Stereophonic Microphone. The unit is 10½ inches long by 1½ inches maximum diameter.*

# A double cardioid stereophonic microphone

Stereophonic quality is dependent on many conditions among which is the choice of microphone and its set up.

by A. Jamroz, P.Eng. and G. B. Thompson, P.Eng.\*

During the past year, we have all been exposed to a tremendous amount of literature on the subject of Stereophonic Sound Reproduction. A great deal of this literature has been originated by advertising agencies and contains statements such as "most thrilling", "samples the excitement" and other high-sounding superlatives which appeal to emotion rather than to reason. This, of course, is understandable, since advertising is primarily designed to sell, rather than inform and, in the words of one of the best known of American salesmen, "The pocketbook is closer to the heart than it is to the head".

Unfortunately, some of this selling philosophy has crept into much of the technical literature. Due to the pressure of economic factors, a disproportionate amount of technical work has gone into the playback end of Stereo systems. There is a definite lack of attention being paid to that portion of the system preceding the magnetic recording head or the record cutting head. The feeling seems to be that somehow, someone will provide two signals; one marked "Left", the other marked "Right". From then on, all that is necessary is to process these signals without distortion and feed them into suitably placed loudspeakers varying in number from two to six or even more. Then, the advertising people take over and invite us to be transported on a magic carpet into the music hall and "sample the excitement of stereo".

All too frequently, the sample has been unimpressive, despite the fact that the original electrical signal marked "Left" and "Right" was carefully recorded and further processed with very little alteration. In many of these cases, the problem can be traced to this original signal. It simply did not contain the necessary information to produce the desired effect.

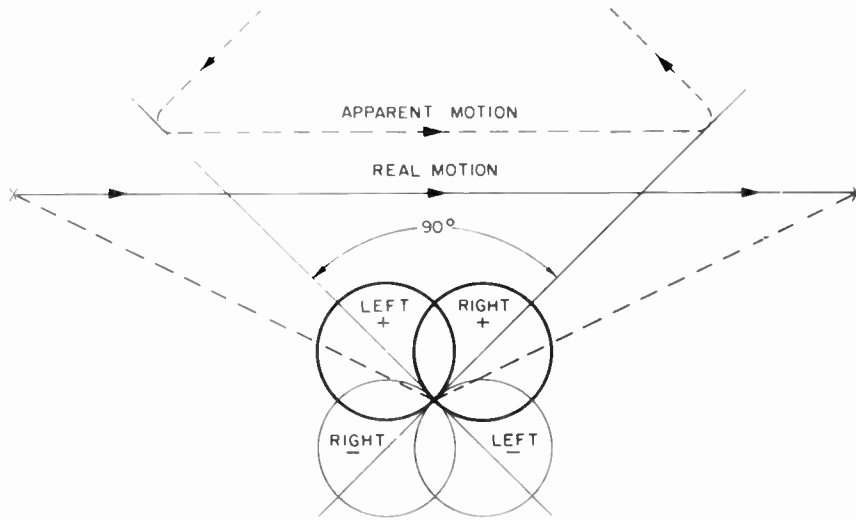


Much of the true stereophonic effect depends on the microphone choice, and the set up. This is a true statement, and there is no argument here. A second statement that is equally true is that these stereophonic recordings, etc. will be heard by means of reproducers having a high degree of mutual interaction or crosstalk before they reach their intended ears, e.g. two loudspeakers as against a set of headphones. Since this last fact is determined by the consumer, engineers can only improve the system by adapting the microphone choice and placement to best suit the actual listening conditions.

Audio recording as practised today, is still in the category of an art rather than a science. Part of this stems from problems introduced by monophonic recording. When a spatially distributed orchestra is compressed to a point, the resultant sound simply cannot be like the original. Much of the effect achieved by a conductor in a concert hall would be lost if the signal was recorded by a single microphone without modification. By the use of multiple microphone pickup, the musical director can approach the desired effect. Since the object of Stereo is to reproduce the spatial characteristics of the original sound, multiple microphone pickup is neither necessary, nor desirable.

If an infinite number of microphones is placed in a vertical plane in front of an orchestra and their undistorted output is subsequently fed to an infinite number of loudspeakers similarly placed, the sound waveform will be reproduced unaltered. If the quantity of microphones and speakers is reduced to some large but finite number, the waveform will still be very closely approximated. If this process is carried to two micro-

\* Mr. A. Jamroz and Mr. G. B. Thompson are employed in the Engineering Department of the Northern Electric Company Limited, Belleville, Ontario.



CHARACTERISTICS OF CROSSED RIBBON MICROPHONES

FIG. 1

phones and two loudspeakers it begins to show definite signs of weakness. Monophonic reproduction has often been referred to as listening through an open window. Stereophonic reproduction, using the space microphone technique, simply provides a second, separate window.

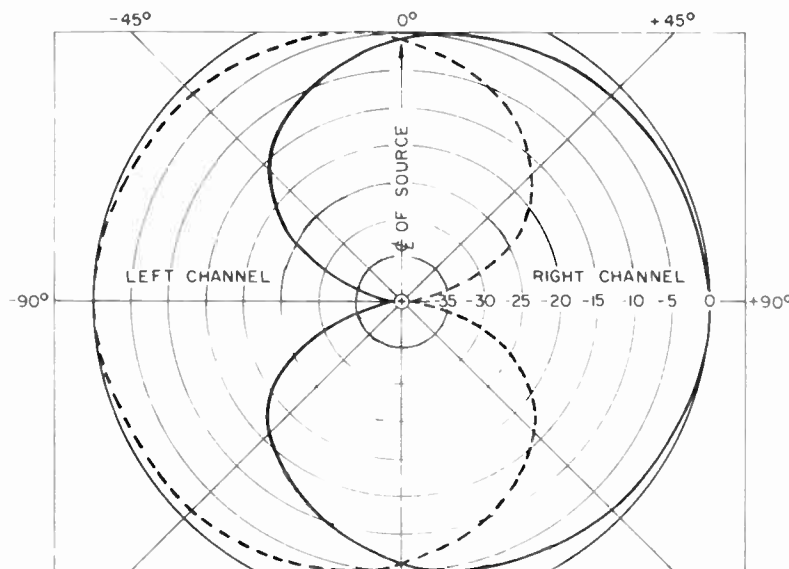
One of the reasons for this is the irrefutable inverse square law. Sound sources immediately in front of the two microphones produce greater output than those farther away. Consequently, the middle is weak and focusing effect takes place which seems to concentrate the sound at the locations of the two speakers. Attempts to improve the middle by providing additional loudspeakers or additional microphones reduce the stereo effect by decreasing the difference between the left and

right channel. In addition, the system becomes frequency sensitive because of interference effects.

This phenomenon is most pronounced when an attempt is made to reproduce the sound of an object moving parallel to the vertical plane of the two microphones. The sound appears to approach the listener, recede, approach and recede again. Vakhitov and Man'kovskii refer to this as the "withdrawal" effect. Their criterion for avoiding this effect is that the emf's produced by the two microphones must have the following relationship when the sound source is located between them:

$$e_1^2 + e_2^2 = e_0^2$$

where  $e_0$  is a constant emf.



DYNAMIC:  $C = S = L + R$   
 RIBBON:  $D = L - R$   
 LEFT:  $S + D$   
 RIGHT:  $S - D$

DIRECTIONAL CHARACTERISTICS OF DOUBLE CARDIOD MICROPHONE  
 (AFTER MATRIXING)

FIG. 2



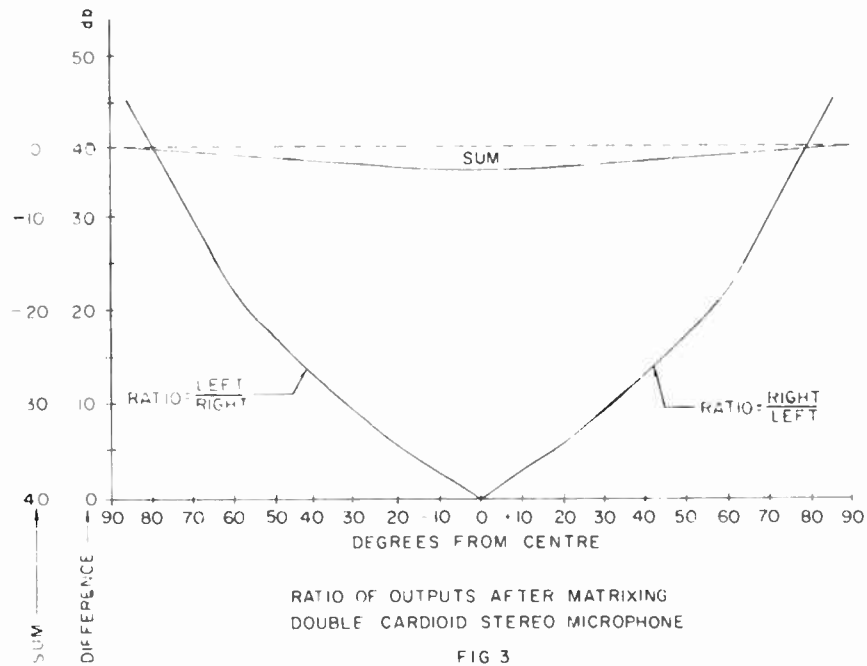


FIG 3

Under these conditions the sum of the intensities produced by the two loudspeakers of a two channel Stereo system is a constant.

### Two ribbon microphones

Recent European literature has placed a great deal of emphasis on the use of one or two microphones occupying the same position in the horizontal plane. Clark, Dutton, and Vanderlyn describe a method using two ribbon microphones with the planes of their ribbons perpendicular to each other. This technique represents a great step forward, eliminating many of the undesirable qualities of the spaced microphone method. However, its narrow working angle (approximately 90 degrees) makes it more suitable for recording small groups rather than large orchestras.

Another disconcerting feature is that a sound source moving across the front from left to right, encounters the back response lobe of the right hand microphone, along with the front lobe of the left, then successively the front lobes of the left and right microphones, and finally the back lobe of the left microphone. This makes the reproduced sound appear to have the path indicated in Figure 1.

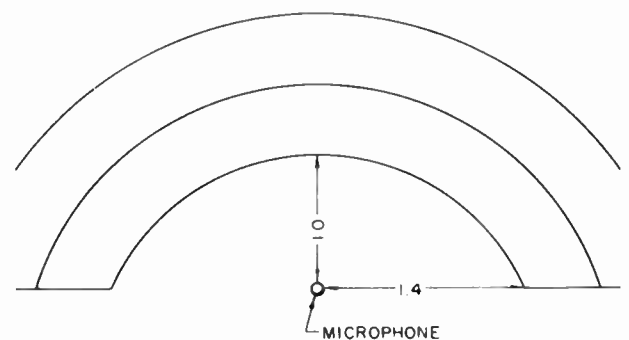
With a single microphone, the polar pattern and actual direction of the sound source cannot effect a change of apparent location of the image in the final rendition. A classic example of this problem is the Stereophonic sound system that was set up in the Canadian National Exhibition Band Shell some years ago. Here it was found that trumpet players sitting on the left side were in such a position that they actually produced more out of the right microphone than the closer left one, due to the fact that the players were facing the right microphone, and the polar pattern of the instrument was such that the closer left microphone was the weaker of the two. Now, a fifteen degree rotation of the trumpet player effectively moved him from the right side to the left, according to the sounds reproduced by the loudspeakers. This trouble could have been lessened by the use of highly directional microphones, but this directivity pattern must be a changing one, preferably under the control of an

operator. Ref. Vakhitov and Man'kovskii.

Ideally, the single microphone should be also a single acoustic element. This approach has not been solved as yet, but there are at least two designs of stereo microphones completed at this time; the Neuman Condenser microphone and the new Northern Electric Double Cardioid.

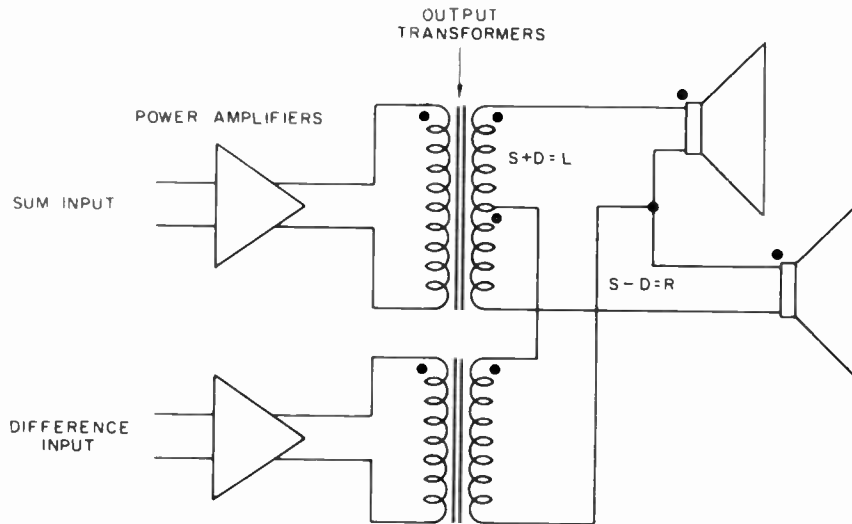
In considering the requirements for a single stereophonic microphone, it is necessary to examine the uses to which the unit will be placed. From this, decisions as to the angle of effective pickup, front to back ratio, etc., can best be weighed and considered in their true light.

In the Double Cardioid microphone a ribbon unit is mounted immediately above a dynamic unit. The ribbon is oriented that its plane contains the center line of the program source. The response of the dynamic unit is non-directional. Its output will clearly be the sum of the signals from the left, plus those from the right. The ribbon unit has a cosine directional characteristic. If signals arriving from the right have a



POSSIBLE ORCHESTRA PLACEMENT  
FOR CONSTANT SUM OUTPUT  
DOUBLE CARDIOID MICROPHONE

FIG. 4



METHOD OF MATRIXING SUM & DIFFERENCE  
TO OBTAIN LEFT & RIGHT

FIG. 5

positive output, those from the left will have a negative output. The ribbon output will then represent the difference between the left and right sides. The outputs of the two units are brought out separately as a sum and difference signal.

These outputs are subsequently passed through a matrixing network, or hybrid, which adds and subtracts the dynamic and ribbon outputs. This results in the double cardioid directional characteristic shown in Figure 2. These patterns provide a working angle of 180 degrees, ample to allow a full orchestra to be accommodated without undue crowding, and still have the microphone close enough to provide good control of the reverberation.

Since both microphone units are essentially at the same point in a horizontal plane, a signal originating from different directions will produce an output which will be constant in phase, in both channels, but will vary in amplitude proportionally to its direction. The stereophonic effect depends on an amplitude difference being supplied to each of the two loudspeakers. Clark, Dutton and Vanderlyn provide an excellent mathematical explanation of this phenomenon.

Figure 3 illustrates the difference in amplitude between the signals supplied to each loudspeaker for various positions of the sound source, relative to the center. It can be seen that at the center, the difference is zero and both loudspeakers are fed the same amplitude of signal. At 90 degrees off center one channel receives its maximum amplitude, while the other receives no signal.

Figure 3 also shows the incoherent sum of the left, plus right signal, or

$$e^2 \text{ equals } e^2 \text{ plus } e^2$$

$$0 \quad 1 \quad 2$$

It can be seen that this sum fulfils Vakhitov and Man'kovskii's condition within plus and minus 1.5 db. This difference becomes zero for coherent signals and has been found to be insignificant for incoherent addition. However, it may be desirable to take advantage

of this 3 db difference at the center to arrange the orchestra as shown in Figure 4.

Incoherent, or power, addition has been used because this system of Stereo does not require the listener to sit exactly on the center line between the two loudspeakers. As shown by Clark, Dutton and Vanderlyn, the stereo effect is maintained for positions which are a considerable distance off the center line.

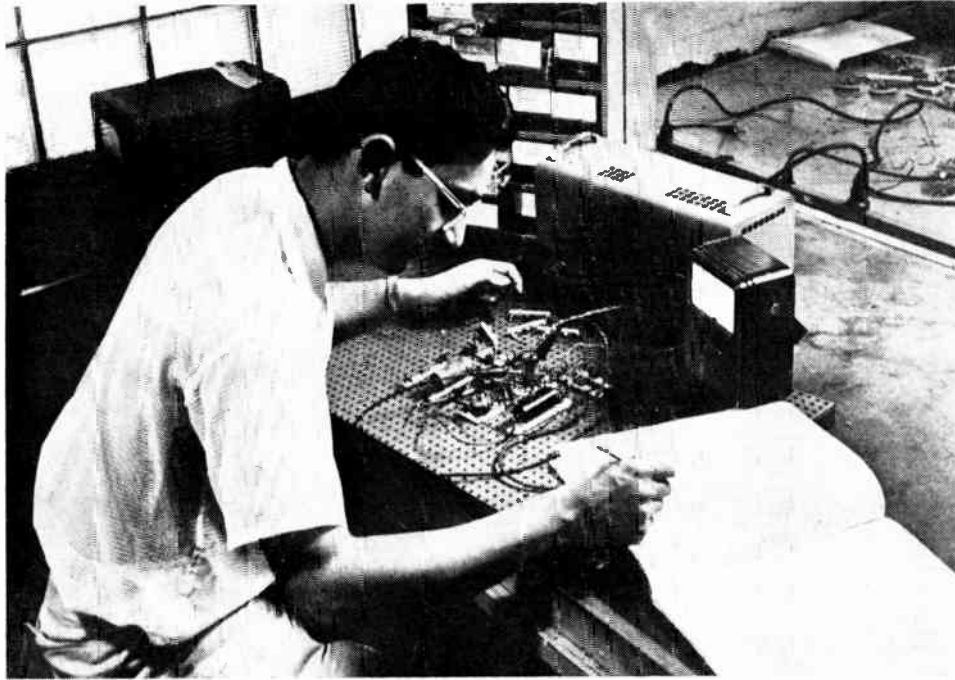
This summer, the unit was tried at the CNE Bandshell, and it overcame the 'Crossed up Trumpet Player Effect' very well. In this instance the working angle was slightly greater than 180 degrees, and the wide angle proved very useful.

A word should be said regarding the method of processing the stereo signals. There are two possible ways of handling these signals; one is to process them as a left and right channel, the other is to maintain them as a sum and difference channel and do the necessary matrixing to convert to left and right at the output of the power amplifier feeding the loudspeakers.

There is a great deal to recommend the latter method. If the signals are processed as a left and right, the equipment used in each channel must be identical, since differences introduced into one of the two signals will tend to reduce the stereo effect. It is extremely important that no extra phase reversal take place in either channel. This latter condition is particularly difficult to meet since the original signals may go through many amplifiers and transformers before they reach the loudspeakers. In addition, the left and right signals are such that neither one can provide a complete program source. This makes the signal difficult to broadcast, since it is incompatible with monophonic systems.

On the other hand the sum and difference signals do not impose any of these restrictions. Since both the sum and the difference signals will appear in each of the loudspeakers, variations in distortion or frequency response will contribute equally to both channels. A phase reversal between the two channels will simply

*Please turn to page 55*



*Research engineer in first stages of designing special receiver circuits. Preliminary design formulated in his engineering notebook, the circuit is built up step by step. Testing and modification are readily accomplished in this initial design phase with the new system of breadboarding.*

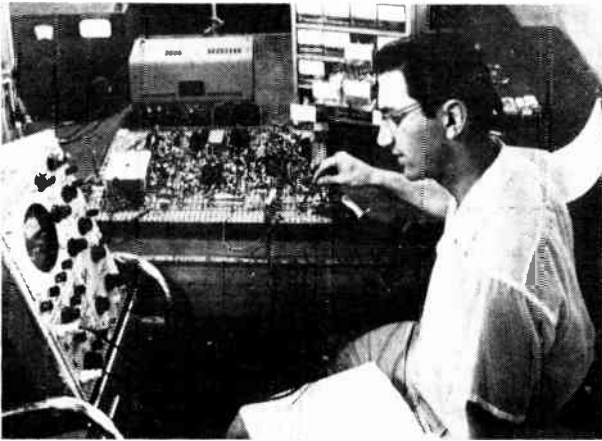
## **Designing for the optimum in electronic circuitry**

*A technique to aid  
researchers and development  
engineers in the production  
of original circuitry and  
a tool of no small  
importance in the field of  
engineering education.*

One of the greatest costs inherent in the end products of the electronics industry is the cost of labor and a large percentage of this cost is eaten up in professional engineering manhours required for the design of new products. It is natural, therefore, in view of the rate of progress of the electronic art and the increasing complexity of circuitry that some means of reducing the end cost of products should be devised and the simplicity of the manner in which this problem has been overcome is more than a little surprising.

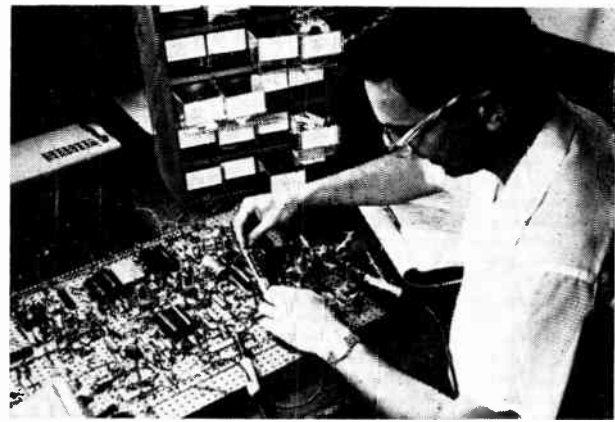
In the past it has been necessary in the course of circuit design to adopt the hit and miss method of drawing out a design, mathematically calculating, as far as this was possible, the optimum type of component and fitting it into the overall design. Next followed the laborious and time-consuming chore of constructing a prototype with its dozens of soldered connections and screwed-in-place components. The frustrating aspect of this method of designing, however, was the ever present thought in the back of the engineer's mind that there could well be a half dozen other circuits that would have achieved greater efficiency. To search for the optimum design, however, by this method of development would require the dismantling of the original prototype or the use of further costly components, material and manhours for the construction of modified versions.





