

ELECTRONICS AND COMMUNICATIONS

Fault Analysis Of Nucleonic Equipment
by R. B. Shields

Tools Required By Management In A
Changing World
by Sir Robert Watson-Watt, C.B., LL.D., D.Sc., F.R.S.

Electronic Detection In Industry

Maintenance Control And The Automatic Factory
by Roland A. Cail

FEBRUARY 1958



AN AGE PUBLICATION
TORONTO, CANADA

MINNI E

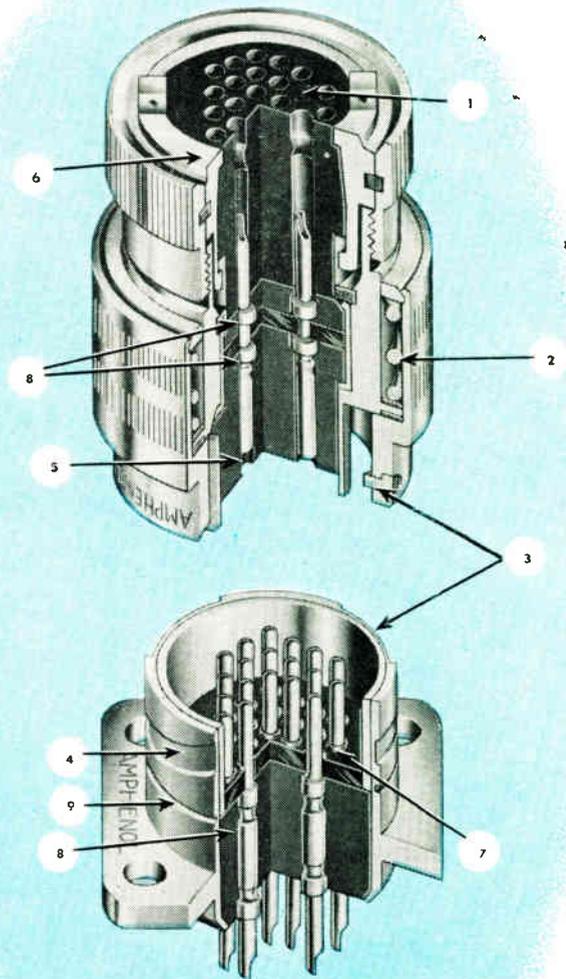
MINIATURE CONNECTORS

... the only miniature connector line fully conforming to the "E" REQUIREMENTS OF MIL-C-5015C.

Meet minniE—a complete line of miniature connectors with outstanding reliability features. The first miniatures to meet fully the "E" performance requirements of MIL-C-5015C, minniE's are environmentally sealed to resist moisture and humidity; ruggedly built to resist shock and vibration; imaginatively designed to provide application versatility.

FEATURES

1. Environmentally sealed with unitized back end grommet. (Also available with provision for potting.) Either grommet seal or potted seal meets moisture resistance requirement of MIL-C-5015C. Paragraph 4.5.21.
 2. Spring-loaded coupling ring provides a positive locking action in the bayonet slot, and a constant compensating force which eliminates the effects of resilient face seal compression set.
 3. Stainless steel bayonet slots and pins reduce wear and frictional characteristics. The three pin bayonet coupling minimizes the rocking action of the mated plug and receptacle.
 4. Flattened incline angle of bayonet slots reduces mating force requirement.
 5. Hooded contacts resist test prod damage as defined in Paragraph 4.5.14 of Amphenol Specification 340-43-2108.
 6. Unitized grommet seal; clamp and grommet form a single unit for ease of assembly and maintenance.
 7. Face seal gasket with individual barriers to isolate each contact.
 8. Hard insert dielectric (plus resilient face seal) positively retains contacts with no possibility of contacts being pushed out of the insert.
 9. A visual full engagement indicator is included in the design to insure the user that he has fully engaged the connectors. The indicator is an orange line around the receptacle shell.
- When using mated sealed connectors, no derating for altitude is necessary at 70,000 feet.
 - Test voltage 1,500 volts RMS 70,000 feet on sealed connectors.
 - Vibration per Method 204 of MIL-Std-202A. 10 to 2,000 cps at 20 g's.
 - Temperature cycling range per MIL-C-5015C, Paragraph 4.5.3 increased to 257°F. maximum and -67°F. minimum.



