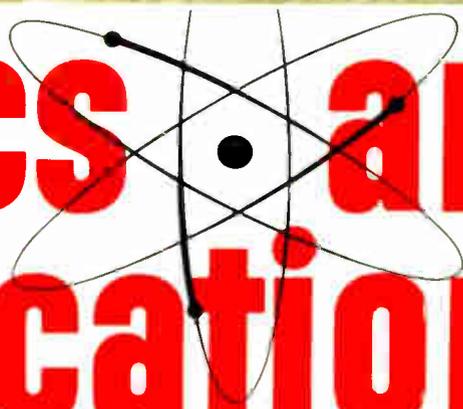




# electronics and communications



an age publication  
MARCH 1960

*Concept of molecular electronics — page 20*

1211C  
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## For ALNICO MAGNETS—Stock or Special Specify “ARNOLD”

### *Materials*

Cast Alnico Magnets are most commonly made in Alnico V, VI or III. Sintered Alnico Magnets usually are made in Alnico II, V or VI. Special permanent magnet materials supplied by Arnold include Vicalloy and Arnox III and V.

### *Engineering Data*

Write for your copy of *Bulletin GC-106C*, a general catalog of all Arnold products. It contains useful data on the physical and magnetic properties of Alnico magnets. Lists stock items and standard tolerances for cast and sintered magnets—also stock sizes and pertinent data on tape cores, powder cores, C & E cut cores, etc.

ADDRESS DEPT. EC-03

**Y**OUR best bet for a source of Alnico permanent magnets and assemblies is Arnold—producer of the most complete line of magnetic materials in the industry. We can supply your need for any size, shape, or type of Alnico magnet. Weights range from small sintered parts weighing less than a gram to large castings of 80 lbs. or more.

Special assemblies such as rotors, traveling wave tube and magnetron magnets, etc., may be supplied aluminum-jacketed for easy mounting and added protection of the magnet—and magnetized and stabilized as desired. Large magnet assemblies

may also be supplied for mass spectrometer and other measuring applications, where a high degree of stability and uniformity of field is required.

For your convenience, we carry a wide range of the more popular sizes and types of Alnico magnets in stock for immediate shipment. Unsurpassed plant facilities assure quick delivery of all special orders.

- Let us handle your permanent magnet requirements, or any tape core, powder core or other magnetic material specification you may have. Get in touch with *The Arnold Engineering Company, Main Office and Plant, Marengo, Ill.*

7613R



# ARNOLD

**SPECIALISTS in MAGNETIC MATERIALS**

CANADIAN Representatives: Bayly Engineering Ltd., First St., Ajax, Ont.  
Telephone (Toronto Exchange): EMpire 2-3741

For complete details check No. 5 on handy card, page 51

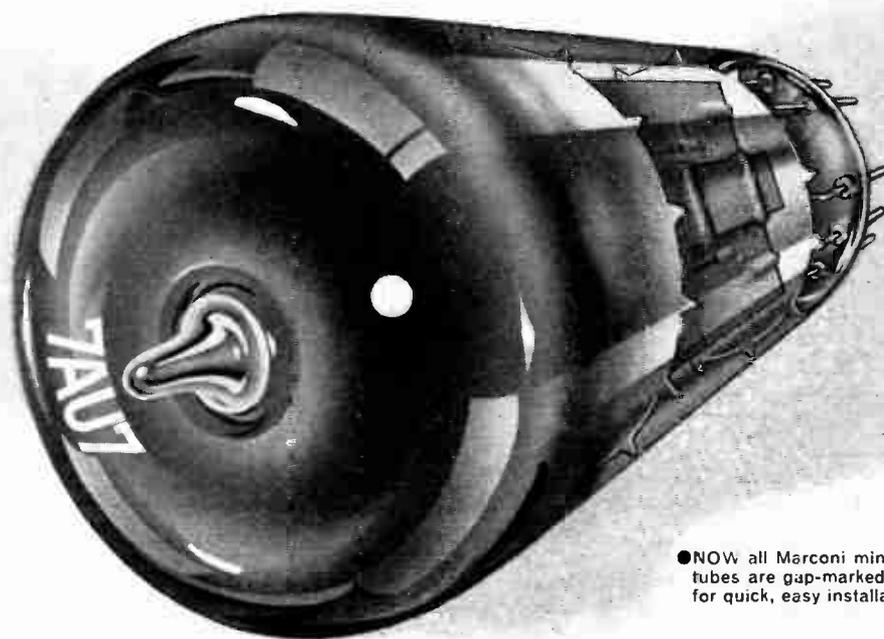
# SPEED UP PRODUCTION WITH NEW MARCONI MINIATURE RADIO AND TV TUBES

● gap-marked and type branded on top for quick, easy installation and identification

NOW! Canadian Marconi comes up with a simple solution to speed up assembly line production of radio and television sets.

NOW! Every Marconi miniature radio and television tube is plainly marked on top with an easy-to-see white dot to indicate the exact centre of the gap. Assembly line workers can line up and position the tube immediately. No fiddling around to find the location of the gap. The type number is branded on top of the tube as well as the side to make identification so much easier.

With new Marconi radio and TV tubes you'll cut production time, increase your output . . . they're quickest and easiest to install.



● NOW all Marconi miniature radio and television tubes are gap-marked and type branded on top for quick, easy installation and identification

ELECTRONIC TUBE AND COMPONENTS DIVISION

CANADIAN **Marconi** COMPANY

830 BAYVIEW AVENUE, TORONTO, ONTARIO

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

For complete details check No. 13 on handy card, page 51

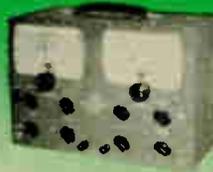
# STARKIT



**MODEL 999**  
Dynamic Plate—Conductance Tube Tester. Versatile, Portable, Tests All Modern Tubes, Tests Shorts, Leakage and Quality. Special Self-Cleaning Lever Switches.  
Kit \$69.95  
Wired \$99.95



**MODEL MK-3**  
Multi-Range Multimeter. 20,000 Ohms/Volt, Molded Case, Unbreakable Meter Front.  
Kit \$39.95



**MODEL SMG-57**  
Sweep Marker Generator. Continuous coverage from 3 to 260 MC. Complete with 4.5 MC crystal. Calibrated to 1% accuracy. Vernier dials.  
Wired \$139.95

**HIGH** in accuracy  
**HIGH** in quality

**LOW ONLY IN PRICE**



**MODEL VMK-2**  
Vacuum Tube Voltmeter. 6" Full View Meter, Input Impedance 10.5 Megacycles. Proven Printed Circuit.  
Kit \$44.95  
Wired \$59.70



**MODEL OSK-1**  
5" Oscilloscope Kit. 5" C.R.T., Push-Pull Horizontal and Vertical Amplifiers.  
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Wired \$99.50



**MODEL MHG-48**  
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Wired \$87.95



**MODEL SWG-58**  
Sweep Generator  
Wired \$97.95



**MODEL TM-7**  
Pocket Multimeter  
Wired \$29.95



**MODEL 1001**  
Multi-Range VOM  
Kit \$39.50  
Wired \$49.95



**MODEL VMK-1**  
Vacuum Tube Voltmeter  
Kit \$39.20  
Wired \$53.95



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VOM Pocket Meter  
Wired \$14.95



**MODEL MT-6D**  
Pocket Meter  
Wired \$24.95



**MODEL MK-1**  
Multi-Range Multimeter  
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**MODEL PD-3**  
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**MODEL RFG-3**  
Signal Generator  
Kit \$29.95  
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Wired \$39.95



**MODEL BJ-1**  
Condenser Analyzer  
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**MODEL 5A-3**  
AC Radio Kit  
Kit \$26.75



**MODEL 5B-2**  
AC-DC Radio  
\$19.95 Less Cabinet



**MODEL KE-S**  
Audio Level Indicator  
Wired \$6.95

**MODEL KED**  
Stereo Level Indicator  
Wired \$12.95

**Stark Electronic Sales Company**  
Ajax, Ont.

Please send me illustrated catalogues.

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Business Address \_\_\_\_\_

Town or City \_\_\_\_\_ Prov. \_\_\_\_\_

**STARK ELECTRONIC INSTRUMENTS LIMITED**  
AJAX, ONT.



an age publication

# electronics • and communications

Canada's pioneer journal in the field of  
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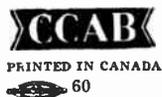
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## contents

**MARCH 1960** Vol. 8, No. 3

- 20** The concepts and capabilities of molecular electronics  
*Research hastens new concept of electronics*  
by Dr. S. W. Herwald
- 24** Transistor techniques for reactor control instruments  
*Enhanced reliability is obtained from reactor instruments incorporating transistor circuits*  
by G. G. Ballard
- 27** A low conductivity magnetic flowmeter  
*Simple design changes extend range of magnetic flowmeter system*  
by Douglas R. Lynch
- 29** Canadian built gradiometer goes on world tour

## departments

- 14** EIA Report
- 16** The Industry's Business
- 40** Product Panorama
- 42** Letters to the Editor
- 44** Scatter Matter
- 46** Briefing the Industry
- 48** Techdata for Engineers
- 50** Engineers' Book-case
- 53** CRTPB Newsletter
- 54** Industry Personnel
- 60** Editorial

# Northern Electric

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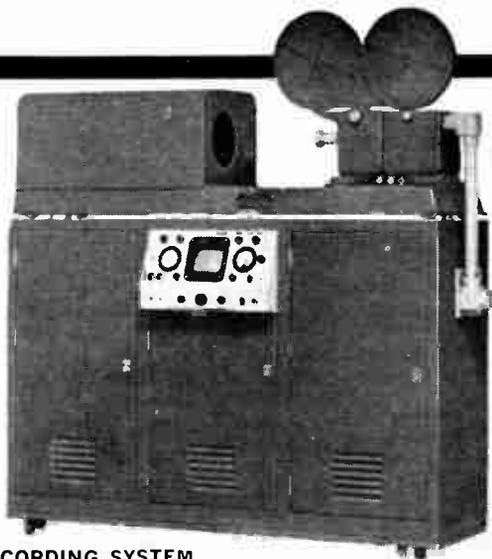
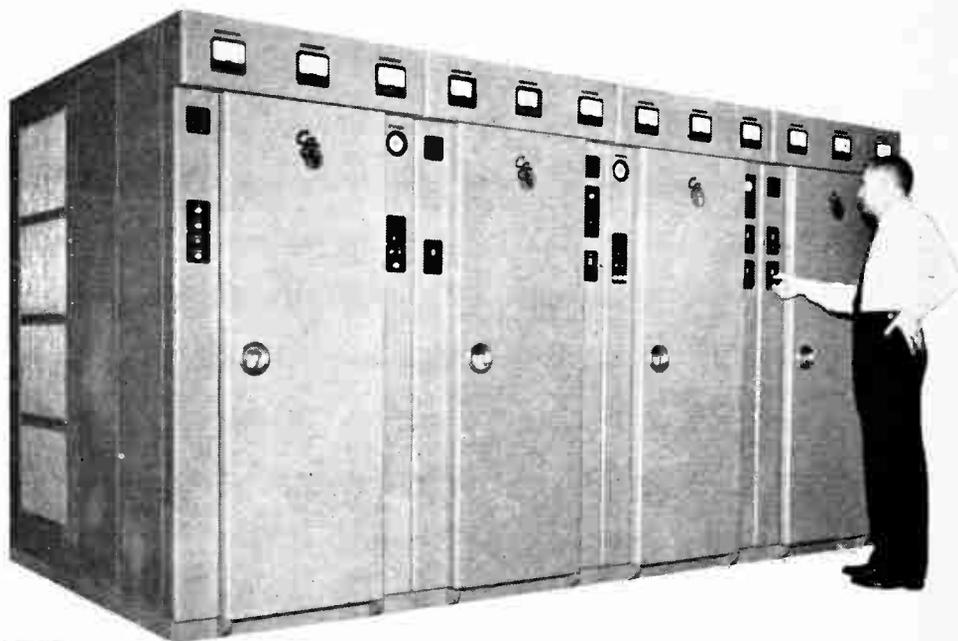
**GPL** GENERAL PRECISION LABORATORY

**NE** NORTHERN ELECTRIC



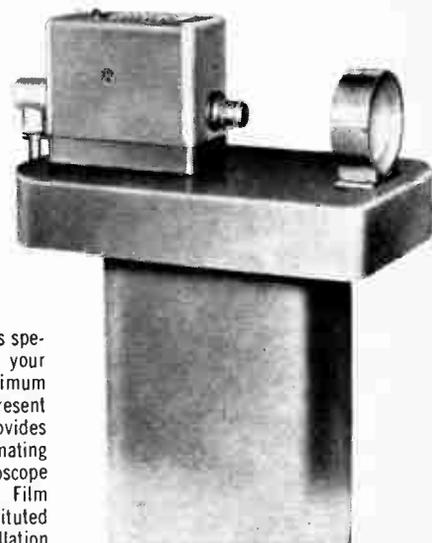
## AM TRANSMITTERS

The Type 317B transmitter is a standard AM broadcast transmitter with a power output of 50,000 watts. High level screen modulation of the 5 KW RF driver stage makes possible excellent performance. The 50 KW amplifier is a high efficiency linear stage using the "Weldon Grounded Grid" circuit. The advantages realized in this circuit are many, including high overall efficiency, extreme stability and the absence of critical neutralizing and tuning adjustment.



## VIDEO RECORDING SYSTEM

The GPL Video Recorder is a complete high quality TV recording system which produces standard 24-frame-per-second motion picture film with excellent picture resolution and correct grey scale. The system is designed for 525-line 60-fields-per-second FCC standard TV. The input signal is standard 0.5 to 2 volt white positive composite video. This is equivalent to better than 1000 lines resolution in television terms. A non-linear amplifier having an effective "gamma" of 0.5, is included in the system and may be used at will to provide the correct grey scale rendition.



## VIDICON FILM CHAIN

The GPL Vidicon Film Chain is specifically designed to replace your iconoscope camera with a minimum rearrangement of your present facilities. Optical system provides throw distances approximating those used with the iconoscope camera. Thus the Vidicon Film Camera can be easily substituted for an iconoscope. This installation can be accomplished over night. All your present projectors, master monitors, utility monitors and standard racks can be used.

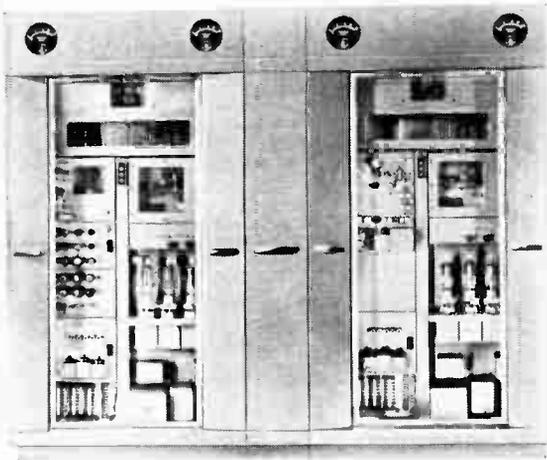
# AM-FM-TV BROADCAST EQUIPMENT



CONTINENTAL ELECTRONICS

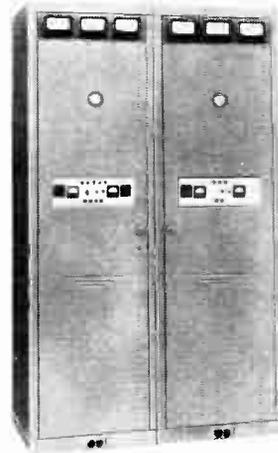


STANDARD ELECTRONICS



## 500 WATT VHF-TV TRANSMITTER (Low Band and High Band)

The 500 watt transmitter is the basic unit in the Standard Electronics VHF television transmitter product line. The visual portion of the transmitter is designed to deliver a standard AM signal of 500 watts peak power, when a standard composite video signal is fed to the visual transmitter input. Together with the aural portion, the equipment comprises a complete 500 watt television transmitter, the output of which after diplexing, may be fed into a suitable television antenna. This transmitter can be used, without modification, as the driver for a 10 KW, 25 KW or 50 KW transmitter by means of Standard Electronics' "Add-A-Unit" feature.



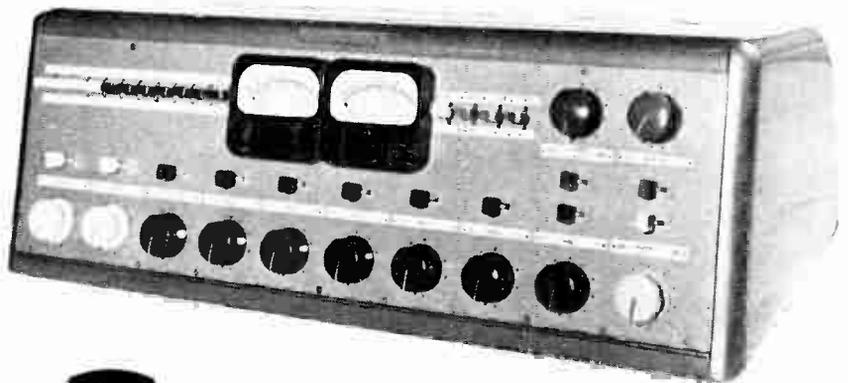
## VERSATILE FM TRANSMITTERS

Standard Electronics has a new range of equipment for simplex FM/FM stereo, and other multiplex operations. Features include built-in "Patchover" system, provision for multiplexing as standard equipment, Serrasoid modulator for inherent stability, and compact accessibility that saves as much as 45% of space.



## TRANSISTORIZED PORTABLE AUDIO CONSOLE R5460B

An AC or battery operated, all transistor, single channel console type program mixing unit designed expressly for the amplification, control and monitoring of program material originating at microphone level in remote broadcast operations.



## SPEECH INPUT CONSOLE R5430A

An audio console having two main program channels which are capable of simultaneous operation on separate programs without interfering with one another.



World Radio History  
NORTHERN ELECTRIC COMPANY LIMITED



12MA1 Actuator

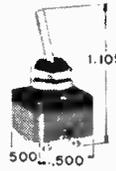


12MA5 Actuator

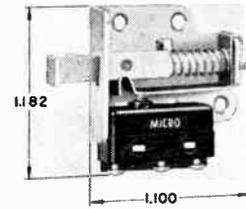
Pushbutton actuators are versatile, low cost

These actuators accept three families of basic pin plunger switches permitting their use in a wide range of applications. Two button sizes—1/2" and 1"—and choice of red, green or black buttons give panel distinctiveness. Switch and actuator mounting hole arrangement permits use in panels from .060" to .312" thick, and simplifies button travel adjustment. Data Sheet 155.

New subminiature "TM" toggle switch uses minimum panel space

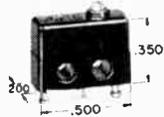


The 2TM1-T offers considerable reductions in space and weight in manual control of compact equipment. Weight—4 1/2 grams. Only 1/2" square at the base. Dependable operation from -65° to +200°F. Low circuit resistance. Rating: 7 amps. resistive, 28 vdc. DPDT. Data Sheet 158.



New subminiature safety door interlock

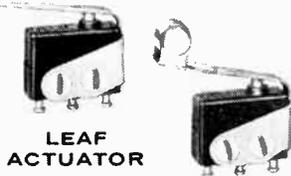
The 17AC1-T cuts off power in equipment cabinets when a service door is opened. Manually pulling the rod actuator to maintained contact position closes circuit for checking. When door is next closed, switch returns to normal... resets itself to safety position. Dependable in temperatures from -65° to +250° F. SPDT. Data Sheet 159.



ACTUAL SIZE

Sub-subminiature series switches

These remarkable switches combine smallest available size with "regular size" electrical capacity, operate dependably in temperatures from -65° to +250°F. Weight—1/28 oz. Qualifies as Military Standard Part Number MS24547-1. Rating: 5 amps., 230 vac; 7 amps. resistive, 28 vdc. Data Sheet 148.



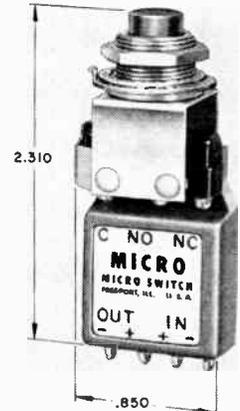
LEAF ACTUATOR

ROLLER LEAF ACTUATOR

Auxiliary actuators add to the versatility of application. Two are shown. Others are pivoted lever and pivoted roller lever. All are stainless steel.

"One-Shot" switches simplify circuit development

Time-consuming custom development of circuits is made unnecessary by "1PB600" Series "One-Shot" pushbutton switches. These switches produce one square wave pulse per operation. Pulse widths from 0.1 to 10.0 microseconds. Applications include computer and radar consoles, electronic test equipment, setting and resetting flip-flops, and reflected pulse systems. Data Sheet 150.



Selections from a line large enough to solve almost any switching problem

MICRO SWITCH makes many hundreds of switches and switch devices especially useful to the electronic designer. Here are a few of them, in a considerable range of sizes, electrical capacities, and functions. MICRO SWITCH development engineers are constantly widening the choice with new switches and devices to meet new requirements. The designer can go ahead with a switching arrangement he has in mind with confidence that MICRO SWITCH can supply his need.

Engineering assistance in switch applications is available without obligation from your nearest Honeywell office, or write Honeywell Controls Limited, Precision Components Division, Toronto 17, Ont.



Honeywell MICRO SWITCH Precision Switches

For complete details check No. 24 on handy card, page 51

# ROGERS

## REFERENCE BULLETIN NO. 6

### Rogers transistors for audio applications

Rogers now offer a broad range of low thermal resistance transistors for low-level, small signal amplifiers and up to 30 watts audio output.

All Rogers *Low Power* types are hermetically sealed for maximum reliability.

All Rogers *High Power* types are sealed in standard TO3 package.

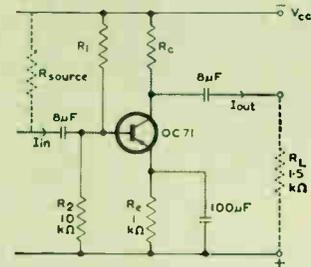
All Rogers *Large Signal* types are designed for minimum change in current gain at large collector currents.

Types OC72 and OC74 are available in matched pairs for low spread in quiescent collector currents used in Class B push-pull circuits.

Clip and file this reference sheet for future use

#### Low Power Input and Driver Stages

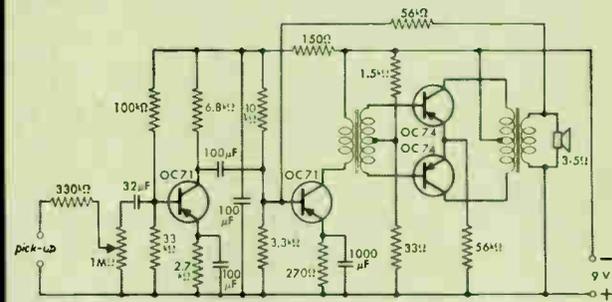
	$V_{CE}$	$W_c$	$\beta$	f.c.o.	
OC70	30	125mw	30	.45mc	low gain
OC71	30	125mw	50	.5mc	medium gain
OC75	30	125mw	90	.75mc	high gain



Typical OC71 preamplifier

#### Medium and High Power Output Stages

	$V_{CE}$	$W_c$	$\beta$	f.c.o.
OC72	32	165mW†	70	.9mc
2-OC72	Matched pair of OC72 for class B output stages.			
OC74	20	550mW†	65	1.5mc
2-OC74	Matched pair of OC74 for class B output stages.			
OC22	32	10W	150	2.5mc
2N1314	32	20W	33	.15mc
2N1315	32	20W	64	.3mc



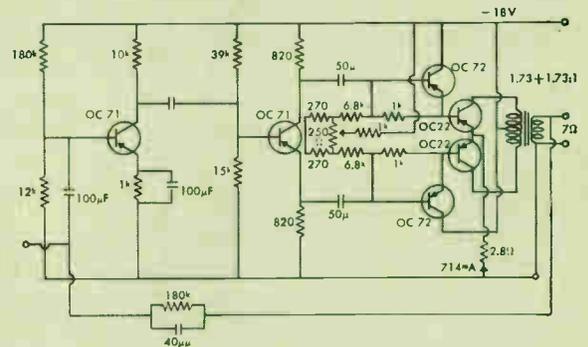
Circuit diagram of 1W(r.m.s.) phonograph amplifier. Frequency response 30cps to 14 kc/s. Sensitivity for full output 750mv. Sensitivity using OC75 in place of OC71 250mv. Total Harmonic distortion 5% at Full Output.

†with mounting clip 56200 and heat sink 2in.

#### Survey of Output Transistor Performance

	Circuit	Supply Voltage	Power Output (r.m.s.)
OC72	Class A	6	38mw
	Class A	12	38mw
	Sliding bias	9	75mw
	Class B, Push-Pull	12	100mw
OC74	Class B, Push-Pull	6	310mw
	Class A	12	390mw
	Class A	6	110mw
	Class A, Sliding bias	9	200mw
OC22	Class B, Push-Pull	6	310mw
	Class B, Push-Pull	9	1.26w
	Class B, Push-Pull	12	4.0w*
2N1314	Class A	7	4.0w
	Class B, Push-Pull	7	10.0w
	Class B, Push-Pull	14	20.0w

\*OC22 for "hi-fi" amplifiers. See circuit.



Experimental circuit for 4 Watt "Hi-fi" Amplifier. Total harmonic distortion at 4W output <1%. Frequency response ±2db 20cps to 20 kc/s. Sensitivity (for full output) 30µA.

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

You are invited to make full use of Rogers Application Engineering Service at any time, on any problem. Just phone or drop us a line.

# ROGERS

electronic tubes & components  
A DIVISION OF PHILIPS ELECTRONICS INDUSTRIES LTD.  
116 VANDERHOOF AVE., TORONTO 17, ONTARIO

# Solid State Reliability

## IN A 10 mc Counter



The CMC 700 Series is the only major breakthrough in counting, timing and frequency measuring equipment in the past 10 years. Here is the first successful application of transistors to high frequency counting and timing. Transistors perform all the functions in CMC's 700 series that required 63 tubes in old style counting equipment. These are the most reliable counters ever made.

### TRUE DIGITAL LOGIC CIRCUITRY

By answering an obvious need for a completely new, up-to-date approach to counting and timing instrumentation, CMC has produced solid state instruments with greatly simplified circuitry, using logic "and" and "or" gates.

### LIGHT AND SMALL, LOWER POWER DRAIN

Each 700 series instrument weighs only 27 pounds, measures 7 inches high, 17 inches wide, and 14 inches deep. Power consumption is a meager 46 watts, 1/10 the amount for vacuum tube models.

### DO ALL THESE JOBS

Measure frequency from dc to 10 mc, time interval from 0.1  $\mu$ sec, ratio 1 cps to 1 mc and unlimited multiple period selection. Frequency converters available for higher frequencies. The counter also generates time interval marker pulses from 1  $\mu$ sec to 1 second. Data can be presented on standard decades or inline Nixie tubes. The 700 series will operate digital recording equipment, punches, inline read-outs, and other data handling gear.

**These Features, Too**—Decade count-down time base — frequency divider circuits never need adjustment. Accuracy,  $\pm 1$  count  $\pm$  oscillator stability. Sensitivity, 0.25 v rms; input impedance, 25 k ohms/volt.

**And The Price**—Higher than vacuum tube models. But you can save the difference on down time in the first year. Model 727A Universal Counter-Timer, \$2,750; Model 707A Frequency-Period Meter, \$2,575; Model 757A Time Interval Meter, \$1,975. Rack mount optional at no extra cost. All prices f.o.b. Sylmar, California.



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## Computer Measurements Co.

A Division of Pacific Industries

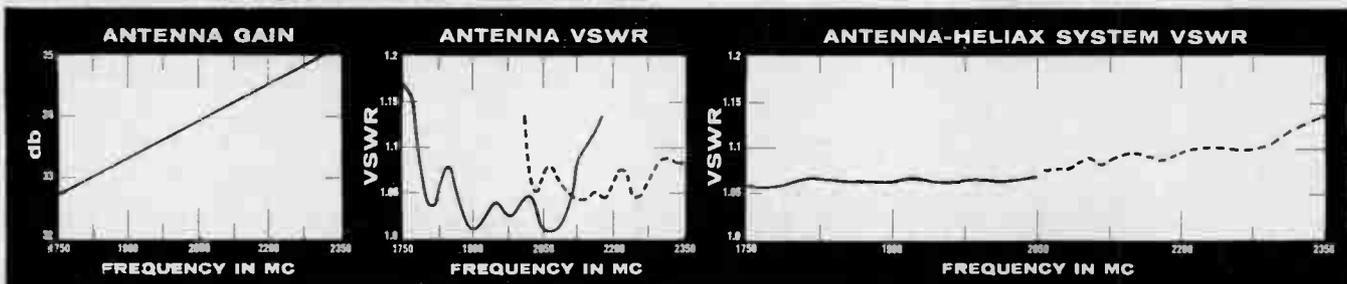
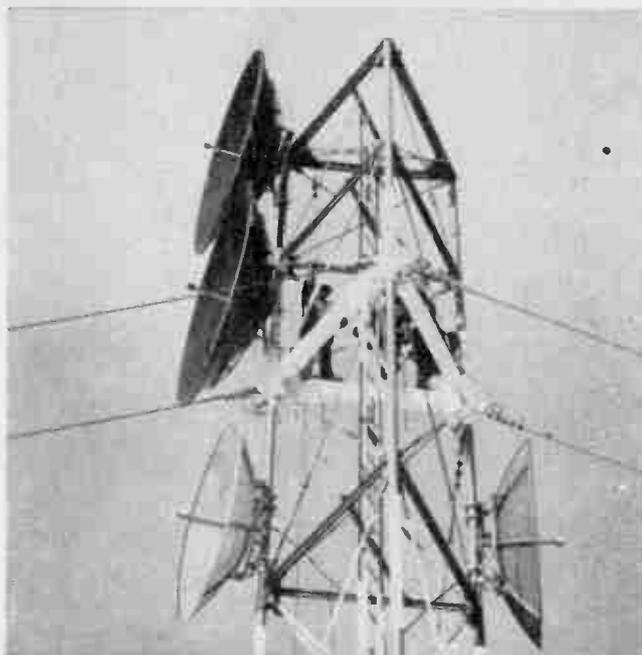
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Markham Road  
AGINCOURT, ONTARIO  
Telephone AXminster 3-7011

11819 Michel Sarrazin  
MONTREAL, QUEBEC  
Telephone R14-1932

For complete details check No. 16 on handy card, page 51

# NO MARGIN FOR ERROR...



Antenna performance based on 60% gain factor

High and low band antenna VSWR plots of production test samples:

Test results of high and low band production antennas and 110 feet of  $\frac{3}{8}$  inch HELIAX cable

A 600-channel microwave system to carry vital defence data was recently developed by Canadian-Marconi Company for the Royal Canadian Air Force. Because of its strategic value, this long haul line-of-sight system demanded reliable performance in the antenna equipment.