*The circuit as first built up, under test. Metal shield can cover the coil in the multiplier circuit because of high Q required.*

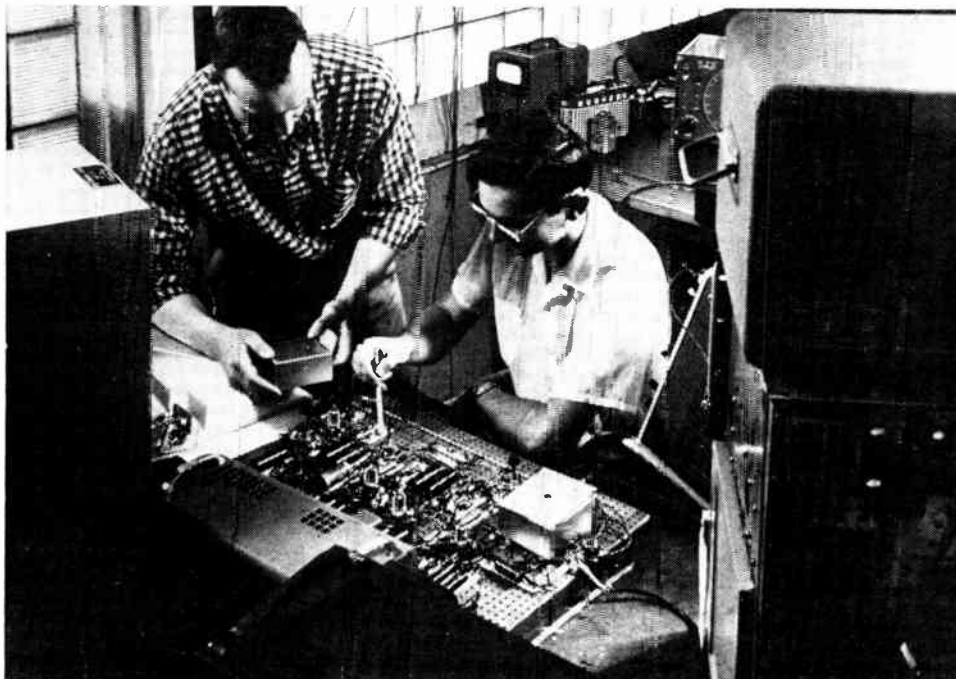
Now, however, it is possible for engineers to optimize their original design by testing and modification on the prototype mock-up by the use of a new breadboarding system known as Erec-Tronic. This optimization is made possible by the simple substitution of component values and layout alterations, which may be accomplished without the necessity of making and re-making soldered connections which hitherto was necessary. The system now being increasingly used by industry, research organizations and universities for the development of circuitry is the essence of simplicity. It consists of four types of parts: the perforated mounting board, mounted components, blank bases and jiffy connectors. The mounting boards are specially designed peg boards with 3/16 inch precision holes drilled on 1/2 inch centers. The boards are of many different sizes and are either shielded or unshielded and are constructed of duron which permits the quick and simple replace-



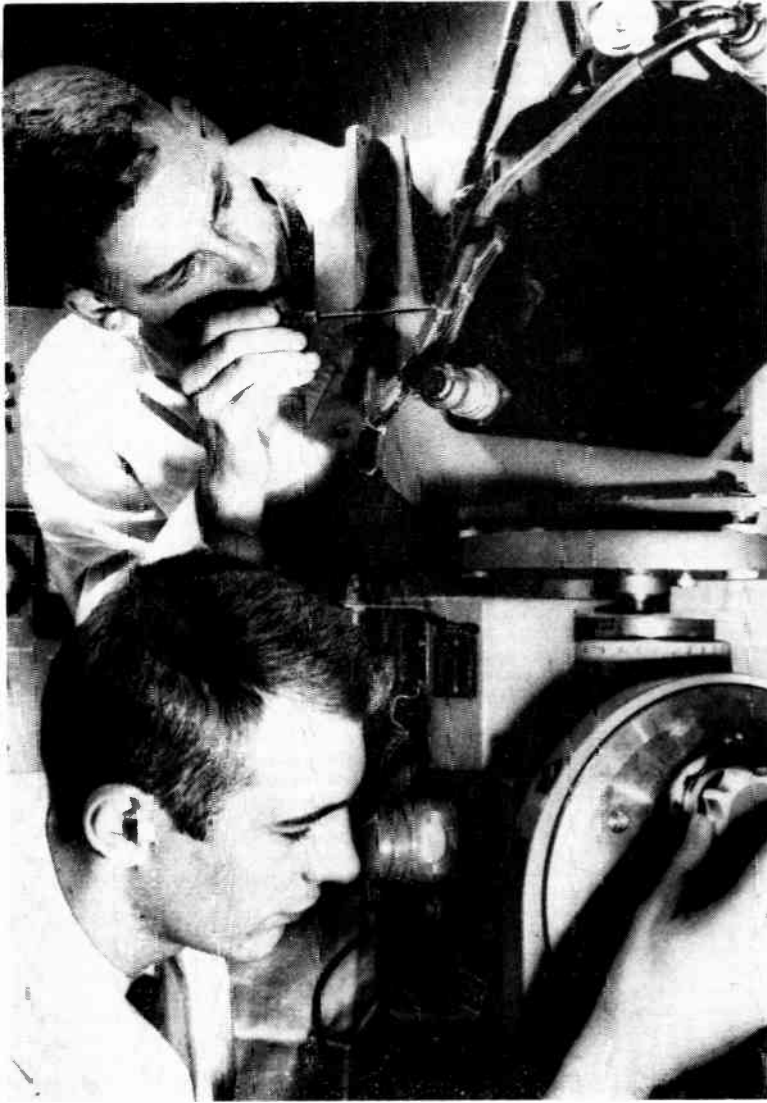
*The circuit is being optimized through quick and simple substitution of values and layout changes. Now in advanced design stage. Note ground bus on front edge of board which grounds on plane built into base.*

ment of mounted components. The components used in the system are normal electronic components which have been permanently mounted on special plastic bases molded from high impact polystyrene. The bases have been fitted with upright terminal posts to which the electronic components have been electrically soldered. The mounting components of this new breadboarding system have been designed in such a manner that they can be plugged into the mounting board in any desired position. Manufacturers of this new system have incorporated a wide diversity of commonly used components to assure that the system's versatility can meet any circuit design problem.

Tests with this new engineering and research tool to ascertain its dollar and time-saving potentialities have shown that in the matter of man-hours it is capable of reducing engineering development time by as much as 96 per cent.



*Design engineer discussing layout of final breadboard in a metal chassis. Up to this point, all metal chassis shop work and technician soldering have been by-passed; the circuit is ready for final chassis design. Circuit performs as well as if soldered, and many hours have been saved.*



*“Brain testers” make final adjustments to guidance reference system for Vanguard rockets used in attempts to launch man-made earth satellite. These gyro system evaluation engineers use maze of costly and complicated electronic equipment to prepare system for its task of guiding huge 72-foot Vanguard rocket through arching path into an orbit so satellite can be launched successfully.*

**It takes more than a rudder to place a satellite in orbit as evidenced by the ten millionth of an inch tolerance which cannot be exceeded in the bearings of the satellite launcher’s controlling gyros.**

## **Hermetic integrating gyros place satellites in orbit**

Guiding the huge Vanguard rockets during 1958 through their arching path to a satellite-launching orbit will be a special guidance “brain”. The major “thinking” part of the electro-mechanical brain — the gyroscopic guidance reference system — was developed and manufactured by Minneapolis-Honeywell Regulator Company.

The Martin Co., Baltimore, is the prime contractor for the Vanguard satellite-launching vehicle.

Honeywell has delivered a dozen guidance reference systems to Martin, some for rocket test firings and the majority for actual satellite launchings. Honeywell’s

basketball-sized Vanguard gyro reference system is produced by the firm’s Aeronautical Division plant in Minneapolis.

Vanguard satellite-launching vehicles, which were developed under management of the Office of Naval Research, will be fired during the 1957-58 International Geophysical Year as part of this nation’s participation in the world-wide effort to learn more about the earth and its surroundings. Each rocket is assembled by mounting three rockets of varying sizes one on the other to form one slender, bullet-shaped vehicle about 72 feet in length.

Each three-stage rocket vehicle will attempt to place a scientific earth-satellite in an orbit circling the earth at a distance ranging from several hundred to perhaps 1,500 miles from earth. The satellites will contain scientific fact-finding instruments and radio equipment to transmit their information back to earth. Scientists estimate the satellites' life in upper atmosphere might last a week or as long as a month, and several predict even a year's life.

Unlike electronic "brain" systems that require radio or radar tracking so that commands can be issued to a vehicle's flight control system, the Honeywell gyro reference system is entirely rocket-borne. Its job is two-fold: (1) Tell the vehicle autopilot that the finless rocket has swerved off course because of sloshing fuel, air currents or other forces; and (2) At the command of a vehicle-borne timer to gradually "tip" the rocket's trajectory so that the satellite-launching vehicle enters a globe-circling course some 300 miles above earth.

Heart of the gyro reference system are three highly-accurate gyroscopes that will be calibrated to a "memorized" heading reference in the three axis or directions of flight — one gyro each for roll, pitch and yaw. These instruments are electronic versions of a centuries-old toy. Known as HIG (hermetic integrating gyros), they have nearly 300 parts — contrasted to 127 parts in an ordinary watch — and require bearings alike to within 10 millionths of an inch. (If you took a human hair and split it into 400 parts, one part would be 10 millionths of an inch wide.)

Since a speck of dust and lint would have the same effect on the gyro as a handful of gravel in an auto transmission, they are assembled in hospital-clean areas. Employees of Honeywell's Aeronautical Division enter the gyro assembly rooms through air locks, passing over gelatin mats to clean their shoes. They all wear nylon smocks and hats; are not permitted to smoke, can't wear nail polish or carry a purse.

A HIG weighs about 4.6 pounds and fits compactly into a cylinder 5.9 inches long and 3.07 inches in diameter. Performance-wise, it can measure the rate at which a glacier melts, or motion 3,000 times slower than the hour hand on a watch. Its response is so fast that the minute movements of a second hand are snail-like by comparison.

Many of the special sensitivity features of a HIG are due to its virtually frictionless operation, created by mounting the gyro rotor assembly and gimbal in a special fluid. If a boy with a sled could slide down a one-foot slope with the same frictionless ease with which the HIG operates, he could glide for some 1,000 miles before coming to a stop.

The HIG gyros have two special properties that make them useful as a guidance brain:

**Stubbornness:** When the 400-cycle operating power is switched on and as the gyro rotor comes up to operating speed (12,000 r.p.m.), it develops a type of inertia. With this property it resists efforts to change the axis rotation directions. Efforts of the gyro to resist changes can be measured. Engineers say that good gyros, because of this characteristic of resisting change, possess a "memory".

**Predictability:** A gyro is predictable because of the action the rotor takes when force is exerted on it. This action is called "precession". If the rotor were not spinning when it was pushed, it would simply fall over. However, if the rotor was spinning, it would precess at right angles to the direction of and in an amount proportional to the amount of the push.

The principal parts of a HIG-6 include a gyro wheel (or rotor), a gimbal surrounding and supporting the wheel, a signal pickoff and a torque generator.

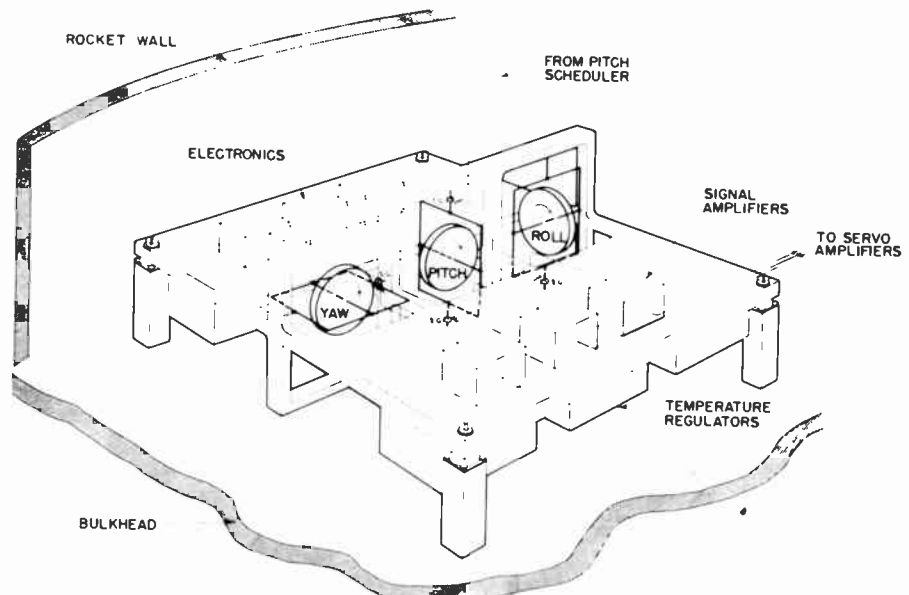
The gyro wheels look like four or five quarters glued together. They're polished smooth to a millionth of an inch. The wheel is mounted inside the gimbal. The gimbal, in turn, is "floated" in a syrupy fluid in the middle position of the gyro container and supported at either end by miniature jewel bearings. The signal pickoff and torque generator units are at the ends of the gyro case.

### The floating gyro

"Floating" a gyro was first achieved successfully at the Massachusetts Institute of Technology under the direction of Dr. C. S. Draper and then developed into a production instrument by Honeywell's 6,000-employee Aeronautical Division plant in Minneapolis. Honeywell has produced more than 20,000 HIGs for various applications.

In non-floated gyros the gimbal bearings must be

*Functional diagram of three-axis guidance reference system for satellite-launching Vanguard rocket shows placement of three HIG-6 gyros on platform in second stage of the three-stage rocket. Each gyro will have its temperature regulator, amplifiers and other electronic equipment. A scheduling device working through the rocket gyro will guide the rocket through its arching path.*





large enough to support the gimbal's weight, and consequently more friction is introduced. By floating the gimbal — thereby counterbalancing its weight — the gimbal bearings can be small and light enough to act only as guides. Even though the gimbal weighs nearly one pound, it is guided by jeweled bearings similar to those used on balance staffs of fine watches. This floating method results in nearly frictionless operation, which is vital for the gyro's ultra-accurate "sensing" of movement.

Damping characteristics of the fluid result in a gimbal deflection rate proportional to the rate of rotation of the gyro case. This characteristic, applied to the Vanguard system, would work like this:

If the rocket rotates incorrectly — because of shifting fuel supply, engine irregularity, cross winds, etc. — about any of the three axis "memorized" by the three gyros (roll, pitch and yaw) even an infinitesimal part of a degree, the gyro motors will respond by rotating the gimbal on its jeweled bearings. This movement is sensed by the gyro signal pickoff and sent out as an electrical signal from the gyro through the autopilot amplifier to the error-correcting servo system. Vickers Electric of St. Louis and Martin's Baltimore plant are manufacturing the magnetic amplifier and electronic-amplifier autopilot versions, respectively.

The HIG-6 gyro used in the Vanguard vehicle application is custom-designed for the system, because — unlike true inertial-type guidance systems — the Vanguard system is "strapped down" to the rocket. Because of this, the HIG-6 would feel the slightest off-course motions of the rocket and be constantly telling the autopilot to correct the rocket's flight.

Because the HIG-6 was too sensitive for the application — like an automobile steering wheel with insufficient "play" — engineers cut the size of the gyro wheel. Consequently, the angular momentum of the wheel was cut. Reducing the weight of the wheel reduces the total weight of the gyro gimbal containing the wheel. Therefore, an equal amount of weight was added to the gimbal so that it would retain the same "floating" properties in the viscous fluid surrounding the gimbal. The gimbal must be neutrally floated in the syrupy fluid to attain the virtually frictionless operation of the HIG.

The fluid also restrains spurious movement of the gimbal for two other reasons: To further reduce non-

linearities; and, to prevent over-stretching of the flex leads carrying operating current to the gyro mechanism.

Temperature controllers for the Vanguard system will be used to keep the gyros at operating temperature through the heaters built in the HIG-6 gyros. The controllers are all-transistor amplifiers built around a half-dozen Honeywell H-6 power transistors, which are used for both power and switching functions because their voltage loss is extremely low. There are no relay contacts in the system, thereby avoiding shock and vibration problems.

At the launching site, a gyro calibrating system for correcting the gyro reference system "memories" for last-minute rocket alignment errors after the rocket is placed on the launching platform is provided.

### Like balancing baseball bat

Line of thrust is controlled by rocket engines in the first and second stages, being manufactured by General Electric and Aero-Jet General. The thrust chambers at the rear of the engines are mounted on gimbal joints and controlled by actuators of the servo system so they can be moved as the rocket is in flight.

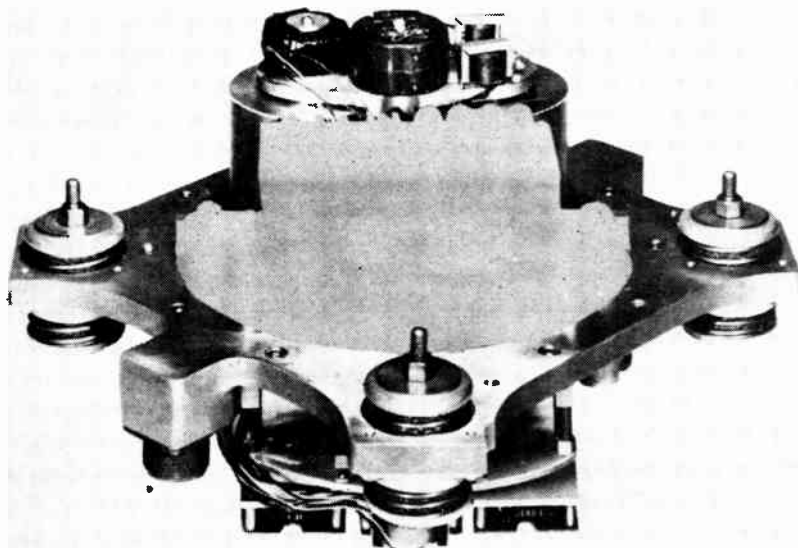
In flight operations, this will mean, for example, if the engine thrust pushes the rear of the rocket to the right a few degrees, the nose of the rocket will swing to the left correspondingly.

A youngster juggling a baseball bat on the tip of his finger illustrates the work of this gyro reference system and the gimballed thrust chambers for Vanguard. The gyros will act just like the juggler's eyesight in assisting his brain in sending signals to the fingertip (or thrust chamber) to counteract the shifting position of the baseball bat (or vehicle heading).

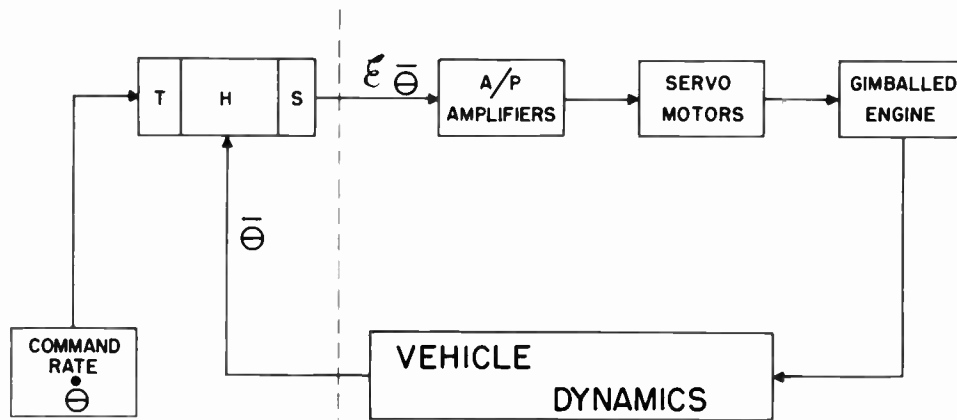
The thrust chambers will change the vehicle heading in pitch and yaw, but it will be necessary to mount off-and-on jets on the sides of Martin's Vanguard to control roll. These auxiliary jets will take their commands from the gyro reference systems.

Besides sensing errors in heading and transmitting corrective signals to the autopilot, Honeywell's system has a third important function: To change the pitch heading of the vehicle. Unless the pitch heading was altered so that the vehicle would slope into an elliptical trajectory around the earth, the Vanguard rocket and satellite might well head straight up toward the moon.

Four factors are important to getting the vehicle



*Guidance reference system for Martin's IGY Vanguard rocket includes three ultra-accurate HIG gyroscopes and a maze of associated electronics (blacked out in photo). Honeywell's electronic "brain" will guide rocket to correct angle and altitude for launching of man-made earth satellite.*



Pitch axis of Vanguard Rocket control system is illustrated in this simplified block diagram. Changes and corrections needed in pitch axis are channeled through the autopilot to the servo system that operates actuators which push and pull on the gimbaled thrust chamber. Resultant changes in Vanguard rocket dynamics are reinterpreted by pitch gyro to complete closed loop system. In the diagram: H stands for angular momentum of gyro wheel, the property that gives the gyro its "memory". T indicates the gyro torquer through which the gyro "memory" is changed. S is the signal pick off. Other figures represent the various angles that must be accounted for in keeping the rocket in the correct pitch heading.  $\Theta$  is the actual pitch angle.  $E \Theta$  is the error in the pitch angle measured by the pitch axis gyro. The error is determined by comparing actual pitch angle  $\Theta$  to the "memorized" pitch angle.  $\Theta$  represents scheduled changes needed in the pitch angle to allow rocket to slope toward an orbit so that satellite might be successfully launched. This constant changing or "brain washing" of the pitch gyro is accomplished by an automatic pitch scheduler which signals changes needed to the gyro torquer in degrees per second.

in the right position in upper atmosphere so that the third stage may be launched and accelerate the satellite into an orbit around the earth: Velocity, heading, trajectory and altitudes. The Honeywell system does not concern itself with velocity. All three gyros control heading. However, one-third of the gyro reference system is specifically concerned with trajectory (or pitch angle) and altitude.

That one-third is the pitch gyro and its supporting electronic equipment.

It is the pitch gyro's job to sense and dictate the arching path for the vehicle. For someone tracing the proposed trajectory, the gradual sloping of the course might begin to appear at several thousand feet altitude.

For an instrument like a gyro to indicate a precise change of altitude seems incongruous when one recalls that gyros are built to resist changes. The answer to that problem is to change the pitch gyro's "memory" so that it will demand changes in the pitch heading. This will be done by a program timer, which will feed a scheduled signal to the pitch gyro's torque generator.

The torque generator — the fourth major component of a floated gyro — is similar in principle to an electromagnet. The program timer will cause a precisely controlled direct current to pass through the

torque generator, which will produce a small torque to rotate the gyro gimbal to a "new" axis.

The program timer is being manufactured by Designers for Industry, Inc., Cleveland, Ohio.

In a sense, the programming process will simulate a continual "brain washing" on the pitch gyro.

The change in the pitch direction will be so controlled that the rocket will make a gradual turn, and by the time it has reached the launching altitude of approximately 300 miles the third-stage rocket will have the right heading so that it can boost the vehicle speed to 18,000 miles an hour along an orbital course before the satellite is separated.

The earth satellite program is a part of the United States' scientific effort for the International Geophysical Year — a program which is sponsored by the US-IGY Committee of the National Academy of Sciences, with the cooperation of the National Science Foundation. Department of Defense participation in the earth satellite program is on a three-service basis, with Navy management under the Chief of Naval Research. The Naval Research Laboratory has the responsibility for overall technical management of Project Vanguard, the name assigned by the Navy to their program to fabricate the satellites, to launch them and to prove them in orbit.

## Radar screen stores image for twenty minutes

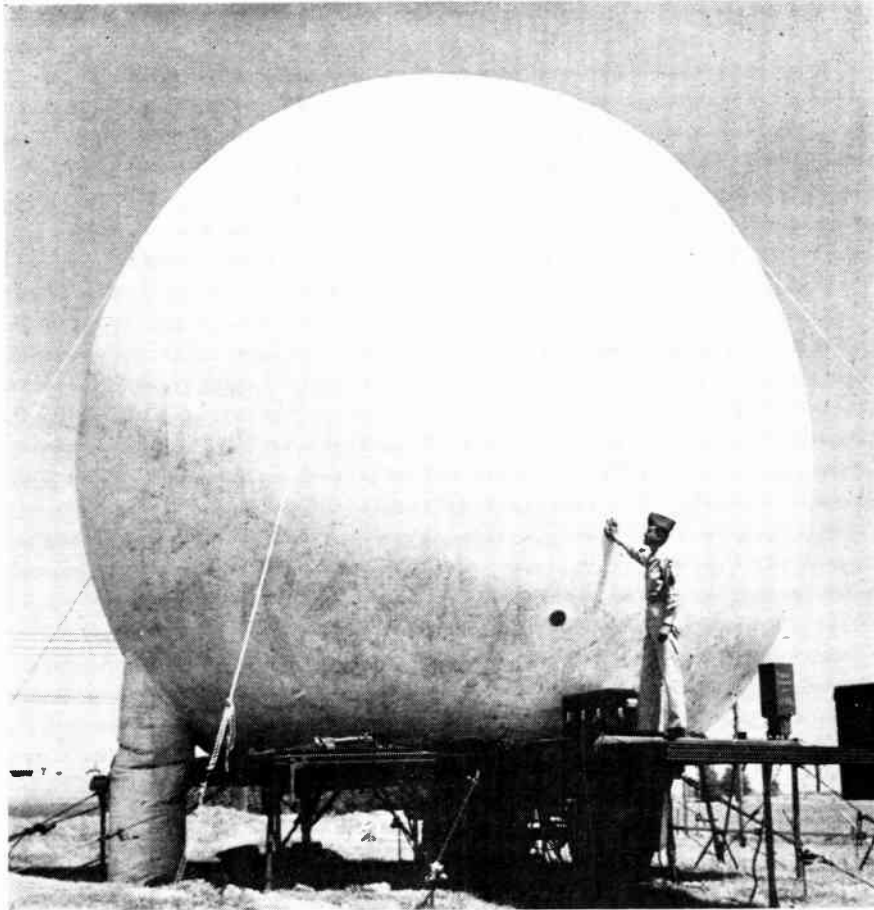
A new British system developed by the Electronics Department of Ferranti has resulted in the production of radar screens which can remember images for periods of up to 20 minutes. Yet, this image is not shown on the actual screen unless a button is pressed, and it will not retain it longer than is desired.