Write for minniE Catalog

AMPHENOL CANADA LIMITED

300 CAMPBELL AVENUE

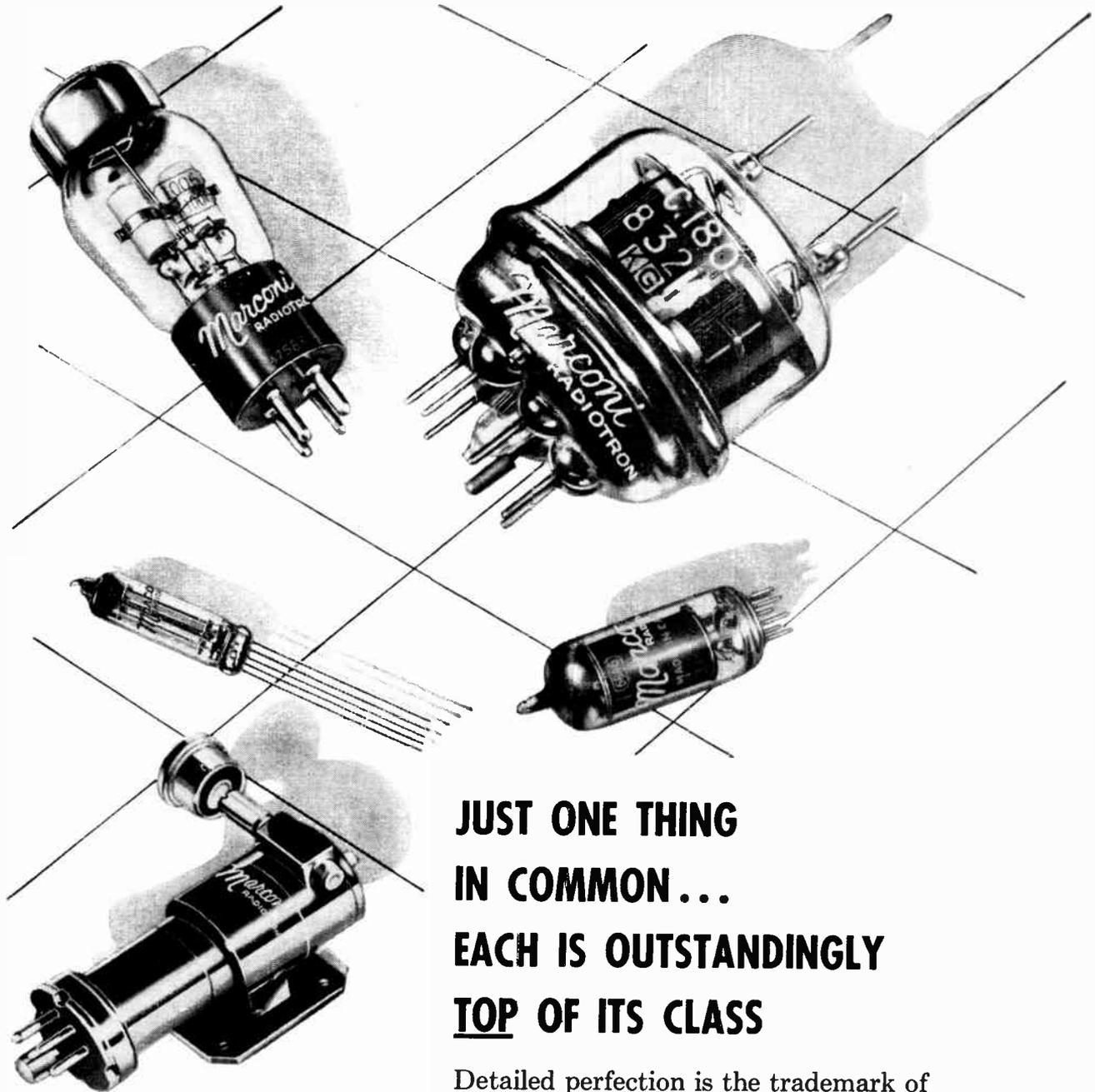
5890 Monkland Avenue
Montreal, Que.

Radiovision Sales Ltd.
325 - 10th Ave. West, Calgary, Alta.

TORONTO 9, ONT.

492 Somerset St. West
Ottawa, Ont.

For further data on advertised products use page 67.



