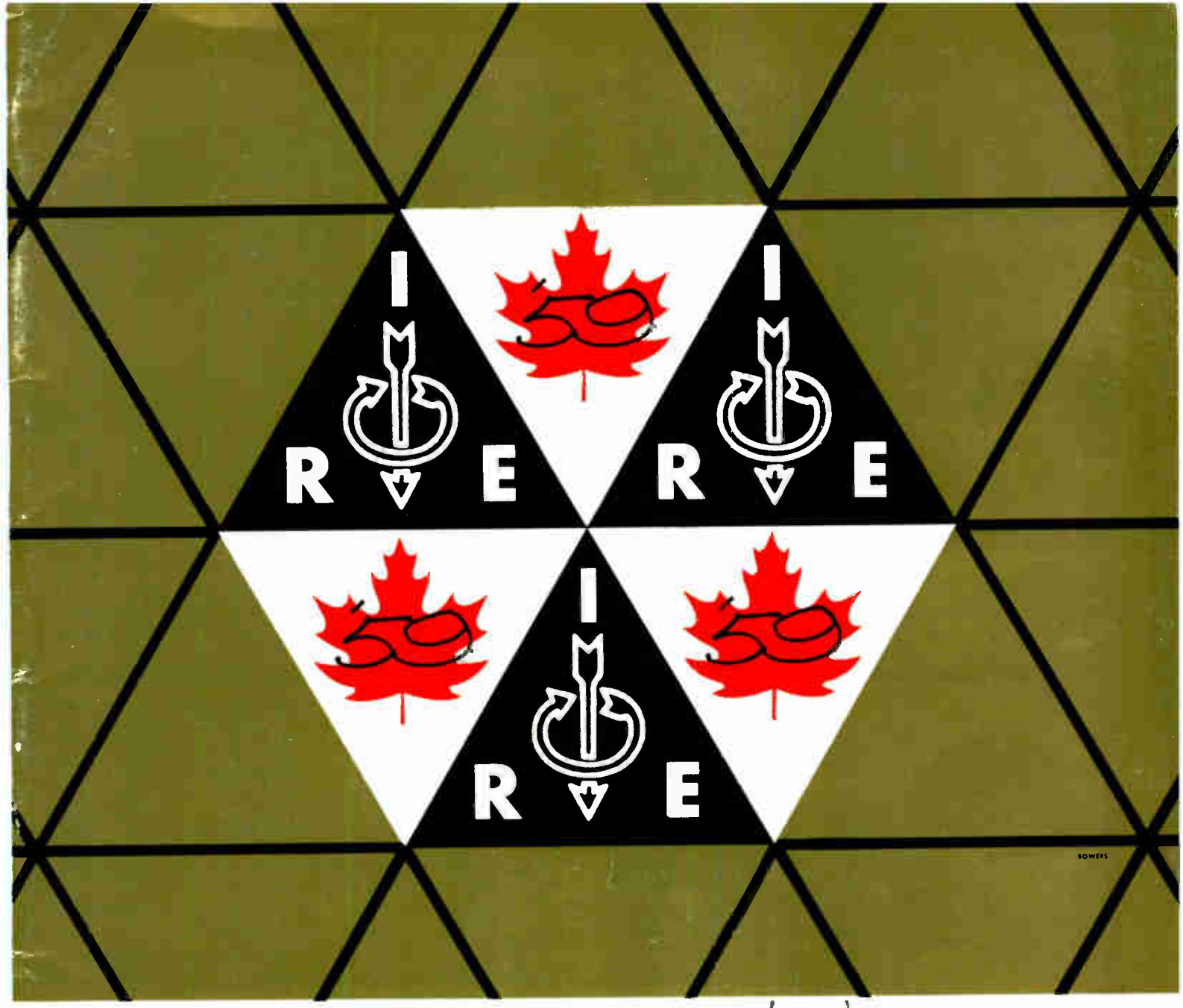

1959 IRE Canadian Convention Issue

electronics and communications

an age publication
OCTOBER 1959

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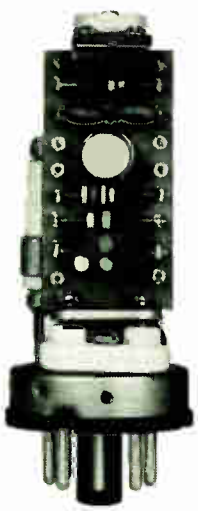
designed for to-morrow's stability to-day



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This may be the answer to your frequency controls problems — available with tubes or transistors.

Frequency range from a few kilocycles to above 100 mc.

Frequency stability in the order of one part in 10^7 may be obtained.

May we have your inquiries?

If your frequency control requirements are in line with to-morrow's trend, don't compromise with anything less than crystals designed and built to to-morrow's specifications.

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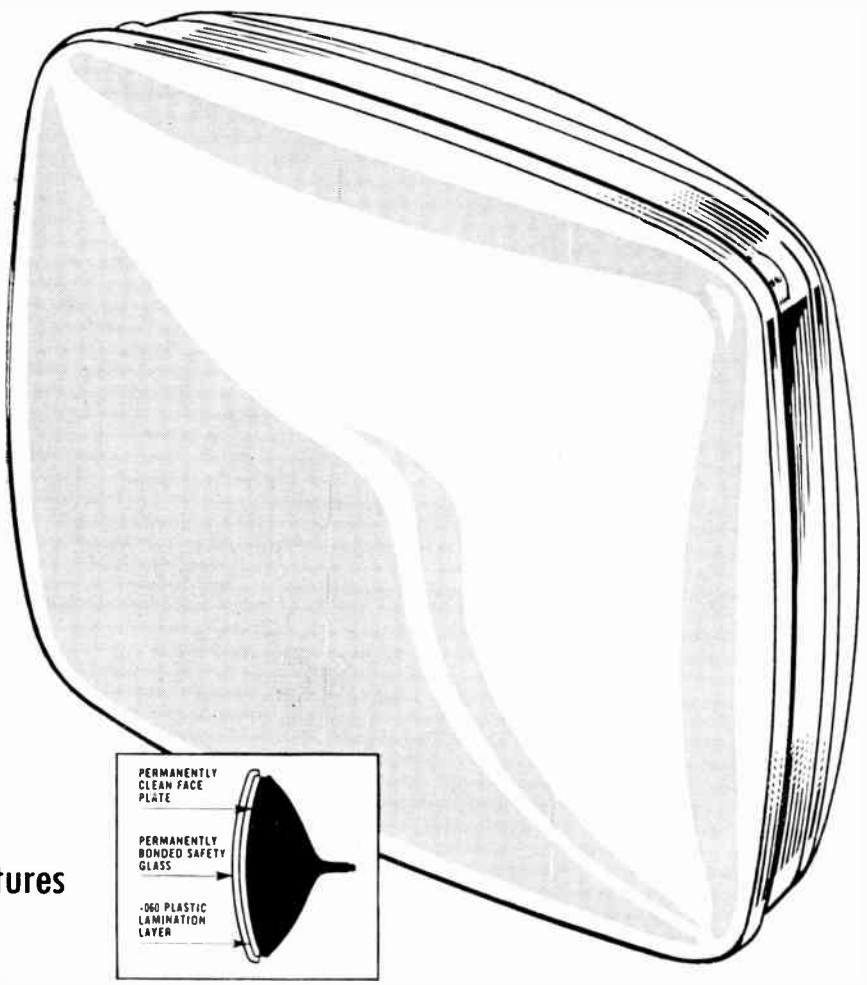

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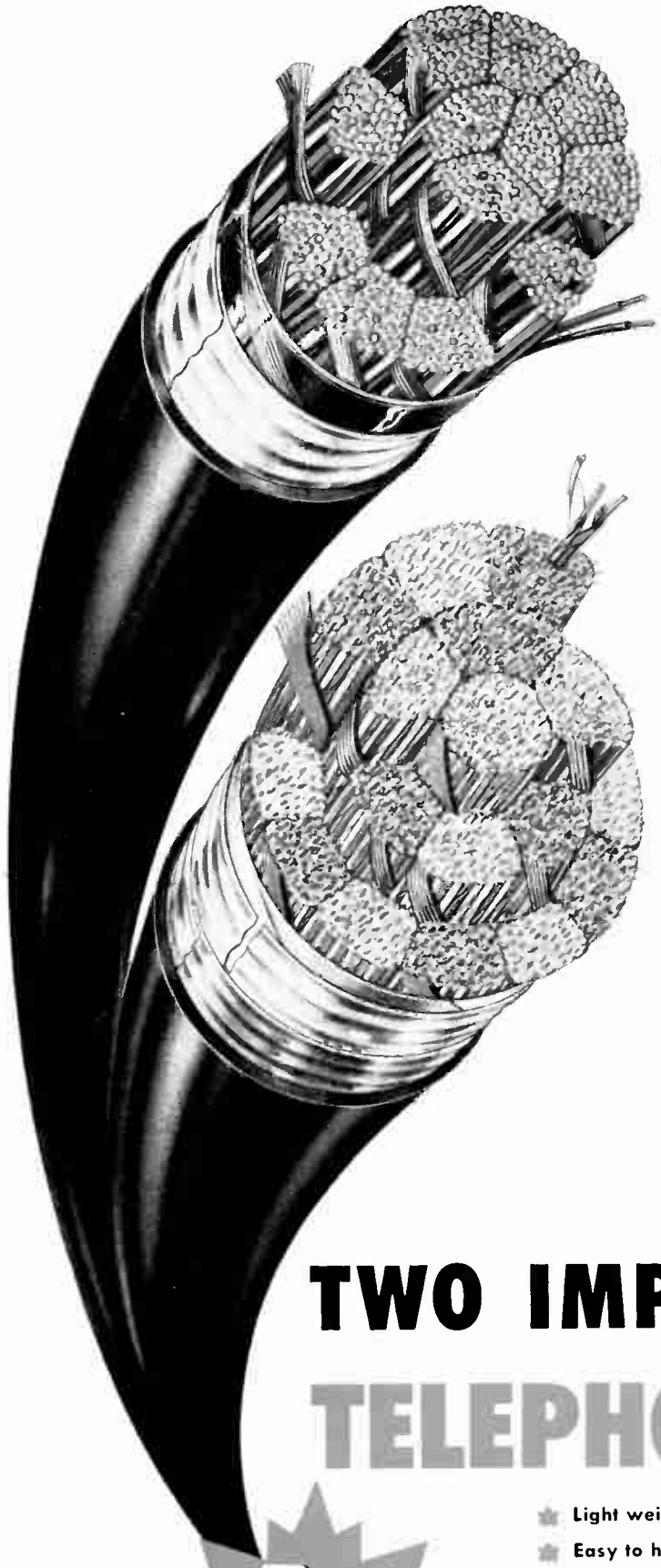
For complete details check No. 22 on handy card, page 93



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Features ● **New Simplified Color Code** now being adopted by major telephone companies. ● **Even Cable Count** consists of multiples of 25 pairs using no spare pairs. ● **New Construction** with corrugated Aluminum Shield for maximum flexibility and electrical protection. ● **Plastic Insulated Conductors**—up to 300 pairs or more. ● **Belted with Mylar-Faced Rubber tape,** for extra protection. ● **Primarily an Aerial Cable** but can be constructed (PAP) for direct burial. ● **Light Weight** reduces shipping costs. ● **Easy to joint** or terminate with readi-access terminals or other approved fittings. ● **Fewer Joints** because longer lengths can be used. ● **High Dielectric Strength** ● **Cuts current loss** in HF carrier circuits.

Phillips STALPETH

● **Up to 2727 pair** at #26 gauge—paper insulated conductors. ● **Primarily for use in ducts** but can be used aerially or constructed (PASP) for direct burial. ● **Costs Less** than paper lead in all available sizes. ● **About half the weight** of paper lead. ● **Fewer Joints** needed. ● Jointing is accomplished by using approved fittings or lead wipe method ● **The soldered steel tape** provides completely moisture proof construction.

TWO IMPORTANT NEW TELEPHONE CABLES

- Light weight
- Easy to handle
- Fewer joints required in general use
- Reduced installation and operational costs
- Moisture proof, corrosion-free jacket is fatigue resistant . . . made of high molecular weight Polyethylene.

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Phillips Electrical Company LIMITED

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5809

For complete details check No. 61 on handy card, page 93

Electronics and Communications

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

an age publication

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Subscription Rates:
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Foreign $10.00 a year

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contents

OCTOBER 1959 Vol. 7, No. 10

departments

ROGERS announces a wide, versatile range of SEMICONDUCTORS for your new-equipment requirements

If you are in the field of entertainment equipment, computors, communications, instrumentation etc., you can now get your semiconductor requirements from Rogers.

Rogers can now offer:

- a wide and versatile line
- stable characteristics and reliable performance
- application engineering services
- technical assistance and data

For long life and top quality, you can rely on the tested and proven performance of Rogers' Semiconductors.

Rogers semiconductors have been designed for the major applications listed below as well as for many other special uses.

Audio Amplifier—low and high power
Radio Frequency Amplifiers
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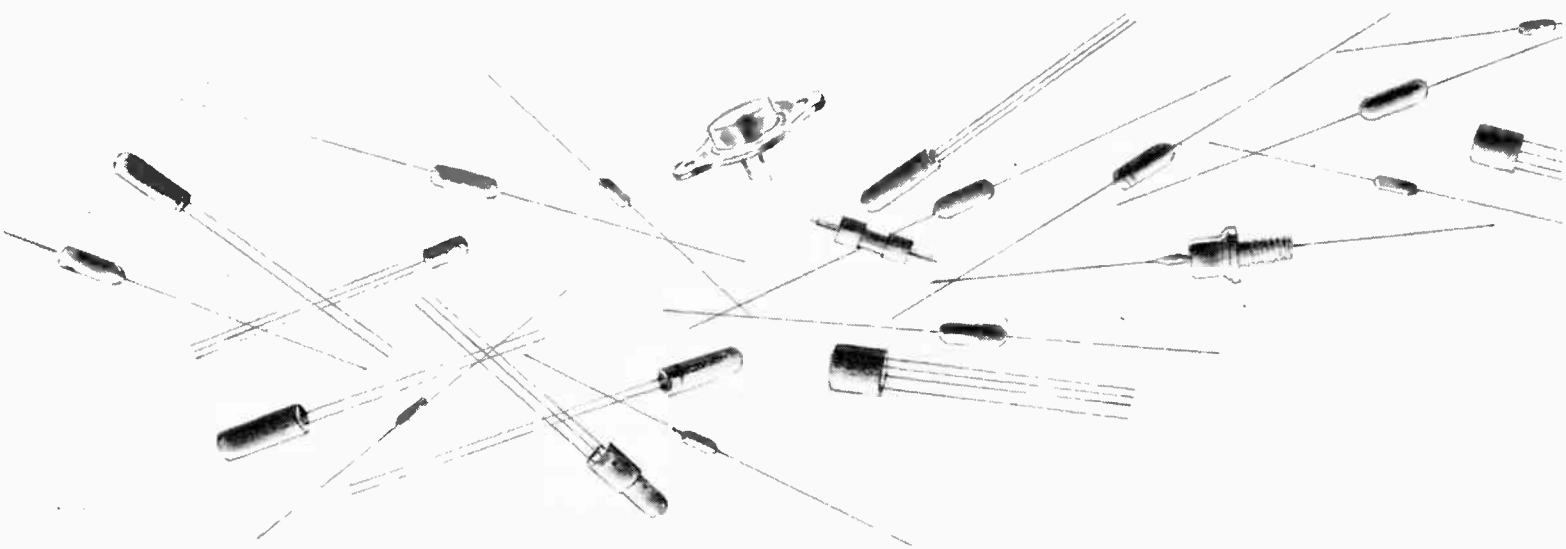
D. C. Amplifiers
Frequency Convertors
Power Convertors
Computor and Switching Applications
Multivibrators and Oscillators
Detection Rectification and Stabilization



Be sure to see the **ROGERS** *line of semiconductors, tubes and components in Booth 150 at the Canadian I.R.E. Convention.*

For complete details check No. 70 on handy card, page 93

ROGERS

REFERENCE BULLETIN NO. 2

Semiconductors. As the list below indicates, Rogers now offers a wide, versatile range of simiconductors to meet your new-equipment requirements. Because this extensive line of semiconductors is produced in quantity by modern production methods; they have good availability and are low in price. For stable characteristics and consistent dependability, you can always rely on Rogers. Condensed data is listed below. Complete technical information, availability and prices will be supplied upon request.

Clip and file this reference sheet for future use

TRANSISTORS

Germanium Audio Frequency

OC70	General purpose BETA = 30
OC71	Medium gain BETA = 41
OC72	Low power audio output
2-OC72	Matched pair of OC72
OC73	Close tolerance medium gain
OC74	Medium power audio output
OC75	High gain BETA = 90
OC76	Low power switching
OC77	High voltage switching
OC80	High current switching

Germanium Audio Frequency Power

2N1314	37 watts dissipation BETA = 45
2N1315	37 watts dissipation BETA = 85
OC28	37 watts dissipation High Ic, High Vc
OC29	37 watts dissipation High Ic, High Vc
OC30	4 watts dissipation
2-OC30	matched pair OC30
OC35	37 watts dissipation High Ic
OC36	37 watts dissipation High Ic

Germanium High Frequency Power

OC22, OC23, OC24	10 watt dissipation at 2.5 Mc/s.

Germanium Phototransistor

OCP71	General purpose phototransistor

Silicon Junction

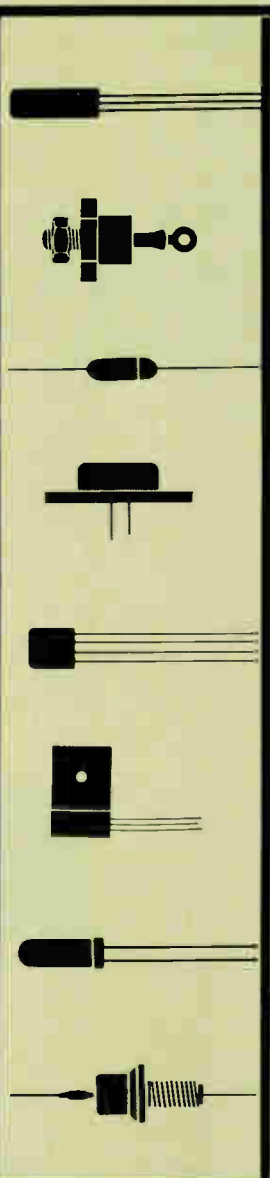
OC200	General purpose—P-N-P
OC201	General purpose BETA = 30 P-N-P
OC203	High voltage, medium gain. P-N-P

Germanium Radio Frequency

OC44	Converter for broadcast receivers f_{co} 15.0 Mc/s.
OC45	I.F. amplifier for broadcast receivers f_{co} 6.0 Mc/s.
OC46	High speed switching transistor f_{co} 3.0 Mc/s.
OC47	High speed switching transistor f_{co} 4.5 Mc/s.
OC139	Symmetrical N-P-N switching transistor
OC140	Symmetrical N-P-N switching transistor
OC141	Symmetrical N-P-N switching transistor
OC169	High frequency alloy diffused transistor
OC170	High frequency alloy diffused transistor
OC171	High frequency alloy diffused transistor

Germanium Subminiature

OC57	General purpose subminiature
OC58	General purpose subminiature
OC59	General purpose subminiature
OC60	General purpose subminiature output amplifier



DIODES AND RECTIFIERS

Germanium Junction Rectifier

OA31	Medium current power diode I = 3.5A

Silicon Junction Rectifiers

OA210	I max. 0.5 A P.I.V. 400
OA211	I max. 0.4 A P.I.V. 800
OA214	I max. 0.5 A P.I.V. 700

Silicon Zener Diodes

OAZ200 to OAZ207	Voltage range 4.7—9.1 V ±5%
OAZ208 to OAZ213	Voltage range 4.2—12.2 V ±15%

Silicon Junction Diodes

OA200	P.I.V. 50 V. I max. 50 mA
OA202	P.I.V. 100 V. I max. 30 mA

Germanium Junction Diode

OA10	Low hole storage computer diode

Germanium Gold Bonded Diodes

OA5	P.I.V. 100 V. General purpose switching.
OA7	P.I.V. 25 V. High speed switching.
OA47	P.I.V. 25 V. High speed switching.
1N281	P.I.V. 75 V. High conductance diode.
1N760	P.I.V. 60 V. Extremely fast recovery diode.
1N788	P.I.V. 60 V. Extremely fast recovery diode.

Germanium Point-Contact Diodes

OA70/1N87	Video detector.
OA72	High frequency diode.
OA73/1N616	Industrial diode.
OA79/1N541	a.m. and f.m. detector.
2-OA79/1N542	Matched pair OA79/1N541.
OA81/1N476	High voltage general purpose.
OA81C/1N477	Clip-in version of OA81/1N476.
OA85/1N478	High voltage general purpose.
OA85C/1N479	Clip-in version of OA85/1N478.
OA86/1N480	Low hole storage computer diode.
OA86C/1N119	Clip-in version of OA86/1N480.
OA90/1N87A	Subminiature video detector.
OA91/1N617	Subminiature OA81/1N476.
OA95/1N618	Subminiature OA85/1N478.
1N126	Subminiature JAN diode.
1N198	Subminiature JAN diode.

This reference sheet is the second in a series from Rogers to keep you informed of electronic developments. A specially designed file folder for these bulletins is available from Rogers on request.

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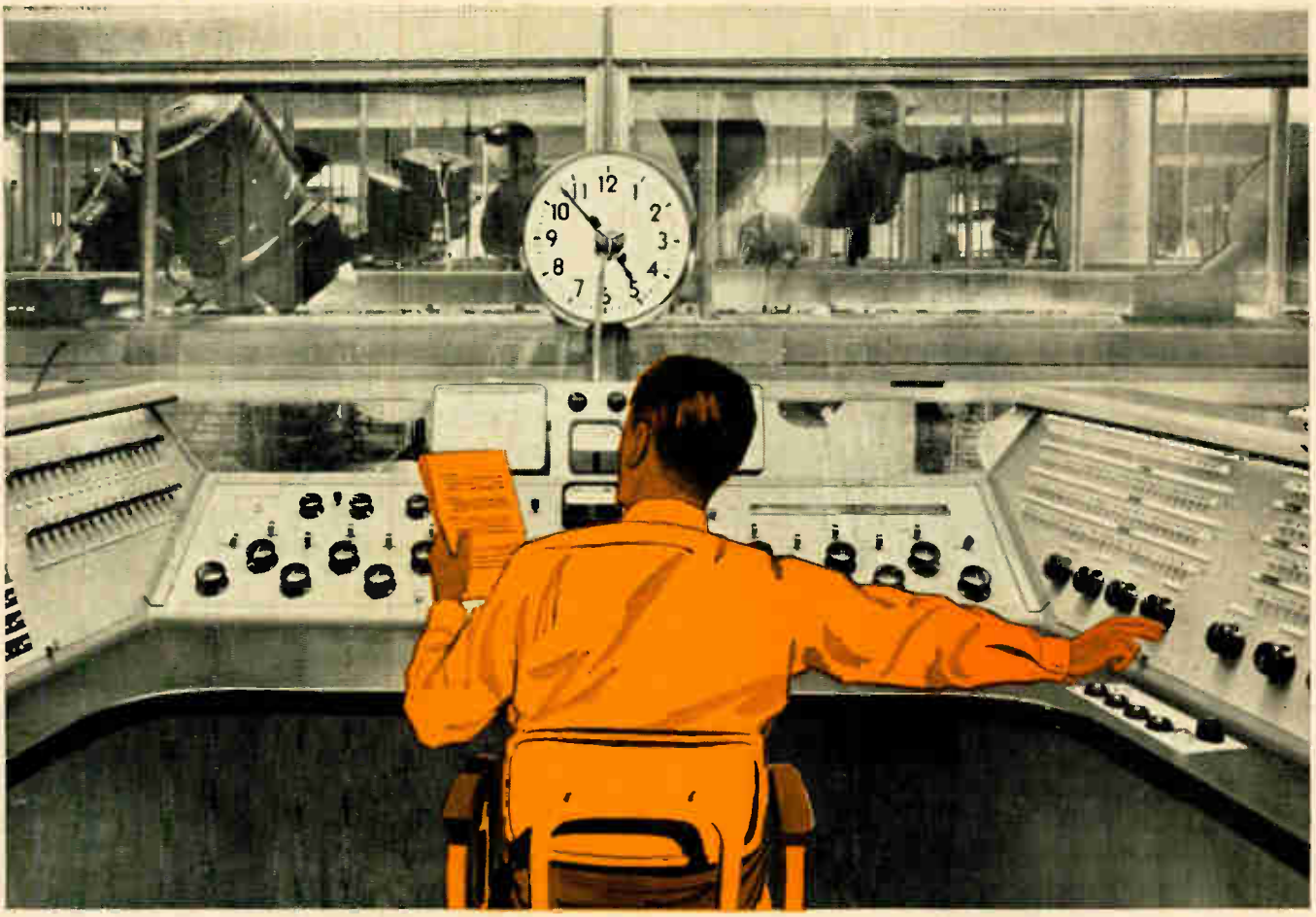
THE TRANSISTOR, BASIC ELECTRONIC COMPONENT OF THE NEW IBM 7070, PERMITS LOWER INITIAL COST, LOWER OPERATING COST

NEW IBM 7070

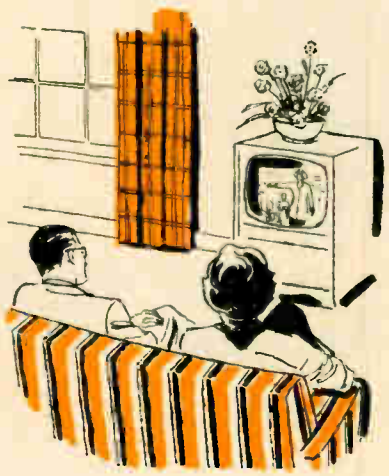
For complete details check No. 44 on handy card, page 93



Discriminating sound selection for listening pleasure

The enjoyment of TV programmes is the result of constant research and engineering knowledge coupled with the manufacture of high quality and complex electronic equipment.

The completely new model AC5 Audio Console shown here—plus its associated equipment—typifies the kind of precision electronic equipment manufactured by Northern Electric at Belleville, Ontario. This console, one of three manufactured for new C.B.C. studios in Toronto and Montreal, was designed by Northern Electric Company from specifications submitted by the C.B.C. engineering staff. These new studios, modern in all respects, are able to provide unexcelled audio quality in all of their television productions.



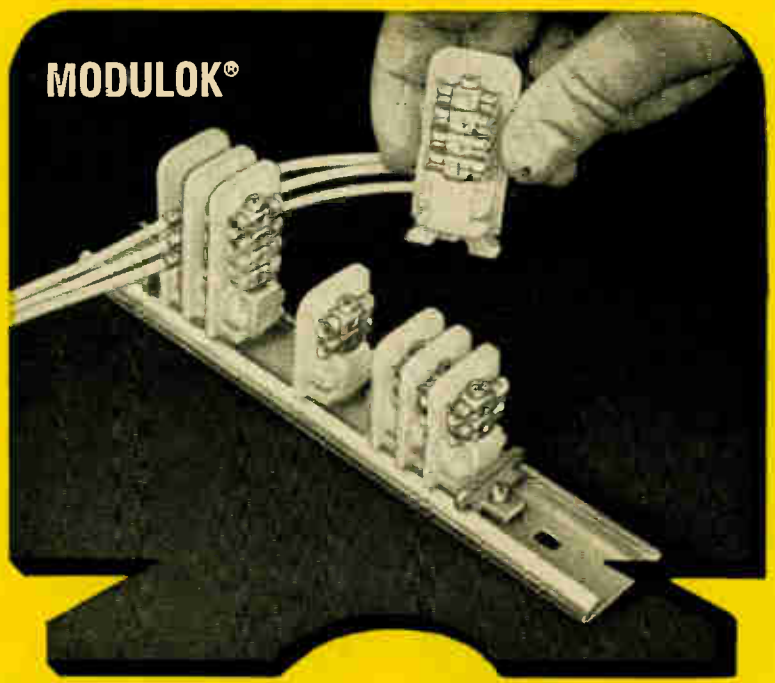
Here, once again, Northern Electric with its creative engineering imagination demonstrates its ability to provide the correct design and craftsmanlike construction in equipment to meet the stringent requirements of present day broadcasting.

Northern Electric

SERVES YOU BEST

1059-2

For complete details check No. 58 on handy card, page 93



Snap-in spring-loaded contacts for quick-disconnect or permanent connection. Modules—2 or 4 tier—snap together or apart for extreme flexibility. Contacts are solderless crimp-type. Up to 30 modules per foot of track.

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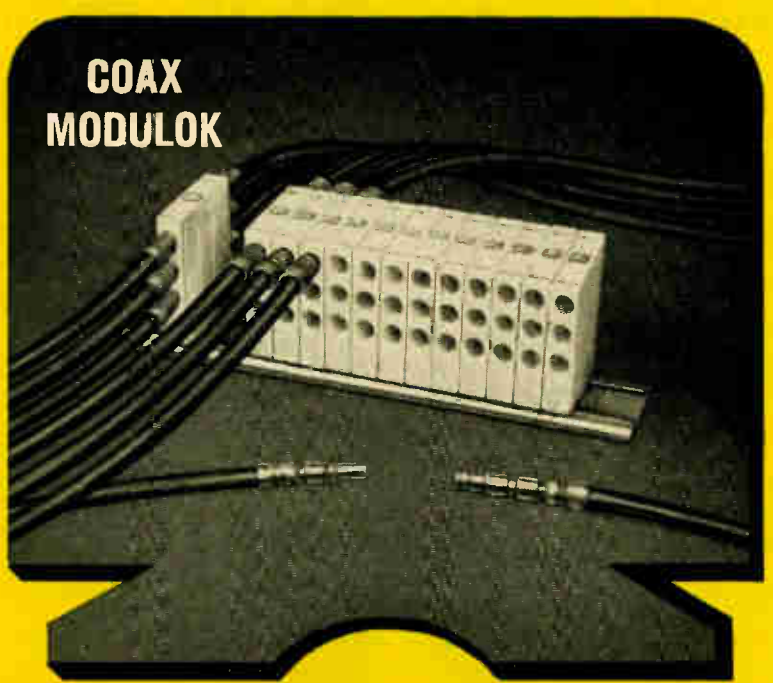

Same flexibility as regular MODULOK. Completely crimped contacts. Snap-in to insert. Press spring-loaded latch to release. Up to 30 modules (90 coax connections) per foot of track.

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For complete details check No. 16 on handy card, page 93

Electronic Industries Association Report

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

Electronics Defense Sharing

In making known the Electronic Industries Association of Canada's support of the forthcoming IRE Canadian Convention, Stuart D. Brownlee, president of EIA, made the following statement prior to the opening of the Convention in Toronto.

In the forty years since electronic equipment production began in Canada, there has been nothing like the present arrangement for sharing the manufacturing of electronic defense equipment between the United States and Canada. Although the two countries co-operated in production-sharing during the war, there has never been a joint manufacturing effort, for common defense, in peacetime.

It is a new concept. It presents us all with new problems. But these difficulties also give us opportunities never before placed in front of a whole industry. The market for defense products in the Canadian electronics industry has, overnight, multiplied many times. Instead of being the supplier of electronic equipment only to the Canadian armed services, we are now in a position of being able to tender, on an equal basis, for contracts let by the United States Navy, Air Force and Army under the joint defense concept agreed to by both our governments.

This is a challenge. It is a challenge to the whole electronics industry and includes all companies, large and small, who produce complete electronic systems, and equipment, and components and who have electronic services to offer. Most of all, it is an opportunity for Canadian scientists, engineers, and sales executives to use their ingenuity and initiative in meeting the new and different demands made upon them. We in Canada are often inclined to hide our light behind a bushel. This is not the time for such modesty, for we are in keen competition with the United States manufacturers.

We believe that the United States government has an honest and earnest intention of making defense production sharing work effectively. In line with this policy, they have already revised the "Buy American Act" and have given duty-free entry privileges to Canadian companies bidding for sub-contracts from United States prime contractors. Additionally, United States security restrictions can now be circumvented when Canadian companies can show that, under the joint defense sharing program, they have a proper interest in the United States programs or projects.

We must remember that, with an estimated 20 per cent lower wage rate than that existing in the United States, Canadian electronic manufacturers have an advantage over comparable manufacturers in the United States.

The Electronic Industries Association of Canada has recently formed a Defense Production Sharing Committee which reports to the Board of Directors. Its purpose is to facilitate the participation of Canadian companies in defense production sharing. It is gathering data on new United States tenders and the procedural complexities of bidding for tenders, interpretation of customs and tax regulations, inspection requirements, security arrangements and statistical information. Participation of Canadian industry in research and in the sharing of development contracts is also being actively investigated.

We in EIA are glad to support the objectives of the IRE Convention. We think that at this critical time in the affairs of the Canadian electronics industry it is vitally important to show our products and potentialities to our American visitors. Our part in defense production sharing will be a real participation if we sell ourselves — our production facilities and factory space but, most of all, we must tell our story of Canadian engineering and scientific achievement, and our research and development progress.

This year EIA officials are co-operating with the IRE's Convention Committee in arranging for a banquet speaker whose address will be of major interest to United States and Canadian industrialists, and defense procurement officials in Washington and Ottawa. We are arranging for a display devoted to the activities of EIA to form part of the IRE Exposition.

As some of you may know, D. A. Golden, Deputy Minister of Defense Production, has already accepted an invitation to be guest speaker at the Convention Banquet to be held at the Royal York Hotel, Thursday, October 8th. We are confident that anything that he has to say about defense production sharing will be of vital interest to Canadian business and industry.

Newsletter

Canadian Radio Technical Planning Board

WHO'S WHO IN THE PLANNING BOARD
No. 17 — Engineering Institute of Canada

The Engineering Institute of Canada was founded in 1887, when it was incorporated by an Act of the Dominion Government, as the Canadian Society of Civil Engineers. Bill 22, passed by the House of Commons in 1918, changed the name to The Engineering Institute of Canada.

The main objectives of the Institute are to develop and maintain high standards in the engineering profession, to facilitate the acquirement and the interchange of professional knowledge among its members, and to encourage original research, and the study, development and conservation of the resources of Canada.

Membership is divided into five categories — honorary members, members, juniors, students and affiliates. Total membership of all categories is over 18,500.

The Institute operates eight specialized technical divisions, national in scope to provide a national forum for discussion of items of interest in each of these major branches of engineering. They are: bridge and structural engineering, chemical, civil, electrical, management, mechanical and mining engineering.

Participation in the sponsorship of programs of international technical organizations, and their conferences, is also an important part of the Institute activities.

CRTPB Exhibit at IRE Show

The 1959 Canadian IRE Show management have donated a booth to the CRTPB which will be used by the latter organization to inform the public through appropriate posters of the aims and objectives of the CRTPB. The booth will be an unmanned booth and will be used as a rest center for footsore visitors to the Show. Also on display in the booth will be the Canadian Radio Frequency Allocation Chart copies of which will be on sale in the booth to interested parties.

Ninth Annual Report of the Canadian Overseas Telecommunication Corporation

In the report of the Canadian Overseas Telecommunication Corporation, tabled in the House of Commons during the summer, it was noted that a new Canada-United Kingdom multi-channel cable, scheduled for completion in 1961 and forming the first leg of a proposed British Commonwealth "round the world" all-purpose cable, occupied the major share of the planning for the Corporation's future projects. Arrangements had also been completed for a telephone cable from Newfoundland and Greenland to Iceland for ultimate connection with the United Kingdom. It is hoped to have the system completed by 1962 at which time it will provide rapid and stable telecommunication facilities which are very badly needed by the International Civil Aviation Organization to meet the demands of the jet age of aviation.

The report noted that the net profit of the $625,703 was made, the ninth successive year of profitable operation since the Corporation was founded in 1950.

Recent CRTPB Meetings

The CRTPB Executive Committee met on September 9 in Toronto. Under discussion were various items of business including the arrangements of the printing and publishing of a small folder describing the work of the board and its objectives. The arrangements for the IRE Show exhibit were also discussed and other details settled.

The Microwave Task Force on Communication System Perameters met on October 6 in Toronto. The committee continued its work on perameters and progress was reported. The Tropospheric Scatter Committee also met in Toronto late in August.