ANDREW Antenna Corporation, Ltd. is proud to have been chosen to design and produce this equipment to meet specific system requirements.

ANDREW microwave antenna, Type 21362, designed for this 1790-2260 mc system guaranteed a vswr under 1.1. Minimum antenna gain of 33 db resulted from production models having gain factors of better than 60%. The antenna characteristics were sustained in the system through the use of ANDREW HELIAX, the flexible air dielectric cable. HELIAX was chosen for its low vswr and attenuation, ease of handling and mechanical stability.

Automatic pressurizing equipment to regulate the dry air supply for this RF system was provided with an ANDREW Type 1910 dehydrator.

This is just one of many ANDREW antenna system installations in Canada that are consistently giving optimum performance in UHF/VHF and microwave frequencies. To get all the facts on ANDREW antenna systems, write or call today, giving your specific requirements.

Be sure and visit us at Booth #1502-1504 at the New York I.R.E. Show.

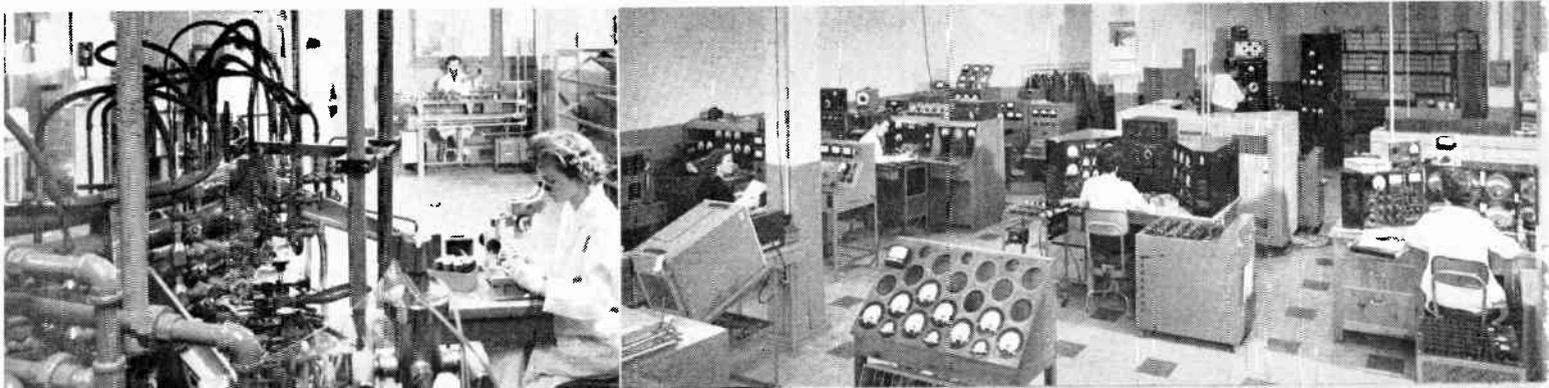


**Andrew**  
ANTENNA CORPORATION LTD.  
606 Beech St. • Whitby, Ontario, Canada  
Telephone: MOhawk 8-3348

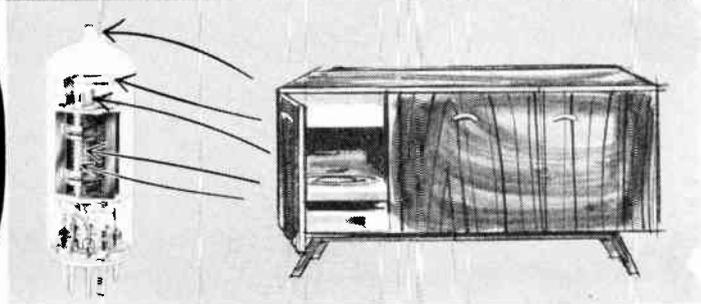
ANTENNAS • ANTENNA SYSTEMS • TRANSMISSION LINES

For complete details check No. 4 on handy card, page 51

ELECTRONICS AND COMMUNICATIONS, March, 1960



# 1959



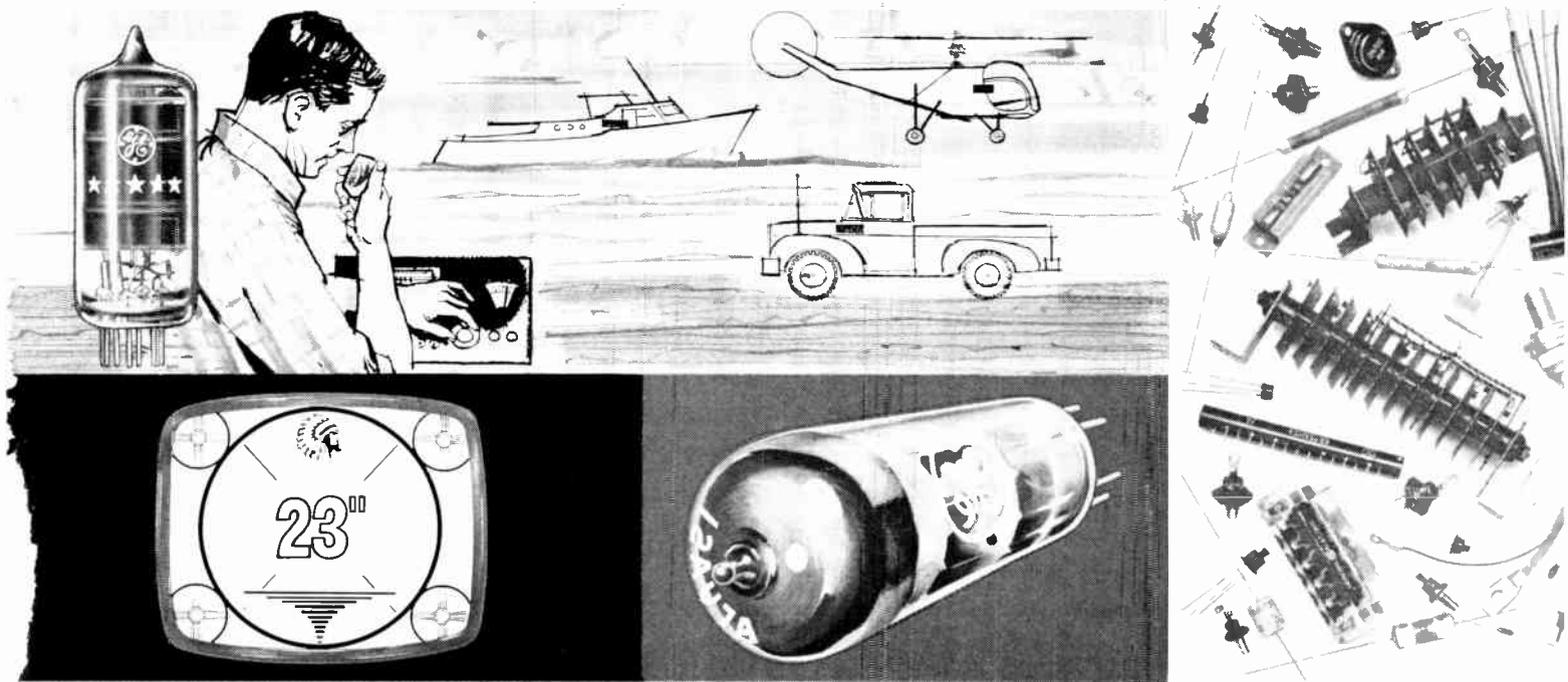
## A YEAR OF PROGRESS AT C.G.E. IN DESIGN, DEVELOPMENT, PRODUCTION OF ELECTRONIC TUBES AND SEMICONDUCTORS

Progress at Canadian General Electric in 1959 meant more than maintaining position as the leading Canadian manufacturer of electronic tubes and semiconductor products.

It included expanded research facilities for designing and developing new types to meet the special demands of Canada's fast growing electronics industry. New design features were incorporated in many existing types to achieve improved performance.

New manufacturing methods and more efficient equipment were combined in 1959 to provide you with products that are superior in every respect . . . at the lowest possible price.

As in 1959, progress gets top priority at C.G.E. in 1960. New products are already on the planning board and engineering research continues to look for ways to improve present products. And to meet your immediate needs, C.G.E. is the one source you can depend on to completely fill your electronic tube and semiconductor requirements.



### New Design Engineering Lab.

The only one of its kind in Canada, C-G-E's design engineering lab was greatly expanded in 1959. It was given completely new and separate facilities and its own highly specialized production equipment. This enabled research and development programmes to be carried out without interruptions. The result was, new advancements were achieved faster, and many new or improved products were made available to you sooner.

### New Tubes For Every Application.

The success of C-G-E's accelerated research efforts is reflected in the number of new tube types that rolled off the production line by the end of 1959. C.G.E. produced 17 new entertainment type tubes, including such advanced types as the 7025A.

The results for industrial and military tubes were equally impressive. 10 new types of high-reliability G-E 5-Star receiving tubes were added to production. In addition this included the specially developed 6J4WB. MIL approval was obtained on 16 types. Three new transmitting tubes were also developed for critical military and industrial application.

In picture tubes, the development and production of the revolutionary new 23" picture tube by C.G.E. was hailed by the entire industry as a notable achievement. New, short, short neck picture tubes were also designed and produced, such as the 17DTP4 and the 21DLP4.

### New Design Features

In 1959 C.G.E. incorporated many fully developed and

thoroughly tested design improvement features into G-E tubes. These features increased the already high standards set by C.G.E. for reliability and performance. FORMED TIPS to reduce breakage and eliminate handling injuries. New HALO GETTER to prevent early failures due to cathode poisoning. CATAPHORETICALLY COATED HEATER BENDS to prevent heater-to-cathode shorts and leakage. FLIPPER MICAS to hold the cathode rigid—eliminating microphonics. TOP BRANDING and PIN LOCATOR DOT for quick identification and faster installation.

Superior performance from all G-E Black-Daylite picture tubes was obtained through new gun design. The new gun improved beam centering and resolution.

### Semiconductor production greatly expanded.

Early in 1959 C.G.E. embarked on an extensive semiconductor development and manufacturing programme. Production of germanium and silicon stacked rectifiers was started, making available over 750 different combinations; 70 new glass encased germanium and silicon diodes were made available. Over 105 new germanium and silicon type rectifier cells were developed. In addition MIL approval was obtained on many new types.

To provide you with better service and to meet growing demands, C.G.E. expanded its sales engineering organization and enlarged semiconductor application engineering facilities.

*Progress Is Our Most Important Product*



**GENERAL ELECTRIC  
ELECTRONIC TUBES  
SEMICONDUCTORS**

**ELECTRONIC TUBE SECTION  
CANADIAN GENERAL ELECTRIC COMPANY LIMITED**

## EIA REPORT *by Basil Jackson*

### 31st Annual Meeting

The 31st annual meeting of the Electronic Industries Association of Canada is scheduled to be held on Thursday and Friday, June 16 and 17, at the Mont Tremblant Lodge, Mont Tremblant, Quebec. The guest speaker for the annual meeting on June 17 will be announced at some future date.

### Television Sales Down in 1959

Television sales — distributors to dealers — in 1959 at 405,965 units were down from the 430,980 units sold in 1958. It is the feeling in the industry that the bottom of the curve has been reached in television sales and that sales should begin to increase in 1960. This was evident at a presentation made by the Market Research Task Force to the Board of Directors, Receiver and Components Division in Hamilton recently. Reasons for optimism include the obsolescence of television sets already in the Canadian consumers' hands, the opening of second television transmitting station in the large metropolitan areas across Canada, the upward swing to second-set homes, and the formation of new family units during 1960.

Radio sales — distributor sales to dealers — at 621,407 units in 1959 showed an increase over the 574,490 units sold in 1958 by EIA member companies. However, although this is an encouraging increase, nearly 90 per cent of the increase in sales was due to the importation of radio receivers from abroad. Importation still poses a serious threat to the Canadian industry and it is encouraging to note that many companies are meeting this competition with comparable products that sell at the same prices, or in one or two cases, even lower, than the comparable imported products. The problem is being tackled on a price-for-price basis with the offering of better quality products.

### Recent EIA Meetings

During the past month there have been no fewer than twelve EIA meetings including the Board of Directors and the Electronics, Components, and Receiver Divisions.

In the engineering committee field an important meeting was held by the sub-committee on Fixed Composition Resistors, Components Engineering Committee, to draw up a questionnaire for the industry regarding standard hole sizes, crimping and spacing of leads of axial lead components used in conjunction with printed wiring boards.

The Sound Equipment Engineering Committee, of the Electronics Division, has almost completed its work on the EIA Standard "Amplifiers for Sound Systems", but some amendments have yet to be made. The Mobile Equipment Engineering Committee, also of the Electronics Division, is proceeding with the compilation of a system standard for mobile equipment. The Receiver Engineering Committee, meeting prior to the Receiver Division meeting in February, among other subjects dealt with the question of line voltage standardization.

### Engineering Standards Available from EIA

Engineering Standards covering all aspects of the electronics industry are available from the EIA Office, 200 St. Clair Avenue West, Toronto 7, Ontario. A list of the recommended standards, specification and engineering publications may be obtained free of charge from the EIA office. Prices to non-members of EIA are on a nominal basis.

In addition to the EIA Standards, the EIA Office is the Canadian distributive agency for television test charts of different types. Also, publications issued by the Joint Electronic Devices Engineering Council (JEDEC) are obtainable from the EIA Office in Toronto.

### Commonwealth Communications

The Honourable George Hees, Minister of Transport, recently announced in the Commons cabinet ratification of Canada's share in the trans-Pacific section of the global cable project which the British Commonwealth has been studying since completion of the first successful trans-Atlantic cable in 1956.

  
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Ranges and scale layouts have been designed for maximum readability with an anti-parallax mirror and knife edge pointer. Precision components and calibration techniques assure accuracies down to  $\pm 1.25\%$  on most of the D.C. ranges, with similar accuracy improvements on other ranges. In addition, the operating manual specifies accuracies on

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For complete details check No. 9 on handy card, page 51

# the industry's business



Secretary, Miss Amy Dunlap demonstrates the new teleprinter as designer Ronald G. Griffith, P.Eng., M.E.I.C., looks on.

## U.S. company gets world rights on Canadian development

Patent rights and tooling of a revolutionary new type of communications teleprinter designed and developed by a Canadian engineer have been purchased by a major United States corporation for marketing throughout the world.

The teleprinter was designed by Ronald G. Griffith, vice-president and chief engineer of Canadian Overseas Telecommunication Corporation, the Canadian crown corporation controlling overseas telecommunications.

The American company which closed the deal for world rights to the machine is Westrex Corporation, part of the major electronics group of Litton Industries Inc., of Los Angeles, Calif.

The Griffith teleprinter, developed in both transmitting and receiving versions, is compatible with all teletype systems operating in the world. Incorporating a number of novel features it can also be used as a read-out device for electronic computers and

other similar machines, and will backup during transmission in order to make corrections in transmitted telegraph copy.

Smaller than most typewriters, the Griffith teleprinter weighs only 35 pounds, occupies desk space of 12 by 17 inches, and is only 10 inches high. The machine will transmit or receive 75 or 100 words a minute. It will be cheaper to manufacture than conventional machines because of a new type-head and every part in the machine is designed afresh to achieve the objectives of lightness, compactness, and ease of maintenance.

### Bayly Engineering take Ballantine line

Bayly Engineering Limited, Ajax, have recently completed arrangements to represent Ballantine Laboratories Inc. in Eastern Canada.

Sales and service will be available from our Ajax offices for this line of electronic voltmeters.

### Burnell appoints Found Brothers Canadian reps.

Burnell & Co., manufacturers of toroids, filters and related networks announces the appointment of the Tex-O-Koma Sales Co., Box 747, Grand Prairie, Texas, as their representative for the Texas, Oklahoma, Kansas and Missouri area. Found Brothers Aviation, Ltd., Malton Airport, Malton, Ontario, has been named Burnell sales representative in the provinces of Ontario and Quebec.

### Memo to engineers and management

Ontario's engineering profession was told recently that today more than ever before there was a need for each member of the profession to stand shoulder to shoulder.

Col. T. M. Medland, executive director of the 18,500-member Association of Professional Engineers of Ontario, told the annual meeting that the public places increasing confidence in the profession.

At the same time, as the country's industry increases in volume and technical complexity, the profession's responsibility becomes greater.

"It may well be that Canada is at a crossroads — a technological crossroads, and if such is the case, it behooves every professional engineer and every scientist to give thought to the manner by which he may make the best contribution to his country," Col. Medland stated.

He said this is not a time for "cleavage between scientist and engineer," nor for "engineer to work against engineer."

"This is not a time for a division of engineers in management from those engineers not in management," he added.

It was a time, he said, for employers to remember that to be an employer there must be employees, and for employees to remember that to be an employee there must be an employer.

"The welfare of each is a component part of the other," Col. Medland said.

## Control Forum for Toronto

"Quality — The Degree of Excellence" has been selected as the slogan for the Seventh Annual Quality Control Forum to be held at Hart House, University of Toronto on Saturday, March 5. The program includes a basic training course in statistical quality control, as well as a diversified series of lectures and panel discussion on quality control applications in industry. The Forum is sponsored by the Toronto Section of the American Society for Quality Control.

## Rudel Machinery named Canadian rep

Rudel Machinery Company Limited, Montreal, Quebec, has been appointed exclusive Canadian Sales Representative for precision, electronic welding equipment manufactured by Weldmatic Division of Unitek Corporation of Monrovia, California.

The Rudel Organization, with sales outlets across Canada, will handle the entire Weldmatic line of portable power supplies, welding heads, and welding hand pieces.

## Telcon Metals Group

The Telegraph Condenser Co. (Canada) Ltd. announce their appointment as exclusive agents in Canada for the Telcon Metals Group.

The many products manufactured by these companies include the following:

Nickel Iron alloys such as Radiometal, Mumetal, Permandur etc. available in strip, section, fabricated parts. Silicon iron laminations. Beryllium Copper alloys, safety tools, thermo-static metals. Strip wound C cores to U.S. specifications, E cores, toroids and cruciforms. Electrical resistance wires and tapes.

## Veeder-Root sales move to Toronto

Veeder-Root of Canada, Ltd., will locate its new sales and service center at 28 Fieldway Road, Toronto, it has been announced. At the same time, Veeder-Root announced the promotion of Daniel J. MacDonald to the position of manager.

The Veeder-Root operations are being transferred from headquarters in Montreal, and all members of the company staff are also making the move to Toronto.

The move to Toronto is being made to provide the company with a location closer to its customers and in an area which is experiencing the greatest industrial growth.

## de Havilland renames Guided Missile Division

The board of directors of The de

Havilland Aircraft of Canada, Limited, announces that the name of the company's Guided Missiles Division

*Continued on next page*

## DDP contracts awarded

*The following is a list of unclassified electronic defense contracts for \$10,000 or more awarded to Canadian firms by the Department of Defense Production for the month of January, 1960.*

Ampex American Corp., Ottawa, Ont., electronic equipment, \$19,634; Aviation Electric Ltd., Montreal, Que., accelerometers, \$176,000; Canadian General Electric Co. Ltd., Toronto, Ont., electronic tubes, \$33,806, electronic components, \$19,642; Canadian Marconi Co., Toronto, Ontario, electronic tubes, \$18,630; Canadian Westinghouse Co. Ltd., Ottawa, Ont., electronic tubes, \$97,920; Collins

Radio Co. of Canada Ltd., Toronto, Ont., electronic equipment, \$66,953; MEL Sales Ltd., Toronto, Ont., radar test sets, \$20,750; Northern Electric Co. Ltd., Ottawa, Ont., airborne electronic equipment, \$5,472,776; TMC (Canada) Ltd., Ottawa, Ontario, electronic equipment, \$36,754; Varian Associates of Canada Ltd., Georgetown, Ontario, electronic tubes, \$20,800.

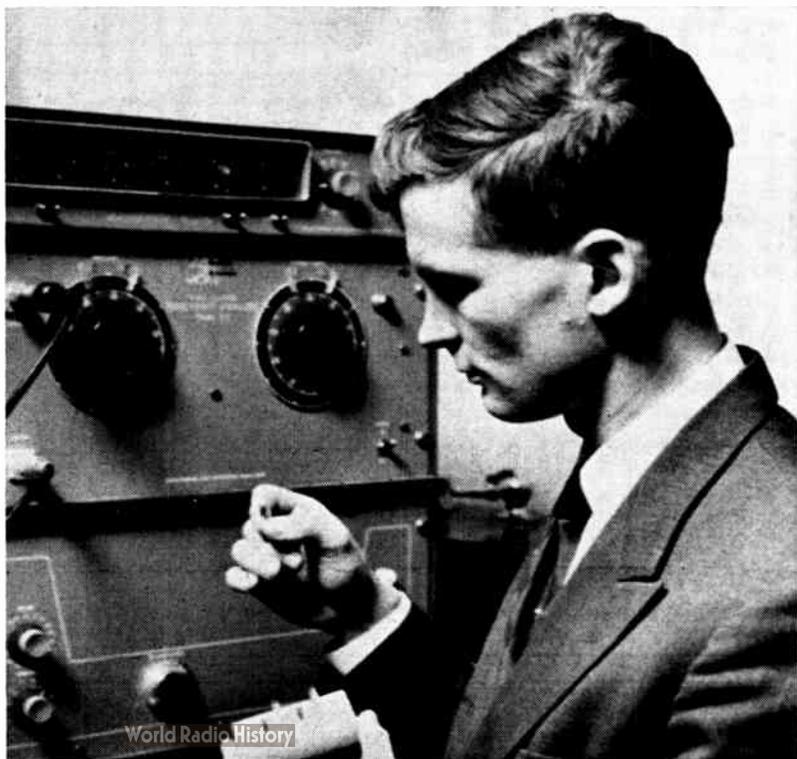
## New nuclear-particle detector offers advantages—RCA Victor

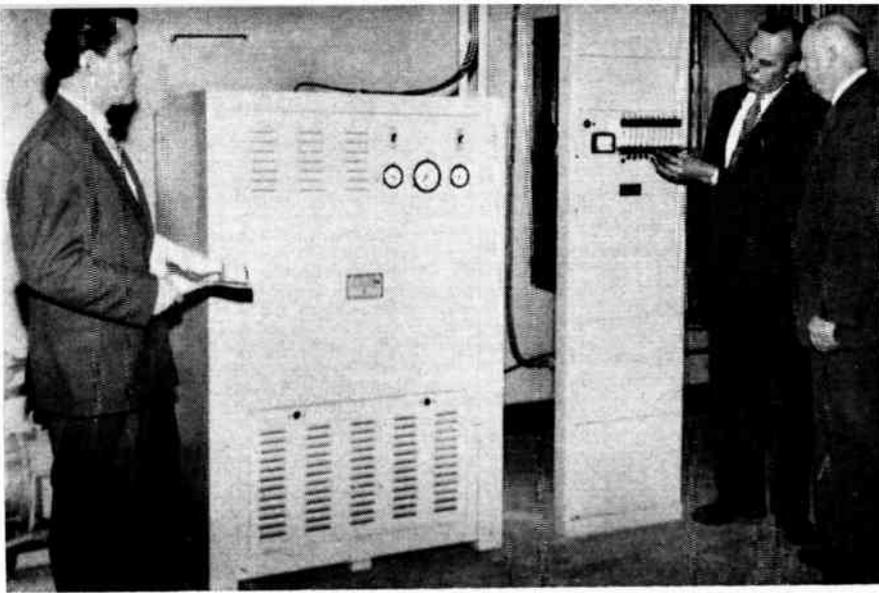
The development of a new semiconductor nuclear particle detector which has significant advantages over detectors at present in use has been announced by RCA Victor Company, Ltd. The development results from work in its Research Laboratories in Montreal which has been carried out in close co-operation with the Electron Devices Sub-Committee of the Electronic Components Research and Development Committee of the Defense Research Board and with Dr. J. M. McKenzie and Dr. D. A. Bromley of

Atomic Energy of Canada Ltd., Chalk River, Ontario.

A continuing program of research at the RCA Victor Research Laboratories in Montreal is investigating many other interesting possibilities including the detection of beta and gamma rays and neutrons with similar devices.

*Paul P. Webb of the RCA Victor Research Laboratories with a sample of the newly-announced alpha-particle detector against a background of the nucleonic equipment used in the RCA Victor tests.*





Inspecting newly installed cable pressurizing equipment at Moncton headquarters of Canadian National Telegraphs are: Benoit Lauzon, district cable inspector; J. D. Chase of the Toronto office of the company's engineering department and H. A. Marquis, superintendent of the CNT at Moncton.

## Circuit breakdowns reduced 80% by constant air pressure

A new type of equipment introduced at Moncton by Canadian National Telegraphs will provide protection to the company's vast communications network, never before allowed.

The unique equipment is used to condition air by means of a refrigeration process, for the supply of dry air to communications cables that are maintained under constant pressure.

By maintaining a constant air pressure within the cable, moisture is

unable to enter the sheath, if any defects occur, due to the air escaping under pressure. This system will reduce the number of breakdowns in circuits by 80 per cent, compared with non-pressurized cable.

While Canadian National Telegraphs has pressurized important cables for some years, rapid growth has created the need for more efficient equipment having a greater capacity than that previously used.

is changed to the Special Products Division effective January 1, 1960.

The new name reflects a changed emphasis in the activities of the Division. The Company intends to achieve diversification into the non-defense field, while continuing to provide specialized equipment for defense requirements.

Major activities of the new Special Products Division are presently concentrated in the field of infrared systems, static transistorized power supplies, thermionic and other advanced power developments, instrumentation, pneumatic, hydraulic and electrical control systems.

## CADIN operators train in Toronto

The vanguard of more than 200 Canadian electronics experts who within a year will man the CADIN radar aircraft warning stations across Canada are undergoing training in Toronto on the giant electronic data processing systems that are a vital part of the equipment used to detect and intercept enemy aircraft.

Eight men, selected because of outstanding careers in electronics, who will become instructors for 200 others scheduled for duty at the CADIN stations, have started training at Burroughs Adding Machine of Canada, Ltd., in special quarters for the project at 728 Bay Street, it has been announced by J. L. Rapmund, general manager for Burroughs.

CADIN is the Canadian counterpart of the SAGE aircraft warning system used by the United States. The same equipment is used in both systems to give both nations greater protection through full integration of the systems into a joint continental detection-warning network in the event of attack.

"Classes of 20 men each will start early next March on the 22-week course after all instructors have completed training," Mr. Rapmund said. "Applicants are now being selected from among Canadians who have had previous radar or communications training or are graduates from Canadian technical trade schools. A new class of 20 men will start each month until the full 200 have been trained."

## CGE buys stock of Montreal firm

The purchase of the capital stock of Montreal Armature Works Limited has been announced by Canadian General Electric Company Limited.

Montreal Armature Works, with 85 employees, operates from a plant with 45,000 square feet of floor space

Continued on page 53



## Defense sharing sales counter

Shown in the above photograph are representatives of the General Electric Company, Syracuse, and management and engineer personnel of the Canadian electronics industry. The photograph was taken on the occasion of the G.E. sponsored seminar held in Toronto to acquaint the Canadian electronics industry with the types of electronic equipment that General Electric is prepared to accept bids on from Canadian firms under the defense sharing program.



# EIMAC KLYSTRONS PUSHING 21,000 HOURS

## ON FIRST COMMERCIAL TRANSHORIZON SYSTEM

A Transhorizon radio telephone system—the first in the world to be commercially operated—has been in service between Kenora and Red Lake, Ontario, since July 1957. Eimac Type 3K3000LQ klystrons incorporated in the equipment, are still functioning perfectly—after well over 20,000 hours.

The Eimac 3K3000LQ is a ceramic and metal, three-cavity, magnetically focussed, power amplifier klystron, designed for use at frequencies between 610 and 985 megacycles. It will deliver a CW output power of two kilowatts, with a power gain of more than 25 db. The resonant cavities are completed through the cylindrical ceramic windows of the klystron, and all tuning is accomplished outside the vacuum envelope. This design permits a wide tuning range and allows repeated tuning cycling, without damage to vacuum seals. Eimac make reflex and amplifier klystron tubes, negative grid tubes, rectifiers, pulse modulators . . . for every type of application, from tropo-scatter to industrial heating. When you want quality power tubes, it will pay you to investigate the Eimac products.