**JUST ONE THING
IN COMMON...
EACH IS OUTSTANDINGLY
TOP OF ITS CLASS**

Detailed perfection is the trademark of every unit . . . the evidence of critical inspection at every stage of production . . . the proof that maximum standards of every specification are observed.

Marconi quality and volume combined with customer-conscious service offers the most for complete satisfaction.



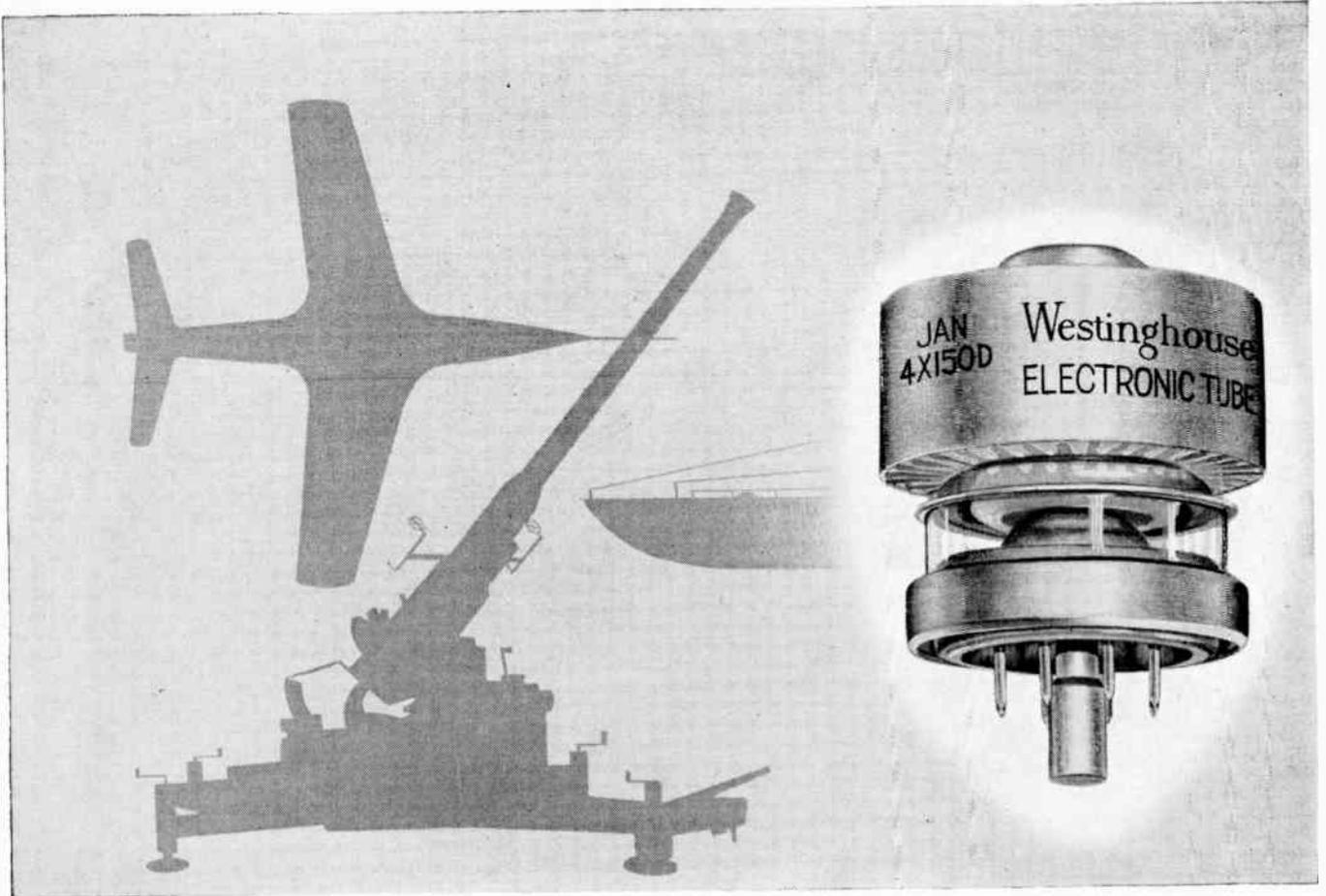
MARCONI  **RADIOTRONS**

ELECTRONIC TUBE AND COMPONENTS DIVISION

CANADIAN **Marconi** COMPANY

830 BAYVIEW AVENUE • TORONTO, ONTARIO

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



in the air—on land—under the sea

Westinghouse Tubes

work magic for Canada's Defence

Plans for Canada's defence weapons . . . her planes, ships and guns are "top secret". But it's no secret that Westinghouse Electronic Tubes are playing an important part in many of the most spectacular developments. This tube, the JAN 4 x 150D, for instance, is an exclusive Westinghouse production in Canada to meet the exacting requirements of a