This has been made possible as the result of a type of phosphor compound now produced in Britain.

Previously storing images of radar pictures such as those recording the continuous movement of an

aircraft or a ship had been limited by the two facts that first, the reproduction of such images could not be stored for periods of minutes before they were thrown on the screen for inspection without harming the phosphor dots which carried the picture.

Secondly the afterglow — of the slowly dying illuminated phosphor — remained for a significant period of perhaps a minute or even more after the inspection had been carried out thereby fogging the picture of the immediately succeeding image.



*Plastic balloon, resting on mobile trailer bed like a golf ball on a tee, forms housing for antenna of Frescanar, revolutionary electronic-beam radar system. Antenna operates from within inflated balloon, protected from snow, ice and wind.*

**A new three-dimensional radar which detects airborne targets at extreme range and for the first time simultaneously computes distance, bearing and altitude is considered to be one of the most important advances made in electronic detection since the development of radar.**

## **The AN/MPS-23 frequency scanning radar**

**by Dr. Nicholas A. Begovich\***

In considering the AN/MPS-23 frequency scanning radar, a thought which often comes to my mind is the global race for technological supremacy, which all of us are well aware is occurring today at a very intense level. It reminds us that to retain a position of world leadership in technological and defense capability, it is necessary not only to refine and improve our existing defense concepts and equipments, but to look in new directions for new ideas which will permit us to cope with existing and future weapons in a superior manner.

This was actually the thought Hughes' engineers had in mind at the time that the development of frequency scanning radar was started. It had been decided to take a completely new engineering "look" at radar, with the intention of creating systems which would be superior in performance and ruggedness, in reliability, and in total simplicity of operation. It was also desired to obtain greater ease of maintenance, reduced size and

*Please turn to page 43*

\* Hughes Aircraft Company





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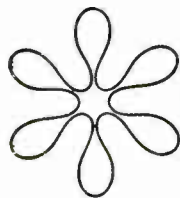
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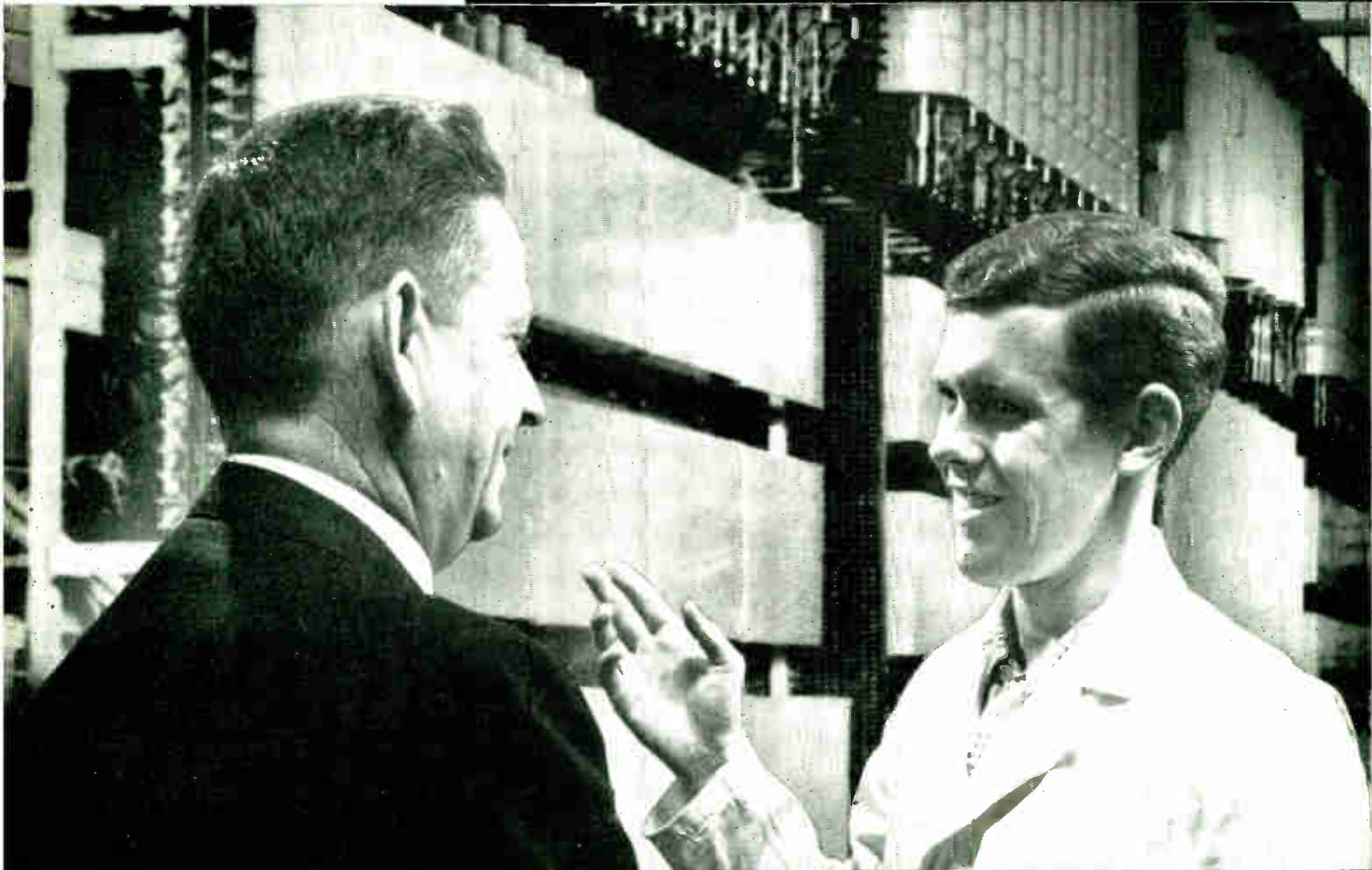


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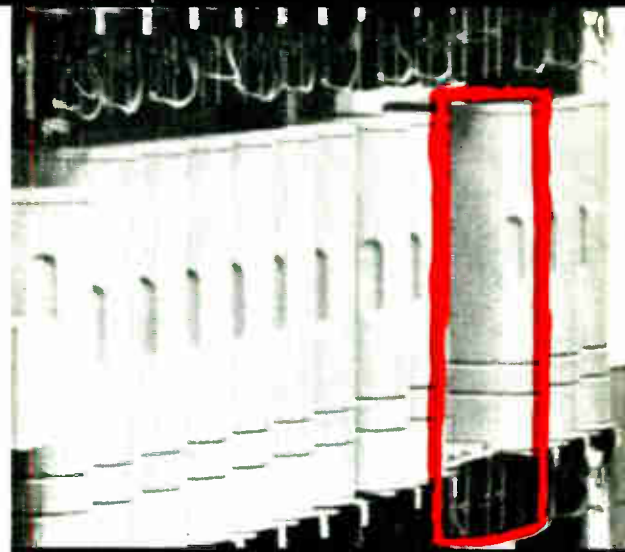
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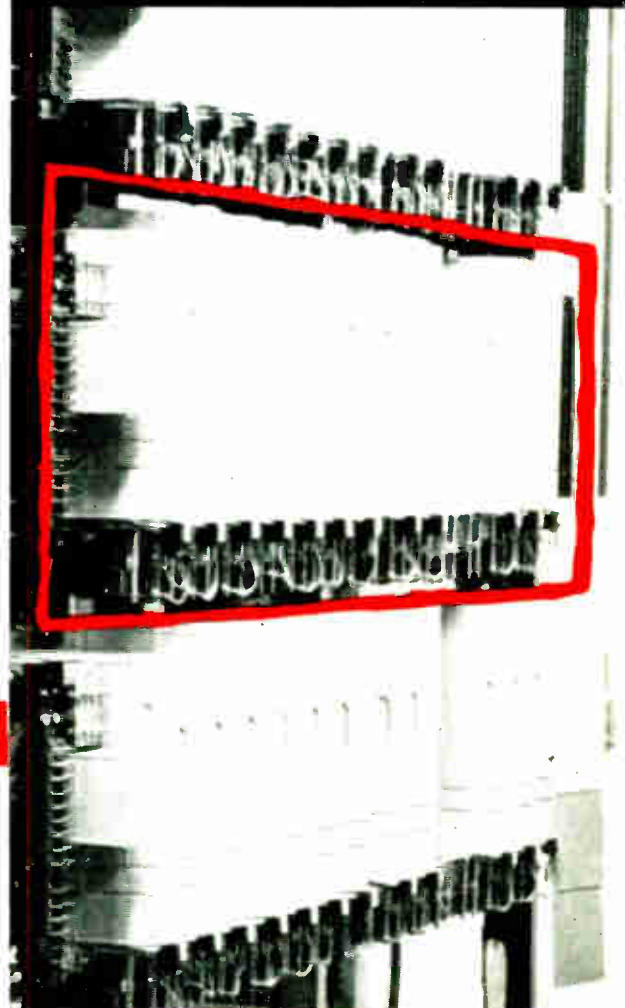
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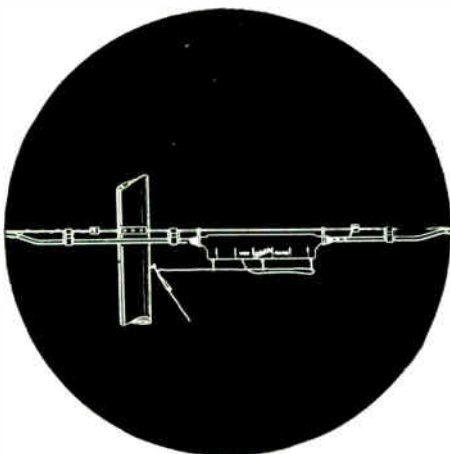


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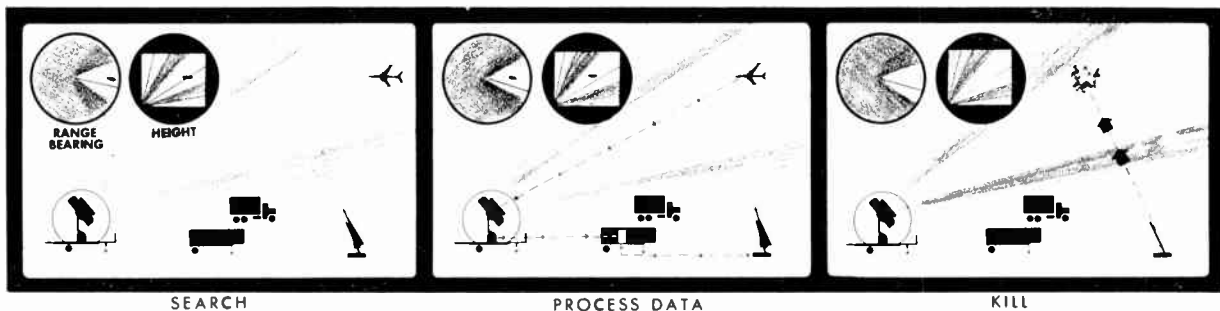
# Frequency scanning radar *Continued from page 38*

weight, increased mobility, and increased speed of operation. On this latter point it was hoped to find ways to increase the rate at which radar surveillance data is obtained not just by a factor of two, or three, but by whole orders of magnitude from those possible with conventional equipments. It was realized that this was absolutely necessary in order to cope with the aircraft and missile velocities, and raid sizes, which exist today, and which will exist tomorrow. It was concluded that what was required to achieve this, was a method for producing motion, or scanning, of the radar beam in space without the necessity to move the antenna physically, as has been the case with every other radar equipment.

In producing a radar beam, radar sets resemble searchlights. To move a searchlight beam up and down, the searchlight must be physically rocked up and down. Rocking the searchlight requires moving a heavy lamp housing, reflector, and light source, which in turn involves a lot of mechanism, gears and levers. It also

involves motors, and a considerable power requirement. But most critical of all, there is an upper limit to how fast the searchlight can be oscillated mechanically without shaking the mechanism apart. This illustrates the limitations of conventional, mechanical scanning radar. What frequency scanning radar does, so to speak, is permit the searchlight mechanism to remain motionless, while flashing the searchlight beam up and down at a very rapid rate.

At the outset of the program to develop a radar which would scan a volume of space electronically, that is, without mechanical motion of the antenna, studies led us to believe that an antenna could be devised whose pointing direction could be made sensitive to the frequency of the electromagnetic energy applied to the antenna. This frequency sensitivity would result in the radar beam being radiated from the antenna at different angles, depending upon the frequency of the energy supplied to the antenna. It will be seen therefore, with this concept, that if we supply a succession



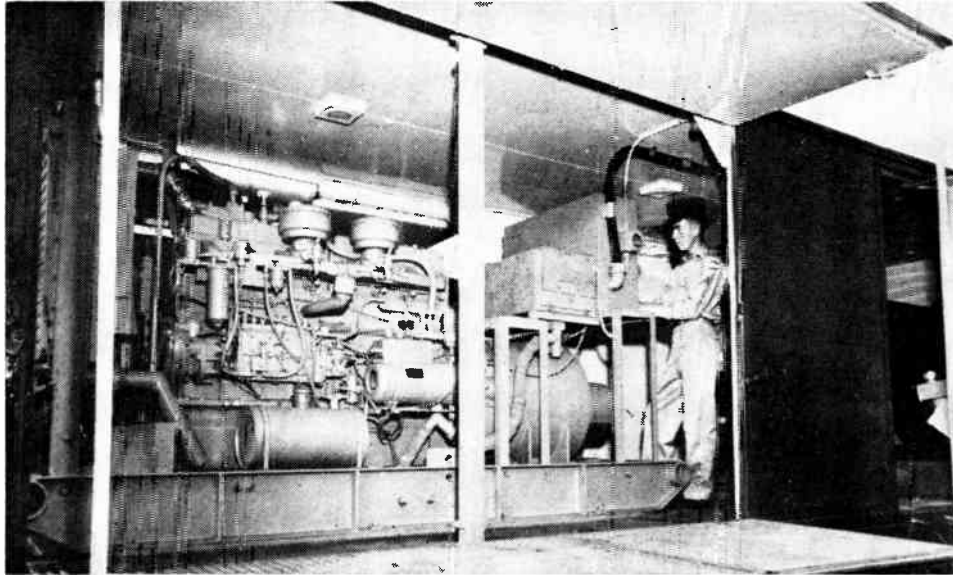
In first panel above pencil-beam antenna is scanning skies at extreme range for possible targets. "Enemy" bomber is detected in second panel and antenna flashes range and bearing for display on monitor scope, altitude on the other. Pertinent information is electronically relayed almost instantaneously to batteries which launch missiles and score "kill" (third panel) while antenna and scopes continue to search and seek other targets.



These two scopes receive target information from radome-encased antenna of Frescanar. Scope on left displays target range and bearing, that on right, altitude. Data is instantaneously transmitted to missile anti-aircraft batteries which automatically track down targets.



Entire console section of new three-dimensional radar slides out on rollers for easy maintenance. Here specialist uses voltmeter to check resistors in electronic circuit. Interior of radar trailer contains dozens of "cards" with printed electrical circuits that can be replaced instantly.



*With its sideflaps peeled back, power truck is ready to operate under field conditions. Under completely mobile system, with single antenna, radar provides simultaneous data on distance, bearing and height of airborne targets, and needs only one equipment van and one power truck in support.*

of frequencies to such a special antenna, we can move the beam through a succession of positions. The frequencies, of course, can be changed at electronic speeds, permitting the radar beam to be moved far more rapidly than possible by physical movement of the antenna. These initial studies by Hughes' scientific staff were followed in 1951 with the construction of a completely successful frequency scanning antenna. This antenna is the heart of the frequency scanning radar set. Once the antenna was developed, extensive research and development had to be performed on the remaining new components required by this new radar technique. The successful completion of these additional components made it possible to construct a complete three-dimension target data radar set, offering high-power hemispherical radar coverage from a single antenna. Such a complete frequency scanning radar was built and extensively tested between 1952 and 1955. One of the first fruits of this electronic scanning radar development, which took almost ten years to complete and whose development was initiated by the Navy, is the AN/MPS-23 frequency scanning radar.

### **To solve defense problems**

The frequency scanning radar was developed to help solve defense problems. During the course of its development, possibilities were seen in its uses beyond even those which had originally been visualized. In connection with the military capability of the United States, our frequency scanning radar for the Army actually adds a new dimension to defense in a number of respects. Basically, with the AN/MPS-23 radar set we are getting more performance with less weight and total equipment and with fewer operators. And we are also getting a very much higher rate of operation, due to the application of the new engineering principle of frequency scanning. In providing range, bearing and height data from a single antenna, transmitter, and receiving channel, frequency scanning radar actually represents a technological breakthrough.

But frequency scanning radars are not only new in principle, and new in the levels of performance that

they achieve, but they are very new in equipment design. It is a well known fact that the design of machines becomes more and more sophisticated each year, in practically every area where they are used. Sometimes this point is made more real by realizing that only a relatively few generations ago the industrial revolution ushered in our first power machines for industry and defense. A point had been reached in the evolution of technology at which machine capability suddenly overtook the manual capability of operators doing equivalent tasks. We have all seen pictures of these early machines: large wheels, pulleys, belts, gears . . . large clumsy machines to do relatively simple functions. Today, the degree of sophistication in the functions performed by machinery is almost incredible. In the AN/MPS-23 radar set for example, the radar beam is being flashed up and down in space at amazing speeds, completely by electronic means, monitoring numerous high-speed aerial targets at all altitudes and ranges. Further, the beams which are emerging from the antenna are programmed by digital means to occupy precisely those successive positions in space which will give the radar set maximum accuracy and coverage. For the number of functions performed, and the flexibility of performance, the weight of equipment is astonishingly small. Not only are all these functions performed compactly and simply in the AN/MPS-23 radar, but the whole radar set has been trailer-mounted to give new dimensions of mobility and flexibility of performance. The radar set can be converted for travel in minutes, and can be moved easily from one location to another to adapt to the changing requirements of a field army tactical situation.

A fourth general way in which AN/MPS-23 frequency scanning radar has added a new dimension to defense appears in the fact that our electronic art, that is the things which we can engineer and make work with today's electronic components and concepts, has been improved. In extending the state of the electronic art, the frequency scanning radar is not only doing things which other equipments have never done before, but it is going to permit new equipments to be built which can do what no equipment today can accomplish.



Equipment designed to meet the rigid specifications of electro-mechanical components for guided missiles is finding a place in nuclear applications where high temperature conditions prevail.

# High-temperature rotating equipment

by C. F. Schunemann\*

In its present rapid growth, the nuclear industry is calling upon the also rapidly advancing technologies of other related and non-related fields. Many nuclear products require significant contributions from the modern technology of servo mechanisms, and the nuclear industry has brought with it many severe requirements resulting from high temperature environments, as well as the specific radiation environments of nucleonics.

In solving these specific problems, maximum results per unit of time and money expended can be gained by adapting to the specific problem specific applicable developments of other fields, or at least by utilizing the directly applicable experience of others in solving similar problems. Frequently a minor change in the specified parameters of the problem will permit an engineering group to simply retrace the steps of previous developments, with change of parameters, yielding the desired hardware at minimum time and cost.

This article presents the results of a high temperature servo motor development of the Electronics Division of Thompson Products. This servo motor was

designed originally as part of the electro-mechanical actuator for operation in ram jet engine fuel at a temperature of 550°F in the fuel tank of the Navaho missile. The basic servo motor was further developed for a 600°F ambient air application.

While these design results may not apply directly to many nuclear applications, many of the design features may be found directly applicable in nuclear high temperature air environments and in other nuclear applications requiring immersion of a servo motor or other electric rotating equipment in liquids of similar properties to the jet fuel used in this program. For those nucleonic programs for which this direct applicability does not exist, the basic development approach is surely applicable, provided full recognition of the environmental parameters is incorporated.

## Servo motor for immersion in fuel

The motor designed for motor operation in ram jet engine fuel in an ambient temperature of 550°F was fabricated of special materials capable of withstanding

\* Mr. C. F. Schunemann is Chief Engineer, Electronics Division, Thompson Products Inc., Cleveland, Ohio.

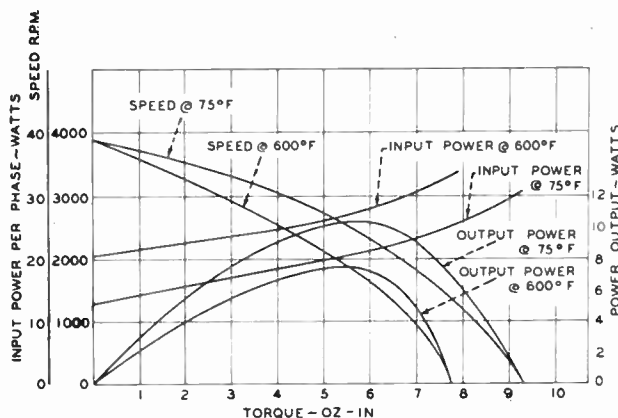


Fig. 1—Motor performance at room ambient and 600F

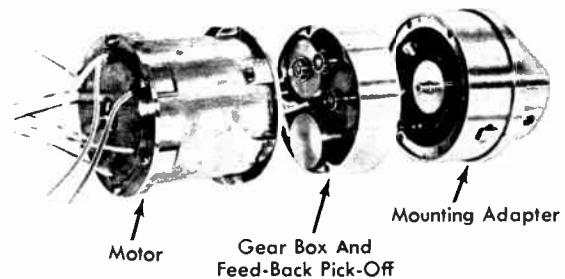


Fig. 2—Two phase servo motor and gear box

the adverse effects of temperature and fuel for the specified 100 hours operating time. Fuel was circulated through the motor to provide cooling, maintaining the winding temperature near the fuel ambient temperature. An investigation was made to determine the insulation materials capable of operation at these temperatures.

The materials considered suitable for testing were silicone, asbestos, Teflon, glass insulations, phenolic resins, and epoxy resins. These materials were tested in fuel at 550°F for 100 hours and withstood the test with the exception of the silicone, which dissolved in the presence of fuel. The sample of epoxy resin did change slightly, both dimensionally and in total weight. Magnet wire was also evaluated to determine the effect of temperature and fuel on the insulating material, dielectric strength, and the conductor material.

Sample coils of wire were fabricated of copper wire with a protective coating of nickel flash and ceramic insulation with Teflon overlay. These coils were tested in fuel at a temperature of 550°F, and at the completion of 100 hours test time, the samples indicated very little change in dielectric strength, and the copper conductor showed no signs of deterioration.

The next step in insulation evaluation was to determine the practicability of their use in a motor stator. Sample stators, using these materials, were fabricated. The slot insulation was Teflon-glass-Teflon. Wedges and lamination end insulators were fabricated from laminated pyrotex felt. Teflon sleeving and tape was used for coil connections. Lead wire was stranded copper, silver plated, with Teflon insulation. Special care was required for insertion of stator coils using the above-tested magnet wire, due to its low abrasion resistance. After the stator had been wound and insulated, the stator was potted with an epoxy type resin used for coil retention. Varnish type impregnation was not used since it would not adhere to the Teflon insulation.