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

4 GOOD REASONS TO SEE COLLINS AT THE IRE SHOW

BOOTH NO. 551-553, EXHIBITION PARK, TORONTO, OCTOBER 8, 9 AND 10

1	2	3	4
AIRBORNE EQUIPMENT	**GROUND COMMUNICATION EQUIPMENT**	**AMATEUR SSB EQUIPMENT**	**BROADCAST EQUIPMENT**
FD-105 Flight Director System ARN-46 TACAN ARC-552 UHF Transceiver 51X-3 VHF Communication Receiver 17L-8 VHF Communication Transmitter	Microwave including Multiplex Kineplex High Speed Data System	KWM-1 Transceiver 32S-1 Transmitter 75S-1 Receiver	212F-1 Speech Input Console 212Z 4-Channel Remote Amplifier TT200 Turntable

Collins CREATIVE LEADER IN ELECTRONICS

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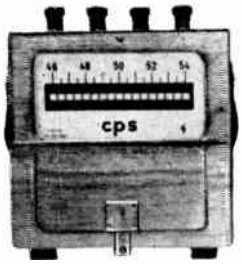

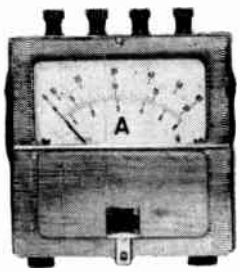

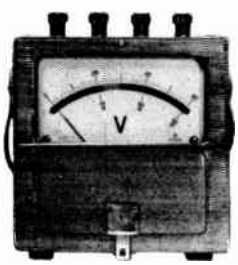

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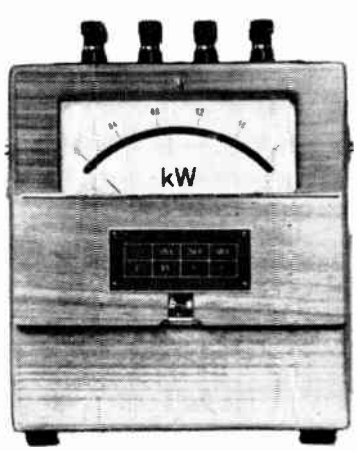

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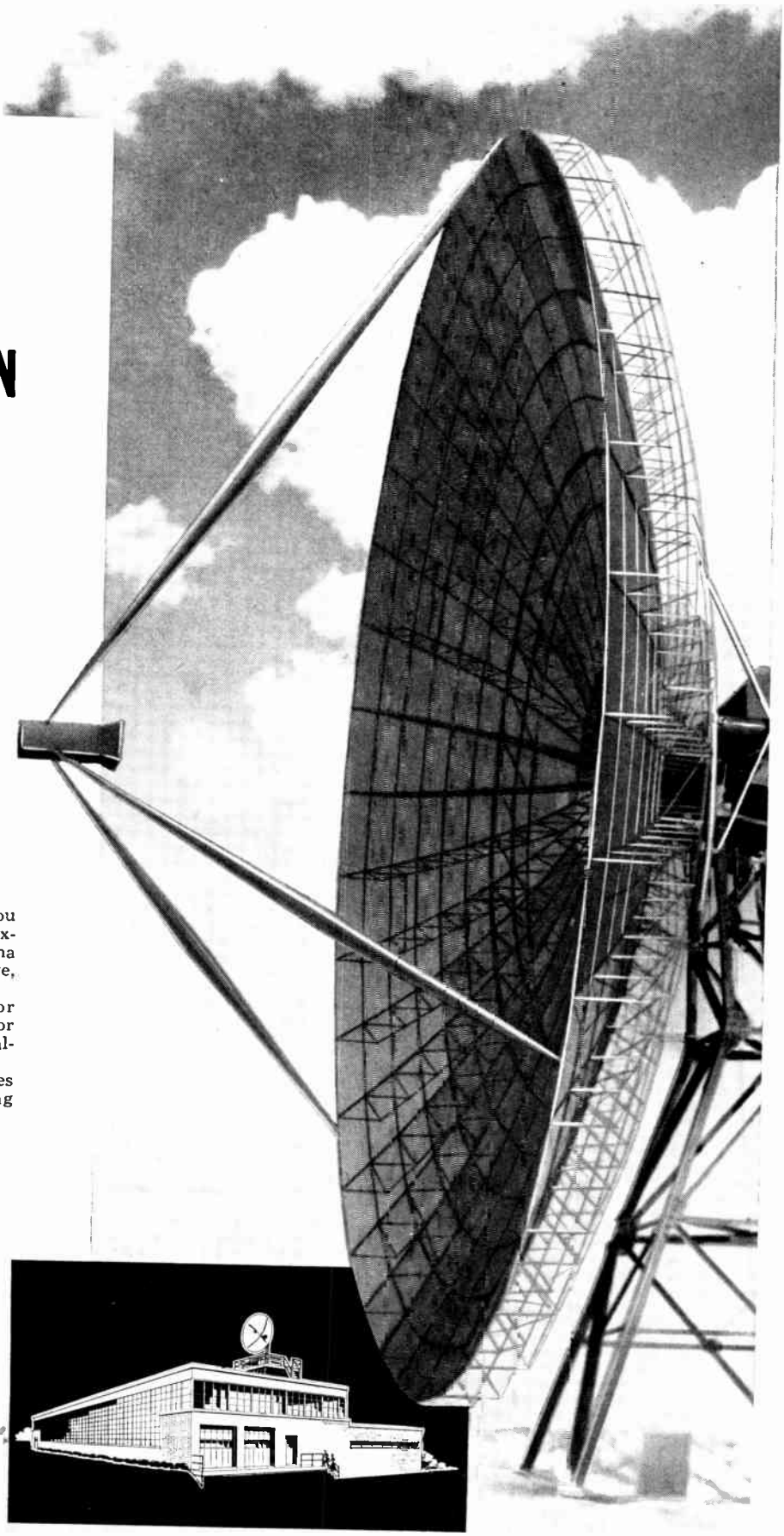

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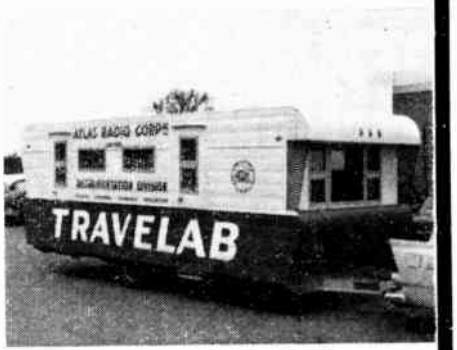

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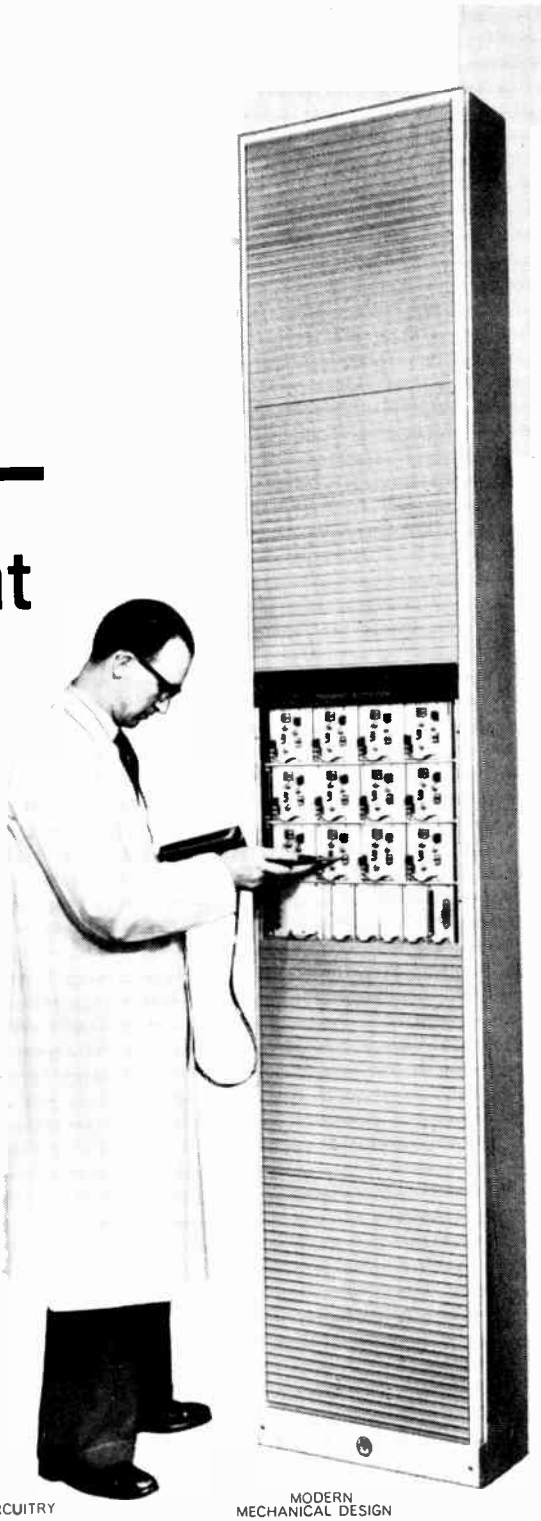

Illustrated is a rackside of telephone channelling equipment for cable or radio systems

The first with all the following advantages:

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- **72 channels on rackside of conventional dimensions**
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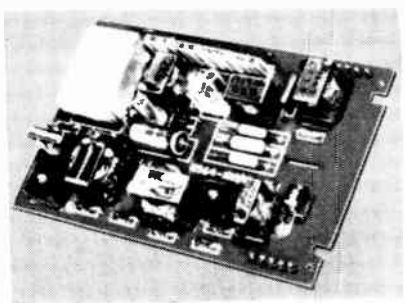
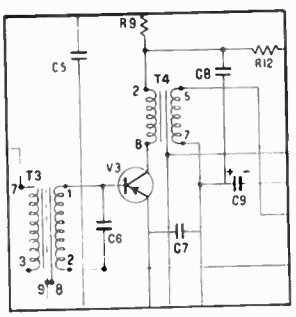


MODERN CIRCUITRY



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Covering the Spectrum with Reliable Ceramic Tubes

UHF

From audio into super high frequencies, Eimac covers the RF spectrum with modern ceramic tubes. This incomparable ceramic electron tube family — more than one-third of the Eimoc line — includes reflex and amplifier klystrons, negative grid tubes, rectifiers, pulse modulators, and receiving tubes. The tubes illustrated are typical of more than 40 Eimac ceramic tube types that are being selected by leading equipment manufacturers for use in all types of applications — from tropo-scatter to industrial heating, from single sideband to pulse.

The advantages of reliable Eimac ceramic tubes include: resistance to damage by impact, vibration, and heat; smaller size; and better processing techniques.

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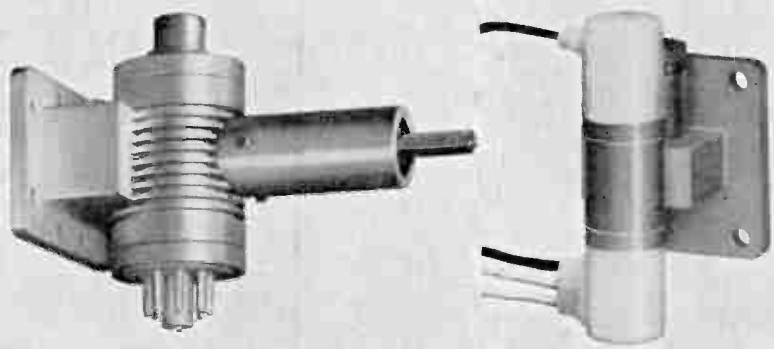

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Component Density 9 per cu. in.*
Diameter 0.625"; Depth 0.371"
Rating 1/10 watt

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Component Density 158 per cu. in.*
Diameter 0.286"; Depth 0.110 ± 5%
Rating 1/10 watt

Here is a graphic illustration of how Centralab has met your needs for greater and greater miniaturization. Pictured (actual size) are three ultra-miniature Centralab Radiohms.® When introduced, each was the smallest variable resistor on the market—and was superseded in that position only by the introduction of the next smaller Centralab unit.

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ultra-miniature
high reliability
VARIABLE
RESISTORS

SPECIFICATIONS:

Model 8 Radiohm®: 500 ohms to 10 megohms at 1/10 watt, wide range of tapers, 250° rotation, minimum rotational life 25,000 cycles.

Model 6 Radiohm®: 500 ohms to 10 megohms at 1/10 watt, wide range of tapers, 250° rotation, minimum rotational life 25,000 cycles. Also available with SPST switch.

Model 1 Radiohm®: 500 ohms to 10 megohms at 1/10 watt, wide range of tapers, 260° rotation, minimum rotational life 25,000 cycles. Also available with SPST switch.

Detailed specifications are available in Centralab Technical Bulletins. Write for your free copies.

Model 1 and Model 6 Radiohms® are stocked by your Centralab distributor, available as the B16 and SM control series respectively.

***Cubic inch, rather than cubic foot, is used to provide a more realistic and more readily visualized standard of comparison.**

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VARIABLE RESISTORS • ELECTRONIC SWITCHES • CERAMIC CAPACITORS • PACKAGED ELECTRONIC CIRCUITS • ENGINEERED CERAMICS

For complete details check No. 25 on handy card, page 93

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HIGH FREQUENCY NPN SILICON DIFFUSED-BASE TRANSISTORS

30mc PULSE RATE SWITCHES

Type Number	hfe	Typical Power Gain	Typical Switching Times (Saturated Test Circuits)
2N1199	12-60(DC)		tr 35 mμ sec ts 10 mμ sec tf 25 mμ sec
2N1267	6-18	25 db at 4.3 mc	
2N1268	11-36		
2N1269	28-90		
2N1270	6-18	25 db at 12.5 mc	
2N1271	11-36		
2N1272	28-90		

Maximum Vcb—20 V
Maximum temperature—150° C
Maximum dissipation—100 MW

60mc AMPLIFIERS

2N1199
This high speed switch has exceptionally low saturation voltage (typically 0.125 V), permitting *practical* design of 5 mc pulse circuits, using conventional saturated switching configurations. 30 mc pulse rates are obtainable in *practical* circuits using non-saturating techniques.

2N1267-68-69
The high gain characteristics of these units make possible the design of high efficiency IF amplifier circuits for communications equipment. These devices have unusually low collector capacitance . . . typically 1.5 μμf . . . and are available with restricted beta ranges to simplify design problems.

2N1270-71-72
The excellent high frequency response of these transistors makes practical the design of high performance communications systems at frequencies up to 60 mc. They have the same low collector capacitance and are available with restricted beta ranges.

Philco Corporation of Canada, Don Mills, Ontario

Please send complete information on the SADT type transistors and descriptive brochure of all type transistors available.

NAME_____

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PHILCO *government and industrial division*

PHILCO CORPORATION OF CANADA LIMITED, DON MILLS, ONTARIO

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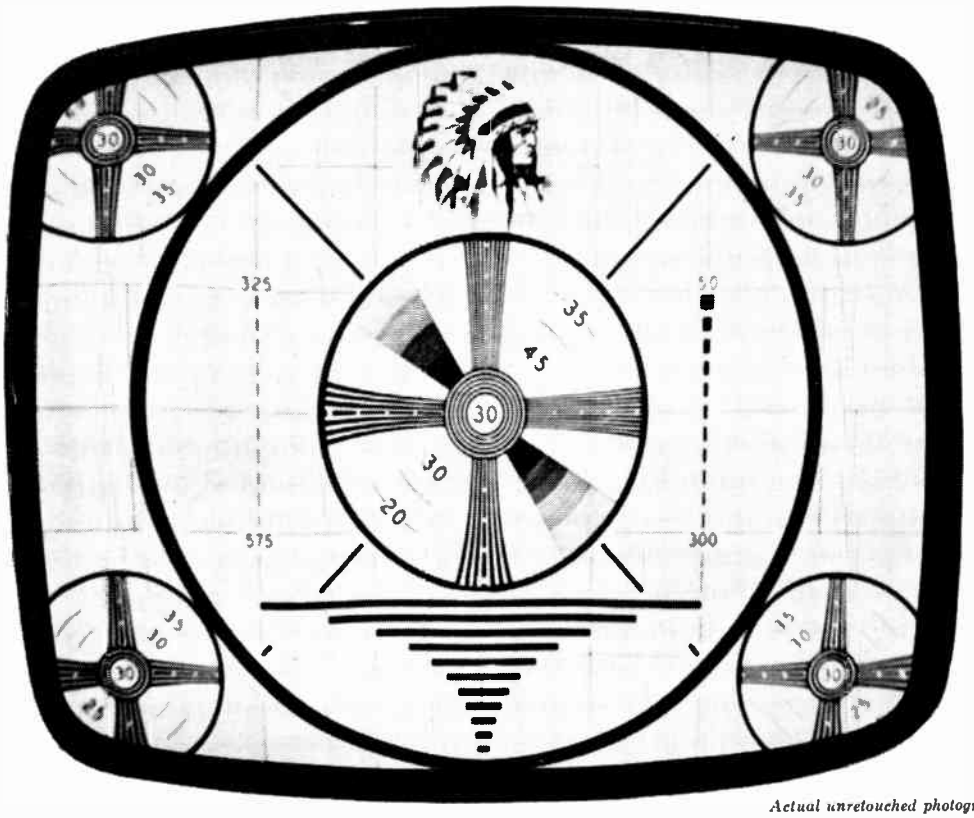

Actual unretouched photograph

How CGE developed the new 23″ Picture Tube

Entirely new in concept, the GE 23″ picture tube has been welcomed by the television industry as a notable advancement in picture tube design.

Bonding the wrap-around safety glass to the picture tube screen was a critical operation and required extremely precise application leaving little or no room for error. The space between the safety glass and screen had to be controlled within ten thousandths of an inch, then filled with a highly viscous epoxy resin, completely free of bubbles. Additional problems of resin clarity, temperature control, stress prevention, and many others were met and overcome by CGE engineers and specially trained personnel, during thousands of hours of research. An entirely new gun was developed and produced by CGE engineers for use in the new tube. This gun has improved focus and resolution characteristics over previous guns.

All the experience, know-how, and technical skill of CGE engineers were needed to solve these varied and complex problems presented in the development and production of this original and unique picture tube. Many of them were without precedent because of the radical departure from conventional picture tube design.

The work of CGE didn't end with the perfection of the new 23″ picture tube. While it is already being mass produced on a limited scale, they are now at work developing new, highly automated equipment capable of producing up to 250,000 of these revolutionary new picture tubes annually. This increased production will be necessary to fill the needs of Canada's leading manufacturers of television sets.

The introduction of the new 23″ picture tube in Canada is an outstanding example of the initiative, skill and experience of CGE engineers. Their continuous research programs result in the improvement of present products and the development of new products designed to add to the convenience and enjoyment of modern living in the electronic age.

GENERAL ELECTRIC
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CANADIAN GENERAL ELECTRIC COMPANY LIMITED

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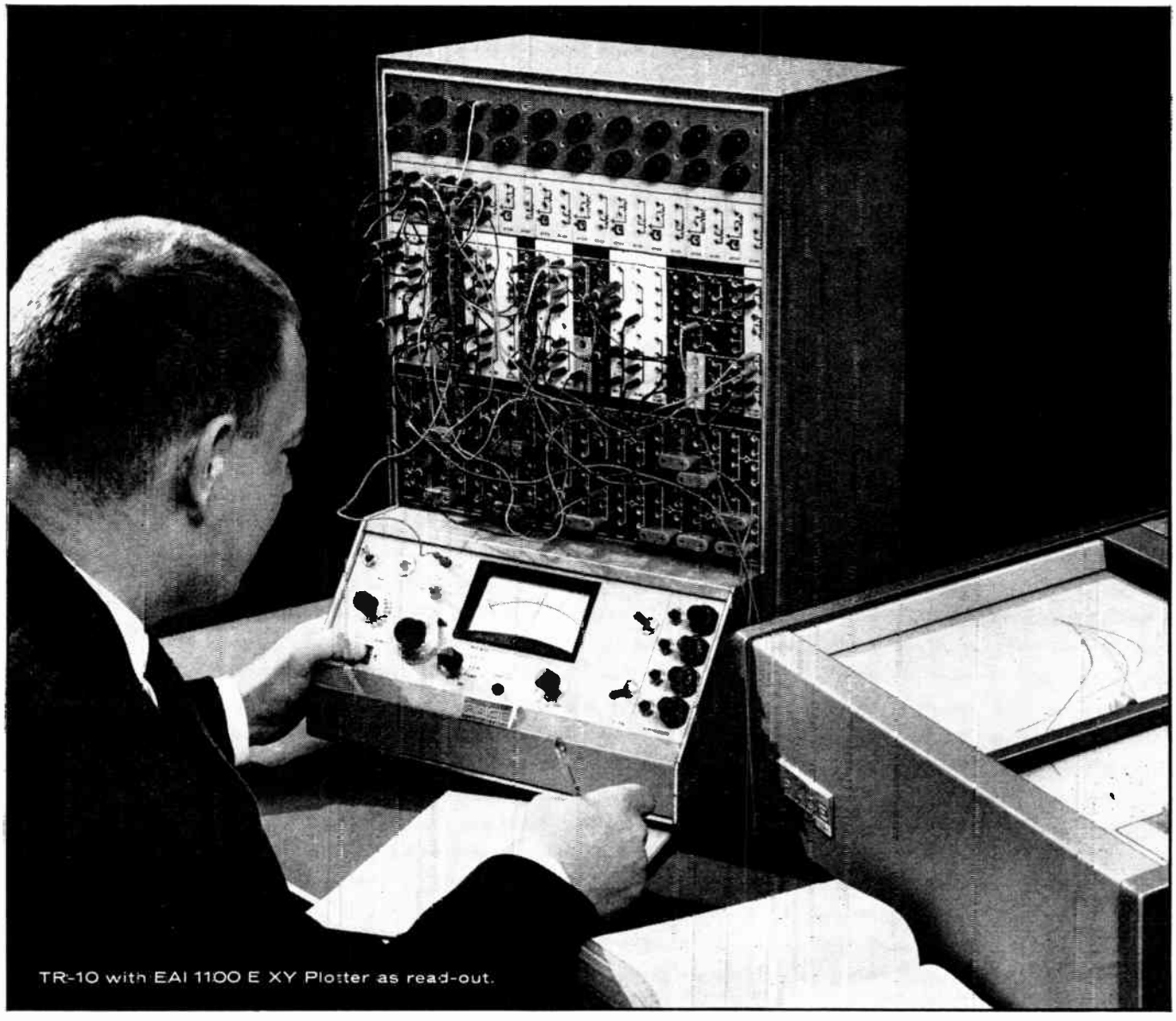

TR-10 with EAI 1100 E XY Plotter as read-out.

THE *FIRST* ALL TRANSISTORIZED ANALOG COMPUTER

—basic model less than $4000

PACE® TR-10 Eliminates Drudgery—Gives New Insight into Engineering Problems

This compact unit, 15″ x 16″ by 24″ high, is powered by 115 volts AC and can provide day-in day-out instant solution of your most vexing engineering problems. Even if you have never seen a computer before, you can learn to operate the TR-10 as easily as you learned to use a slide rule.

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Because of its minimum size and low price, the TR-10 can become your own personal analog computer. You gain first-hand experience with the power of analog techniques, and convert more of your time to *creative engineering*. New ideas that were too costly to try before are now practical. You can design virtually to perfection and have a permanent, visual record of performance before building pilot models or prototypes. As a result, "cut and try" expense is reduced.

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For complete engineering data, write for Bulletin TR-10-H.

EAI ELECTRONIC ASSOCIATES, INC.
Long Branch, New Jersey

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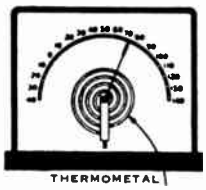

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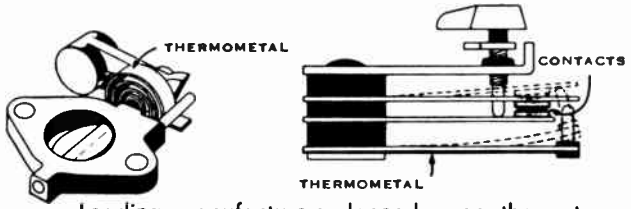

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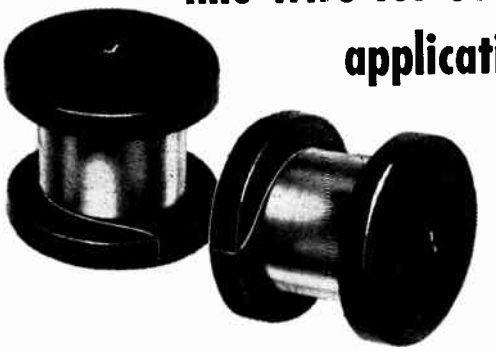

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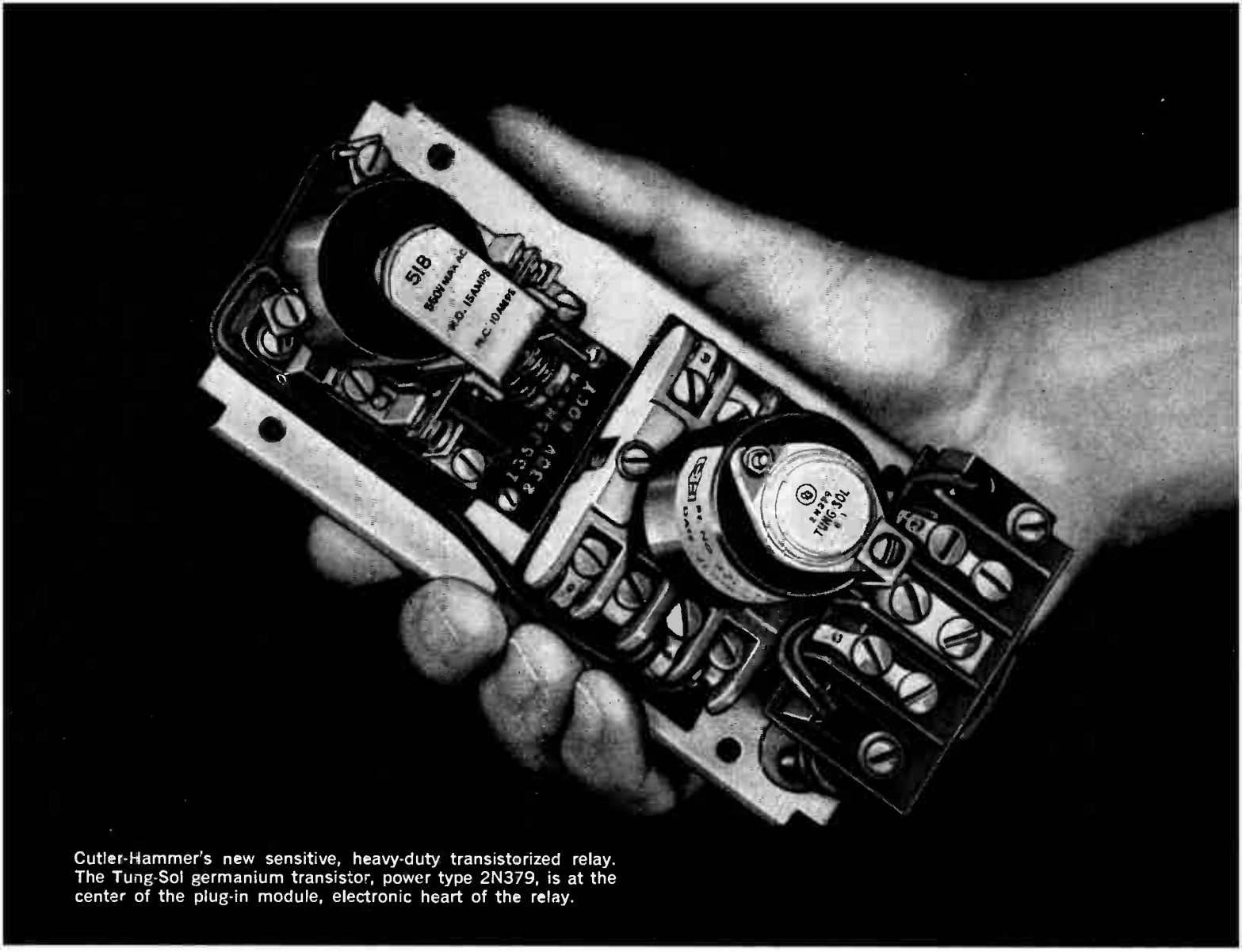
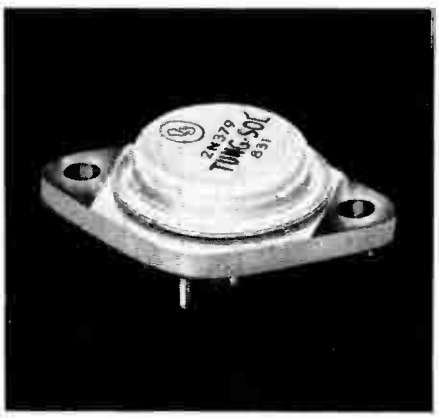


Cutler-Hammer's new sensitive, heavy-duty transistorized relay. The Tung-Sol germanium transistor, power type 2N379, is at the center of the plug-in module, electronic heart of the relay.

New versatile CUTLER-HAMMER CONTROL C-H relay relies on Tung-Sol semiconductor



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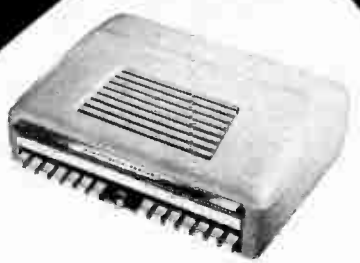

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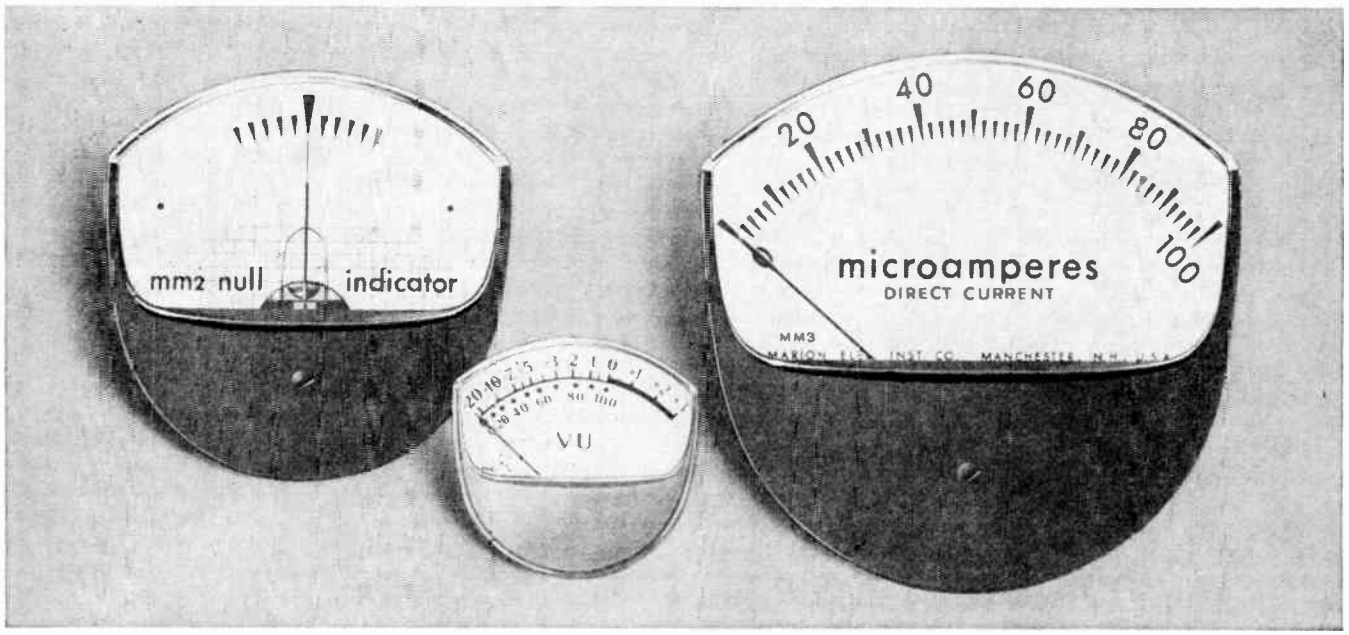

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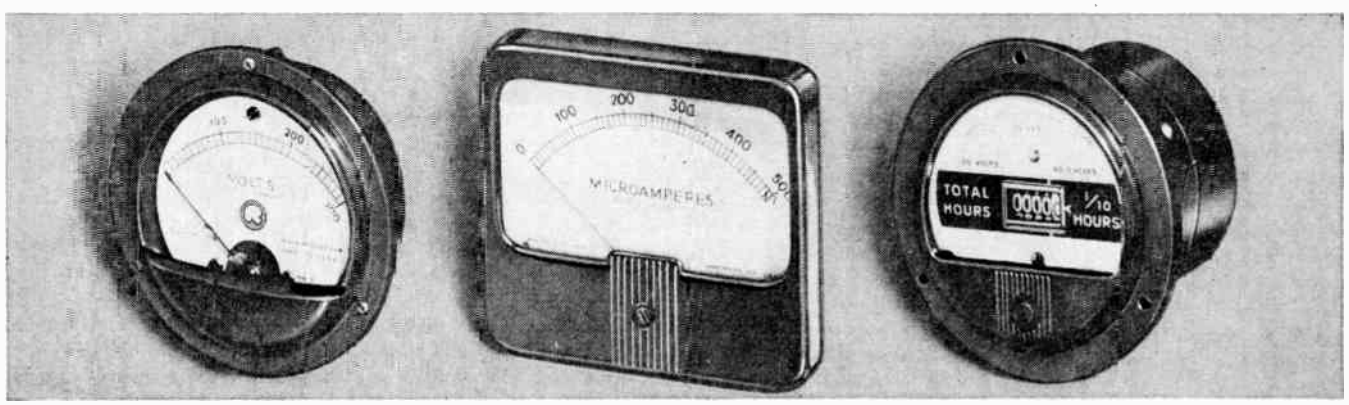

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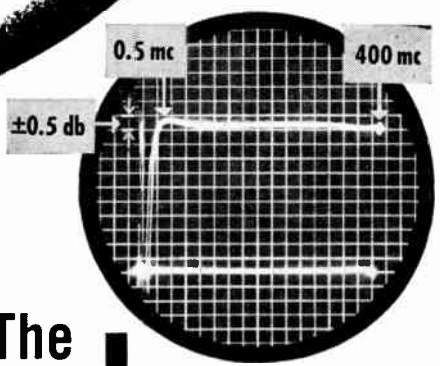

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- **HIGH OUTPUT!**
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  .5 volt RMS on UHF!
- **WIDE SWEEP WIDTHS!**
  From 100 KC up to 400 MCS!
- **FLAT OUTPUT!**
  Flat to ±.5 db on *widest* sweep width!

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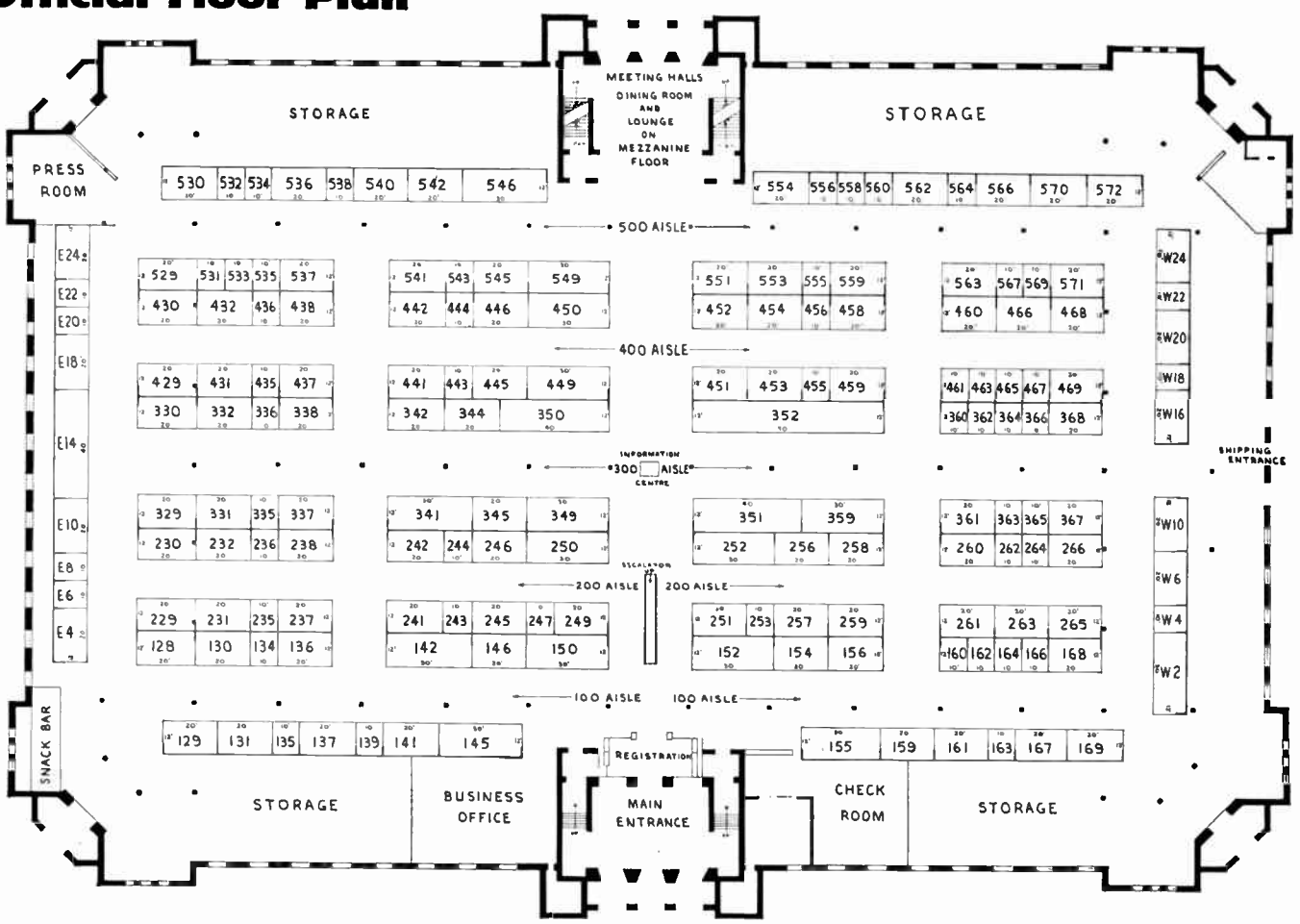

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Technical Program

IRE Canadian Convention & Exposition
Toronto, Canada, October 7-8-9, 1959

PAPER 9008 SESSION 1

AN AREA GAMMA MONITOR FOR USE IN LOW FIELDS

A. R. Jones,
Atomic Energy of Canada Limited,
Chalk River, Ont.

A halogen tube monitor has been developed which covers three decades in one logarithmic scale. The radiation intensity is continuously recorded and a warning light is switched on whenever a chosen level is exceeded. This light remains on until it is reset and serves to draw attention to an abnormal radiation condition during the preceding period, whenever the chart is inspected.

The detector is a halogen counter having a thick chrome iron cathode wall. The counting rate is proportional to the radiation intensity over a wide range of photon energies.

The circuitry is entirely transistorized, containing 7 transistors in all. The power requirements, about 1 watt at normal background level, can be met by the mains or batteries.

PAPER 9058 SESSION 1

A TRANSISTORIZED MARINE GYRO COMPASS

H. H. Rugg,
Sperry Gyroscope Company of Canada, Ltd., Montreal, Que.

To obtain maximum performance in a minimum of space, newer gyro compasses use electronically amplified control signals sensing earth's rotation and local gravity to cause the gyro to point North. Overall accuracy requirements impose rather severe demands for gain stability and linearity in the control amplifiers. This paper discusses a transistorized amplifier system developed to replace a vacuum tube system for such a compass, providing desired electrical performance over a wide temperature range, and reducing the physical volume by a factor of at least 4/1. Principles of operation of a gyro compass are discussed briefly to demonstrate the amplifier functions and electrical requirements.

PAPER 9098 SESSION 1

PRECISION AC TRANSISTOR AMPLIFIER FOR INDUSTRIAL CONTROL APPLICATIONS

J. A. I. Young,
Canadian General Electric Co. Ltd., Peterborough, Ont.

Many control systems in industry are AC systems, where the signals are in the form of the envelopes of "Suppressed-Carrier" modulated voltages. The carrier amplitude denotes the magnitude of a process variable and the carrier phase indicates the sign of the variable. In simple systems, or subsystems of more complex systems, several of these signals are summed in a "Summing Amplifier". Vacuum tube summing amplifiers are almost invariably the well known "Operational" type. However, many signal transducers are inherently low-impedance devices and pose problems for operational amplifiers. This paper outlines an approach using a transistor AC amplifier design which capitalizes upon this low source impedance property to provide optimum signal to noise performance, good response characteristics, linear amplification, excellent dynamic range and freedom from drift.

PAPER 9101 SESSION 1

A NON-OVERLOADING TRANSISTOR PULSE AMPLIFIER FOR NUCLEONIC APPLICATIONS

J. S. Waugh,
Atomic Energy of Canada Ltd., Chalk River, Ont.

The paper describes a transistor pulse amplifier developed for use with methane proportional flow counters. An introduction summarizes the operation and use of such counters, outlines the counter users criteria of amplifier performance and formulates an amplifier specification. The problems and relative advantages resulting from the use of either current or voltage modes of operation in the realization of such an amplifier are considered.

An amplifier developed at Chalk River is described in detail and performance data presented.

PAPER 9112 SESSION 1

CASCADED AUTOMATIC GAIN CONTROL

J. S. Brown,
General Electric Co., Syracuse, N.Y.

The problems of using AGC with transistors are described. An amplifier is described which employs two separate AGC loops. The use of two loops results in an amplifier which does not overload at high signal levels and which has a good noise figure at low input levels.

PAPER 9088 SESSION 2

A TEMPERATURE CONTROL FOR A SINGLE-CRYSTAL GROWING FURNACE

J. H. Simpson,
National Research Council, Ottawa, Ont.

A temperature control for a Czochtalski-type furnace for the growth of single crystals of alkali and silver halides is described. The detecting element is a chromel-alumel thermocouple whose output is compared to a standard DC voltage. The difference is chopped, amplified and demodulated by a transistor amplier and applied to a thyratron circuit capable of applying 1,000 watts of AC (60 cps.) power to a standard resistance heating element surrounding the melt. Some novel features, particularly in the demodulator and output stages, are described.

PAPER 9055 SESSION 2

MACHINE CAPABILITY MEASUREMENT OF A NUMERICALLY CONTROLLED MACHINE TOOL

J. D. Ledoux,
Sperry Gyroscope Company of Canada, Ltd., Montreal, Que.

In recent years increasing attention has been given to the use of statistical techniques to establish the performance capability of machine tools. Every machine has inherent variability and a study of the statistical properties of these variations shows that they follow certain basic laws

IRE CANADIAN CONVENTION TECHNICAL PROGRAM SCHEDULE

Date and Time	SESSIONS				
	Satellite Room	Transistor Room	Aeronautics Room	Pulse Room	Radar Room
Wednesday October 7 2:30 p.m. — 5:00 p.m.	**Session 1** Transistor Applications	**Session 2** Instrumentation and Control	**Session 3** Broadcast	**Session 4** Reliability in Electronics	**Session 5** Radar
Thursday October 8 10:00 a.m. — 12:30 p.m.	**Session 6** Stereophonic Broadcasting	**Session 7** Semiconductors	**Session 8** Air Traffic Control	**Session 9** Medical Electronics I	**Session 10** Antennas I
Thursday October 8 2:30 p.m. — 5:00 p.m.	**Session 11** Audio	**Session 12** Education Panel	**Session 13** Solid State Electronics	**Session 14** Mobile Communications	**Session 15** Antennas II
Friday October 9 10:00 a.m. — 12.30 p.m.	**Session 16** Space Electronics	**Session 17** Design Methods	**Session 18** Analog Computing	**Session 19** Medical Electronics II	**Session 20** Communication Equipment
Friday October 9 2:30 p.m. — 5:00 p.m.	**Session 21** Developments at National Research Council, Ottawa	**Session 22** Engineering Management	**Session 23** Components for Digital Computers	**Session 24** Power Supplies	**Session 25** Communication Systems

Technical Program

as described by the theory of probability.

Statistical techniques were employed on a Turret Drill automated with a Numerical Control. By means of this study, several system faults were detected and corrected which otherwise would not have been found by conventional test methods.

A. R. Low
Member, Technical Program Committee

PAPER 9040 SESSION 2

AN AUTOMATIC GAUGE CONTROLLER FOR THE COLD ROLLING OF STEEL STRIP

B. P. Jacobsen and D. H. Lennox,
Canadian Westinghouse Co. Ltd., Hamilton, Ontario.

The various factors which determine the gauge of strip issuing from a cold rolling mill are discussed and illustrated with simplified graphs. By representing certain variable factors by electrical signals, an electrical analogue of gauge can be computed and utilized for automatic control. The system developed by Canadian Westinghouse Company from the initial BISRA development is described showing how the deviation from the required gauge is computed from the measurements of load on the work rolls, position of the screws, and required setting of gauge, together with compensations for temperature changes in the mill and variations of oil film thickness in the roll bearings.