Canadian Representative:

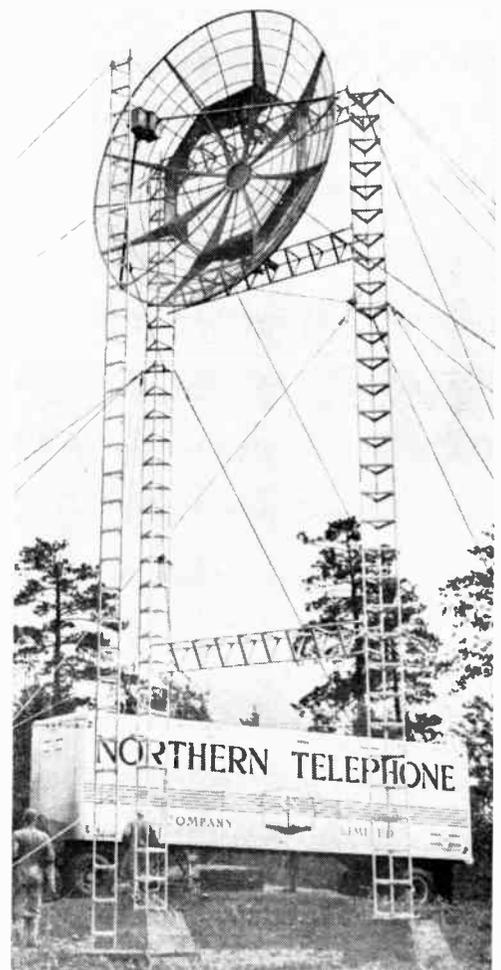
**R. D. B. SHEPPARD** 2036 Prince Charles Rd., Ottawa 3, Canada  
World Radio History

**EITEL-McCULLOUGH, INC.**

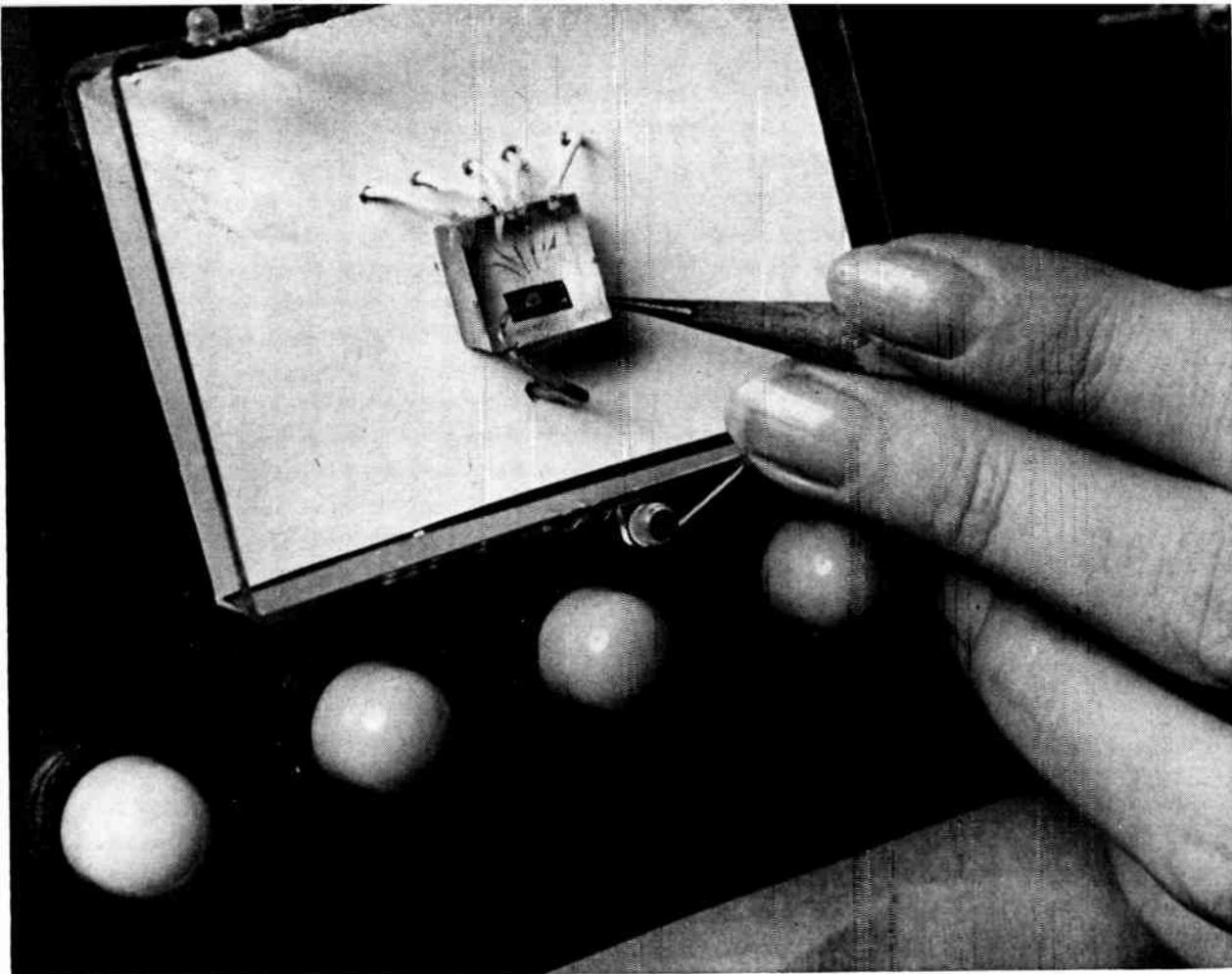
San Carlos

California

The World's Largest Manufacturer of Transmitting Tubes



One of the two 35-foot semi trailers designed and supplied by Collins Radio Company of Canada, Ltd. for Northern Telephone Company's Kenora-Red Lake system. Equipment includes Eimac Type 3K3000LQ klystrons, and Type 3X100A5 driver tubes . . . provides up to five toll quality voice channels.



*Pencil indicates a molecular electronic "OR" switch.*

## MOLETRONICS

# The concepts and capabilities of molecular electronics

*"Function blocks" are more than just components*

by Dr. S. W. Herwald\*

Efforts to elevate air and space craft to new plateaus of capability are continually made more difficult through a technical paradox. As we make these craft more sophisticated through the use of advanced electronic gear, the risk of failure among components and connections grows. And as we add this more complex electronic equipment it becomes more difficult to provide for its weight and size.

As a result, focused programs for the improvement of reliability plus weight and size reduction of electronic equipment are now underway in several locations. These problems may be approached in several ways. For example, improved reliability can be realized by better quality control on components and connections.

However, the probability of simultaneous successful operation of all components in any system is the product of all the individual probabilities of a component functioning without failure, and better quality control does not invalidate this limitation imposed by the laws of probability. Smaller and lighter components in more compact packages can be obtained by miniaturization, but such techniques, while exploiting modern technology, do not yield maximum reliability. On the contrary, the emphasis placed on size and weight reduction has usually meant that components and internal connections become so critical that they must be built with extreme precision if their failure rate is to be acceptable.

In the recent past, a substantial part of Westinghouse research and development effort has been

\* Vice-President -- Research, Westinghouse Electric Corporation, Pittsburgh, Penn.

focused on a new and quite distinct approach to both problems. It exploits a new concept in the design and function of electronic systems. In fact, it is a broader concept of electrical engineering which we call "molecular electronics" (*Electronics & Communications*, Sept. 1959) to indicate its dependence on phenomena occurring within or between domains of molecules in the solid state.

Recognizing the potential importance of this concept to defense, the Wright Air Development Division's Air Force Electronic Technology Laboratory has directed the employment of Westinghouse facilities in a program to prove its feasibility. Specific objectives were: to determine to what extent molecular electronics can be used to perform complex functions in several systems of basic importance to the Air Force; to develop sub-systems for use in those systems; and to develop new

Figure 2A — Light telemetry subsystem in which single light-responsive monolithic element delivers output whose frequency is measure of light intensity.

materials that will advance the usefulness of the concept.

As one accomplishment of the joint program, there is now being produced a variety of molecular electronic "function blocks", three of which are shown in Figure 1, as solid-state elements that achieve, entirely within themselves, electronic results such as have been gained only by assembling many, varied items of electronic hardware. Because of this, these elements are not intended as "components", as we think of transistors and tubes, but rather as "subsystems" since each of the function blocks has the ability to achieve an electronic result which is essential if all the subsystems in the entire system are to work together effectively. Examples of functions performed by function-blocks are such electronic operations as amplification, oscillation, and telemetering.

### Failure risk reduced

Because there are no internal connections or components, and the only external connections needed are those for coupling inputs and outputs to the complete system, we are able to build subsystems whose risk of failure should be equal to or less than that of familiar solid-state devices and perhaps one-thousandth of that for a subsystem built of many parts for the same purpose. This ability of molecular electronics to reduce

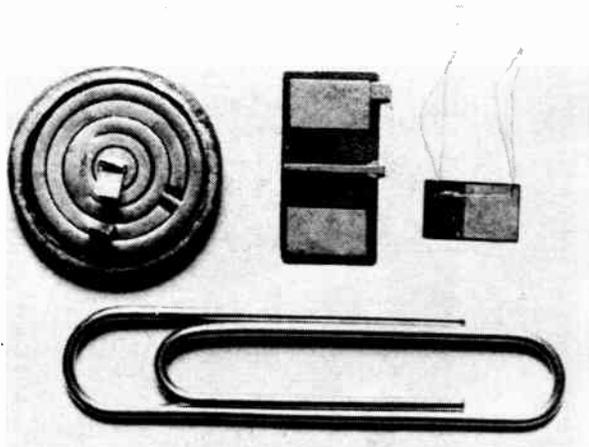


Figure 1 — Three of eight molecular electronic function blocks demonstrated as subsystems. Device bearing concentric arcs is an audio amplifier, at center is a free running multivibrator, and at right, a two-stage video amplifier.

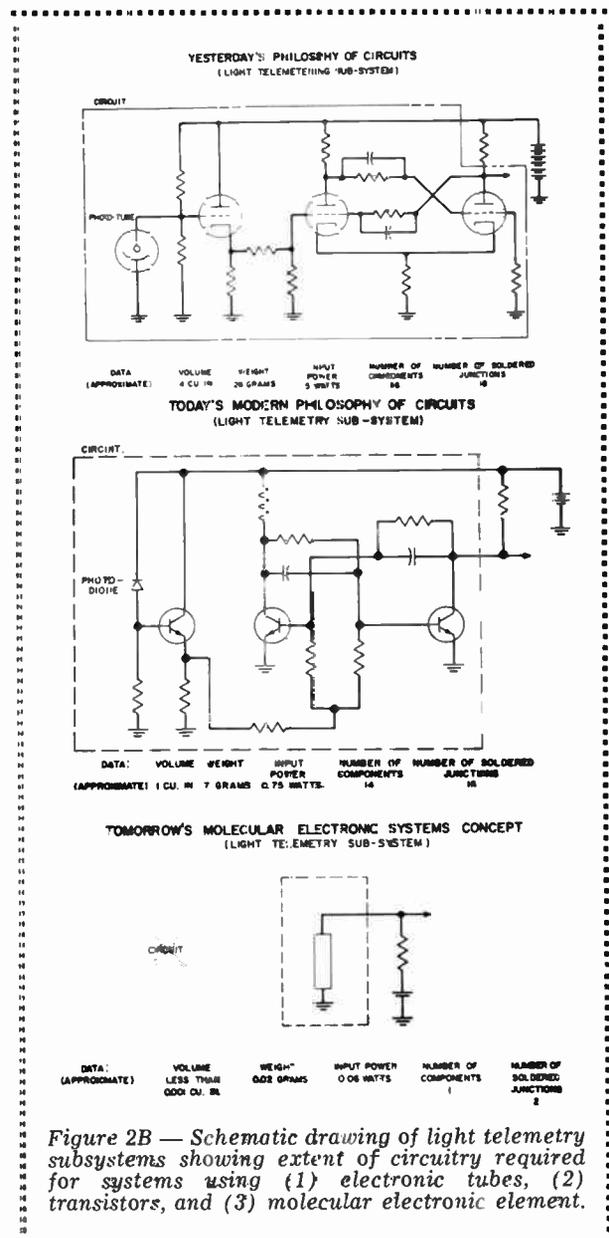
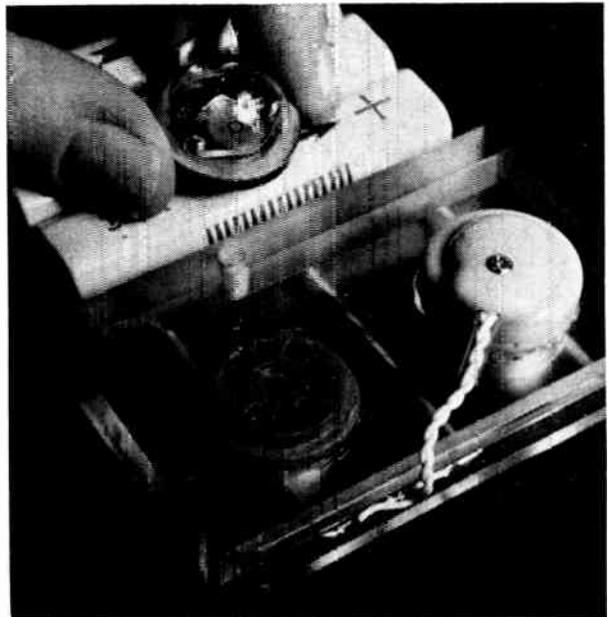
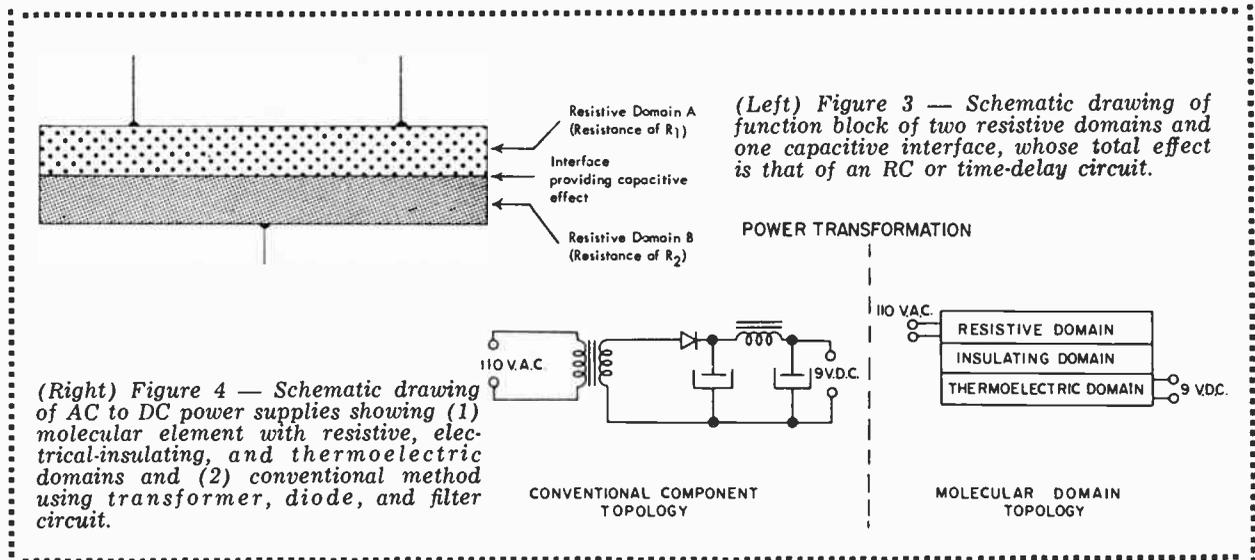


Figure 2B — Schematic drawing of light telemetry subsystems showing extent of circuitry required for systems using (1) electronic tubes, (2) transistors, and (3) molecular electronic element.



the number of components and connections required is illustrated by a comparison of three designs for a light telemetering subsystem, Figure 2A and 2B. When designed to use electronic tubes, this subsystem required 16 components and 18 soldered connections; when designed to use transistors, it required 14 components and 15 connections. In contrast, when a molecular electronic subsystem was developed to achieve the same purposes, it needed but one component and two connections.

Also, because their internal functions involve distances of the order of a few atomic spacings, these function blocks are almost microscopically small and virtually weightless. For example, weight of the light telemetry subsystems was reduced from about one ounce to one quarter of an ounce, the weight of the monolithic element to about seven ten-thousandths of an ounce.

As a result of the joint program, there have now been developed eight classes of function blocks to demonstrate the feasibility of molecular electronics at frequencies ranging from infrared to direct current. These function blocks are: (1) a 5-watt directly cascaded audio amplifier, (2) a two-stage video amplifier, (3) a frequency selective amplifier with notch filter in a feedback loop around the amplifier structure, (4) a variety of multivibrators — bistable, monostable and astable. (5) a variable potentiometer based on logarithmic addition of two inputs, (6) a variety of multi-position switches (including an "OR" switch, a multiple NPN Dynistor switch, and a multiple NPN Trinistor switch with firing electrode), (7) an analog-to-digital

converter employing an NPN relaxation oscillator, and (8) a two-stage cooler, employing the Peltier effect, covering frequencies from 1 cycle or less to 3 megacycles, for cooling infrared detectors to proper operating temperatures.

As the basis for these molecular electronic subsystems, we have a very substantial knowledge of solid state phenomena developed over the past 30 years. It is simple now to create materials having excessive positive or negative electrical charges and, by placing these materials in physical contact with related materials, to bring about such phenomena as rectification or amplification, as in diodes and transistors. Also, we can readily take advantage of the ability of radiation to cause charge paths to occur in a semiconductor material along which current will flow when the material is irradiated.

Effects of this general type are used in molecular electronic blocks by creating — usually in single crystals — a number of distinct operative domains, which can be regarded as molecular "communities" having a common civic purpose, in that each domain will sustain a desired electronic occurrence. The domains border one another at boundaries called interfaces, which are like political frontiers in their ability to initiate phenomena different from those occurring inside the molecular domains.

As a simple example in the element diagrammed in Figure 3 we see that it is composed of two domains which meet physically at one interface. One of these domains is composed of a resistive material selected and shaped to present a resistance  $R_1$  to the passage

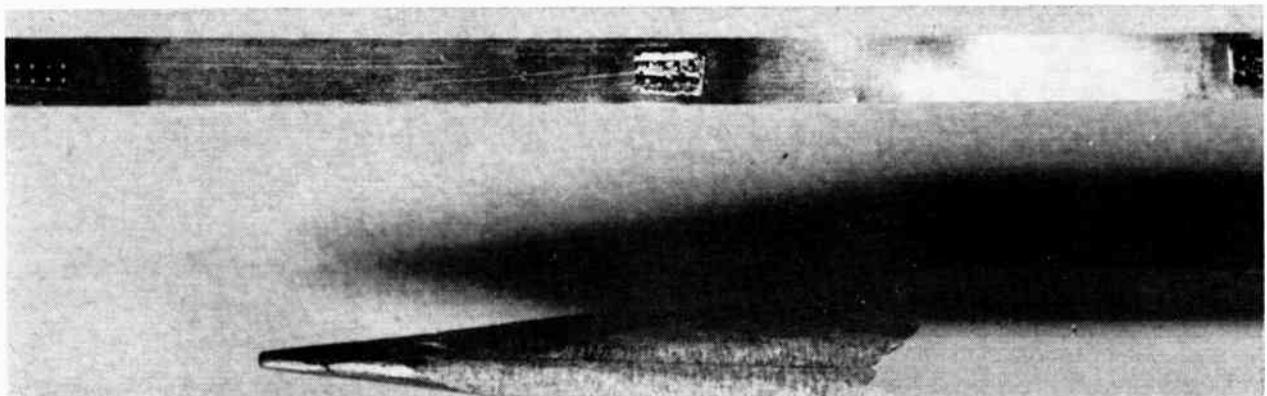


Figure 5 — Ribbon bearing multiple-junction systems on germanium crystal produced by dendrite process.

of current; the other domain is also resistive, but is so planned that it has a resistance  $R_2$ . At the interface, the interaction between domains causes a capacitive effect. Thus, in one tiny element we have a subsystem equivalent to a time-delay circuit.

Another illustration of the uses of domains and interfaces is a function block designed as an AC to DC power supply for transistor circuits. It makes use of the Seebeck effect for the thermoelectric generation of electricity to convert 110-volt alternating current to 9-volt direct current power. In contrast, the conventional circuit, Figure 4, requires five individual components — a transformer, a diode, and the inductive and capacitive elements making up the LC filter circuit. To accomplish this same purpose with molecular electronic methods, we have a function block comprised of the three separate domains. When AC power is applied to the resistive domain, the heat that is generated passes through the domain at the center — this domain is an electrical but not a thermal insulator — and into the thermoelectric domain where the energy is converted into electrical energy by the Seebeck effect. By proper control over the materials used, we provide the 9-volt DC output we desire. An interesting aspect of the power supply is that elimination of ripple as an undesirable variation in voltage is inherent since heat flows from the resistive domain to the thermoelectric domain at practically a constant rate.

As these two examples suggest, the concept of molecular electronics makes no use of the traditional circuit-and-component approach to electronics. Instead, the objective is to use our knowledge of the structure of matter to synthesize monolithic function blocks whose arrangement and composition permit each to serve as a substation to perform an electronic function in the control or transformation of energy.

To achieve function blocks with this capability, a number of effects and phenomena of the solid state are available. The only firm limitations on choice are that the effect must not react adversely on system reliability and must lend itself to consistent results when included in a function block. Methods typical of practice so far include: solid-state phenomena, such as Seebeck generation, Peltier cooling, and Hall-effect multiplication; the use of PN semiconductor junctions arranged to produce a result which would otherwise require numerous individual components; and when necessary, fabrication of circuit elements within a function block. Although such phenomena will be most often used for the control of electrical signals, they will also be suitable when quantities like electromagnetic radiation, heat, and mechanical displacement are inputs or outputs.

### Design factors

The design of a subsystem begins with the designer's analysis of the requirements of the system, to establish the functions to be performed by the function block. After logic processes are determined and suitable physical effects settled upon, a topologist — a mathematician who works with shapes — determines the structure of the block by designing, on paper, the arrangement of domains and interfaces that is to control the flow of energy in the block. The block is then produced by the materials engineers who use germanium and silicon as the basic semiconductor materials.

In producing these blocks we do not assemble them from various tiny components. Rather, we start with a basic semiconductor wafer and produce the necessary

domains and interfaces by techniques used in the production of conventional semiconductor devices, including diffusion, plating, electron beam machining, etching, cutting, radiation, alloying, and photographic processes. Although the function block so produced can now perform its function, additional processing steps are required to encapsulate the block, protect it against shock and vibration, and make it stable under the conditions of temperature and radiation it will encounter.

As we have observed, the dominant theme, the essential philosophy of molecular electronics is that we can now create, modify, and process materials to endow them with the ability to accomplish electronic tasks through solid-state phenomena. The foundation of our success has been our ability to develop new materials and to process available materials in new ways.

One important illustration of the contributions made by materials scientists is the development of a method for the rapid production of semiconductor crystals in a form that requires no removal of material to make them into suitable wafers for use as transistors or as the basic elements of molecular electronic elements. This is the dendrite process announced several months ago, in which germanium crystals in the form of ribbons about one-eighth of an inch wide and a few thousandths of an inch thick, are produced by drawing them from a molten mass. In contrast, in the conventional method, germanium crystals are grown as thick ingots, or boules, which require X-ray or crystallographic inspection before they can be sawed into precisely oriented wafers and then must be lapped, etched, and polished to obtain a satisfactory working surface. In addition to the waste of material and the cost of machining involved in the standard method, a serious disadvantage to its use for the production of molecular electronic blocks is the wide variation in characteristics frequently displayed by wafers, even by those cut from adjacent regions of a single ingot and processed identically. In the production of transistors, this difficulty can be circumvented by testing a production run to select those with proper values. In molecular electronics, however, it is necessary to build junctions in adjacent portions of the same crystal; thus it is essential to have materials whose characteristics are uniform if the yield is to be acceptable.

Other advantages of this dendritic method of importance to molecular electronics are these:

It is essentially a continuous process in which the germanium ribbon grows at a rate of 6 to 12 inches per minute and in the precise direction of crystal growth we require for application. Thus, no X-ray or crystallographic examination is necessary, and the surfaces of the ribbon are always correctly oriented, optically flat, and immediately usable as working surfaces. An additional advantage is that if a contaminant enters the melt during the process, the resulting inclusion is "self-healing" so that when the process is completed, the affected portion can be cut away and the unaffected portion put to use.

### Transistor growing techniques

Now, although this dendritic method has immediate usefulness in molecular electronics today, we are confident that its greatest significance is its ability to bring about a number of completely new processes for producing functional blocks. We are now most interested in a recent modification which makes it possible and practical to carry out diffusion, plating,

*Continued on page 30*

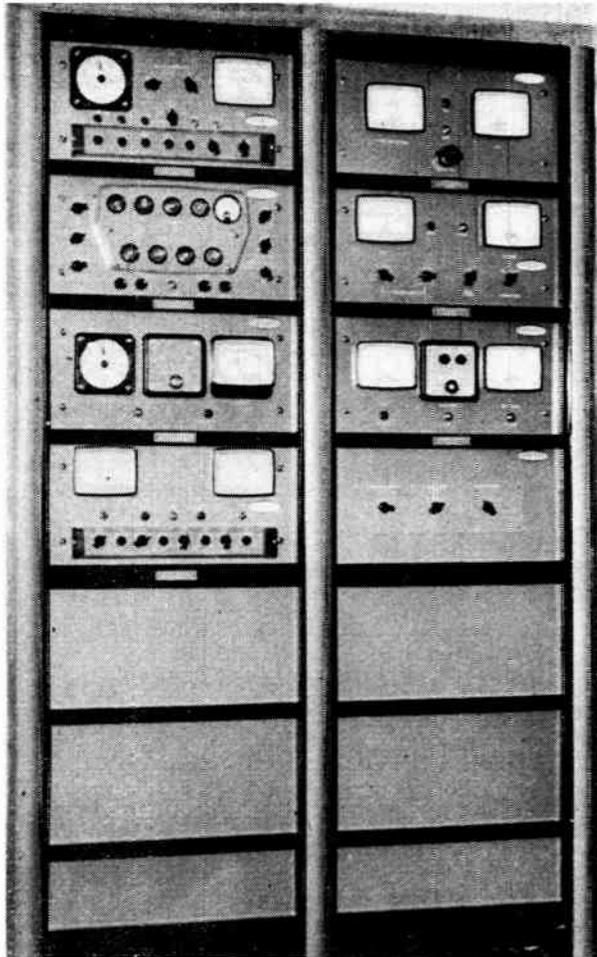


Figure 3 — Cabinet of transistorized nuclear control instruments showing the compact arrangement obtainable by the use of these devices.

*Enhanced reliability is obtained from reactor instruments incorporating transistor circuits*

by G. G. BALLARD\*

About three years ago, the availability and technology of transistors had advanced to the point where it became practical to consider the use of these solid state devices in such critical systems as reactor control, and the following report describes the application of these techniques. In this system valves are used only in essential circumstances.

The equipment discussed is suitable for measuring and controlling reactor power over a wide range of neutron flux, low power measurements being made by pulse counting equipment whilst at higher power levels direct current measurements are made possible by the use of ion chambers. Fail to safety requirements are met on all equipments which directly govern reactor safety. All such units provide switched outputs which may be used to shut down the reactor in the event of an excess neutron flux.

The range of input current within the operating

\*Chief Engineer, Elliott Nucleonics Ltd., London, England.

## NUCLEONICS

# Transistor techniques for reactor control instruments

Detector	Instrument Components	Output
BF <sub>3</sub> Counter	Pulse Amplifier Discriminator Log. Ratemeter Period Meter Trips EHT Supply	1. Log. Counting Rate 2. Period 3. High and Low Level Alarms
Compensated Ion Chamber	Log. DC Amplifier Period Meter Trips H. T. Supplies Low Voltage Trips	1. Log. Neutron Flux 2. Period 3. High and Low Level Alarms
Uncompensated Ion Chamber	Linear DC Amplifier HT Supply Low Voltage Trip	Linear neutron flux or deviation from demanded flux
Uncompensated Ion Chamber	Shut down Amplifier HT Supply Low Voltage Trip	Excess Flux trip — N.B. must "fail safe" as far as possible

Figure 1 — Typical Flux Measuring Channels

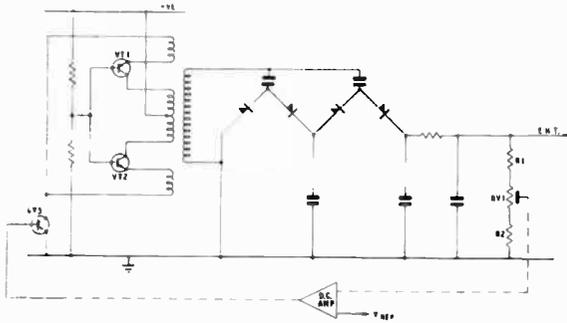


Figure 2 — Stabilized E. H. T. generator.

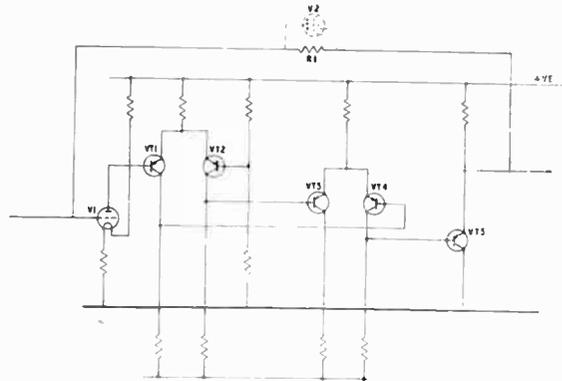


Figure 4 — DC amplifier.

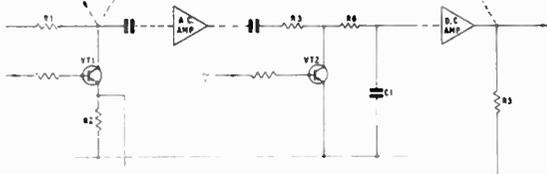


Figure 5 — DC chopper amplifier.

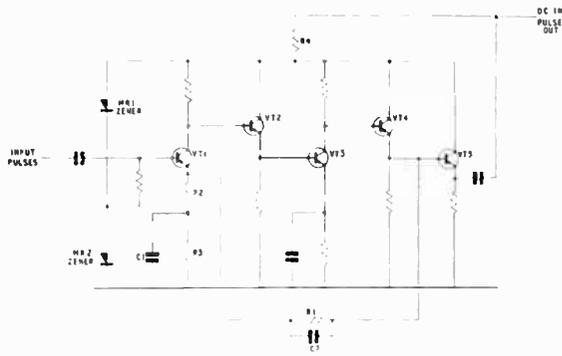


Figure 7 — Pulse amplifier.