After subjecting this stator to 550°F, electrical failures occurred due to relative movement of the conductors resulting from shrinking of the epoxy type potting compound. This condition was accentuated by the temperature cycling from room temperature to 550°F during the test. Some further experimentation with this potting compound indicated that reduction

in shrinkage could be realized by proper mixing and curing techniques.

Lamination material chosen was of a silicon steel alloy. The magnetic properties of this steel remain substantially constant in this temperature range of operation. Stator lamination stacks for aircraft motors of this size are frequently fabricated by cementing each lamination during the stacking process and heat curing. The completed stator stack, in turn, is retained in the stator housing by press fit or cement. Mechanical retention is used in some instances, especially in large motors. The laminations in this high temperature motor were coated with a phenolic resin and cured in a stacking fixture. The cement used for lamination retention provided mechanical support to the stator stack and thus reduced problems of machining the I.D. of the lamination stack. Cements for use at high temperature lose mechanical strength; therefore, additional lamination retention was provided on the O.D. of the lamination stack by Heli-arc welding. The stator lamination stack was retained in the stator housing by press fit. The I.D. of the stator lamination stack was protected against the effects of corrosion by nickel plating.

The rotor was also fabricated of silicon steel alloy and was of squirrel cage construction. Cast aluminum bars and end rings are frequently used in servo motors; however, aluminum loses some of its physical strength and expands at the motor operating temperature. A typical servo motor with aluminum bars, exposed on their O.D., was subjected to 550°F temperature. Inspection of this rotor after test revealed an increase in O.D. over the exposed aluminum bars. The rotor lamination configuration which was used in the high temperature motor had a smooth rotor O.D. with rotor bars buried a few thousandths below the O.D. Rotor bars and end rings were fabricated of brass, and silver solder was used as the electrical bonding agent. The rotor stack was retained on the shaft by press fit, and the rotor was then nickel plated for corrosion protection.

#### Servo motor for 600°F ambient air

The previously described development was reinitiated with a new set of environmental parameters when a new requirement materialized for such a servo motor to operate in 600°F air. Because of the ambient

	<i>550F Motor Immersed in Ram Jet Engine Fuel</i>	<i>600F Motor in Air</i>
Stator Housing End Bells	347 Stainless Steel	347 Stainless Steel
Shaft	303 Stainless Steel	303 Stainless Steel
Laminations	4½% Silicone Steel	4½% Silicone Steel
Magnet Wire	Conductor-Copper with Nickel Flash Coating. Insulation — Ceramic with Teflon Overlay.	Conductor-Copper with Nickel Flash Coating. Insulation — Ceramic with Teflon Overlay.
Lead Wire	Silver plated stranded copper with Teflon insulation.	Stranded nickel clad copper conductors. Insulated with Teflon, felted asbestos, and glass braid.
Slot Insulation	Teflon Fiberglas	Silicone Fiberglas.
Sleeving	Teflon	Fiberglas.
Slot Wedges		
Rotor Conductors	Annealed Brass	Annealed Brass.
Bearings	Ball type, material 440C stainless steel normalized at 900F. Lubrication Ram Jet Engine Fuel.	Ball type, material 440C stainless steel normalized at 900F. Lubrication colloidal graphite.

temperature increase to 600°F, and the absence of ram jet engine fuel, the materials of the first motor were revised in accordance with the new operating requirements. Beneficial cooling effects of fuel were no longer present, permitting hot spot temperatures to increase above 700°F. The variation of output performance characteristics is greater due to the larger change in rotor resistance and stator copper losses. The problem of bearing operation is greatly increased primarily due to the lack of a proper lubricating agent for this temperature.

Teflon insulation used above 500°F decomposes. The rate of decomposition is a function of temperature. For motor operation at 600°F, Teflon insulation is of little value except possibly as a protective coating on insulating materials to facilitate the assembly operation. Since fuel was no longer present, silicone impregnated insulating materials could be utilized. Silicones deteriorate at high temperatures; however, like Teflon, they can be used as an impregnating agent to aid in assembly. Glass, ceramic mica, and asbestos are applicable as high temperature insulating materials. Silicone varnished Fiberglas was used in the 600°F motor for slot liners, sleeving, and wedges. In time, the silicone deteriorated and only glass remained. The resulting dielectric strength of the remaining Fiberglas insulation is then essentially equal to that of an equal spacing of air. The magnet wire used was the same as used in the previous motor, copper with a nickel protective coating and insulated with ceramic and Teflon. The Teflon, as mentioned previously, decomposed at temperatures of 500°F; however, the ceramic coating remained and provided the necessary interconductor insulation. Lead

wire was flexible stranded nickel-clad copper conductor. Teflon tape, impregnated felted asbestos, with an outer coating of glass braid.

Rotor, housing, shaft, and end bells were not changed for the 600°F motor. The problem of bearing lubrication, however, required considerable investigation. Many lubricants were evaluated including greases, oils, and dry film lubricants. The greases and oils tested were rated for temperatures below 600°F but were tested to determine the length of time they would remain in a grease or oily state. The greases after a few hours became solid and the remaining residue reduced bearing life as compared to dry bearings. The oils evaporated in a matter of minutes when exposed to 600°F and in some cases a residue remained. The final motor design contained stainless steel ball bearings lubricated with colloidal graphite. To date this motor has operated successfully in a 600°F air ambient loaded at 5 oz. in. and at a speed of 2000 r.p.m. for a period of 62 hours. Typical performance characteristics at 75°F and 600°F and application data are shown in Figure 1. A summary of the materials used in both servo motor designs is shown in the accompanying table.

The Electronics Division of Thompson Products is continuing its pioneering development work in the field of high temperature servo motors and other electrical rotating equipment, Figure 2. Testing is in progress on magnet wire capable of operation at 1000°F. Further improvements in the motor designs which have been described are possible, one of which is in the method of insulating the stator. Molded mica could be utilized in stator slot and wedge insulation.

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## A surge protection system for pipeline facilities

**Simple in conception, the operating principles of this system have been used in vital signalling applications for years.**

An all-relay, self-monitoring system to automatically protect pipelines and pumping stations from dangerous line surges is proving its capabilities to the satisfaction of leading pipe line organizations.

Under normal operation, the system continuously transmits, by carrier or direct current, a 120 pulse-per-minute code from the monitoring location to one or more upstream pumping stations. The circuitry is so arranged that any interruption to this code, such as power outage, loss of code or carrier signal will result in visual and audible system fault alarms but will not cause station "shut-down". The alarm condition will not clear until the system is reset.

Also operating continuously at the monitoring station, but having no effect on the transmitter, is a

180 pulse-per-minute code. This code, in conjunction with a reliable pressure sensing device, constantly guards against line pressure surges. The operation of the 180 code is also continuously checked locally by relays and other circuitry. Any interruption is indicated by visual and audible alarms.

Terminal equipment required at the monitoring location includes simply a transmitter and a power supply. At the pump station location, a receiver and a power supply are also required. Code transmitter relays used in this system have also been used for years in vital signaling applications. Trunnionless relays have been incorporated in the system to provide the ultimate in foolproof, fail-safe operation. Use of this type of relay eliminates the possibility of relay trunnions



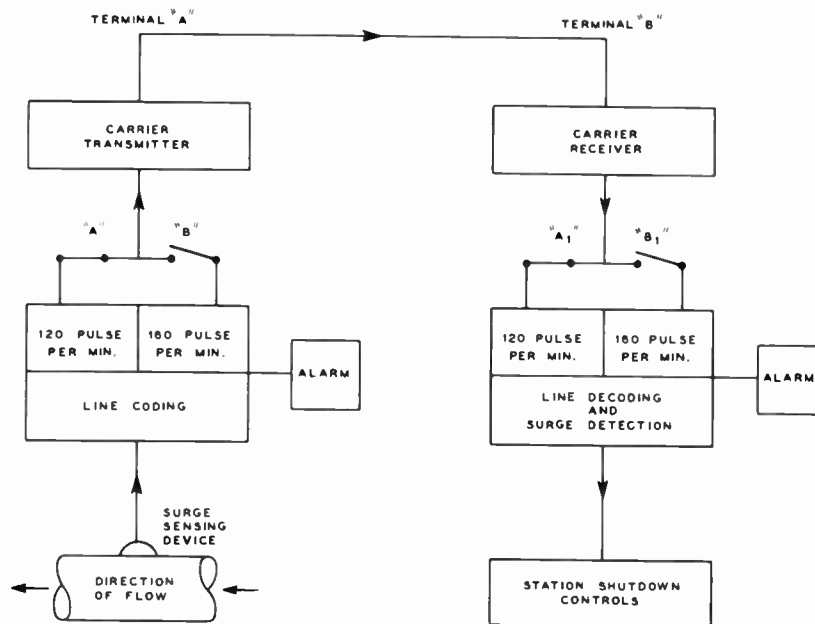


Figure 1

becoming corroded and perhaps inoperative after being held in one position for long periods of time in this continuously energized system.

When a line pressure surge occurs the pressure sensing device activates the relay circuitry which permits the 180 code to key the transmitter, instead of the 120 code, although the 120 code continues to operate locally.

Upon receipt of the 180 code at the upstream station, or stations, a contact of a code following relay will operate to energize breaker trip coils which will automatically initiate the shutdown of the upstream pump station and cause audible and visual system fault alarms to operate.

When the surge terminates and surge coding stops, the circuit is automatically reset and again ready to "take action" against line surges. The 120 code again keys the transmitter, and the 180 code circuitry at the monitoring station continuously guards against line pressure surges.

A step up in code rate to a highly selective second code is the only thing that can cause automatic shutdown action. A very highly selective unit, mechanically tuned to the second code is receptive only to this code and only when the second code is received will a shutdown occur.

Continuous pulsing maintains the system's self-checking feature, and the system is normally in the code state. Components are built for continuous operation for years with little or no maintenance.

The carrier circuit when used for this system can easily be integrated into existing carrier facilities with the installation of suitable band pass and blocking filters. This system is a simple, automatic, all-relay, highly selective system which provides a protected transmission facility for instantaneously transmitting dangerous pressure surge information to upstream stations which will shut down pumps to prevent cracked pump cases or line blowouts.

Under normal pressure operation, 120 pulse-per-minute code is transmitted from Location "A" (See Figure 1), received at Location "B" and repeated through the action of a code following relay. When a surge occurs, contact "a" will open, contact "b" will close, and the transmitter at Location "A" will be keyed at the rate of 180 pulses-per-minute. Receipt of the 180 code at Location "B" will cause contact "A<sub>1</sub>" to open and "B<sub>1</sub>" to close. The 180 code operates a contact of a code following relay which establishes a circuit to automatically initiate immediate shutdown of the upstream station and cause audible and visual system fault alarms to operate. When pressure returns to normal the circuit will automatically reset.

## Electronics and Communications 5th Annual Directory and Buyers' Guide

Canada's established Buying Guide for the electronic and communications market.  
This Directory will be published in December 1958 to serve our readers and advertisers during the following twelve months. It is a must for engineers and purchasing agents.

# business briefs and trends

★ Six television cameras recently shipped to Canada from Britain will be used in the new C.B.C. studios in Toronto and Montreal. This consignment brings the total television channels purchased by C.B.C. from Marconi's Wireless Telegraph Company Limited, England, to nearly seventy.

\* \* \*

★ As a result of the recent cancellation of the Astra I System for the CF-105 Arrow, it is estimated that no less than 300 top level engineers and scientists assembled into one company team in Canada from all over the world will be disbanded.

\* \* \*

★ Stuart D. Brownlee, Executive Vice-President of the Canadian Admiral Corporation Limited, has announced the signing of a contract with the Department of National Defense for the production of telephone amplifiers for the Royal Canadian Navy.

\* \* \*

★ British built equipment for a microwave radio link between St. John's, Newfoundland and Sydney, Nova Scotia, has been ordered by the Canadian National Telegraphs from the Automatic Telephone and Telegraph Company Limited, London, England. This company is represented in Canada by Telephone Manufacturing Company Limited of Toronto.

\* \* \*

★ Defense spending for electronic equipment in the United States during the fiscal year ending June 1958 reached an all-time high and amounted to \$4.05 billion.

\* \* \*

★ The Air Industries & Transport Association has recently formed a new avionics committee. The reason for the new committee within the parent body has been stated to be the increasing importance of electronics in the aviation and weapons field.

\* \* \*

★ J. Herbert Smith, president of Canadian General Electric Company Limited, has suggested that industrial leaders should be consulted more often by Federal authorities on the matter of defense production planning. Mr. Smith stated that defense is not the exclusive problem of the Federal Government, but is a matter in which all segments of industry must accept a fair share of responsibility.

\* \* \*

★ Canada, Finland, Brazil and the Argentine have placed orders for British high voltage testing equipment worth £100,000 with Ferranti Ltd. of Lancashire, England. The Canadian representative of this company is Ferranti-Packard Electric Ltd., Toronto, Ontario. Canadian portion of the above equipment is for an 80 kw-seconds impulse generator, designed in such a manner that it can later be modified to provide any increased output voltage needed.

\* \* \*

★ Mr. Eijiro Fujise, recently appointed director of the Japan Trade Center in Toronto, has stated that it is his country's aim to expand her foreign trade in an orderly and cautious manner while considering the welfare of her trading partners, such as Canada. It is interesting to note that manufacturers of electronic equipment in Japan have set up a joint firm in Tokyo to promote sales of their goods abroad. The firm, called the Japan Electronic Equipment Export Association, will conduct market surveys and other activities for the promotion and orderly marketing of exports as well as servicing for goods exported. The firm, which represents 68 different electronic concerns, plans to set up an electronics equipment export center in New York.

\* \* \*

★ The world's largest network VHF radio communications system will soon link ten Caribbean islands. The system to be installed by the Pye Corporation of England will extend from Trinidad, Grenada, St. Vincent, Barbados, St. Lucia, Martinique, Dominica, Guadalupe, Antigua and St. Kitts.

# *NEW* Westinghouse

## **VIDICON**

**SPECIALLY DESIGNED  
FOR STUDIO WORK**

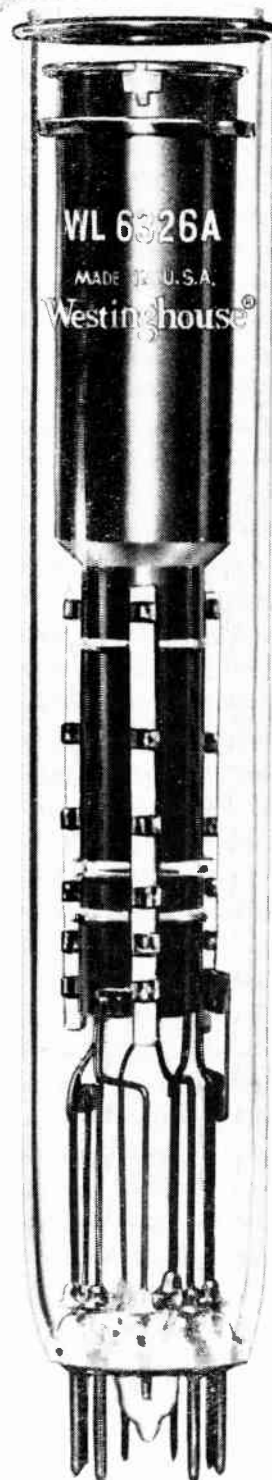
- UNIFORMITY OF SIGNAL OUTPUT
- BLEMISH-FREE TARGETS
- HIGH SIGNAL TO NOISE RATIO
- EXCELLENT DETAIL CONTRAST
- IMPROVED SENSITIVITY
- ELECTRO POLISHED PARTS PREVENT TUBE CONTAMINATION

The new Westinghouse WL-6326A Vidicon has been engineered with the particular needs of studio work in mind. Its performance is far superior to that of other types developed basically for closed circuit application and the WL-6326A offers complete flexibility of installation since it is operable in any position.

**YOU CAN BE SURE...IF IT'S**

# Westinghouse

WATCH "WESTINGHOUSE DESILU PLAYHOUSE" CBC TV MONDAYS



**CANADIAN WESTINGHOUSE COMPANY LTD. ★ ELECTRONIC TUBE DIVISION, Hamilton, Ont.**



# New Products

New Product specifications published in Electronics and Communications have been briefed for your convenience. If you require further information on any of the items published you may readily obtain such by using our Readers' Service, Page 67. Just mark the products you are interested in on the coupon on Page 67 and the information will be in your hands within a few days.

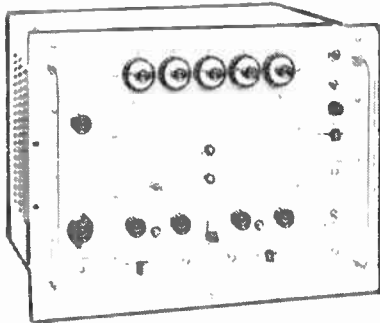
## Precision Delay Generator

Item 2136

A new precision delayed-pulse generator providing a variable time-interval standard is now available from the Hewlett-Packard Company.

The new instrument, Model 218A Digital Delay Generator, produces two accurately controlled time intervals. It is a direct slave to any beginning or synchronizing pulse, even though random.

The 218A is particularly useful in calibrating timing circuits such as those found in radar systems, oscilloscopes and marker generators; in timing responses from drum storage systems of computers, and in the precision pulse code modulation of control carriers.



The range of delay times is digitally adjustable in 1 microsecond steps from 1 to 10,000 microseconds with provision for continuous interpolation between the 1 microsecond steps. Overall accuracy of each delay is within  $\pm 0.1$  microsecond ( $\pm 0.001\%$  of the selected delay). Jitter is less than 0.02 microseconds.

Time intervals or delays may be initiated by an internal rate generator at rates from 10 cps to 10 kc, or by external signals from 0 cps to 10 kc.

The 218A is designed to accept three different types of plug-in units to fulfill a wide variety of time and delay generation requirements. These units, also available from Hewlett-Packard, include the 219A dual trigger unit, the 219B dual pulse unit, and the 219C digital pulse-duration unit.

For further information contact Atlas Instrument Corp. Limited, 50 Wingold Ave., Toronto 19, Ontario.

## Magnetic Pin Locator

Item 2137

A new magnetic miniature tube pin locator has been introduced by Canadian General Electric Company Limited. The pin locator is designed to speed TV service, and is available through G-E Tube Jobbers.

C.G.E. says that this locator offers a new method of centering miniature tube pins, eliminating the difficulty in hard-to-reach locations, and preventing tube damage or bent pins.

For further information contact Canadian General Electric, 214 King Street West, Toronto, Ontario.

## Multimode Test Turntable

Item 2138

A multimode turntable for laboratory test and evaluation of inertial navigation equipment has been introduced by J. W. Fecker, Inc., a subsidiary of American Optical Company. The Model 052 table also is designed to determine transfer functions of gyros or other inertial devices to programmed sinusoids or step functions.

The unit offers a wide range of features normally found only in several special purpose tables, and may be used either as a servo table or a sidereal rate table. It has been designated by the U.S. Air Force as the standard for its applications.

A highly accurate test instrument, the Model 052 is ruggedly constructed to stand up under continuous operation in production line testing. The platform and its driving mechanism comprise a unit assembly precision-mounted on a horizontal axis within a U-shaped pedestal yoke.

The 26-inch diameter platform can accept loads up to 500 pounds. Turning on precision pre-loaded roller bearings to insure exactly concentric rotation, it has a range of turning rates of from 0 to 2 revolutions per second. Its microsyn drive maintains a positional accuracy of plus or minus 10 seconds of theoretical value.

The table drive is servo activated by an error signal developed either by the inertial element under test, or by the microsyn attached to the platform drive shaft. The hollow shaft, with 30 shielded slip rings of 3 ampere capacity, provides the means for wiring platform surface-mounted test elements as well as the leads to the microsyn. A standard modification of the test table with 50 slip rings also is available.

The Model 052's component photoelectric readout system provides highly accurate indication of turntable motion in the form of an electrical pulse, coincident with each 6 or 10 seconds of arc. The system consists of a calibrated glass circular scale accurate to 2 seconds of arc and a reading head which are part of the platform assembly, plus a pre-amplifier, amplifier, phase discriminator, counters, and an adding machine tape printer.



Complete gyro power supplies, as well as table control equipment, are available for use with this table for both automatic and manual testing systems.

Smooth, constant rotation of the table without backlash or other gearing error is achieved through a direct drive DC torque motor.

For further information, write to J. W. Fecker, Inc., 6592 Hamilton Avenue, Pittsburgh 6, Pennsylvania.

## Custom Built Helipot® Slidewire Assemblies

Item 2139

Harassed engineers with knotty potentiometer problems will find Helipot Division of Beckman Instruments, Inc., Toronto, Ontario, has the answer to many a brain-buster in their custom-built slidewire assemblies, rectilinear and sector-motion units.



Designed to meet the needs of each peculiar situation, these pots can be built in many shapes and sizes and with characteristics to fit scores of applications.

Any reasonable length from one inch up can be supplied. Terminals, taps and mounting styles are all at the discretion of the designer. Contacts are usually of wear-resistant, low-noise level precious metals, but can be altered to suit the installation.

Resistance values range from 0.25 to 17,000 ohms per inch . . . typical linearity tolerances are  $\pm 0.5\%$  in one inch,  $\pm 0.15\%$  in three inches and  $\pm 0.025\%$  in eleven feet . . . it's all up to the designer.

Resolution from 100 to 600 turns per inch are available. Power rating depends upon the installation and materials used . . . breakdown voltage is 1,000v in most cases.

Applications of these versatile potentiometers are as follows: machine tool carriage position sensors, triangle solvers in navigational computers, small angle sensing pickups in submarine inclinometers, aircraft landing gear position sensors, gyroscope pick-off element, flowmeter float level repeaters, liquid level pickups, special tapped slidewires in industrial potentiometer recorders, position pick-off on radar slotted lines.

Enquiries should be directed to:  
R-O-R Associates Limited, 1470 Don Mills Road, Don Mills, Ontario, Helipot Division Sales Engineering Representatives.

## Time Saving Case Construction System

Item 2140

Measurement Engineering Ltd., announces MEL-Imlok — a new, cost-reducing case and rack construction system. The MEL-Imlok system can be applied to any design of case or rack except circular shapes.

This system consists of two basic components — extrusions with grooves into which sheet metal panels are fitted, and corner castings which act as connectors. Panels desired to be removable are fastened to the extrusions with panel screws. A number of MEL-Imlok accessories such as specially designed hinges, handles and locks are also available.

MEL-Imlok construction saves many hours of assembly time and provides a neat, functional appearance.

Measurement Engineering Ltd., Arnprior, Ontario.

# New Products

## Electronic Aid for Designing Transistor Circuits

Item 2141

A new electronic unit developed by National Electronics Laboratories called the Transistor Circuit Synthesizer readily enables designers to check the performance of contemplated circuit designs without the need for a "breadboard" of soldered wires. This instrument has four independent panels, each a transistor stage, and a master metering panel.



The Transistor Circuit Synthesizer provides extreme flexibility to assemble Common Base, Common Emitter and Common Collector circuit configurations. By combining two or more transistor panels through wires or plug-in shorting bars, circuits such as amplifiers, flip-flops, oscillators, and gates can be readily assembled.

Either PNP or NPN transistors can be employed in the circuits. A floating battery power supply is contained within the cabinet, and the negative, positive, or in-between taps can be selected as ground reference. This allows the use of the instrument in combining stages of PNP with stages of NPN transistors with only one multitapped battery supply.