PAPER 9021 SESSION 2

A VERSATILE DATA RECORDING UNIT FOR THE ATOMIC POWER DEVELOPMENT LABORATORY

R. S. Flemons,
Canadian General Electric Co. Ltd., Peterborough, Ont.

The recording of data in experiments simulating the transfer of heat in an atomic reactor presents interesting problems.

Many diverse quantities must be measured, including pressures, DC voltage and current, AC power, absolute and differential temperatures. More than 30 such variables are recorded on a single 20 point strip-chart potentiometer. The more important quantities are registered every 40 seconds, while others may be as infrequent as every 400 seconds.

A cross-bar switch has been interconnected with a standard multipoint recording potentiometer to provide a versatile instrument capable of easy modification during the progress of experimental work.

The paper outlines the requirements of this field and the characteristics of the major components such as the recording potentiometer and the cross-bar switch. Some details of the programming circuit are described to illustrate how the cross-bar switch can be operated with very few relays. A resumé of the results obtained will be included.

PAPER 9131 SESSION 2

TRAFFONICS

J. T. Hewton,
Municipality of Metropolitan Toronto, Toronto, Ont.

The art of designing, or adapting electronic devices for, and applying them to, the special problems of traffic engineering with special reference to current practice and future possibilities in the fields of research, control and enforcement.

PAPER 9035 SESSION 3

ENVELOPE DELAY MEASUREMENTS IN THE 20 - 100 mc FREQUENCY RANGE

V. Ventser,
Northern Electric Co. Ltd., Montreal, Que.

The condition for distortionless FM transmission over radio links for multichannel telephony is that envelope delay of the system be constant, otherwise intermodulation noise and crosstalk between channels will result.

This paper describes a method for measuring envelope delay, using commercially available equipment, to an accuracy of ± 0.25 millimicroseconds for delays around 50 musec.

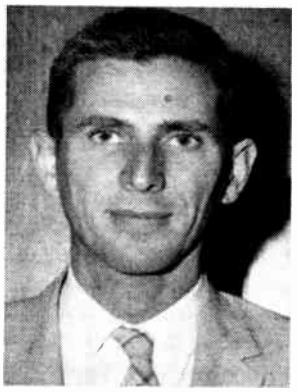
An amplitude modulated test signal is split and passed through the unit under test and through a standard path. Both signals are demodulated and the phases of the two modulating signals are compared. The phase shift between the two signals serves as an indication of envelope delay.

PAPER 9015 SESSION 3

THE USE OF PHASE EQUALIZERS TO IMPROVE THE TRANSIENT RESPONSE OF A TELEVISION TRANSMITTER SYSTEM

J. K. MacDonald,
Canadian Broadcasting Corp., Montreal, Que.

The improvement in transient response and hence of picture quality which was achieved at one of the CBC transmitter in-



H. W. Jackson
Recording Secretary, Executive Committee

stallations due to the use of phase equalizers is described.

Basic theory governing amplitude vs frequency and phase vs frequency characteristics and their effect on transient response is given as applied to a square wave and to the sine-squared pulse.

The alignment of the station monitor demodulator is described and the type of test equipment used. The techniques of transient testing of the transmitter are described.

Photographs are included of Amplitude vs frequency, differential gain, line rate and field rate window tests on the apparatus as well as of the square wave and sine-squared pulse waveforms through the equipment.

Waveform photographs are included showing the improvement in transient response with the adjustment of the phase equalizers. Photographs of the envelope delay characteristics of the equipment are included. Photographs of the transmitted monoscope picture are included to show the improvement in picture quality with phase equalization.

A recommended test procedure for transient testing is included and a tentative specification for the limits of performance of the station monitor demodulator to a square wave and a sine-squared pulse.

PAPER 9052 SESSION 3

AN H.F. LINEAR AMPLIFIER WITH LOW INTERMODULATION DISTORTION

J. A. Jarvis,
Northern Electric Co. Ltd., Belleville, Ont.

A new general purpose H.F. transmitter is described which has been designed to meet new requirements of low intermodulation distortion and low harmonic output.

The paper reviews the problems of third and higher order distortion products, the use of R.F. and envelope feedback, and proceeds to describe new approaches which were used to reduce distortion. The relationship of second harmonic generation and third order distortion are discussed.

PAPER 9039 SESSION 4

TEST METHODS TO DETERMINE EQUIPMENT RELIABILITY

L. E. Marzec,
Canadian Westinghouse Co. Ltd., Hamilton, Ont.

Stringent reliability clauses are becoming a more and more common feature of current specifications for military electronic equipment. Previously, the requirements have been very vaguely expressed and in many instances ignored. The onus has now been placed on the supplier to prove to the satisfaction of the customer that the equipment does actually meet the stipulated reliability requirements. This paper outlines some of the statistical methods employed in testing for the required measure of reliability. A short summary is also given of the necessary reliabilty functions which have to be performed to ensure that the manufactured electronic equipment has a good chance of meeting the reliability requirements specified in the contract.

PAPER 9005 SESSION 4

ENVIRONMENTAL TESTING OF RELAYS TO MIL-R-5757C

J. A. J. Musselman,
Canadian Westinghouse Co. Ltd., Hamilton, Ont.

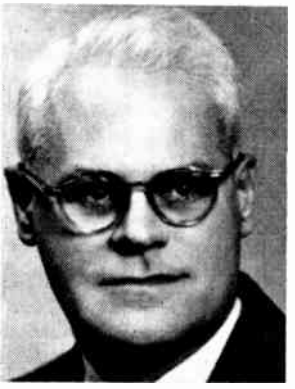
All tests required for Quality Approval are covered, test by test. Various methods, and the instrumentation required, are discussed, and illustrated with slides. Anomalies in the various test paragraphs, and test methods, involving good engineering practice, to overcome these anomalies, are covered where they occur. Special instrumentation developed for monitoring contact chatter and opening during vibration and shock is discussed, and calibration methods of this instrumentation is also covered. Types of failures that occur during individual tests, and possible reasons for these failures, are gone into, especially the intermittent, recurring type of failure, such as contact opening during vibration and shock that occurs only once during a test.

PAPER 9003 SESSION 4

HOW CAN WE ATTAIN HIGH RELIABILITY OF COMPLEX MILITARY ELECTRONIC EQUIPMENT?

M. Halio,
Ballistic Research Laboratories, Aberdeen Proving Ground, Maryland.

Each piece of military electronic equipment passes through various phases in its normal life cycle. These are planning, design and development, pilot production,



H. F. Shoemaker
Chairman, IRE Toronto Section

manufacture, transportation, storage, operation and maintenance. Each of these stages is replete with opportunities for the introduction of unreliabilities. This paper points out the pitfalls which may be encountered and makes specific recommendations to

Technical Program

avoid these so that the full amount of potential reliability may be realized in the final equipment.

E. (Al) Jones
Chairman, Advertising and Publicity Committee

PAPER 9080 SESSION 4

RELAY RELIABILITY — A PRODUCT OF DESIGN
R. K. Empey,
Automatic Electric (Canada) Ltd., Brockville, Ontario.

The second most unreliable component in present electronic equipment — this is the dubious distinction tendered the electro-mechanical device — the relay.

In recent years many articles and papers have been written concerning component reliability and considerable time and money has been spent by research and development laboratories on relay development and modification of design in order to provide relays which will perform required functions with a high degree of reliability.

It is the intention of this paper to outline the problems encountered and the results achieved in the design of a reliable armature type telephone relay compatible with present day circuitry and components.

PAPER 9069 SESSION 5

ASPECTS AND PROSPECTS OF MODERN RADAR THEORY
F. E. Howley,
RCA Victor Company, Ltd., Montreal, Quebec.

This exploratory paper examines some of the more fundamental limitations of current radar theory. The various statistical techniques which have been applied to the radar reception problem are reviewed and their relative merits assessed. In particular the Decision Theory approach to radar design is examined in the light of future needs. It is concluded that the incompleteness of information on the statistics of the radar input data is the most important single factor limiting the design of radar systems for optimum performance. To avoid the necessity for basing radar designs on invalid assumptions, the incorporation of "learning" or "Adaptive" features in systems is proposed.

PAPER 9113 SESSION 5

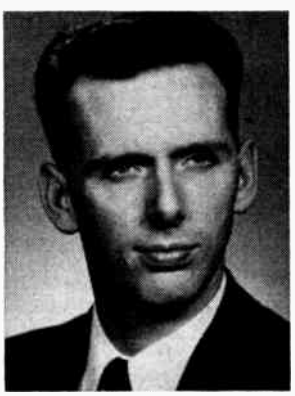
RADAR SYSTEM CALIBRATION THROUGH THE USE OF SOLAR NOISE
J. A. Kuecken,
Avco Corporation, Cincinnati, Ohio.

The described technique is shown in application to a mobile C-Band height finding radar. A method is demonstrated whereby the boresight calibration of a radar set in the field may be very accurately checked and errors measured. This is accomplished through the use of solar noise and without the aid of any auxiliary transmitters or electronic equipment. The measurement is simple in nature and may be performed by relatively untrained field personnel. An additional confidence factor is furnished in that the strength of the received signal provides a measure of the overall system sensitivity including antenna gain.

PAPER 9004 SESSION 5

DELAY-LINE SECONDARY RESPONSES IN AM AND FM SWEEP INTEGRATORS
H. Urkowitz,
Philco Corporation, Philadelphia, Penna.

A video sweep integrator is a device for adding the successive detected radar returns of successive transmitted pulses. One type of video sweep integrator uses an ultrasonic delay line for storage and the addition is obtained by means of a closed regenerative loop operated continuously with exponential memory. Delay-line secondary, or spurious, responses result from multipath propagation through the delay line. The cumulative effect of these responses after they are recirculated in the sweep integrator may be very significant. The exact effect depends to a certain extent upon the type of modulation that is propagated through the delay line. In this paper the buildup effects of secondaries are determined for both AM and FM transmission through the delay line. With AM there is coherent buildup, which results in a secondary buildup relatively much greater than the buildup of the desired signal. With frequency modulation it is possible to alleviate the buildup effect of secondaries by introducing a small amount of hum deviation on the carrier frequency, which results in a random buildup. Experiments with FM sweep integrators confirm the expected coherent buildup without hum



E. L. Kerridge
Member, Technical Program Committee

deviation and also confirm that random buildup occurs when the hum deviation is introduced.

This paper also derives formulas for the effects of delay-line secondaries when the integrator operates with uniform or constant memory for a finite time. In this mode of operation with FM transmission through the delay line, the secondaries build up noncoherently without the introduction of hum deviation.

PAPER 9056 SESSION 5

A DIGITAL APPROACH TO RADAR SIMULATION
T. G. Rankin,
Sperry Gyroscope Company of Canada, Ltd., Montreal, Que.

This paper describes a digital radar simulator which has been designed to provide military and naval PPI indicators with signals which represent radar targets, jamming and noise. The equipment consists of a number of target generators which compute the absolute position of each target from the course and speed of the target, a computer which calculates the relative position of each target from each simulated radar unit as well as the target signal strength, and radar control units which convert the digital computer output to a suitable radar signal and supplies jamming and noise signal.

Since the target generator and computer are fairly conventional they are described only briefly while the radar controls are given a much more detailed treatment.

PAPER 9134 SESSION 6

NEW DIMENSIONS IN SOUND — VIA A SINGLE AM BROADCAST CHANNEL
H. E. Sweeney and C. W. Baugh, Jr.,
Westinghouse Electric Corp., New York, N.Y.

This new system makes possible the broadcast of two-signal stereophonic sound over a single AM channel by simultaneous amplitude and frequency modulation of the carrier.

Transmitter and receiver circuitry are discussed as well as the need for a compensating system to overcome the lack of uniform response in the receiver.

Results of field tests at KDKA confirm laboratory experiments.

PAPER 9135 SESSION 6

A REPORT ON FIELD TESTS OF STEREOPHONIC BROADCASTING BY AM MULTIPLEXING
W. P. Boothroyd,
Philco Corporation, Philadelphia, Penna.

A proposal for standards for stereophonic broadcasting by compatible AM multiplexing is discussed. An analysis of the radiated signal and its main characteristics will be discussed with relation to the requirements on transmitters and receivers. Information on a transmitter multiplexer and a consumer type receiver is included. A summary of equipment installation and field test results of broadcasts from an AM transmitter (WABC, New York) completes the paper.

PAPER 9117 SESSION 6

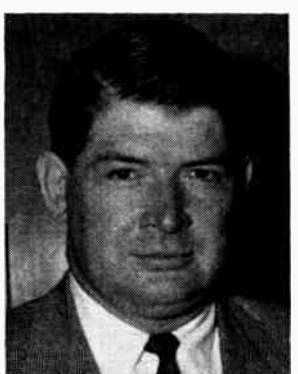
PERFORMANCE CHARACTERISTICS OF FM MULTIPLEX STEREO TRANSMISSION
M. G. Crosby,
Crosby Laboratories, Inc., Syosset, New York

The techniques employed in the transmission and reception of FM multiplex stereo, whereby the monaural listener receives a compatible balanced program, will be described. Performance characteristics, based on measurements, will be given which show the signal-to-noise ratio characteristics obtained with the standards which provide the optimum performance of an FM station as a stereo broadcasting station. These characteristics will be compared to those of the proposed system which utilizes two subcarrier channels, one of which provides stereo information and the other a subsidiary communications channel.

PAPER 9136 SESSION 6

A SYSTEM FOR COMPATIBLE STEREOPHONIC BROADCASTING IN THE AM BROADCAST BAND
J. Avins,
RCA Laboratories, Princeton, New Jersey.

A system for compatible stereophonic broadcasting in the AM broadcast band is described. The background leading to the choice of the system and the system parameters is discussed. Both transmitter and receiver problems are considered.



Tom Purdy
IRE Region 8 Liaison Officer

The system has been installed in Station WRCA, New York and field tested from the viewpoint of compatibility and stereo performance. The field test experience obtained has demonstrated a high degree of compatibility and good stereophonic reception on relatively simple receivers.

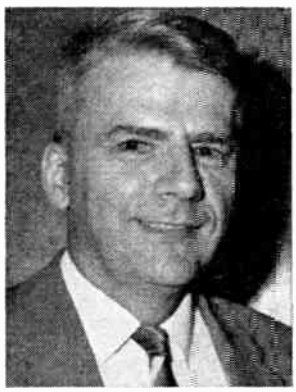
Technical Program

PAPER 9137 SESSION 6

THE NATIONAL STEREOPHONIC RADIO COMMITTEE

C. G. Lloyd,
National Stereophonic Radio Committee, Auburn, New York.

This paper will discuss the objectives of the National Stereophonic Radio Committee (NSRC) the manner in which it is organized



Fred J. Heath
Vice-Chairman,
IRE Convention Executive Committee

and the status of its work to date. General information will be given on the types of systems proposed for AM, FM and TV Stereo broadcasting.

PAPER 9068 SESSION 7

STUDIES ON AVALANCHE BREAKDOWN IN SILICON

P. Webb and R. J. McIntyre,
RCA Victor Company, Ltd., Montreal, Que.

A study has been made of voltage breakdown phenomena in diffused silicon junctions. Measurements and observations are reported for the temperature range from 77°K to 300°K. The breakdown current at a given applied voltage is carried by a series of random pulses of constant height. The mean pulse lengths are found to increase greatly with decreasing temperatures while the pulse height decreases. The phenomena observed are explained in terms of a model and a mechanism for the switching on and off of a microplasma.

PAPER 9106 SESSION 7

INFLUENCE OF MINORITY CARRIER RECOMBINATION ON THE CURRENT GAIN OF A MESA TYPE DRIFT TRANSISTOR

D. P. Kennedy,
International Business Machine Corporation, Poughkeepsie, N.Y.

In transport efficiency calculations using a simplified one-dimensional model, minority carrier spreading within the base region of a transistor is not considered. Frequently the validity of such approximation methods is questioned when applied to devices exhibiting a large current gain. The simplified model eliminates a minority carrier current component parallel to the collector junction face; this elimination is believed to introduce an error in the calculated magnitude of recombination current.

PAPER 9034 SESSION 7

DIFFUSION OF INJECTED CARRIERS IN SILICON

C. H. Champness,
Northern Electric Co. Ltd., Montreal, Que.

The field free diffusion of minority carriers injected at a point into silicon has been studied. The time from injection to the maximum due to the arriving carriers has been measured for various emitter collector distances. The results do not agree with the conventional solution of the differential equation involving carrier diffusion and life time. There are indications that the effective life time may be a function of the distance from the emitter. This could be the result of enhanced recombination due to a very large concentration of excess carriers at the emitter point during injection.

PAPER 9067 SESSION 7

A NOTE ON THE MODULUS AND PHASE OF THE COMMON-BASE CURRENT GAIN α, OF THE DRIFT TRANSISTOR

J. M. Stewart,
RCA Victor Company, Ltd., Montreal, Que.

The frequency behavior of the modulus and phase of α of the drift transistor is discussed with emphasis on the modulus and phase of α at f_α, the transistor cut-off frequency in the common-base connection. An attempt is also made to explain the dependence of f_α on injection level. Previous work of Almond and McIntyre on the drift transistor has been extended to include the effects of transition capacitance. Provided a constant injection efficiency is assumed, the emitter transition capacitance is seen to be responsible for the dependence of f_α on emitter current; also, at low current levels, it drastically reduces the improvements in cut-off frequency gained by introducing the drift field into the transistor. An interesting result of this investigation is that measurements of f_α against I_e for the drift transistor can lead to accurate determination of both C_{de} and C_{te}, the emitter diffusion and transition capacitances respectively. Up to the present, some doubt has existed as to the best method of determining these parameters and the method proposed may prove to resolve these difficulties.

PAPER 9048 SESSION 8

BRIGHT RADAR DISPLAY FOR CANADIAN AIR TRAFFIC

T. W. R. East,
Raytheon Canada Limited, Waterloo, Ont.

A Bright Display which allows viewing in normal lighting greatly increases the usefulness of radars such as those used for air route surveillance. A Radar-to-TV Scan Converter developed in Canada uses a two-gun recording storage tube in which the information is stored as an electrostatic charge distribution, and displayed on TV monitors at 525-lines, 30 frames per second. RF modulated read-out is used to prevent cross-talk between the beams. Dynamic focus on write and read beams allows an overall resolution of 500 lines. The stored pattern fades at a rate which can be controlled by the operator, so that moving targets leave a trail which shows direction of motion.

W. Ornstein
Member, Technical
Program Committee

PAPER 9027 SESSION 9

AUTOMATIC RECORDING TECHNIQUES USING THE TELEVISION EYE MARKER

E. Llewellyn-Thomas, M.D., R. Howat, N. H. Mackworth, M.D.
Defence Research Medical Laboratories, Toronto, Ont.

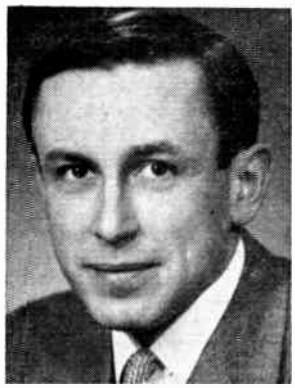
Where a man looks and how he searches for visual information when performing various tasks is becoming of increasing importance. This paper describes a method of following the various positions of eye fixation, by the use of a television camera or an ordinary movie camera, viewing the moving corneal reflection or "eye spot". It also describes a method of recording this information by means of a photocell matrix on a monitor screen, and converting the photocell impulses to code for the production of punched tape, suitable for immediate inclusion in a computer program.

PAPER 9031 SESSION 9

X-RAY PROJECTION MICROSCOPY — APPLICATIONS IN BIOLOGY AND MEDICINE

R. L. de C. H. Saunders and L. Van der Zwan,
Dalhousie University, Halifax, N.S.

The inherent higher resolving power of X-rays has led to their application to research in microscopy. Primarily magnified images using X-radiation have been obtained by different procedures. Owing to the difficulty of making lenses to focus X-rays, a projection type of X-ray micro-



W. E. Hodges
Member, Technical
Program Committee

scope (Cosslett and Nixon) has been developed, which utilizes electro-magnetic lenses to focus the electron beam and to produce a point source of X-rays, which casts an enlarged image of the specimen on to a distant screen or plate. Metallurgical, botanical and entomological studies have been carried out. Recent studies of the peripheral and cerebral vascular systems will be summarized, illustrating the microcirculatory detail obtainable. Exploratory studies of soft and mineralized tissues by X-ray projection microscopy will also be discussed with reference to possible quantitative interpretation.

PAPER 9061 SESSION 9

BODY SCANNER

J. Cederlund, H. E. Johns and A. D. Rotenberg,
Ontario Cancer Institute, Toronto, Ont.

In order to try to locate small metastatic nodes, a total body scanner, using a 5 inch diameter x 2 inch high sodium iodide crystal and 5 inch photomultiplier, has been constructed. The crystal is protected from background radiation by a lead shield weighing about 1500 lbs. A focussing collimator insures that only radiation originating within a very small volume will be registered by the crystal. This detector head is arranged to move in two directions at right angles beneath a prone patient. A synchronously moving plotting unit produces two different pictures of the distribution of the radioactivity within the patient. One is obtained by means of an electrical stylus which produces a mark on a sensitized paper for each pulse. In addition, a light source, the brightness of which is controlled by the counting rate, is arranged to exposed a film. The contrast on the film may be altered electronically.

PAPER 9084 SESSION 10

THE DESIGN OF OMNIDIRECTIONAL RING ARRAYS

G. Sinclair,
University of Toronto, Toronto, Ont.

A study has been made of design procedures for ring arrays suitable for high power broadcast stations. Special attention has been paid to arrays having a large number of elements, and design data has been obtained using a high speed computer.

Technical Program

PAPER 9066 SESSION 10

AN ANTENNA DECOUPLER

W. V. Tilston,
Sinclair Radio Laboratories Ltd.,
Toronto, Ont.

Whenever two separate communication systems are used, there is a certain amount of mutual coupling between them. This coupling depends on the antenna type, orientation, and spacing.

For reasons of economy, it is often desirable to mount the two antenna systems colinearly on the same tower. The disadvantage of this is that the lower antenna usually has much less coverage than the higher one. To overcome this, a method has been devised and tested, by which the two antennas may be placed much closer to one another, while still maintaining the coupling at a very low value.

Dr. George Sinclair
Past General Chairman, IRE Canadian Convention Executive Committee

PAPER 9138 SESSION 10

DESIGN OF TV TRANSMITTING ANTENNAS

N. Tomcio
Canadian General Electric Co. Ltd.,
Toronto, Ont.

This paper describes general design and performance requirements of TV transmitting antennas and how they can be met by various types of antennas including batwing, helical and slotted cylinder antennas. Various types of array illuminations and their effect on vertical array patterns are discussed. Methods for modifying horizontal radiation patterns are indicated.

The art of design of VHF-TV transmitting antennas has advanced to a state in which a high quality of performance and reliability has become a standard feature.

It is possible in a relatively economical way to satisfy many special coverage requirements by applying beam tilt, null fill-in, vertical pattern contouring, and modification of the horizontal pattern to meet a particular market requirement.

PAPER 9105 SESSION 10

BROADSIDE ARRAYS OF LONG-YAGIS

D. L. Sengupta, D. D. Y. Tang and J. L. Yen,
University of Toronto, Toronto, Ont.

The long-yagi is a very simple low cost end-five antenna capable of narrow beam operation. However, due to the structural limit of maximum length attainable in practice, there is a limit in beam width or gain. To achieve much narrower beam width, the long-yagis can be used as elements in a broadside array. The design aspects, some experimental results, and finally, the advantages of such arrays are presented. They are most suitable in the UHF range because of the dimensions involved. The investigation was motivated by the feasibility study of very large arrays for high resolution radio astronomical observations. Moderate sized long-yagi arrays should compete favorably with parabolic reflectors in the UHF range for many other applications.

PAPER 9051 SESSION 11

VARIABLE GAIN AMPLIFIER

D. G. Vice,
Northern Electric Co. Ltd.,
Belleville, Ont.

Variable gain amplifiers as compressors and limiters have found wide application where overload of circuits due to rise in signal input level or excessive peaks in dynamic range of input level are to be prevented.

In addition to a discussion of design objectives and limitations encountered in a variable gain amplifier for use in high quality audio applications, this paper also describes a new variable gain device — the expander — compressor — which is capable of giving considerable signal to noise improvement as subjectively measured, on speech or program signal.

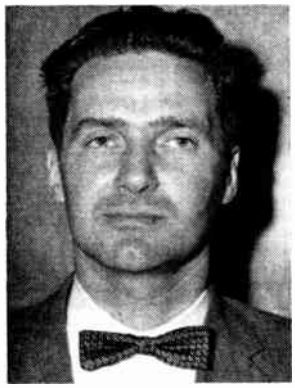
The paper will be accompanied by a demonstration of the effects of these devices on program material.

PAPER 9097 SESSION 11

THE DISTORTION DUE TO THE USE OF CENTRE TAPPED TRANSFORMERS IN A CLASS B POWER AMPLIFIER

R. G. deBuda,
Canadian General Electric Co. Ltd.,
Toronto, Ont.

The transformer-coupled class B amplifier is investigated with regard to even harmonic distortion and over-voltage effects caused by the use of a center tapped transformer. A detailed study of the circuit shows which characteristics are required of the transformer to achieve acceptable distortion levels in the amplifier. The interdependence of low frequency response, stray capacitance, leakage inductance and voltage rating is discussed in demonstrating the compromises necessary to achieve a good yet realistic transformer specification.



S. F. Love
Member, IRE Convention Awards Committee

PAPER 9010 SESSION 11

TECHNIQUES AND INSTRUMENTATION FOR ACOUSTIC MEASUREMENTS

J. B. Harris,
Radio Speakers (Canada) Ltd., Toronto, Ont.

This paper concerns the transmission of sound in a gaseous medium, and the effects of obstructions on a plane sound wave. Type of meters for sound pressure measurement and allied measurements are described and the effect of various rectification circuits considered. A multi-tone calibration system is outlined. The effect of various sizes and shapes of baffles on loudspeaker response curves is described. A suggested method of specifying the overall efficiency of a loudspeaker which takes into account the conversion efficiency, distortion, directivity and power handling ability is advanced.

PAPER 9064 SESSION 11

THE ACOUSTICS OF SMALL ROOMS

J. R. Richardson,
Sinclair Radio Laboratories Ltd.,
Toronto, Ont.

The fundamental resonances of small rooms lie in the lower region of the audible range and are therefore predominant in the acoustical properties of such enclosures. Both the steady-state and transient-state behavior of a rectangular enclosure with varying boundary values is considered and results which show the variations in decay form and decay time under different conditions are given.

J. R. Bain
Member, Technical Program Committee

SESSION 12

EDUCATION

Panel Discussion on Recent and Projected Changes in Electrical Engineering Curricula at Canadian Universities.

Chairman: Prof. J. W. Porteous, University of Alberta, Edmonton, Alta.

Panel Members: Panel members are being selected from some of those Canadian Universities which are most active in curriculum planning. The panel will table changes which are now in effect at their own universities as well as changes which are projected for the immediate future.

Among those already selected are: Dr. G. L. d'Ombrain, McGill University, Montreal, Que. Prof. A. D. Moore, University of British Columbia, Vancouver, B.C. Prof. G. R. Slemon, University of Toronto, Toronto, Ont.

PAPER 9118 SESSION 13

THE PROPERTIES OF METALS AT LOW TEMPERATURES

A. C. H. Hallett
University of Toronto, Toronto, Ont.

A review will be given of the experimentally determined electrical and magnetic properties of metals at low temperatures including such phenomena as superconductivity and resistance anomalies. The fundamental processes which occur in metals to produce the observed behavior will be discussed briefly.

PAPER 9144 SESSION 13

MOLECULAR ELECTRONICS

G. C. Szikiai
Westinghouse Electric Corp., Pittsburgh, Pa.

The Molecular System Engineering concept provides a revolutionary new method of electronic system fabrication and design. The new system is built by topology of material domains rather than by the arrangement of components. The molecular system concept provides great savings in size, weight, and power consumption, as well as a high degree of reliability, and promises to stimulate the invention of new systems.

The Molectronics approach of system design provides a direct interchange of knowledge of structure of matter and modern system logic. With this new approach, subsystems have been designed and built in monolithic form, proving the practical value of Molectronics.

PAPER 9087 SESSION 13

FUEL CELLS — A "STATE OF THE ART" SURVEY PAPER

E. L. R. Webb and R. R. Jackson
National Research Council, Ottawa, Ont.

Fuel cells, i.e. electromechanical converters of combustion energy to electrical energy, have been studied for 120 years.

Technical Program

In recent times, concentrated effort has been directed to the production of practical fuel cells, and it appears that they will be commercially available in the fairly near future. The paper gives a brief historical outline, a discussion of the operating principles of existing types and some economic and physical parameters of the hydrogen-oxygen cell.

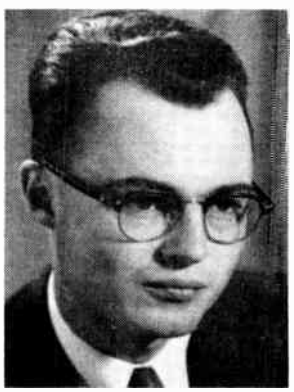
PAPER 9145 SESSION 13

TUTORIAL PAPER ON MASERS

G. A. Woonton
McGill University, Montreal, Que.

The name Maser, coined in 1955 by Prof. C. H. Townes of Columbia University is made up of the initial letters of the following phrase which is descriptive of the device: Microwave Amplification by Stimulated Emission of Radiation.

The Maser takes advantage of the fact that atoms or molecules may exist in several energy states. Exposure to an electromagnetic field may stimulate transitions between these states with an accompanying absorption or emission of electromagnetic energy. It is part of the Maser technique to arrange that the net effect is emission with the result that the stimulating radiation is amplified.



Frank A. Ford
Member, Technical Program Committee

PAPER 9140 SESSION 14

GROWTH OF MOBILE COMMUNICATIONS IN THE UNITED STATES

C. B. Plummer,
Federal Communications Commission, Washington, D.C.

The rapid growth of land mobile radio use in the United States has required a reappraisal of the distribution of frequencies among the various users in order to meet the requirements for continued expansion. Channel splitting has provided an opportunity to appreciably expand the number of frequencies available for rapidly growing uses while, at the same time, uses that had reached apparent maturity in their growth cycle were only moderately expanded. Eligibility for use of a particular group of frequencies has been changed from a single eligibility policy to a multiple eligibility policy in order to accommodate multiple business users and simultaneously increase efficiency of frequency utilization.

PAPER 9116 SESSION 14

SEAWAY COMMUNICATION SYSTEM

J. E. Coke
The St. Lawrence Seaway Authority, Cornwall, Ont.

There are two communication systems in use on the St. Lawrence Seaway; a conventional land line telephone service for point to point communication, and a marine radio telephone system for ship to shore vessel despatching. The history and development of both these systems will be given, starting from the magneto telephone system in use on the old canals to the installation just completed.

An AM and an FM radio telephone service is presently in use. This is only a temporary condition, as it is anticipated that once the navigators see the advantages of FM, all ships will be so fitted thus making all communications for canal despatching in the future FM only.

PAPER 9119 SESSION 14

TRANSISTORIZED PROGRESS LINE SYSTEMS

J. M. Barnes
General Electric Co., Lynchburg, Va.

A brief story of the transistor in mobile equipment will be presented and the reasoning behind the decision to design a new and radically different mobile system will be discused. Receiver and transmitter circuitry will be presented briefly and the interelated necessity for thermal isolation and vehicle mounting compatibility will be explained. The system interconnections will be presented. Emphasis will be placed on the portions of the circuitry which are radically different from conventional circuitry. The main factors which concern the lack of necessity for constant temperature crystal ovens and the incredibly low standby drain (.040 amp) will be discussed. In summation, a comparison will be made between Progress Line and a conventional tubed mobile combination.

PAPER 9142 SESSION 14

A NEW CANADIAN DESIGN OF VHF MOBILE COMMUNICATIONS EQUIPMENT

W. Ornstein
International Systcoms Ltd., Montreal, Que.

An unusually compact mobile radiotelephone design having a power rating of 10 or 30 watts is described. The unit incorporates transmitter, receiver, operating controls and loudspeaker in a single aluminum alloy case. Total weight is less than twelve pounds. The unit is small enough for underdash mounting in a modern passenger car. The transistor power supply is in a separate case designed to be mounted on the vehicle firewall. Heater voltage regulation is employed to maximize vacuum tube reliability. Careful attention to thermal design has minimized the development of hot spots in the interior of the equipment.

PAPER 9095 SESSION 15

RESISTIVELY TERMINATED SPIRAL ANTENNA

F. V. Cairns,
National Research Council, Ottawa, Ont.

Many of the characteristics of double archimedes spiral antennas have been known for some time. However, since this information is not readily available in the literature a brief description and a simplified theory of operation of spiral antennas is justified by this simple theory. Details of some spiral antennas and measured results showing the improvement in the effectiveness of the spiral antenna as a broad band receiving antenna as a result of the resistance terminated are presented.

PAPER 9053 SESSION 15

A DUAL REFLECTOR MICROWAVE ANTENNA

E. S. Kelsey,
Northern Electric Company, Ltd., Montreal, Que.

The antenna described in this paper consists of two singly curved parabolic reflectors and a feed horn or equivalent point source. The first reflector converts the spherical waves originating from the point source into cylindrical waves and the second reflector converts the cylindrical waves into plane waves. Singly curved parabolic surfaces have the advantage over a paraboloidal dish that they can be formed from plane sheets. Also, the supporting structure can consist of straight members in one direction and of identical parabolic curved ribs at right angles thereto.

PAPER 9063 SESSION 15

DUPLEXER OPERATION IN A Tx — Rx SYSTEM AT 950 MC

W. V. Tilston and J. R. Richardson,
Sinclair Radio Laboratories Limited, Toronto, Ont.

A Duplexer which permits the simultaneous operation of a transmitter and receiver on a single antenna in the 900-1000 MC band has been constructed from sections of waveguide. Satisfactory operation is possible with a transmitter power of 1 kw and separations between the transmit and receiver frequencies of 5 MC or more, tuning to any given pair of frequencies being possible by means of adjustable posts. The development and operation of the Duplexer and its performance with respect to frequency separation, isolation between the transmitter and receiver, insertion loss and bandwidth, are described.

PAPER 9139 SESSION 15

THE OUTER IONOSPHERE AS A TRAVELLING WAVE TUBE

R. E. Barrington,
Defence Research Board, Ottawa, Ont.

The whistler mode of propagation is such that the phase velocity of the waves is very much less than the velocity of light. Hence, for whistler frequencies, the outer ionosphere may be considered as a giant slow wave circuit which guides the waves along a line of force.

At times of solar disturbances, and magnetic storms, streams of ions are thought to be precipitated into the earth's ionosphere along the lines of force of the earth's magnetic field. Their velocity is estimated to be of the same order as the whistler phase velocity and thus the interactions of these ion streams with the earth's ionosphere may be described in terms of travelling wave tube theory.

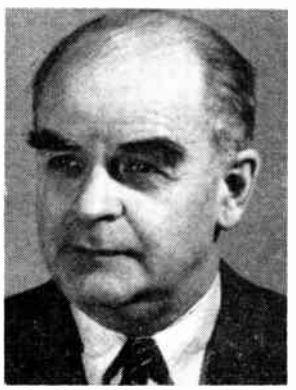
Some of the results of an investigation to determine if such a mechanism can be responsible for the naturally occurring low frequency emissions associated with magnetic disturbances, will be presented.

PAPER 9094 SESSION 15

MICROWAVE ANTENNA COUPLERS FOR COMPARATIVE LOSS MEASUREMENTS

K. A. Steele,
National Research Council, Ottawa, Ont.

An antenna coupler is used as a coupling device for making comparative loss measurements on microwave transmission systems terminated by antennas having similar near-field radiation patterns. By making the coupler nearly reflectionless, it can be placed very close to the aperture of the antenna under test without the usual effects of mutual reflections. Design requirements are discussed and the performance of broadband couplers for L-band and K_u-band is given.



Lloyd M. Price
Chairman, Registration and Reception Committee

PAPER 9128 SESSION 16

SPACE INSTRUMENTATION

R. K. Brown
Defence Research Board, Ottawa, Ont.

This paper reviews briefly the ionospheric investigations which have been a part of the program of the Defence Research Telecommunications Establishment in Ottawa.

The author points out some of the limitations of measurements of the ionosphere made from the surface of the earth and indicates that it would be desirable to make measurements within and from above the ionosphere.

Two experimental programs are described. The first makes use of rocket born equipment to measure the electron density within the ionosphere. The second experiment is designed to make measurements of the ionosphere from above using equipment carried in a satellite.

Technical Program

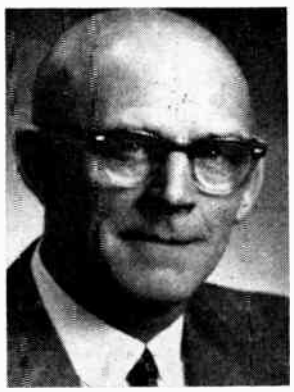
The rockets and the rocket vehicle which will be used to put the satellite in orbit are being supplied by the National Aeronautical and Space Administration of the United States.

PAPER 9111 SESSION 16

LUNAR SPACE COMMUNICATIONS

T. A. Randell
Westinghouse Astronautics Institute, Baltimore, Md.

The paper concerns system parameters and concepts for Lunar communications between the earth and the lunar surface and Lunar vehicles in transit.



Eric L. Palin

General Chairman, IRE Canadian Convention Committee

Three major requirements will be considered:
(1) Speech transmission
(2) Code
(3) Wide band TV type transmissions.

Various important system configurations are derived which arise from the need to achieve an extremely long range with a minimum of power. The effects of beamwidth and doppler frequency shifts are important in deriving the optimum pass band for each type of transmission.

Various vehicle characteristics which affect the communication system are discussed which will have a strong influence on the type of communication system likely to be employed.

PAPER 9130 SESSION 16

SPACE MISSIONS OF THE NEAR FUTURE

A. E. Maine
The Canadian Astronautical Society, Downsview, Ont.

Since the time of Verne, and indeed earlier, authors of both serious and fictional works have described space missions and vehicles based either on pure imagination or at the best conjecture. Over the course of the last few years this situation has changed and it is now possible to peer into the near future with considerably more assurance in regard to man's new generation of space ships and missions. Gone are the days of sleek torpedo shaped rockets complete with rows of portholes and for that matter many of the bizarre devices reminiscent of sections of oil refineries in free orbit. Such pictures have been replaced by the missions already announced by NASA, ARPA and we see a reasoned and systematic extrapolation of what might be called the "big-missile" art. Clearing the fog from area of impending space developments has been due to a larger number of individuals notable among these being K. Von Erich of Convair. This paper draws on recently released information concerning the United States Space Program and commencing with the ATLAS missiles in its astronautical roles outlines what we may reasonably expect to take place over the next twenty years or so. Naturally many things can change in a period such as this and some of the predictions might well turn out to be in error . . . nonetheless what is presented herein represents a careful summary of the considerations of many true contributors and experts in the field of astronautics.

PAPER 9073 SESSION 17

A NEW GRAPHICAL DESIGN PROCEDURE FOR LC FILTERS

L. Slaven,
RCA Victor Co. Ltd., Montreal, Que.

The basic transmission equation of the Zobel type filter is analyzed. This equation is then utilized in deriving the set of relationships necessary for the construction of a graphical procedure for the design of these filters.

Its use in the design of "dissipationless" low pass, high pass and band pass filters is illustrated.

Another application discussed is the use of this method in determining the optimum design parameters of a tone channel multiplex system. It is shown that the determination of maximum obtainable bandwidth, maximum adjacent channel rejection, and optimum channel spacing for a given filter structure can be easily determined by this method.

The conditions necessary for adding a given number of channels to an existing system are also considered.

Finally, the effects of dissipation, reflection loss, and interaction loss in practical filters are discussed. Methods for allowing for this effect are illustrated.

PAPER 9025 SESSION 17

INTERPRETING MEASURED POWER SPECTRA OF SHORT SAMPLES OF TIME SERIES

R. H. T. Bates,
Canadian Westinghouse Co. Ltd., Hamilton, Ont.

It is shown that the power spectra of short samples of time series are distorted from long term values in two largely independent ways. The fluctuations in the average powers of the samples increase with decreasing sample length. The distortion in the shape of the spectra increases with decreasing sample length. From a consideration of the autocorrelation function of a sample a simple method of estimating the long term spectrum is derived. The method suffers from being inductive, but the direct approach is hindered by analytical difficulties and appears to be too complicated for practical use.