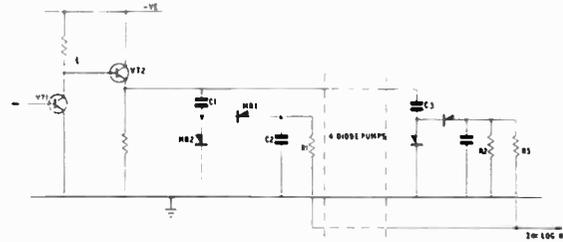
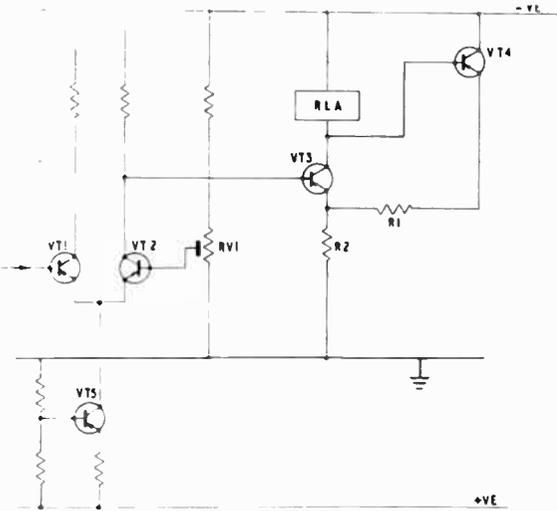


Figure 9 — Logarithmic ratemeter.



limits varies from  $10^{-12}$ A. to a maximum of  $10^{-4}$ A. whilst the pulse channel count rate varies in the range 10 counts per second to a maximum of  $5 \times 10^5$  counts per second. In terms of neutron flux using conventional detectors this would correspond to 3 neutron/cm<sup>2</sup>/sec. to a maximum of  $10^{10}$  neutrons/cm<sup>2</sup>/sec. at the measuring point. The total coverage of 10 decades of neutron flux is made possible by the use of both logarithmic and switched linear range instruments.

The table (Figure 1) gives examples of how complete channels may be formed.

The use of transistors makes possible an indefinitely long working life since, unlike valves, transistors are not subject to gradual deterioration. Coupled with this, the transistor circuit, in general, consumes approximately one-hundredth the power of its valve counterpart and, since the space occupied is also reduced by a factor of approximately ten, it follows that the heat per unit volume is only one-tenth of the valve equivalent. Because of these facts an enhanced reliability is obtained from reactor instruments incorporating transistor circuits.

In order to obtain the maximum flexibility to meet the varying requirements of reactor instrumentation, the equipment described was designed in the form of a series of plug-in sub-units as shown in Figure 2. These comprise a large number of "building bricks", each brick forming a small but complete section of the whole instrument. By a careful selection of the circuits used to form each "brick", it is possible with a minimum of different component parts to form one of the measuring or control channels shown in the table (Figure 1) and any additional features can be readily incorporated by adding an extra "brick" unit.

The individual building bricks are housed within a standard 19" rack mounting case, the case being made to contain a maximum of 24 narrow width bricks, or any combination of narrow or wide units. The front panel of the case is manufactured to suit individual reactor requirements, in that the meter display or controls required are not in any way predetermined. A typical arrangement of the case with individual brick units in position is shown in the lead illustration. Due to the simplicity of construction the case may be manufactured to be bench standing whilst still retaining all standard features.

In general the building bricks fall into two main groups, those which are employed for direct current measurements and those for pulse counting purposes. Within the group used for DC measurements there are several types of amplifier whose design is fundamentally related to the input sensitivity required. Usually transistors are not suitable for low current measurement from high impedance sources, and under such conditions it is normal to employ one valve. An electrometer is used in conjunction with transistors to form a complete DC amplifier and such an amplifier is shown in Figure 4. In practice it is arranged so that any drift on the output is a function only of valve drift. This is achieved by the use of silicon transistors which are employed in balanced pairs and initially have a small collector leakage current. This amplifier may be arranged to detect currents as low as  $10^{-12}$ A. to an accuracy of 1 per cent, the limit being set by the voltage drift of the electrometer valve.

The basic amplifier shown in Figure 4 may be arranged to form a switched linear channel by selecting the value of the feedback resistor R1 over a range of say six decades. Under these conditions the input of the amplifier becomes a "virtual earth", the input

impedance being equal to the value of the feedback resistor divided by the loop gain of the system. In this manner, since the input cable capacity is shunted by the effective input resistance, the response time is quite small.

In order to convert the amplifier to a logarithmic unit the feedback resistor R1 is replaced by a logarithmic element, in this case diode V2. When connected in this way the unit provides logarithmic coverage over seven decades from  $10^{-11}$ A. to  $10^{-4}$ A. For period signal applications the input is connected via a capacitor. Any input signal is thus differentiated and the output becomes a function of the rate of rise of reactor power.

When lower voltages drifts are required or when the input current is in excess of  $5 \mu$ A. an AC carrier type of amplifier may be employed. This system is shown in Figure 5. A transistor is used as a signal modulator. Under these conditions any DC input is earthed on alternate half cycles of a reference supply applied to the base of the input modulator, resulting in an AC signal of peak to peak amplitude proportional to the input current. The AC signal is amplified and detected by VT2. Overall DC feedback is provided using R6

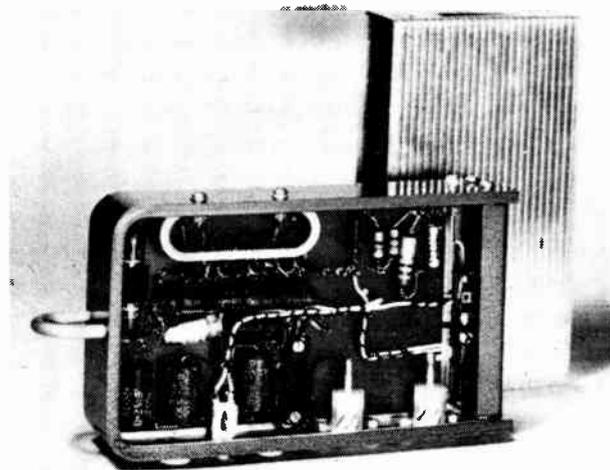


Figure 11 — Transistor voltage converter.

in order to achieve a high degree of stability and linearity.

When it is required to detect a small voltage input as opposed to a current input the feedback is applied using R5 and R2, the values of which are chosen to provide the correct scaling factors.

Using this type of DC amplifier the voltage stability may be maintained below  $100 \mu$ V. whilst the current stability is normally  $10^{-6}$ A. The system is thus suitable for a large number of applications from switched linear channels of relatively high currents to thermocouple inputs. In order to form a shut down amplifier it is only necessary to inject a reference at the input terminal, this signal serving to "back off" the independent variable input. When both become equal the output of the amplifier reduces to zero and can be made to cause a trip relay to de-energize.

### Pulse counting equipment

A general pulse counting channel is given in Table 1 and is shown schematically in Figure 6. Reference to this Figure will show that the channel employs brick

*Continued on page 28*

# A low conductivity magnetic flowmeter

*Simple design changes extend range of magnetic flowmeter system*

by DOUGLAS R. LYNCH\*

Use of magnetic flowmeters in process control systems has been limited in the past to liquids of relatively high conductivity. To better understand techniques recently developed to extend this range of application, it would be well first to review the operation of a typical present day system.

Essentially, a magnetic flowmeter system consists of a primary flow transducer and secondary amplification instruments. System performance depends on both these elements. This entire assembly behaves like an AC generator in which the conductive liquid serves as the driving armature. The equation relating flowrate to the induced voltage may be written as

$$q = KD (E_o/B)$$

where  $q$  is the volume flowrate,  $K$  a meter constant,  $D$  the diameter of the meter,  $E_o$  the induced voltage, and  $B$  the flux density of the magnetic field. The derivation of this equation is rather straightforward and need not be reviewed here. The equation shows, however, that for a given meter size, volume flowrate depends only on the relationship between the induced emf and the flux density and is completely independent of the many variables which normally affect the operation of conventional head meters.

In practice it is difficult to maintain a constant flux density  $B$ , but it is relatively simple to maintain the  $E_o/B$  ratio. Generally this is accomplished by using the output of a transformer (connected either in series or in parallel with the field coils) in conjunction with external dividing networks to produce a reference voltage. Then, any disturbance which affects the flux density will similarly affect the signal voltage.

Experiments have shown that the meter co-efficient  $K$  is essentially constant provided that the magnetic field is uniformly distributed and the fluid conductivity remains above the minimum threshold. Hence the meter is fully independent of Reynolds number.

## Secondary instruments

Figure 1 shows a complete system using a special servo-driven null-balance potentiometer. The emf generated at the meter goes directly to high impedance balancing transformers. The balancing signal from the current transformer in the meter is operated on by a balancing network in the servomotor panel before being applied in phase opposition to the flow signal in the differential amplifier. That portion of the available balancing signal to be applied as a comparison voltage against the flow signal is a function of the angular displacement of the closed-loop servosystem from a null

\*Fischer & Porter Co.

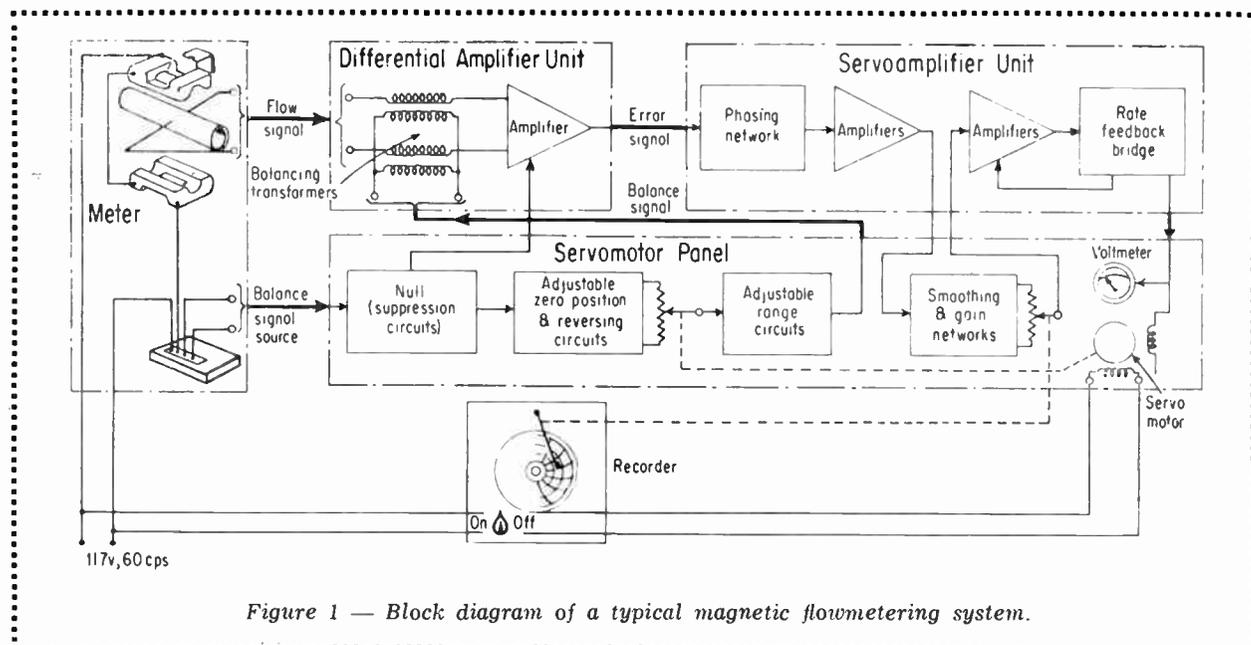


Figure 1 — Block diagram of a typical magnetic flowmetering system.

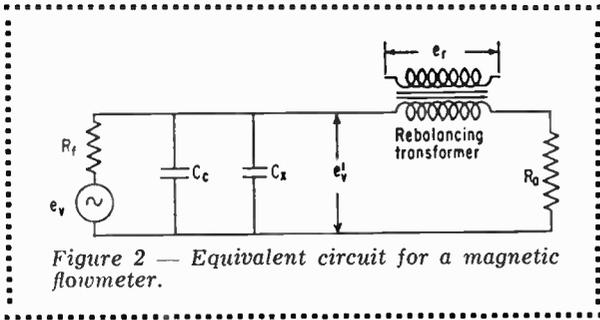


Figure 2 — Equivalent circuit for a magnetic flowmeter.

or balance position. The balancing network also provides a suppression voltage for unwanted longitudinal pickup and quadrature voltages that appear on the high impedance transmission cable or in the primary meter electrode leads. This suppression voltage is introduced to the differential amplifier unit for pickup cancellation. The error signal then enters the high gain servoamplifier which boosts it to a level sufficient to drive the servomotor, provides a phasing adjustment to maintain proper phase relationship with the servomotor, applies rate-feedback to prevent overshoot, and also permits external gain adjustment. The amplified error signal then passes to the servomotor which mechanically positions both the recorder pen and the potentiometer in the balancing network. When the balancing signal equals the flow signal, the system will be in balance.

### Lowering the conductivity threshold

A liquid conductivity of  $20 \mu$  mhos per cm has been suggested as a practical minimum for magnetic flowmeters. This figure however includes a wide safety margin since tests under laboratory conditions have shown that conductivities as low as  $1.57 \mu$  mhos produce little change in the flow co-efficient.

Figure 2, an equivalent circuit for a magnetic flowmeter, illustrates the approach taken in developing a system for even lower conductivities. Since the input impedance of the differential amplifier  $R_a$  poses no loading problem, and further, since the resistance of the fluid  $R_f$  is the quantity to be determined, these values need not be varied. The clue to lower conductivity thresholds, then, lies in reduction of cable capacitance  $C_c$  and transformer capacitance  $C_x$ .

As a first step, the balancing transformers were

moved from the secondary instrumentation to the vicinity of the primary. Maximum allowable cable length was set at 20 ft. Next, residual cable capacitance was minimized by using twin shielded electrode cables and allowing the outer shields to serve as electrostatic shields while the inner ones are driven to the same potential as the center conductor by the rebalancing voltage. This technique neutralizes the capacitive loading between center conductors of the two leads. A circuit analysis showed that maintaining the inner shields at a slightly higher potential than the conductors would also neutralize the remaining transformer capacitance.

In today's "high-conductivity" systems the problem of quadrature voltage is eliminated by use of phase-sensitive components. However, with higher fluid resistances the phase of the quadrature shifts so that some in-phase component is added to the signal. The next step was to add a second servosystem, phase-sensitive to quadrature voltage alone. The rebalancing voltage then serves a second purpose in that it also drives the inner shields to the same quadrature potential as the center conductors, thus maintaining quadrature voltage in its proper phase relationship.

Finally, a considerable reduction in noise interference and zero stability problems has been brought about by 1) development of a transistorized differential amplifier and power supply, 2) careful attention to special noise producing circuit details, and 3) lifting all intermediate grounds in favor of a single-point grounding system.

While the changes described above have produced a magnetic flowmeter system capable of handling liquids with specific conductivities as low as  $0.1 \mu$  mho per cm (or about one-tenth the conductivity of distilled water), they have by no means exhausted the possibilities of further improvement in the near future. The present limit, like its  $20 \mu$  mho predecessor, provides a wide safety margin; it too is subject to considerable reduction under laboratory conditions.

### Transistor techniques

Continued from page 26

units of both DC and pulse form. The area contained within the large dotted square is built in one rack mounting case whilst the head unit is manufactured for use as a remote unit.

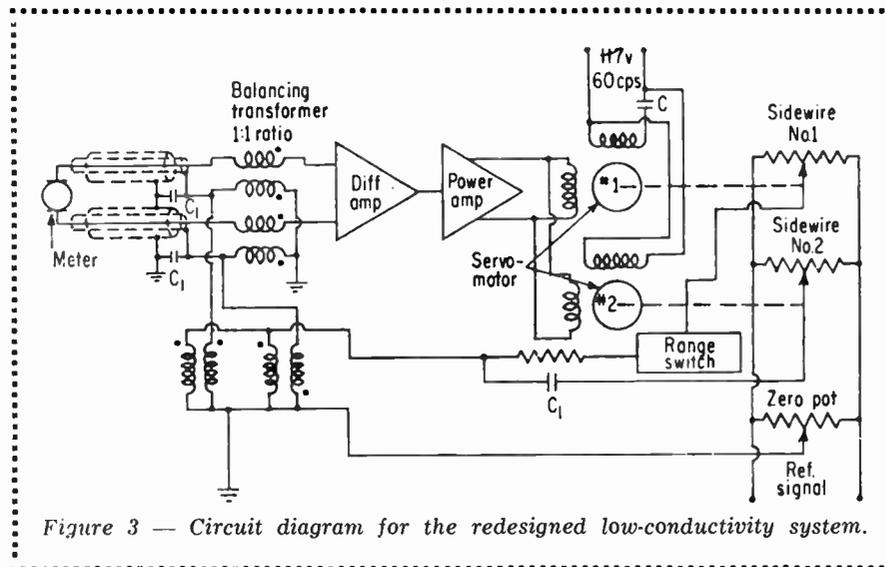


Figure 3 — Circuit diagram for the redesigned low-conductivity system.

Each pulse amplifier brick unit is identical in form and houses a feedback amplifier having a gain of 50 times with a bandwidth of some 3 Mc/s. Although primarily being used as an AC amplifier, the unit is directly coupled, the DC gain of the unit being made less than unity. In this way stabilization of the transistor operating points is achieved and large temperature changes cause only very small variations in bias potentials. The circuit is shown in Figure 7 and, as can be seen, the basic system employs a "ring of three". Although the conventional "ring of three" is

modified by the insertion of emitter followers between amplifying stages. By this means the large base capacity of the amplifying stages is prevented from shunting the preceding stage.

The actual gain of each unit is determined by the feedback components R2 and R1, whilst the correct transient response is determined by C2. Although the input impedance of 10 k $\Omega$  is low compared with an equivalent thermionic amplifier, it is of no consequence since the equipment is actually measuring charge per input pulse. By careful design the noise charge sensitivity can be made as low as  $5 \times 10^{-15}$  coulombs and the signal to noise ratio does not deteriorate rapidly for increase of cable length between the detector and head amplifier since both the pulse and noise are reduced in a similar manner. This may in some cases provide a significant saving on equipment involved. A further feature of the transistor head amplifier is that the output pulse may be carried on the same cable conducting the power supply to the unit. This is illustrated in Figure 7 by the use of resistor R4, which under normal circumstances would terminate the cable.

For applications involving either proportional or fission counters, three of these amplifiers would be cascaded. Differentiating and integrating time constants would be provided between stages to prevent "pile-up" effects and to reduce any alpha count contributions from the fission counter.

The output pulses from the amplifier are fed to a pulse height discriminator which serves to distinguish between counts due to noise components and those arriving from neutron flux. The discriminator comprises a Schmidt trigger circuit shown in Figure 8, and the paralysis time of such a circuit using conventional transistors can be reduced to 0.5 microseconds. The resulting rectangular output pulse of 2.5 V peak amplitude may be used to drive the logarithmic ratemeter shown in Figure 9.

The log ratemeter comprises a pulse height defining stage followed by a series of diode pump circuits. Each pump employs silicon diodes in order to obtain low leakage characteristics and has a built-in response time defining network, C<sub>2</sub>R<sub>1</sub> etc. In this way the response of the unit may be made variable over the entire logarithmic range. The output currents from each of the diode pump sections are summed to provide a continuous indication of count rate over a range of some 5 decades. The current at full scale deflection is 50  $\mu$ A., and for convenience this is amplified by the use of an electrometer/transistor amplifier, described earlier, to form a full scale output of 5 volts.

### DC trip units

In order to provide trips and alarms for high flux, low flux and period signals it is necessary to provide units which will monitor the DC output voltage either from the ratemeter amplifier or any DC output dependent on flux levels.

These trip units take the form shown in Figure 10 and basically comprise a comparator stage using two transistors connected as a "long tailed pair". The common emitter current is determined by VT5, which provides a constant current high impedance source.

The independent variable signal corresponding to flux or period information is connected to one base whilst a reference signal, preset to the trip level required, is connected to the second base. A trigger circuit VT3 and VT4 is driven from the output of the comparator. Under safe conditions RLA is energized

*Continued on page 30*



*First gravity profile of major segment of earth measured. John B. McClusky, marketing engineer with Lundberg Explorations, receives records made of changes in the earth's gravity. Holding the gradiometer is Wally Hobbs, chief electronic technician, and handing over the records. Lloyd Leach, laboratory chief.*

## BUSINESS

# Canadian gradiometer goes on world tour

The world's first airborne gravity gradiometer, after being unveiled and successfully demonstrated to leading international scientists, is being sent abroad for further demonstrations. It is scheduled to be shown shortly in Paris, Stockholm, Mexico City, Houston and New Orleans. Other demonstrations are planned.

A classified instrument which is closely guarded, the gradiometer has already proved effective in hitherto unannounced major aerial surveys throughout North and South America and Africa.

Scientists say the gravity gradiometer will be a vital aid in: 1. The search for essential oil, gas and minerals by providing fundamental gravity data revealing geological structure. 2. The determination of the true shape of planet earth necessary for the navigation of nuclear submarines, intercontinental ballistic missiles, rockets and "space ships".

Dr. Hans Lundberg, internationally recognized geophysicist for a quarter of a century, demonstrated the device to the recent first International Symposium of Arctic Geology in Calgary sponsored by the Alberta Association of Petroleum Geologists. Scientists there said the gradiometer will be extremely valuable in the Canadian Arctic. The Canadian Government recently announced a crash program to map the continental shelf of the Arctic and survey the natural resources of the Arctic islands, about which it is recognized the U.S.S.R. knows more than Canada does. Vast concessions have recently been granted in the Canadian Arctic to petroleum exploration companies.

The gravity gradiometer was flown to Calgary from Toronto in one of the survey aircraft operated by Lundberg Explorations Limited. En route the gradiometer recorded changes in the earth's gravity in the mineral-rich Precambrian Shield and across the sedimentary basin of Western Canada to the Rockies.

# The concepts and capabilities of molecular electronics

*Continued from page 23*

and evaporation processes directly on the crystal as it grows from the furnace melt. With this technique, we are able to create semiconductor devices ready for the attachment of leads. One of the first uses has been to grow transistors in the form of a long germanium crystal.

When the ribbon-like crystals are cut into segments, only simple processing is needed to produce transistors at a yield very near 100 per cent. By this method we have produced lengths of ribbon along which small multiple-junction subsystems are distributed, Figure 5. Since these ribbons can easily be processed to become a long series of tiny amplifiers, it is not at all facetious to say that this ribbon can be snipped into lengths to give us amplifiers of whatever gain we desire.

A more recent and extremely significant achievement resulting from our research is that we have now discovered how to grow multizoned crystals as dendrites, directly from the furnace melt. We regard this development as a major event in new technology of molecular electronics. It makes available to us basic building blocks having at least three layers of zones and two interfaces. Thus it will no longer be necessary to perform many operations to create multizone elements.

In considering the implications of this basic method for crystal growth, one most interesting possibility is that it will prove practical to combine our ability to grow multizoned crystals with our ability to perform operations on the crystal at the time it is growing in the furnace. Admittedly, to achieve near-automatic production of semiconductor devices and molecular electronic function blocks is a long-range objective, but it is probable that we will eventually be able to "grow" from a pool of molten semiconductor materials some items of electronic equipment that today are of the order of complexity of radio receivers and amplifiers.

Fortunately to achieve these and other objectives,

we are not forced to rely on "wild-cattling" methods of prospecting for new materials. Instead, present programs of planned research will yield solutions to such problems as the development of materials that will withstand very high temperatures and intensive radiation and the development of function blocks that will have high power handling capacities.

Investigation now underway with the so-called 3-5 compounds supports our approach to the development of heat- and radiation-resistant materials. And our ability to produce large, perfectly flat working surfaces on crystals of germanium will be basic to increasing the power-handling capacity of molecular electronic function blocks.

Turning now from materials development for a few summary comments, we at Westinghouse are confident that the urgent need for light, small, and highly reliable electronic systems can be answered by application of the molecular electronic concept. At first, of course, application will be limited by cost and the necessities of defense to uses where the need for reliability, lightness, and compactness is greatest, as in airborne systems; later, as we gain experience in developing and fabricating molecular electronic blocks, they will find application in land-based military equipment and, ultimately, in commercial and industrial applications.

Although there was a 20-year interval between the invention of the vacuum tube and its first significant application, and an 8-year interval between the development of the transistor and its first uses, it is almost certain that no such delay is likely for molecular electronics. In my opinion, in three to five years we will see the molecular electronic concept widely applied in air/space electronic systems for such important applications as telemetering, fire control guidance, communications, counter weapons, and flight control systems.

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## Transistor techniques for reactor control instruments

*Continued from page 29*

and is caused to de-energize when the reference signal exceeds the present trip level.

### EHT supply units

In order to provide the necessary polarizing voltages for the various detectors it becomes necessary to generate EHT supplies. In general these supplies must be capable of operation over a voltage range of 200 V up to 2.5 kV. When the supplies are used to polarize ion chambers, an unstabilized output is adequate, since the chambers are usually operated at three times the voltage required for 90 per cent collection.

Figure 11 shows a transistor voltage converter. The unit comprises a push-pull oscillator. The amplitude of oscillation may be manually adjusted by inserting a variable resistor in place of VT3. Under these conditions the AC waveform on the transformer secondary is controlled so that the resulting DC output from the voltage multiplier is varied from 200 V to 2.5 kV. When the equipment is used with a proportional counter the

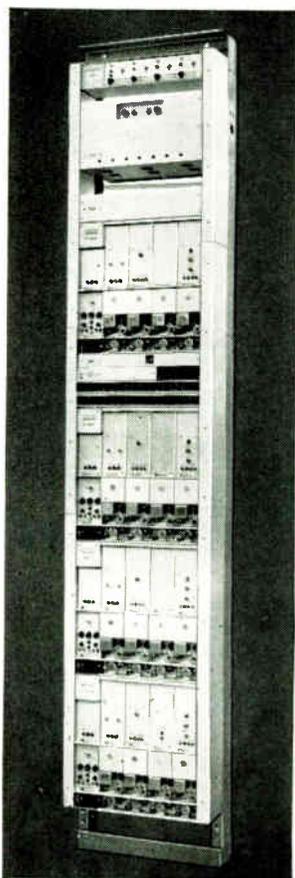
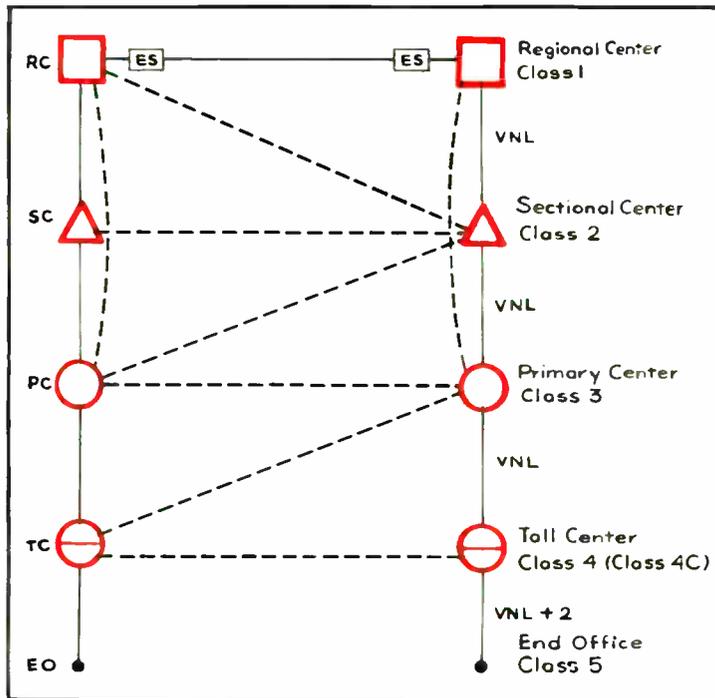
DC output voltage is stabilized by comparing it with a fixed reference signal. Any error between these signals is amplified and used to control the oscillator. If required, the DC trip units may be used to monitor the EHT unit and form a tell-tale for broken ion chamber leads in addition to actual EHT failure.

### Complete system

By utilizing the building bricks described above it becomes possible to form a complete reactor instrumentation which is both reliable and compact in addition to demanding a minimum of power to operate. The entire system of five complete channels — DC linear, DC logarithmic, DC drift power, DC shut down and pulse channel — consume only 40 VA. Since the supply requirements are small in power and voltage, it is quite possible to drive the units directly from batteries. This feature can form a considerable simplification where emergency supplies are concerned.

**Maintain**  
**OBJECTIVES**  
**not**  
**EQUIPMENT**  
**with**

*Lenkurt* **45C CARRIER**



Meeting Via Net Loss objectives involves, among other things, the reduction of regulation error to the absolute minimum. The equipment used must be capable of precise regulation in order to minimize channel net loss variations.

In a properly engineered system, Lenkurt's 45C open-wire carrier equipment will automatically maintain channel drop levels to within  $\pm 1.0$  db over a wide range of line conditions. The achievement and maintenance of this close a tolerance demands the use of pilot regu-

lators both on the system and on each individual channel. The slightly higher cost involved in this approach will pay substantial long-term dividends in improved performance and reduced second-order costs.

In addition to superior regulation, the highly flexible 45C systems provide such features as transistorized repeaters which permit operation from a 48V source, and interchangeable terminal and repeater common equipment.