A feature of the metering panel is the curve tracer. The curve tracer is used in conjunction with an external oscilloscope which is connected to the vertical and horizontal output jacks of the panel. This feature allows for a visual display of the plot of collector voltage versus collector current. A family of curves will result when the base current of the transistor under test is varied by means of adjustments provided in the panel. The value of the base current bias for each curve can be measured concurrently with the visual display by depressing a momentary switch.

Additional information on the Transistor Circuit Synthesizer may be obtained by writing to National Electronics Laboratories, Inc., 1713 Kalorama Road, N.W., Washington, D.C.

## Microwave Ferrite Rotators with Microsecond Switching

Item 2142

Airtron has developed a series of Ultra High Speed Faraday Rotational Waveguide Switches which are capable of switching times down to 1 microsecond. Applications are for medium power, airbound or ground-radar systems.

Driving circuits using miniature and small hydrogen thyatrons are available from Airtron. Hard tube modulators can also be used, depending on the switching requirements.

For narrow band applications solid dielectric supported Faraday Rotators are used with appropriate orthogonal junctions. For extremely broad band applications, cruciform or quadruple rigid waveguide structures are used to cover 12% band widths.

For further information write to Airtron Canada Limited, 300 Campbell Avenue, Toronto 9, Ontario.

## Flexible Heater Cord

Item 2143

The manufacture of a new style of type HPN flexible heater cord is announced by the Federal Wire & Cable division of H. K. Porter Company (Canada) Limited. Basic construction of the cord consists of two neoprene covered, tinned flexible copper conductors separated by a green neoprene insulated ground wire, all three conductors are parallel which gives the cord a flat-oval cross-section.

Manufactured in sizes 16 and 18 awg the cord is constructed using highly flexible conductors. The neoprene covering is ribbed on one outer edge for conductor identification purposes and is grooved longitudinally for easy stripping.

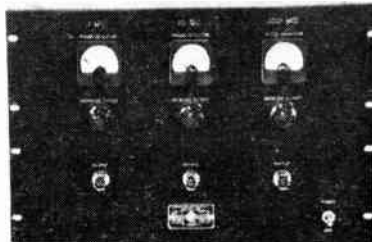
This type HPN heater cord is approved by CSA for use in installations where the maximum voltage is 300 volts and the temperature does not exceed 90° C. Applications for this cord would be in the installation of oil burners, portable electric heaters, space heaters, food preparing machines, heating pads, etc., where a ground wire is required.

For further information contact H. K. Porter (Canada) Ltd., Disston Division, Toronto 3, Ontario.

## Standard Frequency Multipliers

Item 2144

Accurate measurements of microwave frequencies are facilitated by use of the new General Radio Type 1113 Standard Frequency Multipliers with a crystal-controlled frequency standard. These multipliers generate sine-wave signals of 1, 10, 100, and 1,000 megacycles and greatly extend the useful range of conventional frequency standards such as the GR Type 1100-A. The instruments are characterized by low noise and by almost complete freedom from submultiple-frequency spurious signals. In addition, the phase stability of the output signals is maintained at a high value.



The multiplier chain consist of two units, the first providing 20 milliwatts at 1, 10, and 100 megacycles from three phase-locked quartz-controlled oscillators; the second, 50 milliwatts at 1,000 megacycles from a phase-locked klystron oscillator. The input to the first unit, the Type 1112-A, is normally 100 kilocycles, but alternatively, 1, 2.5, or 5 megacycles can be used (when 2.5- or 5-megacycle input is used, the 1-megacycle output cannot be used). The second unit, Type 1112-B, is driven from the 100-megacycle output of the first unit.

For further information contact: General Radio Company, 99 Floral Parkway, Toronto 15, Ontario.

## Transient Eliminators Protect Transistorized Circuits

Item 2145

Development of a new instrument, designed to protect transistor circuits from high-voltage transients, announced recently by the Engineered Magnetics Division of Gulton Industries, Inc.

The new transient eliminators are being produced in two models, EM 446 for airborne applications, and EM 472 for use in laboratory and ground support equipment.

When placed in series with power sources, absorb high-voltage transients and prevent their appearance at the output of the eliminator thus protecting the transistor load. High-voltage transients, which are inherent in many commercially available power

supplies, will short transistors if they are too high.

The new instruments will find extensive use in laboratory applications for development and production work, and in the fields of telemetry, computing and airborne instrumentation.

Prior to the development of the transient eliminators, high-voltage transients had to be filtered out, causing inefficiency. The new models cause only the very slightest decrease in power supply voltages, protecting equipment and maintaining efficiency.

Both units are rated for continuous operation at 32 VDC and 15 Amps., and satisfy military specifications, MIL-E-5272. Other outstanding features are portability, lightweight, short circuit proof, high reliability, no stand-by power and little line drop. The units are protected against reversed polarity, inductive kick-back and over-voltage.

For further information, requests should be made to the Canadian Representative, Lake Engineering Co. Ltd., 767 Warden Ave., Scarborough, Ontario.

## Thickness and Density Gage

Item 2146

An entirely new non-contacting gage has been put on the market by Nuclear Systems, a Division of The Budd Company. The machine continuously measures the thickness and density of materials through the use of gamma radiation.

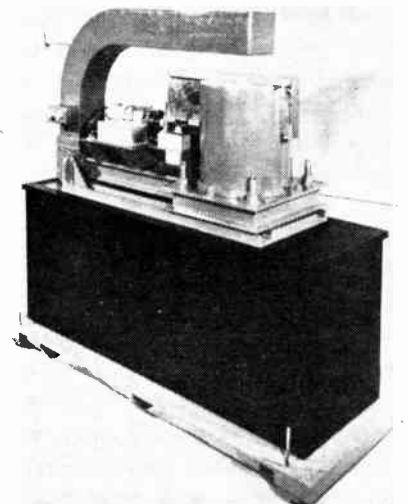
GAMMASCAN has a very high rate of response (in milliseconds) which makes it useful to measure and control the thickness of continuously produced materials such as steel plate. The GAMMASCAN's thickness capability ranges from light gage metals to more than a foot of steel or equivalent. The machine can inspect a wide variety of products such as rolled sheet steel, extruded forms and solid fuel for missiles.

In operation, gamma radiation from the machine's thoroughly shielded Cobalt 60 source passes through the material being inspected to a scintillation detector which converts the radiation to an electrical current. Variations in this current are interpreted by the GAMMASCAN as changes in material thickness or density.

GAMMASCAN's output is indicated visually on a meter calibrated in thickness increments and can be fed to a chart recorder for a permanent printed record. Output can also be used to actuate servo-mechanisms which provide continuous production control.

Speed of response and high degree of accuracy allow GAMMASCAN to pay for itself rapidly through material savings and improved quality control.

Nuclear Systems' technical specialists will provide the installation engineering to adapt GAMMASCAN to suit special customer requirements.



For further information: Nuclear Systems, 2450 Hunting Park Avenue, Philadelphia 32, Pa.



# New Products

## Strippit Short-run Stamping Service

Item 2147

As the result of a new unique, "Fast-Tool" Method, Strippit Tool & Machine Limited, Brampton, Ontario, has formed a Stamping Division to produce short-run metal stampings in quantities of 25 to 25,000 parts. This new method is particularly adapted to small parts, whether of a complicated or simple design. Strippit Sales Manager, Chesley Somerton, announced that the new division is equipped to handle any shape or material that can be blanked, pierced, extruded, formed or drawn, as well as drilling, tapping, counter-sinking and similar operations.

"Flexibility is the essence of the operation," stated Somerton, "and for that reason, we can save money for all types of manufacturing plants and particularly when they are making prototype or pilot models of products where design changes may be frequent. For most factories, this in-between or pre-production stage is a highly unprofitable one. In taking the job off their hands, we are able to effect savings up to 85% of conventional tool costs."

For further information contact Strippit Tool and Machine Limited, Brampton, Ontario.

## Delay Lines for Printed Circuit And Transistor Applications

Item 2148

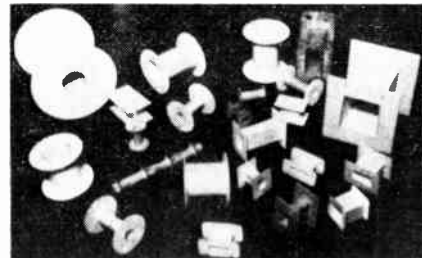
Precision lumped constant delay lines suitable for transistor and printed circuit applications are offered in a new sub-miniature case size by Valor Instruments, Inc. These delay lines consist of sub-miniature powdered iron toroidal inductors and temperature compensating ceramic disc capacitors in a lumped constant configuration which is phase and frequency compensated for optimum pulse response. They are packaged in a 1" x 0.4" metal tube with glass to metal end seals to bring out the pigtail type leads. Seven units are included in this series with characteristics ranging from 0.1 microsecond delay, 0.03 us rise, and 500 ohm impedance (Type No. 1C9-3/5) to 0.7 microseconds delay, 0.23 us rise and 1,600 ohm impedance (Type No. 7C9-3/16). This entire group of seven delay lines is available in kit form.

For further information contact Valor Instruments, Inc., 13214 Crenshaw Boulevard, Gardena, California.

## Coil Bobbins High Temperature Applications

Item 2149

The manufacturing ability to run several classes of materials on the same tooling has enabled one large aircraft components manufacturer to procure bobbins for various temperature applications on one set of tooling.



Rigid, close tolerance bobbins of glass silicone for Class H, glass melamine for Class B, and glass phenolic for Class A uses can all be run from one set of low cost tooling. Thus components designed for Class A applications can be modified to meet Class H applications without additional tooling.

Stevens Products Inc., 86-88 Main Street, East Orange, New Jersey.

## Electro-Snap Sub-Miniature Switch

Item 2150

Known as the T3 Series this SPDT Electro Snap Switch measures only .526" long, .250" wide, .323" high and features:

Electrical Life Rating—6 amps, 125/250 V AC, 30 V DC resistive.

Extreme small size—may be ganged in minimum space—4 switches to 1 inch in width.

Long, long mechanical life—2½ million cycles.

Longer electrical life than switches twice its size.

No dead break—perfect for super sensitive applications.

High repeatability—only one moving part besides button.

Consistent, close tolerance mounting—in single or ganged set-ups.

Rugged, durable high temperature and impact resistant case—Ambient Temperature—65° to +250° F Std.

Super long life model available with limited overtravel.

Wide range standard actuators available in leafs, toggles, pushbuttons, etc.

For further information write to: J. R. Longstaffe Company Limited, 300 Campbell Avenue, Toronto 9, Ontario, for Data Bulletin.

## Mercury Battery Holders

Item 2151

Cambridge Thermionic Corporation has added three more mercury battery holders to its line of electronic components.

One new clip, #2475, is 2½" long and three cell, built to hold Mallory battery TR-133R. The second clip, #2477, is 3½" long, four cell, and will hold Mallory battery TR-134R. #2324, the third new clip, is 3.541" long, five cell, and will hold Mallory battery TR-135R. All units stand 7/8" high when mounted.



The new clips are designed to grip batteries under the most severe conditions of shock and vibration. They mount directly to the chassis or printed circuit board. A unique spring loaded end accommodates the production tolerances of the mercury cell and allows insertion of the cell in tight spots no longer than the holder itself. All parts are non-ferrous and electroplated, guaranteed to be corrosion-proof even under battery leakage.

For further information write to Cambridge Thermionic Corporation, 445 Concord Avenue, Cambridge 38, Massachusetts.

## Circumaural Earphones

Item 2152

These earphones were developed by the National Research Council in the first instance and further developed by Sharpe Instruments Ltd., Willowdale, Ontario, to provide near ideal response. On a frequency response curve graph the ideal would be represented by a straight line. The curve obtained with the earphones was smooth and straight. Beside it, the curve obtained with a loudspeaker system in a modern L-shaped living room looked like the temperature chart of an excitable patient.

Circumaural earphones will undoubtedly have special uses for the armed forces, for industry, and, in fact, for all for whom noise suppression is vital. For the hard-of-hearing they provide improved reception. Record bars could use them for demonstration tapes and save themselves the inconvenience, expense and space wasted through having to sound proof a room. This would also apply to the hi-fi fan. With these earphones, he could have near perfect response anywhere in the house or apartment, and could have it without disturbing others



and without being disturbed by them. Here, too, is something for the late TV watcher, for while he could listen undisturbed, others could sleep.

### Specifications:

Frequency Response: 20 CPS to 15 K.C.  
Flat to 12 K.C. 4 d.b. down at 15 K.C.  
Impedance: 6.4 ohms each phone.  
Max. Power Level + 100 d.b. each phone.  
External noise attenuation—40 d.b. at frequencies 1 K.C. or higher.  
Cushion: Vinyl plastic with glycerine.  
For further information contact Sharpe Instruments Ltd., Willowdale, Ontario.

## Continuous Slot Metal Framing System

Item 2153

Details of a new structural system, known as Flexibar, that provides fast on-the-spot erection of racking, pipe and cable supports, have been released by Burndy Canada Ltd.

The manufacturer claims that the new system is quick and easy to erect. No special experience or skill is needed, and the only tools required are a wrench and a hacksaw.

Flexibar consists of ready-made slot metal struts that can be cut to any length, plus a variety of standard framing fittings. Parts are rigidly secured in place by specially designed spring-loaded nuts which are captured in the strut channels. The whole system is extremely flexible as the nut can be adjusted through the complete length of the channel.

A partial-assembly service is available at the Burndy factory, as well as an engineering service in the field.

For complete information and a copy of the new Flexibar Catalog, contact Burndy Canada Ltd., 1530 Birchmount Road, Scarborough, Ontario.

## Type 543 DC-to-30 MC Oscilloscope

Item 2154

The Tektronix Type 543 is a fast-rise oscilloscope with the Tektronix plug-in feature. Nine plug-in preamplifiers are available for signal-handling versatility. Sweep range is 0.02 μsec/cm to 15 sec/cm, accelerating potential is 10 kv, built-in voltage calibrator has 18 outputs from 0.2 mv to 100 v peak-to-peak.

New features for a DC-to-30 MC oscilloscope are: Sweep magnifications of 2, 5, 10, 20, 50, and 100 times; single-knob control of 24 direct-reading calibrated sweep rates; improved triggering with preset controls; lockout-reset circuitry for single-sweep recording; new frame-grid dual-triodes for greater dependability.

For further information contact: Tektronix Incorporated, 3 Finch Ave. East, Toronto, Ontario.



# New Products

## Miniature Contactor Switches 60 Amperes

Item 2155

Potter & Brumfield Inc. has developed a miniature contactor capable of switching loads up to 60 amperes with control signals as small as 2.7 watts.

Designated the MB, it can be furnished with spst double break contacts either normally open or normally closed. In addition to normal load currents of 60 amperes at 30 volts DC, the MB contacts can handle starting surges up to 150 amperes for 300 milliseconds. A double throw version of this relay can also be furnished with contacts derated to 20 amperes.

The miniscule contactor can be furnished to operate under shocks of 30g and 10g vibrations to 500 cycles; tests from 10 to 55 cycles at .065 inch displacements fail to open the contacts.

The MB can be furnished open or hermetically sealed, the sealed version can be equipped with an octal plug or with a multiple solder header with stud mounting.

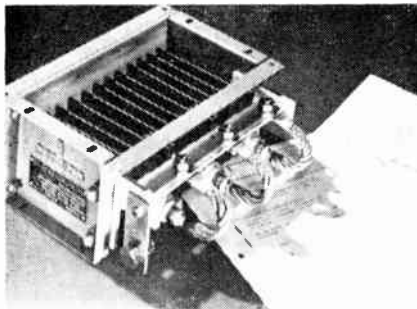
The open version measures 1-21/32" long x 27/32" wide x 1-17/32" high and weighs only 2 ozs. The sealed version measures 1 3/8" long x 1-7/16" wide x 2 1/8" high and weighs 4 ozs.

For additional information write Potter & Brumfield Canada, Ltd., 135 Oxford Street, Guelph, Ontario, Canada.

## Silicon Rectifiers By Siemens

Item 2156

A comprehensive range of silicon rectifiers, designed and developed by Siemens, is now available in Canada from The Ahern and Soper Company Limited.



Made from silicon with a purity of less than one alien atom to ten billion, the rectifiers have impressive physical properties:

Current density:	
self cooled	515 A/in <sup>2</sup>
forced cooled	1290 A/in <sup>2</sup>
A.C. applied voltage (max.)	380 volts per cell
Maximum temperature	140° C.
Efficiency	99.6%
Full load voltage drop	1 volt per cell

For further details write to The Ahern and Soper Company Limited, 384 Bank St., Ottawa, Ontario.

## Portable Power Source

Item 2157

A major "break-through" in the development of portable power sources has just been announced by National Carbon Company, Division of Union Carbide Canada Limited. It's the new "Eveready" Energizer, a leak-proof alkaline cell which will give up to ten times longer service than a standard flashlight battery.

The new cell will supply high currents in continuous service and will perform in temperature ranges of from -40 degrees to +200 degrees Fahrenheit. This is of major importance in outdoor applications since

the standard batteries fail to operate at these temperature extremes. According to National Carbon, low temperature operation of the alkaline cell is approximately three times that of the best low temperature cell heretofore available. High temperature characteristics are also vastly superior to those of the ordinary battery.

Principal significance of the new "Eveready" Energizer is that it will bring to reality a host of portable electronic devices which up to this time have been considered impractical due to the lack of this very type of power source. The ability of this cell to operate satisfactorily under heavy drain conditions now places such devices well within the realms of possibility. Modern appliances do everything from whipping potatoes to making music.



As labor savers and entertainers they are a real boon—but most of them are only as handy as the nearest wall socket. Now, with this new "Eveready" Energizer many appliances will be completely portable. In addition, this revolutionary development will provide more efficient power source for existing portables including portable radio amplifiers, tape recorders, phonographs, as well as for toys, home movie cameras, electric shavers, electronic photoflash equipment and fire and burglar alarms.

Physically, the larger version of the new alkaline cell resembles a standard flashlight battery and is hermetically sealed and encased in steel. The cells boast an excellent shelf life, comparable to that of a flashlight battery. They are currently available in two sizes, the standard "D", weighing 3.8 ounces, and the 1/2 length "D", weighing 1.6 ounces. The former has a short circuit amperage of 20, and the 1/2 "D", 8. Each cell has a nominal voltage of 1.5. The characteristics of the alkaline cell are such that it can be manufactured in other sizes and shapes, depending on the requirements of the application.

These new batteries, which represent many years of combined research and development effort, are now being supplied to manufacturers of electronic devices as initial power equipment. National Carbon states that both the "D" and 1/2 "D" will be generally available to consumers.

National Carbon Company, Division of Union Carbide Canada Limited, 805 Davenport Rd., Toronto 4, Ontario.

## Portable, Adjustable Vise and Card Holder

Item 2158

A portable, fully-adjustable Tronic-Vise and Card-Holder designed to hold printed circuit boards and small sub-assemblies for maximum accessibility to either side is now being distributed in Canada by W. R. Watkins Co. Ltd., 41 Kipling Ave. S., Toronto.

Sturdily constructed of heavy gage steel, cadmium plated, this equipment holds units firmly but gently, freeing both hands for easy assembly. A hard, corrosion-proof plastic ball housed in an aluminum socket locks in any position through 90 degrees.

The Tronic-Vise, with rubber lined jaws and speed knob, opens up to 6 1/2 inches. The Card-Holder is adjustable, and will take printed circuit boards from 3 to 10 inches wide and up to 1/8-in. thick.

W. R. Watkins Co. Ltd., 41 Kipling Ave. S., Toronto, Ontario.

## Pneumatic Control Valves

Item 2159

Pneumatic control valves of a new type, developed for and now in use in missile loading control systems, are being made available by Industrial Division of Honeywell Controls Limited for advanced industrial process control in chemical, petroleum and nuclear applications.

The valves, in-throttling (Type 57) and two-position (Type 44) models, are designed to control extremely small flows of liquids and such hard-to-handle gases as nitrogen, oxygen and helium at pressures of up to 10,000 psi and temperatures ranging from -65° F to 400° F. Construction can be modified for temperatures from -400° F to 1,000° F depending upon application.

Air-to-open and air-to-close, as well as line and panel mounting hand control versions, are being produced. Designated as Series 200, the valves have a maximum shut-off rating of 6,000 psig without leakage. Full valve travel is accomplished in less than two seconds.

All valve models are of split-body construction with seat rings in the lower half of the body. Body sections can be assembled to attain straight-through or angle line connection configurations. The bodies, made from forged stainless steel, have 1/2 inch or 3/4 inch NPT end connections, bolted packing box and solid Teflon V-ring packing. Plug is of the single-seated, contoured type with linear flow characteristics.

The valves can be equipped with accessories and other remote position indicators, pressure regulators or solenoid valves.

For further information contact: Merchandising Department, Honeywell Controls Limited, Vanderhoof Avenue, Toronto 17, Ontario.

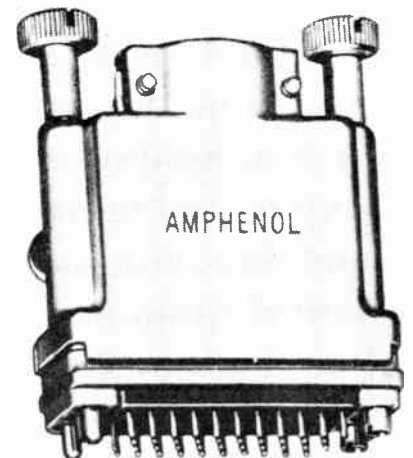
## Rack and Panel Connector with Poke-Home Contacts

Item 2160

The new Amphenol 93 Series Rack & Panel Connectors incorporating the versatile poke-home contacts. Wired separately from the connector these contacts are then poked-home for fast assembly.

Features:

- 3 insert arrangement—8 varieties of housings—connector rating 7.5 amp @ 500V DC sea level 7.5 amps @ 125V DC 70,000 feet.
- Temperature range — 65° | 200° C, meets MIL-C-8384.
- Hooded contacts to resist test prod damage per MIL-C-5015C. Paragraph 4.5.14.1.
- Insertion and withdrawal per contact 2 oz. min. to 12 oz. max.
- Resistant face gasket of silicone rubber prevents circuit interruption by moisture, dust, dirt or metallic particles when connectors mated.



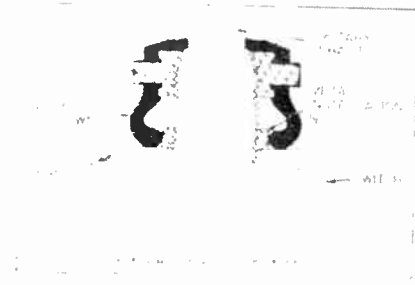
For further information write to: Amphenol Canada Limited, 300 Campbell Avenue, Toronto 9, Ontario.

## New Products

### High Pressure Shaft Seal for Locking-Type Rotary Devices

Item 2161

A seal for locking type shafts has been introduced by the A. P. M. Company (Automatic & Precision Mfg.), 252 Hawthorne Ave., Yonkers, N.Y. These novel sealing devices are designated Hexseal®, Series NLK-9000. This series of Hexseals are intended for use with Allen Bradley potentiometers, Type J, and similar adjust-and-lock components.



The basic design is a one-piece silicone rubber bellows molded to a metal nut. The bellows seals against the panel and an inwardly protruding O-rib seals against the rotary shaft. Series NLK-9000 are also available to fit all standard thread and shaft sizes. The materials used are unaffected by salt water, acids and ozone. They are useful over the temperature range of  $-160^{\circ}\text{F}$  to  $500^{\circ}\text{F}$ . Series NLK-9000 Hexseals are recommended for use in pressurized and environmentalized equipments.

For additional information contact A. T. R. Armstrong Company, 700 Weston Rd., Toronto 9, Ontario.