unit of vital importance to Canada's defence air craft. The same engineering skill and modern up-to-the-minute equipment that produced this tube are available to Canada's Electronics Industry. Westinghouse Electronic Tubes are completely reliable . . . for the first line of defence or for your line of work.

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

CANADIAN WESTINGHOUSE COMPANY LTD.
ELECTRONIC TUBE DIVISION - HAMILTON, ONT.

For further data on advertised products use page 67.

Electronics And Communications

VOLUME 6

FEBRUARY, 1958

NUMBER 2

FEATURES

Fault Analysis Of Nucleonic Equipment	24
by R. B. Shields	
Tools Required By Management In A Changing World	27
by Sir Robert Watson-Watt, C.B., LL.D., D.Sc., F.R.S.	
Electronic Detection In Industry	29
Maintenance Control And The Automatic Factory	32
by Roland A. Cail	
A Numerical Position Control System	35
A pH Control System For Bright-Dip Rinsing	43
A d/M Gage For The Measurement Of Moisture	45

DEPARTMENTS

Editorial	7
RETMA Report	11
C RTPB	12
Editor's Page	15
Business Briefs And Trends	37
New Products	46
News Report	51
Book Review	71

President, Norman G. McHardy; Editor, Thomas W. Lazenby; Consulting Technical Editor, Leslie Hill, Ph.D. Eng.; Editorial Assistant, D. K. Trowell; Advertising Manager, H. E. Dallyn; Assistant Advertising Manager, Arthur Dixon; Production Manager, Nevill A. Campling; Business Manager, Clifford A. Sparks; Circulation Manager, Paul A. Irwin; Art Editor, Wm. McReynolds; Photo Editor, Guido Milanese. United Kingdom and European Representative, Norman F. Keenan, 47 Manchester Street, London W. 1, England. West Coast Representative, Dillenbeck-Galavan, Inc., 266 South Alexandria Ave., Los Angeles 4, Calif.

PUBLISHED BY AGE PUBLICATIONS LIMITED

Founded in 1923 by Norton W. Kingsland

Publishers of Heating, Plumbing and Air Conditioning AGE • Restaurants and Institutions
Automatic Heating • Wine, Beer and Spirits in Canada • Industrial Aeronautics

TORONTO, ONT., CANADA: 31-35 Willcocks Street, Tel. WALnut 2-3115. MONTREAL, QUE., CANADA: Keith Edgar,
116 Rue de Flandre, Montreal 23 (Preville), Quebec, Telephone: OR. 1-2020.

SUBSCRIPTION RATES: Canada, U.S.A. and British Possessions - \$5.00 per year • Foreign - \$10.00 per year.

Contents copyright by Age Publications Limited. No part of this periodical may be reproduced without the consent of the publisher.

Authorized as second class mail. Post Office Department, Ottawa



Member Canadian Circulations



Audit Board, Inc.

PRINTED IN CANADA
60

It takes many hats to show the entire
 Burndy electrical terminal line!
 But here—and in our brochures
 . . . you'll find that **BIG IDEA** in wire
 termination, to save you money,
 speed your production, improve your
 product! With Burndy, your selection
 is broadest—a variety of terminals
 for every wire size . . . and a range of
 installation tooling to fit your
 production methods. For your electrical
 terminations—make a "bee-line" to
 the better way—Burndy! Write
 Burndy Canada Ltd
 1530 Birchmount Rd., Scarborough, Ontario.

let us put a

B

in your bonnet!



BURNDY

5804

For further data on advertised products use page 67.

Electronics And Communications

Volume 6

February, 1958

Number 2

Import Adjustments And Canadian Electronics

Despite the aims of government authorities to divert 15 per cent of its United States purchases to Great Britain it is more than likely that Canadian electronics firms will continue to rely heavily on American purchases to fill their needs. Management in Canadian industry, it is reported, do not believe that a 15 per cent adjustment in trade balance between the United States and Great Britain could be effected over a short period of time and not too much has been heard of the proposed trade adjustment since the return of the Canadian trade mission from the United Kingdom some two months ago.