**Complete information on Lenkurt 45C carrier is available from your nearest Automatic Electric office.**

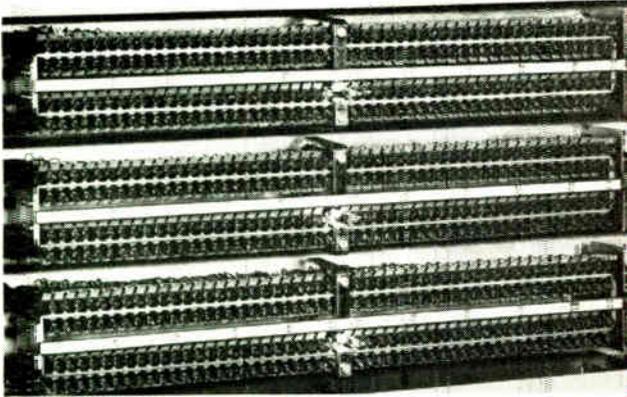
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**AUTOMATIC ELECTRIC**

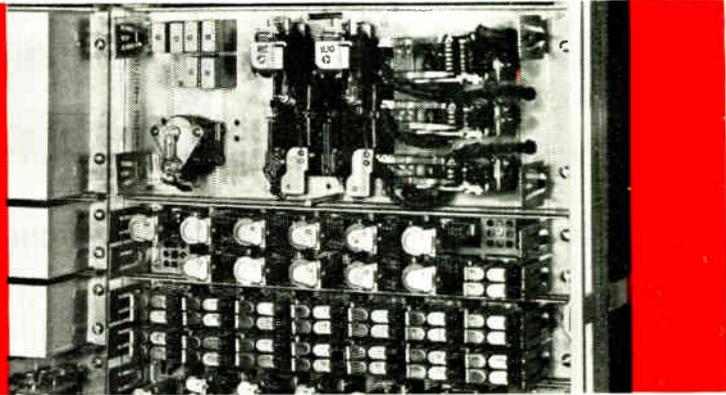
Subsidiary of  
**GENERAL TELEPHONE & ELECTRONICS**



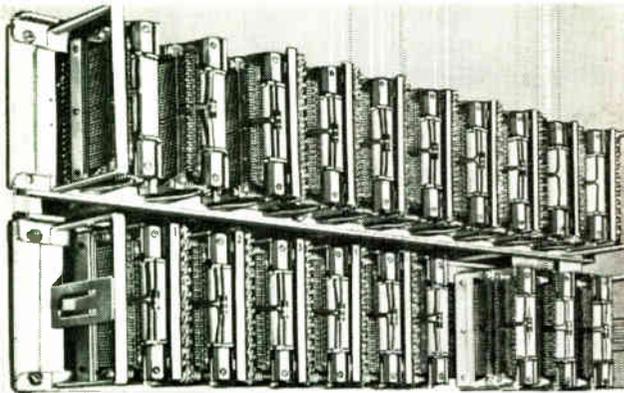
# your next step to



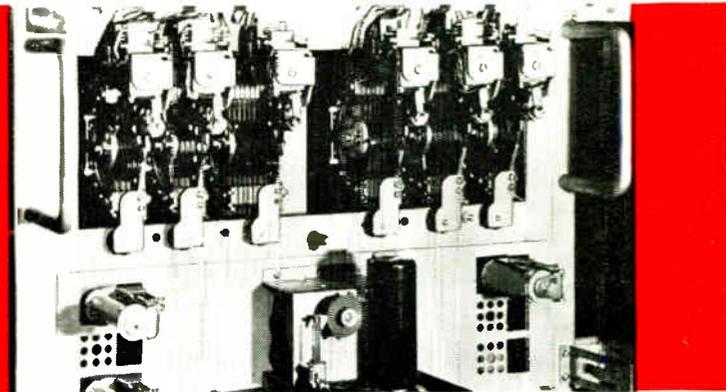
**1** Detector provides positive identification of calling lines—and of calling party on party lines, even up to 10-party.



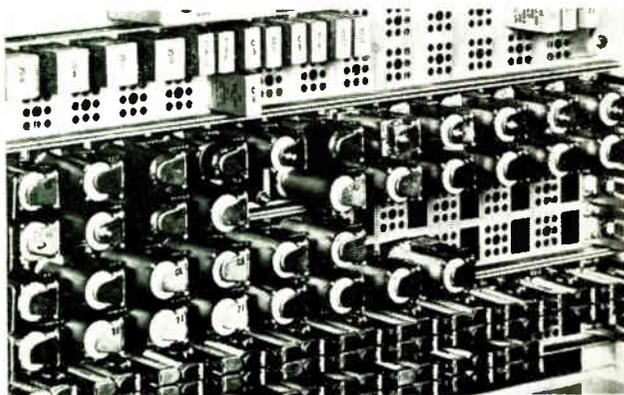
**2** Ticketer remembers calling and called numbers and registers length of conversations. Data is stored electrically until call is completed.



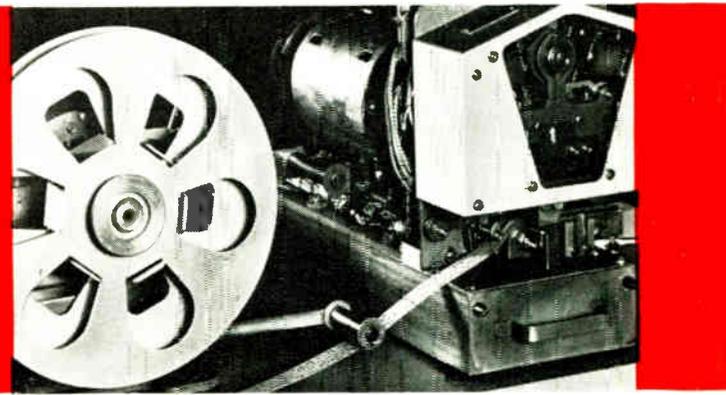
**3** Translator determines best possible route for call, works closely with Transender (not shown) which channels call to destination.



**4** Dater-Timer registers date and time of each call. Adjusts automatically for number of days in month, and for day and night rate changes.



**5** Tabulator automatically collects and records all data from Ticketer and Dater-Timer. Passes data to Tape-Perforator.



**6** Tape-Perforator punches permanent, visible record on tape of all completed calls. Tape data is then used to prepare subscriber toll tickets.

For complete details check No. 7 on handy card, page 51

# greater revenues...

## **STROWGER** **AUTOMATIC** **TOLL TICKETING**

More and more people are making long-distance calls—in every part of Canada. And every month long-distance calls are accounting for a higher proportion of telephone revenues.

One way of coping with the extra work is to take on additional staff. The modern, low-cost, efficient way is to have the job done automatically—by SATT.

SATT cuts your handling costs because it's much faster in operation than even the most experienced operators.

It provides faster completion and recording of calls because it's fully automatic.

It eliminates all likelihood of error, assures positive identification of all calling numbers.

Because customers enjoy dialing their own long-distance calls, and appreciate the much faster operation and the privacy SATT provides, many more toll calls are made—and your revenues soar!

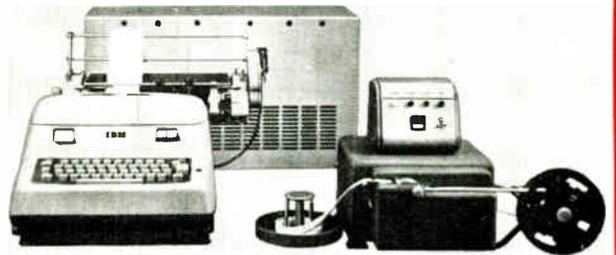
SATT ensures that a maximum number of trunks are available during peak hour loads, an idle ticketer is always standing by ready for the next call.

With SATT, data can't be erased! You get a permanent, readily visible record of every completed call.

Only SATT throws out incompleting calls before the tape is made, so your equipment is *never* tied up needlessly.

And SATT's extreme flexibility means you can add the equipment you need, *as* and *when* you need it, efficiently *and* economically.

For the full story on SATT and what it can mean to *you*, call or write any Automatic Electric office today.



**7** SATT Ticket Printer enables even small exchanges with limited toll revenue, to process SATT tape data economically. Printer records tape data on pre-printed toll tickets which identify each item on bill.

## ***AUTOMATIC ELECTRIC***



Subsidiary of  
**GENERAL TELEPHONE & ELECTRONICS**

6017



# ringing and talking **CURRENT** year after year without attention!

Ringing-talking power units by Lorain provide absolutely reliable current for PBX and switchboards . . . without maintenance, lubrication or replacements . . . and without inspection of the ringing generator. There are no moving parts . . . no lamps, vibrators or brushes to cause service

interruptions or to need continual replacement. And the stable circuit elements operate without any mechanical movement . . . without wearing out . . . and without any change in their characteristics . . . year after year.

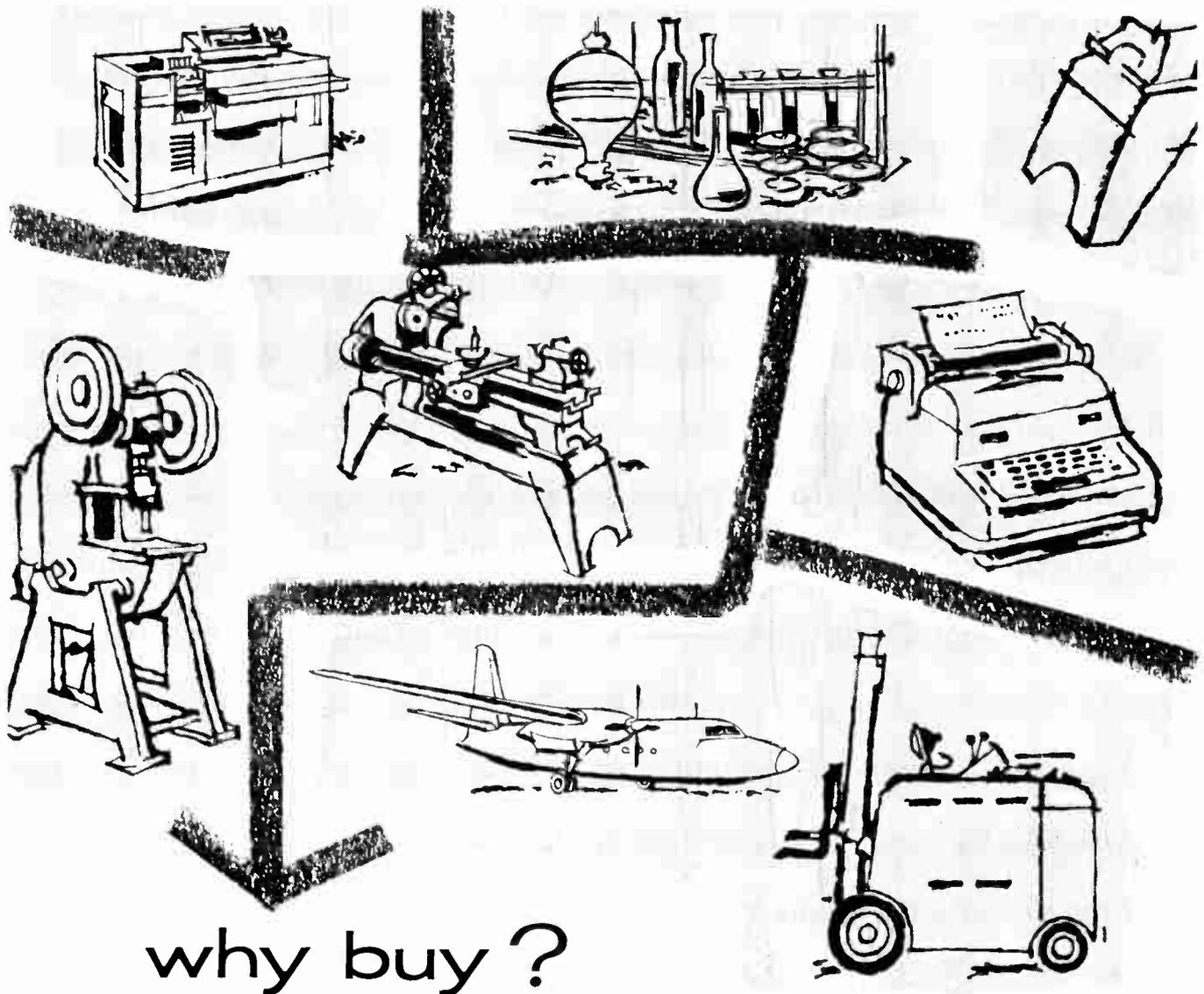
Call any Automatic Electric office or write us today for your copy of bulletin 159B. It gives full details on the complete Lorain RT range.

***AUTOMATIC ELECTRIC***

Subsidiary of

**GENERAL TELEPHONE & ELECTRONICS**





why buy ?

## lease your equipment

...and free capital for other uses

One of the great challenges facing Canadian business today is the need for *expansion* and *modernization* to meet competition. The practical means of acquiring equipment today, without cutting into capital or raising new money, is *leasing*.

Leasing provides the plant and facilities you need to realize greater operating profits, stay competitive.

Leasing frees capital for other profitable uses.

Leasing avoids obsolescence. Machines that were ultra-modern ten years ago are now, in many cases, out of date and costly.

Leasing conserves credit lines. Costs are met on a "pay-as-you-earn" basis, enabling you to derive profits from both equipment *and* capital.

What can you lease? Practically any non-expendable item, from an office typewriter to an aircraft.

Let a CDL representative explain how leasing can help you in *your* business.

For full information write for CDL's free brochure "Leasing".



"Profits are earned through the use — not the ownership — of assets"



# CANADIAN-DOMINION LEASING

CORPORATION LIMITED

Canada Permanent Bldg., 320 Bay St., Toronto, Ontario. Telephone — EM. 3-4021

For complete details check No. 11 on handy card, page 51

ELECTRONICS AND COMMUNICATIONS. March, 1960

35



## ... and 200 miles away a telephone rings!

Eight hours ago, an expanse of barren mountainous country made communication impossible. Tonight, 60 telephone channels and teletype span the wilderness.

Transportable MICROSCATTER is a super high frequency radio system for long-range communication. Developed by Canadian Westinghouse, MICROSCATTER beams signals high above the earth sending two-way voice and teletype messages up to 200 miles over land and water . . . *without* costly relay stations.

The compact MICROSCATTER radio system fits in a standard 30 ft. truck trailer. Now, whenever men and equipment move, MICROSCATTER moves right along with them. It is particularly suited to military and government projects in remote locations. Units designed for self-contained field operations are set down by helicopter.

CANADIAN

# Westinghouse Microscatter

A Westinghouse communications specialist will be pleased to explain fully the MICROSCATTER operation and relate it to your problem. Contact your nearest Westinghouse office, or write to Canadian Westinghouse Company Limited, Electronics Division, Hamilton, Canada. **YOU CAN BE SURE . . . IF IT'S WESTINGHOUSE.**

### MICROSCATTER APPLICATIONS

COMMERCIAL		MILITARY	
Fixed Station	— 120 telephone channels — television and sound	Wide Band	— radar — data — 120 telephone channels
Transportable	— 60 telephone channels — teletype	Tactical and Transportable	— 60 voice channels — teletype — data

### FEATURES

- Frequency—4400-5000 mc
- Antennas — 10 to 28 ft. diameter
- Power—2 KW
- Range—100 to 200 miles

HIGHEST QUALITY, LOWEST PRICE . . .

# HEATHKIT

## TEST EQUIPMENT!



### HEATHKIT "Extra Duty" 5" Oscilloscope

Patented by Heath, the sweep circuit in this scope offers you 5 times the normal sweep frequency range found in other scopes. The wide band amplifiers are ideal for color TV servicing as well as specialized and general circuit investigation. Two etched circuit boards and precut, cabled wiring harness cut assembly time and offer a greater degree of stability.

HEATHKIT O-12 **\$80.95**



### Mutual Conductance Tube Tester (TT-1)

Service technicians throughout the country will hail the new Heathkit TT-1 Mutual Conductance Tube Tester as one of the greatest test instrument developments in many years. In addition to providing quick and accurate tests of transconductance and grid current in multi-element tubes, it will also check diodes and rectifiers, voltage regulators, low-power thyratrons, and electron eye-tubes. The TT-1 contains an impressive list of electronic and mechanical features seldom, if ever, found in a single, compact and portable tube tester.

HEATHKIT TT-1 **\$185.95**

### HEATHKIT Test Oscillator

Fast, easy alignment and troubleshooting. Switch selection of 90, 100 and 107 mc signals provided for RF "front end" alignment and variable width 10.7 mc sweep with 10.7 mc crystal-controlled center frequency marker and 100 kc sub-markers for IF alignment. The internally generated 400 cycle tone may be used to modulate the RF signal or to check audio sections of



receiver. The 10 mc crystal-controlled oscillator signal is used to calibrate the instrument and is also available separately for use as a standard in calibrating other equipment. 400 cycle AM modulated 10.7 mc signal allows easy alignment of ratio detector and discriminator transformers. 5 lbs.

HEATHKIT FMO-1 **\$43.95**

### HEATHKIT Vacuum Tube Voltmeter

This multi-function VTVM will measure AC volts (RMS), AC volts (peak to peak), DC volts, resistance, and DB. A zero center scale db range is provided and a convenient polarity reversing switch is employed for DC operation, making it unnecessary to reverse test leads when alternately checking plus and minus voltages. A large 4½" meter is used for indication, with clear, sharp calibrations for all ranges.

HEATHKIT V-7A **\$36.95**

W-V-7A (wired) \$56.95



**SAVE 50%  
OR MORE  
WITH HEATHKIT  
TEST EQUIPMENT**

## DAYSTROM LIMITED

2 RAITHERM ROAD, TORONTO 19, ONTARIO

Distributors of Heathkits in Canada

For complete details check No. 17 on handy card, page 51

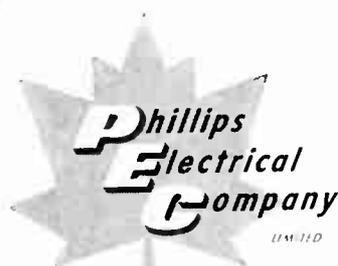
**This new Phillips catalogue lists...**



**989**

**DIFFERENT TELEPHONE  
WIRES AND CABLES!**

**FREE . . .** As a comprehensive reference on wire and cable specifications, this new catalogue is an invaluable aid to anyone in the communications field. For your free copy, address your letterhead request to: *Adv. Dept., Phillips Electrical Co. Ltd., Brockville, Ont.*



**WIRES CABLES**

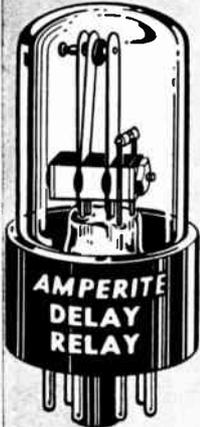
Head Office — Brockville, Ontario.  
Branches — Halifax, Montreal, Ottawa, Toronto,  
Hamilton, Winnipeg, Edmonton, Vancouver.

6019

For complete details check No. 31 on handy card, page 51

# AMPERITE

## THERMOSTATIC DELAY RELAYS



### 2 to 180 Seconds

Actuated by a heater, they operate on A.C., D.C., or Pulsating Current.

Hermetically sealed. Not affected by altitude, moisture, or climate changes.

SPST only—normally open or closed.

Compensated for ambient temperature changes from  $-55^{\circ}$  to  $+70^{\circ}$  C. Heaters consume approximately 2 W. and may be operated continuously. The units are rugged, explosion-proof, long-lived, and—inexpensive!

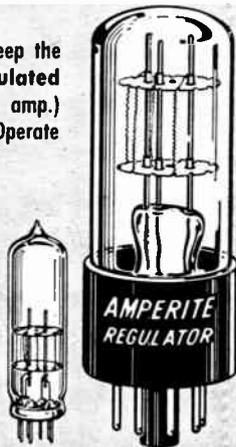
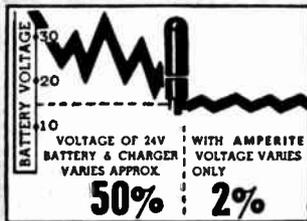
TYPES: Standard Radio Octal, and 9-Pin Miniature . . . List Price, \$4.00. Standard Delays

Also—Amperite Differential Relays: Used for automatic overload, under-voltage or under-current protection.

**PROBLEM? Send for Bulletin No. TR-81**

# AMPERITE BALLAST REGULATORS

Amperite Regulators are designed to keep the current in a circuit automatically regulated at a definite value (for example, 0.5 amp.) . . . For currents of 60 ma. to 5 amps. Operate on A.C., D.C., or Pulsating Current.



Hermetically sealed, they are not affected by changes in altitude, ambient temperature ( $-55^{\circ}$  to  $+90^{\circ}$  C.), or humidity . . . Rugged, light, compact, most inexpensive . . . List Price, \$3.00.

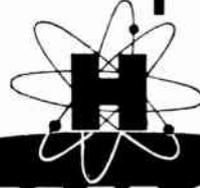
Write for 4-page Technical Bulletin No. AB-51

# AMPERITE

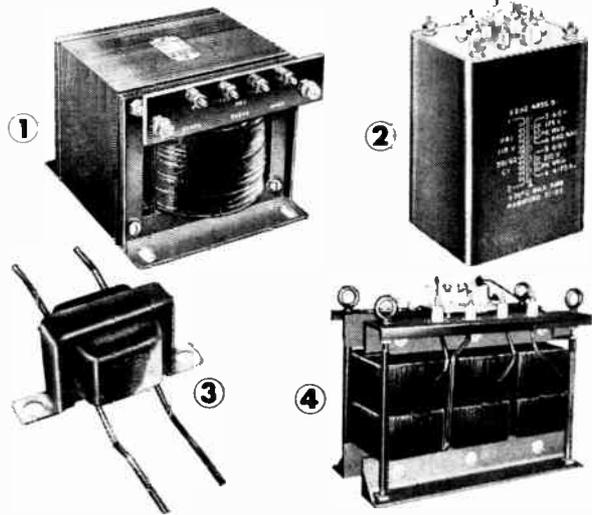
561 Broadway, New York 12, N. Y. . . . CAnal 6-1446  
In Canada: Atlas Radio Corp., Ltd., 50 Wingold Ave., Toronto 10

For complete details check No. 2 on handy card, page 51  
ELECTRONICS AND COMMUNICATIONS, March, 1960

# ENGINEERED TO YOUR REQUIREMENTS FOR Electronic Equipment!



## HAMMOND TRANSFORMERS



- 1 **OPEN COIL and CORE TYPES:**—for all applications 5 V.A. to 10,000 V.A. These Transformers are economical, compact and efficient.
- 2 **HERMETICALLY SEALED TYPES:**—built to meet MIL "T" 27 A Specifications, Grades 1, 4, Classes Q.R.S.T., in Power, Plate, Filament and Audio Transformers, and Reactors.
- 3 **TRANSISTOR TYPES:**—as small as  $7/16'' \times 7/16'' \times 1/2''$ . Input, Interstage and Output Transformers with flexible or solid leads and 4 different mountings.
- 4 **3-PHASE TYPES:**—to 75 KVA, for low and high voltage rectifier systems, open or enclosed.

Hammond has built transformers to more than 52,000 different specifications.

WRITE FOR BULLETINS — Bulletins are available on all types shown above, also on: Audio Modulation, Filament, Power, Plate, and Pulse Transformers, Filters, Chokes and Reactors.

More than 1,000 catalogued items stocked by Hammond and distributed by jobbers coast to coast.

**HAMMOND MANUFACTURING COMPANY, LIMITED**  
Guelph, Ontario, Canada H-18

For complete details check No. 23 on handy card, page 51

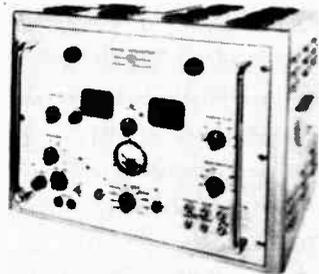
# product panorama

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 Readers' Service, Page 51. Just mark the products you are interested in on the coupon on Page 51 and the information will be in your hands within a few days.

## Signal generator

Item 359

The Type 957 Signal Generator provides a source of CW or pulse-amplitude-modulated power for the measurement of radio receiver characteristics, or for other laboratory or production line measurements, in the frequency band of 800-2100 Mc/s.



Frequency Range: 800-2100 Mc/s in one band; single-dial control directly calibrated to  $\pm 1\%$ .

Frequency Stability: Warm-up drift less than .2%; ambient drift approx. equal to .003% /°C.

Power Output: 0 to -100 db continuously adjustable by a directly calibrated control relative to 1 mW. Absolute accuracy of reading  $\pm 2$  db; relative accuracy  $\pm .2$  db. Power is monitored by a temperature compensated thermistor bridge operating a panel meter.

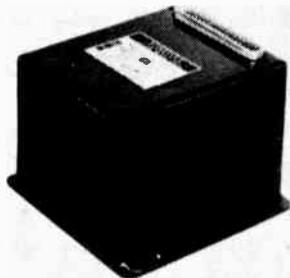
Output Impedance: 50 ohms at VSWR not worse than .5; "N" type connector.

Details and specifications from Mechtron Engineering Products Limited, 2437 Kaladar Avenue, Ottawa, Ontario.

## Electronic commutator

Item 360

A new electronic commutator for all aircraft and missile multiplex telemetering systems is available from Kinetics Corporation, Solana Beach, Calif. It offers a high degree of commutation fidelity with extremely short rise and fall times. Faithful reproduction will continue through a forecast life of 10,000 hours or more.



There are no built-in amplifiers to affect the signal in the straightforward Kinetics electronic commutator design. It is a solid state unit — semi-conductor components are used throughout.

For more information, write to Kinetics Corporation, 410 South Cedros Avenue, Solana Beach, Calif.

## Tester

Item 361

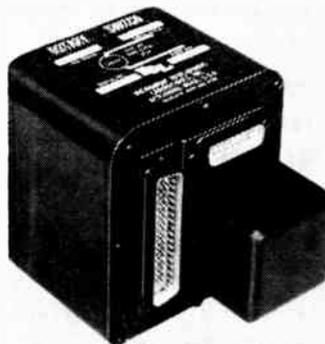
Canadian General Electric announces a new compact tester designed to facilitate the testing and servicing of 720 cycle carrier controllers used by electrical utilities for peak load control. This tester features 720 cycles for calibrating or timing the circuit, as well as the mixing of 720 cycle with 60 cycle for operational testing. The cathode ray tube gives visual indication for the adjustment of 720 cycles. The tester can be supplied with or without a test voltmeter.

Canadian General Electric Company Limited, 940 Lansdowne Ave., Toronto 4, Ontario.

## Missile switch

Item 362

Instrument Development Laboratories announces it has, within 4 months, designed and produced a new 2-pole, 60 position, motor-driven, low-level sampling switch which has run continuously at 60 rps for more than 200 hours



without contact bounce or signal contamination. This switch has performed satisfactorily while undergoing missile vibration testing of 20 to 3000 cps at 35 "G's" for 35 minutes per axis. Designed for application to an Area Defense Missile Guidance Radar System, this switch samples Doppler velocity data for Ranging purposes.

For further information, write the Instrument Development Laboratories, Inc., 67 Mechanic St., Attleboro, Massachusetts, U.S.A.

## Light-spot follower

Item 363

Operating on the light-spot follower principle, the Photodyne is designed to solve in one instrument most of the problems of laboratory recording of frequencies up to 2 cps. It is entirely independent of the measuring instrument which may be electrical or purely mechanical. The measuring instrument has only to be fitted with a small mirror for deflecting a beam of light. Hence a high sensitivity may be obtained and transmission is possible at any potential or under pressure or vacuum.

The Photodyne requires only a few minutes to set up and can operate in a normally lighted room, and has the advantage that the record is continuously visible. Inscription is achieved in rectangular co-ordinates by means of a

pen attached to a recording carriage which also carries the photo electric light spot receiving element. The output current of this cell is amplified and drives a servomotor which keeps the light spot centered on the cell.

For further details contact Tellurometer Canada Ltd., 1562 Carling Ave., Ottawa, Ontario.

## Potentiometers

Item 364

This unique new mounting style is available for all standard Bourns models . . . humidity-proof, high power, sub-miniature and high temperature models. Individual specifications and operation of panel mount units will be the same as the standard Bourns Trimpot of the same type.

Requiring only 1/12 square inch or less of panel area, the units feature a self-locking shaft which does away with cumbersome lock nuts. The multi-turn adjustment provides up to 9000° of rotation to speed up and simplify the adjustment or balancing of circuits.

The stainless steel construction assures compliance with military specifications for vibration, shock, salt spray, etc. Screwdriver adjustment is easily made from the front of the panel, and the recessed head prevents accidental changing of the setting.

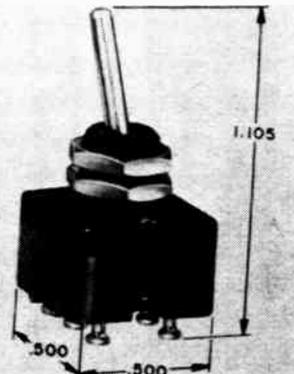
Douglas Randall (Canada) Ltd., 126 Manville Road, Scarborough, Ontario.

## "TM" toggle switch

Item 365

A new miniaturized 2-position toggle switch, offering considerable weight and space savings, has been announced by Micro Switch, Toronto, Ontario, a division of Honeywell Controls Ltd.

Catalog listing 2TMI-T measures only 1/2" x 1/2" at the base and weighs only 4 1/2 grams (approximately 1/8 ounce). However, miniaturization has not caused compromises in switch performance.



Integral terminals, gold-plated stationary contacts and a high contact force give the "TM" a low circuit resistance. Dependable operation is furnished in a temperature range of -65° to 200°F.

The construction of the case around the contacts and other current carrying parts provides this switch with a high dielectric strength.

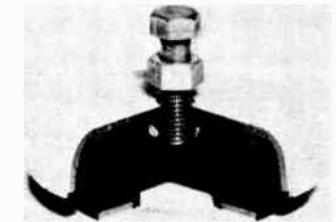
B. Colwell, Merchandising Dept., Honeywell Controls, Vanderhoof Ave., Toronto 17.

## Machinery mounts

Item 366

When the Fuller Brush Company of Hartford, Connecticut, moved into its new \$6 million plant, maintaining work flow was a prime consideration.

To simplify the problem of moving over 700 machines weighing more than two and a half million pounds, Fuller Brush selected leveling Barrymounts for mounting their machinery. These unique vibration eliminators are installed on the machinery feet as the machine is moved into position. Because they hold a heavy machine securely, the mounts eliminate the need for



drilling holes in the floor of the brand-new facility and lagging the machine with bolts. The moving contractor for Fuller Brush simply sets the machine in place and levels it in minutes by using the built-in leveling feature.