### Miniature Silicon Rectifier

Item 2162

The culmination of research, engineering and production experience covering millions of silicon rectifiers is packed into the recently developed Tarzian "F" series silicon rectifiers. Rated at 750 milliamperes dc with voltage ratings of 200, 400 and 600 volts, these rectifiers are encapsulated into

a volume less than .004 cubic inch. The new line is the lowest priced 750 milliamper silicon rectifiers on the market to allow wide commercial use. This new series is in production and available now from:

A. T. R. Armstrong Ltd., 700 Weston Road, Toronto.

### Dual Stereophonic Hi-Fi Preamplifier

Item 2163

A new dual stereophonic high fidelity preamplifier, featuring high sensitivity, low hum and noise, high channel separation, and individual switching for each channel to select phono or tape input, is available from Canadian General Electric.

The new preamplifier, the "Stereo Classic" Model MF-1, will be available in November. It is the 12th new G-E hi-fi component product announced to date this year, and has monaural applications as well as stereo.

It is designed primarily for use with magnetic stereo cartridges, for conversion of existing ceramic cartridge stereo systems where the necessary preamplification is not available in the system.

The MF-1 also is equipped for use with stereo tape heads. In addition to providing two stages of preamplification in each channel, it provides proper feedback type circuit equalization for discs (RIAA) and tape (NARTB), for very low distortion.

It may be used as a stereo headphone amplifier, for individual listening, and, with a minor circuit modification, as high gain, high quality monaural or stereo tape recorder microphone preamplifier. Its low impedance output of less than 10K ohms at 1 kc allows the use of an output cable up to 50 feet long.

Nominal specifications:

Stereo magnetic phono inputs (2): For all stereo magnetic cartridges; resistance, 47K ohms; sensitivity, four millivolts to produce 0.6 volt output at 1 kc.

Stereo tape head inputs (2): Sensitivity four millivolts to produce 0.4 volt output at 1 kc; NARTB tape equalization.

Inputs: Over 40 db.

Frequency response: Within 2 db of stated equalization characteristics, at rated output.

Hum and noise: Better than 60 db below 1 volt output, unweighted.

Distortion: Less than 0.2% harmonic at 1 kc, at 1 volt output; will handle peak voltages at all frequencies from recordings without clipping.

Sensitivity: Over 40 db for either input.

Separation between channels: Better than

40 db at rated operating levels.

Channel balance: Gain of channels at 1 kc equal within 1.5 db.

Power supply: Self-contained selenium rectifier; line power, 102-125 volts; 50-60 cycles four watts at 117 volts.

Tube complement: 2 7025, 12AX7 special low noise dual triodes.

Dimensions: Length, 6½"; width, 3¾"; height, 4".

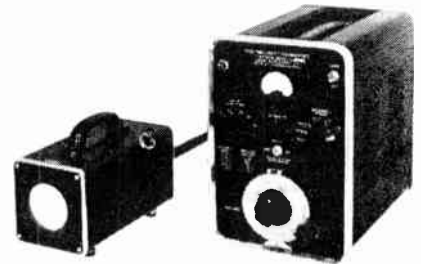
Further information on the MF-1 is available from Canadian General Electric Company Limited, 189 Dufferin Street, Toronto, Ontario.

### High Frequency Stroboscope

Item 2164

A new instrument for measuring speeds and slow motion observations within the range not normally attainable by the use of normal gas discharge tubes. This equipment employs a special cathode-ray tube light source to extend the frequency range to 10 Kc/s. The light source is about 2" in diameter and the intensity is of the same order as that obtained from a typical neon stroboscopic lamp.

The instrument consists of a calibrated oscillator covering the range of 10 c/s to 10 Kc/s, pulse forming circuits, the cathode-ray tube light source and the necessary power supplies.



The standard tube has a phosphor coating with a green luminescence and a decay time of less than 1 microsecond. Where greater light intensity is required, a yellow-green phosphor with a decay time of about 6 microseconds is available. In addition, special phosphors with ultra-violet or blue luminescence can be supplied.

For further information contact Cossor (Canada) Ltd., 72 Grenville St., Toronto 5, Ontario.

## Stereophonic microphone *Continued from page 31*

interchange the left and right signals. Consequently, it is only necessary to make certain that the loudspeaker phasing is correct to obtain the proper stereo effect. Since the sum signal contains all the monophonic information, it can be used to feed the main channel of an FM multiplex system and thus be perfectly compatible with existing monophone equipment.

It appears desirable that, for professional equipment, facilities should be such that as much processing and handling is done on a sum and difference basis as possible, and that such things as tape players, turntables and the like should have sum and difference outputs with left and right, if the manufacturer feels generous. The sum signal allows adequate monitoring and is a well balanced signal available for use by those people not equipped to decode the stereo signal. Tape recordings done on the sum and difference basis allow greater latitude in the adjustment of controls, and distortions due to differences in signal to noise ratios, frequency response, etc., of the two channels tend to be smoothed out.

Figure 5 shows the method of converting a sum and difference signal to a left and right signal in the output of the two power amplifiers.

It seems appropriate in the early stages of stereo to make a plea for more natural recordings. It is possible to obtain weird and wonderful pseudo-stereo effects by manipulation of the electrical signals. However, it must be remembered that the role of recording and reproducing equipment is to re-create, as naturally as possible, the original sound.

The authors wish to acknowledge gratefully the co-operation of Mr. W. Woods and Mr. W. Maude for their assistance during the microphone tests

#### REFERENCES:

- (1) Clark, Dutton and Vanderlyn: "The Stereoscopic Recording and Reproducing System". Proceedings of the Institute of Electrical Engineers, September 1957.
- (2) Blumlein, A.D. British Patent No. 394325.
- (3) Vakhitov I. S. & Man'kovskii V.S. "On the Shape of Directivity Patterns of Microphones Employed in Stereophonic Sound Reproduction". Acoustics Journal (Russian) April 1957



# News Report

*A monthly roundup of news and personnel changes in the Canadian electronics industry*

## E. H. Oliver Named General Manager

Appointment of E. H. Oliver as general manager, Electrical Supplies Limited, Winnipeg, was announced on October 1st by Noel Cuthbert, president, treasurer, and board chairman.



E. H. Oliver

Mr. Oliver is also vice-president of the company. He joined them in 1940 and has been sales manager since 1945.

Electrical Supplies Limited distribute Marconi radio and television, Moffat thermomatic ranges, Capitol records — as well as many leading wiring and electronic lines.

## C.N. Telegraphs Open New Montreal Center

Two million dollars' worth of telegraph equipment has been put into operation at Montreal by Canadian National Telegraphs.

Known as a reperforator switching system the new center will flash an immense volume of messages, not only between Canadian points but to and from all parts of the world. It has a direct-line hook-up with every office in Quebec Province and 120 telegraph offices at major points from Newfoundland to Vancouver. Direct connections also link it with the Western Union network in the United States.

Operation of the new center climaxes six months' installation work by CN Telegraphs crews. To link the equipment, they made no fewer than 250,000 soldered connections. There are 1,162 miles of cable conductors between the switching units, and another 250 miles of wiring within the units. Six railway box cars were required to transport the equipment.

All the complicated planning to integrate the center into the CN communication system was done by the company's traffic experts. The practical capacity of the new equipment is 82,000 messages per day.

The switching center — known to CNT as "Plan 23" — occupies 5,000 square feet of floor space on the fourth floor of the Bonaventure Building, 600 Windsor Street.

## Standard Telephones & Cables Announce New Computer

Standard Telephones & Cables Mfg. Co. (Canada) Ltd., have released details of their latest electronic digital computer — Stantec-Zebra. Although amongst the lower priced computers it nevertheless appears to offer great flexibility in a wide variety of different applications.

Designed initially by mathematicians for mathematicians, 'Stantec-Zebra' will obviously prove a valuable asset to those engaged in research in many fields, and in engineering and design work of many kinds. It has already proved its value in dealing with industrial and commercial problems where these can be expressed in terms of mathematical equations.

This new field of the application of mathematics to industrial problems is well illustrated by the use to which one of these machines is already being applied. Briefly, the problem is to determine the most economical use of available raw materials in the production of a particular range of end products.

## RCA Appointment



J. D. Houlding

*P. J. Casella, president, RCA Victor Company, Ltd., announces that the board of directors at its meeting held at the head office in Montreal on October 16, appointed J. D. Houlding as vice-president and general manager. Formerly Mr. Houlding was vice-president, Technical Products, including Defense Systems, Tubes and Research Divisions.*

## Toronto IRE Members Tour Bell Telephone Facilities

The Bell Telephone Company of Canada was host to the Toronto Section of the IRE at the second of the IRE's technical meetings for this season. A record crowd toured the Telephone Company's new Direct Distance Dialing facilities in Toronto.

Telephone facilities provided by the Bell Telephone Company have grown remarkably during the past few years. The most significant and noticeable addition to their facilities is, of course, the Direct Distance Dialing Plan which has been introduced gradually over a period of time to many interconnected areas on the North American continent. In Toronto Direct Distance Dialing (DDD) is only a few months old at this time but even so it now counts for some 39% of long-distance telephone traffic originating in Toronto. Equipment providing this service is centralized in the Telephone Company's Asquith Building. A recent addition to this building was necessary to house additional equipment. The many features of the Asquith Building which were seen by the Toronto Section IRE members and friends were explained by technical representatives of the Company. This DDD equipment center is the first of its kind in Canada. Windsor had direct distance dialing service before Toronto, but subscribers there depend upon equipment in Detroit. Canada's second installation was in Guelph last June, and Montreal's installation will be early in 1960.

## CKVR - TV Barrie, Increases Power

With the installation of additional amplifiers, Channel 3, Barrie will go on the air with the full allowable E.R.P. of 100,000 watts.

This Standard Electronics Corporation equipment purchased from Philco Corporation of Canada Limited, Government and Industrial Department consists of two cubicles. One aural 12½ KW, and one visual 25 KW.

These units are completely self contained with transformers mounted within. No external water or air supply is needed for cooling.

Of the 53 tubes used there are only 8 different types. All controls are conveniently located at the front of cubicles and results are easily readable on large meters.



## SPC Announces New System of Communication

High voltage electrical transmission lines are now being used as a means of communication in the Saskatchewan Power Corporation's northern electrical system. Because of the need of flashing information concerning abnormal situations from one end of the transmission line to the other, the Corporation found it necessary to install power line remote control equipment. Since this equipment can be used with only very slight modification to transmit telephone conversations or messages by teletype, the Corporation has installed a complete communication system over its 138,000-volt transmission lines which enable all information concerning operating problems to be relayed immediately between power generating stations.

Harold Kaldor, SPC communications engineer, stated that the initial stage, first placed into operation in September, links Saskatoon and Wolverine by means of 138,000-volt lines, and North Battleford, Saskatoon, and Prince Albert by means of 72,000-volt lines. This system will also provide a remote control link of the substations at North Battleford, Saskatoon and Wolverine. On the occasion of a power outage, a signal will be sent to the operating points, tripping the circuit breaker at the other end of the faulty line. This will leave the remainder of the system intact, minimizing the area affected.

This power line carrier system will be extended next spring to Hawarden, Pasqua, Regina, Weyburn, Boundary Dam Generating Station, Estevan, Yorkton and Beatty, providing immediate communications between all major electrical installations in Saskatchewan.

## Admiral Adopts New Sales Technique For Hi-Fi

Admiral stereophonic high fidelity instruments are speaking directly to the retail customer these days, via a new "turntable salesman."

Bert Bartholomew, product manager — radio and hi-fi, announced that Canadian Admiral Corporation has created a 12-inch demonstration stereo record which (1) narrates the whole story of what stereo hi-fi is and (2) demonstrates the tone quality of Admiral sets with specific sound effects.

This special recording is now included with several models shipped from the factory. It is played in the showroom in lieu of a semi-expert "spiel" on the part of the floor salesman, and goes to the purchaser's home along with the instrument.

The record was developed by the company to supplement its sales training program and to overcome what the electronics industry — as well as virtually every other industry — has come to recognize as the tendency of the retail salesman to be too much an order-taker and too little a hardsell, aggressive sales-seeker.

Admittedly, stereo requires a great deal of explanation to the uninitiated consumer. Canadian Admiral believes this demonstration record will be a highly successful educational medium.

## Ferro Enamels Canada Ltd. Obtain Manufacturing License

Ferro Enamels (Canada) Ltd. has been granted an exclusive license by Industrial Enterprises, Inc., to manufacture and sell in Canada the complete line of NoVo Sonic Sifters and Filters, E. A. MacDonald, President of Ferro Enamels (Canada), announced recently.

Ferro Enamels, with headquarters at Oakville, Ontario, will make available to Canadian industry NoVo Sonic Sifters, NoVo Sonic Wet Screens, NoVo Sonic Filters and the Schallfix laboratory analysis equipment.

These new machines, which have five times the production capacity but use only one-third the power of present day equipment, apply the principles of sonic vibration to sifting and filtering operations. They were developed in Germany and have been used for a number of years in a wide variety of industries in Europe. NoVo Division of Industrial Enterprises, Inc., has adapted the German machines to American and Canadian needs and in some cases has extended the limits of their use through new applications and developments.

## Muirhead Instruments Appoints Two To Executive Posts

A. J. Muirhead, vice president and general manager of Muirhead Instruments Limited, Stratford, Ontario announced the promotion of F. E. Lyons to the position of product manager and N. G. Arkell to the position of project manager.

## Onan Adds A New Distributor In Canada

A new distributor for Onan Products in Edmonton is announced by Hiram Hascall, vice president - sales, D. W. Onan & Sons Inc., Minneapolis, Minnesota.

The new Canadian distributor is Simson-Maxwell Alberta Ltd., 10325-59th Avenue, Edmonton, Alberta.

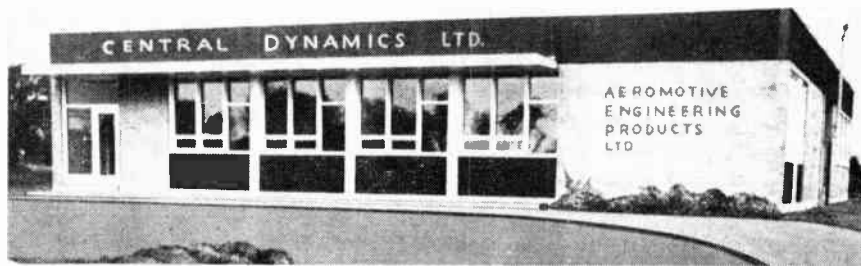
In addition to its regular lines of merchandise, the firm will now handle the complete line of Onan Gasoline and Diesel Electric Generating Plants, Air Cooled Engines and Separate Generators.

## New TV Color Course

Canadian General Electric has introduced a new 135 page manual "Color TV Principles and Practices," designed to provide up-to-date practical information about this subject to service dealers. The color manual is available through authorized G-E tube jobbers.

Contained in the manual are six sections of NTSC standards, TV systems, specifications, data, theory, and six pages in color detailing trouble shooter hints and suggestions. The comprehensive manual is written in an easy to read style with interesting and easy to follow drawings, diagrams and charts.

## New Offices and Warehouse



Shown above is the new building which has recently been completed on the outskirts of Montreal for Aeromotive Engineering Products Ltd.

Aeromotive Engineering Products Ltd. are sales agents and distributors for a number of American and European companies manufacturing electric, electro-mechanical, electronic, aircraft hydraulic and pneumatic components and equipment.

The new building is located at 147 Hymus Blvd., Pointe Claire, Que., and is to be shared with Central Dynamics Ltd., who will provide repair and overhaul facilities.

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## Canadian Survey Equipment Passes U.S. Operational Test

Canada's most efficient radar aid to surveying and mapping techniques, the Airborne Profile Recorder, has successfully completed its operational tests in the Lockheed RC-130 aircraft carrying out the new U.S. Air Force program of bringing the world's geography up to date. The average accuracy of  $\pm 10$  feet was met as specified. When this giant mapping project is fully under way, fifteen APR-equipped RC-130's will be taking part. They will be flown by the 1370th Air Photographic Group of the U.S. Air Force, based at Palm Beach, Florida.

The Airborne Profile Recorder (APR), designed and built in Toronto by Canadian Applied Research Limited, underwent stringent testing by the U.S. Air Force, along with other systems, before the Canadian company's instrument was chosen for the project. The APR is now in full production at the Toronto plant and deliveries are proceeding on schedule.

## Computer Designs Save Ten Per Cent In Steel

A Toronto engineer, Murray Lount, P. Eng., is blazing a pioneer trail in a new field of engineering — that of using the superhuman speeds of an electric computer to revolutionize the technique of calculating the design of a modern building.

The Toronto firm — A. M. Lount and Associates — entered the computer field on a 100 per cent basis when they realized that the engineering application of computers implied something more than just going to a mathematician for a solution.

Said Mr. Lount, explaining the set-up of his offices on Eglinton Avenue in North-central Toronto:

"We came to realize that every engineering problem called for an engineer to set up the computer. Our work put us in close contact with computer developments in the United States and we found that, with computers such as the one we use, something more than a saving of time was achieved. Using this machine (A Bendix G15D) — which is primarily a scientific engineering tool as opposed to a commercial computer — the old pre-war method of designing by approximate methods no longer served.

"For example, designing a 4-storey building by the old approximate (and manual) methods would have taken one or two days of calculations and the results would only have been approximate.

"Today, taking the same job, it would be done with the computer and

the whole operation could be finished in three hours. But in addition to arriving at the exact instead of the approximate structural information, it is found — by actual calculations of a specific project—that a saving of 10% in steel was achieved. The old 'hand-book' system of using empirical formulae made it necessary to allow a larger safety margin."

Mr. Lount predicts that the advent of engineering electronic computers will rank as one of the greatest achievements of the 20th century, by completely changing the engineer's point of view.

"Essentially," says Lount, "it will remove the drudgery of lengthy calculations, thereby releasing engineers for creative thinking."

## Air-Marine Motors, Inc. Appoints Canadian Distributor

Announcement has recently been made by Aircraft Appliances & Equipment Limited, Box 177, Toronto 15, Ontario of its appointment as Canadian distributor and overhaul contractor for Air-Marine Motors, Inc. of 369 Bayview Avenue, Amityville, N.Y. and 2221 Barry Ave., Los Angeles, California.

Air-Marine Motors specializes in a highly demanding field: the design, testing, and manufacture of subfractional and fractional horsepower motors, blowers, and fans essential to electronic and control equipment.

## Appointed President



**A. Ainaly**

Lake Engineering Limited has announced the appointment of Art. Ainaly as president of the company, at a recent directors' meeting. Mr. Ainaly joined Lake Engineering Limited in September 1955 as vice-president and general manager. Mr. Ainaly is a senior member of IRE, past chairman of Hamilton IRE section and junior member of the Engineering Institute of Canada.



**Cossor (Canada) Limited  
To Handle Dawe Instruments**

Cossor (Canada) Ltd., announce that effective October 1st, they have taken over the facilities of the Canadian Office of Dawe Instruments Ltd., of Ottawa.

Mr. S. A. Rybb, M.Sc. (Eng.), P.Eng., formerly manager of the Canadian Office of Dawe Instruments, has joined Cossor (Canada) Ltd., as manager of instrument sales, which includes the products currently manufactured and distributed by Cossor and those formerly handled by Dawe Instruments, namely A. C. Cossor Ltd., Cossor In-

struments Ltd., Cossor Radar Ltd., Dawe Instruments Ltd., Evans Electro-selenium Ltd., Rank Cintel Ltd., Rotschild, Spencer Kennedy Inc., and General Radiological.

Cossor's Toronto office at 72 Grenville Street, becomes the center for their instrument sales, with branch offices located in Montreal and Ottawa, and the head office and plant in Halifax, N.S., covering the Maritime Provinces. Substantial stocks of instruments and servicing facilities are being maintained in Toronto and the opening of showrooms is being contemplated in the near future.

**Canadian Station Changes**

Three Canadian radio stations undertook extensive reorganization of equipment recently following transmission site and frequency changes.

Station CFCW in Camrose, Alta., took delivery of a new Gates BC-IT transmitter from Canadian Marconi.

For a recent power increase to 1 KW, change of frequency and switch to a new transmission site, CKSF, Cornwall, Ontario, installed a similar transmitter.

Canadian Marconi also provided Gates phasing and antenna coupling equipment for CFOS, Owen Sound.



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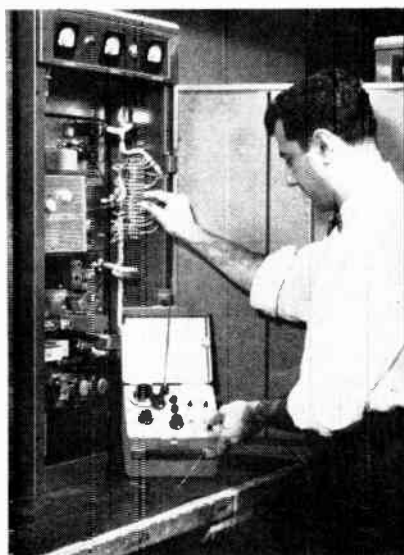
**ELMWOOD  
casino** DETROIT PHONE WO 5-6877

**ELMWOOD MOTOR HOTEL  
and CASINO  
WINDSOR, CANADA**

DETROIT PHONE WO 5-3320



*verify transmitter frequency—  
any channel, (25 MC to 470 MC)  
EASILY, QUICKLY, POSITIVELY!*



**DU MONT**®  
**TYPE 5890-A/B**  
**24-CHANNEL**  
**TRANSISTORIZED**  
**MOBILE**  
**RADIO**

## FREQUENCY METER

**A Du Mont exclusive!** The Du Mont Frequency Meter is a compact, accurate piece of test equipment that every user of mobile radio needs. It covers any rf channel between 25 MC and 470 MC. The Frequency Meter permits a direct comparison of transmitter frequency on any one of 20 rf channels. Error between transmitter and assigned frequency is indicated on easy-to-read meter, or monitored aurally through headphones. The Frequency Meter also provides crystal-controlled rf and if frequencies for precise receiver alignment, and a 1 kc audio signal which permits accurate setting of transmitter deviation limiter.



### FEATURES

- 24 rf/if channels and 1 kc audio signal.
- Guaranteed accuracy:  
Type 5890-B,  $\pm .0005\%$  ( $+20^{\circ}\text{C}$  to  $+40^{\circ}\text{C}$ )  
Type 5890-B,  $\pm .00025\%$  ( $+20^{\circ}\text{C}$  to  $+50^{\circ}\text{C}$ )
- Transistorized. Battery operated.
- Modulation deviation check.
- May be used as signal generator for receiver checking, including up to 4 if frequencies.
- Checks adjacent- or split-channel equipment.
- Measures transmitter relative field strength.
- Built-in counter calibrating facilities.
- Built-in battery checker.

**\*Write For Complete Details...**

Canadian Distributor:  
**ELECTRONIC SERVICE SUPPLY COMPANY**  
210 - 9th Avenue East Calgary, Alberta  
Branches or representatives  
in most Canadian cities.

### J. G. Little Appointed General Manager

J. G. Little has been appointed general manager of the wire and cable division of the Northern Electric Company, Limited, succeeding W. H. Eastlake who retired on October 31.

Mr. Little was born in Trenton, Ontario, received his early education there and graduated in engineering from the University of Toronto in 1928.



J. G. Little

He joined the Northern Electric Company upon graduation and was successively engaged in various engineering capacities and, in 1942, was appointed technical superintendent in

charge of manufacturing engineering in their telephone division.

In 1946 he was appointed works manager of their electronics division and in 1950 he was transferred from that division at Belleville, Ontario, to the wire and cable division, Montreal, as works manager. In 1956 he was appointed assistant general manager of that division.

He is a member of the Engineering Institute of Canada and the Corporation of Professional Engineers of Quebec.