PAPER 9006 SESSION 17

THE ANALYSIS OF THE OPERATING POINT INSTABILITY OF ELECTRONIC DEVICES

B. A. Bowen,
Royal Military College of Canada, Kingston, Ontario.

This paper presents a formal method of analyzing a device to determine the variations in operating point which would be caused by changes in various influencing parameters. A general functional relation is expanded as a partial differential equation. This stability (or instability) equation has terms which depend upon the circuit environment of the device as well as the independent parameters causing the instability. It is shown that a particular device can be analyzed to provide the terms for the stability equation, which can then be integrated to determine the total change in bias over the range of interest. Several definitions are postulated which tend to clarify the use of such terms as 'stability', 'stability factor' and 'stabilization'.

To illustrate the theory, experimental results are presented to show the effects of temperature and power supply ripple on transistor amplifiers employing single and double stage stabilization.

PAPER 9082 SESSION 17

STABLE HORIZONTAL MULTIVIBRATOR OSCILLATOR DESIGN BY GRAPHICAL METHODS

C. L. Barsony,
Dominion Electrohome Industries Ltd., Kitchener, Ont.

This paper describes a graphical method for determination of horizontal multivibrator oscillator stability. The causes of various effects such as "mode-hopping", "back-locking" and "frequency shifting" are discussed and described by graphs of the oscillator transfer function. Using the transfer function as an index of oscillator stability, it can be determined what effect component variation, tube cut-off voltages, frequency corrective measures, and pull-in range unbalance as well as horizontal AFC system damping will have on oscillator stability. Optimum methods for adjustment of oscillator frequency are discussed.

PAPER 9104 SESSION 17

UHF PARAMETRIC AMPLIFIERS

S. Dmitrevsky and J. L. Yen,
University of Toronto, Toronto, Ontario.

This paper describes the development work on parametric amplifiers at the University of Toronto. One result of this program is a 320 MC amplifier for radio astronomical observations. After a brief review of the basis of parametric amplification the analysis of amplifier performance is given. Problems encountered in the design of devices of this type in both the UHF and the VHF region are described, Detailed experimental investigation of the effects of various circuit parameters on amplifier performance is then presented. Finally, the design and operation performance of a three cavity amplifier for the 320 MC radiometer of David Dunlop Observatory is given.

PAPER 9059 SESSION 18

AN ELECTRONIC SWITCHING MATRIX

P. T. Caden,
Sperry Gyroscope Company of Canada Ltd., Montreal, Quebec.

This paper describes a high speed electronic commutator, or switching matrix, intended to be used for switching DC analog signals in a data gathering system. The design of this commutator was directed toward reduced setting errors, scale errors, cross talk, and gating pulse energy. In the conventional diode bridge electronic switch, some of these requirements are considered to be mutually exclusive.

The design and construction of a high speed switching matrix consisting of 64 transistorized modular commutator elements is discussed, and sources of error are considered in detail.

H. Ross Smyth

Chairman, IRE Convention Awards Committee

PAPER 9033 SESSION 18

ANALOG MULTIPLIER UTILIZING HALL EFFECT

George S. Glinski and Charles H. Le May,
University of Ottawa, Ottawa, Ontario.

In recent years, the availability of semiconductor materials with large Hall constant renewed the interest in the utilization of the Hall effect for economical and accurate analog electronic multiplication.

After the brief introduction to physics of the Hall effect, this paper discusses several second order effects complicating the design of a practical Hall effect multiplier. Some of these effects have their origin in the charcteristics of Hall effect semiconductor itself (magneto-resistance, temperature dependence, resistive and inductive coupling, etc.) and some are due to the other necessary components (nonlinearity of core material producing the magnetic flux density, frequency dependence of magnetizing current, etc.).

Practical compensating means for the elimination of these undesirable secondary effects are suggested and supported by the experimental results.

Technical Program

PAPER 9108 SESSION 18

A PULSE POSITION MODULATION ANALOG COMPUTER

E. V. Bohn,
University of British Columbia, Vancouver, B.C.

An important field of application for computers is in real-time systems simulation. This requires the generation of non-linear functions, obtaining the sums and products of these functions and solving systems of non-linear differential equations. A new type of analog computer suitable for systems simulation is described which combines the desirable features of the digital and analog computers in its mode of operation. Variables are represented by the time interval between pulses. Utilizing a few basic components it is possible to carry out the operations of addition, subtraction, multiplication and function generation to 0.1 per cent accuracy.

George Armitage
Chairman, IRE Convention Exhibits Committee

PAPER 9042 SESSION 18

A POLYNOMIAL COMPUTER FOR SYSTEM FUNCTIONS

A. D. Moore, F. A. Ruegg and E. W. Scratchley,
University of British Columbia, Vancouver, B.C.

An analog computer for factorizing algebraic polynomials, representing rational system functions, and generating periodic waveforms, is described. Intended for use in the analysis and synthesis of communications networks or control systems, the instrument is believed to be more versatile than other similar devices. Using resolvers as electromechanical phase-shifters in a carrier system, two polynomials of degree up to ten can be represented simultaneously for system-function studies. For polynomial factorization, provision is made for complex coefficients, or for cascading the two channels to handle polynomials of higher than the tenth degree.

The same instrument can be used for Fourier synthesis. Test results indicate that the instrument can determine the zeros of polynomials to two significant figures under favorable conditions.

PAPER 9107 SESSION 18

A FEED-BACK METHOD FOR OBTAINING A SYNCHRO OUTPUT SIGNAL PROPORTIONAL TO INPUT ANGLE θ FOR LARGE θ.

M. B. Broughton, Ste. Foy, Quebec, P.Q.

The AC output signal from the cosine terminal of a Scott-connected transformer attached to the outputs of a three phase synchro transmitter is fed back through an amplifier of suitable gain to provide a signal at the sine terminal of the Scott-connected transformer which is porportional to the rotor rotation for angles of up to 90° or greater. For example: if the region of θ is ±90°, the deviation from linearity of θ $\frac{\text{Sin } \theta}{a + b \text{ Cos } \theta}$ can be kept within 0.005 by proper choice of a and b. The constants a and b and the deviation from linearity are in general functions of θ max.

PAPER 9028 SESSION 19

AN ULTRA-LOW-FREQUENCY ANALYZING SYSTEM

J. F. Davis, H. A. Ferris and H. A. Kolshorn, Royal Victoria Hospital, Montreal, Que.

The electrical potential in the gastro-intestinal tract varies with a number of physiological factors including chemical, mechanical, metabolic and others. The spectral distribution of these variations, distinguishable from noise, covers the range from 4 minutes per cycle to 0.5 cycles per second. The wave forms, registered by a DC amplifier and recording system, are transferred to a magnetic tape loop using a novel twin-carrier modulation technique, which is relatively independent of tape variations and speed perturbations, resulting in an economical tape transport mechanism, operating at $\frac{1}{32}$ inch per second.

Demodulation is carried out at a tape speed of 7½ inches per second (translation ratio of 240:1), giving a new spectral distribution of 1 cps to 100 cps. The analyzer writes out the average amplitude for each of 20 different frequency bands in this range. A 20-minute sample of original recording thus takes 5 seconds of playback time. The frequency profiles obtained in this way are more amenable to statistical analysis than are measurements made on the raw data. Some clinical results will be discussed.

PAPER 9047 SESSION 19

AUTOMATIC COMPUTING OXIMETER

P. Sekelj,
The Montreal Children's Hospital, Montreal, Que.

The unit to be described was developed as a joint project of the Department of Physiology, McGill University and the Department of Biophysics of the Montreal Children's Hospital. It has been designed for automatic computation and recording of the absolute value of oxygen saturation in man.

The principles upon which the operation of this instrument is based have been reported earlier. With the instruments described by us in the past the photoelectric signals picked up by the earpiece were recorded on a two-beam galvanometer and converted into absolute value of oxygen saturation by means of a manually operated calculator. In the present instrument the photoelectric signals are modified in an appropriate manner and fed into an electronic computer. The absolute value of the oxygen saturation is read off the scale of a vacuum tube voltmeter and may be continuously recorded by a pen recorder.

This instrument has provided trouble-free operation for over three years. It is considered as an essential part of the routine catheterization equipment and has been extensively used on various research projects.

PAPER 9091 SESSION 19

AN ELECTRONIC DEVICE FOR THE CONTINUOUS MEASUREMENT OF SWEAT RATE

O. Z. Roy,
National Research Council, Ottawa, Ont.
and
A. C. Custance,
Defence Research Board, Ottawa, Ont.

In the determination of physiological stress, sweat rate appears to be one of the most reliable indexes. An instrument for the continuous and automatic measurement and recording of this by a novel technique will be described.

A humidity-sensing element is mounted in a small chamber against the skin in such a way that the atmosphere within it can be held to a given relative humidity by controlled flushing with dry air. The amount of air required at any given moment is a reflection of the sweat rate.

A servomechanism has been designed to regulate and record this flow of air across the element.

PAPER 9121 SESSION 19

THE DESIGN AND USE OF A COPPER MAN FOR CLOTHING INSULATION ASSESSMENT

F/L D. J. G. Soper and F/O C. L. Allen, The Royal Canadian Air Force, Toronto, Ont.

An artificial copper man which has been designed and built by the RCAF is described. The "man" is essentially a calorimeter fashioned in the shape of a human body with articulating joints. Fourteen separate electrical circuits are employed to supply heat to the various segments of the "man" whose skin temperature is measured with thermocouples. The power required to maintain a steady skin temperature under cold ambient conditions is a measure of the thermal efficiency of the clothing in which the man is dressed. The advantages of this device as a laboratory tool and its proper use in a clothing development program are discussed.

PAPER 9123 SESSION 19

CENTRALIZED SURGICAL MONITOR SYSTEMS

M. J. Fischer,
Epsco Inc., Worcester, Mass.

Some of the oldest applications of Electronics have been in medicine. The first electrocardiogram was made in 1887. Use of electronic diagnostic equipment has been greatly stimulated by World War II and post-war developments.

The discovery of the effect of anesthetic agents on brain waves opened up the field of electronic surgical monitoring. Estimation of patient's condition previously depended on evaluation of surface clinical signs. Advanced surgery, such as cardiac repair, requires much closer control. First monitoring instruments were miscellaneous equipment mostly intended for other purposes. Centralized surgical Monitor Systems are described. They concentrate equipment in a central control room, thereby reducing clutter in operating rooms, create no contamination or fire hazard and provide 100% monitoring of operating suite.

PAPER 9114 SESSION 20

COMMUNICATION NETWORKS FOR INTEGRATED DATA PROCESSING

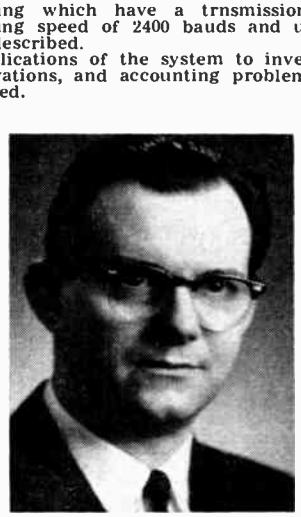
J. M. Unk,
Philips Telecommunication Industries, Hilversum, Netherlands

A high speed communication network capable of transmitting digital information from many "user" centers to a central computer, and vice versa, has been designed and produced by Philips Telecommunication Industries, Hilversum, the Netherlands. In the design of the communication network, emphasis has been placed on three main requirements, namely reliability of operation, speed of transmission, and efficient utilization of transmission equipment.

A system capable of transmitting three priorities of messages at a rate of 1,000 bauds (1333 words per minute) between many widely separated stations is discussed.

Future communication networks for data handling which have a trnsmission and handling speed of 2400 bauds and up are also described.

Applications of the system to inventory, reservations, and accounting problems are outlined.



D. K. Ritchie
Member, Technical Program Committee

PAPER 9049 SESSION 20

A NEW 11 KMC RADIO SYSTEM

J. E. A. Yeats,
Northern Electric Co. Ltd., Montreal, Que.

TJ radio is designed for short-haul line-of-sight microwave transmission of television, multiplex telephony, or other broadband communication signals.

The system operates in the common carrier band between 10,700 and 11,700 megacycles — a frequency range where rainfall absorption and multipath fading are particularly significant in the determi-

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nation of radio channel loading, system length and repeater spacing.

System features include (1), frequency diversity protection against multipath fading and equipment failure and (2), a remodulating type of repeater which reduces the FM radio signals to baseband so that video and message circuits may be inserted or dropped at each repeater point.

PAPER 9075 SESSION 20

A NEW HIGH-CAPACITY MICROWAVE RELAY SYSTEM

C. G. Arnold et al,
RCA Victor Co. Ltd., Montreal, Que.

This paper will discuss the performance objectives, basic design and test results of a new IHigh Capacity Microwave Relay System. The system is capable of transmission of 600 frequency division multiplex voice channels with CCIR performance; it is also capable of transmitting monochrome or color video. The system uses frequency modulation and heterodyne repeaters with 70 megacycle intermediate frequency. Travelling wave tubes are used in the transmitter. A new type of antenna with superior performance is employed.

A modular expandable alarm and service channel facility has been incorporated in the basic equipment design.

Data on performance of a 2 hop field test link will be described.

PAPER 9086 SESSION 21

DESIGN CONSIDERATIONS IN THE DEVELOPMENT OF THE OMEGATRON — A MINIATURIZED MASS SPECTROMETER

L. R. McNarry,
National Research Council, Ottawa, Ont.

The application of the omegatron, which operates on the cyclotron principle, to mass spectrometry is well-known. Investigation of the effects of electric and magnetic field inhomogeneities has lead to improvement of the practical resolving power. Some data on the nature of the background ion current are included. Construction details of an omegatron which is useful up to mass 100 are given and a theoretical extension to any desired resolving power is discussed.

PAPER 9085 SESSION 21

A MICROWAVE POSITION FIXING SYSTEM EMPLOYING DIGITAL DISPLAY

K. Ayukawa and R. I. Mott,
National Research Council, Ottawa, Ont.

The microwave position-fixing system is designed for line of sight position fixing over water and is expected to have its chief application in hydrographic surveying. It consists of three microwave transmitters placed at known locations ashore, and a receiver whose position may be determined by measuring the two included angles between the transmitters. This paper describes the electronic equipment used to measure and display these angles automatically. Evaluation of the inherent accuracy made from a series of laboratory tests and the results of operational trials in Georgian Bay in co-operation with the Canadian Hydrographic Service are discussed.

PAPER 9037 SESSION 21

PHASE JITTER PROBLEMS IN X-BAND FREQUENCY MEASUREMENT

H. Daams and S. N. Kalra,
National Research Council, Ottawa, Ont.

In making high precision frequency measurements in the X-band a large order of multiplication of the reference crystal oscillator frequency is needed. This introduces a certain amount of phase jitter in the reference output frequency. Quantitative measurements of this and similar effects have been made in relation with the measurements of frequency against the National Research Council Caesium-beam resonator standard. Simple techniques have been developed to measure this frequency to an accuracy of $1:10^{10}$. The phase jitter and its effects will be discussed.

PAPER 9092 SESSION 21

IMPROVEMENT OF SQUARE LAW RESPONSE OF MICROWAVE RECTIFIERS

A. Staniforth and J. H. Craven,
National Research Council, Ottawa, Ont.

Crystal rectifiers have been used for many years as video detectors in microwave measurements. In most of these applications the detection characteristic at low level is assumed to be square law. It is well known that, in general, this assumption is not justified particularly if reasonable accuracy is desired. The conditions required to increase the dynamic range over which square law response may be achieved have been investigated experimentally. It has been found that with a forward bias of 100 microamperes or more and a low video load resistance, the law of response is more closely square law with an increased dynamic range.

PAPER 9124 SESSION 22

THE NEED FOR BALANCED ATTENTION BETWEEN BUSINESS FACTORS AND TECHNICAL FACTORS IN ENGINEERING WORK

H. S. Dawson,
Canadian General Electric Co. Ltd., Toronto, Ont.

Every engineering problem encountered in industry has an economic problem hidden just beneath the surface. Industry, therefore, needs all technical work to be tempered with large amount of business perception. How can the engineer, with his consuming interest in things technical, be encouraged to apply to a greater extent, his recognized analytical powers, to the business factors interwoven in his technical problems?

The speaker describes an Engineering Measurement Plan used in one company to target increased emphasis in this direction. Three main factors — Quality, Cost and Time of engineering work are selected, and each engineering job is evaluated against established goals. Feedback of the scores achieved by the individual engineer permits self-correction to the balanced emphasis required by the business.

PAPER 9011 SESSION 22

THE COMPANY MODEL

R. Scott,
J. Edgar Dion & Co. Ltd., Montreal, Que.

With the growing complexity of decisions facing management and the advent of new tools to aid management such as computers, electronic data processing, and operational research techniques, the need for the systems engineering of an entire company has become of interest and importance. Model concepts as applied to business organizations are presented; existing partial models are reviewed; and the limitations and requirements for the construction of a company model are developed. The company model is viewed as a major tool of the professional manager in the future.

PAPER 9072 SESSION 22

THE FUNCTION OF PROJECT ENGINEERING IN A DEFENCE ENGINEERING ORGANIZATION

P. S. Erlick,
RCA Victor Co. Ltd., Montreal, Que.

In an engineering organization of up to 125 engineers, taking into account the present trend towards highly specialized areas in the field of electronic engineering — especially in defence products, the Project Engineer becomes more and more necessary.

The Project Engineer's duties and functions are such that he effectively co-ordinates the specialized engineering activities on a project, provides the proper conditions for stimulating new ideas for a better equipment, and produces savings in time and money by elimination of duplication of effort.

As electronic products become more complex, and as the state of the art changes at a rapid rate, the importance of a Project Engineer becomes more evident.

PAPER 9018 SESSION 23

A NEW TRANSISTOR BISTABLE CIRCUIT

D. P. Henderson,
Defence Research Board, Ottawa, Ont.

Two transistor switching amplifiers, employing a unique method for DC feedback, are interconnected in such a manner as to provide an asymmetrical bistable device, exhibiting properties similar to an electronically activated single pole double throw switch.

The device is characterized by:

1. High operating efficiency resulting from low internal impedance and negligible idling currents.
2. Very large current carrying capacity in either direction.
3. Single voltage supply operation.
4. Rapid transition speeds because of double regenerative action to either state.
5. Short resolution times due restricted carrier storage.
6. Good triggering sensitivity.

PAPER 9043 SESSION 23

A NOVEL MAGNETIC CORE COINCIDENT CURRENT MEMORY

R. S. C. Cobbold,
Defence Research Board, Ottawa, Ont.

This paper discusses the performance and construction of a novel type of coincident current magnetic core memory system. A three dimensional approach to the wiring of a coincident current memory enables the usual 45° 'read' wire to be replaced by a wire which is at right angles to both 'drive' wires. Cancellation of the partial disturb voltages from the cores onto the 'read' wire is obtained for both 'drive' wires. The method of construction could enable memories to be produced in a fully automatic manner. The paper concludes with a discussion of the advantages and disadvantages of this new type of memory.

PAPER 9024 SESSION 23

A DIGITAL MAGNETIC WIRE STORAGE WITH NONDESTRUCTIVE READOUT

C. G. Shook,
Stromberg-Carlson Company, Rochester, New York

After a brief review of pertinent magnetic effects and sonic wave propagation in elastic media, a nonvolatile, digital, magnetic storage scheme is described, wherein binary words may be stored by magnetizing segments of a wire, and the information may be read out an unlimited number of times with no detrimental effects to the storage. Two storage schemes are presented, a permanent, program type store, and a temporary, electrically changeable store. Bit storage density, readout and input pulse shapes, and readout frequency are discussed. Possible limitations such as loss, temperature effects, and pulse shape are balanced against advantages and finally a comparison is made to a number of other types of bit storage.

PAPER 9029 SESSION 23

A TIME DIVISION MULTIPLEX TELEPHONE SYSTEM USING NON-DESTRUCTIVE MAGNETIC STORAGE

Robert C. Curry,
Stromberg-Carlson Company, Rochester, New York

An entirely solid-state, time-division-multiplex telephone system serving a 100 line block is described, which utilizes a non-volatile digital storage with non-destructive sonic readout. This is a temporary (that is, reversible) storage which is used to perform line finding, time-slot allotting, dial-converter allotting, and connecting. The actual connecting of lines to the highway is acomplished by solid-state controlled switches gates.

Time-slot allotting is done on a stand-by basis, i.e., a time-slot is always available and as each time-slot is assigned, another is made available.

The line circuit, and the dial converter utilize core-transistor logic to perform lock-out, busy test, supervision and dial-pulse counting.

While certain sections of the system are continuously interrogated, the system is essentially non-synchronous and no programmer is required.

PAPER 9057 SESSION 24

A TRANSISTORIZED HIGH VOLTAGE POWER SUPPLY FOR SCINTILLATION COUNTING

J. R. G. Cox,
Sperry Gyroscope Co. of Canada Ltd., Montreal, Que.

A high voltage power supply covering the range from 500 volts to 4,000 volts at 10 milliamperes is described. High voltage is developed by an oscillator, transistor power amplifier, step-up transformer and high voltage rectifier. Reference voltage is provided by a precision Zener reference diode incorporated in a transistor DC regulator circuit. Error voltage is amplified by carrier type DC amplifier utilizing input modulator and output demodulator and is used to control amplitude of oscillation of the oscillator. Regulation of 0.01 per cent against both line and load changes and long term stability of the same order is achieved.

PAPER 9089 SESSION 24

THE DEVELOPMENT OF A PRECISION POWER SUPPLY FOR USE WITH PHOTOMETRIC STANDARDS

R. S. Richards and B. D. Stedman,
National Research Council, Ottawa, Ont.

The paper describes the development of a voltage regulated power supply furnish-

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ing standard incandescent lamps with voltages between 10 and 120 volts at currents up to 10 amperes.

Two regulators are discussed; in each, smooth DC goes to a bank of power transistors which form a controlled impedance. The first design uses a precision Zener diode reference source, with a balanced transistor chopper amplifier and a wide band AC channel in parallel; the second employs a vacuum tube amplifier stabilized by a mechanical chopper.

Half-hour stabilities achieved were about 0.01 per cent and 0.002 per cent respectively.

PAPER 9103 SESSION 24

MAGNETIC FREQUENCY MULTIPLIERS

P. P. Biringer and G. R. Slemon,
University of Toronto, Toronto, Ont.

This paper describes a group of power modulators in which the output frequency is some integral multiple of the supply frequency and the output power is controlled by a direct-current control signal. These devices consist primarily of nonlinear iron-cord coils connected in various configuration to polyphase supplies. Filtering of a particular harmonic is achieved by the system of interconnection of the coils rather than by band-pass filters. A frequency multiplier therefore provides a simple, static and highly efficient means of producing a controllable output at higher-than-supply frequency.

The application of frequency modulators arise both from their frequency multiplication property and from their power modulation property. A number of current and proposed applications are discussed in the paper.

PAPER 9099 SESSION 24

A METHOD FOR IMPROVING THE REGULATION OF 3 PHASE POWER SUPPLIES

F. J. Heath,
Canadian General Electric Co. Ltd., Toronto, Ont.

The regulation of a 3 Phase Full-Wave Rectifier when protected by current limiting reactors is much worse than would be expected if one assumes that the rectifier presents a resistive load to the power transformer. The reason for this poor regulation is that the currents drawn by the rectifiers have a very large harmonic content which is attenuated by the current limiting reactors. The use of capacitors across the secondary of the transformer provides a low impedance path for the harmonic currents and results in improved regulation of the power supplies.

In an experiment on a 50KW Broadcast Transmitter the regulation was reduced from 5.2 per cent to 2.8 per cent by the addition of the capacitors mentioned above.

PAPER 9083 SESSION 25

CODERS FOR COMPRESSING THE BANDWIDTH OF SPEECH SIGNALS

M. P. Beddoes,
University of British Columbia, Vancouver, B.C.

Excessive wastefulness of the speech waveform for representing the very limited number of speech sounds is commented on. For example, a channel with 40 DB signal to noise ratio and a 3 KC bandwidth is shown to be capable of supporting not one but three hundred speech signals. This is a theoretical limit. For background purposes, the following coders for compression of speech signals are described: frequency modulation; Vocoder; two frequency dividers; slope-feedback.

A new method of specifying the speech signal in terms of three parameters is given. This is shown to lead to reduced bandwidth. Possible uses of existing compressors with special attention to the, as yet untried, slope-feedback coder, with the new method are outlined.

A short description of experimental apparatus for testing the slope-feedback coder is given.

PAPER 9062 SESSION 25

AN OBSTRUCTED PATH VHF RADIO SYSTEM

S. Bonneville,
The Bell Telephone Co. of Canada, Montreal, Que.

A 120 mile, single hop VHF radio system has been installed between Emeril, Labrador and Lake Barbel, Quebec on a temporary basis. Designed to provide teletype and telephone service to the mining community at Lake Barbel and Lake Jeannine, it consists of three parallel radio systems operating in the 152-174 MC band. The paper includes a description of the radio and multiplex equipment used plus the results of some system evaluation tests consisting of measurements of RF levels, test tone stability and circuit noise. These results are then compared with the theoretical values calculated from the original design figures.

PAPER 9036 SESSION 25

SWITCHING CONSIDERATIONS FOR STANDBY APPLICATIONS IN MICROWAVE INSTALLATIONS

M. Harp,
Lenkurt Electric Inc., San Carlos, Cal.
and
R. A. Marsh,
Lenkurt Electric Co. of Canada Ltd., Vancouver, B.C.

The requirements for high speed in automatic standby switching systems are reviewed. A transfer arrangement is described which is applicable to operating standby providing an anti-fade diversity feature, in addition to equipment failure protection. A second arrangement is discussed which features a microwave ferrite switch to yield milli-second service restoration. In addition, the special considerations involved in a one-standby for three-operating system are covered, with details of a practical one-for-three operating system.

PAPER 9016 SESSION 25

PERFORMANCE OF THE CANADIAN JANET B SYSTEM IN THE AURORAL ZONE

J. H. Crysdale,
Defence Research Board, Ottawa, Ont.

The Canadian Janet B system, developed by Ferranti Electric under DRB contract, has undergone extensive trials on a circuit in the auroral zone, between Edmonton and Yellowknife, at frequencies in the vicinity of 40 and 50 MC. Circuit performance and its correlation with geomagnetic conditions have been analysed with the assistance of an IBM 650 computer.

Performance was reasonably satisfactory during periods when the meteoric mode predominated. However, the error rate usually increased and at times became excessive when auroral propagation occurred. The circuit was adversely affected by low lying absorbing layers produced by intense solar flares.

Conclusions and recommendations are presented and discussed.

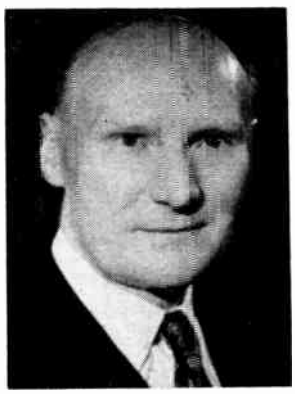
PAPER 9120 SESSION 25

DEVELOPMENT OF A SYDNEY, N.S./ST. JOHN'S, NFLD. CANADIAN NATIONAL MICROWAVE SYSTEM

C. Bridgeland, A. Piechota, B. MacKenzie,
Canadian National Telegraphs, Toronto, Ont.

A 650 mile radio relay composed of 22 "line-of-sight" paths now supplements the Canadian National Communications between Sydney, N.S. and St. John's, Nfld. Overcoming a 70 mile overwater section at the Sydney end of the system was a major problem. Standard Telephones & Cables' equipment suitable for transmission of television program or the equivalent of 600 toll quality message circuits was selected for the project.

The system, divided into three sections with back-to-back terminals at Corner Brook and Gander for general communications also provides television to any locations along the route. Each section has a separate comprehensive supervisory and control facility from the terminals.



Dr. Ernst Weber

Benefits derive from international cooperation

From the early days of wireless through the development of the electron tube and the recent utilization of electrons in the solid state of matter, electronics has come to penetrate every phase of communications, of industrial production and process control, of military armaments, of travel within the bounds of the earth as well as beyond, and of nuclear power generation and control. And the Institute of Radio Engineers has grown apace.

The imminent IRE Canadian Convention in Toronto demonstrates quite graphically the international scope of IRE which is now the largest engineering society in the world with nearly 74,000 members from almost all the member countries in the United Nations. Giving added stature to the Canadian Convention is the fact that the Canadian Region of the Institute of Radio Engineers constitutes the largest membership in any single country, except for the United States. We all have a vital interest in this annual convention and exhibit and know that it will be a resounding success.

No one today can afford to disregard the tremendous contributions that electronics has made and is making to the benefit of mankind. But only international cooperation in the widest and truest sense can assure that these contributions are, indeed, to the benefit of mankind. The Canadian Convention clearly indicates the need for and the benefits which derive from international cooperation.

Dr. Ernst Weber, President,
Polytechnic Institute of Brooklyn.

A. P. H. Barclay

"... a shoulder to the wheel ..."

During, and since the Second World War, the electronics industry in Canada went through an enormous expansion. Changes in defense policies over the past two years have caused a drastic curtailment of its progress. Such events and associated problems should not be unexpected in our rapidly changing world. Solutions demand resourcefulness not uncommon to the industry. The government is aware of these problems and is developing a partnership with industry to assist in coping with the situation. Witness the efforts of the Department of Defense Production to establish a Production Sharing Program with the United States, to produce goods for the mutual defense of the two nations. Fruitful results are beginning to appear, particularly where inter-company relationships exist. It is evident that where no affiliations are there to assist, even more resourcefulness is required.

It is also evident, that production is not enough and a sharing of research and development must take place to provide a challenge for our technical personnel and a chance for them to grow. Out of research and development programs, new skills are born, new products accrue and the proper atmosphere for production arises.

In Canada, we cannot hope to spread ourselves across the whole electronic horizon, but must narrow our sights to particular fields of endeavor. Pioneer developments have been accomplished in areas not covered by the United States. There must be products with components as by products. These together with experience can be promoted, which in turn will attract further research and development. We must, with imagination, search out these products, by products and this experience, and exploit them with vigor to achieve a co-ordinated program.

The path is not an easy one and all must put a shoulder to the wheel.

A. P. H. Barclay,
Director, Canadian Region IRE.

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IRE Canadian Convention & Exposition

Toronto, Canada – October 7, 8, 9, 1959

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Canadian Marconi Company, E T & C Division, 830 Bayview Avenue, Toronto. Booth 145.
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Attending Personnel: J. E. Smith and representatives of each Department of the Norden Division.
Companies represented: Norden Division of United Aircraft Corporation.

Canadian Radio Technical Planning Board, 200 St. Clair Ave. West, Toronto. Booth 131.

Canadian Research Institute, 46 St. George Street, Toronto, Ontario. Booth E-10.
Attending Personnel: R. Spencer Soanes, Egon Manthey, Wolfgang Petschke.
Companies represented: Canadian Research Institute, Baird-Atomic Inc., Photovolt Corp., Gossen & Co., Elmes-Staub & Co., Emel Camera Co.

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Collins Radio Company of Canada Ltd., 11 Bermondsey Road, Toronto 16, Ontario. Booth 551.
Attending Personnel: Anthony Davies, director of sales; Edward Edge, manager, ground communications; Phillip Wharton, amateur and broadcast; Jack McLeod, aviation sales; Murray Binions, military sales.

Exhibitors/Attending Personnel

Companies represented: Collins Radio Company of Canada Ltd., Collins Radio Company, Cedar Rapids, Iowa.

Conrad Inc., 141 Jefferson, Holland, Mich. Booth 244.
Attending Personnel: D. F. Beechey, C. Conrad.

The Constanta Co. of Canada Ltd., 280 Regina Avenue, Montreal, P.Q. Booth 146.
Attending Personnel: R. P. Aldred, Bruce M. Pfeiffer.

Constellation Components Co., 136 Tower Drive, Scarborough, Ont. Booth 449.
Attending Personnel: E. J. Mulvey, C. G. Bell.
Companies represented: Licon Switch Division, Muirhead Instruments Ltd., Engel & Gibbs Co., Torsion Balance Co.

Geo. W. Crothers Ltd., 1101 Millwood Rd., Toronto, Ont. Booth 133.
Attending Personnel: D. K. Richardson, A. R. Oliver, P. C. Neilsen.
Companies represented: Kohler Co.

Daystrom Limited, 840 Caledonia Road, Toronto, Ont. Booth E-26.
Attending Personnel: H. W. Cowan, vice-president and general manager; D. Beattie, Ontario sales manager; R. J. Berry, G. Rosamond, W. Clark, C. Rutledge, Heath sales service manager; R. Rae, G. Kennedy.
Companies represented: Daystrom-Weston, Daystrom Pacific, Daystrom Transicoil, Heath Company.

Department of Transport, Telecommunications Branch, Ottawa, Ontario. Booth 546.
Attending Personnel: E. W. Groves, E. H. Leaver.

Dynamic Gear Co., Inc., 20 Merrick Rd., Amityville, L.I., N.Y. Booth 336.
Attending Personnel: Tom Smith, Tony March, E. E. Whittaker, Jim Scammell.

Edwards High Vacuum (Canada) Ltd., P.O. Box 515, Burlington, Ontario. Booth W-22.
Attending Personnel: R. G. Webster, P. W. King, G. E. Neapole, M. Inglis, M. P. Michaels.
Companies represented: Edwards High Vacuum Ltd., SAES Getters.

Eitel-McCullough, Inc., 301 Industrial Way, San Carlos, Calif. Booth 129.
Attending Personnel: Berkley Baker, Warren Hoffman, Hal Yokela, Fred Johnstone, Fred Speaks, Robby Robinson.

Electrodesign, 35 Mulholland St., Toronto 19, Ontario. Booth 366.
Attending Personnel: Hyman Schwartz, Ken Paul, Harry Schwartz.
Companies represented: Nagard Co. Ltd., England; Metrawatt Co., Nurenberg, Germany; Branson Instrument Inc., Stamford, Conn.

Electronics and Communications (Age Publications Limited), 450 Alliance Avenue, Toronto 9, Ont. Booth 437.
Attending Personnel: N. McHardy, T. W. Lazenby, H. E. (Bud) Dallyn, J. R. Stocks, D. K. Trowell.

Electro Sonic Supply Co. Ltd., 543 Yonge St., Toronto, Ont. Booth 159.
Attending Personnel: C. MacKenzie, B. Barnett, H. Nogly, A. Herron, J. Moore, C. Savage.

Electronic Industries Association of Canada, 200 St. Clair Ave. W., Toronto, Ontario. Booth 362.

E.M.I. — Cossor Electronics Ltd., Woodside, Dartmouth, N.S. Booth 130.
Attending Personnel: Harry Clarke, Fred Martin, E. C. Richards, Geo. Beyrouty.
Companies represented: Electrical Musical Industries Ltd., Hayes, Middlesex, England: A. C. Cossor, London England; Dawe Instruments, Uxbridge, England; Cintel, London, England.

Ferranti-Packard Electric Ltd., Industry St., Toronto 15, Ont. Booth 337.
Attending Personnel: F. M. Squires, G. W. L. Davis, L. R. Wood, M. K. Taylor.

General Radio Company, 22 Baker Ave. West, Concord, Mass. Booth 152.
Attending Personnel: C. E. Worthen, Stephen W. DeBlois, Robert E. Wilson, Art Kingsnorth, Richard Provin.

The Glendon Instrument Company Limited, 44 Wellington St. E., Toronto, Ontario. Booth 335.
Attending Personnel: S. A. Rybb, D. A. Pitman, Mrs. Olivia Padgett.
Companies represented: Electronic Instruments Ltd., Richmond, Surrey, England; Wayne Kerr Laboratories Ltd., Chessington, Surrey, England; Croydon Precision Instruments, London, England; Evans Electroselenium Ltd., London, England.

Hammond Mfg. Co. Ltd., Guelph, Ontario. Booth 454.
Attending Personnel: R. M. Brown, R. J. Bruce, H. D. Iler, Peter Duncan, Crawford Robinson, Ernest Britton, Ross E. Wilson, Len Hammond, Roy Hammond, Ken Hammond, Fred Hammond.

John Herring & Company Ltd., 3468 Dundas St. W., Toronto, Ontario. Booth 265.
Attending Personnel: John Herring; Fred Utter, Tom Stone, Barber Colman Co.; Jack McNiff, Landis & Gyr, Inc.; Milton Prince, Mucon Corp.
Companies represented: AEMCO Inc., Barber-Colman Co., Fortiphone Ltd., H-B Instrument Ltd., Landis & Gyr, Inc., Mucon Corp., George Rattray & Co., Shallcross Mfg. Co., Stevens-Arnold Inc., Industrial Tectronics Inc., Superrite Instrument Corp., Ripley Co. Inc.

Honeywell Controls Limited, Vanderhoof Ave., Toronto 17, Ont. Booth 351.
Attending Personnel: J. C. Cowdrey, — Toronto; W. J. Rimmer — Montreal.
Companies represented: Micro Switch Division, Marion Instrument Division, Semi Conductor Division — all Honeywell Divisions.

M. J. Howard & Co. Ltd., 1206 Bank St., Ottawa, Ontario. Booth E-12.
Attending Personnel: M. J. Howard, C. L. Emerson, Jr., G. Egan, W. W. Bartell.
Companies represented: Emerson & Cuming, Inc., Induction Motors Corp., Waters Manufacturing, Inc.

Hysol (Canada) Ltd., P.O. Box 53, Station "R", Toronto, Ont. Booth W-4.
Attending Personnel: Russell Smith, David Caven, William Jenner, Walter Thorpe.
Companies represented: Houghton Laboratories Inc. and Hysol (Canada) Ltd.

The Institute of Radio Engineers, 72 West 45th St., New York 36, N.Y. Booth 164.

Instronics Limited, P.O. Box 100, Stittsville, Ont. Booth 553.
Attending Personnel: John E. Knowles.
Companies represented: Allegany Instrument Company, Inc., Cumberland, Md.; BJ Electronics, Div. of Borg-Warner Corp., Santa Ana, Calif.; Datex Corporation, Monrovia, Calif.; Donner Scientific Co., Concord, Calif.; Empire Devices Products Corp., Amsterdam, N.Y.; Lavoie Laboratories, Inc., Morganville, N.J.; Lumatron Electronics, Westbury, L.I., N.Y.; Millivac Instruments, Schenectady, N.Y.; Potter Instrument Co., Plainview, L.I., N.Y.; Racal Engineering Ltd., Bracknell, Berkshire, England; Radio Frequency Laboratories, Inc., Test and Service Equipment Division, Boonton, N.J.; Stelma Incorporated, Stamford, Conn.; Texas Instruments Incorporated, Industrial Instrumentation Division, Houston, Texas.

International Rectifier of Canada Limited, 1581 Bank St., Ottawa 1, Ontario. Booth 461.
Attending Personnel J. T. Cataldo, J. Vickrey, E. F. Johnson, J. Conto.
Companies represented: International Rectifier Corporation, El Segundo, California.

Jerrold Electronics (Canada) Ltd., 50 Wingold Avenue, Toronto 19, Ontario. Booth 443.
Attending Personnel: Alex Kirklady, Philadelphia; Ken Hynes and A. E. Dworkin — Jerrold Canada.

Kay Electric Company, Maple Avenue, Pine Brook, N.J. Booth 536A.
Attending Personnel: John Gilmore, Tom Dougherty, Mel Sales Rep.

Keithley Instruments, Inc., 12415 Euclid Ave., Cleveland 6, Ohio. Booth 556.
Attending Personnel: Robert D. Wood, district manager.

Kester Solder Company of Canada Limited, P.O. Box 474, Brantford, Ontario. Booth 543.
Attending Personnel: Ernie Walton, Jon Lloyd-Jones, Paul Perrault, J. A. T. Butler, C. L. Barber.

Lake Engineering Co. Ltd., 123 Manville Rd., Scarborough, Ont. Booths 436-438.
Attending Personnel: A. Ainlay, F. P. Taylor, E. E. Thompson, R. J. A. Turner.
Companies represented: Aladdin Electronics, Nashville, Tenn.; Birtcher Corp., Los Angeles, Calif., Chicago Miniature Lamp Works, Chicago, Ill.; Consolidated Electronic Equipment Co. Ltd., Willowdale, Ontario; Continental Carbon Division of Wirt Co., Philadelphia, Pa.; Corning Glass Works, Bradford, Pa.; Dialight Corporation, Brooklyn, N.Y.; Erie Resistor of Canada Ltd., Trenton, Ontario; Garlock Packing Co. (Electronic Products), Camden, N.J.; Grayhill Inc., La Grange, Ill.; Grigsby Co. Inc., Arlington Heights, Ill.; Hawkesbury Wire Co. Ltd., Hawkesbury, Ontario; International Telephone & Telegraph Corp., Components Division, Clifton, N.J.; Kearfott Co. Inc., Clifton, N.J.; James Knights Co., Sandwich, Ill.; Kuthe Labs Inc., Newark, N.J.; Leecraft Mfg. Co. Inc., New York 12, N.Y.; Litton Industries Inc., Components Division, Van Nuys, Calif.; Microdot Inc., South Pasadena, Calif.; C. R. Snelgrove Co. Ltd., Don Mills, Ontario; Stanwyck Coil Products Ltd., Hawkesbury, Ontario; Stegg Electric Ltd., Belleville, Ontario; Transistor Electronics Corp., Minneapolis, Minn.; Plastic Capacitors Inc., Chicago, Ill.