Samuel C. Hooker (Canada) Ltd., 2425 Grand Blvd., Montreal, Quebec.

## Power monitor diode

Item 367

A new power monitor diode, the MA-437 (1N2771) provides an accurate and inexpensive method of monitoring power output of RF generating devices in the 140 MC to 750 MC range. It is especially suited for communications and TV transmitters, and may be coupled directly to a microammeter for an accurate indication of transmitter RF power.

The MA-437 is a point-contact silicon diode with a cartridge construction identical to the 1N23 series and conforms to MIL-E-1 requirements.

Rectified current through the diode is monitored in a standard holder at three frequencies: 140 MC, 375 MC, and 750 MC, at input power levels of -2.8 dbm, 0 dbm, and 3.6 dbm. Within this power range, power monitoring error is less than 1 db over the given frequency range. At each specific test frequency, the power error is less than 0.5 db.

Using the MA-437 in a relatively simple circuit arrangement enables considerable manufacturing economies when compared to the use of bolometer bridges or other accurate monitoring standards.

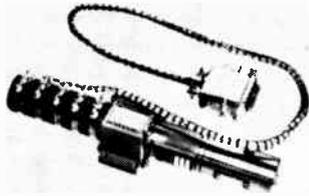
Output is coupled directly to a DC microammeter, which can be calibrated directly in units of RF power. All diodes of this type number used in accordance with the specifications, in well-designed holders, obey a law of detection which is reproducible for any MA-437 (1N2771) diode selected at random from production samplings.

Details are available from E. G. Lomas, 227 Laurier Avenue W., Ottawa 4, Ontario, Canada.

## In-line servopackages

### Item 368

System engineers in need of servo position indicators, integrators and other servosystem assemblies can have quick delivery of in-line servopackages, according to Helipot Division of Beckman Instruments, Inc., Fullerton, California.



These compact, space-saving modules free the designer from positioning, testing, matching and aligning individual components.

Typical of Beckman servopackages, developed by Helipot, is a size 11 system module consisting of a 115-volt, 400 cycle servomotor-rate generator; gearhead; mounting pad; five ganged Helipot Model 5203 single-turn potentiometers; and AN connector. The entire unit measures only 7 $\frac{3}{4}$ " x 1 $\frac{1}{2}$ ".

R-O-R Associates, 1470 Don Mills Road, Toronto, Ontario.

## Time delay switch

### Item 369

The L.422 is a simply constructed thermal delay switch of small dimensions (approx. 1.5" long x 0.5" wide x 0.3" deep). It may be wired as either an independent or series heater type.

The switch is made in two basic types: type /1B with normally-open contacts and type /1C with normally-closed contacts. Three variations are available in each of these types; suffix /A, uncalibrated, adjustable by user within a time range from 0.5 to 45 seconds; suffix /S, calibrated for "short" time delay of between 0.5 to 10 seconds; suffix /L, calibrated for "long" time delay of between 10 and 45 seconds.

The units may be connected to operate as flashers when flash rates of between 30 and 120 flashes per minute may be obtained, at normal heater power, with a dark to light ratio of 1.5 to 1.

The standard heater is rated at 6 volts, and consumes approximately 1.5 watts. Contact switching capacity is 1 amp. at 30 volts AC. Reset time is of the order of 10 seconds, maximum, irrespective of the duration of heater energization.

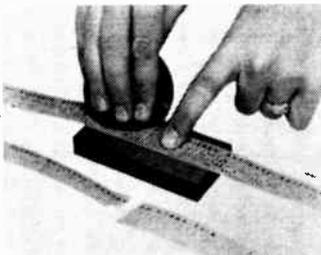
Astral Electric Company Ltd., 44 Danforth Road, Toronto 13, Ontario.

## Tape splicer

### Item 370

The Unicorn splicer proves invaluable wherever perforated programming paper, aluminum, Mylar, or other perforated tapes must be corrected, repaired or changed in part.

It provides an inexpensive solution to the problem facing users of programming punch tape by



permitting secure and precise overlapping, or flush splices, on damaged or broken tapes. The kit consists of a small metal block with a row of small pins which fit into the feed holes of all standard tapes. The tape ends are aligned on the metal block by the feed hole pins, pushed down and smoothed out, and a short piece of adhesive material with punched holes is placed over the joined ends.

The Unicorn splicer is manufactured by Computer Measurements Company, 12970 Bradley Avenue, Sylmar, California.

Electromechanical Products, Warden Avenue, Agincourt, Ont.

## Terminals

### Item 371

Quick-connect or "push-on" type terminals can now be provided on many Ohmite tap switches, power resistors, power rheostats, relays and "vt" variable transformers. These terminals are specially shaped tabs to which leads can be quickly connected by means of commercial quick-connect female connectors.



Such connectors (also known as quick-disconnect terminals) are produced by a number of electrical hardware manufacturers. Automatic machinery is available to fasten these connectors to the leads at high speed thereby offering important time savings.

In use, the "female" connector is pushed onto, and slides over, the tab terminal.

Request additional information from Ohmite Manufacturing Company, 3653 Howard Street, Skokie, Illinois.

## Duplexer

### Item 372

A ferrite phase differential duplexer providing the advantages of both a Duplexer and Load Isolator in a single unit construction has been developed by Airtron.

This unit, when used as a Duplexer, not only functions as a switching device between the transmitter-receiver and antenna but furnishes sufficient isolation between transmitter and RF energy reflected from long line mismatches. This future makes that unit ideal for use in microwave relay applications.

The WR-137 waveguide size duplexer consists of a folded matched tee, the ferrite sections, and a short slot hybrid coupler with a dual adaptor which connects a matched load and antenna to the hybrid. The folded magic tee short slot hybrid and dual adaptors are standard broad band microwave components, while the ferrite section consists of a double waveguide unit with ferrite slabs placed to produce the desired differential phase shift.

For further information write to Airtron Canada Limited, 349 Carlaw Ave., Toronto 8, Ontario.

## Recording microvolt-microammeter

### Item 373

To meet the increasing demands from science and industry for a fast, sensitive recorder Kipp has introduced the "Micrograph". It incorporates 6 current ranges, the lowest being 0.1 $\mu$ A FSD, and the highest, 5 $\mu$ A FSD. There are 6 voltage ranges — the lowest, 0.05 mv, and the highest, 2.5 mv FSD. Ranges are selected by a single switch.

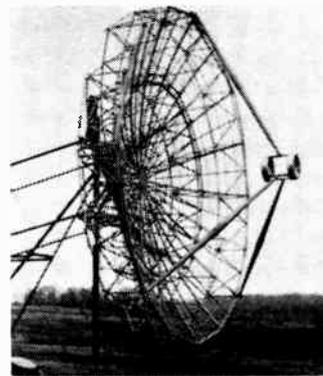
The "Micrograph" operates on the continuous self-balancing potentiometer principle. The moving coil detector forms part of a DC to AC photo-electric amplifier-converter. A light source projects a beam to a mirror on the moving coil, and is reflected to a pair of photocells. The AC signal developed by the displacement of the light spot over the photocells is passed through a photostabilized amplifier to drive a servo motor. Rotation of the motor moves the sliding contact over the potentiometer. As the compensating current becomes equal to the current being measured, the signal disappears and the servo motor stops. Thus the displacement of the sliding contact is independent of the linearity of the amplifier, and is a linear function of the input current. The displacement is recorded by a pen connected to the sliding contact.

R. H. Nichols Limited, P.O. Box 500, Downsview, Ontario.

## Hubloc antennas

### Item 374

Hubloc antennas — large size parabolic antennas employing a new structural design resulting in new levels of performance. Features high surface accuracy, high rigidity to weight factor, easy installation and light weight for given windload rating. Construction of back frame accomplished with two basic elements; tubular bars and connecting hubs fabricated for press fit connection eliminating welding or special tools for assembly. Mechanical characteristics superior to



conventional designs and methods presently employed in large antennas. Range of sizes, up to 60 feet in diameter.

Andrew Antenna Corporation Ltd., 606 Beech Street, Whitby, Ontario.

## High speed oscilloscope

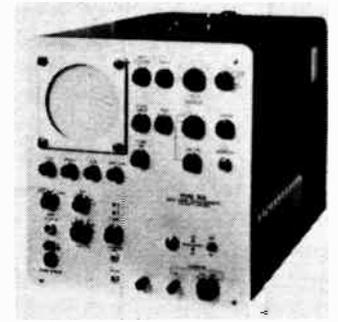
### Item 375

Designed around the latest type of high sensitivity cathode ray tube, this instrument provides all the essential features of a wide band oscilloscope with accurate measuring facilities and an exceptionally wide range of sweep speeds.

The aim has been to get these features incorporated in the least complicated manner, resulting in a compact, rugged and reliable design produced to the highest standard of workmanship at an economical price.

Calibrated sweep times from

0.5 sec to 0.1  $\mu$ sec per cm. accurate with 2% by direct reading of time per cm. An uncalibrated fine control increases the maximum sweep time to 1.2 sec/cm.



or 12 secs for a full screen sweep of 10 cms.

Sweep expansion x 10 reduces the minimum sweep time to 10  $\mu$ sec/cm. equivalent to a sweep speed of 1 mm. per  $\mu$ sec. Versatile and highly efficient triggering circuitry provides both repetitive and single stroke conditions.

Electrodesign, 736 Notre Dame St. West, Montreal, P.Q.

## Stereoscopic television

### Item 376

An advanced system of stereoscopic closed-circuit television has been developed by E.M.I. Electronics Ltd. to meet the requirements of nuclear plants and other establishments where dangerous materials have to be manipulated remotely.

E.M.I.'s stereoscopic equipment utilizes the Company's standard closed-circuit units and consists of two camera channels mounted side-by-side and arranged to relay pictures onto two monitors. The pictures from these are then superimposed on each other by means of a mirror and polarized glass, to form a single image.

When viewed with polarized spectacles this produces a realistic three-dimensional picture. The equipment has already been demonstrated on the Continent and in England, and has proved highly successful in practical demonstrations.

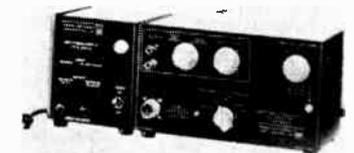
Features of the E.M.I. system include the simplicity with which it can be set up, and controlled, and the novel arrangement by which the human eye's 'angle of squint' has been realistically achieved by mechanical means.

E.M.I. Electronics Ltd., Hayes, Middlesex, England.

## Frequency standard

### Item 377

A compact, crystal-controlled Time/Frequency Calibrator (Type 1213-D), with a short-time stability of 1 part in 10<sup>7</sup>, which furnishes standard frequencies from 10 kc to 1000 Mc not only for the calibration of electronic equipment, such as oscillators, receivers and transmitters, but also for the measurement of unknown frequencies, has been developed by the General Radio Company, West Concord, Mass.



The instrument also provides timing markers at decade intervals from 0.1 to 100 microseconds.

General Radio Company, 99 Floral Parkway, Toronto, Ont.

Continued on page 47

**NEW**



**CATALOG IEC-3**

**AMPHENOL HAS JUST PUBLISHED  
A NEW INDUSTRIAL ELECTRONIC  
COMPONENTS CATALOG IEC-3**

*WRITE FOR YOUR COPY TODAY*

STUB E CONNECTORS      MINI E CONNECTORS      COAXIAL CABLE  
AN/MS CONNECTORS      BLUE RIBBON CONNECTORS      RF CONNECTORS  
ELECTRONIC COMPONENTS



**CANADA LIMITED**

349 CARLAW AVE., TORONTO 8, ONT.

SALES OFFICES: OTTAWA • MONTREAL • CALGARY

For complete details check No. 3 on handy card, page 51

**NEW TYPE GBT  
1/2 & 1 WATT**

**COMPOSITION RESISTORS**

New attractive appearance  
New smaller size — 1 watt

MANUFACTURED IN CANADA

*Ask our IRC salesmen  
about NEW GBT  
Carbon Composition Resistors*

WRITE TODAY FOR BULLETIN B-1



**RESISTORS**

division of  
Renfrew Electric Co. Limited

349 CARLAW AVENUE • TORONTO 8, ONTARIO

SALES OFFICES: OTTAWA • MONTREAL • CALGARY

For complete details check No. 26 on handy card, page 51

**Highly commendable effort**

The Editor:

I would like to say that your February issue of new products is a highly commendable effort.

As far as I am concerned, the problems of new product releases are thoroughly appreciated; I must admit that I have received every co-operation from yourself and Bud Dallyn.

Enclosed, herewith, photographs of two new products which you may be able to run in future issues of your magazine.

Yours truly,  
J. Kingsnorth  
Marketing Manager,  
International Systems  
Ltd.  
Montreal, P.Q.

**Product reference file**

Mr. Editor:

May I congratulate you on the February 1960 issue of *Electronics and Communications*. It is full of interesting new product information which will serve as a product reference file for the future. At all times I have found the various issues of interest and worthy of careful perusal.

I look forward to your future issues with anticipation.

Sincerely,  
James H. Rowlett,  
Manager, Electronics Division  
Mechron Engineering  
Products Ltd.  
Ottawa, Ont.

**Likes front cover**

The Editor:

We were very pleased to see our Security Systems appear on the front cover of your January issue and for this we thank you very much.

As John Holehouse has probably told you, we are on the alert for any unusual instrumentation stories that would fit into your publication.

Thank you and best regards.

K. K. Warne,  
Merchandising Manager,  
Honeywell Controls Ltd.,  
Toronto, Ont.

**An excellent job**

The Editor:

I have looked through your Electronic Product Preview Issue and feel that this will prove of value and interest to purchaser and supplier alike.

Probably one of the biggest problems in the trade today is that the continual rapid development of new products and methods makes it almost impossible for any of us to keep the customer fully informed. Usually, by the time an item appears in print, it has actually been on the market for some months. As you know, there are so many developments that, budget wise, it is not feasible to advertise them all. Therefore, the one method of keeping the trade fully conversant is through 'new products' columns.

Your special issue must have demanded a great deal of effort and, for the excellent presentation and the service it provides to the industry, you have our sincere thanks.

Congratulations on an excellent job.

Jack H. Crisp,  
Advertising Manager,  
Aviation Electric Ltd.  
Montreal, P.Q.

### Keep up the good work

The Editor:

We do feel you should be complimented on the very fine presentation of new products which you have provided in your February issue. While we have, in the past, sent in a fair number of our own new product releases we have always felt we received a pretty fair share of publicity.

We are pleased to see in this issue that there are so many of our principals' products shown. It is only regretted that the new junction block developed within the last two months by Consolidated Electronics Equipment Co. Limited, of Toronto was not included. Perhaps this could find its way in during the coming months.

The final comment is suggested "Keep up the Good Work".

A. Ainlay,  
General Manager,  
Lake Engineering  
Co. Ltd.  
Scarborough, Ont.

Address your letters to Mr. T. Lazenby, Editor, Electronics & Communications, 450 Alliance Ave., Toronto 9, Ontario.



## ... the "quality package" in mobile communications

**NEW!** No derating of performance  $-40^{\circ}\text{F}$  to  $+140^{\circ}\text{F}$ . Quiet running, dependable transistorized power supply. Compact case, easy to install. Competitive in cost, this high-power mobile unit gives base-station stability . . . provides crystal clear reception at maximum working distances . . . is fully certified for land-mobile service and complies with D.O.T. type approval requirements for split channel use. Write for literature on Du Mont mobile radio systems . . . Canada's "quality package" in mobile communication.

● **HI-POWER**

Mobile units with the equivalent power of a conventional base station.

● **HIGH STABILITY**

through the use of high precision low drift crystals.

● **COMPLETE YET COMPACT**

Transmitter, receiver, power supply and all relays in one compact case.

● **SEALED SELECTIVITY**

If selectivity determined by directly interchangeable fixed frequency filters for either split channel or adjacent channel operation.

**DEALER ENQUIRIES INVITED**



**ELECTRONIC RESEARCH AND DEVELOPMENT COMPANY LTD.**

Western Sales Office:  
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Calgary - Alberta

Eastern Sales Office:  
3534 Dundas Street W.  
Toronto - Ontario

For complete details check No. 20 on handy card, page 51

## scatter matter

According to the Russian news agency Tass the output of computing machines in Russia will have increased by 370 per cent by 1965.

A general reshuffling of TV channel assignments is being considered by the Federal Communications Commission of the United States which is also considering the possibility of narrowing present separations between stations in order that more stations may operate on the VHF channels 2 to 13.

Hughes Aircraft Company of California one of the United States biggest aircraft and electronic manufacturers is building a \$280,000 factory at Glenrothes, Fife, in Scotland. Production is expected to start in September 1960 and the number of employees is expected to reach as high as 500.

British and Russian engineers are working on a scheme for the Baghdad Radio Authorities that will cover the Middle East with stronger radio broadcasts and make available to Iraq a nationwide television service.

Japan, now the leading producer of high-quality, low-cost transistor radios, introduced in January a four transistor low-priced hearing aid priced drastically below the cost of the standard American models. The set, which will sell for as little as \$29.95, will be manufactured by Toshiba. A deluxe version will retail for \$39.95.

The first computer controlled chemical plant in the United States has begun start-up operations at Luling, Pa. The plant which is for the manufacture of ammonia employs an RW-300 Digital Control Computer manufactured by Ramo-Wooldridge.

American companies handling foreign-made electronic components have been urged to make certain that the country of origin is clearly marked on products, packaging and advertising and literature, to comply with regula-

tions outlawing deceptive trade practices. This applies to all sellers of such goods, whether they are manufacturers, distributors or dealers.

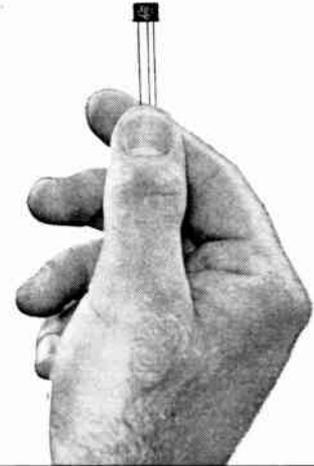
A decision by the USSR to join the International Federation of Computer Societies brings to 12 the number of nations which have ratified the statutes of this new international organization. The Academy of Sciences of the USSR will be represented in the Federation by its Computing Center.

The establishment of an annual award in memory of Guglielmo Marconi, the world-famed radio pioneer, is announced by Permindex, the World Trade Center in Rome. This award will be made to the individual making the greatest contribution to the development of Marconi's discoveries. Recipients will be chosen by a Committee composed of important international personalities, a member of the Marconi family and representatives of Permindex.

Loran-C, an experimental radio navigation system, operated successfully at ranges up to 2,300 miles and provided ship position "fixes" of fantastic accuracy, during a year's testing program according to an evaluation report released by the U.S. Navy and Coast Guard. The evaluation, conducted by the independent consulting firm of Jansky and Bailey, Inc., Washington, D.C. for the Office of Naval Research, analyzed a year's operation of a Loran-C monitor station located 550 miles from the closest transmitter and about 900 miles from the most distant transmitter. Results proved that a ship in the area could expect 95 per cent of its "fixes" to be within 800 feet of the exact geographical position.

The U.S. electrical manufacturing and electronics industry leased approximately 16,000 automobiles in 1959 in fleets for its salesmen, a gain of 15 per cent. This was the greatest number ever leased by the industry and it is predicted that 1960 will show another 15 per cent jump.

## TEXAS INSTRUMENTS SEMICONDUCTORS



DELIVERED  
OVERNIGHT  
*Anywhere in Canada*

Off-the-shelf  
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For fast, reliable delivery on all TI use-proved, guaranteed semiconductors and components, just call Lafayette Radio and get *off-the-shelf* delivery.

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Telephone or write now for your free copy of Lafayette Radio's new industrial electronics catalog . . . over 300 pages describing the industry's latest electronic equipment, including Texas Instruments complete line of semiconductors and components.



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## Western Canada's first hi-fi exposition

Western Canada's first High Fidelity and Stereo Exposition was held in the Hotel Georgia, Vancouver, B.C., from January 27 to January 30 inclusive. This show was sponsored by the

### Holes for Poles

Simple solution to one of the really serious economic problems experienced by telephone companies has lately been proved out by New York Telephone Company's Nanuet District.

The problem is digging pole holes in rocky ground. The



Nanuet district, in the South-eastern corner of New York State, contains a broad range of ground conditions — loam, gravel, hardpan, red-rock, frost, and granite lumps — but the ground which has the greatest problem is earth interspersed with granite boulders.

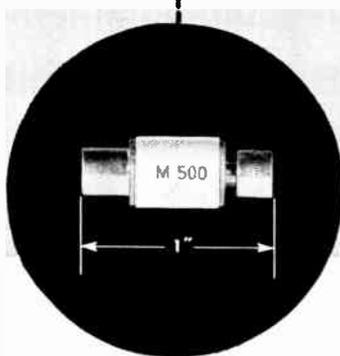
For the rapidly expanding telephone system, pole installation needs augers that can dig in such ground without delay. Division's line foreman, Charles Smith, a natural experimenter, tried out the first model of a new auger, designed by Trainer Associates of New Castle, Delaware, and dubbed the PolerBore. The auger was meant primarily for frost digging. Smith discovered that it licked most other ground problems in Nanuet equally well.

Dominion High Fidelity Association, which has successfully conducted similar expositions in Toronto and Montreal over the past three years.

H. Roy Gray, vice-president of the Association, acted as host to the trade and to the public.

# TARZIAN M-500...

*a high efficiency  
silicon rectifier  
commercially  
priced*



**500-ma  
ferrule rectifier  
connects easily to standard clips**

The Sarkes Tarzian M-500 silicon rectifier is rated at 500 milliamperes dc, with a peak inverse voltage rating of 400 volts. This was the first commercially priced silicon rectifier, and more M-500's are now in use than any similarly rated unit.

The Tarzian M-500 is a cartridge type rectifier with end ferrules that snap quickly and easily into standard clips. These silicon rectifiers are made by a special Tarzian process that provides optimum forward to reverse ratios and long, useful life.

For additional information, practical application assistance, and prices on the M-500, write to Section 4393J, Semiconductor Division, Sarkes Tarzian, Inc., Bloomington, Indiana.

#### M-500 Characteristics

DC amps (100° C)	Peak Inv. Voltage	Tarzian Type	Max. RMS Volts	Max. Recurrent Peak Amperes (100° C)	Max. Surge Amps 4MS	JEDEC No.
0.5	400	M-500	280	5	30	1N1084



## SARKES TARZIAN, INC.

SEMICONDUCTOR DIVISION  
BLOOMINGTON, INDIANA

In Canada: 700 Weston Rd., Toronto 9, Ontario  
Export: Ad Auriema, Inc., New York City

For complete details check No. 35 on handy card, page 51

## briefing the industry

■ Canadian General Electric Company has revealed price reductions ranging from twenty to forty per cent on all its production models of silicon controlled rectifiers. The new prices range from \$21.27 each to \$109.25 each on the eight models in the 16-ampere line; from \$16.10 each to \$81.65 each on the eight types comprising the 10-ampere line, and from \$27.60 each to \$131.10 each on the seven devices in the inverter series. All prices are for production quantities to original equipment manufacturers.

■ The Electronics Industries Association of Canada reports that the factory sale of TV sets in November 1959 was 46,125, a drop of about 10 per cent from the November 1958 total of 51,417. Dealers' orders for the first 11 months of 1959 reached 373,757 about four per cent lower than for the same period in 1958. The sale of radios in November 1959 reached 68,402 sets compared with 71,042 for November 1958.

■ Arrangements have been completed between the Canadian and U.S. governments for the construction of 45 new radar stations to supplement the Pine Tree line. No cost sharing arrangements have been announced but it is expected that Canadian companies will receive a large portion of site construction work as well as a significant part of the electronic contracts.

■ E.M.I. Cossor of Woodside, N.S. have received an order for six Ionospheric Recording Units from the Russian government. Cost of the contract, it is reported, is just under the \$100,000 mark.

■ A further and more impressive contract recently placed with E.M.I. Cossor is for \$2,750,000 worth of anti-submarine equipment for the Royal Canadian Navy. First equipment which is of the Sonar type will be fitted in the new MacKenzie class destroyer escort vessels to be laid down in Halifax some time this year.

■ Prime Minister Diefenbaker has described the electrical industry as holding "the key to the development of our vast national resources". Extending best wishes for the success of the N.E.W., Mr. Diefenbaker said the electrical industry "is a flourishing industry which, in the next decade, can be expected to meet the demands of our continued industrial expansion while still providing every Canadian family with more and more facilities for a greater enjoyment of life."

■ The Lockheed JetStar, first multi-purpose jet utility transport, is being evaluated by various commercial interests and government agencies at Ottawa, Trenton and Winnipeg. Officials from the Department of Transport, which has already purchased the aircraft, will also fly in the aircraft. The specially-fitted Department of Transport model, to be delivered next year, will be used to evaluate navigational aids at altitudes as high as ten miles.

■ Canadair Limited starts production of the first sub-assemblies for the Luftwaffe's new Super-Starfighters in six weeks. Delivery to the Lockheed Aircraft Corporation in California, which is in charge of the final assembly, is scheduled for July. This subcontract by the designers of the supersonic NATO fighter to Canadair lays the basis for production by the Montreal company of 200 of the same aircraft for the RCAF eight squadrons in Europe. The Lockheed-Luftwaffe subcontract means \$4 million worth of work for Canadair and its many subcontractors extending into 1962. The same period is set for construction of the RCAF's CF-104 Super-Starfighters.

■ Burroughs Corporation of Detroit will subcontract in the neighborhood of \$20 million for electronic equipment for the CADIN electronic data processing system, the radar aircraft warning system to be built across Canada. It is expected that about \$7 million of the total amount will be spent with Canadian firms.

## Raytheon Canada appoints Linuntronics Labs

Linuntronics Laboratories of Willowdale, Ontario, owned by John T. Linnell, have been appointed field service engineers for Raytheon Canada Ltd. of Waterloo, Ontario. In this capacity Linuntronics Laboratories will be responsible for service on Raytheon's Commercial Products in the Toronto and district area on a 24 hour, seven day week. The telephone number for service is Baldwin 2-1775.

In addition, Linuntronics Laboratories also service radiation detection and monitoring equipment, manufacture their own design of transistorized flasher for the flashing barricade industry, and do short run electronic assembly on a sub-contract basis.

## Centralab appointments

Peter J. Heenan has been named general manager of Centralab Canada Limited. His promotion from sales manager of that company was announced by William S. Parsons, president.

Mr. Heenan has been associated with the Canadian Electronics Industry since 1936. He is an associate member of the Institute of Radio Engineers, and a past chairman of the Canadian Electronic Sales Representatives Association.

At the same time Mr. Parsons announced the appointment of J. F. Brooks, who has been plant manager for the past eight years, to manager of manufacturing in Centralab Canada Ltd.'s new facilities located on McMaster Ave., Ajax.

According to Mr. Parsons, these appointments have been made in line with the company's policy of developing the organization to keep pace with the rapidly expanding electronics industry.



P. J. Heenan

## CITA appoints PR officer

The Canadian Independent Telephone Association announces the appointment of **William Pryde** as public relations counsel to serve the industry.

The board of governors of CITA have felt keenly aware of the pressing need to bring a greater awareness to the public on the extent of independent telephony, the rapid increase in telephone installations in rural areas, particularly throughout Ontario and Quebec.

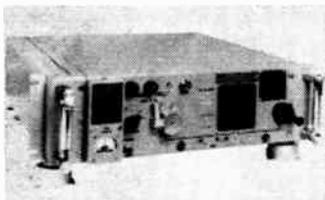
## product panorama

Continued from page 41

### Crystal frequency synthesizer

Item 378

A Crystal Frequency Synthesizer, capable of producing over 64,000 discrete frequencies with a stability of better than  $1 \times 10^{-8}$



per day, is now available commercially from Manson Laboratories of Stamford, Connecticut. The unit, which will be demonstrated at the IRE Show, includes among its more notable performance characteristics: zero-error readability of the mechanical and electrical readouts; an accuracy and a stability of 1 part in  $10^4$  per day or better, substantial immunity to environmental conditions; and the suppression of spurious signals (except harmonics of the output) to  $-80$  db.

Called the Model N317 Frequency Synthesizer, the equipment is based on the indirect method of synthesis, and all frequencies are derived from a single, highly stabilized crystal. The unit is all electronic, and pull-in and hold-in are accomplished without mechanical means. Reset after power failure is automatic and exact.

Manson Laboratories Inc., P.O. 1214 Stamford, Conn.

### Rotary waveguide shutter

Item 379

The MA-788 rotary shutter is a new, compact, magnetically operated waveguide switch for use in RG-48/U S-band applications (2.7-3.1 kMc).

The operating voltage is 20-29V DC. Current at 28V is 560 milliamps and coil resistance at 25°C is 50 ohms. In the normally closed position the shutter provides 25 db attenuation for reliable standby protection of receiver elements.

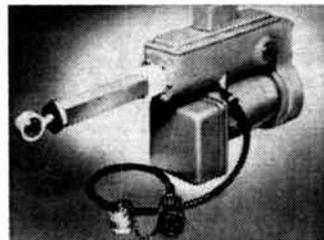
In the open position the MA-788 insertion loss is 0.2 db maximum and VSWR (open position) is 1.0 maximum. The shutter is designed to operate under military conditions of shock, vibration (5G at 50 to 500 cps) and temperature cycle from  $-40$  to  $+100^\circ\text{C}$ .

Additional information is available from E. G. Lomas, 227 Laurier Avenue West, Ottawa 4, Canada.

### Linear actuator

Item 380

The Lear Model 499B is a heavy-duty electrically-driven linear actuator suitable for use wherever open-loop positioning is required. Built with the precision,



ruggedness and reliability of Lear aircraft and missile actuators, the Model 499B can move up to three-quarters of a ton and can hold

a ton-and-a-half. A brake is used to reduce overcoast to a minimum.

The stroke of the Model 499B is continuously adjustable from 4.25 to 5.25 inches. Also available is a second version of this actuator, designated the Model 499B-1, which offers a shorter stroke of from 2.75 to 3.75 inches.