### Appointment



R. W. Watler

A. J. Muirhead, vice-president and general manager, Muirhead Instruments Limited, Stratford, Ontario, is pleased to announce the appointment of R. W. Watler, A.M.I.E.E. as chief sales engineer. Mr. Watler was formerly servo systems engineer with Muirhead's English parent company.

# Switchboard efficiency to meet your needs!



## No. 555

### PRIVATE BRANCH EXCHANGE

This is a modern switchboard with the new "plug-in" type units, permitting actual service requirements to be closely met.

Available in capacities of

- 60 and 120 Station Lines
- 14 Central Office Trunks
- 15 Cord Circuits

Two positions may be installed side-by-side to increase the maximum capacity to 240 lines.

The low design makes it convenient for attendant-receptionists to converse with employers' visitors or client over the top of the switchboard.

## No. 507

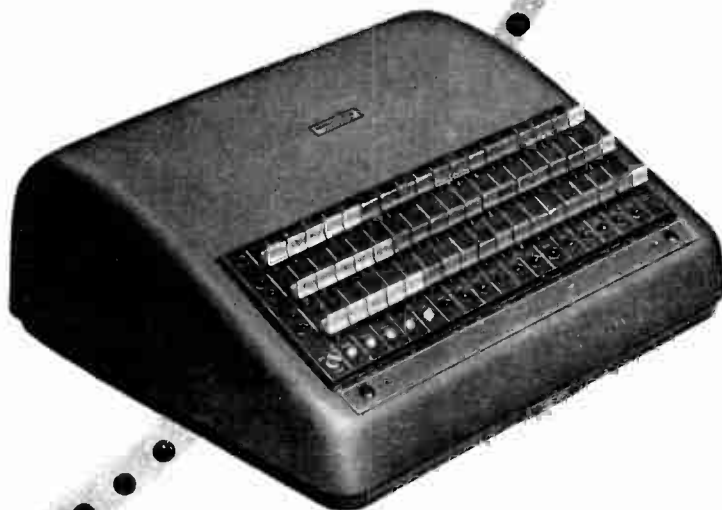
### PRIVATE BRANCH EXCHANGE

A small compact switchboard with a capacity of

- 12 Station Lines
- 5 Central Office Trunks
- 5 Connecting Circuits.

Requires about the same amount of space as the average typewriter.

Convenient and simple to operate by an attendant with other duties.



# Northern Electric

COMPANY LIMITED

44 BRANCHES THROUGHOUT CANADA



**FOREMOST IN  
SONAR  
UNDER WATER ACOUSTIC DETECTION  
AND RANGING EQUIPMENT**

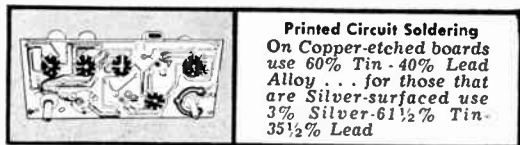
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**MORE** *ACTIVE!  
EFFECTIVE!*



**THE BEST FOR TV-RADIO WORK . . .  
EVERYTHING ELECTRICAL**—Kester "Resin-Five"  
Core Solder is better and faster than any solder ever  
developed. It has an activated flux-core that does a perfect job on  
all metals including zinc and nickel-plate. The flux residue  
is absolutely non-corrosive and non-conductive.

Available in all practical Tin-Lead  
Alloys; 40/60, 50/50 and 60/40 in  
diameters of  $\frac{3}{32}$ ",  $\frac{1}{16}$ ",  $\frac{3}{64}$ ",  $\frac{1}{32}$ " and  
others.



**Printed Circuit Soldering**  
On Copper-etched boards  
use 60% Tin - 40% Lead  
Alloy . . . for those that  
are Silver-surfaced use  
3% Silver-61½% Tin-  
35½% Lead

**KESTER SOLDER COMPANY**  
OF CANADA, LTD., Dept. U Brantford, Canada

**J. R. Longstaffe Co.  
Staff Promotions**

J. R. Longstaffe, president of J. R. Longstaffe Co. Ltd., and Associated Companies, has announced the following appointments.

Mr. K. J. Davis is the newly appointed general manager of International Resistance Co. Ltd. He is a graduate of Radio College of Canada and joined the company in 1945 in the Production Quality Control Department for fixed composition resistors. After various production jobs,



K. J. Davis

Mr. Davis joined the I.R.C. sales department on the order desk. In 1951 he was appointed sales manager and held this position until this new appointment.

Mr. A. F. Askew is the new sales manager for Renfrew Electric Limited, Renfrew, Ontario. Mr. Askew joined the company in 1952 as advertising manager and was responsible for the establishment and operation of the newly formed advertising department.



A. F. Askew

Mr. J. Dunsmoor has been appointed supervisor in charge of the Jobber Sales Division. Mr. Dunsmoor, who recently joined the organization as a jobber salesman, spent over twenty years in the electrical appliance, radio, television and hi-fi sales field.



W. R. Longstaffe

Mr. W. R. Longstaffe becomes the general manager of the Relay & Speaker Division. Mr. Longstaffe joined the company in 1953 as an apprentice after graduating from the University of Western Ontario. In 1955, after completing his apprenticeship program, "Production Methods & Administration", he was transferred to the relay division in charge of production planning and was responsible for setting up the Canadian manufacturing facilities.

Mr. B. F. Lord becomes manager of Radiovision Sales Ltd., Calgary, Alberta. Mr. Lord joined the company in 1950 on the sales desk. In 1952 he



was appointed distributor salesman and in 1955 was promoted to distributor sales supervisor for all companies. A graduate of the Radio College of Canada, Mr. Lord held the position of distributor sales supervisor until this appointment.



**B. F. Lord**

Mr. J. E. Partridge is the new general manager of Amphenol Canada Limited. He joined the company in 1954 when Amphenol Canada Limited was first formed. At that time he was in charge of setting up all Canadian manufacturing facilities of this company. Prior to 1954, Mr. Partridge spent several years with the Ontario Hydro as a supervisor in the 60 cycle conversion program.



**J. Dunsmoor**

Mr. E. D. Smith is the new general manager of Airtron Canada Limited. Mr. Smith, a member of the I.R.E., joined the company in 1954. At that time he was salesman in charge of Eastern Ontario territory. In 1957 Mr. Smith was appointed sales manager of Airtron Canada Limited, a newly formed company. Prior to joining this organization he had his own firm manufacturing electronic and medical equipment.



**E. D. Smith**

Mr. B. D. Vallillee becomes sales manager of the International Resistance Company Limited. Mr. Vallillee joined the organization seven years ago on the I.R.C. sales order desk. After spending two years in this position, he was made industrial salesman in charge of the Western Ontario territory.



**B. D. Vallillee**

This association of companies with plants in Toronto and Renfrew manufacture a complete line of resistors, relays, speakers, transformers, micro-wave components, connectors, cable and other electrical and electronic component parts.

**SHOCK**

name  
your  
punish-  
ment...

and you'll find the Helipot Series T  
all-metal single-turn precision  
potentiometer can take it!

Name your linearity, to  $\pm 0.20\%$ ...your  
resistance, from 650 to 100,000  
ohms...up to 5 ganged sections

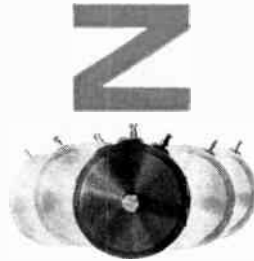
and 9 taps per section...servo or  
bushing mount, with bearings  
front and rear for perfect alignment.

Put them all together, in the T's  
new cup-type housing, and you'll  
have the best-value miniature

you can design into your system!

For the full T-Pot Story, whistle for  
cata file E112.

potentiometers : dials : delay lines : expanded scale meters : rotating components : breadboard parts



The T  
takes  
50G's  
meeting  
MIL-R-19;  
exceeding  
NAS 710  
proc. III

**VIBRATION**

The T  
takes  
500 cps  
at 30G's,  
meeting  
NAS 710  
proc. III

**ACCELERATION**

The T  
takes  
100G's,  
exceeding  
MIL-R-19

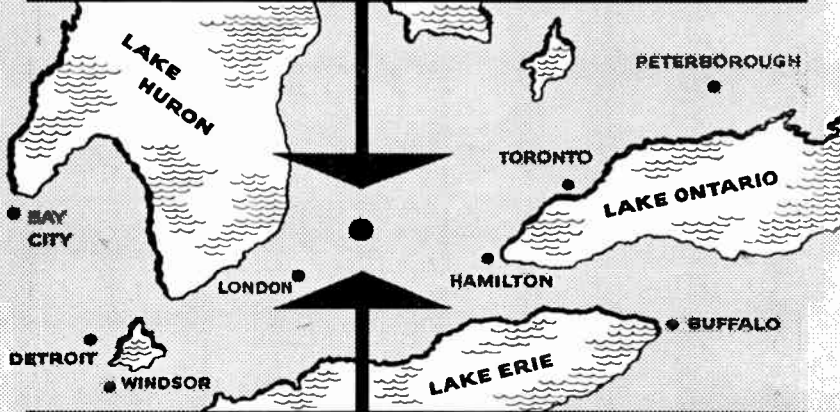
The T  
takes  
 $-55^{\circ}$  to  
 $+125^{\circ}$ C,  
with 1.2  
watts  
at  $40^{\circ}$ C

**TEMPERATURE**

**Beckman® Helipot®**

Helipot Division of  
Beckman Instruments, Inc.  
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Toronto 18, Ontario  
Sales Representative:  
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Don Mills, Ontario

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Ontario**

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and other precision electrical instruments

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PRECISION ELECTRICAL INSTRUMENTS

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## C. G. E. Appoints J. R. Oakley Sales Manager

John R. Oakley has been appointed Sales Manager — Semiconductor Products in Canadian General Electric's Electronic Tube Section, according to an announcement by Vernon B. Dowdell, Manager of Marketing.

Mr. Oakley, who was previously engaged in design engineering for the company's Electronic Equipment Section, will now be responsible for sales and application of semiconductor products. Mr. Oakley is a graduate of the Institution of Electrical Engineers, London, England, and is registered in Ontario as a professional engineer.



J. R. Oakley

Since joining Canadian General Electric in 1954, Mr. Oakley has held important assignments in defense activities. In 1954 he worked as a development engineer on the APG-501 airborne radar set used in RCAF Sabre aircraft. Later he served in Europe as a Technical Representative for CGE to the RCAF. In 1957 he returned to Canada and joined an advance engineering team working on the development of data link equipment. His final assignment before joining the Electronic Tube Section was in the development of ultra low frequency oscillator equipment for the RCN.

Mr. Oakley has his office at 189 Dufferin Street, Toronto.

## Frank R. Deakins

After a lengthy illness, Frank R. Deakins, chairman of the board, RCA Victor Company, Ltd., died November 4th at his son's home in Valley Forge, Penn.



F. R. Deakins

Born in Jasper, Tenn., U.S.A., Mr. Deakins was educated at the Alabama Polytechnic Institute (B.S.). After a number of years with the Radio Corporation of America, Mr. Deakins joined RCA Victor in Canada as vice president in 1932. On April 1st, 1944 he was appointed president and on September 21, 1956 was named chairman of the board. A member of St. James Club, Royal Montreal Golf Club and the Seignory Club, he was as well past president of the Electronic Industries Association.



## Tele-Radio Systems Limited

### Appointed Canadian Reps

Tele-Radio Systems Ltd., 3534 Dundas Street W., Toronto 9, Ont., have been appointed exclusive Canadian representatives for the Communications Division of Hallamore Electronics Co., Anaheim, California.

Hallamore manufacture E-type negative impedance repeaters under license from Western Electric. Bell System practices apply to these units which are electrically and mechanically equivalent to WE E-2 and E-3.

In addition Tele-Radio Systems Ltd. have also been appointed Canadian representatives for Radio Specialists Co. of Denver, Colo., manufacturers of the world's only 450 mc. FM walkie-talkie.

## CBC Gets Marconi Cameras

The CBC's new television studios in Montreal and Toronto are equipped with Marconi TV cameras. A recent order of eight additional Mark III camera channels brings the total number of Marconi cameras purchased by the CBC to nearly seventy.

The studios — largest and most extensively equipped in Canada—will each house four of the new cameras, with further expansion scheduled for the near future.

The Mark III camera channels can be used with either the 3 inch or 4½ inch image orthicon tube.

## Representative



W. M. Hummel

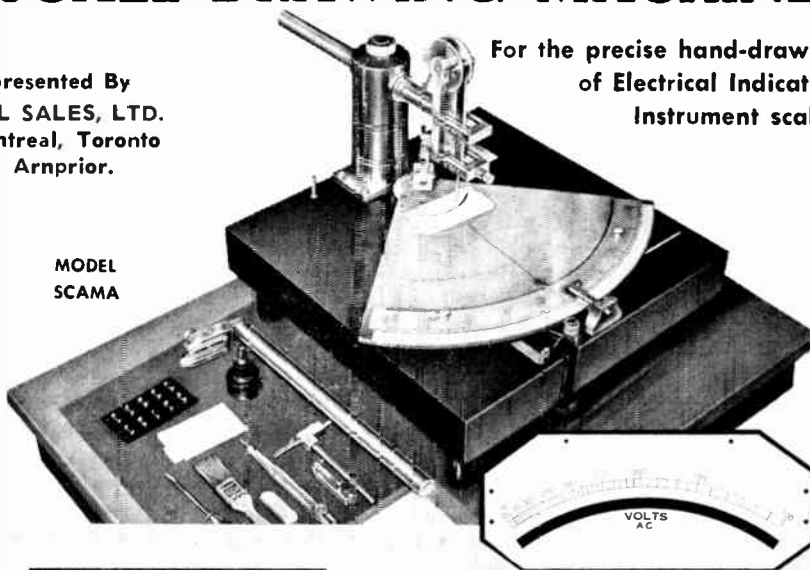
Bradford Components, Inc. of Salamanca, New York, announce the appointment of William M. Hummel, 150 Pinewood Trail, Port Credit, Ont., as their exclusive manufacturer's representative for Canada. At the same time it has been announced that Mr. Hummel has been appointed exclusive Canadian manufacturer's representative for Connector Corporation of Chicago.

*"The accuracy of an instrument is no better than its calibrated scale."*

# SENSITIVE RESEARCH SCALE DRAWING MACHINE

Represented By  
**MEL SALES, LTD.**  
Montreal, Toronto  
and Arnprior.

For the precise hand-drawing of  
Electrical Indicating  
Instrument scales.

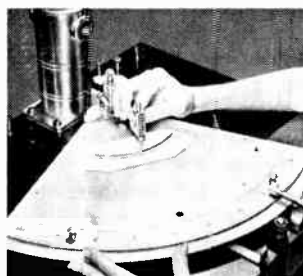


MODEL  
SCAMA

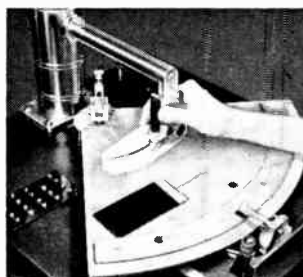
Typical AC-DC Polyrange scale



Drawing scale calibration lines



Drawing scale arcs



Printing scale numerals

The Model SCAMA is designed for use by military and industrial personnel engaged in the repair and maintenance of electrical indicating instruments. It is an exact duplicate of the scale drawing machines used in SRIC's own production laboratories for the past 31 years.

Wherever the efficient in-plant repair of indicating instruments is a necessity, the economies of owning a scale drawing machine are readily apparent. The best craftsmen, furnished with the finest electrical standards, are still inadequately equipped if they lack the means necessary to "wrap the job up" by restoring the instrument to its original accuracy. It is incongruous that the one thing that is usually missing is the equipment to match or re-draw the instrument's scale to its pointer deflection. The Model SCAMA is furnished complete with all necessary accessories to draw and print any flat scale plate to infinite accuracy. Included is a 40-hour course of instruction in its use given at SRIC's plant.

If you are an organization or group actively engaged in the repair of electrical indicating instruments, we urge you to investigate further the potentialities of the Model SCAMA.

## SENSITIVE RESEARCH INSTRUMENT CORPORATION

NEW ROCHELLE, N. Y.

ELECTRICAL INSTRUMENTS OF PRECISION SINCE 1927







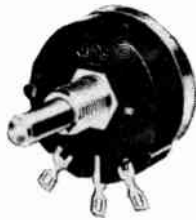
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New 2 Watt (Type 2W) and 4 Watt (Type 2WP) Rheostat — Potentiometers with Smaller — More Compact Design. Providing:

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- Greater Dust Protection
- Increased Mechanical Rotation
- More Resistance Values
- Increased Electrical Rotation
- Tapered and Tapped Windings Available

Design-Resistance Values and size of the 2 and 4 Watt Units are identical. Designed for Current & Future Electronic Circuits, this Modern Unit Offers Maximum Application Adaptability.

For Further Information Write to Dept. 35 for Data Bulletin No. A-3



Type 2W  
CAMESA Approval  
No. 2572



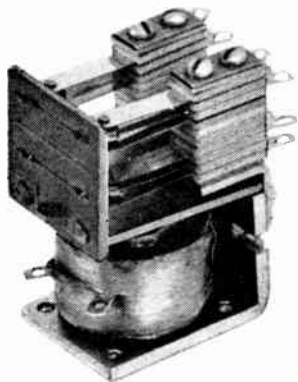
## INTERNATIONAL RESISTANCE CO. LTD.

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SALES OFFICES:

Radiovision Sales Ltd. 492 Somerset St. West 5890 Monkland Ave.  
325 Tenth Ave. West Ottawa Montreal  
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## "Made in Canada"

OSBORNE'S new general purpose relay, Type F, features multiple contacts, rugged dependability, and low cost.

Available in all standard coil voltages, either a.c. or d.c., and with standard contact arrangements, from SPST to 4PDT rated eight amperes.

This relay is also available to special order, with coils for any voltage or frequency, a.c. or d.c., and with contacts up to 1/4" diameter in any arrangement within the capacity of the relay frame.

Manufactured by

## OSBORNE ELECTRIC COMPANY LTD.

95 WESLEY STREET TORONTO 18, ONT.

"Specializing in custom built relays"

# OTTAWA

Canada's Capital City  
*Your year 'round playground*

**Spring** — Tulip Festival "during May"

**Summer** — Fishing, Hunting

**Fall** — Carnival of Colors — Gatineau Hills  
Late September, Early October

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Experimental Farm      National Art Gallery

. . . . Plus many other places of interest

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Only steps from the Parliament Buildings, leading stores, railway terminal, and theaters. 400 rooms with bath and shower. TV and Radio in all Guest Rooms.

**CAR PARK**  
—supervised on premises (100 cars)  
Single from \$6.00 Double from \$9.00  
**FAMILY PLAN**

Tours on week-ends arranged for School Groups. Write the manager for complete information and Club Rates.



## FOR SAFE SHIPMENT OF DELICATE EQUIPMENT



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- Dural Body
- Weather-Proof
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- Foam Padding
- No fatigue or low-temperature problems
- Made to order for sure fit

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(State, when applicable, whether electronic equipment or components are manufactured, sold, or used in manufacturing, etc.)

Signature ..... Position .....  
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Name ..... Position .....

Company ..... Nature of Business .....

Street ..... City ..... Prov. ....  
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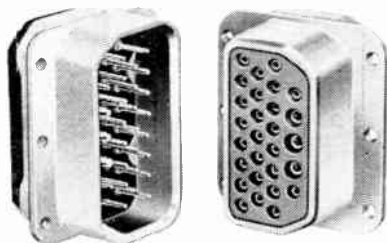


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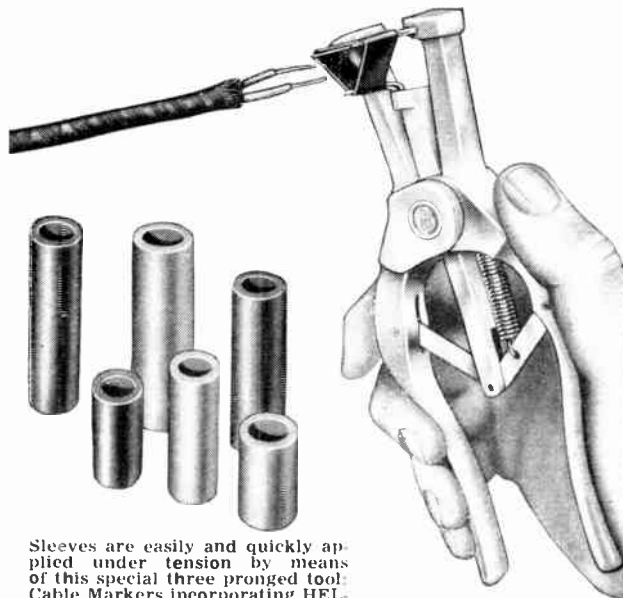
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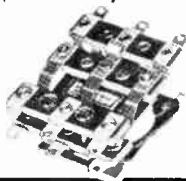


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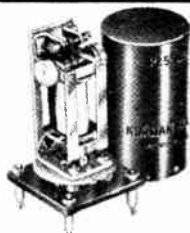
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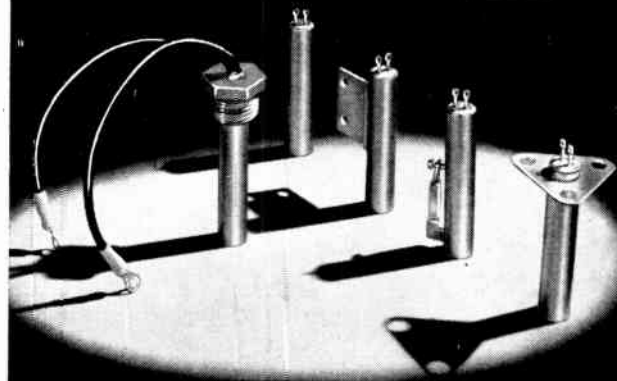
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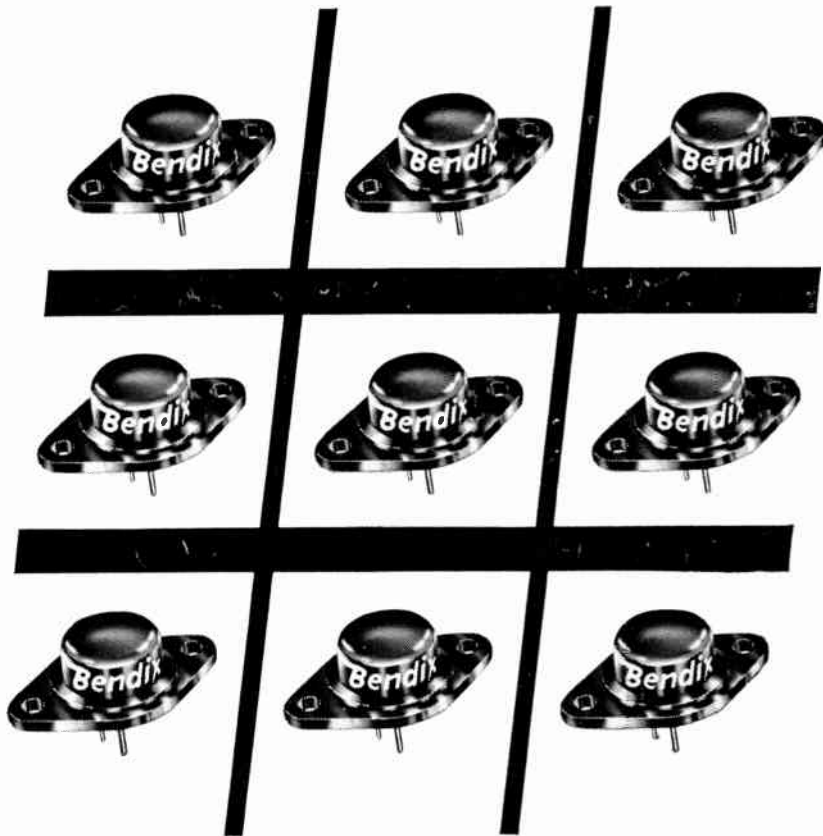
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## RCA Appoints J. G. Sutherland General Manager

J. D. Houlding, vice-president and general manager, RCA Victor Company, Ltd., has announced the appointment of J. G. Sutherland as general manager, Technical Products Division which comprises engineering products, research and defence systems. Mr. Sutherland was formerly manager of the company's engineering Products Division.