Masson Seeley & Company, 60 Brydon Drive, Rexdale, Ontario. Booths E-18 and E-20.
Attending Personnel: F. T. Powell, Local Director; R. G. Cox, Chief Technical Representatives; J. C. Bain, Sales; L. J. McCarthy, Technical Representative.
Companies represented: Masson Seeley & Co. Ltd., London, England.

The McBee Company Limited, 179 Bartley Drive, Toronto 16, Ontario. Booth 329.
Attending Personnel: P. W. Warkenton, Gary Glover, Stan Crause.

McCurdy Radio Industries Ltd., 22 Front St. W., Toronto, Ontario. Booth 245.
Attending Personnel: Ken MacKenzie, Norman Farr, George E. McCurdy.
Companies represented: McIntosh Laboratory Inc., "McCurdy" line.

Measurements Corporation, Boonton, N.J. Booth 555.
Attending Personnel: H. Roy Gray, D. W. Rippin (M.I.R.E.), B. D. Coyne.

MEL Sales Limited, 1969 Avenue Road, Toronto 12, Ontario. Booth 534.
Attending Personnel: F. J. Ball, J. B. Turner, Lyle Smith, A. McQuarrie.
Companies represented: Arizona Telemetering Corp., Phoenix, Arizona; Boonton Electronics Corp., Morris Plains, N.J.; Communication Measurements Laboratory Inc., Plainfield, N.J.; The Digitran Company, Pasadena, California; Endevco Corporation, Pasadena, California; Frequency Standards Inc., Redbank, N.J.; Instrument Development Laboratories Inc., Attleboro, Mass.; International Radiant Corp., New Cassell, L.I., N.Y.; Kay Electric Company, Pine Brook, N.J.; Krohn-Hite Export Corp., Cambridge, Mass.; Ling Electronics Inc., Winchester, Mass.; Narda Microwave Corp., Mineola, N.Y.; Narda Ultrasonic Corp., Westbury, N.Y.; Polarad Electronics Corp., Long Island City, N.Y.; The Reflectone Corp., Stamford, Conn.; Sanders Associates Inc., Nashua, N.H.; Sensitive Research Instrument Corp., New Rochelle, N.Y.; Servo Corporation of America, New Hyde Park, N.Y.; Trad Electronics Corp., Asbury Park, N.J.; Technology Instrument Corp., Acton, Mass.; Weldmatic, Division of Unitek Corp., Pasadena, California.

Exhibitors/Attending Personnel

Milgray Electronics, 136 Liberty St., New York, N.Y. Booth 359.
Attending Personnel: Tom Connors, Murray Foster, Herb Davidson, Henry Harris.
Companies represented: Texas Instruments Incorporated.

T. M. Moran & Associates, 74 Pleasant Blvd., Toronto, Ontario. Booth 467.
Attending Personnel: T. M. Moran, R. Van Middlesworth, M. Eustace.

Morina Electronics Engineering Co., 52 Advance Rd., Toronto, Ontario. Booth 444.

National Semiconductors Ltd., 146 Bates Rd., Montreal 26, Que. Booth 134.
Attending Personnel: Don A. Anderson, Geo. J. Pankau, Geo. Redmond.

Northern Electric Co. Ltd., 1600 Dorchester St. W., Montreal, Que. Booth E-14.
Attending Personnel: M. M. Beresford, M. Sakovich, D. Shantz, A. Banting, N. Moore, C. Gray, E. Rickards, W. Heaven, G. Baxter, M. Coyle, J. Murray, A. Houston, R. Watt.
Companies represented: Northern Electric Co. Ltd., General Precision Laboratories, Automatic Signal Division of Eastern Industries Inc., Machlett Laboratories, Alford Manufacturing Company Inc.

PIC Design Corporation, 477 Atlantic Ave., East Rockaway, L.I., N.Y. Booth 235.
Attending Personnel: John Swane, Philip French.

Philips Electronics Industries Limited, Electronics Equipment Group, 116 Vanderhoof Ave., Leaside, Ontario. Booth 549.
Attending Personnel: E. Batler, H. Pollock, G. Crossan, R. Perkins.
Companies represented: Ebert Electronics Corp., Analogue Controls Inc., Haydon Switch Inc., Babcock Relays Inc., Oil Well, Water Locating Co., Scientific Atlanta Inc.

Polarad Electronics Corp., 43-20 34th St., Long Island City 1, N.Y. Booth 530.
Attending Personnel: A. A. Goldberg, R. J. Sheloff.

Potter & Brumfield Canada Ltd., 135 Oxford St., Guelph, Ontario. Booth 361.
Attending Personnel: Alan Laws, T. B. White.

Premier Metal Products Co., 337 Manida St., Bronx, N.Y. Booth 330.
Attending Personnel: Edwin L. Kossoy, Walter Odze, Harold L. Millen.

Provincial Institute of Technology & Art, Electronics Department, Calgary, Alberta. Booth 465.

Radio Trade Supply, 490 Yonge St., Toronto, Ontario. Booth 236.
Attending Personnel: Frank White, Jr., Eugene Hyshka, Al. Chrysler.
Companies represented: Rogers, Ward Leonard, Spraye and Knight Kits.

Radionics Limited, 8230 Mayrand Street, Montreal 9, Que. Booth 451.
Attending Personnel: S. H. Ungar, R. H. Carleton, D. Kirshner, G. F. McCarthy, G. Sadler.
Companies represented: Huggins Laboratories, Inc.; Veeco Vacuum Corp.; Airborne Instruments Laboratory; FXR, Inc.; Julie Research Laboratories; Southwestern Industrial Electronics Co.

Douglas Randall (Canada) Ltd., 126 Manville Rd., Scarborough, Ontario. Booth 253.
Attending Personnel: H. D. Randall Jr., G. E. Geduld, L. Williams, R. Smith, E. Muldoon.
Companies represented: Douglas Randall (Canada) Ltd., Bourns Laboratories Inc., ETC Inc., North American Electronics Inc., Diehl Manufacturing Co., Reeves Instrument Co., Taurus Corporation, Electronic Controls Limited.

Raytheon Canada Limited, 61 Laurel St. E., Waterloo, Ontario. Booth 367.
Attending Personnel: J. R. Cann, R. S. Williams, Dr. Tom East, G. S. McElhinney, B. McConachie, J. E. Kadish, J. Grey, T. DeHaas.
Companies represented: Raytheon Company, Waltham, Mass.

Renfrew Electric Co. Limited, 349 Carlaw Ave., Toronto 8, Ont. Booth 231.
Companies represented: Airtron Canada Limited; Amphenol Canada Limited; IRC Resistors — Jensen Speakers — Struthers-Dunn Relays (Divisions of Renfrew Electric Co. Ltd.).

Rogers Electronic Tubes & Components, 116 Vanderhoof Ave., Leaside, Ontario. Booth 150.
Attending Personnel: M. C. Patterson, D. S. Simkins, J. Beardall, J. F. Pounder, R. M. Gale, V. Cummings, K. Johnston, D. Hamilton, G. Armitage, E. Hugenholtz.
Companies represented: Rogers, Philips, Mullard, Amperex.

R-O-R Associates Ltd., 1470 Don Mills Rd., Don Mills, Ontario. Booths 261-263.
Attending Personnel: John S. Root, Ralph Haywood, Bob Wood, Jim Stemler, Geo. Williams.
Companies represented: Hughes Aircraft Co., Helipot Division, Beckman Instruments.

Rutherford Agencies, P.O. Box 1013, St. Laurent, Que. Booth 535.
Attending Personnel: W. C. Otto, T. R. Rosser, D. A. Rutherford, E. D. Rutherford.
Companies represented: Cornell-Dubilier Electric Corp., Telequipment.

Ryerson Institute of Technology, 50 Gould St., Toronto, Ont. Booth 469.
Attending Personnel: Students from final year.

Sensitive Research Instrument Corporation, 310 Main St., New Rochelle, N.Y. Booth 532.
Attending Personnel: Marvin I. Steinberg, Earl Elliott.

Sharpe Instruments Ltd., 6080 Yonge St., Willowdale, Ont. Booth 156.
Attending Personnel: E. J. Sharpe, G. C. Legere, Val Burda, J. T. Ward.

D. T. Shaw Company, 2340 Lucerne Rd., Montreal 16, Que., and P.O. Box 33, Weston, Ont. Booth 343.
Attending Personnel: D. T. Shaw, F. H. Peters, F. Burridge, D. Stewart (Sigma), R. S. Kurtz, B. Berlin (Heinemann).
Companies represented: Heinemann Electric Co., Sigma Instruments Inc.

Sigma Instruments, Inc., 170 Pearl St., South Braintree 85, Mass. Booth 341.
Attending Personnel: Frank Burridge, Donald Stewart.

A. C. Simmonds & Sons Limited, 100 Merton St., Toronto 7, Ont. Booth 250.
Attending Personnel: L. Claude Simmonds, David S. Simmonds, G. Douglas Pettifer, William A. Strangways, Richard C. Ferguson, Walter B. Campion, D. Ralph Snyder, Robert J. McAuley.
Companies represented: Collaro Limited, Curtis Development & Manufacturing Co. Ltd., Goodmans Industries Ltd., Guardian Electric Manufacturing Co., E. F. Johnson Co. Ltd., P. R. Mallory & Co. Inc., Ohmite Manufacturing Co., Shure Brothers Inc., Weller Manufacturing Co.

Sinclair Radio Labs. Ltd., 21 Toro Rd., Toronto, Ont. (Box 179, Downsview P.O.) Booth 537.
Attending Personnel: P. Yachimec, A. Secord, F. Buckles, W. V. Tilston, J. Richardson, J. Hanson, R. Sears.

Southco Division, South Chester Corporation, Lester, Pa. Booth 364.
Attending Personnel: H. J. Jordan, manager of fastener sales; Lucien Boudrias, representative; J. de Bellefeuille, representative.

Spaulding & Fibre of Canada Ltd., 70 Coronet Rd., Toronto 18, Ont. Booth 154.
Attending Personnel: T. C. Drees, Bill Christensen, Mike Komar, Art Robertson, Geo. Holme, Doc Kearney, Ben Orth.

Stark Electronic Sales Co., Ajax, Ont. Booth 230.
Attending Personnel: M. J. Stark, L. L. Samuel, C. Stoneman, A. Kasperski, G. Micklewright.
Companies represented: Hickok Electrical Instrument Co., Shielding Inc., Anton Electronic Labs.

Sterling Precision Corporation, Port Washington, N.Y. Booth 262.

Strippit Tool & Machine Company, Brampton, Ont. Booth 259.
Attending Personnel: C. Somerton, J. Eimer, H. Cartwright, A. Duerksen, H. Reichel.

Sylvania Electric (Canada) Ltd., P.O. Box 2190, Station "O", Montreal, Que. Booth 458.
Attending Personnel: B. Holsinger, A. Lawruk, L. Murphy, T. Kolsinki.

T. M. C. (Canada) Limited, R. R. No. 5, Ottawa, Ont. Booth 242.
Attending Personnel: D. V. Carroll, H. C. Ashdown, M. Yurko, H. Rowley, A. G. Sheffield, F. J. Rapp.
Companies represented: The Technical Material Corporation, Mamaroneck, N.Y.

Tektronix Inc., 3 Finch Avenue East, Willowdale, Ont. Booth 160.
Attending Personnel: Scotty Pyle, Bill Kladke, Ray Lisiecki, Udo Lindenmeyer, Marcin Crouch.

Tele-Radio Systems Ltd., 3534 Dundas St. W., Toronto, Ont. Booth 155-157.
Attending Personnel: Ivor Nixon, Geo. Scanlon, John Fellows. — Tele-Radio; Geo. Steck, Geo. Constantine — Westrex Corp.
Companies represented: Northern Radio Co., Kaar Engineering Co., Railway Communications Inc., Westrex Corp., Moore Associates Inc., Erd/Du Mont, Radio Specialists Co., Times Facsimile Corp., Budelman Electronics Corp.

Tellurometer Canada Ltd., 1562 Carling Ave., Ottawa, Ont. Booth 243.
Attending Personnel: R. K. Rosebrugh, J. B. Erskine.
Companies represented: Mervyn Instruments, Woking, England; Shaw Moisture Meters, Bradford, England.

John R. Tilton Limited, 51 McCormack St., Toronto, Ont. Booths 363 and 365.
Attending Personnel: John R. Tilton, D. B. Black, H. W. Brieger.
Companies represented: Capitol Machine Company, Standard Electrical Products, Osborne Electric Company Ltd., Raytheon Canada Ltd., JFD Manufacturing Company Inc., R. P. Scherer Ltd., Sprague International Ltd., Sightmaster Corporation.

Universal Winding Company, P.O. Box 1605, Providence, R.I. Booth 554.
Attending Personnel: W. T. Crocker, manager, Coil Winding Div., C. J. Zaikowski, sales engineer; I. J. Marsh, service engineer; D. Halliday.

Varian Associates of Canada Ltd., 45 River Drive, Georgetown, Ont. Booth 368.
Attending Personnel: B. H. Breckenridge, J. G. Matthies, M. Viant, G. M. Frost, R. R. Crichton, H. T. Sanderson, K. J. Lavell.
Companies represented: Varian Associates of Canada Ltd., Varian Associates, Palo Alto, California.

Ward Leonard of Canada Ltd., 1070 Birchmount Rd., Toronto 16, Ont. Booth W-6.
Attending Personnel: D. S. Brown, W. A. Wilson, I. Mudrick, W. R. Wiltshire, J. Boles.

Wholesale Radio & Electronics Ltd., 66 Orfus Rd., Toronto 19, Ont. Booth 456.
Attending Personnel: W. King, D. Higgins.
Companies represented: Canadian General Electric Company, Industrial Timer Corporation.

A. C. Wickman Limited, 1425 Queensway, Toronto 14, Ont. Booth 241.
Attending Personnel: B. H. McGregor, D. W. Miller, W. J. McNeil.
Companies represented: Epsco - Worcester, Daytronic Corporation, Houston Instrument Corp., Micro-Test Inc.

John Wiley & Sons, Inc., 440 Fourth Avenue, New York, N.Y. Booth 564.
Attending Personnel: Rosemary Leap.
Companies represented: A joint exhibit of John Wiley & Sons and the University of Toronto Press.

Wind Turbine Company of Canada Limited, 145 Lucan St., Waterloo, Ont. Booth W-16.
Attending Personnel: Dr. A. C. Veldhuis, T. P. F. Henshall.

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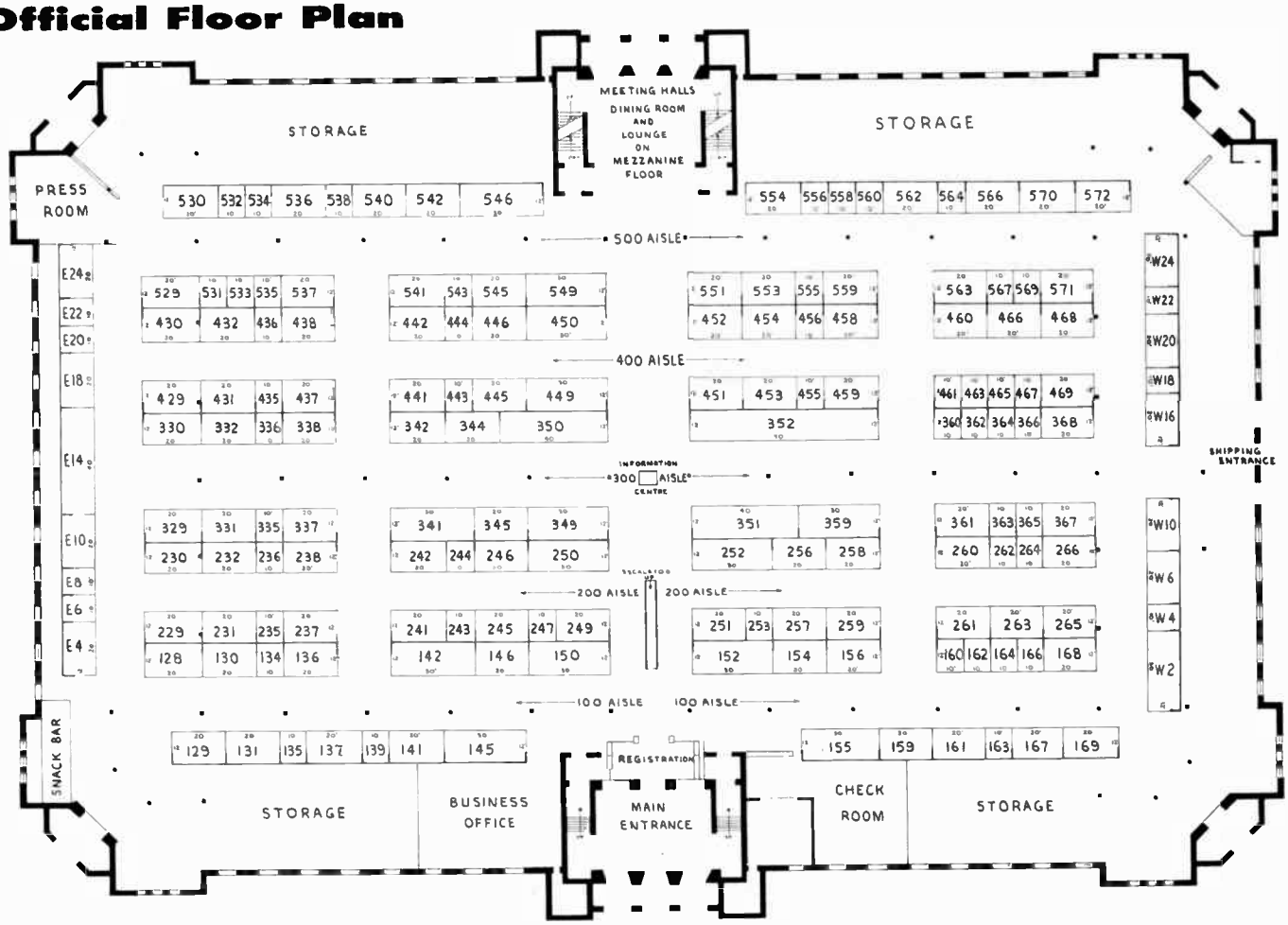

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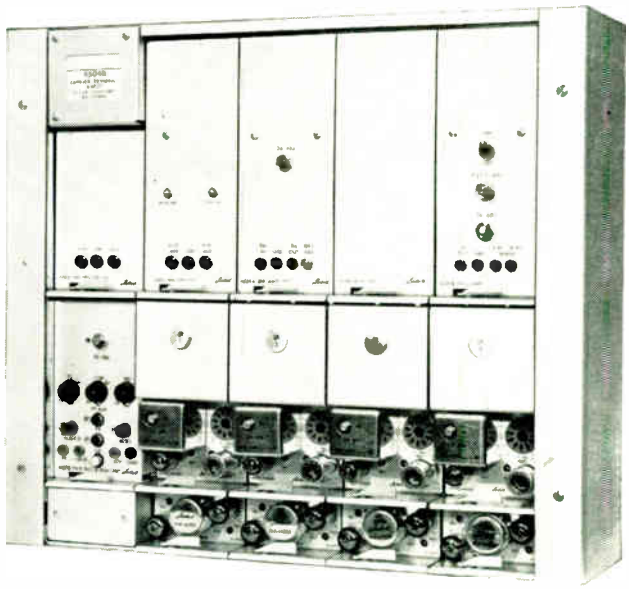
SELECTION OF CARRIER EQUIPMENT is much like chess...



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The new 45C systems, like the knight, are effective in a wide variety of circumstances and environments. They are compatible with the Western Electric O-class equipments, and interconnectable with the other Lenkurt 45-class systems.

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The complete frequency range from 2 kc to 156 kc is covered by the latest Lenkurt carrier telephone equipment. The 45C series, heralded by the widely-acclaimed 45CB1 system, has been expanded to include the 45CA2, 45CC2, and 45CD2 systems. The new design features used in these three systems have also been incorporated into the 45CB1 system, which will now be designated the 45CB2.

Complete information on the Lenkurt 45C carrier systems is yours for the asking; we're quite sure that, given this information, you'll make the right move.

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5931

Be sure to see the latest in Lenkurt equipment at Booth 563, I.R.E., Toronto

For complete details check No. 10 on handy card, page 93

STROWGER AUTOMATIC TOLL TICKETING

A PROFITABLE INVESTMENT TODAY, WITH

Nationwide Customer Toll Dialling is getting nearer every day. A SATT system installed now is a solid investment. For the smallest or largest network, today *and* tomorrow, it can pay very substantial dividends.

CUT YOUR OPERATING COSTS — WITH SATT!

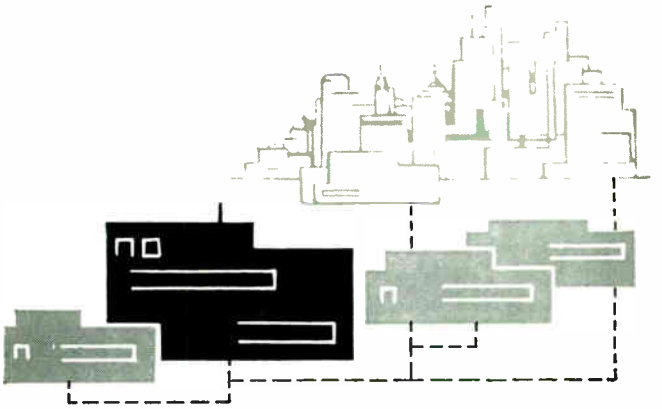
Strowger Automatic Toll Ticketing systems keep an automatic "ticker tape" record of every completed toll call—every item you need to prepare a customer's toll bill. Calling and called station directory numbers, date, time, and the duration of each call are all stored, and recorded the instant the call is completed.

SATT systems provide completely automatic bill processing, but if you prefer a manual method of billing—to tie in with your existing accounting practices—SATT can print a complete toll ticket on each call. Then, next year or the year after, when you're ready to change over to automatic accounting, there's no need for any change in your SATT equipment. In addition, the data used for billing can be made available to your traffic and commercial departments as well.

For complete information contact your nearest Automatic Electric office, or write us direct.

For complete details check No. 11 on handy card, page 93

THE NEW SATT TYPE 59 DUAL-SERVICE SYSTEM



The well-known SATT BD system has proven completely satisfactory in operation, as well as extremely profitable for the telephone companies using it. The new SATT Type 59 Dual Service system now incorporates many improvements based on experience with BD systems—meets all the latest operating requirements of larger toll centres.

- The new system provides customer direct distance dialling (DDD) on a nationwide basis for station-to-station sent-paid messages to all dialable points.
- It can be installed in toll centres to serve exchanges *and* tributary offices. The small amount of special equipment required for tributary offices is inexpensive and readily installed.
- It can serve single tributary offices where toll call traffic and potential revenues justify installation.
- Completed calls are recorded on punched, coded, multi-channel paper tapes that can be automatically converted into typed toll tickets or standard business punched cards.
- Calling party dials a special directing code to access toll-ticketting system, and then either a 7-digit number, or a 3-digit area code plus the required number in the particular numbering-plan area.
- Calling number can be identified automatically (ANI service), or by checking operator (CKO service), and the two methods of operation can be mixed as required. ANI service for instance, may be offered in the toll centre and CKO service for tributary offices. Or ANI service may be provided for frequent toll users and CKO service to other lines.
- Using CKO equipment, high speed toll service can be made available to customers at low initial cost, and subsequent upgrading from CKO to ANI service can be carried out over any period, to any degree warranted.

H GUARANTEED DIVIDENDS TOMORROW!

PLUS THESE THREE IMPORTANT ADVANTAGES FOR INDEPENDENT COMPANIES

Low conversion costs

Automatic number identification (ANI) for two-party lines has been greatly simplified, and special party identity dials are no longer required on single or two-party lines. This favors more extensive use of ANI services, as it substantially reduces station conversion costs.

More economical operation

A special new detector provides more efficient ANI service at lower cost, permitting greater initial use of ANI in marginal situations. The detector is based on a SATT system circuit that has proven reliable over 10 years of operation.

Greater choice of access codes

The new Type 59 system provides a much greater choice of access codes. It can use any 1, 2 or 3 digit code, as well as code 112 which is favored by many telephone companies because of its wide use in step-by-step Bell exchanges.

5905-R

AUTOMATIC ELECTRIC SALES (CANADA) LIMITED

Head Office: 185 Bartley Drive, Toronto 16

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AUTOMATIC ELECTRIC

ORIGINATORS OF THE DIAL TELEPHONE

Tracer gas is sprayed over the relay enclosure while it is under high vacuum.

100% leak-free hermetic sealing

We reject relays with leaks so tiny that it would take 30 years to admit 1 cubic centimeter of air!

Hermetically sealed relays are safe from the dangers of human tampering, and from severe conditions of dust and dirt, sand, moisture and high humidity, fungi, salt spray and reduced air pressure. To insure this safety, however, sealed relays must be absolutely free from leaks.

That is why, at Automatic Electric, every single hermetically sealed relay undergoes a *sensitive mass spectrometer test.* This highly refined method of testing detects leaks so tiny that it would take *more than 30 years for one cubic centimeter of air to pass through!* To protect you, we reject "leakers" able to pass ordinary immersion tests with ease.

Thanks to unusual care like this at every step of manufacture, Automatic Electric relays are the most reliable you can buy.

Hermetically sealed relays are available in many varieties. *Write today for full information. Address: Automatic Electric Sales (Canada) Ltd., 185 Bartley Drive, Toronto 16, Ontario. Branches across Canada.* 5948

AUTOMATIC ELECTRIC

PIONEERS IN AUTOMATIC CONTROL

GENERAL SYSTEM

AN ORGANIZATION SERVING CANADIAN INDUSTRIES WITH COMMUNICATION, TIME AND CONTROL SYSTEMS

For complete details check No. 12 on handy card, page 93

News Report

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

IRE Canadian Convention & Exposition

• Program • Exhibits • Awards • Activities

The Canadian Region of the Institute of Radio Engineers proudly presents its fourth annual Convention on October 7, 8 and 9.

In these days of rapidly changing events the Convention will be of importance to everyone in the electronic and allied fields. This annual conference provides an unparalleled opportunity to meet fellow scientists, engineers, educationalists, technologists and business men — to see hundreds of new products and ideas at the exhibits and to attend technical sessions for first hand reports on new advances.

This is your one opportunity of the year to study the Industry's latest engineering achievements under one roof. Attendance is expected to top last year's record of 10,142. Be sure to put the IRE Canadian Convention on your schedule NOW for October 7, 8 and 9!

The Convention Committee is happy to announce that the IRE Board of Directors (international) will be in attendance and will conduct its meetings simultaneously with the Convention.

Accommodation — Convention site is the Automotive Building, Exhibition Park, only ten minutes from the heart of Toronto. In addition to one of the finest exhibit halls on the continent and fully equipped meetings rooms, facilities and services include a first class restaurant for full course meals, snack bars, a well appointed lounge and ample parking space.

Technical Program — The newest developments and techniques in the field of electronics and nucleonics will be covered in 109 papers presented by the nation's leading engineers and scientists. This outstanding program is divided into 25 sessions in the three-day Convention.

Exhibits — The industry's newest products and services will be shown by over 150 leading manufacturers and distributors from Canada, the United States and abroad in the most comprehensive display of its type in Canada's history.

Awards — Last year's successful Exhibit Award Competition has been enlarged to include two awards — one for the most outstanding Canadian product, and one for the most outstanding Canadian component exhibited. Awards in the form of engraved sterling silver plaques will be presented to the winners at the Convention banquet on Thursday evening, October 8th.

A Pioneer Award will also be presented to a leading Canadian pioneer in electronics.

Registration — IRE members and all those engaged in the electronic, nucleonic and associated industries are welcome to attend the convention and exposition. The registration desk will be open during convention hours at the Automotive Building. Registration fee, including technical program and exhibits is $1.00. Students of Universities and accredited technical schools will be registered without charge on presentation of school registration or student IRE membership cards.

Continued on page 56

IRE CANADIAN CONVENTION PROGRAM

Dates	October 7 - 8 - 9, 1959.
Location	Automotive Building, Exhibition Park, Toronto.
Exhibit Hours	Wednesday, October 7th — 10:00 a.m. to 6:00 p.m.. Thursday, October 8th — 10:00 a.m. to 6:00 p.m. Friday, October 9th — 10:00 a.m. to 8:30 p.m.
Technical Sessions	Wednesday, October 7th — 2:30 p.m. to 5:00 p.m. Thursday, October 8th — 10:00 a.m. to 12:30 p.m. and 2:30 p.m. to 5:00 p.m. Friday, October 9th —10:00 a.m. to 12:30 p.m. and 2:30 p.m. to 5:00 p.m.
Registration	At the Convention Building during exhibit hours. Fee is $1.00.
Convention Banquet	Thursday, October 8th — 7:30 p.m. at the Royal York Hotel.
All Industry Cocktail Party	Wednesday, October 7th — 5 to 7 p.m. at the Convention Building.
Ladies Headquarters	Royal York Hotel.

IRE Convention

Convention Banquet — All delegates, exhibitors and their wives, are invited to attend this outstanding social event of the Convention, which will be held at the Royal York Hotel on Thursday evening, October 8 at 7.30 p.m. A cocktail hour will precede the banquet. The speaker of the evening will be Deputy Minister D. A. Golden of the Department of Defense Production in Ottawa, who will speak on the vital topic of "Canada's New Role in Defense".

All Industry Cocktail Party — An opening day "get acquainted" gathering for delegates, visitors and exhibitors. The All Industry cocktail party will be held on the mezzanine floor of the Automotive Building on Wednesday, October 7, from 5 to 7 p.m.

Ladies' Activities — An exciting program has been arranged for the ladies under the Chairmanship of Mrs. Eileen Barclay. Headquarters for ladies' activities will be the IRE Ladies' Suite at the Royal York Hotel.

IRE Canadian Convention Awards increased to three

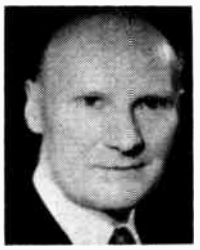
In addition to the award presented for the best new product exhibited at the IRE Canadian Convention, an award that has been presented in the past there will this year be two additional awards to be won at the Convention. The first of the two new awards will be for the best component exhibited at the Exposition and the second of the two additional prizes to be known as the Pioneer Award will be presented to the person who, in the opinion of Awards Committee, contributed most to the advancement of the radio art in the early days of its existence in Canada.

Members of the Awards Committee are Ross Smyth, National Research Council; George Glinski, Professor Electrical Engineering, University of Ottawa; Syd Love, Dominion Electrohome Industries Limited; Jim McKay, Department of Transport, and Eric Robinson, National Research Council.

Members of the Awards Sub-Committee who will have the somewhat difficult task of selecting the recipient of the Pioneer Award are: A. P. H. Barclay, Director of the Canadian Region of the Institute of Radio Engineers; Dr. J. P. Henderson, National Research Council; Dr. D. W. R. McKinley, National Research Council, and F. G. Nixon, Department of Transport.

Visiting American IRE Directors

G. A. Fowler



Dr. Ernst Weber

Prof. A. H. Waynick

Dr. R. L. McFarlan

Dr. E. H. Schultz

R. L. Cole

First Canadian locale for IRE Directors meeting

For the first time in the history of the Institute of Radio Engineers the Directors of the Institute will hold their annual meeting in Canada in conjunction with the IRE Canadian Convention and Exposition to be held at Exhibition Park, Toronto on October 7, 8 and 9.

Among the topics to be discussed by the Directors will be the participation of the IRE in forthcoming international events. Directors who will be attending the Canadian meeting are: Dr. G. K. Teal, Dr. George Sinclair, Dr. E. H. Schultz, Dr. J. D. Ryder, Dr. Oliver, Dr. Daniel E. Noble, Dr. R. L. McFarlan, Dr. J. T. Henderson, Professor Charles Harp, D. G. Fink, Ralph Cole, Dr. E. Weber, William Doherty, Professor Hamburger Jr., Professor Waynick, Dr. W. G. R. Baker and Dr. Lloyd Berkner.

Canada's first industrial anechoic room

Continuing its policy of broadening facilities for research and development in all aspects of the communications field, Northern Electric Company Limited has recently designed and built an "anechoic chamber" for use in making accurate measurements of microphones, loud speakers, telephone instruments, etc. This chamber, which has been built at the Belleville Branch Laboratories, is believed to be the first industrial room of its kind in Canada. With wall treatment up to five feet in thickness, the chamber creates for the experimenter a very close approximation to free space with the propagation of sound waves unaffected either by reflection or by interference from external sources.

Earl Stanley manages IRC Ottawa office

International Rectifier of Canada Limited have announced the establishment of an Ottawa office at 1581 Bank Street with the object of increasing service to the many users of industrial rectifiers in the Ottawa area.

Manager of the newly formed IRC Ottawa office is Earl Stanley who has been associated with the Canadian electronics industry for a number of years and whose broad experience in the field of circuit design and component application eminently qualifies him to give the best in rectifier consultation service.

Management appointments Saskatchewan Government Telephones

The promotion of S. B. Medhurst to the position of general manager and Deputy Minister of Telephones, and C. W. Sparrow to manager of operations and engineering of Saskatchewan Government Telephones, has been announced by the Hon. C. C. Williams, minister in charge. The appointments are effective October 1, 1959. Mr. Medhurst succeeds S. R. Muirhead whose retirement from the telephone system was announced recently.

Mr. Medhurst, presently manager of operations and engineering, started with the telephone system in 1919, serving in the plant department at various points throughout the province until he was appointed assistant division superintendent at Saskatoon in 1944.

C. W. Sparrow

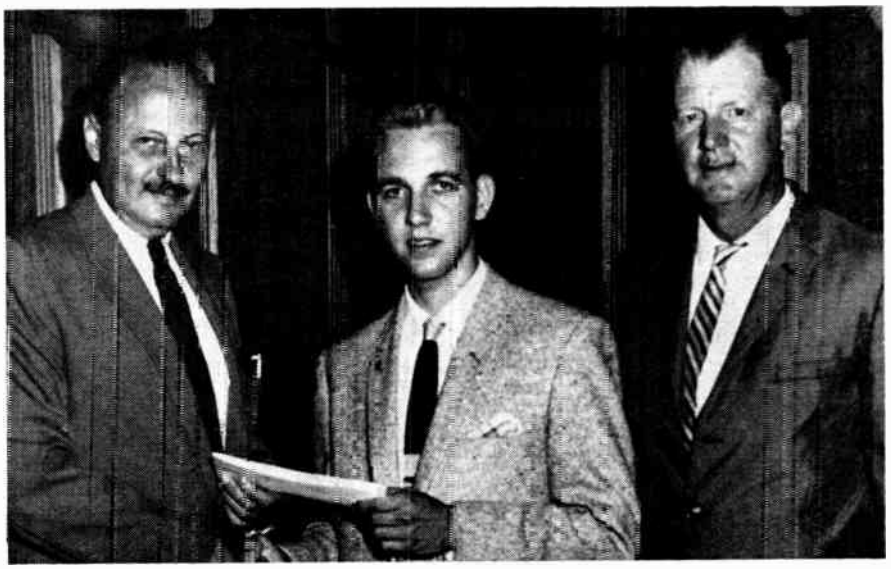
S. B. Medhurst

Mr. Medhurst now assumes the dual position of Deputy Minister of Telephones and General Manager of the Corporation. He will also serve as a member of the management committee of the Trans-Canada Telephone System.

His successor as manager of operations and engineering, Mr. Sparrow, is presently chief engineer for the system, a position which he has held since 1948. Prior to his appointment as chief engineer he served as transmission and equipment engineer. In his new position he will co-ordinate the activities of the plant, traffic, commercial and engineering departments.

Mr. Sparrow is a member of the Engineering Institute of Canada and of the Association of Professional Engineers of Saskatchewan.

Electrohome Electronics Education Award



Norman John Kilian, 19, of Kitchener, was this year's winner of the Electrohome Electronics Education Award. Carl A. Pollock, left, president of Dominion Electrohome Industries Ltd. is shown here presenting Mr. Kilian with the award while A. F. Duncan, principal of Eastwood Collegiate, Kitchener, looks on. Mr. Kilian will enroll this fall in the Engineering Physics course at the University of Toronto. In addition to the $1,600 which Mr. Kilian receives for tuition payments, Dominion Electrohome makes a donation of $500 to the university which the award winner chooses to attend.

Garlock Packing Company assumes distribution

Effective June 29, 1959, Fluorocarbon Products Inc., Camden 1, N.J., an affiliate of The Garlock Packing Company, will be dissolved as a separate corporation. The Garlock Packing Company will then assume all distribution obligations of the plastic electronic products and components previously sold by the dissolved company.

Canadian agent for the Garlock Packing Company is Lake Engineering Company, Manville Road, Scarborough, Ontario.

TCA buys Canadian designed reservation system

Ferranti-Packard Electric Limited, Toronto, has just been awarded a contract to design and manufacture a large digital computer for Trans-Canada Air Lines. The general purpose computer will be the electronic brain of a nationwide TCA reservation system, the field equipment for which is presently being built by Ferranti-Packard. The entire system will cost close to 3½ million dollars.

This complete commercial electronic computer system is the first such system to be awarded for Canadian design and manufacture and as such, is the first breakthrough for Canadian talents on a broad general scale in the data processing field. The entire system will begin operation in 1961.

Trans-Canada Air Lines presently handles 3,500,000 transactions in flying 250,000 passengers per month. The Ferranti-Packard electronic system will reduce the number of necessary human transactions by 60 per cent. In addition, speed of operating will permit reservations enquiries to be handled in approximately 2 seconds regardless of the geographic location of the reservation source.

Freed Transformer Company names Canadian agent

Freed Transformer Company, Inc., has announced the appointment of Conway Electronics Enterprises, 1514 Eglinton Avenue West, Toronto 10, Ontario, as their sales agent in Canada.

The Conway organization will handle the entire Freed line of power and communication components as well as Freed's comprehensive line of precision laboratory test instruments and counters.

RCA Victor appointments

K. G. Chisholm, manager, field sales, Commercial Marketing Department, Technical Products Division, RCA Victor Company, Ltd. recently announced the appointments of D. E. M. Allen and J. M. McCook to the company's technical field force. Mr. Allen has been named manager, Manitoba, Saskatchewan and North West Ontario with offices in Winnipeg. Mr. Allen was formerly manager of Broadcast and Antenna Engineering at the Company's Montreal head office. Born in Winnipeg, Mr. Allen graduated (B.Sc., E.E.) from the University of Manitoba. He is a member of the Institute of Radio Engineers and the Corporation of Professional Engineers of Quebec.

J. M. McCook

D. E. M. Allen

J. M. McCook has been appointed technical representative, Alberta and British Columbia. Born in Calgary, he received his early education in Regina, Ottawa and the United Kingdom. In 1952 he graduated from McGill University with a B.Sc., having majored in mathematics and physics. He also obtained, in 1958, the degree of Master in Business Administration from the Harvard Business School where he held a David Sarnoff Employee Fellowship. Mr. McCook has spent several years in the Broadcast Consulting group and in marketing work for RCA Victor.

Philco appoints transistor distributors

The appointment of Electro Sonic Supply Company Limited, Toronto, and Canadian Electrical Supply Company Limited, Montreal, as Ontario and Quebec distributors of Philco Transistors, was recently announced by J. A. Price, manager of Philco's Government and Industrial Division.

Set up primarily to give rapid service to transistor users of quantities 1 to 99 of fast moving types, they are backed by a complete stock of Philco Transistors and Diodes at Philco's Don Mills plant.

Quantities of 100 and up required by equipment manufacturers are available directly from Philco at Don Mills.

CNR chooses Bendix railroad radio

The Canadian National Railroad has purchased Bendix locomotive radio sets and way station equipment for use on the Edmonton-Vancouver portion of the CNR transcontinental line.