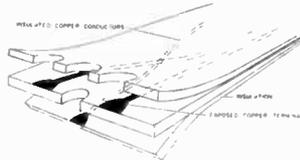
The Model 499B is powered by a single-phase 115-volt, 60-cycle motor capable of developing 0.14 HP at 5,000 rpm.

For further information, contact J. A. Andrews, Lear, Incorporated, P.O. Box 688, Grand Rapids 2, Michigan.

### Etched circuitry

Item 381

Custom designed Flexible Etched Circuitry, available in any production quantity, is now available



from IRC. Conductors are embedded between 2 sheets of thermo plastic that have been fused into one homogeneous mass, eliminating many environmental problems such as salt spray, polarization, and oxidation.

Recommended uses include cables . . . and harnesses in sliding drawers, and drop panels . . . switchboards . . . computers . . . aircraft . . . and missiles . . . anywhere maximum size and weight are critical.

Prototype samples of specific etched circuit applications are available at nominal cost.

For further information write to IRC Resistors, Division of Renfrew Electric Co. Limited, 349 Carlaw Avenue, Toronto 8, Ont.

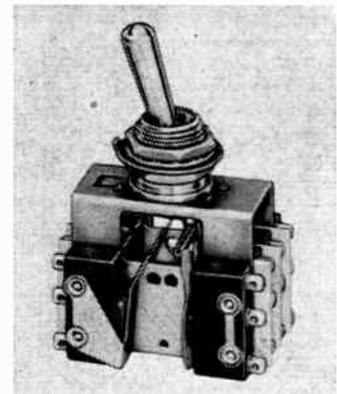
### Toggle switches

Item 382

The Electronic Equipment Group, Philips Electronics Industries Ltd., announces a new line of Haydon subminiature toggle-actuated switches. The 5300 Series Toggle Switch Assemblies are available with from 1 to 8 pole, double-throw contact arrangements. Toggle actuation can be either 2 or 3 position, and furnished in various combinations of momentary and maintained positions.

Switches are rated at 5 amps Resistive, 3 amps Inductive, at 30 Volts, DC and 115 Volts, AC and are available in three terminal designs: solder hole type, turret type, or double turret type. Any toggle switch assembly can be furnished with either the standard type of bushing or the panel seal version.

For further information, write to Electronic Equipment Group, Philips Electronics Industries Ltd., 116 Vanderhoof Ave., Toronto, Ontario.



Continued on page 49

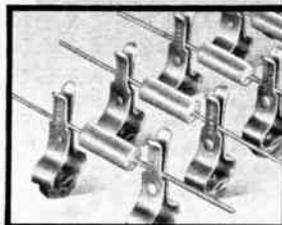
## TESTS CLIPS with ADJUSTABLE TENSION

Grayhill Test Clips, designed for panel mounting, permit faster testing without manual opening and closing of jaws. Tension easily and simply adjusted by turning hex nut. Standard (No. 2-0) projects 1.25" above panel—Miniature (2-20) projects only 3/4". Also available with banana plug, pin jacks or molded board mounting (10 standard variations available.)

Write for Catalog



Grayhill Tests Clips



Phone: Fleetwood 4-1040  
573 Hillgrove Avenue,  
LaGrange, Illinois

**Grayhill**

PIONEERS IN MINIATURIZATION

For complete details check No. 22 on handy card, page 51  
ELECTRONICS AND COMMUNICATIONS, March, 1960



## SEALED ELAPSED TIME INDICATORS

### SCHEDULE MAINTENANCE — STUDY PRODUCTIVITY

Glass-to-metal sealed ELAPSED TIME indicators. Compact, low cost, tamper-proof. Standard ASA/MIL dimensions, 2 1/2" and 3 1/2" sizes. Easy to read standard size counter registers 1/10 hour steps to 9999.9 or hour steps to 99999. Hermetically sealed. Shielded. Starts, operates continuously from  $-55^\circ\text{C}$  to  $+85^\circ\text{C}$ . For 110-125 or 220-250 volts 60 cycle AC. Bulletin on request. Honeywell Controls Limited, Precision Components Division, Toronto 17, Ont.

**Honeywell**

**H** First in Control  
SINCE 1880

For complete details check No. 24 on handy card, page 51

# techdata for engineers

## Magnetic design data

**Magnetic Metals Company, Hayes Ave. at 21st St., Camden 1, N.J.** 24-page Bulletin C-5 gives extensive design data, test data and magnetization curves for centricores (toroidal cores wound from thin magnetic tapes), stamped ring cores (made from laminations), and precision die-cut DU laminated cores. Also included is data on Super Squaremu "79" Centricores for magnetic amplifier applications. Test methods outlined follow recommended procedures standardized by industry committees and include circuit diagrams.

## "Practical hi-pot testing"

A twelve-page application bulletin, titled "Practical Hi-Pot Testing" is offered by **Associated Research, Inc., 3777 W. Belmont Avenue, Chicago 18, Illinois.**

Separate sections cover AC and DC breakdown testing, with discussion on non-destructive tests of dielectric strength in wiring harnesses, motors, cables, solenoids, thermostats, and similar equipment.

The bulletin "Practical Hi-Pot Testing" will be sent on request by **Associated Research, Inc., 3777 W. Belmont Avenue, Chicago 18, Illinois.**

## Electronic forum bulletin

The first number is published of the Bulletin of the Electronic Forum for Industry ("E.F.F.I. Bulletin") with a foreword by Lord Brabazon of Tara.

The first number of the Bulletin consists of articles based on papers read at an Open Day of the Forum held earlier this year. Authors are A. H. Cooper, Technical Director, E.M.I. Electronics; Gordon Cushing, Publicity Executive (Computers), International Computers and Tabulators; B. B. Swann, Sales Manager, Ferranti Computer Department; and T. I. Quinn Hall, Senior Technical Officer (Guided Weapons), Society of British Aircraft Constructors.

The Bulletin which is to be published at irregular intervals, is obtainable from the **Electronic Engineering Association, 11 Green St., London, W.1. England.**

## Electronic data book

A new VECO Data Book has just been published covering thermistors and varistors, thermal conductivity

cells, electronic controls and thermal, electronic and physical-sensing devices. The new Data Book includes R vs T curves and E vs I curves, plus additional information on VECO Silicon Carbide Varistors including curves.

The new edition was prepared to offer engineers, purchasing and sales personnel, management and others responsible for their company's progress sufficient information for them to evaluate the needs in their own activities for thermistors, varistors and allied devices. It is available from **Victory Engineering Corp. for \$1. Victory Engineering Corp., 525 Springfield Road, Union, N.J.**

## Laboratory services

This brochure contains important information of a new service for engineers and manufacturers in all branches of business and industry.

The equipment and skills of Avro's Experimental Engineering Laboratories, built up in recent years to meet the formidable problems presented by the development of modern military aircraft, are available to assist in the solution of a wide variety of industrial problems. We invite your enquiries, and will be glad to discuss with you the application of our facilities to your business.

In this brochure we have outlined in detail the equipment and services which are now at your command, and which we believe represent one of the finest and most comprehensive facilities for engineering test work in Canada.

Catalog obtainable from the **Chief Test Engineer, Avro Aircraft Limited, P.O. Box 4004, Terminal A, Toronto.**

## Teaching servosystems

A new method for teaching servo systems that bridges the gap between theory and practice is described in a special report published by Servo Corporation of America. The report shows how engineering schools have actually built their courses around the new Servolab (TM) Servo System Simulator. Indications are that students learn more, faster, and are both stimulated and prepared for the servo control analysis procedures they will encounter in industry.

Copies of Special Report SR-3 may be obtained by writing to **Servo Corporation of America, 111 New South Rd., Hicksville, L.I., N.Y.**

## Philips Electronics staff changes

D. C. F. van Eendenburg, president, Philips Electronics Industries Ltd. has announced the formation of two new divisions to market products formerly sold through Philips Industries Limited Division.

The Home Entertainment Products Division will market television, radio



L. B. Kiely



D. H. Prentice

and high fidelity sets. General manager, marketing, is **L. B. Kiely**, who was formerly vice-president, sales, Philips home entertainment products. Assistant general manager is **N. Coxall**. **B. Barbour** is general sales manager for Rogers Majestic home entertainment products.

The Light and Appliance Division will market Philishave electric shavers, tape recorders, dictating equipment, car radios, lamps and their accessories and will be responsible for the development of new consumer products which will be sold through the appropriate divisions. General manager, marketing is **D. H. Prentice** who was formerly vice-president and assistant general manager, Philips Industries Limited. He is supported by product marketing managers, **A. V. Richards**, electric shavers and small appliances; **W. A. Grant**, tape recorders and dictating equipment; **J. J. Brydges**, car radio, **J. de Jager**, lamps and their accessories.

## K. J. Davis assistant director of sales

**J. R. Bach**, president of Welwyn Canada Limited, London, and Welwyn International Incorporated, Cleveland, manufacturers of Welwyn deposited carbon and power oxide resistors for the North American continent, announces the appointment of **Ken J. Davis** assistant director of sales.

Mr. Davis, formerly with Renfrew Electric Co. Ltd. (IRC Resistor Division) in the capacity of general manager and sales manager, has spent 15 years in the resistor industry and is well known to the Canadian Electronics trade.



K. J. Davis

## product panorama

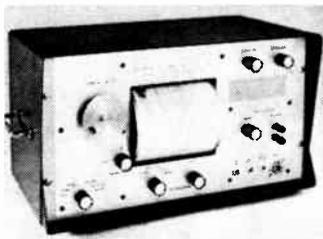
Continued from page 47

### Audio response plotter

Item 383

SIE (Southwestern Industrial Electronics Co.), a division of Dresser Industries, Inc., announces the introduction of its new Model ARP-2 Audio Response Plotter. The new ARP-2 provides permanent, pen-written frequency response curves of any audio range equipment quickly, easily and economically.

The ARP-2 not only eliminates costly hand-plotting methods, but will plot curves far too complex to be drawn by hand — such as the response of a loudspeaker in a live room. Other uses for the ARP-2 include operating it as a motor-driven audio oscillator and for plotting vibration curves of equipment tested on a shaking table. Circuitry is now included to allow the ARP-2 to be used as a 0 to 1 vdc recording volt-



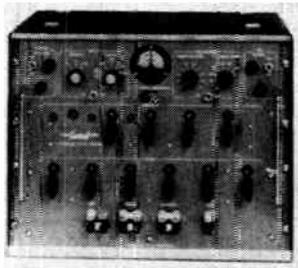
meter. The front panel is now slotted to permit the ARP-2 to be rack-mounted.

Southwestern Industrial Electronics Co., 10201 Westheimer Rd., Houston, Texas.

### Complex ratio bridge

Item 384

A new complex ratio bridge manufactured by Gertsch Products, Inc., Los Angeles, Calif., measures both in-phase and quadrature voltage ratios with high accuracy. Unit is used to test 3- or 4-terminal networks such



as transformers, synchros, resolvers, gyros and transducers.

Manufacturer: Gertsch Products, Inc., 3211 S. La Cienega Blvd., Los Angeles 16, California.

### Cardiac apparatus

Item 385

One of the most valuable of recent developments for the diagnosis of cardiac diseases is the Dye-Dilution Recording Apparatus produced by the Cambridge Instrument Co. Ltd. It is used to determine cardiac output, and intra-cardiac shunts can be detected and located. It is also finding increasing use in the study of congenital heart conditions and valvular incompetence.

The Apparatus is designed to record the change of concentration of a dye injected in the venous circulation. This change is determined by a photo-electric attachment on the ear or by a

photo-electric cuvette through which blood is permitted to flow. The output from either of these units is fed into a special Cambridge Electronic Recorder. The instant of dye injection is marked on the recorder chart by pushing the event-marker switch. As the dye passes through the detector, a time concentration curve is traced. Either detector can be used with Evans Blue Dye (Azovan Blue) or Fox Cardio Green (Indocyanine Green).

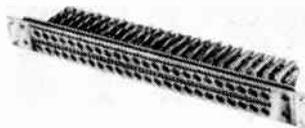
R. H. Nichols Limited, P.O. Box 500, Downsview, Ontario.

### Jack panels

Item 386

This company has announced a new, Series 2800, Aluminum Jack Panel, weight approximately 25 per cent less than Phenolic Panels.

Constructed of clear anodized aluminum, sandwich-like frame design, yet with the strength and lightweight of aluminum.



Double Row, mounts 24 Jacks per row (48 jacks total per strip) on 5/8" centers. Included is a new, narrow designation strip for each row, with a "stop" for each insert — not necessary to remove a long identification strip to make a change. Stock panel has angle (offset) ground lug on Jack to facilitate common wiring of ground; available special order with standard jack. Special finishes of front panel available on production quantity orders.

Full information may be had by addressing Atlas Radio Corporation Ltd., 50 Wingold Avenue, Toronto 19.



### Twenty million megohmmeter

Item 387

The Model 29 Twenty Million Megohmmeter is an instrument designed for the precise measurement of electrical resistance over a range of 300,000 ohms to 20,000,000 megohms in six decades. Both high and low internal test voltages are provided. The instrument is simple and safe to use and is suitable both for the laboratory and for the production test line. It is also recommended for the tests of surface resistivity of plastic materials and the oil resistivity tests. In addition to its very high upper limit of measurement, other unusual features are the direct reading character of the instrument and the low test voltages that are employed.

Further information available from The Glendon Instrument Company Limited, Toronto, Ont.

Use handy coupon on page 51

# FREE!

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Get your free subscription to this informative, illustrated HI-FI magazine written in down-to-earth terms everyone can understand.

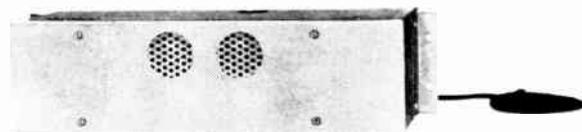
ABSOLUTELY NOTHING TO BUY. Please send name and address, to:

### PAYETTE RADIO LIMITED

730 St. James Street West - Montreal

For complete details check No. 30 on handy card, page 51  
ELECTRONICS AND COMMUNICATIONS, March, 1960

## PBX SUPPLY



MODEL RTS-1

Features ringing, talking and signalling outputs with improved efficiency and regulation plus increased capacity in much less space.

IMMEDIATE SHIPMENT FROM STOCK

Write for further details to:



PYLON ELECTRONIC DEVELOPMENT company, Ltd.

Communications Systems and Equipment

161 CLEMENT ST., VILLE LA SALLE, MONTREAL 32, QUE.

For complete details check No. 33 on handy card, page 51

## engineers' book-case

**Encyclopedic Dictionary of Electronics and Nuclear Engineering** by **Robert I. Sarbacher**.

This new reference work, designed to serve as a central source for the standard definitions approved by every official technical society, is intended to be of use to a wide spectrum of scientific and industrial technicians and experts, ranging from the assembly line technician to the designing engineer.

All the modern terms and definitions, equipments, elements, components, and systems in the electronics and nuclear engineering fields are covered in alphabetical order. There are approximately 14,000 entries and 1,400 illustrations. Cross-references are incorporated on an equally extensive scale, numbering more than 17,000.

Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N.Y., contains 1417 pages, hard cover bound, price \$35.00.

**An Introduction to Electronics for Physiological Workers — Second Edition** by **I. C. Whitfield, B.Sc., Ph.D.**

This book will be of value in filling the gap between the elementary and more advanced radio textbooks for graduate students and others wishing to use electro-physiological techniques. The author has included an account of basic electronic theory with the emphasis placed according to the relevance of each matter to the biologist's viewpoint. Quantitative treatment, together with worked examples, has been given wherever possible.

The Macmillan Company of Canada Ltd., 70 Bond St., Toronto, Ont., contains 263 pages, hard cover bound, price \$3.00.

**Fundamentals of Electron Devices and Circuits** by **Herman R. Weed and Wells L. Davis**.

This volume presents the reader with a clear survey of the problem of electron devices, consistent with the standards of an electrical engineering text yet well within the grasp of the non-electrical student as well.

The authors give a complete analysis of such new devices as transistors, diodes, and magnetic amplifiers — in conjunction with the more orthodox vacuum and gas tubes.

Prentice-Hall, Inc., 70 Fifth Ave., New York 11, N.Y., contains 591 pages, hard cover bound, price \$9.50.

**Encyclopedia on Cathode-Ray Oscilloscopes and their uses (2nd Edition)**

by **John F. Rider and Seymour D. Uslan**.

The Second Edition is a greatly expanded version of the extremely popular first edition. The book begins with cathode-ray tube construction and theory, then carries the reader through an analysis of modern oscilloscope circuitry, commercial scope types and maintenance, to a detailed treatment of how the scope is operated for all applications. It covers the latest in special purpose cathode-ray tubes, new data on probes, related information on scope photography. New sections on pulse measurements and square wave testing have been added.

John F. Rider Publisher, Inc., 116 W. 14th St., New York, N.Y., contains 1356 pages, hard cover bound, price \$21.95.

**Industrial Electronics and Control — Second Edition** by **Royce Gerald Kloeffer**.

This book represents a new approach to electronic theory and its applications in industry. Anyone concerned with electronics and its commercial applications will find this book practical, thorough, and understandable, even if his technical background includes only physics.

The Second Edition of *Industrial Electronics and Control* differs from its predecessor in that it approaches the electronic theory of rectification, amplification, and oscillation through solid state theory rather than by way of the vacuum and gaseous tubes.

John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y., contains 540 pages, hard cover bound, price \$10.00.

**The Theory of Numbers and Diophantine Analysis** by **Robert D. Carmichael**.

These two complete works, bound together in one volume, form one of the most lucid, easy reading introductions to number theory. Though no previous training is necessary beyond a firm foundation in high school mathematics, the materials will be found useful by teachers and students at all levels of ability.

"Theory of Numbers" deals with one of the most extensive and elegant disciplines in the whole body of mathematics.

"Diophantine Analysis" is organized around the notion of a multiplicative domain.

Dover Publications, Inc., 180 Varick St., New York 14, N.Y., contains 118 pages, paper cover bound, price \$1.50.

## E. F. Johnson heads IRC's Ottawa office

International Rectifier Corporation announces the successful completion of the first year of its Canadian subsidiary, International Rectifier of Canada Ltd., 1581 Bank Street, Ottawa, Ontario.

The Canadian company is headed by **Earl F. Johnson**, secretary-manager, who has been associated with Canadian electronics industries in sales, engineering and management capacities for several years.

The formation of the Canadian company represents another phase in the foreign expansion program of International Rectifier Corporation. Subsidiaries have already been established at Geneva, Tokyo and Paris, and in Great Britain.



E. F. Johnson



R. E. Bishop

## Sales rep for mobile radio

The appointment of **Robert E. Bishop** as mobile radio sales representative for eastern and south-western Ontario, is announced by P. T. Wilson, manager, mobile radio sales, Canadian General Electric Company Limited.

Mr. Bishop, a native of London, Ontario, joined Canadian General Electric in 1953, following five years service with the communications branch of the Royal Canadian Navy.

He was employed on communications systems and radar installations with CGE until 1954, when he transferred to the microwave maintenance section. He was supervisor of national field operations, microwave maintenance, until his present appointment.

## Donald Wharin sales manager

Bohne Industries Limited of Toronto, manufacturers of precision mechanical springs for industry, announce the appointment of **Donald D. Wharin** as sales manager of the organization.



D. Wharin

## CGE buys stock

Continued from page 18

located at 7420 Upper Lachine Road, Montreal, and is engaged in the repair and service of heavy apparatus and electric motors. It will come within the responsibility of Canadian General Electric's Apparatus Department.

Canadian General Electric Vice-President **Walter G. Ward**, who is general manager of the Apparatus Department, has been appointed president of Montreal Armature Works Limited.

## Kelvin Hughes and Curtiss-Wright agreement

An agreement, taking effect immediately, has been concluded between Kelvin & Hughes Ltd. and the Curtiss-Wright Corp. of America for the exclusive right to manufacture and sell the non-destructive testing equipment of the other partner. This includes instruments for the inspection and measurement of materials, and equipment employing ultrasonic techniques in all industrial fields.

The agreement covers certain defined territories. Kelvin Hughes will represent both interests in the U.K., the Commonwealth (except Canada) and Europe, and Curtiss-Wright in the U.S.A. and Northern America.

Each party to the agreement will offer full sales and service facilities on the joint range of equipment.

## Directors of Sola Electric Canada Ltd. elect J. R. McGovern as vice-president

The board of directors of Sola Electric (Canada) Ltd. announced the election of **J. R. McGovern**, Toronto, as vice-president and general manager of the company, and his re-election to the board.

He is currently in charge of operations at the Sola plant, 24 Canmotor Avenue, Toronto, and will also be in charge of a new plant to be opened within several weeks at 377 Evans Ave., Toronto, in line with expanding operations of Sola in Canada. Plans for the opening of the new plant were discussed by the board at a recent meeting.

### PROJECT ENGINEER

Preferably with background in chemistry or physics to develop designs, standards and manufacturing techniques on semiconductor electronic components. Salary and fringe benefits. Apply in writing quoting full details to:

**Syntron (Canada) Limited**  
P.O. Box 10  
Stoney Creek, Ont.

## C RTPB NEWSLETTER

### Frequencies for Educational Television

At the recent CRTPB Executive Committee meeting it was noted that the Canadian Education Association stated that there was a great deal of confusion in the minds of educators at the present time regarding the allocation of radio frequencies for Canadian educational television stations. It had been suggested that the Planning Board could be of great assistance in this field. The Canadian Educational Association will contact the Board of Broadcast Governors to find out what policy the governors have in respect to educational television and to find out if any channels will be made available for educational purposes.

### Interference from Satellites

At the same CRTPB Executive Committee meeting it was noted that serious interference might result from proposals of the United States government agencies to place in orbit around the earth large satellites which would act as reflectors to permit communications over long distances. Because of the possibility of interference from these satellites, the Western Canada Telecommunications Council, which had brought the matter up, requested that this problem be brought to the attention of the Planning Board, the Department of National Defense Radio Physics Laboratory, and the Department of Transport, with a request that the situation be studied and the necessary representations be made to the United States agencies concerned. It was noted that space communications will eventually warrant a separate study and will undoubtedly have a CCIR Committee set up to discuss the subject in 1963.

### Stereophonic Sub-Committee Meet

The CRTPB Stereophonic Sub-Committee of the Broadcast Committee met late in January to report on the status of the NSRC considerations of stereophonic standards. A discussion took place with representatives of DOT and the Board of Broadcast Governors to determine their attitudes on stereophonic broadcasting and other items of business were discussed. It is hoped to report more detailed reports of the activities of this Committee in due course.

### Federal Communications Commission Report

In a year-end statement marking its 25th year of operation, the FCC in the United States said that 570,000 radio station licences had been issued to cover more than 1.7 million radio transmitters. There were now 665 FM stations broadcasting compared with 570 at the end of 1958. At the end of 1959 there were 3,450 AM transmitting stations in operation. There were more than 500 television stations, including 76 UHF stations, in operation at the end of 1959.

### U.S. Citizens Radio Service

The Class D Citizens Radio Service in the United States will now be policed by the industry after being criticized by government agencies in Washington. After a recent meeting of interested groups it was planned to urge all Class D radio manufacturers selling equipment to marine operators to provide equipment operating on one or two channels. Selected for this purpose were channels 9 (27.115 mc.) and 13 (27.065 mc.) It was believed that these two frequencies were best suited to operations in coastal waters and in lake areas. The FCC is studying the situation in the Class D bands and hopes to prepare distance and time limitations for the class. Nearly 7,000 applications a month are being received by the FCC for operation in this class.

*Prepared by Canadian Radio Technical Planning Board, 200 St. Clair Avenue West, Toronto 7, Ontario. F. H. R. Pounsett, President; C. J. Bridgeland, Vice-President; R. A. Hackbusch, General Co-ordinator; R. C. Poulter, Director of Public Relations; F. W. Radcliffe, Secretary-Treasurer.*

## Industry Personnel

### W. H. Furneaux appointed president of Aerovox Canada Ltd.

The board of directors of the Aerovox Corporation, New Bedford, Mass., and Aerovox Canada Limited, Hamilton, Ontario; are pleased to announce the appointment of **Walter H. Furneaux** as president of Aerovox Canada Limited.

Mr. Furneaux has been, and will remain, a vice-president of the parent Aerovox Corporation and will continue to serve on their board of directors.

Mr. Furneaux, a Canadian by birth joined Aerovox Canada Limited in 1931 and served successively as office manager, plant manager, general manager, and managing director. For the past seven years he has been vice-president of both the New Bedford and Canadian operations.



W. H. Furneaux

These Divisions include Thomas A. Edison Industries, Toronto, CLM Industries, Scarborough, Ontario, and the Small Appliance Division, Oakville, Ontario.

**George Axson**, Toronto, formerly Treasurer of Canadian Line Materials Limited, has been appointed vice-president and treasurer of McGraw-Edison (Canada) Limited. Other McGraw-Edison officers for Canada will include: president, **Alfred Bersted**, Elgin, Illinois; controller, **R. W. Martin**, Chicago; and secretary, **Judson Large**, Chicago.

Additional key appointments announced include **J. R. Lister**, Toronto, former general manager, who now becomes division president of Thomas A. Edison Industries. **Thomas G. Quance**, Toronto, previously assistant to the president of Canadian Line Materials Limited, will now act as division president of both the newly formed CLM Industries and the Small Appliance Division.

### Quebec appointments for C.G.E.

The appointment of **Archie F. Johnston** as Manager—Quebec District of the Wholesale Department of Canadian General Electric Company Limited has been announced by **R. N. Fournier**, department General Manager. Mr. Johnston will undertake his new responsibilities effective February 15.



L. E. Butters



A. F. Johnston

Mr. Johnston will succeed **Louden E. Butters** who has been assigned to direct special commercial projects for the department at Head Office and in the Province of Quebec. Mr. Butters' office will be located at 214 King St. W., Toronto.

Prior to undertaking his responsibilities as Manager—Quebec District, Mr. Johnston was Manager—Finance at Wholesale Department headquarters. A graduate in commerce of Queen's University and a veteran of six years' wartime service with the Canadian Army, Mr. Johnston joined Canadian General Electric in 1949, and has held managerial appointments in several of the Company's major sales offices.

Mr. Johnston will have his offices in the department's Quebec District headquarters at 5000 Namur St., Montreal.

### Ward Leonard appointment

**J. Boles**, president, Ward Leonard of Canada Limited, Toronto, announces the appointment of **A. D. (Art) Burford**, P.Eng. to direct the sale of the company's complete range of electrical and electronic products.

The appointment, says Mr. Boles is in line with the company's expanding manufacturing activity in Canada. Mr. Burford was formerly associated with Amalgamated Electric and has been product sales manager since 1956.



A. D. Burford



W. N. K. Mainguy

### R-O-R increases engineering staff

**W. N. K. Mainguy** has joined R-O-R Associates as a field engineer, to strengthen R-O-R sales and engineering coverage for their electronic instruments and components.

### McGraw-Edison forms Canadian corporation and announces key appointments

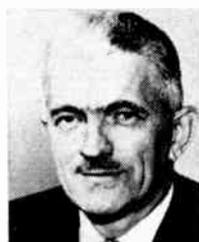
Formation of McGraw-Edison (Canada) Limited, with headquarters in Toronto, to act as an entirely Canadian operated corporation was announced



J. R. Lister



A. Bersted



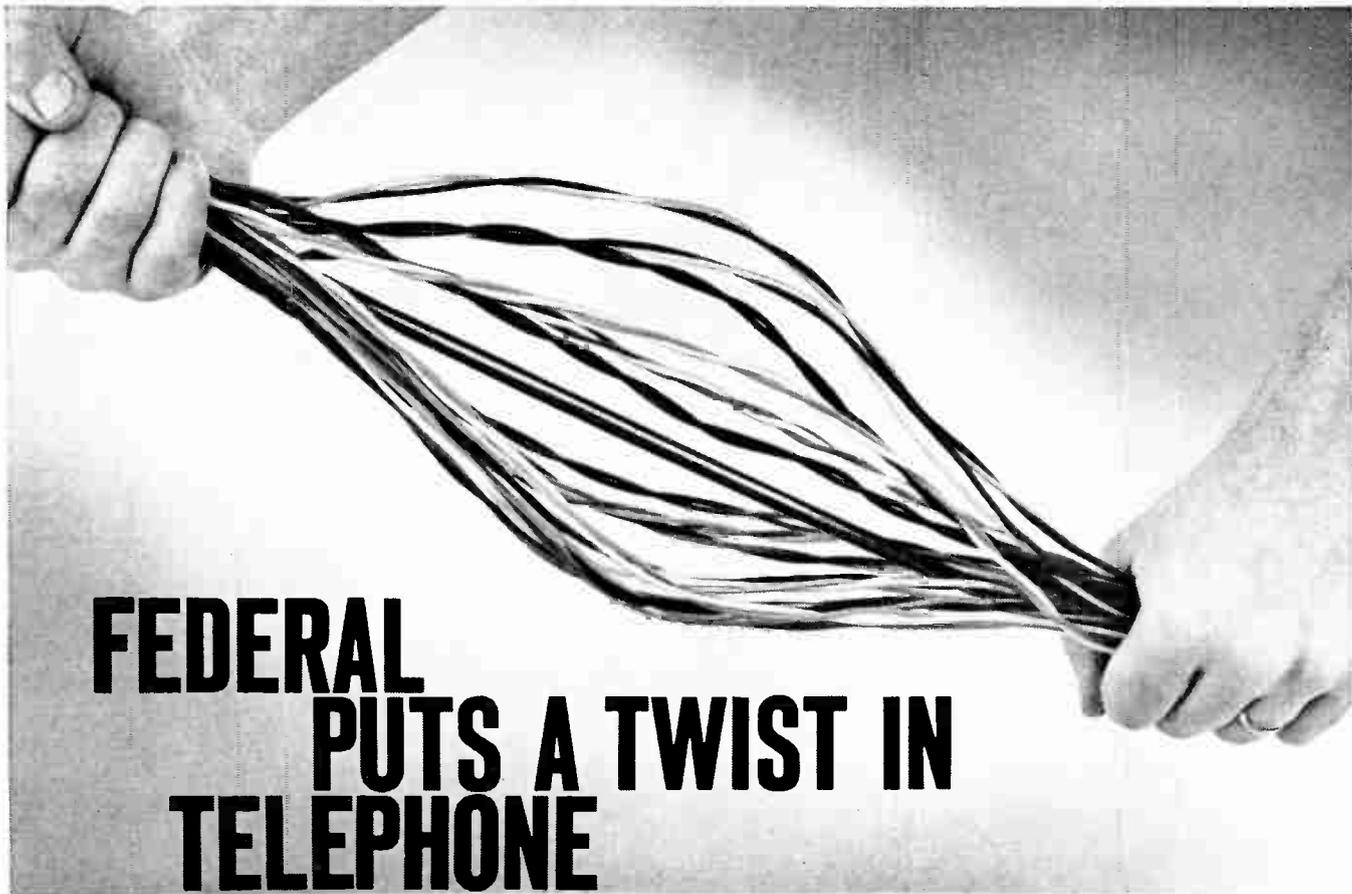
T. G. Quance



G. Axson

February 11th on the 113th anniversary of the birth of Thomas Alva Edison.