There are two reasons why Canadian electronic firms who have been doing business with American companies in the past will continue to do so. Firstly, many Canadian firms have worked out closely-knit business arrangements with American companies that have resulted in Canadian firms either becoming subsidiaries of American firms or licensees. Secondly, Canadian manufacturers, and indeed Canadian consumers of electronic equipment, have become accustomed to American products and any deviation from this established order of things would not be easy of achievement.

Some observers believe that any proportioning of trade between the United States and the United Kingdom could only be achieved by lowering tariffs against British imports and raising those against American imports. This, however, is unlikely observing that the Canadian govern-

ment is not disposed to disturb the present tariff structure in the hope of improving Canadian exports to the United States.

It is interesting to note that the government is placing an increasing number of contracts with the Canadian electronics industry for defense equipment and components for this equipment, when they require to be imported, are obtained largely from the United States. For this reason, many observers believe that if there should be a shift in the proportioning of order placements for electronic equipment, the end result will find the Canadian industry benefiting rather than that of the United Kingdom.

Insofar as the manufacture of radio and television sets is concerned, most Canadian firms are affiliates of American concerns turning out the same sets as marketed in the United States and enjoying tariff protection for their efforts. Much the same conditions hold true for the Canadian manufacturers of industrial electronic equipment, all of which adds up to the belief that should the government win a mandate at the polls this coming March and thereafter decide to press on with their trade adjustments, the Canadian electronics industry will not be adversely effected. This especially so in observance of the fact that a goodly proportion of British-made electronic equipment is already being imported into the country with no ill result to Canadian manufacturers.

Progress On Astra I

In a 27,000 square foot hangar at the Newcastle County Airport hangar near Baltimore an activity is taking place that is truly indicative of Canadian-American co-operation in the pooling of technical resources and know-how necessary for the design and development of intricate electronic apparatus.

Activity at this particular airport concerns the efforts of Radio Corporation of America to bring into being a completely new and integrated electronic system for Canada's new supersonic interceptor the Avro Arrow, a plane which some sources have indicated may well become the number one fighter aircraft of the NATO nations.

Although officials of RCA have maintained discreet silence on the top secret electronic system which has been named Astra I, it is known that the speed and maneuverability of the Arrow has posed more than a few problems that are anything but easy to solve by the engineers of RCA and the Minneapolis Honeywell Regulator Company who are associated with RCA in carrying out the multi-million dollar contract awarded to RCA by the Canadian government a little over a year ago.

While it has been indicated that the 57 electronic engineers employed by RCA at the Newcastle site and the Camden N.J. staff of RCA who are also working on the project have set a completion date for Astra I it has not, so far, been divulged.

Until recently information concerning the electronic system for the CF-105 has been strictly taboo to the public but it has now been learned that RCA as prime contractor for the system is responsible for the development and production of a specially designed system which will combine the automatic flight, weapons fire control, communications and navigation systems of the CF-105. Minneapolis Honeywell's part in this project is the production of an automatic flight control system.

Control of the Avro Arrow, it has been learned, will be effected by a three phase system: a complete ground control system that will guide the aircraft toward the general area of the target, a mid-course system for use while the aircraft air search radar is in operation and in addition, a terminal system for use when the aircraft radar is locked on a target. This composite system, it is understood, will permit a ground control to monitor the entire function, and if need be, take over the operation if any part of the airborne system fails.