A total of 72 locomotive sets and 45 way station equipments were involved in the purchase. When installation is complete, which will be early in 1960, communication between dispatchers and train crews will be as simple as making a 'phone call. End-to-end, train-to-train, and train-to-wayside communications are all provided for. The locomotive equipment operates on two frequencies, one for end-to-end or train-to-train use, and one for train-to-wayside. Wayside stations are connected by land lines so that a dispatcher in a division point can select a wayside station nearest to the specific train he wishes to call.

Choice of Bendix equipment was made after lengthy and thorough evaluation by the CNR of several available systems. Bendix equipment, purchased through Computing Devices of Canada Limited, was said to have been chosen primarily because of its proven ruggedness and reliability, its competitive cost, and its availability for fast delivery. More than 30 major United States railroads are now using Bendix railroad radio.

Hunting Associates Limited consolidate staffs

Hunting Associates Limited have announced that staffs of associated companies formerly housed in different locations in Metropolitan Toronto have now been consolidated at the Group's headquarters at 1450 O'Connor Drive, East York (Toronto 16).

A second building has been leased by Hunting Associates, adding 24,000 square feet of floor space to the 40,000 square feet already occupied on O'Connor Drive.

The following units were relocated:

Hunting Technical & Exploration Services Ltd. staff, formerly located at 285 Danforth Road.

Hunting Airborne Geophysics Ltd. Ltd. staff, formerly located at 1485 Woodbine Ave.

Canadian Hunting Companies Research and Development Division, formerly located at 5385 Yonge Street.

Unaffected by the moves are The Photographics Survey Corporation Ltd., Kenting Aviation Ltd., and Kenting Helicopters Ltd., all with headquarters at 1450 O'Connor Drive; and Field Aviation Company Limited, with headquarters at the Oshawa, Ont. Municipal Airport.

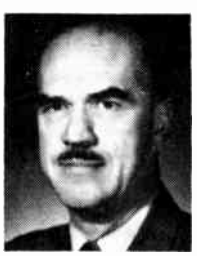
Also unaffected are other Hunting associated companies, staffs, offices or installations at Quebec City, Montreal, Ottawa, Winnipeg, Calgary and Vancouver.

International Systcoms Limited name sales officers

John M. Young resident of West Vancouver, B.C., has taken up the appointment of Western area sales manager, responsible for the sales of the company's products and control of dealer set-up. Mr. Young obtained his M.Sc. from McGill in 1928 and has served in England as a research engineer from 1946 to 1950. He served the Canadian Marconi Company as development engineer from 1946 to 1950 and previously served that company as a seagoing wireless officer.

During the period 1950 to 1954 he was appointed assistant to the general manager of Canadian Marconi Company and in 1954 was appointed director of Canadian Radio Patents Ltd. and held the post of manager, Patents and External Relations Division of Canadian Marconi, when he travelled extensively in South America and Europe conducting market surveys.

Mr. Young has wide engineering knowledge and valuable planning and management background which will further strengthen the sales organization of International Systcoms Ltd.



John M. Young

J. DiMichele

Jack DiMichele resident of Montreal, Quebec, has taken up the appointment as assistant to marketing manager, responsible for product promotion, administration and back-up to area sales managers.

Mr. DiMichele has had a wide experience of administration and accounting procedure in the electronic industry, previously served with RCA and the Canadian Marconi Company.

Born in Italy and resident in Canada for the past thirty years, he is fluent in Italian, French and English which will be an asset to his new appointment.

Powertronic Equipment Limited executive appointments

The Board of Directors of Powertronic Equipment Limited announces the election of D. G. Willmot as chairman, B. W. Richardson as president, and the appointment of W. D. Sikrtanc as general sales manager. Messrs. Richardson and Bawden have been with Powertronic for some years and Mr. Sikrtanc has been sales manager of the Montreal area of the company for six years.

D. G. Willmot is president of the Anthes-Imperial Company Limited which recently acquired a 50 per cent interest in Powertronic, a wholly Canadian company. These executive appointments reflect the policy of broadening the present electrical and electronic operations into other Canadian markets and will be strengthened by the Anthes facilities from coast to coast.

Powertronic Equipment is also pleased to announce its participation in the formation of a new Canadian company, Evershed-Powertronic Ltd., in partnership with Evershed Vignoles. Ltd., a leading electronic manufacturer in London, England. The new company will engineer and manufacture instrumentation and telemetering systems in Canada.

TelePrompTer of Canada appointment

Chris Hrushowy has taken up the duties of sales and service representative for TelePrompTer of Canada Ltd., a Division of S. W. Caldwell Ltd., Toronto.

Hrushowy is re-entering familiar territory. He was a technician in the company last year, resigning to take the position of chief film editor for Industrial Film Maintenance.

Prior to his first TelePrompTer post Hrushowy gained experience in TV lighting and camera techniques with CBUT Vancouver and CFRN Edmonton.

Companies group under Renfrew Electric Co. Ltd.

J. R. Longstaffe, president of Renfrew Electric Company Limited has announced that the following companies, J. R. Longstaffe Company Limited, International Resistance Company Limited and Renfrew Electric Company Limited have simplified their operations by changing the above Limited companies into a single company "Renfrew Electric Co. Limited". The operations of the above companies will be carried on as divisions of Renfrew Electric Co. Limited, as follows: IRC Resistors, Jensen Speakers, Struthers Dunn Relays, P & S Wiring Devices and Canadian Beauty Appliances.

The head office and sales offices are now located at 349 Carlaw Avenue, Toronto, with manufacturing facilities at this address and in Renfrew, Ont. Sales offices are maintained at Ottawa, Montreal and other main centers across Canada.

General Instrument adds three to sales staff

John McK. McLean, vice-president and general manager of General Instrument — F. W. Sickles of Canada Ltd. announces the appointment of Harold Carioni, A. Fred Penny, and Jack F. Thompson to the sales organization of General Instrument in Canada.

Jack Thompson, formerly purchasing agent for Sylvania Electric in Dunnville, will assist Lloyd R. Harris in sales to radio and television receiver manufacturers of the comprehensive General Instrument component line.

J. F. Thompson

Fred Penny will represent General Instrument in the field of industrial components, including selenium and silicon rectifiers, diodes, Micamold capacitors, delay lines, toroids and filters. For the past several years Mr. Penny has represented Canadian General Electric in the sale of components to the electronic industry.

Harold Carioni, president of Telequipment Co. of London, Ontario, will be responsible for the sale of General Instrument products to Canadian electronic wholesalers.

A. F. Penny

H. Carioni

The establishment of this organization will enable Mr. Harris, the director of sales, to devote increasing attention to the growing market for the company's end equipments for industrial and defense applications.

Frank P. Labey appointed regional sales manager

Frank P. Labey has been appointed regional sales manager of Toronto region in the sales division of Northern Electric Company Ltd.

Born in Stonewall, Manitoba, Mr. Labey graduated from the University of Manitoba with a B.Sc. degree in electrical engineering in 1934.

F. P. Labey

The next five years were spent with electrical companies in England, following which he joined Northern Electric in Montreal as illumination assistant in the general sales department.

In 1948, Mr. Labey was appointed illumination manager, remaining in this capacity up to the time of his appointment as wiring materials manager in 1954. A year later, he was appointed wiring materials marketing manager and, in 1957, supply manager.

Mr. Labey is a member of the Electrical Club of Montreal, the Canadian Electrical Association and Engineering Institute of Canada.

Stereophonic High Fidelity exposition

Sponsored and conducted by the Dominion High Fidelity Association, the 1959 Toronto Stereophonic High Fidelity Exposition will be held in the Park Plaza Hotel in Toronto from October 28th to October 31st, inclusive. Four floors of the north wing of the Park Plaza will be used by exhibitors to show and demonstrate the newest offerings in complete stereo and monophonic music systems, records and tapes, amplifiers, pre-amplifiers, FM-AM tuners, turntables, record changers, phono cartridges, microphones, music control centers, speakers and speaker enclosures, equipment cabinets, circumaural headsets, finished and assembled do-it-yourself kits, etc.

H. Roy Gray, president of the Association, states that the 1959 Toronto Exposition promises to surpass all previous shows conducted by his association and that with 92 per cent of the available space already contracted for, success is assured for this year's undertaking. Attendance-wise, it is expected to attract upwards of 12,000 persons from Toronto and surrounding area. Last year in Montreal, the attendance was upwards of 10,000 persons.

THE BEST TO BE SEEN

at E.M.I.-COSSOR ELECTRONICS LTD.
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IRE CONVENTION

E.M.I. WM16 Oscilloscope	Ultrasonic Cleaning Equipment
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Sales Offices: 2005 McKay St., Montreal,
3077 Bathurst St., Toronto, Ontario,
P.O. Box 525, Dartmouth, N.S.

For complete details check No. 89 on handy card, page 93

Canadian Westinghouse awarded NATO communications contract

One of the first communications orders ever received by a Canadian firm for Western European defense has been awarded to Canadian Westinghouse by Supreme Headquarters Allied Powers in Europe.

The order received by the Hamilton firm is for two superhigh frequency "line-of-sight" microwave radio systems for delivery in early 1960.

The first is a truck-mounted three-hop system with four completely mobile terminal and repeater stations. The entire system can be transported with a high degree of mobility. It has a 120 channel capacity for voice and data transmission with an operating frequency of 4400 to 5000 megacycles.

The second part of the contract is for a two hop system with two terminals and a repeater station. This equipment is extremely compact and is mounted in transportable carrying cases. A drop-panel on the case facilitates easy operation of the transmitting and multiplexing equipment.

A portable antenna system which can be erected and dismantled easily and quickly without tools is a part of both orders. The mast rises approximately 60-feet into the air.

The order was signed by the Canadian Westinghouse International Company after negotiations in Europe with SHAPE officials. Westinghouse is associated in this contract with "Societe Anonyme de Telecommunications" of France who will supply the multiplex equipment and all necessary trucks, power equipment and transportable shelters.

Clairtone Sound Corporation appoints sales VP

Wallace R. Johnston has been appointed vice-president of sales, Clairtone Sound Corporation Limited.

Clairtone, a wholly Canadian company with plant and head office at Weston, Ontario, produces a line of stereophonic high fidelity models and is a leading seller of FM radios.

Mr. Johnston is one of the best known sales personalities in the electronics industry. For the past 23 years he has been associated with leading electronics manufacturers and is well known to dealers and distributors from coast to coast.

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 93. Just mark the products you are interested in on the coupon on Page 93 and the information will be in your hands within a few days.

Multi-range multimeter

Item 2452

The 0.6 volt range provided by the STARKIT Model MK-3 is most convenient for measuring low voltage drops in transistor equipment such as radios, hearing aids, etc. A multi-range multimeter, the unit is designed to measure DC voltage from 0.01 to 6000 volts; AC voltage from 0.1 to 1200 volts; DC current from 1 microamp to 12 amps; resistance from 1 ohm to 50 megohms; audio power levels from —20 to +63 Db on a 600 ohm line. The more frequently used ranges are measured by using only two banana jacks and the range switch to speed selection and changing ranges. The unit is available in wired and calibrated form only.

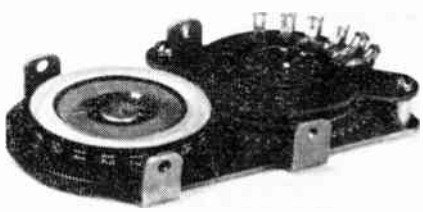
Details from **Stark Electronic Sales Co., Ajax, Ontario, Canada.**

Thumbwheel-operated switches

Item 2453

Grigsby Co. Inc., announces a new series of thumbwheel-operated switches for those applications where panel space is at a premium.

Switches are available in 10 and 20 position forms with larger configurations possible on special order.



Thumbwheels can be supplied with any combination of letters, numerals, and special signs. Indications may be illuminated, if so desired.

The switches may be furnished with multiple wafers where necessary.

The thumbwheel switches exceed the requirements of MIL-S-3786.

For information contact: **Lake Engineering Co. Limited, 123 Manville Road, Scarborough, Ontario.**

Ferrite variable attenuator

Item 2454

A ferrite type of electro-magnetically controlled attenuator designed for remote control use has been developed by Airtron. Compact in size, these units are suitable for use where an increase in the dynamic range of radar systems is desired. Weighing less than 19 ounces, their frequency range is 8500 to 96 megacycles with a maximum insertion loss of 0.5 db.

For further information write **Airtron Canada Ltd., 349 Carlaw Avenue, Toronto 8, Ontario.**

New Products

P-A-B-X system

Item 2455

A new P-A-B-X business telephone system, designed in Canada to meet Canadian requirements, is now available from Automatic Electric Sales (Canada) Limited.

Known as the Type 90-B-20, the new system offers packaged installation, plus many of the latest advances in telephone technology and design. The attendant's cabinet for instance is push-button operated, with optional key marker, for keying instead of dialing local lines. The switchboard is divided into two units, one for immediate use, the other to meet future expansion needs.

Installation of the first unit provides complete service for a minimum of 30 local lines and 7 central office trunks. Packaged components are available to cover additional circuit needs, and the first unit can be expanded to a maximum capacity of 50 local lines and 10 central office trunks. The second unit can be added easily and economically to provide the ultimate capacity of 90 local lines and 20 central office trunks.

For complete information write **Automatic Electric Sales (Canada) Limited, 185 Bartley Drive, Toronto 16, Ontario.**

Time recorder + Totalizer

Item 2456

The Time Recorder + Totalizer records on a chronologically-printed strip chart the duration of productive and non-productive time of any machine, process or system. It also furnishes a cumulative total of productive time or number of operations. Its easily-read data furnish a basis for time study, cost accounting and preventive maintenance. Continuous 4-month tape chart. Electrically-actuated stylus needs no ink.

Further information from **Modenco of Canada Limited, 4975 de Sorel Street, Montreal, Que.**

Thyratron tubes

Item 2457

Two new thyratron tubes (WL-7306 and WL-7307) used for general purpose control and welding control service are now available from the Canadian Westinghouse Co. Ltd.

In addition to xenon filling which minimizes tube voltage drop, each tube has a rugged button stem designed to assure immunity from mechanical failure. Special glass, particularly adapted to automatic sealing machine techniques, is used.

To minimize grid current, a special carbonized nickel grid is employed. Also, high alumina ceramic insulators are used throughout the tubes to insure strength and high insulation resistance.

The WL-7306 xenon-filled thyratron is a direct electrical and mechanical replacement for the 5684, C3JA, 5632, C3J. Because of its mercury and xenon filling, the WL-7307 provides an improved life in most sockets now using inert gas thyratron tubes 5684, C3JA, 5632, C3J, and WTT 106. This tube replaces the 6011 and the 710.

For further information, write **Information Department, Canadian Westinghouse Co. Ltd., P.O. Box 510, Hamilton, Ontario.**

New Products

Potting compound with a memory

Item 2458

A completely new electrical potting material, designated Dow Corning Dielectric Gel, has just been announced by Dow Corning Silicones.

Easily applied, Dielectric Gel has an initial viscosity similar to molasses, and when poured over any electrical component it readily surrounds it with a crystal clear, transparent silicone dielectric. Dielectric Gel then cures in place to form a resilient clear mass that combines outstanding dielectric properties with thermal stability and moisture resistance.

With a curing time that may be varied from 30 minutes to as much as 48 hours, Dielectric Gel exerts no stresses on delicate electronic components, either during or after the cure. Curing itself requires only temperatures from 40 to 150 C.

One of the advantages of potting components in this new clear silicone compound, is that they may be easily traced and test probes accurately inserted right through the gel. Once the probes are removed, Dielectric Gel exhibits its amazing memory by simply "healing"' itself immediately.

Resilient, this material protects potted parts from shock and vibration, and is stress-free throughout its wide operational temperatures span of —60 to 400 F. Delicate parts are not damaged by fluctuating temperatures . . . a problem with rigid materials. In addition to this Dow Corning Dielectric Gel is already showing unlimited application possibilities. For example, it has a possible damping application or for the impregnating of capacitors, magnetic amplifiers, or similar devices.

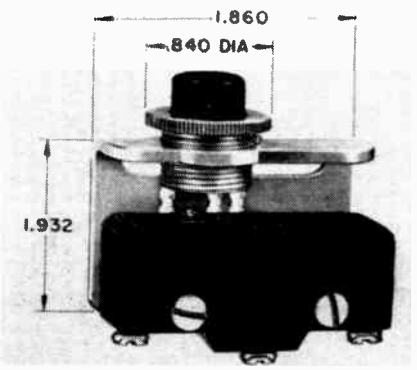
Additional information on this product and other Dow Corning Silicone dielectrics, is available from **Dow Corning Silicones Limited, 1 Tippet Road, Downsview, Ont., Canada.**

Micro switches

Item 2459

The new "12MA" series of pushbutton actuators for basic switches is the subject of a new data sheet, number 155, just released by MICRO SWITCH, Toronto, a Division of Honeywell Controls Limited.

The data sheet shows how the six catalog listings in the series (two button sizes in three colors each) allow use of a great selection of MICRO SWITCH basic switches.



Included is a chart which gives typical current and circuitry requirements; then shows which basic switch may be used with the actuators to meet each requirement. Complete dimension drawings are given for both button sizes.

For further information write: **B. Colwell, Merchandising Department, Honeywell Controls Limited, Vanderhoof Avenue, Toronto 17, Ont., Canada.**

Epoxy dipping compound

Item 2460

A new epoxy compound has been developed for encapsulating, by dipping, small electrical components such as ceramic wafer capacitors, resistors and small transformers. Identified as HYSOL 10-80, the black thixotropic material produces an even non-dripping coat on pieces up to one inch cube.

HYSOL 10-80 Dipping Compound has passed the temperature and immersion cycling tests set down by MIL-C-11015A "Capacitors, Fixed Ceramic Dielectric." The 10 day moisture resistance test was passed averaging 100,000 megohms against the specified minimum of 1000 megohms.

For further information write to: **Hysol (Canada) Limited, P.O. Box 53, Station R, Toronto, Ont.**

Toroidal coil winding machine

Item 2461

A new toroidal coil winding machine, called MINITOR and manufactured by Boesch Manufacturing Company, Inc., will wind coils to a residual inside diameter of $\frac{1}{32}$", a reduction of 50 per cent compared to the smallest I.D.'s previously available.

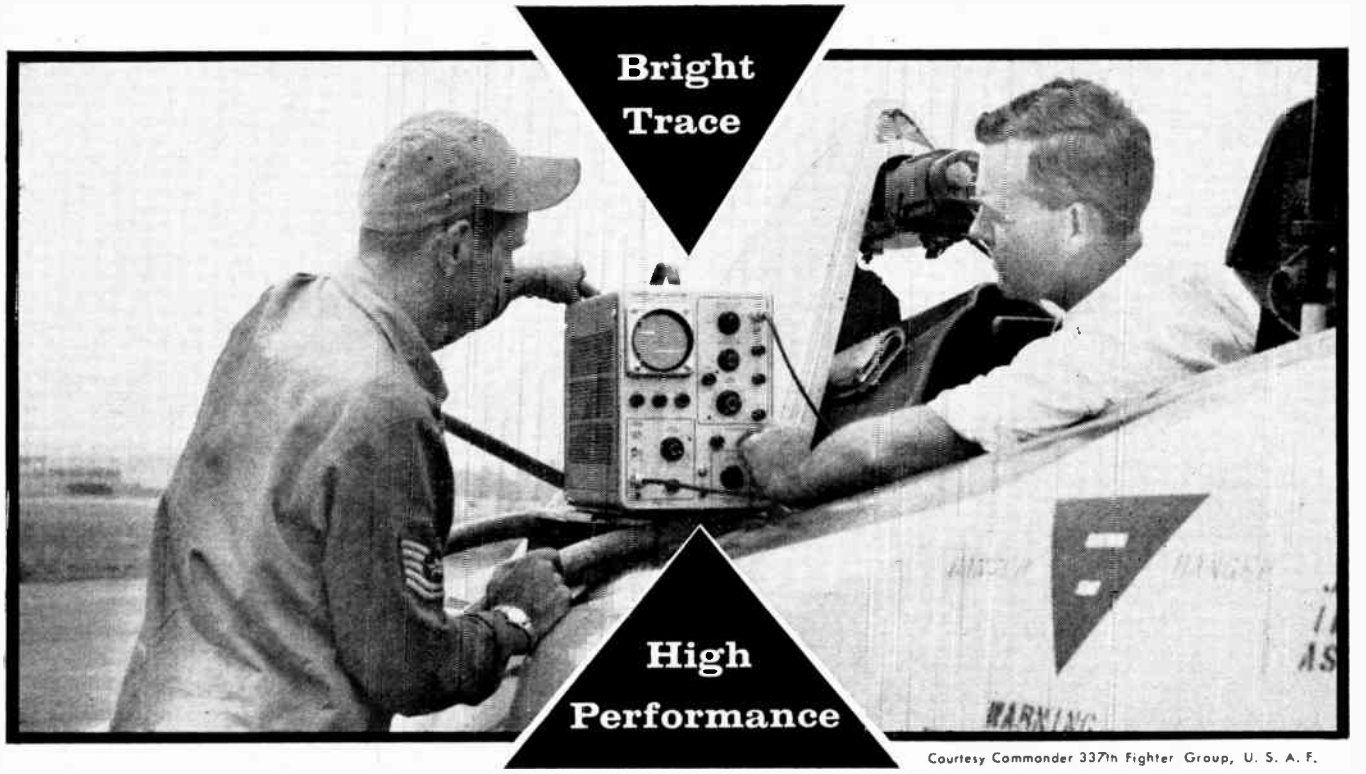
These new performance specifications reflect a new concept in small-coil winding which has been perfected by Boesch. The wire is loaded inside a hollow, round cross-section shuttle, and the winding is spun out. A single loading of this unique shuttle is usually enough to wind several coils.

Minitor will handle wire sizes from No. 36 to No. 50 AWG, and winds up to 500 turns per minute. Maximum finished coil size is $\frac{3}{4}$".

Shuttles are loaded by a separate machine, the Boesch PW-100 Loader. This machine can service as many as 20 winding machines, and can also be used to load needles for hand winding.

Descriptive literature on Minitor may be obtained from **Bayly Engineering Limited, Ajax, Ontario, Canada.**

Continued on page 66



Courtesy Commander 337th Fighter Group, U. S. A. F.

Low Cost DAYLIGHT OSCILLOSCOPE

TYPE 317—It's excellent for the daylight conditions often encountered in the field and at production test stations. The brilliant trace, provided by 9-KV accelerating potential on a new Tektronix 3-inch cathode-ray tube, is easily readable in bright areas, even at low sweep-repetition rates. And its DC-to-10 MC vertical response easily takes care of most of today's complex field applications.

The Type 317 is an excellent laboratory oscilloscope, too. Ask your Tektronix Field Engineer or Representative to arrange a demonstration in your most demanding applications.

TYPE 317 CHARACTERISTICS

VERTICAL RESPONSE

Passband—dc to 10 mc.
Risetime—0.035 μsec.
Sensitivity—0.1 v/div to 125 v/div, dc-coupled and ac-coupled—0.01 v/div to 0.1 v/div, ac-coupled only. Twelve calibrated sensitivity steps.

SWEEP RANGE

0.2 μsec/div to 6 sec/div. 22 calibrated steps from 0.2 μsec/div to 2 sec/div.
5-x magnifier increases calibrated sweep rate to 0.04 μsec/div.

TRIGGERING

Preset or manual stability control with amplitude-level selection, and fully-automatic triggering.

ACCELERATING POTENTIAL

9-KV on new Tektronix high-voltage 3-inch cathode-ray tube.

CALIBRATOR

Amplitude calibrator, 0.05 to 100 v in 11 steps, square-wave frequency about 1 kc.

OTHER FEATURES

Electronic power-supply regulation.
External input to horizontal amplifier.
Warning lights for uncalibrated sweep-rate and sensitivity settings.
Magnifier indicator light.
Size—8½" wide, 12" high, 19½" deep.
Weight—35 lbs.

Type 317 . . . . . **$800** (50 to 60 cycle supply).
Type 317 MOD101 . . . . . **$835** (50 to 800 cycle supply).
RACK MOUNTING MODEL—Same electrical specifications as Type 317. Dimensions: 7" high, 19" wide, 17 9 16" rack depth.
Type RM17 . . . . . **$875**
f.a.b. factory

ENGINEERS—Interested in furthering the advancement of the oscilloscope? We have openings for men with creative ability in circuit and instrument design, cathode-ray tube design, and semiconductor research. Please write Richard Rapiequet, V.P., Eng.

Tektronix, Inc.

P. O. Box 831 • Portland 7, Oregon
Phone CYpress 2-2611 • TWX-PD 311 • Cable: TEKTRONIX

CANADIAN FIELD OFFICE:
3 Finch Avenue East, Willowdale, Ontario
Phone: Toronto, BAldwin 5-1138

For complete details check No. 81 on handy card, page 93

New Products

Dynamic output tube tester

Item 2462

The following is a description of the new Jackson Dynamic Output 658 Tube Tester that tests tubes under actual operating conditions, e.g. Commercial, Magic Eye, Rectifier and car radio type tubes, etc.

Dynamic output principle — 8 voltage positions for plate, screen and voltage regulators. Variable DC voltage, plus variable AC signal voltage is applied to control grid. The meter then reads only the AC component in the plate circuit. A much more valid test than mutual conductance, because it consider the entire output curve of the tube, not just a small portion.

Tests new 12-volt plate hybrid tubes — Ample current capacity for even high current space charge grid tubes. The 658 is the only tester made with this capability.

True rectifier tests — AC voltages are applied to diodes and rectifiers. Meter then reads plate current — the only valid test for rectifiers. Easily handles even high current rectifiers up to 250 ma.

Grid leakage tests — Highly sensitive grid leakage test indicated directly on special meter scale. Sensitivity of 15 megohms.

Tests "Eye" tubes under dynamic conditions — Eye can be opened and closed to determine accurately its operating limits.

Heater-current tests on series string tubes — Actual current is read directly on meter scale.

Heater continuity check without warm-up — No wasted time if the heater is burned out.

Tests all voltage regulator and reference tubes — Actually indicates striking voltage and control voltage range.

For further information write: **Canadian Marconi Company, Electronic Tube and Components Division, 830 Bayview Avenue, Toronto, Ont.**

Printed circuit resistor

Item 2463

Type PC5, a low operating temperature, 5 watt resistor, especially designed for printed circuit use has been announced by IRC.

Combining a unique design with a high degree of automatic assembly, IRC's type PC5 resistor is particularly recommended for aircraft and missile applications where printed circuitry is used solely as a means of improving uniformity and reliability of a product.

Alloy coated leads for positive soldering, are secured to a resistance element, uniformly and tightly wound on a fiber glass core, sealed in a rectangular ceramic case with the same special IRC process that insulates the military power resistors. All materials are inorganic for fullest protection against flame or decomposition at overload conditions. A highly automated production process ensures high quality consistency which is important in aircraft and missile printed circuit board applications.

For Catalog Data Bulletin P5 please write to **Renfrew Electric Co. Limited, 349 Carlaw Avenue, Toronto 8, Ontario. — Manufacturers of IRC Resistors in Canada.**

New Products

Wheatstone and Kelvin bridges

Item 2464

Conway Electronic Enterprises Reg'd. now offer 3 models of Wheatstone Bridges, one a straight DC Bridge which measures from .05Ω to 50,000Ω using an internal DC source. Another has the same ohmic range but will measure both AC and DC resistance as it contains an internal AC source, the third unit consisting of a Kelvin Bridge which measures from .0001Ω to 20Ω. The accuracy of these instruments is 1 per cent. They are attractively housed in black hard bakelite cabinets with internal galvanometers as per illustration.

For information concerning the above, contact — **Conway Electronic Enterprises Reg'd., 1514 Eglinton Ave. West, Toronto 10, Ont., Canada.**

Voltmeter - Ohmmeter - Ammeter - Amplifier

Item 2465

A compact, multipurpose voltmeter which makes precision measurements of DC voltage, current and resistance — all over a wide range — is now available from the Hewlett-Packard Company.

The new meter, Model 412A measures voltage between 100 microvolts and 1000 volts. (Maximum full scale sensitivity 1 millivolt.) Accuracy is 1 per cent of full scale. It measures current from 0.1 microampere to 1 ampere. (Maximum full scale sensitivity 1 microampere.) Accuracy is 2 per cent of full scale. As an ohmmeter, it insures accurate resistance measurements from 0.02 ohms to 5,000 megohms.

412A high stability and low drift make it ideal for high gain DC amplification. A maximum voltage gain of 1000 is provided. The amplifier output is proportional to the meter reading and may be used to operate potentiometer or galvanometer recorders.

The extreme stability of Model 412A eliminates the need for a zero adjustment. The instrument has only three controls, a function selector, a 13 position range switch and a lever type polarity switch

The new meter's VTVM circuit employs a newly-developed photo-chopper in place of the old-style mechanical vibrators, virtually eliminating drift, hum and noise. Input is floating, with resistance increasing from 10 megohms on the 1 mv range to 200 megohms on ranges above 100 mv. Current and voltage ranges have a 10 db sequence for maximum readability and overlap.

The ohmmeter is a modified Kelvin bridge eliminating lead resistance error. It provides accurate resistance measurements on wire sections as short as 6".

For further information, please write or call **A. H. Langdale, Atlas Instrument Corp. Ltd., 50 Wingold Ave., Toronto 19, Ont., Canada.**

New Products

All-transistor HF communications receiver

Item 2466

The Model N625F is a six-channel portable crystal-controlled receiver covering the range 2 to 6 megcycles. Eight transistors are used including an RF stage and push-pull output stage which delivers ½ watt to the self-contained loudspeaker. Telescoping whip antenna is built-in; connections are provided for external antenna, external battery and break-in. Normal power supply consists of six flashlight cells housed in the case. Weight complete with batteries is only 5½ lbs.

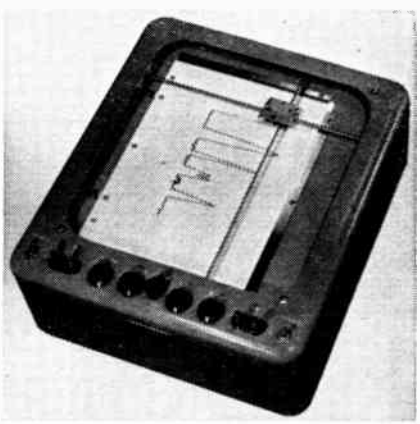
A single-channel version is also available. Dimensions are 8¼ x 8¼ x 3½ inches.

Manufacturer — **Northern Radio Co., Seattle, Wash.,** represented by **Tele-Radio Systems Ltd., 3534 Dundas Street West, Toronto 9, Ont.**

New X-Y recorder

Item 2467

Houston Instrument Corporation offer their new HR-92 Series X-Y Recorders for computer readout, and for plotting stress vs. strain, hysteresis curves of magnetic materials, tube and semiconductor characteristics, pressure vs. temperature, speed vs. torque, or any other two related variables. For ease of filing, and ready reference, the unit is designed for use with standard 8½" x 11" graph paper.



The new recorders feature simple, rugged design to achieve low cost and reliability. Use of self-balancing potentiometer servos assures .5 per cent accuracy and drift-free performance at available sensitivities of up to 1 millivolt per inch. Three turn rebalance slide wires are specially lubricated to provide years of satisfactory operation. Pen speed is 1 second full scale in either plane without overshoot.

Further information is available from **A. C. Wickman Limited, 1425 The Queensway, Toronto 14, Ontario.**

Precision potentiometers

Item 2468

Douglas Randall (Canada) Limited announces the availability of a new line of multi-turn precision potentiometers, miniature configuration. Resistance range 250 ohms to 300K ohms. Standard tolerance +5 per cent. Coil length 21" over an effective electrical angle of 3600°.

These potentiometers are quality products having all metal housings; ball bearings used are class 7 stainless steel.

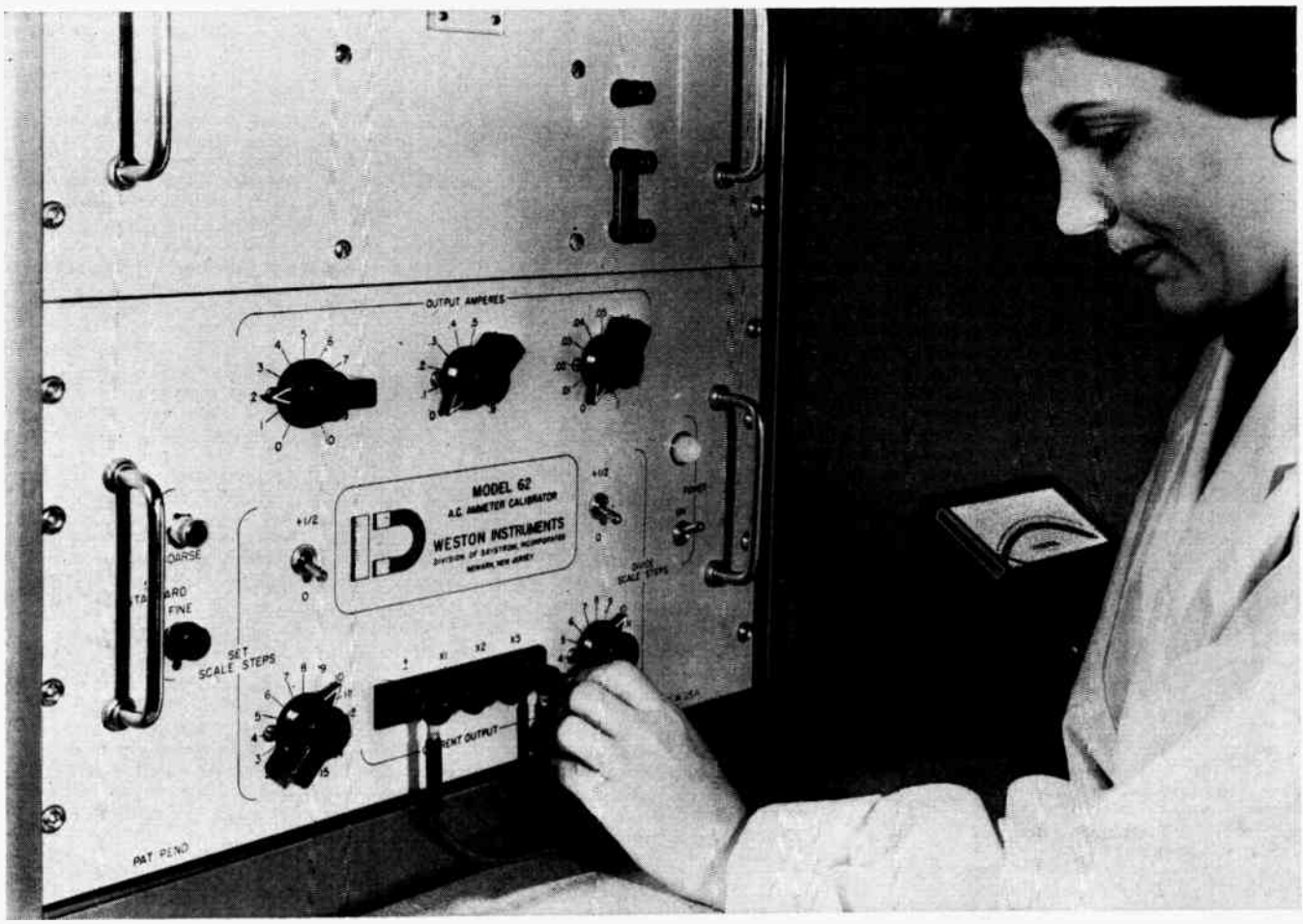
These potentiometers meet applicable sections of NAS-710, MIL-R-19, JAN-R-19 and MIL-R-19518 specifications.

These potentiometers are manufactured by The Gamewell Company, Newton, Mass. For further information please contact: **Douglas Randall (Canada) Limited, 126 Manville Road, Scarborough, Ontario.**

Continued on page 70

A TOTALLY NEW CONCEPT—
SEE IT AT THE I.R.E. SHOW!

NOW YOU CAN CALIBRATE YOUR OWN PORTABLE PRECISION INSTRUMENTS



WESTON'S NEW MODEL 60 SERIES CALIBRATORS

● MORE ACCURATE than the conventional laboratory standard instrument—Weston's new Instrument Calibrators provide accuracy of 0.05% of indicated value!

● AUTOMATIC OPERATION, controlled by a single technician—on a job that previously took two highly trained specialists!

● A COMPLETE STANDARDIZATION LABORATORY for portable precision measuring instruments—the answer to costly delays awaiting calibration by independent or government laboratories!

Using an AC instrument calibrator—one of four new calibration consoles now available from Daystrom's Weston Instruments Division—a laboratory technician sets up the simplified switching circuit to check a 10-ampere meter with 10 cardinal points. The operator, now starting his check on the tenth point, completes the check of the instrument without need of another operator to check the monitor.

For complete information write:
Daystrom Limited,
840 Caledonia Road, Toronto, Ontario;
5430 Ferrier Street, Montreal, Quebec
Subsidiary of Daystrom Incorporated.

A DAYSTROM UNIT

WESTON *Instruments*

5935

Visit our Booth No. E-26 at the IRE Show, Toronto

For complete details check No. 28 on handy card, page 93

New Products

One megacycle stable oscillator

Item 2469

The development of a 1 megacycle frequency standard stable oscillator has been announced by RCA Victor Company, Ltd.

The unit which is fully transistorized is designed as a frequency-standard which, when combined with transistorized frequency divider circuits, provides a compact frequency source.

It has maximum application in equipment where a frequency or timing accuracy of 1 part in 10^7 is required. With dividing chains it can provide this accuracy in the range of a few cycles to 1 Megacycle and is suitable as the Master Timing Clock for data-handling. There are applications for this unit in portable test jig assemblies where discrete test frequencies are valuable when combined with low size and power consumption.

In the design emphasis has been on the temperature control of the crystal and oscillator using thermistors and a DC Amplifier Servo System. Printed board construction has been used and while it is not at present built to Mil specifications, it will meet wide temperature variations and can be modified to meet these specifications.

For further information, contact **RCA Victor Company, Ltd., Technical Products Marketing Division, 1050 Lacasse Street, Montreal, Quebec, Canada.**

Marine radiotelephone

Item 2470

Spilsbury & Tindall Ltd. announce the release of a new marine radiotelephone, Model MRT-200. While production of small radiotelephones in Canada is not uncommon, the new Spilsbury & Tindall MRT-200 is unique in that it is the first 25-watt marine radiotelephone to be approved by the Department of Transport under Specifications 112 and 110. A land version of the same set has also been approved under Specification 116. The overall versatility of the set makes it equally suitable for land, marine or mobile use.

The MRT-200 has approximately 25 watts of power, five channels, broadcast band, and is available for 12-volt DC, 32-volt DC, or 115-volt AC operation. Power supplies are plug-in and instantly interchangeable. The newest techniques and circuitry have been incorporated, greatly improving performanec over previous models in this class. An exclusive feature is a special rotating chassis suspension which greatly facilitates installation, tuning and inspection, making it an instant hit with the service men. The new set is extremely compact, with a cabinet size of 11 in. wide by 11 in. deep by 15½ in. high.

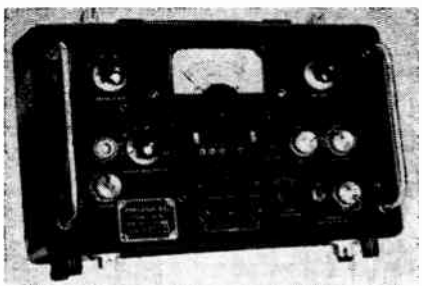
Further information can be obtained from: **S & T Sales Ltd., 120 East Cordova Street, Vancouver 4, B.C.**

New Products

"Avo" DC amplifier

Item 2471

This DC Amplifier has been designed primarily to measure the minute currents produced in ionization chambers, but it has various other application in medicine, industry and experimental work connected with reactor instrumentation. The unit has been produced in conjunction with the Atomic Energy Research Establishment, in Harwell, England.



The current to be measured develops a voltage across a high value resistor. This voltage is amplified and fed to an indicating meter. Negative feedback is employed so that the readings are independent of the amplifier gain. A control varies the time constant of the four most sensitive input ranges, and provision has been made for access to the feedback line to enable a long time constant to be obtained, such as is required for a slow neutron count.

For further information write: **R. H. Nichols, P.O. Box 500, Downsview, Ontario.**

Self-indicating thyratrons

Item 2472

Enthusiastic industry acceptance of the prototype CH1116 has prompted Tung-Sol Electric Inc. to register this type as the Tung-Sol/Chatham 7400. The 7401, a subminiature version, has also been made available, as has the hot-filamentary type 7323. Together they compose the first complete family of self-indicating thyratrons to be made available to designers.

The cold cathode types 7400 and 7401 require no heater power and provide a bright surface glow indication for end-on viewing. A small pulse voltage, such as can be generated by transistorized equipment, is superimposed on a DC bias to trigger these tubes. Long-life stability is "built in" by the use of reference tube materials and processing.