McGraw-Edison's Canadian corporation will consist of three Divisions, which previously operated as subsidiaries to their respective parent companies in the United States.



# FEDERAL PUTS A TWIST IN TELEPHONE CABLE

## Special 'Unilay' Construction

Twist it's open . . . twist it's closed! Just as simple as that, this one-direction cabling technique gives easy access to inner conductors . . . makes possible faster, more efficient mid-span taps.



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#### FEDERAL TYPE B RURAL DISTRIBUTION WIRE

Because of its high tensile strength, it is ideal where longer spans are required. Its rugged construction gives excellent service life and permits re-use after emergency operation. Thus, considerable time and expense are saved in new construction. Engineered for maximum dielectric strength, low transmission loss and cross talk, Federal Rural Distribution Wire provides the best in subscriber service at minimum cost.

### Another fine product . . .

#### FEDERAL TYPE NC TELEPHONE DROP WIRE

is specially built for life-long resistance to severe wind and ice-loading conditions. Its high dielectric rubber insulation is securely bonded to No. 18 copperweld conductors. The tough, reinforced neoprene sheath is ribbed for quick polarity identification by touch. It comes in solidly taped 1,000 foot "Tangle-proof" coils for fast, efficient installation. Buy Federal quality for dependable service.

**FEDERAL WIRE**



**& CABLE DIVISION**

**H.K. PORTER COMPANY (CANADA) LTD.**

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For complete details check No. 32 on handy card, page 51

ELECTRONICS AND COMMUNICATIONS. March, 1960

One of a Series

## Predetermining Counters provide simplified methods for Automatic Control

Veeder-Root Predetermining Counters now make it possible to design and build automatic control into equipment of all types. They are available for mechanical, electrical and electronic control and offer many features and options to give your equipment extra value and versatility.

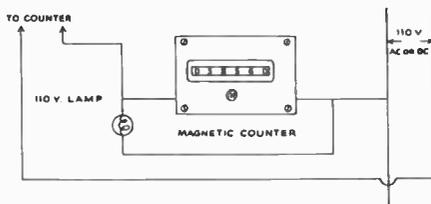
Predetermining Mechanical Counters can be applied to rotary, eccentric or stroke type motion, registering or counting whatever units are required — such as revolutions, motions, turns, pieces, lengths, and strokes. The newer electric and electronic Predetermining Counters use a special high speed light source and photo cell for non-contact counting on any machine or process.

Automatic control is provided by the predetermining counter actuating such devices as: lights, bells, signals and stop motions. They work at speeds up to 8000 counts per minute, can be easily incorporated into machine design and control panels. Application assistance is available from a Veeder-Root Counting Engineer; and specialized designs and modifications can be supplied in most cases. For complete information, call or write your nearest Veeder-Root office.

### High Speed, Quick Reset Predetermining Counters for electrical and mechanical control, at speeds to 8000 cpm.



This counter has one set of wheels which are preset to any figure within the capacity of the counter by depressing the reset lever, raising the cover, and turning. The counter subtracts from the preset number to "00000", when a knock-off lever actuates an electrical switch. To reset, just press the reset lever, and counter returns instantly to preset figure. For Mechanical Control, counter actuates a mechanical lever instead of electrical switch. Speeds: 6000 rpm or 8000 counts per minute.



### Addition of Magnetic Counter Provides Record of Total Lots.

A Veeder-Root Magnetic Counter connected in series with the alarm or stop motion registers one unit for each of the predetermined lots produced. Provides a simple means to obtain both machine control and production control.



The High Speed Predetermining Counter is the basic counter in this complete line. It provides automatic control by this simplified method: . . . to set a run of 5451 pieces on the counter: (1) Set all white wheels to zero with one turn of wing-nut; (2) Now, set the metal wheels, one by one. Set first wheel to "5", opposite zero on its "opposite number" white wheel, then set the "4", "5" and "1" and that's all . . . you're ready to throw the switch and start the run.

### Electric Predetermining Counter Ideal for Batching, Length Measurement and Materials Handling.

This new counter offers automatic reset plus other important features: 1. Instant automatic reset . . . Control contacts operate and hold for 0.3 seconds . . . or for 2 seconds . . . or indefinitely. 2. Counter can be modified for automatic sequential predetermining, using two or more preset numbers. 3. A batch or totalizing counter can be added. This counter is adaptable to material handling applications, slow speed batch counting, length measurement, slitting, and similar applications. Speeds up to 1000 cpm.



### High Speed Electronic Predetermining Counters Feature Automatic Reset, 5000 cps.



The No. 1604 features instantaneous recycling. Up to six decade counters, with one, two, or more sets of preset numbers . . . with or without photohead or enclosure. Output relay provides momentary or indefinite holding time. Batch totalizing available. Ideal for all high speed counting, up to 5000 cps, recycle at 1000 cps.

Send for Literature and Technical Data . . . Extensive information and specifications on how to use Veeder-Root Predetermining Counters are yours for the asking. Send today.

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955 St. James St., Montreal 3

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# 2 NEW GENERAL-PURPOSE OSCILLOSCOPES

introduce **TEKTRONIX QUALITY** to the  
**DC-to-450 KC RANGE**



The Tektronix Type 503 and Type 504 are the first of a family of new oscilloscopes for the DC-to-450 KC application area.

- Both feature high reliability, simple operation, light weight.
- Each excels in performance characteristics in its class.
- Both now established as production instruments.



Prices to be  
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## Tektronix, Inc.

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

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**TEKTRONIX ENGINEERING REPRESENTATIVES:** Hawthorn: Electronics; Portland, Oregon • Seattle, Washington. Tektronix is represented in twenty overseas countries by qualified engineering organizations.

For complete details check No. 38 on handy card, page 51

ELECTRONICS AND COMMUNICATIONS, March, 1960

### TYPE 503

The Type 503 is a differential-input X-Y oscilloscope with the additional features—linear sweeps, dependable triggering, sweep magnifier, bright trace, amplitude calibrator—desirable for general-purpose applications.

#### FREQUENCY RESPONSE

dc to 450 kc

#### VERTICAL AND HORIZONTAL AMPLIFIERS

Differential input at all attenuator settings.

1 mv/cm to 20 v/cm in 14 calibrated steps.

Continuously variable between steps, and to approximately 50 v/cm uncalibrated.

Constant input impedance at all sensitivities (standard 10X probes can be used).

#### SWEEP RANGE

1  $\mu$ sec/cm to 5 sec/cm in 21 calibrated steps.

Sweep time adjustable between steps, and to approximately 12 sec/cm uncalibrated.

#### SWEEP MAGNIFICATION

X2, X5, X10, X20, and X50  
Magnification.

#### AMPLITUDE CALIBRATOR

500 mv and 5 mv peak-to-peak square-wave voltages are available from front panel.

#### 3-KV ACCELERATING POTENTIAL

5-inch Tektronix crt provides bright trace, 8-cm by 10-cm viewing area.

#### EASY TRIGGERING

Fully automatic, amplitude-level selection on rising or falling slope of signal, or free-run (recurrent). AC or DC coupling, internal, external, or line.

#### REGULATED POWER SUPPLIES

All critical dc voltages electronically regulated, plus regulated heater supplies for the input stages of both amplifiers.

#### SIZE AND WEIGHT

13½" h, 9¾" w, 21½" d—  
approximately 29 lbs.

### TYPE 504

The Type 504 has the basic features desirable for most general-purpose applications — sensitive vertical amplifier, linear sweeps, easy triggering, amplitude calibrator.

#### FREQUENCY RESPONSE

dc to 450 kc

#### VERTICAL AMPLIFIER

5 mv/cm to 20 v/cm in 12 calibrated steps.

Continuously variable between steps, and to approximately 50 v/cm uncalibrated.

Constant input impedance at all sensitivities (standard 10X probe can be used).

#### SWEEP RANGE

1  $\mu$ sec/cm to 0.5 sec/cm in 18 calibrated steps.

Sweep time adjustable between steps, and to approximately 1.2 sec/cm uncalibrated.

#### AMPLITUDE CALIBRATOR

500 mv and 25 mv peak-to-peak square-wave voltages are available from front panel.

#### HORIZONTAL INPUT

0.5 v/cm, with variable attenuator.

#### 3-KV ACCELERATING POTENTIAL

5-inch Tektronix crt provides bright trace, 8-cm by 10-cm viewing area.

#### EASY TRIGGERING

Fully automatic, amplitude-level selection on rising or falling slope of signal, or free-run (recurrent). AC or DC coupling, internal, external, or line.

#### REGULATED POWER SUPPLIES

All critical dc voltages electronically regulated, plus regulated heater supplies for the input stages of the vertical amplifier.

#### SIZE AND WEIGHT

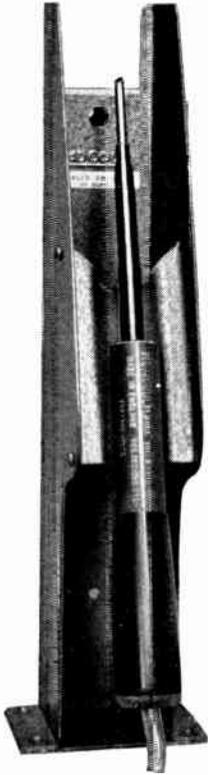
13½" h, 9¾" w, 21½" d—  
approximately 29 lbs.

*Rack-mounting models will be available, of course!*

1/8" Bit L. No. 70  
Shield L. No. 68

**ADCOLA**  
(Regd. Trade Mark)

3/16" Bit  
L. No. 64



**C.S.A. APPROVED  
SOLDERING  
INSTRUMENTS**

Designed in Three Sizes  
1/8" 3/16" & 1/4" Bits.

Manufactured for  
All Supply Voltages  
6/7 to 230/50 v.

Instruments maintain  
soldering temperatures  
and thorough jointing  
is achieved in all the  
fields of soldering, from  
pin point to general  
work in all sound equip-  
ment.

Insulation standards are  
approved in all leading  
countries.

All Designs Cover the  
Demands for Continual  
Bench Production  
Assembly.

Canadian, British and  
Foreign Pats.  
Reg. designs, etc.

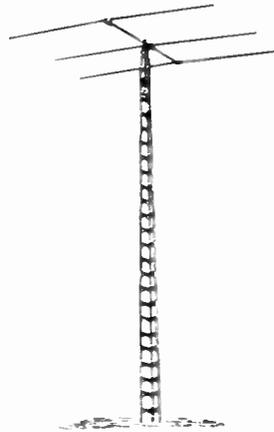


Canadian  
Representative:

**L. J. LAMB**  
Box 103 - Weston, Ont.

For complete details check No. 1 on handy card, page 51

# NEW THE DELHI SPAULDING STRATO-TOWER



**SELF-SUPPORTING  
TOWERS UP TO 67 FT !**

- Heavily galvanized, all-steel construction
- Riveted joints — no rust-prone welds
- Smart, modern styling
- "X" brace design for greater strength
- Beaded channel leg eliminates twisting
- Quickly, easily erected
- A Product of Canada's leading TV Antenna manufacturer

**Your Choice of 4 Bases**

The Strato-Tower comes with four different types of base: One for anchoring in concrete; one using a screw anchor; another using a cylinder base; and one to be anchored to the side of a building with ground rods driven through holes in the base.

See the Spaulding Strato-Tower today at any Delhi dealer

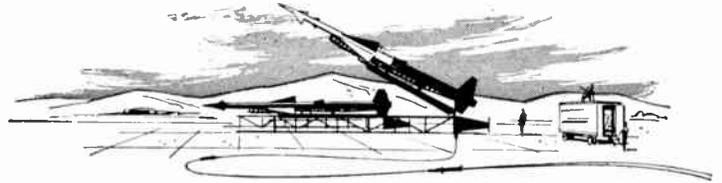
**ALSO AVAILABLE:**

Guyed towers up to 150 ft. in height and an "Erect-Tower" using a crank-up principle to 100 ft.

**DELHI METAL PRODUCTS LIMITED**  
DELHI, ONTARIO

For domestic TV and all types of commercial requirements

For complete details check No. 18 on handy card, page 51



*Why it pays you to specify*

## Bendix QWL Electrical Connectors for use with Multi-conductor Cable

For use with multi-conductor cable on missile launching, ground radar, and other equipment, the Bendix\* QWL Electrical Connector meets the highest standards of design and performance.

A heavy-duty waterproof power and control connector, the QWL Series provides outstanding features: • The strength of machined bar stock aluminum with shock resistance and pressurization of resilient inserts. • The fast mating and disconnecting of a modified double stub thread. • The resistance to loosening under vibration provided by special tapered cross-section thread design. (Easily hand cleaned when contaminated with mud or sand.) • The outstanding resistance to corrosion and abrasion of an aluminum surface with the case hardening effect of Alumilite 225 anodic finish. • The firm anchoring of cable and effective waterproofing provided by the cable-compressing gland used within the cable accessory. • The watertight connector assembly assured by neoprene sealing gaskets. • The addi-

tional cable locking produced by a cable accessory designed to accommodate a Kellems stainless steel wire strain relief grip. • Prevention of inadvertent loosening insured by a left-hand accessory thread. • The high current capacity and low voltage drop of high-grade copper alloy contacts. Contact sizes 16 and 12 are closed entry design.

These are a few of the reasons it will pay you to specify the Bendix QWL electrical connector for the job that requires exceptional performance over long periods of time. \*TRADEMARK

Canadian Affiliate: Aviation Electric Ltd., 200 Laurentien Blvd., Montreal 9, Quebec.

Scintilla Division  
Sidney, New York



For complete details check No. 10 on handy card, page 51

# 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 Ave., 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

## 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

**DIRECT READING OF  
FM DEVIATION . . .  
25 to 500 mc. At Low Cost!**



## LAMPKIN 205-A FM MODULATION METER

- Indicates instantaneous peak modulation, plus or minus, on 0-12.5 or 0-25.0 KC scales.
  - Accuracy 10% of full scale.
  - Tunable 25 to 500 MC in one band, with fast and slow controls.
  - Sensitivity 20 millivolts or better throughout range.
  - Speaker for aural monitoring, oscilloscope output for visual monitoring.
  - Meets Department of Transport specs for mobile-radio maintenance.
  - Size only 7" x 12" x 7 1/4". Weight 13 lbs.
  - Price \$270.00 (does not include duty).
- Satisfaction guaranteed or money refunded. To measure transmitter center frequencies, from 0.1 to 175 MC (to 3,000 MC by checking multipliers), with an accuracy better than 0.0025%, use the LAMPKIN 105-B MICROMETER FREQUENCY METER.

Write today for technical data on both instruments.

**LAMPKIN LABORATORIES, INC.**  
Dept. 707, Bradenton, Florida, U.S.A.

For complete details check No. 40

## GRADUATE ELECTRICAL ENGINEER

desires position with Canadian firm. Experience includes flying time of 500 hours as a navigation officer and two years as a telecommunications officer with the RCAF. Opportunity to gain technical experience considered of greater importance than remuneration involved. Complete resume will be forwarded on request.

Box 5027  
Electronics and Communications  
450 Alliance Avenue - Toronto 9, Ontario

## TECHNICAL SALES REPRESENTATIVE

of imported electronic equipment seeks change to position dealing with equipment or parts of Canadian or American origin. Extensive technical background. Connections with jobbers and industry.

Box 5029  
Electronics and Communications  
450 Alliance Avenue - Toronto 9, Ontario

## AMERICAN TELETYPE EQUIPMENT

Models 15, 14, Morkram, Weathstone. Keyboards, Rectifiers, Tables etc. Numerous spares and kits. British Creed Teleprinters and Spares. Telephone Material American and British. Lists on request.

Suplex Lamps Limited  
239 High Holborn, London, W.C. 1, England

## GRADUATE ELECTRONIC TECHNICIAN

seeks employment in a research, development or adaptation laboratory. Willing to re-locate anywhere in Canada. For complete information as to experience please write to —

Box 5030  
Electronics and Communications  
450 Alliance Avenue, Toronto 9, Ontario

## NEW OIL CAPACITORS

60 GE 1/2 MFD 25,000 VDC \$29.50 ea.  
300 POTTER 16 MFD 660 VAC \$2.35 ea.

Navilog, Box 9  
Englewood, New Jersey

## EXECUTIVE (36) — P.ENG., B.A.S.C.,

desires Vancouver location. Seeks appointment in administrative, technical liaison or sales capacity in telecommunications or related fields. Well versed in all levels negotiations, both Government and Commercial aspects. Experience includes technical knowledge of communications systems, financial and budget controls, project planning, sales management, contract preparation, negotiation administration.

Box 5031  
Electronics and Communications  
450 Alliance Avenue - Toronto 9, Ontario

# Standard Signal Generator...

# NEW



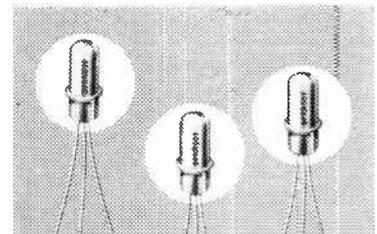
## for mobile communications . . .

- Frequency ranges 25-54, 140-175, 400-470, 890-960 Mc.
- Fine tuning control shifts carrier  $\pm 8$  Kc.
- Peak deviation to  $\pm 16$  Kc. read directly on meter.
- Residual FM less than 100 cycles at 460 Mc.
- Output 0.1 to 100,000 microvolts accurate  $\pm 10\%$  across 50 ohm termination.
- Excellent stability.
- Modulation by 1000 cycle internal or by external source.



H. ROY GRAY LIMITED  
46 Danforth Road • Toronto 13, Ont.

For complete details check No. 28



## Super High-Speed Switching Transistors Type 2N501

Sprague Type 2N501 germanium micro-alloy diffused-base transistors are the fastest mass-produced transistors available anywhere! Their ultra-low rise, storage and fall time cannot be matched by any other transistor.

# SPRAGUE®

## CANADIAN MANUFACTURING REPRESENTATIVE

Micarta Fabricators  
Limited

18 Toronto Street  
Toronto, Ontario

Phone EMpire 8-4251

For complete details check No. 38

## U. S. small business and defense sharing

The following is an excerpt from "Notes on Canadian-United States Defense Production Sharing", a document distributed by the Department of Defense Production in Ottawa.

" . . . Small business and labor surplus areas within the United States are given special consideration under the procurement regulations of the U.S. Armed Services. Canadian suppliers are excluded from bidding on requirements which are set aside for U.S. firms in these two categories.

The U.S. Small Business Administration has developed programs with the U.S. Armed Services under which Government procurements are set aside, in whole or in part, for tendering by U.S. small business firms on a competitive basis.

A U.S. small business concern is one with fewer than 500 employees or one that has been certified as a small business concern by the Small Business Administration.

An Armed Service contracting officer can agree with the Small Business Administration to set aside the **entire** amount of an individual procurement or a class of procurements where there is a reasonable expectation that bids or proposals will be obtained from a sufficient number of responsible small business concerns so that awards will be made at reasonable prices.

A set-aside for U.S. small business can be a **portion** of a procurement where it is found that a total set-aside is impractical and that the procurement can be divided into two or more economic production runs or reasonable lots, and further, where two or more small business concerns are expected to have the technical competency and productive capacity to furnish an economic production run at a reasonable price.

In instances of these partial set-asides Canadian companies may come across the following note in Invitations for Bid or Requests for Proposal: '(Units) of this procurement are to be awarded only to one or more small business concerns. Negotiation for award of the portion of this procurement set-aside for small business will be conducted only with responsible (U.S.) small business concerns who submit responsible bids or proposals on the non-set-aside portion at a unit price within 120 per cent of the highest award made on the non-set-aside portion. Etc.'

It is also U.S. Department of Defense policy to afford U.S. small business concerns 'equitable opportunity to compete for Defense subcontracts within their capabilities'. It will be seen that such firms are not to be given special privileges at the subcontract level; that they are merely to be given equal opportunity. . . ."

In view of the fact that the Canadian electronics industry is made up for the most part of small business concerns of the nature of U.S. small business, it is only reasonable to expect that they may look forward to defense sharing work of the same category as may be handled by small American firms. If, therefore, the interests of small American business is to be protected to the exclusion of small Canadian business, it becomes difficult to comprehend the fortunes of the many small firms in the Canadian electronics industry in the matter of sharing defense work. It would appear, on the surface at least, as if their welfare in the Defense Sharing Program is pretty much in the hands of the U.S. Small Business Administration.



# A 2-WAY SAVING

ON THE RESISTORS THAT ARE  
SETTING TODAY'S QUALITY STANDARDS

1. Now you can get resistors for today's most critical military requirements . . . direct from a Canadian Manufacturer . . . at favourable Canadian prices. They're Coldite 70+ Fixed Composition Resistors designed to exceed MIL-R-11 requirements and made by an exclusive cold moulding process that assures unmatched load life, moisture resistance, and other important performance characteristics.

2. No other resistors can match Coldite 70+ for production line efficiency — because their exclusive solder-coated leads makes them far and away the easiest

resistors to solder by any method. This saves your company money on their use.

Coldite 70+ Resistors are the latest development of a firm which, since the early days of radio, has been one of the largest, most dependable resistor suppliers. Laid end to end, the resistors Stackpole has produced would extend around the world so many times you'd get dizzy counting them!

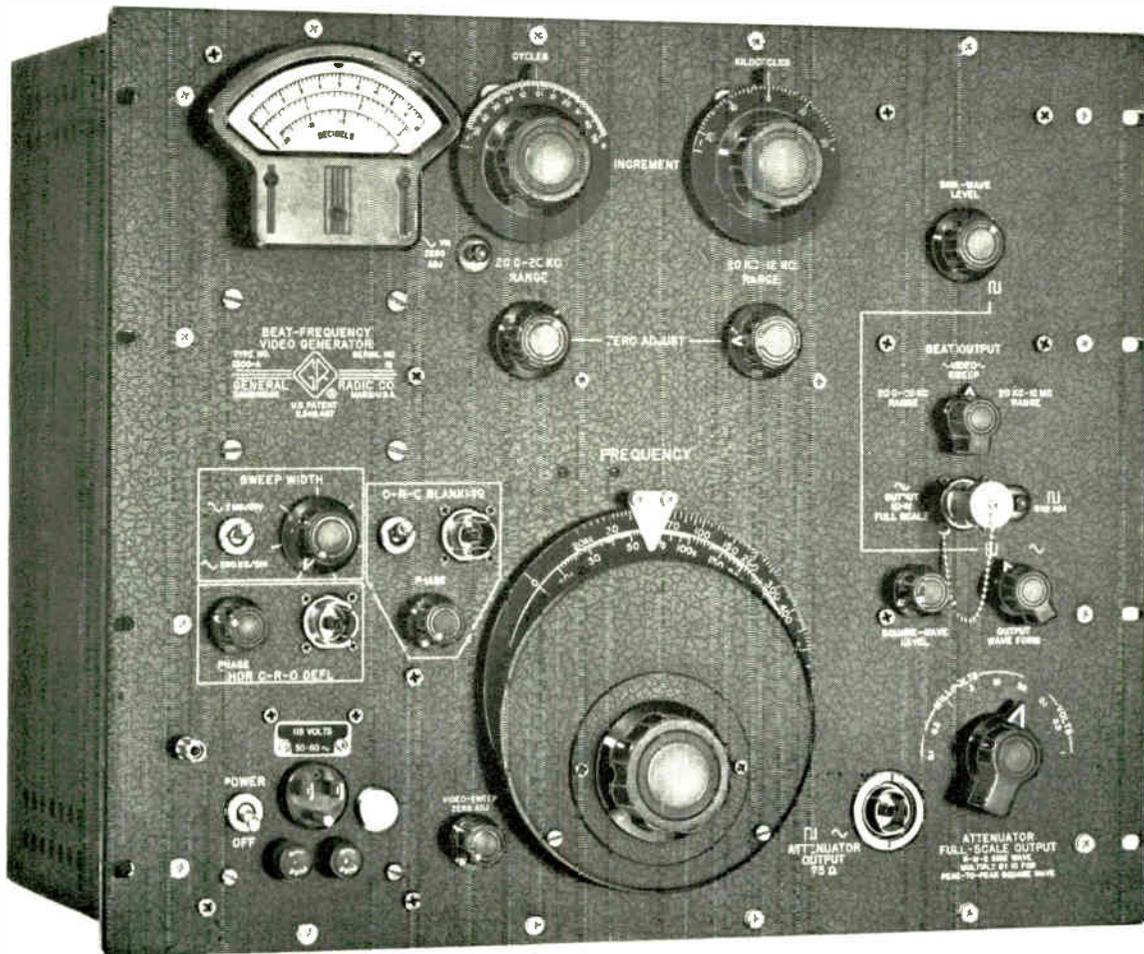
Coldite 70+ Resistors are now made in Toronto by Canadian Stackpole Limited in the complete range of 5%, 10% and 20% "preferred" values in 1/2-, 1-, and 2-watt styles.

CANADIAN STACKPOLE LIMITED  
550 Evans Avenue - Toronto 14, Ontario  
Telephone: CLifford 5-2373



For complete details check No. 14 on handy card, page 51

# NEW 20c to 12-Mc Beat-Frequency Generator for Sine/Square-Wave and Sweep Applications



**Type 1300-A Beat-Frequency Video Generator . . . \$1950.**

The features of beat-frequency generators, so well liked for audio-frequency testing, are now available for ultrasonic and video-frequency work. Features include: complete audio- or video-band coverage in one sweep of the dial without annoying range switching . . . high resolution provided by incremental frequency dials for accurate point-by-point studies of amplitude peaks and dips . . . continuously adjustable electronic sweep for video measurements at center frequencies to 12 Mc . . . automatic graphic-level and x-y recording with accessory G-R Dial Drives . . . square-wave output for frequency-response testing by transient techniques (e.g., rise-time and ramp-off measurements) . . . adjustable  $\pm 6$ -Mc sweep at center frequencies from 36 to 42 Mc (obtained directly from internal oscillators) for television i-f testing.

This instrument's many outputs and different modes of operation, coupled with excellent frequency stability and high output (10v) over the entire frequency range, make it the most versatile audio-video test instrument commercially available.

**As Manually-Tuned Generator:**

Sine Wave: 20c to 12 Mc  
Square Wave: 20c to 2 Mc

**As Sweep Generator (60c sweep rate):**

Sine Wave: 20 kc to 12 Mc  
Sweep width is continuously adjustable from 0 to  $\pm 6$  Mc at any center frequency from 0 to 12 Mc.

Horizontal deflection voltage and blanking pulse provided for scopes.

**Calibration Accuracy:**

20c to 20 kc,  $\pm (1\% + 1c)$   
20 kc to 500 kc,  $\pm (2\% + 1 kc)$   
500 kc to 12 Mc,  $\pm (1\% + 1 kc)$

In addition to the main frequency dial, two increment dials calibrated from  $-50c$  to  $+50c$ , and  $-20 kc$  to  $+20 kc$ , are provided. Calibration accuracies are  $\pm 1c$  and  $\pm 0.5 kc$ , respectively.

**Sine Wave** — harmonic distortion  
20c to 20 kc:  $< 1.5\%$  of output  
20 kc to 12 Mc:  $< 4\%$  of output

**Square Wave**  
Rise time less than 0.075  $\mu sec$  above 300 kc  
Top flat to 2% of peak-to-peak at 60c, 5% at 20c.

**Hum:** less than 0.1% of output

	Voltage Range		Accuracy	Frequency Characteristic	Output Impedance
	Sine-Wave (rms)	Square-Wave (peak-to-peak)			
Attenuator output	0.1, 0.3, 1, 3, 10, and 30 mv; 0.1, 0.3, and 1v full scale, open circuit	1, 3, 10, 30, 100, and 300 mv; 1, 3, and 10v full scale, open circuit	$\pm 3\%$ of full scale; attenuator db increments $\pm 1\%$	flat within $\pm 0.25$ db from 4kc to 20 kc ( $\pm 0.75$ db at 20c); $\pm 1$ db from 20 kc to 12 Mc	75 $\Omega$ $\pm 2\%$
High output	0 to 10v	C to 10v	$\pm 3\%$ of full scale	flat within $\pm 0.25$ db from 20c to 20 kc; $\pm 1$ db from 20 kc to 12 Mc (open circuit)	820 $\Omega$ $\pm 2\%$

Write for complete information

**AT THE IRE SHOW**  
Booth Nos. 3201 to 3208

*See a Typical Standards and Measurements Laboratory in Operation . . . Impedance Measurements from D-C to Microwave Frequencies*

The New Beat-Frequency Generator Will Be on Display as well as many other instruments

**GENERAL RADIO COMPANY**  
Since 1915 — Manufacturers of Electronic Apparatus for Science and Industry

WEST CONCORD, MASSACHUSETTS  
Canadian Engineering Office in TORONTO  
99 Floral Parkway, Toronto 15, Ontario  
Arthur Kingsnorth • Richard J. Provan  
Tel: CHerry 6-2171  
Repair Service: Bayly Engineering Ltd., Ajax, Ontario

For complete details check No. 21 on handy card, page 51