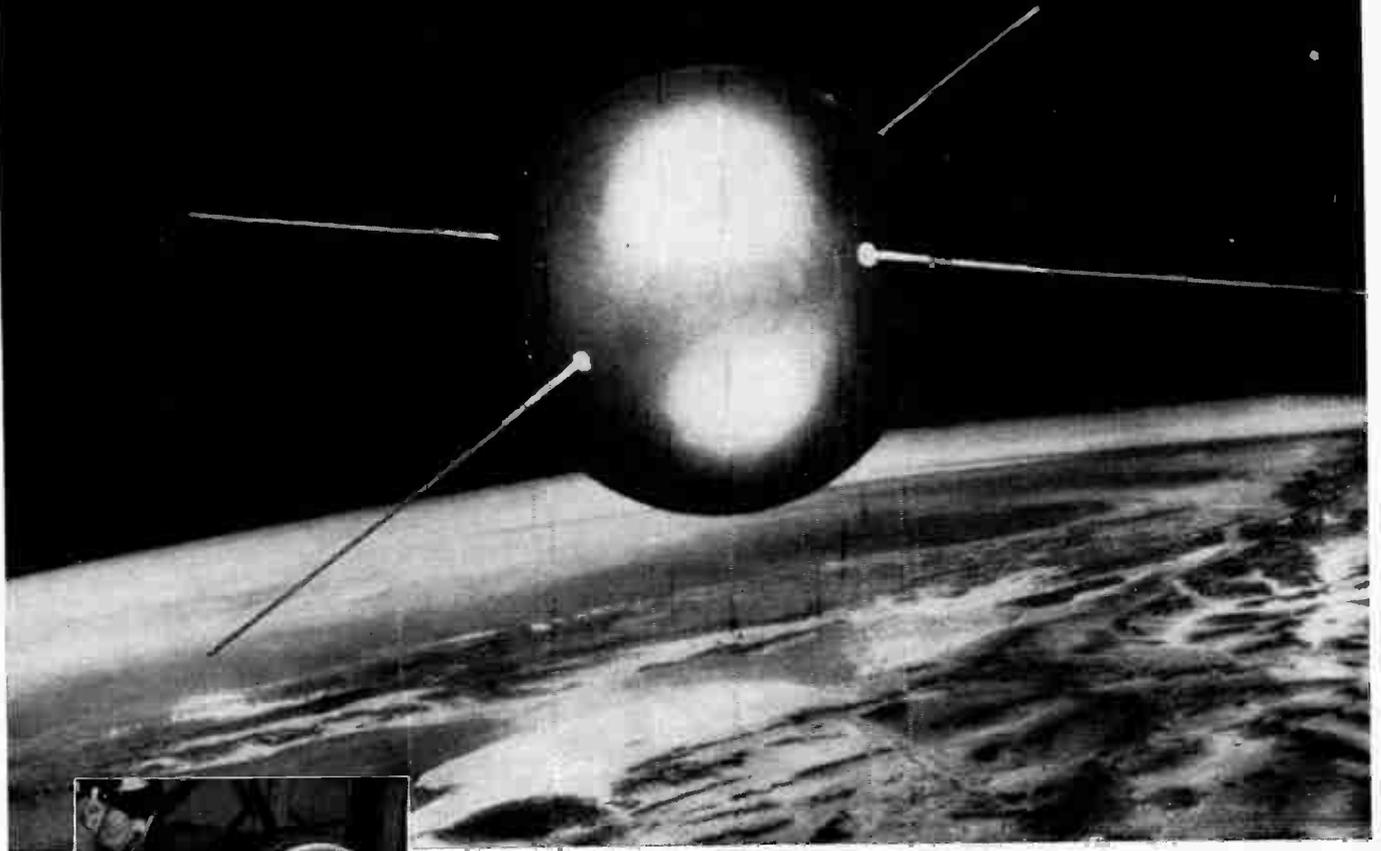
According to RCA engineering officials, Astra I is likened unto an ultimate automatic system for the Arrow and although produced specifically for Canada's supersonic fighter could be adapted to other types of aircraft.

When completed the apparatus will be able to pick out an aircraft well beyond the range of normal vision and supply the pilot with a constant stream of information that will be electronically processed to provide data on position, rate of closing and range.

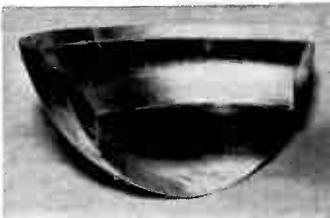
First test bed used for the Astra I system was a U.S. turboprop Convair. Royal Canadian Air Force CF-100's are also being used for the testing of electronic equipment that will be fitted into the Astra system and these aircraft make frequent flights to Canadian bases at which points both RCA and Minneapolis Honeywell technicians are also engaged in development work on certain aspects of the Astra I system. The Avro Arrow itself is scheduled to be flown to the Newcastle base sometime following its maiden flight for advanced testing of the system.

Progress on Astra I, the system that will guide Canada's 1500 mile per hour fighter, is advancing steadily and when the system emerges as a completed package will rank among the world's most modern fighter aircraft control systems.