J. G. Sutherland

Born in Winnipeg, Mr. Sutherland graduated in electrical engineering from the University of Manitoba. After a period of service with the Royal Canadian Corps of Signals, Mr. Sutherland joined the Engineering Products Department of RCA Victor in 1946 and has been closely associated with all phases of the company's activities in the electronic field.

Mr. Sutherland is a member of the Professional Engineers of Quebec and is a senior member of the IRE.

## Personnel Director



W. C. Black

William C. Black, whose appointment as director of personnel was recently announced by P. J. Casella, president, RCA Victor Company, Ltd. Mr. Black, educated at Queen's University, has had a wide experience in the industrial personnel field both in Toronto and Montreal. He is a member of the Montreal Personnel Association and is a former president of Toronto Personnel Association Inc. Mr. Black is also chairman of the program committee of Industrial Relations Center at McGill University.



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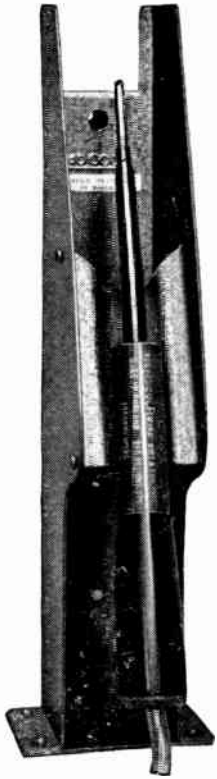
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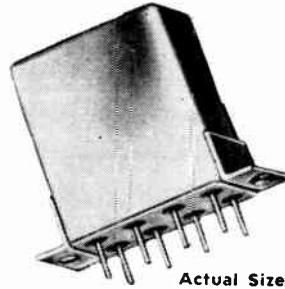
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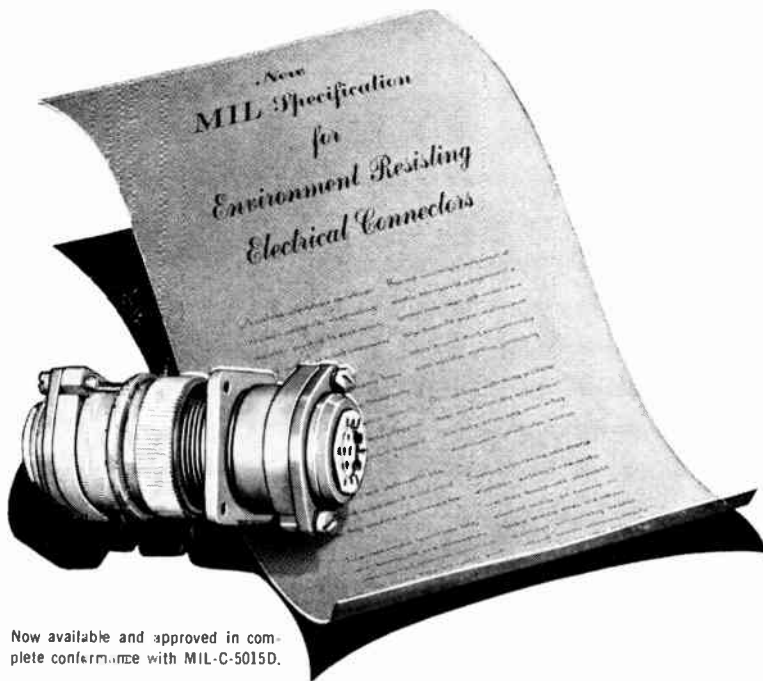
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# Book Review

**Switching Circuits And Logical Design** by Samuel H. Caldwell, Professor of Electrical Engineering, Massachusetts Institute of Technology.

This book deals with the methods used to handle the problems of circuit synthesis using various kinds of components, and presents the principles of switching circuit design. It provides the fundamentals which, when mastered, will promote a knowledge of the complex applications of switching theory.

The broad coverage ranges over a wide field of application. The author first establishes mathematical ideas that apply throughout the subject, and then brings out the relationships between new topics and older ones. The material has been selected and organized to help the reader achieve an understanding that will enable him to create his own methods for handling new problems.

The book discusses such things as the properties and applications of switching circuits; switching components and their characteristics, including relays and high-speed components; contact networks; gate circuits; and switching aspects of codes.

**Switching Circuits And Logical Design** is published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N.Y., contains 686 pages, hard cover bound, price \$14.00.

**Progress In Semiconductors (Volume 3)**, edited by A. F. Gibson, P. Aigrain, and R. E. Burgess.

At the present time, when hundreds of papers on semiconductors and allied subjects are published every year, it is difficult for any one specialist to read more than a small fraction if he is to leave any time for original work. This is true even with papers in his own particular field, and it is almost impossible for him to keep abreast of developments in related subjects, developments which may have considerable bearing on his own work.

This annual series of volumes is planned to meet this difficulty. A limited number of topics taken from the whole field of semiconductors will be included each year. The articles generally will be critical reviews, giving an assessment of the present state of knowledge. Some, however, will contain significant amounts of original work. Each volume will be fully international.

The need for such a series has already been demonstrated by the encouraging reception given to the first two volumes in all parts of the world.

**Progress In Semiconductors (Volume 3)** is published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N.Y., contains 210 pages, hard cover bound, price \$8.50.

**Coil Winding (2nd Edition)** by Wm. Quemfurth.

The 2nd Edition, recently issued, contains 2,700 gear ratios for universal coil winding never before available, 100 illustrations, 6 chapters and 192 pages, describing coil winding procedures, winding machines and associated equipment. The 2,700 gear ratios alone are a valuable time-saver for anyone winding universal type coils.

Two chapters are devoted to universal types of windings. Other chapters discuss single layer windings, multi-layer windings, toroidal windings and deflection yoke and armature windings. Detailed instructions are given on how to set up and align winding machines of various types, how to lay out a bench to best advantage for coil winding, how to make an arbor, chuck and collet, how to design cams, how to align wire guides and how to select and adjust various wire tension devices. The book is believed to be the only text of its kind available.

**Coil Winding (2nd Edition)** is published by Geo. Stevens Mfg. Co., Inc., Pulaski Road at Peterson, Chicago 46, Ill., contains 192 pages, hard cover bound, price \$5.00.

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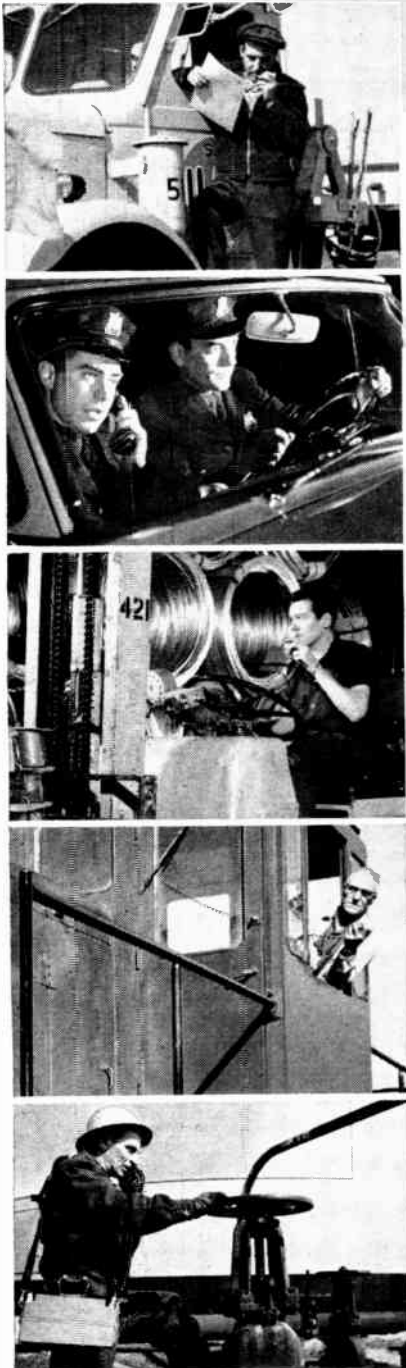
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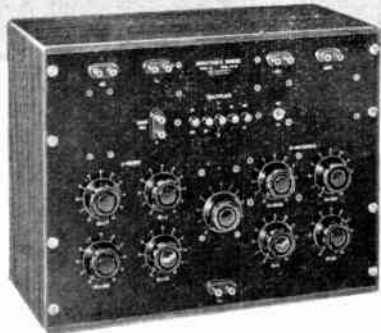
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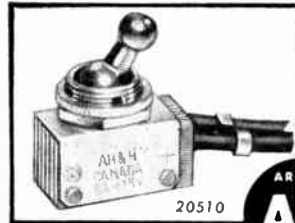
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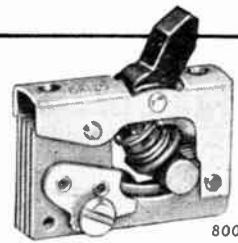


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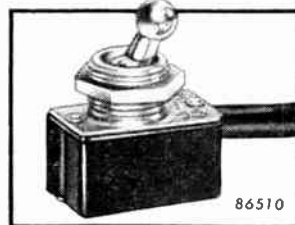


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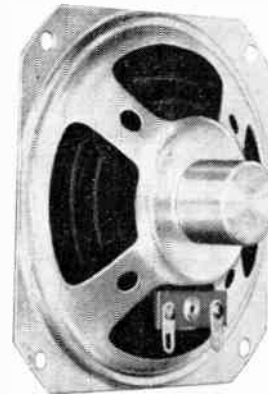
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## Book Review

**Magnetic Amplifiers: Theory and Application** by Sidney Platt, Director of Engineering Research and Development, Warner, Inc., New York City.

This new, up-to-date book in the expanding field of magnetic amplifiers emphasizes a practical, descriptive approach. Its logical and thorough treatment will be useful to the technician and engineer.

It is a comprehensive book covering the history and development of the magnetic amplifier, starting with the basic saturable reactor circuit and continuing to the present state of the magnetic amplifier art.

Fundamentals of magnetism, electromagnetism and electromagnetic induction are discussed in detail in the early chapters, followed by a description of the theory, operation, and application of saturable reactors and magnetic amplifiers in both non-feedback and feedback cases.

Present commercial and industrial uses of the devices are illustrated profusely and described thoroughly. The magnetic amplifier's advantages and disadvantages are also fully discussed.

**Magnetic Amplifiers: Theory And Application** is published by Prentice-Hall, Inc., 70 Fifth Avenue, New York 11, N.Y., contains 238 pages, hard cover bound, price \$7.00.

**Automatic Process Control** by Donald P. Eckman, Professor of Instrumentation Engineering, Case Institute of Technology.

Written for all engineers who are concerned with instrumentation, this book treats the important principles of automatic control, emphasizing block diagrams and frequency techniques in process control. It begins with process analysis and carries on into the generalized behavior of closed-loop systems. System problems are given a great deal of study.

The techniques of analysis are used to the fullest extent, and enough detail is carefully presented so that some of the more difficult problems in automatic process control may be inspected rather closely. The author incorporates numerous problems with answers and nine detailed experiments, including the analog computer.

Special topics covered include: new electronic controllers; control elements and actuators; non-linear elements often encountered in process control; Nyquist and Bode diagrams; fluid and thermal process control; computer optimizing control; direct comparison of control actions.

**Automatic Process Control** is published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N.Y., contains 368 pages, hard cover bound, price \$9.00.

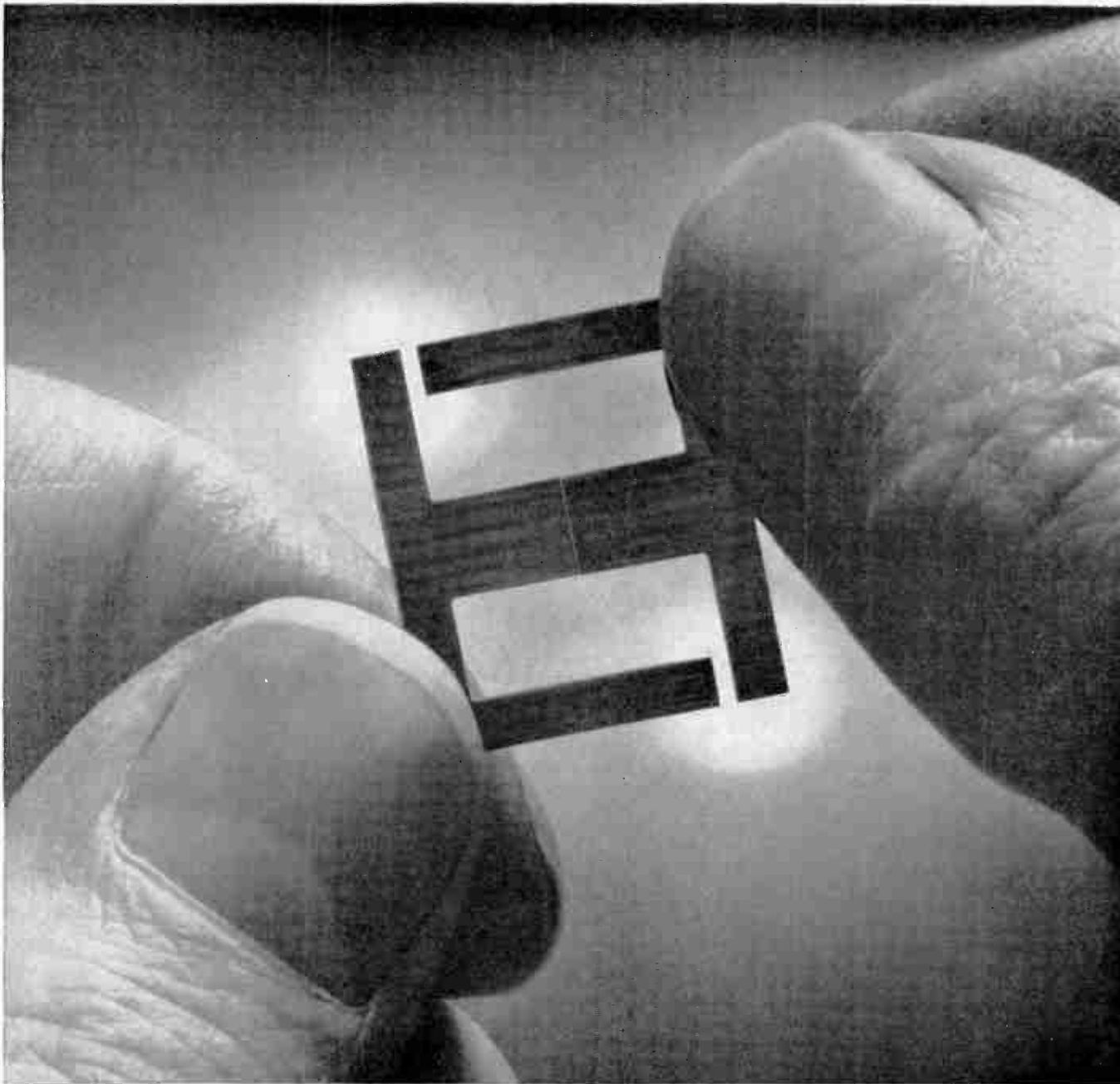
**Electronics Of Microwave Tubes** by W. J. Kleen (translated from the German by P. A. Lindsay, A. Reddish and C. R. Russell).

This book provides a unified treatment of the microwave tubes currently in use. A presentation of the fundamental interaction processes involved is followed by a clear discussion of tube applications, noise, and the most important structural components—resonators, delay lines, and electron guns. The author explains, both qualitatively and quantitatively, the effects governing the operation of those microwave tubes now used in telecommunications.

The elucidation of basic concepts and concise survey of the field make the work suitable as a textbook for students with the requisite physical and mathematical background. Physicists and engineers active in the field of microwave research, in particular those working in microwave laboratories, will find this book a valuable reference tool.

**Electronics Of Microwave Tubes** is published by Academic Press Inc., 111 Fifth Avenue, New York 3, N.Y., contains 349 pages, hard cover bound, price \$9.00.





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## The next boom — industrial electronics

"Science and Securities", the quarterly publication of Harris Upman and Company, New York investment brokers, states that "in the 1962-1972 period, electronics will actually infiltrate virtually every industrial and business operation, with markets of a volume and scope far above those of today. These markets will probably total \$20 billion by 1962 and should increase substantially in the ten years to follow."

The booklet points out that "the current boom took root in 1955 when the Missile Era began to come into its own. Of the billions now being spent for missile development and production, nearly half is committed for electronic guidance systems, telemetering equipment and a wide variety of other electronic gear. So, as missile millions grow — and grow they will — so also will the sale of electronic equipment soar. Where the government spent \$628 million on missile electronics in 1956, it is expected to spend over twice that amount in 1958. The total military market for electronics equipment, including research and development, is expected to reach \$3.9 billion this year. The value of all electronics equipment, at the manufacturers' level, is expected to reach \$7.2 billion.

"Only a handful of companies", the report adds, "have achieved leadership in all four phases of the industry's life; meanwhile, scores of firms became leaders in radio, radar or TV manufacture only to fade into oblivion under the pressure of stiff competition and headlong technological development. Will the next boom, then, boost the present leaders or will other companies come to the fore?"

"In our opinion there will be a fifth great upsurge in electronics sales and profits. We do not refer to the field of color television although that medium is sure to be successfully developed in time and yield a potent shot in the arm for the television segment of this industry. Television may receive an assist in two other areas as well — subscription and closed-circuit TV.

"The next real boom will occur in what we call the age of Industrial Electronics, an era that has already begun in a very modest way but will start to achieve major proportions about 1961-62 and will grow rapidly during the following decade and beyond. This new age, however, will differ from its four predecessors in several ways:

"It will not be based on the development of a single new device or upon achievement of a single technological breakthrough. Consequently it will not be characterized by mass production of a single type of equipment. It will not rest on military or any other government demand. Its application will not be limited to doing a few jobs which never have been done before but to the performance of hundreds of tasks already being performed in some manner, but which can be performed more quickly, more accurately or more efficiently with electronics.

"This new Industrial Age", the report concludes, "actually will represent the real maturity of the electronics industry. Electronics will no longer be considered a specialized miracle worker, but a work saver useable in virtually every industry or business. Instead of a thoroughbred racehorse it will become a reliable workhorse.

"Industry sources estimate", for example, "that there were some 100 million transistors and semiconductor diodes manufactured in this country in 1957, for a total dollar volume in excess of \$100 million. We predict that combined sales of transistors and diodes will exceed the \$500 million mark by 1965."

And so through the crystal ball of a highly respected and reliable brokerage firm is the future of the United States electronics industry forecast. In like manner there is no foreseeable reason why the Canadian industry should not prosper proportionately during the same period of time, particularly in the area of industrial electronics. Here in Canada, as in the United States, the application of electronics to industry, as pointed out in the above report, has had but a modest beginning and as Canadian industry incorporates more electronic equipment into its manufacturing processes, as it will most assuredly do in the years ahead, so will there be established a domestic market for the supply of a wide variety of replacement parts.

There is every likelihood too that the Canadian industry will be asked to assume an increasingly important role in the manufacture of military equipment for the United States as the result of a more closely integrated defense system between the two countries. For such reasons, therefore, the future of the Canadian electronics industry should be equally as bright as that forecast for the electronics industry south of the border.



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★ High accuracy . . .  $\pm 0.1\%$  with direct method; 0.2% with substitution method.

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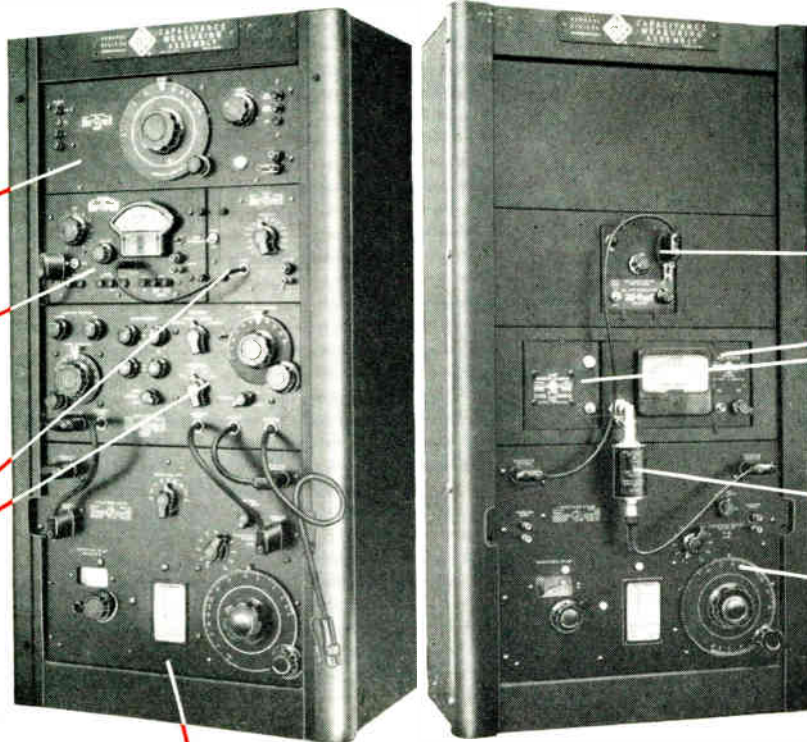
• For two-terminal measurements only . . . Type 1610-A2 Capacitance Measuring Assembly . . . \$1,795.

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**1231-BRA AMPLIFIER AND NULL DETECTOR** . . . Linear amplifier for general laboratory use, logarithmic response for bridge measurements . . . less than 25  $\mu\text{v}$  at 1 kc for 1% indication.

**1231-P5 ADJUSTABLE FILTER** . . . Reduces harmonics and background noise; at least 30-db second-harmonic rejection. Eleven fixed settings from 50 c to 100 kc in 1-2.5 sequence. May be tuned to any frequency between 20 c and 100 kc by adding external capacitors.

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**1212-P2 ONE-MEGACYCLE FILTER** . . . Provides 20-db insertion gain at 1 Mc when used with 1212-A and 716-CS1.

**716-CS1 CAPACITANCE BRIDGE** . . . For use from 0.5 to 3 Mc (bridge direct reading at 1 Mc). Range, direct method, 100 to 1150  $\mu\mu\text{f}$ , substitution method, 0.1 to 1050  $\mu\mu\text{f}$ , otherwise identical to 716-C Capacitance Bridge.

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. . . Useful for measurements from 30c to 300 kc . . . can also be used for measuring dielectric properties of insulating materials, resistance and parallel capacitance of high-value resistors, inductance and storage factor of inductors, and characteristics of electrolytes and other materials through capacitance measuring techniques.

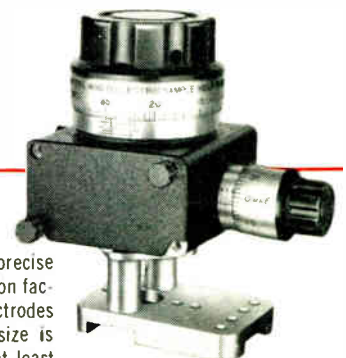


### Type 1691-A CAPACITOR TEST FIXTURE . . . \$22.50

Provides a standard means for attaching capacitors, eliminating variable lead capacitance. Particularly useful for high-frequency measurements.

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