The 7323 filamentary-type indicator requires ⅓ watt filament power, and —4.5 volts DC grid bias. Trigger signals can be applied directly at ground reference level. The gas discharge glow, while not as brilliant as the cold cathode glow, can be viewed from end-on or from any side.

For further information write to: **Tung-Sol Electric Inc., 95 Eighth Ave., Newark, N.J., U.S.A.**

Push button switch

Item 2473

Grayhill, Inc., announces the addition of the 40-1 illuminated push-button switch to its line of miniature electronic components. This normally-open, momentary-contact switch is rated at 1 amp. 115 VAC for a minimum life of 500,000 operations.

The light circuit incorporates an NE-2 neon bulb and is independent of the switch circuit, thereby permitting maximum flexibility of application. ⅜" — 32 threaded bushing, $\frac{7}{16}$" maximum diameter, and less than 1¼" behind panel length allow for minimum mounting space. Nut and housing are made of anodized aluminum; contacts are of fine silver. Solder-type terminals are standard.

For further information, contact: **Lake Engineering Co. Ltd., 123 Manville Road, Scarborough, Ontario.**

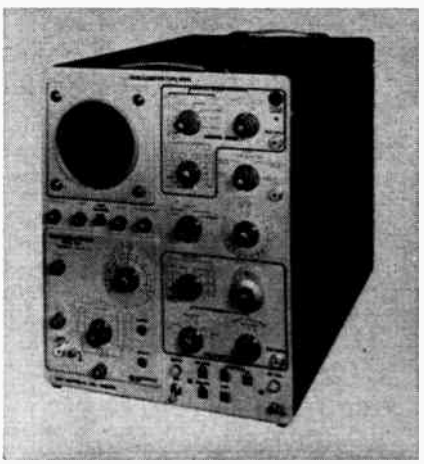
New Products

Oscilloscope

Item 2474

The W.M.16 oscilloscope is a wide band instrument with versatile plug-in units which has just been added to the range of the Instrument Division of E.M.I. Electronics Ltd. It is designed to meet the needs of electronic engineers working in specialized fields such as radar, television, computers and millimicrosecond oscillography.

Outstanding features of the instrument are its fast rise time, 10 mμS, excellent sensitivity of 50 mV/om. Effortless time and voltage measurement ± 3 per cent, and versatile sweep facilities.



The instrument's unique plug-in units provide maximum adaptability, and top reliability is ensured by sound design.

The W.M.16 has a band width of DC-40 Mc/s. It has been designed specially to meet the requirements of overseas markets and is fitted with Wide Band Amplifier Type 7/1.

For further information write **E.M.I. Electronics Ltd., Hayes, Middlesex, England.**

Thermal relay for missile use

Item 2475

The Type PT Thermal Time Delay is a completely new design developed to provide greater shock and vibration resistance and higher precision than has been available before. This relay may be operated under vibration of 20 g up to 2000 cps and under shock of 50 g for 11 ms. There is no resonance below 2000 cps and extended exposure to these conditions causes no damage or change in characteristics.

Operating time delays of 3 to 60 seconds are available. Time delay is factory set within a tolerance of ±5 per cent. Effects of ambient temperature have been greatly reduced and are held to ± 5 per cent over the range of —60°C to +125°C. Heater voltages range from 2 to 115 volts for delays of 3 to 12 seconds and from 2 to 230 volts for the longer delays.

Relays are hermetically sealed in a rectangular case 1⅞" x 2¼" x ¾" high. Leads project through the bottom of the case and are located on 0.2" grid spacing for convenience in use with printed circuits. Weight is 2 to 2¼ ounces.

Contacts are single pole, single throw, either normally open or normally closed, rated at 2 amps. resistive at 115 v. AC or 28 v. DC. Dielectric strength is 1000 v. at sea level and 500 v. at 70,000 ft.

Relays for test and prototype work are available now. Detailed specifications and test data will be supplied on request to **G-V Controls Inc., Okner Parkway, Livingston, N.J., U.S.A.**

New Products

Dummy load
Item 2476

TRYLON Type WDL-1000A is a self-contained water cooled Dummy Load for operation in the 0-30 mc range with a power handling capacity of 100 KW with A3 modulation and 400 KW peak envelope power. Referred to 600 ohm the input VSWR does not exceed 1.2 over the range. Other input impedances are available on request. Provision is made for deliberate mismatching for transmitting testing.

The dissipated power is indicated on a large direct reading scale on the front panel. All operating controls are located on the front panel. The R.F. connections are made to large bowl insulators on the back of the unit, away from the operator.

Mounted on large rubber wheeled casters, the Dummy Load can be moved to convenient locations in the transmitting room or laboratory. The load is completely shielded and, therefore, no radiation occurs other than from the connecting open wire line. The electrical center of the load is grounded.

Further details from **The Wind Turbine Company of Canada Limited, 145 Lucan Street, Waterloo, Ontario.**

Microwave signal generator
Item 2477

A new microwave generator in the 2,000 to 4,600 mc frequency range, Model MSG-2P developed by Polarad Electronics Corporation, 43-20 34th Street, Long Island City 1, New York, provides high calibrated power output.

The instrument provides maximum signal strength of 10 mw (Φ 10dbm) with calibrated attenuation down to --127 dbm. The direct-reading internal attenuator, is accurate to 2 db below 1 mw, and 8 db above 1 mw.

The Model MSG-2P generates cw, pulse, square wave, fm and synchronizing pulse signals. Internal pulse and square wave repetition rate is adjustable from 40 to 4,000 pps; pulse width, 0.5 to 10 microseconds; delay, 2.5 to 300 microseconds. Pulse rise and decay time is less than a microsecond. The instrument may be externally modulated.

This rugged, portable tabletop instrument features a direct-reading linear frequency dial accurate to 1%, UNI-DIAL control, and non-contacting short-type klystron cavity chokes for noiseless tuning and long equipment life.

For further information write: **Polarad Electronics Corp., 43-20 34h Street, Long Island City 1, New York.**

Metal film precision resistors
Item 2478

New sizes have now been added to Ohmite Manufacturing Company's line of metal film precision resistors. Along with this, **Ohmite has reduced prices of these units so that they are directly competitive with wirewound precision resistors.** This move is expected to spur the use of these excellent resistors in numerous applications where lower cost, but less suitable units were previously used.

The expanded line of metal film units now provides:

(1) a resistance range to one megohm
(2) sizes even smaller than before for application in miniaturized circuits
(3) more sizes to meet the physical styles of MIL-R-10509C and MIL-R-19074B (Ships).

With the new additions, the entire Ohmite line of metal film resistors consists of 7 different sizes and a total of three styles — full cylindrical, semi-cylindrical, and rectangular. The semi-cylindrical or flat-sided type offers the maximum economies in space, and the rectangular type has radial leads convenient for assembly into printed circuits.

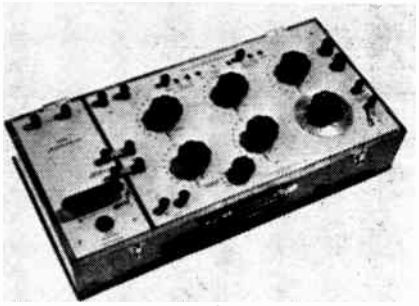
For additional information, request Bulletin 155 from **Ohmite Manufacturing Company, 3625 Howard Street, Skokie, Illinois, U.S.A.**

New Products

Precision Wheatstone bridge

Item 2479

A high grade Wheatstone bridge suitable for the precise measurement of resistance over a wide range in the standards room, laboratory or workshop. It is available from The Glendon Instrument Company, Limited, 44 Wellington Street E., Toronto. It is extremely robust, pleasing in appearance and will maintain its original calibration under the most arduous conditions.



The instrument has specially designed decade switches having two parallel brushes in order to minimize contact resistance variations and to ensure long life and trouble free operation. Many other noteworthy features are included, such as a built-in spot reflecting galvanometer, complete with switch operated shunt, four pairs of plug ratios, a center zero slide wire with adjustable zero setting, and provision for shorting the slide wire when using uneven ratios. A National Physical laboratory report can be provided at cost.

For further information write to: **The Glendon Instrument Co. Ltd., 44 Wellington St. East, Toronto.**

Low-frequency oscillator

Item 2480

For measurements on low-frequency systems and components, such as sonar, geophysical gear, servomechanisms, power system analogs, transducers and networks, the General Radio Company, West Concord, Mass., has developed a new low-frequency oscillator (Type 1305-A) covering frequencies between 0.01 and 1000 cps.

Basically, the oscillator is a three-phase generator, whose frequency is determined by three cascaded RC networks. The circuit utilizes the Miller Effect to obtain large effective capacitance from small-magnitude polystyrene capacitors. An adaptor converts the three-phase output to four-phase and two-phase. The variable phase output has a phase-angle accuracy of ± 0.5° for angles of less than 10°. Its maximum possible error is ± 3° occurring at higher phase angles. More important, however, is the fact that small phase differences can be measured at any point on the dial to an accuracy of ± 0.25°.

Three ganged logarithmic potentiometers serve as frequency-varying elements. Output voltage indication is provided by a voltmeter circuit using a three-phase full-wave rectifier to minimize ripple.

The instrument is being built for bench and relay-rack mounting: panel width is 19″ x 7″ high, and depth behind the panel is 12″.

For further information write to: **General Radio Company, West Concord, Mass., U.S.A.**

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1N96	**Parametric Diodes**	458
1N100A	HPA 2800	459
1N270	HPA 2810	461
1N198		462
		463
		464
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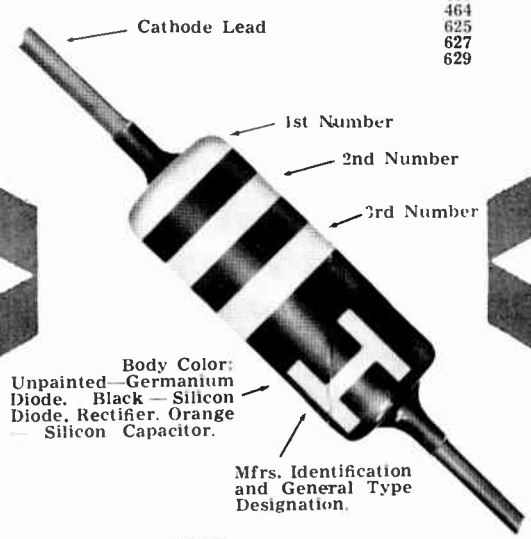
		629



Actual Size

All types are identified by three colored bands on the cathode end, in keeping with the proposed EIA standard for color-coding semiconductor devices. These bands of color designate the type number. In addition to the three bands, the letter "H" is printed on the body to indicate the name of the manufacturer. The color of the letter "H" also has significance, as indicated in the following table.

Gold	EIA	**Brown**	Rectifier
White	Special	**Black**	Capacitor

HUGHES INTERNATIONAL
A DIVISION OF HUGHES AIRCRAFT COMPANY, U. S. A.

The styles listed represent a wide range of performance parameters — however Hughes has **thousands** of semiconductor types to fit particular applications. Contact R-O-R for engineering details, current prices and data sheets.

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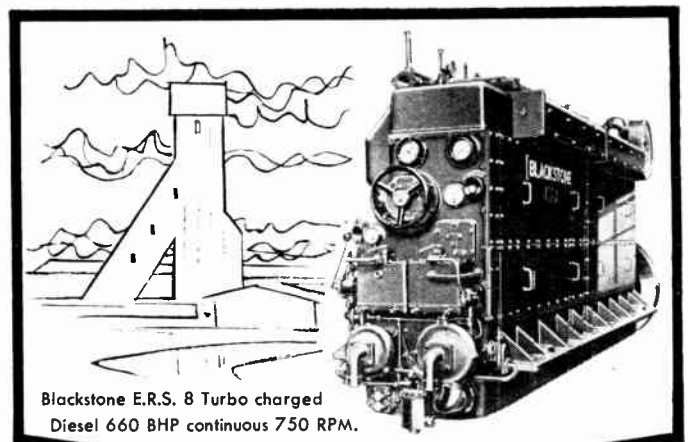
For complete details check No. 21 on handy card, page 93



Blackstone E.R.S. 8 Turbo charged Diesel 660 BHP continuous 750 RPM.

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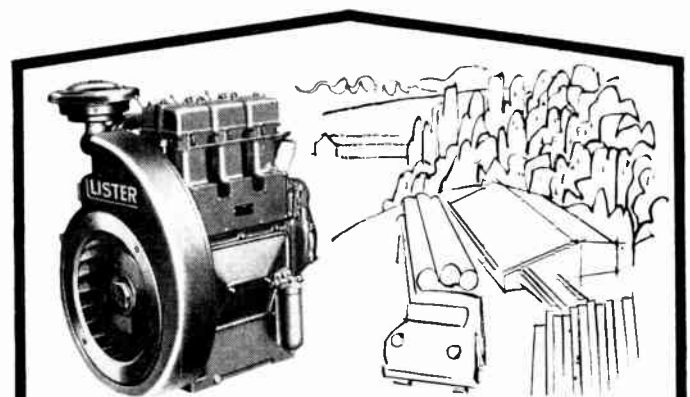

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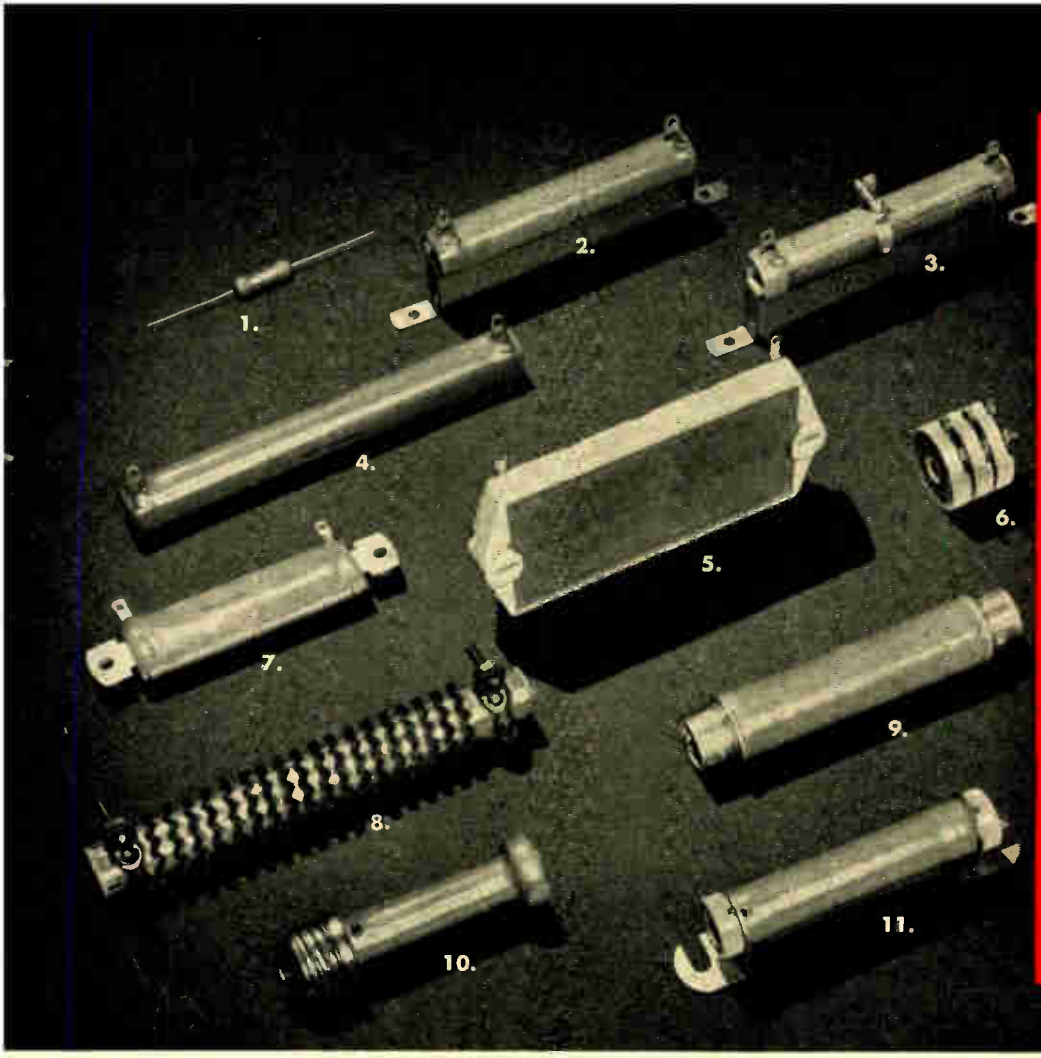

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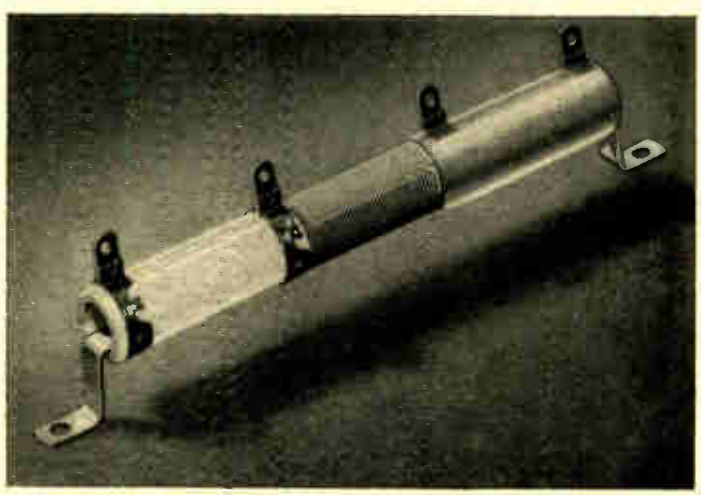

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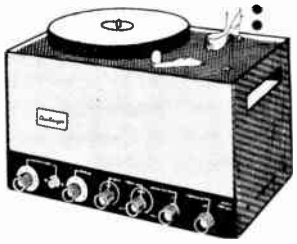

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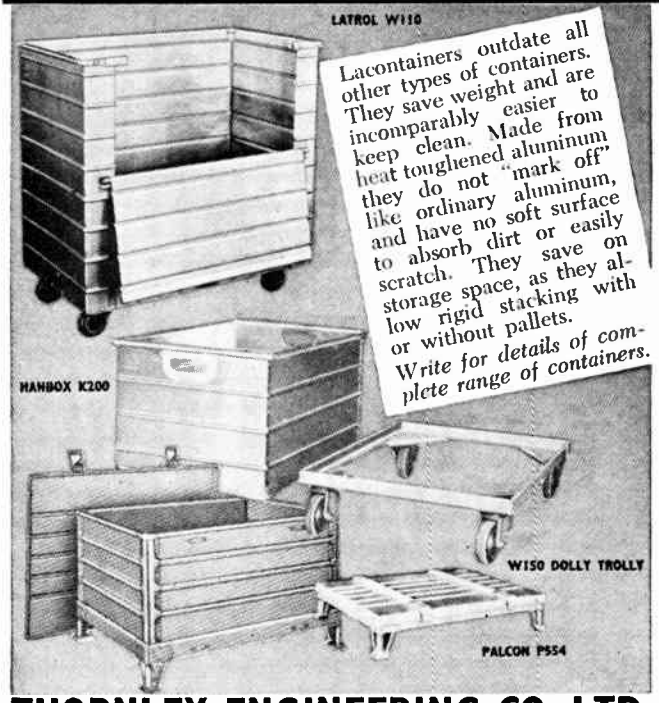

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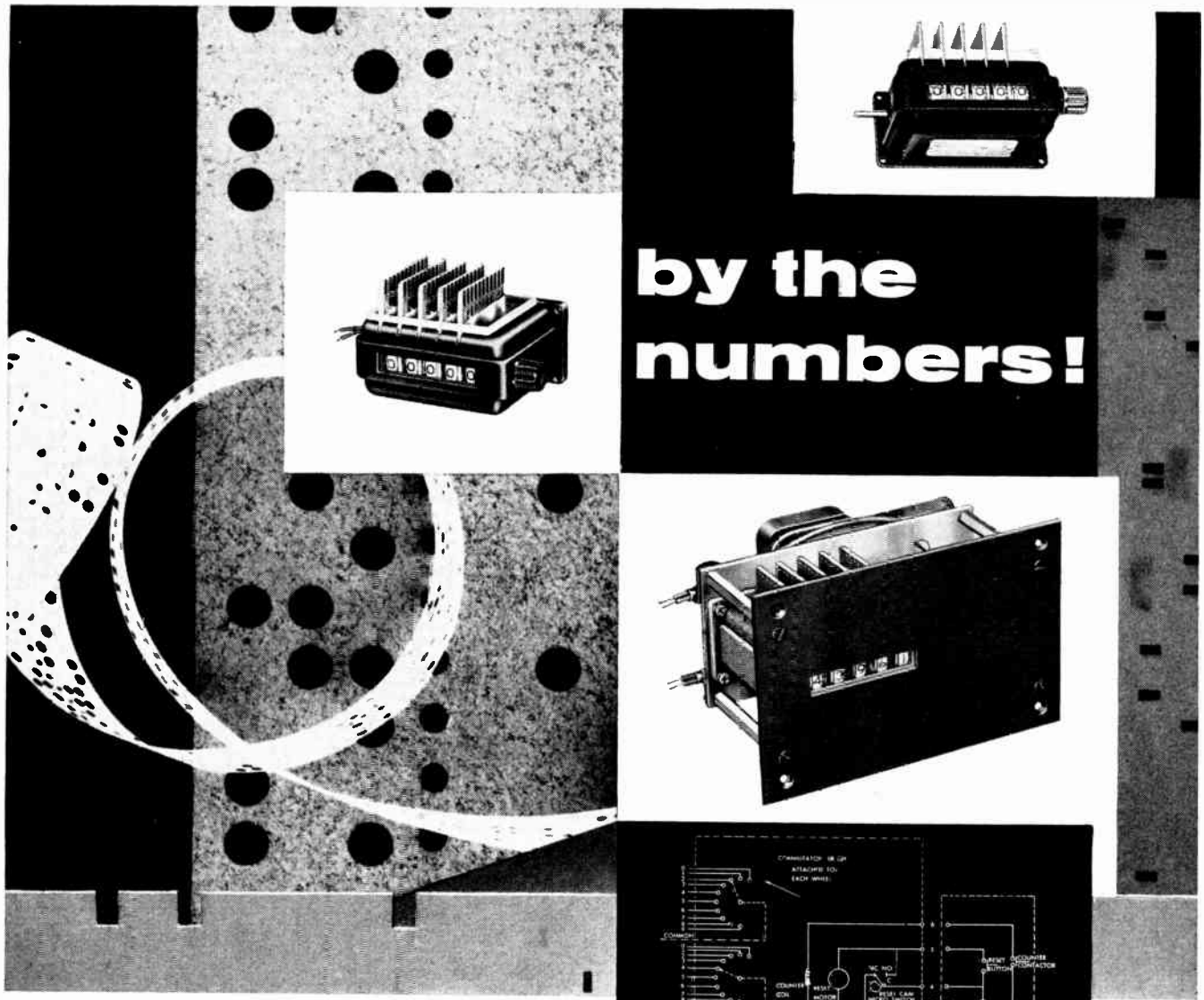
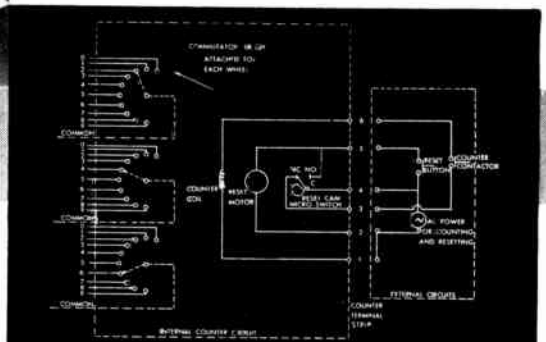


Remote Readout Counters Simplify Automatic Data Processing



How these counters work: Data Readout Counters are actuated mechanically by rotation of a shaft or electrically by making and breaking a circuit. Each wheel has a printed circuit with a contact for each digit. Remote Data Readout Counters are available with manual or electrical reset, and for base or panel mounting. Standard Models are available from stock.

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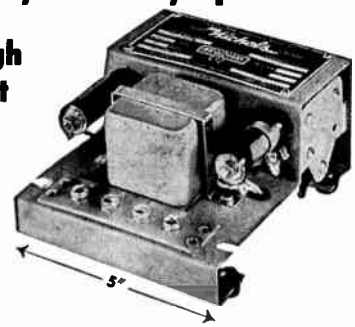

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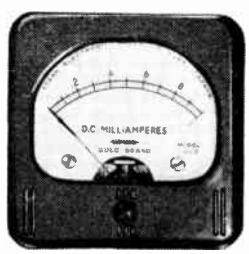

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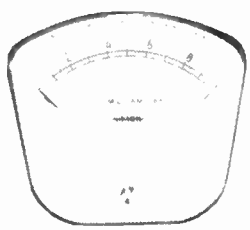

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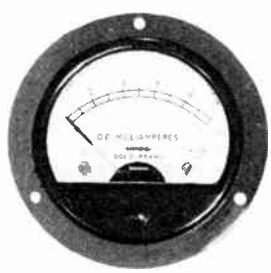

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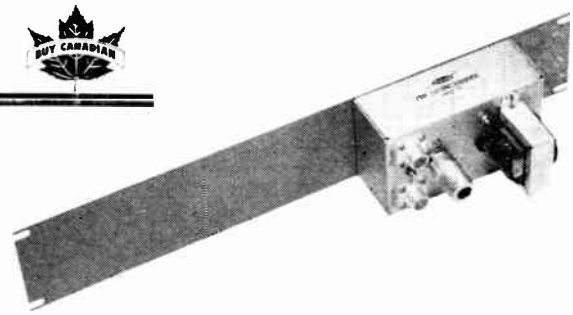

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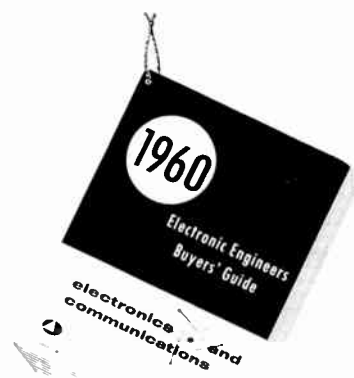

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SPECIFICATIONS

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Voltage Range: 10 μv to 300 v, 15 ranges

Warm-up Time: None

Voltage Accuracy: ± 5% of full scale

Residual Mod. & Hum: More than 75 db down

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± 25 cycle b.w., at least 50 db down
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Input Impedance: 100,000 ohms on 4 most sensitive ranges; 1 megohm on others

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

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

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

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hp 302A easily measures small signals on noisy circuits

For complete details check No. 39 on handy card, page 93

A unique Canadian marketing research study tells

How industry buys

'LONDON STUDY' *of industrial purchasing traces influences at work in making industrial sales*

THE unique industrial marketing research report, known as the London Study, has now been published in book form under the title *How Industry Buys, with conclusions and recommendations on marketing to industry*. The study probed in depth the industrial purchasing-selling process in Canada and was sponsored by the Business Newspapers Association of Canada and the Canadian chapters of the National Industrial Advertisers Association.

The study was directed by Dr. Donald H. Thain and Dr. D. S. R. Leighton, associate professors of business administration at the University of Western Ontario School of Business Administration and Charles B. Johnston, lecturer in business administration at the school.

Field interviews covered 36 companies representative of the Canadian industrial market—in the London, Ontario area—and examined the history from realization of the need to actual purchase of a large, medium and small purchase in each company. Graduate students from the university carried out the interviewing under the direction of the authors.

The London Study is the first detailed examination of the industrial purchasing-selling process ever made in North America and yields fascinating insights into the buyer-seller relationship.

It examines the impact of mechanized promotion and personal selling on the industrial buyer and traces the complex process of an industrial purchase through teams of buying influences inside and outside the purchasing companies.

Chapters on advertising, direct mail, distribution and other marketing factors discuss the quality of industrial marketing in Canada today. The 36 case-reports on the companies and purchases studied are published in detail in *How Industry Buys*.

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Senior executives, marketing management, advertising management and advertising agency staffs will find *How Industry Buys* an absorbing and penetrating examination of the most critical problems they face today.

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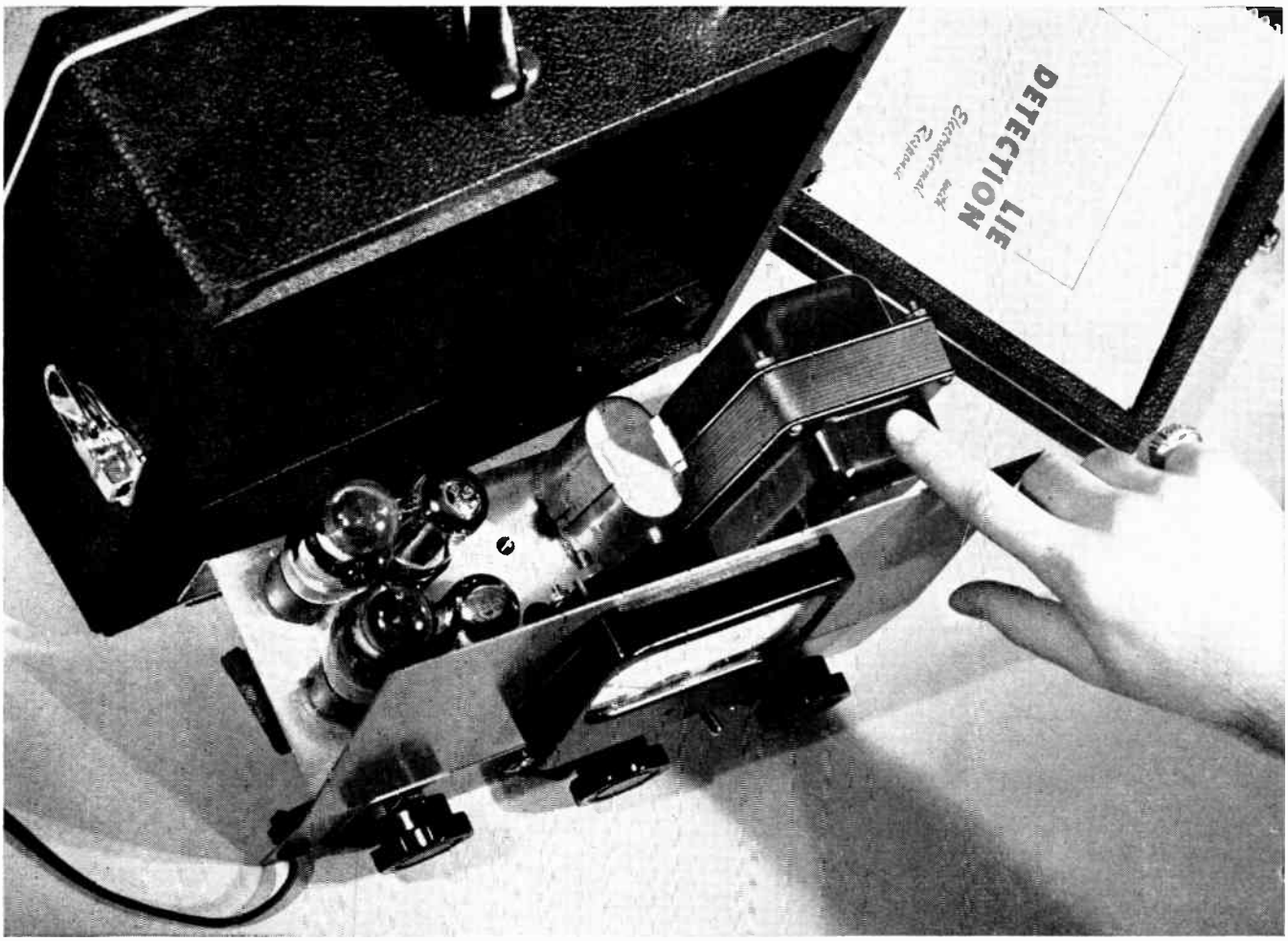

B & W Associates built in a Sola regulated plate-filament power transformer as an integral component in their portable lie-detection apparatus.

Portable lie detector operates accurately with Sola-regulated plate and filament voltages

This sensitive polygraph operates by picking up and immensely amplifying tiny electrodermal responses. It's small wonder that line voltage variations encountered in field operation must be corrected if the responses of the witness are to be measured accurately.

The lie detector's built-in power supply transformer is a Sola Constant Voltage Plate-Filament Transformer which performs this dual function: (1) it supplies plate and filament voltages just as an ordinary power supply transformer would do; (2) it regulates these supply voltages within ±3% even when the line voltage varies over a 100 to 130-volt range.

Besides providing regulation which assures accurate polygraph operation, the Sola transformer protects tubes and components from cold inrush current and from fault currents.

This simple, reliable component costs little more than ordinary, non-regulating transformers. And compared to other types of regulating circuitry used with conventional power transformers, it is considerably cheaper.

The plate-filament regulator is only one of the complete family of Sola Constant Voltage Transformers including such special types as filament and adjustable-output units. More than 40 models are available from stock, and Sola manufactures custom-designed units in production quantities to meet special needs.

See this and other Sola Products at Booth No. E.8, Canadian IRE Convention, October 7th, 8th and 9th.

SOLA ELECTRIC (CANADA) LTD., 24 Canmotor Avenue • Toronto 18, Ontario • Phone: CLifford 1-1147
In The United States, Sola Electric Co., Chicago 50, Illinois, A Division of Basic Products Corporation

For complete details check No. 76 on handy card, page 93

HUNT R.C.E. for PRINTED CIRCUIT BOARDS
(Rapid Circuit Etch)

Hunt R. C. E. is a proprietary etchant, formulated to etch printed circuits fast and to speed up production. It offers these 6 big advantages:

- 15% increase in etching speed
- Fast action over entire circuit
- Uniformly smooth etching
- Easily removed by washing
- Substantial increase in capacity
- Freedom from fumes

HUNT S.C.E. for SOLDER-PLATED CIRCUIT BOARDS
(Solder Circuit Etch)

This ready-prepared product is designed to etch solder-plated circuit boards more easily, more effectively than it has ever been done before. You'll find that Hunt S. C. E.

- Etches rapidly at room temperatures
- Has a high capacity for copper
- Never attacks the circuit
- Has guaranteed uniformity, and is of the highest quality because of rigid laboratory control

Hunt S. C. E. is essentially an oxidizing solution with the capacity to keep the oxidized copper permanently in solution. Although many acids will etch copper, S. C. E. solution has the peculiar property of not attacking the solder . . . but giving fast, odorless etching of the copper.

WRITE TO NEAREST HUNT BRANCH FOR:

TECHNICAL BULLETIN NO. 1 — "The Etching of Copper by Hunt R. C. E. Solution."

TECHNICAL BULLETIN NO. 3 — "The Etching of Solder Plate Circuit Boards by Hunt S. C. E. Solution"

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HUNT — QUALITY CONTROLLED — CHEMICALS

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TAlbot 8-1253

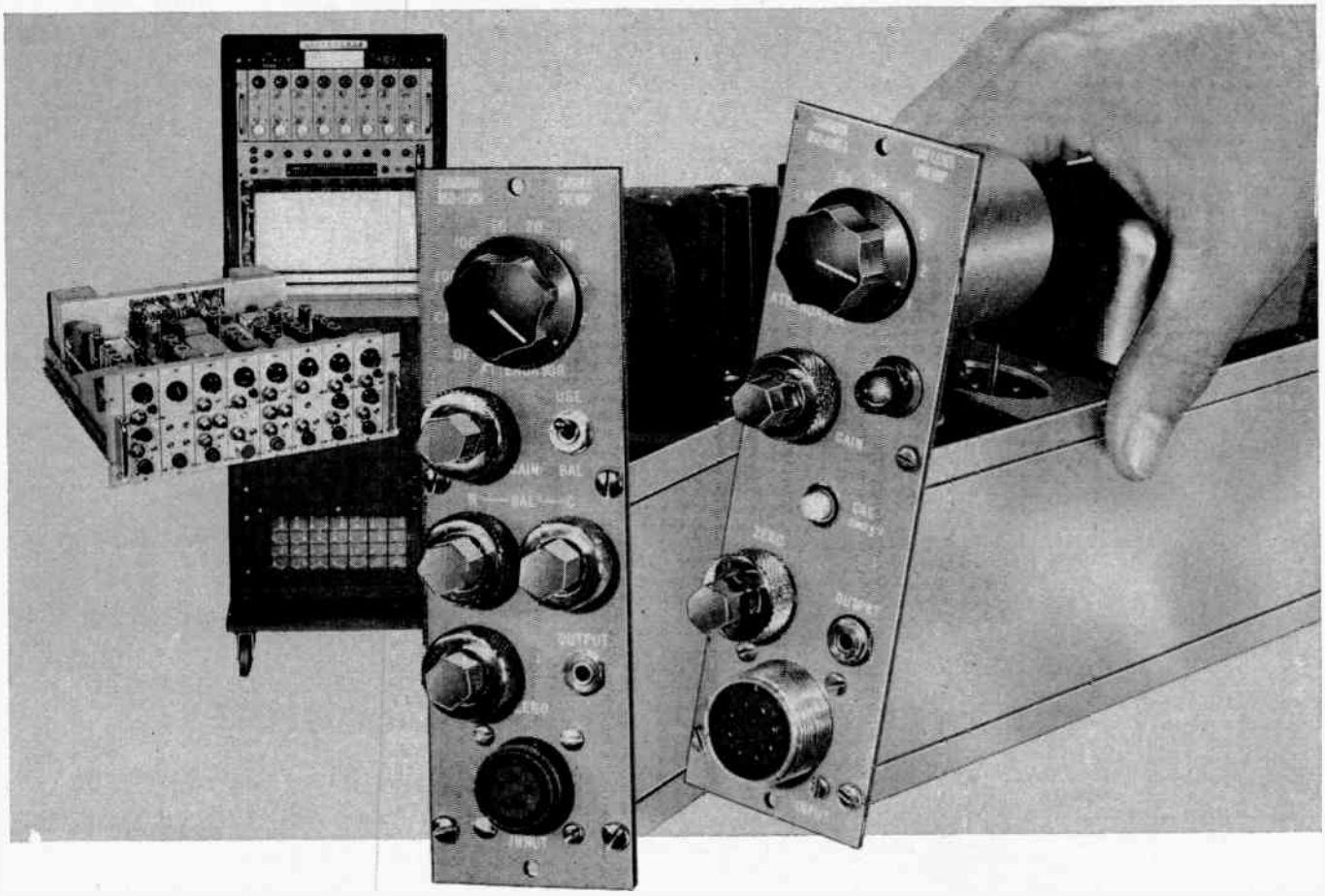
Toronto Branch
21 Benleigh Dr.
Scarboro
AXminster 3-7806

For complete details check No. 43 on handy card, page 93

NEW

CARRIER AND LOW LEVEL PREAMPS OFFER MORE RECORDING USEFULNESS

–per inch
–per dollar
–per channel



WITH the availability of these two new plug-in preamplifiers and associated MOPA, Sanborn 6- and 8-channel "850" oscillographic recording systems can now record an even *wider* variety of inputs — wherever *many channels* are needed in *minimum panel space*, with *no* sacrifice in system accuracy or reliability. The 850-1100A is a carrier amplifier-demodulator unit designed to work with resistance bridge, variable reluctance and differential transformer transducers. Attenuator, smooth gain, position and balancing controls are on the 2″ x 7″ front panel; input and output connections are provided at both front and rear. The 850-1500A is a chopper amplifier with floating input isolated from a floating output, capable of measuring low level DC-100 cps signals such as those from thermocouples and strain gage bridges. Design provides low noise operation, greater freedom from ground loop interference and high common mode rejection ratio. Required carrier excitation (2400 cps standard, 600, 1200 and 4800 cps optional) and chopper drive (440 cps) voltages are supplied by the 850-1900 MOPA, a dual-oscillator unit which can handle up to eight of each preamplifier.

SPECIFICATIONS

	850–1100A	850–1500A
Sensitivity	100 μv in gives 1 v at output	
Input impedance	approx. 2500 ohms	approx. 100,000 ohms
Output	±2.5v across 3300 ohms	±2.5 volts across 2500 ohms
Freq. response	−3 db at 20% of carrier freq.	0–100 cps, −3db
Linearity	±0.5% of full scale	±0.1% of full scale
Common mode performance		120 db for 60 cps, 160 db for DC with 5000 ohms unbalance in input
Noise		2 μv p-p over 100 cps bandwidth

(data subject to change without notice)

Ask your Sanborn Sales-Engineering representative for complete facts on all "850" system units — or write the main office in Waltham.