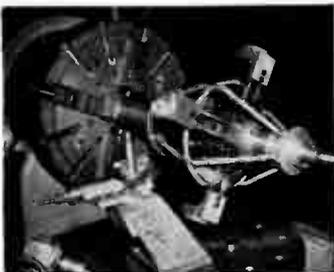
When ordinary gold plate won't do...



Basic structure of the Satellite consists of two hemispheres which are spun to exact contour. They are made of Magnesium alloy.



An inner ring forms a pressure-tight circular chamber in the finished hemisphere. Cross-section view shows the resulting pressure cavity.



The internal structural frame of the Satellite is chiefly Magnesium tubing. This is also plated with Sel-Rex Bright Gold.

EARTH SATELLITE PLATED WITH SEL-REX BRIGHT GOLD

To provide maximum heat reflectivity and emissivity, the United States IGY Earth Satellites have been plated with SEL-REX Bright Gold Process underneath their final coatings. This patented formulation was also used to plate most internal parts and instrument housings for temperature control.

The Satellites will transmit data to earth observation stations, from altitudes of 200-1400 miles, as they revolve in orbit around the earth at 18,000 miles per hour. This journey, through space, will subject the Satellites to temperatures ranging from -5°C to $+45^{\circ}\text{C}$, every 90 minutes. Selecting appropriate materials of construction required the solving of problems by engineers and scientists *never even before encountered.*

The fact that SEL-REX Bright Gold Plating was selected for this important protective job proves the undoubted superiority of this process, NOW AVAILABLE IN CANADA THROUGH:—

THE ELECTRIC CHAIN COMPANY OF CANADA

LIMITED

86 BATHURST STREET

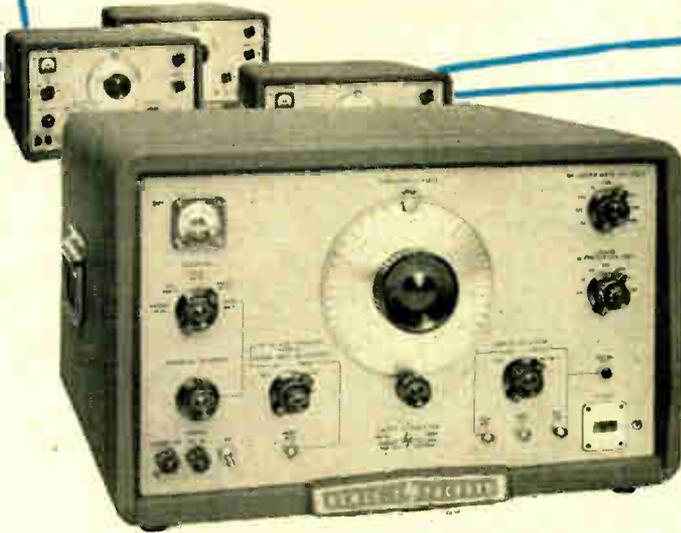
EM. 3 - 8881

TORONTO 2B, ONT.

If You Manufacture Products in the Fields of Electronics and General Industry Requiring the Maximum Precision Protective Coatings it will Pay You to Investigate Sel-Rex Bright Gold and Bright Silver Processes.

Write or 'phone us NOW.

Now! Four new all-electronic sweep oscillators simplify measurements 3.95 to 18.0 KMC!



-hp- 684 Series Sweep Oscillators

Now -hp- offers 4 new electronic sweep oscillators covering the G, J, X and P bands, respectively.

These new 684 series instruments all have a wide range of sweep speeds so measurements of reflection, attenuation, gain, etc., can be displayed on an oscilloscope or recorded on X-Y or strip-chart recorders. Either CW or swept rf output is available.

The 684 series oscillators use new backward wave oscillator tubes whose frequency is shifted by varying an applied potential. Troublesome mechanical stops or tuning plungers are eliminated. Sweep range is continuously adjustable and independently variable; sweep rate is selected separately; either can be changed without affecting operation. Full band width can be covered in time segments from 140 seconds to 0.014 seconds.

Swept rf output is linear with time, and a linear sawtooth is provided concurrent with each rf sweep to drive an oscilloscope or recorder. Sweeps may be triggered electrically externally, or manually.