SANBORN COMPANY
Industrial Division
175 Wyman St., Waltham 54, Mass.

NEREM '59, Comm. Armory, Boston, November 17, 18, 19.

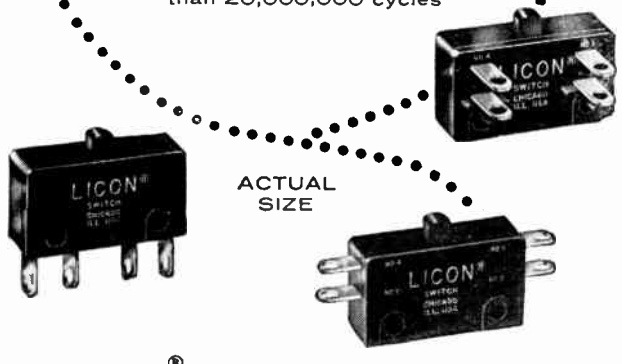
R-O-R Associates, 1470 Don Mills Road, Don Mills, Ontario, Canada

For complete details check No. 72 on handy card, page 93

You've never seen a SUB-MINIATURE switch as mighty as this

BIG switch performance in sub-miniature size

Rated 10 amps 30 V.d-c. inductive (L/R- .026). Consistently more than 20,000,000 cycles



NEW LICON® TYPE 16 SWITCH measures only 25/32" long and ¼" thick but packs quality and dependability never before achieved in sub-miniatures. With characteristics found only in much larger precision switches, the Licon Type 16 is ideal for aircraft safety applications, has performance and size vital to guided missiles. Passes Navy 1300 G shock test . . . exceptionally shock and vibration resistant even near the trip point. Its new switch mechanism with stainless steel springs avoids early fatigue and provides the advantages of double break contacts with wiping action in a wide range of movement differentials and operating forces.

WRITE FOR FREE LICON TYPE 16 SWITCH BULLETIN

Engineering data, characteristics, modifications . . . write for complete information on the new Licon Type 16 Sub-miniature Switch today.

NOW MADE IN CANADA

LICON

SWITCHES AND CONTROLS

DIVISION OF

CANADA ILLINOIS TOOLS LTD.

67 Scarsdale Road
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Exclusive Sales Agents

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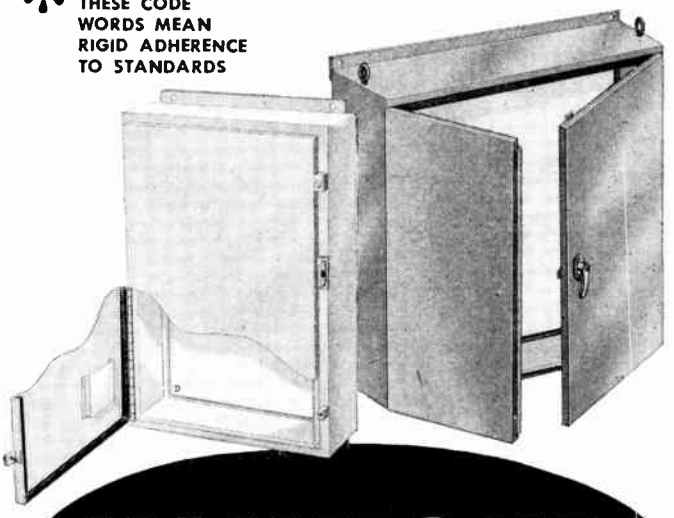
136 Tower Drive, Toronto
17041 Omega Place
St. Genevieve, Montreal

LI-A

For complete details check No. 18 on handy card, page 93

J·I·C * N·E·M·A·12

* THESE CODE WORDS MEAN RIGID ADHERENCE TO STANDARDS



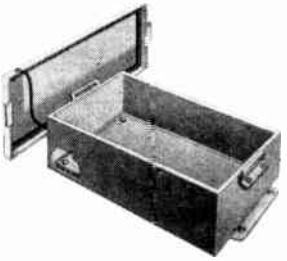
HAMMOND PANEL ENCLOSURES

Moisture-proof · Dust-proof

Hammond J.I.C. and N.E.M.A.12 Enclosures have achieved wide popularity with Canadian Industry as a most satisfactory method of housing electrical control equipment in moist, steamy, oil or dust-laden atmospheres. Construction provides a removable mounting panel and permits good visibility with maximum accessibility. The cabinets have a durable baked enamel, grey exterior, white interior finish and offer a pleasing appearance for installations which must be kept on display.

A complete range of sizes from 12" x 24" x 6" to 72" x 72" x 12" is available. They are made from heavy gauge steel, all-welded, and designed to resist distortion. Doors are completely gasketed with cellular neoprene permanently held by channeling to protect against spray from cutting-oil, hose washdowns and other hazardous environment.

Mounting feet and Drip Shield are optional.



CAPTIVE-LID CABINET

These rigidly constructed panel enclosures are stocked in sizes from 4" x 4" x 3" to 16" x 14" x 6". Finished in baked gray enamel over phosphatized steel.

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HAMMOND MANUFACTURING CO. LTD.

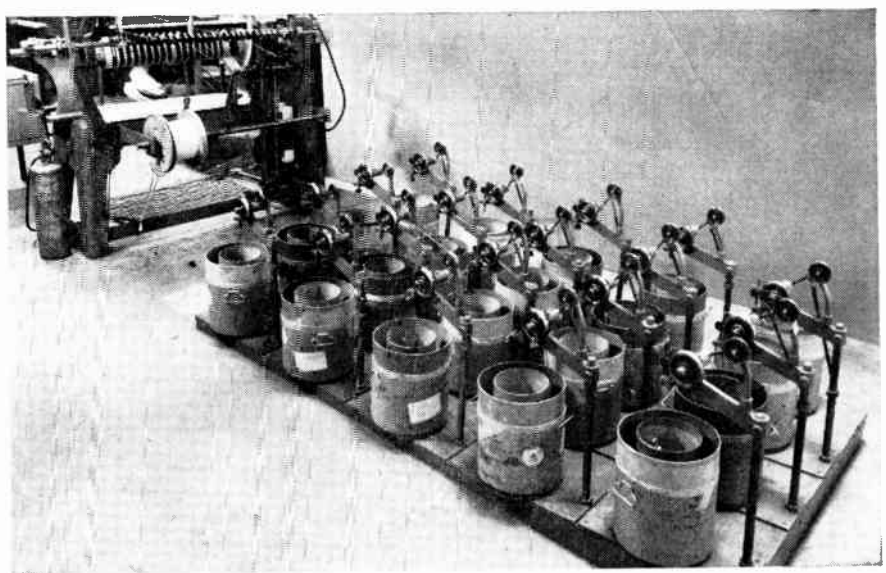
GUELPH, ONTARIO, CANADA H/16

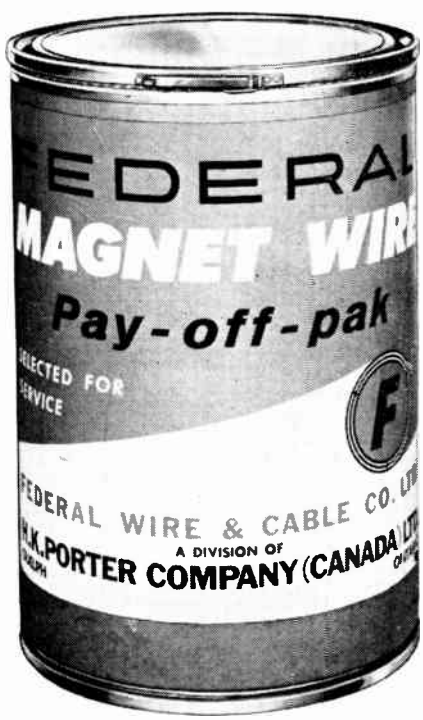
For complete details check No. 37 on handy card, page 93

FEDERAL "Pay-Off-Paks"

pay off in *speed* and *profits*

This cost-reducing method of magnet wire packaging and handling, pioneered by Federal Wire in 1956, has been paying off in speed and extra profits on every installation. Simply open the container and thread. The wire pays off like a fisherman's line from a spinning reel. There are no backlash, overrun or inertia problems and most important—no stopping to solder during winding.





- One "Pay-Off-Pak" holds approximately 500 lbs. of size 12-23 magnet wire—replaces 10 reels—reduces soldering and downtime.
- "Pay-Off-Paks" eliminate need for a wide range of reel sizes.
- Reduced investment in returnable reels.
- Set-up time on the winding machines is cut to a minimum.
- Interlocking tops and bottoms allow storage in a minimum amount of space.
- Made of tough, reinforced fibre—standard-size container weighs only 22 lbs.
- Also sizes 24-29 available in 100 lb. "Pay-Off-Pak" and sizes 12-23 AWG in 250 lb. "Pay-Off-Pak."

Speed up production with a Federal "Pay-Off-Pak". You can depend on the quality of Federal Magnet Wire.

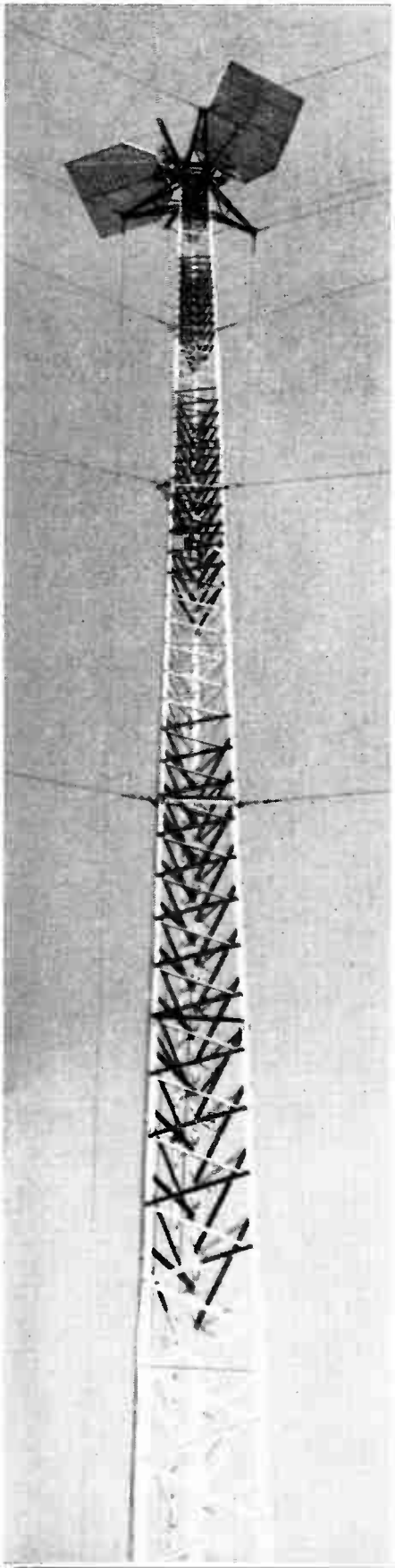
5900

FEDERAL WIRE PORTER ***& CABLE DIVISION***

H.K. PORTER COMPANY (CANADA) LTD.

PORTER SERVES INDUSTRY: with Rubber and Friction Products—THERMOID DIVISION; Electrical Equipment—DELTA-STAR ELECTRIC DIVISION, NATIONAL ELECTRIC DIVISION; Specialty Alloys. RIVERSIDE-ALLOY METAL DIVISION; Refractories—REFRACTORIES DIVISION; Electric Furnace Steel—CONNORS STEEL DIVISION, VULCAN-KIDD STEEL DIVISION; Fabricated Products—DISSTON DIVISION, FORGE AND FITTINGS DIVISION, LESCHEN WIRE ROPE DIVISION, MOULDINGS DIVISION, H.K.PORTER COMPANY de MEXICO, S.A., and in Canada, Refractories, "Disston Tools," "Federal" Wire and Cable, "Nepcoduct" systems H. K. PORTER COMPANY (CANADA) LTD.

For complete details check No. 62 on handy card, page 93



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MICRO-TOWER LIMITED

has designed, supplied and erected
more than twice as many

MICROWAVE TOWERS

as all other Canadian sources combined

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- Canadian Motorola Electronics Ltd.
- Canadian National Telegraphs
- Bell Telephone Co. of Canada
- Saskatchewan Gov't Telephones
- Collins Radio Co. of Canada
- Alberta Gov't Telephones
- Dept. of Defence Production
- Canadian Pacific Telegraphs
- Northern Electric Co. Ltd.
- Central Ontario Television
- Canadian General Electric Co. Ltd.
- Canadian (B.C.) Telephones & Supplies Ltd.
- Quebec North Shore & Labrador Railway Co.
- Manitoba Telephone System.

MICRO-TOWER LIMITED provides

- DESIGN, FABRICATION and ERECTION of MICROWAVE TOWERS . . . . PASSIVE REFLECTORS and PASSIVE REPEATERS of all sizes.
- CONSTRUCTION and INSTALLATION of RADIO REPEATER BUILDINGS . . . . WAVEGUIDE BRIDGES . . . . TRANSMISSION LINE SUPPORTS . . . . ANTENNAS . . . . TRANSMISSION LINES . . . . WAVEGUIDES.
- TOWER INSPECTION AND MAINTENANCE — ALL BY OUR OWN CREWS.

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MICRO-TOWER LIMITED

42 CROCKFORD BLVD.
TORONTO • CANADA

For complete details check No. 53 on handy card, page 93

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☐ 2472	☐ 2473	☐ 2474	☐ 2475	☐ 2476	☐ 2477	☐ 2478	☐ 2479	☐ 2480	☐ 2481
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☐ 73	☐ 74	☐ 75	☐ 76	☐ 77	☐ 78	☐ 79	☐ 80	☐ 81	☐ 82	☐ 83	☐ 84
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CCAB

audited publication

New Products

TV-FM marker generator

Item 2481

Stark Electronic Sales Co., Ajax, Ontario, now have available a new TV-FM Marker Generator designed especially for use in aligning and servicing TV, FM, and VHF receivers.

This instrument, the STARKIT Model MHG-48, has a frequency range from 3.5 MC to 250 MC covered in 6 bands. An internal crystal oscillator of 4.5 MC is available for marking and frequency checking.

Two modulation frequencies permit the generation of vertical and horizontal bar patterns for linearity checks of the TV receiver circuits. Modulation frequencies of 250 KC and 720 CPS are used for the vertical and horizontal bar pattern generation. A companion instrument, the STARKIT SWG-58 TV-FM Sweep Generator, is also available, the combination of which offers accurate results in servicing, production, maintenance and all-around shop work.

Stark Electronic Sales Company, P.O. Box 240, Ajax, Ontario, Canada.

Absolute pressure switch

Item 2482

An absolute pressure switch to open or close an electrical circuit automatically has been designed by the Friez Instrument division of Bendix Aviation Corporation.

Called the Bendix Pressurmite (Model 655), it has only one moving part — a pressure-sensing diaphragm, which is insensitive to temperature changes over a wide span. The switch consists of two precious metal contacts within an evacuated hermetically sealed chamber and encased in a protective, thermo-setting plastic housing. One contact is welded to a sensing diaphragm which responds to outside pressure changes. The other contact is attached to a threaded bushing, permitting the cap between the contacts to be adjusted so the switch will respond to a pre-set pressure. The enclosed contact is explosion proof and protected from contamination. Several elements can be enclosed in one housing, and set to operate at different pressures.

Weight: 2.2 ounces without bracket, 2.7 ounces with bracket. Temperature range: —65 degrees C to plus 150 degrees C (—85 F to plus 300 F). Pressure ranges: Setting, 2 to 14.7/psia (116 to 1013 Millibars) or sea level to 5,000 ft. altitude. Proof pressure: 0 to 35./psia (Higher pressures on special order.) Contact current rating dependent on application, consistent performance at 0.20 amps, maximum at 28 volts.

For further information write: **Computing Devices of Canada Limited, Box 508, Ottawa 4, Ontario.**

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.

Best of all — a **new low price** making the finest in measurement available to all sizes of pocket books — all made possible only by complete **Canadian** manufacture.

RANGES:

D.C. Current. From 50 Microamps to 10 Amps in 6 ranges.

D.C. Volts (20000 ohms/volt). From ¼ volt tc 5000 volts in 7 ranges.

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.

Price — tax included **$55.00**

The long tradition of fine instrumentation of the Model 260 is now extended to the custom-engineered Model 270, providing increased accuracy, a mirror scale and movement overload protective service, along with full perdetails. Priced at $63.07.

Sales Tax Included.

4-8333

Bach-Simpson LIMITED

1255 BRYDGES ST. LONDON, ONT.

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

For complete details check No. 15 on handy card, page 93

THE TOP NAMES and PRODUCTS in Communications and Microwave Test Equipment

WILL BE SEEN AT BOOTH 530 - 531

Arizona Telemetering Coporation
Boonton Electronics Corp.
Communication Measurements Laboratory
The Digitran Co.
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Frequency Standards Inc.
Instrument Development Laboratories
International Radiant Corp.
Kay Electric Co.
Krohn-Hite Export Corp.
Ling Electronics Corp.
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Narda Microwave Corp.
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Weldmatic, Division of Unitek Corp.

REPRESENTED IN CANADA BY:

MEL

MEL SALES LIMITED

ARNPRIOR, ONTARIO

5813

For complete details check No. 52 on handy card, page 93

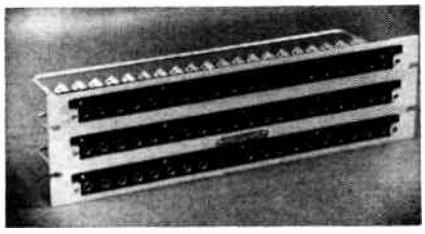
New Products

Audio jackfields

Item 2483

The Transmission Division of Pye Canada Limited, Ajax have introduced a range of audio jackfields complementing their range of sound broadcast equipment.

Jackfield Type 3394 consists of 3 rows of 20 jacks and is supplied wired to give 20 vertical sets of "Line-Listen-Apparatus" routing. In normal condition the line is routed through the jack contacts to the apparatus. The line or apparatus circuits may be re-routed by the insertion of a jack cord into the "line" or "apparatus" jacks respectively, these two circuits being disconnected from each other in each case.



The "listen" jack is in parallel with the line and enables high impedance equipment such as headphones or meters to be tapped across the circuit without causing any interference to the signal. All sleeves are normally connected together for grounding purposes but may be isolated for particular application.

For further information write: **Pye Canada Ltd., Ajax, Ontario, Canada.**

Bulletin describes "EX" cannon plugs

Item 2484

Cannon Electric Canada Limited now has available a complete new bulletin describing the Type EX Cannon Plug. This new line of electrical connectors is fully environmental-resistant. It is designed primarily for use in aircraft and missiles, where prime requirements are resistance to vibration, extreme temperature, and the effects of reduced atmospheric pressure.

The EX Bulletin describes the four basic EX types, and shows the many variations in shell size and insert arrangement available. External dimensions of EX Cannon Plugs are identical to those of MS-type connectors. Thus they can mate and seal with all standard MS types.

EX Cannon Plugs are ruggedly built to withstand the rigors of supersonic flight. The silicone rubber insulator is of monobloc construction, thus eliminating moisture-trapping voids inside the connector. Materials and construction used in the EX make it inherently vibration-resistant. Operates continuously at temperatures up to 325°F.

Write for Bulletin EX-1. **Cannon Electric Canada Limited, 160 Bartley Dr., Toronto 16, Ontario, Canada.**

Nesting-stacking trays

Item 2485

National Fibre Co. of Canada, Ltd., announces an improved line of Kennett nesting-stacking trays. Incorporating a pair of specially designed nesting stops riveted to each end, these trays are lighter, smoother and easier to handle than earlier models. They are excellent for conveyor use because they have smooth, rounded lines with no protrusions or sharp points that might cause damage when jammed together.

These versatile trays meet the needs of many industries for collecting, storing and transporting such items as electrical components, machines parts, baking ingredients, pharmaceutical products and frozen foods.

The new streamlined nesting stops prevent trays from wedging tightly into one another yet do not interfere with handling and movements. Anchored to the nesting stops are metal stacking arms that swing over tray tops to permit stacking.

The new nesting stops take the place of wood strips, that are used on earlier designs. As a result, the new trays weigh less and are smoother. Having no sharp metal or wood edges, they provide better safety to personnel.

Additional information on new Kennett nesting-stacking trays is available from **National Fibre Co. of Canada, Ltd., 107 Atlantic Avenue, Toronto, Ontario, Canada.**

FM radio terminal equipment

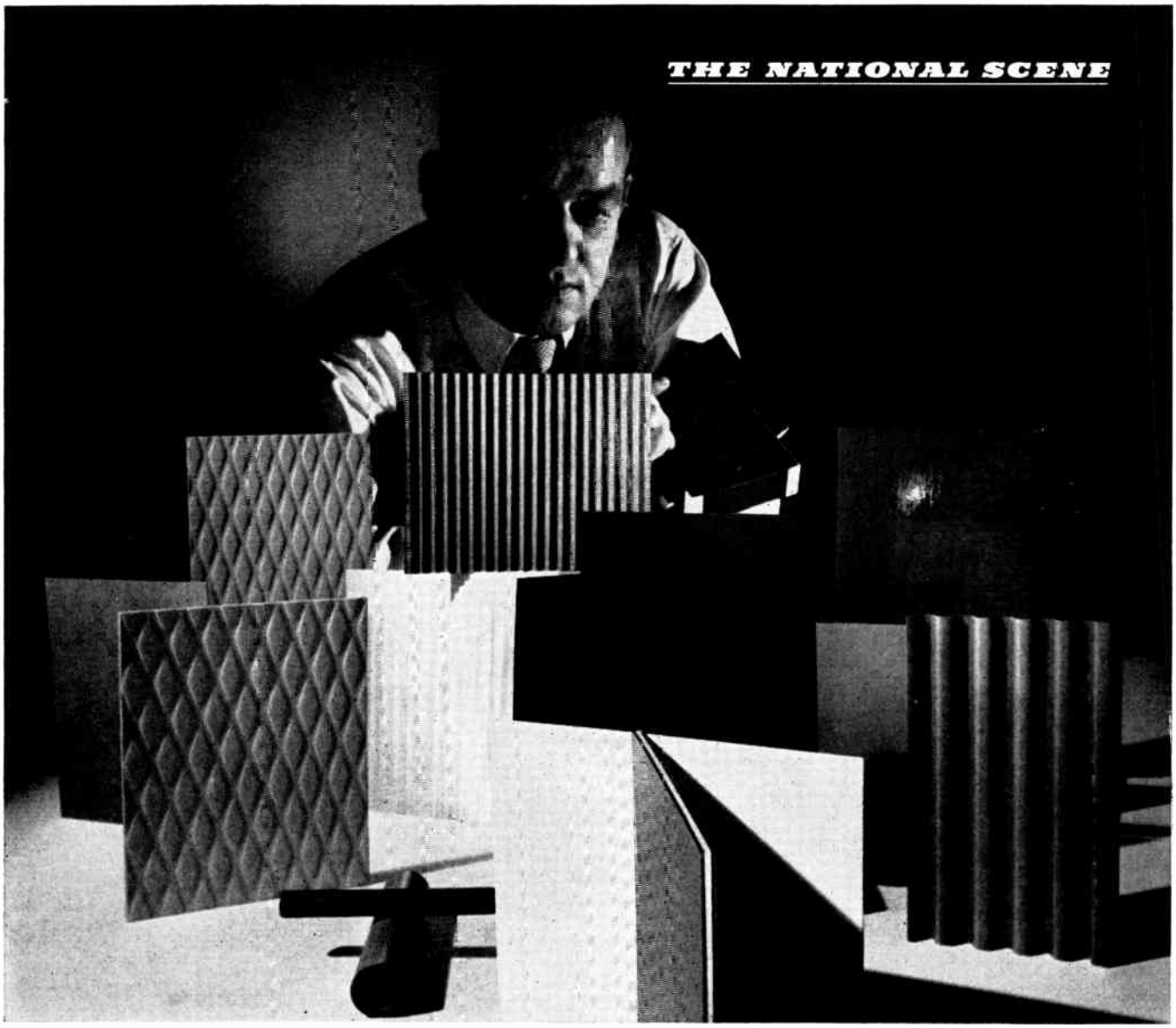
Item 2486

New FM narrow band multi-channel radio equipment developed by REL Inc. is now available through The Ahearn and Soper Co. Ltd. It will find wide application with public utilities, telephone companies, development companies, railways, oil and gas companies and the armed services.

This equipment is able to operate in the 132-174 mc/s band with 10 and 70 watts output. The baseband is 300 c/s to 24 kc/s allowing for the accommodation of six 4 kc/s voice channels. In addition, telegraph, teletype, facsimile and telemetering channels may lie super-imposed on these voice channels.

The equipment has been designed using the same principles as found in broadband radio relay equipment and is not a modified mobile type equipment. The design is simple and front access allows easy servicing. Carefully selected tubes and silicon rectifiers are used throughout to give prolonged life. This modestly priced equipment offers for the first time equipment designed expressly for his particular field.

Additional data available by writing to **The Ahearn and Soper Company Limited, 384 Bank Street, Ottawa 4, Ontario.**



"Here's a boxful of cost-cutting, product-improving ideas for you"

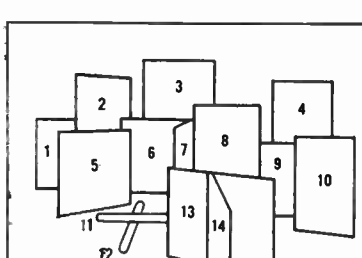
In versatility, performance and cost, Vulcanized Fibre may help crack your next design problem

For proof, look at this National product and its almost unbelievable range of uses. To name a few: delicate surgical instruments; rail joint insulation for railroads; clothes hampers for the home; dense, durable gears and cams; flexible backings for abrasive disks; arc chutes for lightning arrestors; motor insulation; punched tape for data processing machines; formed athletic guard equipment.

Among engineering materials you'll find National Vulcanized Fibre unique and surprisingly economical. It weighs only half as much as aluminum. It has unsurpassed arc resistance, low thermal conductivity, excellent resilience and high abrasion resistance. It absorbs sudden and repeated shock and impact without failure. And it is available in a fire resistant grade.

After 100 years, users are still finding new things they can do *to* Vulcanized Fibre. It can be machined, polished, painted, embossed, lacquered and combined with other materials, such as laminated plastic, aluminum, wood, rubber, asbestos or copper. It can even be formed or deep drawn into intricate shapes. Available in both standard and special forms and sizes.

Send for our special kit of samples (shown above)—write on your letterhead please—and evaluate the design possibilities personally. Let us know what use you have in mind. We'd like to help. National Fibre Company of Canada, Ltd., Dept. O-10, Toronto 3, Ontario.



1. "Peerless" Electrical Insulation. 2. Embossed, vinyl finish. 3. Corrugated "Peerless" .010. 4. Fibre and "Mylar." 5. Cold embossed. 6. Fibre-Copper, two-sides copper. 7. Black Commercial. 8. Fibre-Laminated Plastic, two-sides fibre. 9. Red Commercial. 10. Corrugated. 11. Rod. 12. Tube. 13. White. 14. Fibre Armored Plywood.

For complete details check No. 55 on handy card, page 93

Sola Electric (Canada) Ltd. announces new appointments

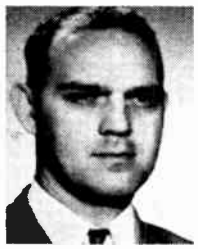
Three appointments in the sales department are announced by J. R. McGovern, P.Eng., sales manager, Sola Electric (Can.) Ltd. Mr. McGovern said they will provide for expanded services to customers. They are part of a program of company-wide sales development and expansion now under way at Sola.

G. V. Fortier

Guy V. Fortier has been appointed sales representative for all of eastern Canada including the province of Quebec, the maritime provinces and the city of Ottawa. He is a graduate of Columbia University and has had six years' experience in industrial electronics.

James W. Roe was recently appointed sales representative for the province of Ontario with the exception of Ottawa. He is a graduate of Ryerson Institute of Technology. Since his graduation he has been active in the field of specialty transformers.

J. W. Roe



D. A. Ligertwood

Douglas A. Ligertwood, manufacturer's agent, is now representing Sola in Winnipeg. His territory includes the provinces of Manitoba and Saskatchewan. He has had over ten years' practical experience in specialty transformer sales and services.

All three men represent Sola for its entire line of products: fluorescent and mercury lamp ballasts, constant voltage transformers and regulated DC power supplies.

Muirhead Instruments to rep for Timber-Top Inc.

Muirhead Instruments Limited have been appointed sole Canadian distributors of Synclamps by Timber-Top Inc., Freeport, New York.

Synclamps (U.S. Patent 2,896,295, Canadian Patent Pending) offer a unique, quick release method of mounting synchros, servomotors and other instruments with a similar outline. They are available from Canadian stocks for immediate delivery.

OPPORTUNITIES

These classified advertisements are published to assist those in the trade who have articles for sale, positions available, positions desired, sales agency openings or business opportunities. Charges are 25c per word or figure, not including heading or box number. Minimum charge is $5.00 payable on submission. No agency commission paid.

There is absolutely **no charge** for "positions desired" advts. Send all material to the attention of the advertising manager of ELECTRONICS AND COMMUNICATIONS, 450 Alliance Avenue, Toronto 9, Ontario.

INTER-OFFICE EQUIPMENT FOR SALE

One G.E.C. Private Automatic Telephone Exchange Cat. No. PX 2125 wired and equipped for 25 Telephone Extensions and 3 Speech Circuits. One G.E.C. SU. 1102 Battery Eliminator. For use with the above Desk-Wall Type Telephones.

Contact Mr. Rosenberg, RU. 1-3501
Toronto, Ontario

ADDITIONAL LINES WANTED

Established manufacturers' representative with good connections in Montreal is looking for radio lines — calling on radio manufacturers, jobbers and industrial accounts in the Province of Quebec, Ottawa Valley and Maritimes. Write:

Ben Manis Associates Reg'd.
5317 Prince of Wales Avenue
Montreal 29, Quebec

GRADUATE ELECTRONIC ENGINEER

or Physicist required, 25-35, with broad technical background, exceptionally interesting career opportunity in engineering sales. Submit detailed résumé in strict confidence.

Box 5018
Electronics and Communications
450 Alliance Avenue, Toronto 9, Ontario

ELECTRONICS TECHNICIAN

seeks sales position. Graduated from electronics course. Experience includes working as technician in development lab of well-known company, teaching radio at a high school, and serving as service representative for Bell Telephone Co.

Box 5019
Electronics and Communications
450 Alliance Avenue, Toronto 9, Ontario

SALES ENGINEER REQUIRED

Young university graduate required for sale of electronic instruments to industrial, educational and government laboratories. Should be familiar with chemical, nucleonic and electronic test equipment instrumentation. Sales experience preferred but not necessary. Salary.

Box 5020
Electronics and Communications
450 Alliance Avenue, Toronto 9, Ontario

SALES AGENCY OPPORTUNITY

U.S. manufacturer requires sales and possibly engineering facilities for range of DC, regulated, transistor, variable, voltage regulated, power supplies.

Box 5021
Electronics and Communications
450 Alliance Avenue, Toronto 9, Ontario

BRITISH FIRM SEEKS U.K. AGENCY RIGHTS FOR CANADIAN ELECTRONICS MANUFACTURER

A large and reputable firm of British electronic equipment and component manufacturers situated in the North of England is desirous of obtaining U.K. representation rights for Canadian manufactured electronic equipment and components. The firm seeking this arrangement is a supplier of electronic equipment to H.M. Admiralty, Ministry of Supply and the United Kingdom Atomic Energy Authority. In reply interested parties should state the types of equipment or components they are prepared to place on the British market through such an arrangement. Address replies to:

Box 5022
Electronics and Communications
450 Alliance Avenue - Toronto 9, Ontario

CANADIAN REPRESENTATIVE WANTED

American manufacturer of AC, DC, regulated, transistor and variable power supplies is anxious to establish Canadian outlet. In reply submit details of industry connections.

Box 5023
Electronics and Communications
450 Alliance Avenue - Toronto 9, Ontario

SALES PROMOTION OPPORTUNITY

Internal sales promotion man wanted by small sales organization in radio and telephone communications. Responsibility for organizing direct mail catalogues, sales correspondence, etc. Opportunity to participate in future growth.

Box 5024
Electronics and Communications
450 Alliance Avenue - Toronto 9, Ontario

U.S. FIRM SEEKS CANADIAN REPRESENTATIVE

Manufacturer of wide range of electronic components and equipment in the United States seeks to negotiate an arrangement with a Canadian company now established in the electronics business to act as Canadian representative. Please include resume of company history and status in first reply.

Box 5025
Electronics and Communications
450 Alliance Avenue - Toronto 9, Ontario

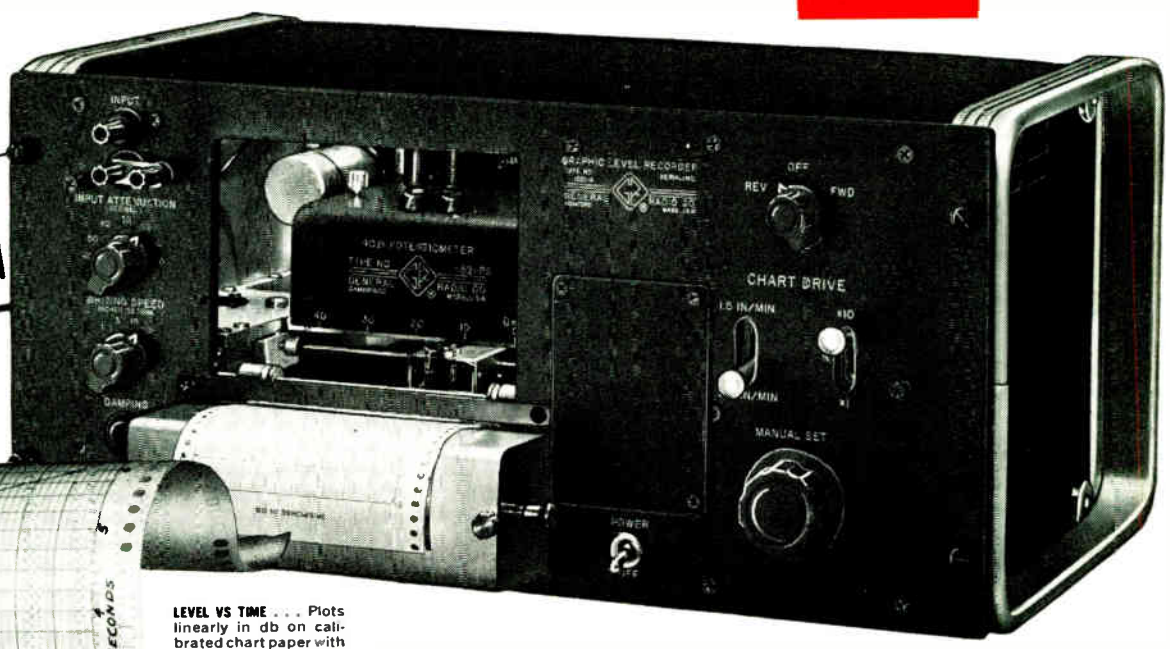
CANADIAN SALES AGENCY OPPORTUNITY

American manufacturer of power supplies, reactors and toroids seeks to establish connection with Canadian firm to act as Canadian outlet.

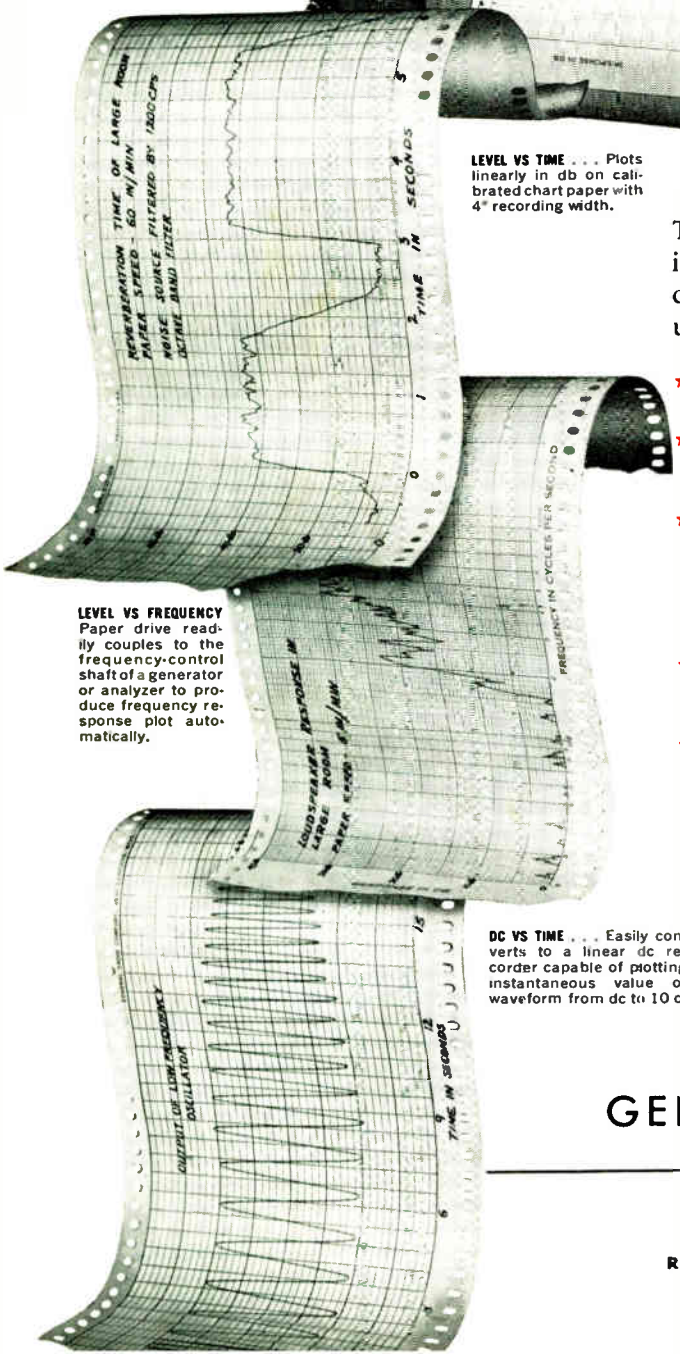
Box 5026
Electronics and Communications
450 Alliance Avenue - Toronto 9, Ontario

NEW RECORDER

Completely Transistorized



LEVEL VS TIME . . . Plots linearly in db on calibrated chart paper with 4" recording width.



LEVEL VS FREQUENCY Paper drive readily couples to the frequency-control shaft of a generator or analyzer to produce frequency response plot automatically.

DC VS TIME . . . Easily converts to a linear dc recorder capable of plotting instantaneous value of waveform from dc to 10 c.

The Type 1521-A Graphic Level Recorder* provides permanent ink records of the response of electronic and electro-acoustical devices as a function of either frequency or time. It can also be used as a linear dc recorder.

- ★ Traces the rms level of ac voltages from 20 cps to 200 kc.
- ★ High Sensitivity . . . 1-mv minimum input level, corresponds to 0-db point on chart paper.
- ★ Input Ranges . . . 40 db . . . 20-db and 80-db ranges provided by accessory plug-in Potentiometers . . . 0.8v full scale for dc recording, with accessory Linear Potentiometer.
- ★ 60-db Calibrated Attenuator changes 0-db level from 1 mv to 1v in 10-db steps.
- ★ Rms Response . . . preferable to peak or average response, as it is more nearly independent of input signal waveshape.
- ★ Four Pen Writing Speeds . . . 1, 3, 10, and 20 in/sec (10, 30, 100, and 200 db/sec with 40-db Potentiometer) with less than 1-db overshoot.
- ★ Four Paper Speeds . . . 2.5, 7.5, 25, and 75 in/min. Accessory slow-speed motor provides speeds from 2.5 to 75 in/hour. Recorder can be driven in reverse as well as forward.
- ★ Static Accuracy is better than 1/64" or 0.4% of full scale; fast servo system with low overshoot provides excellent dynamic accuracy.
- ★ Input Impedance . . . 10 kΩ for ac level recording, 1 kΩ for dc recording.
- ★ Can be either bench or rack mounted.
- ★ Drive and Link Units available for coupling to generator or analyzer; chart papers available calibrated linearly, logarithmically, or for use with G-R Sound Analyzer.

*Patent No. 2,581,133

Type 1521-A Graphic Level Recorder with 40-db Potentiometer . . . $995.

Write for Complete Information

GENERAL RADIO COMPANY

Canadian Engineering Office in TORONTO

1927 First Beat-Frequency Oscillator

99 Floral Parkway, Toronto 15, Ontario
Arthur Kingsnorth • Richard J. Provan
Tel.: CHerry 4-6221

Repair Service: Bayley Engineering Ltd., Ajax, Ontario