Represented in Canada by
ATLAS RADIO CORPORATION, LTD.
50 Wingold Avenue, Toronto 10, Ontario
106-525 Seymour St., Vancouver 2, B. C.
505 McIntyre Bldg., Winnipeg, Manitoba

Cover full band, or any part

Use with 'scope or recorder

Direct reading, independently
adjustable sweep range
and rate controls

TYPICAL SPECIFICATIONS

Below are specifications for -hp- 686A Sweep Oscillator, 8.2 to 12.4 KMC. Specifications for -hp- 684A (G band), 685A (J band), and 687A (P band) are similar except for frequency range.

Types of Outputs: Swept Frequency, CW, FM, AM.

Single Frequency Operation

Frequency: Continuously adjustable 8.2 to 12.4 KMC.

Power Output: At least 10 milliwatts into matched waveguide load. Continuously adjustable to zero.

Swept Frequency Operation

Sweep: Recurrent; externally triggered; also manually triggered single sweep. Rf sweep linear with time.

Power Output: At least 10 MW into matched waveguide load. Output variations less than 3 db over any 250 MC range; less than 6 db over entire 8.2-12.4 KMC range.

Sweep Range: Adjustable in 7 steps 4.4 MC to 4.4 KMC.

Sweep Rate-of-Change: Decode steps from 32 MC/sec. to 320 KMC/sec.

Sweep Time: Determined by sweep range and rate; from 0.014 to 140 seconds over full-band.

Sweep Output: +20 to +30-volt-peak sawtooth provided at a front-panel connector concurrent with each rf sweep.

Modulation

Internal Amplitude: Square wave modulation continuously adjustable from 400 to 1200 cps; peak rf output power equals cw level.

External Amplitude: Direct coupled to 300 KC; 20 volt swing reduces rf output level from rated cw output to zero.

External Pulse: +10 volts or more, 5 millisecond maximum duration.

External Frequency: FM and external sweep voltages.

Price: -hp- 684A (3.95-5.85 KMC) \$2,265.00
-hp- 685A (5.30-8.20 KMC) \$2,265.00
-hp- 686A (8.20-12.40 KMC) \$2,615.00
-hp- 687A (12.40-18.00 KMC) \$3,115.00
(Prices above are f.o.b. factory for cabinet models. Rack mount instruments \$15.00 less.)

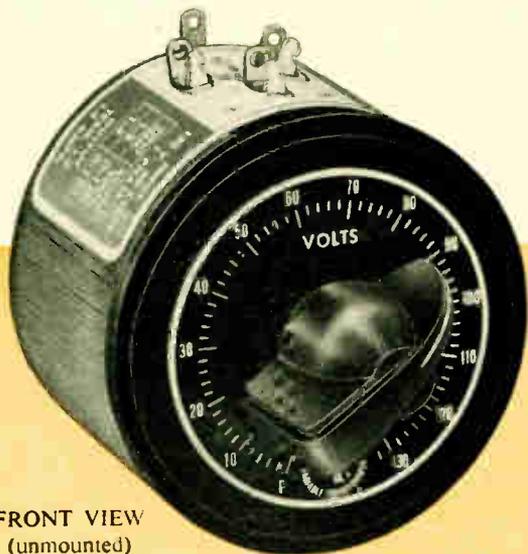
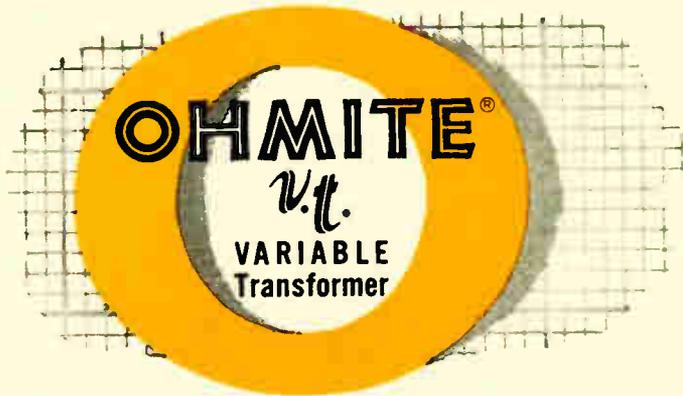
Data subject to change without notice.



instruments save measuring time

INDUSTRY'S MOST ADVANCED DESIGN!

(Patent No. 2,790,882)



FRONT VIEW
(unmounted)

MORE CAPACITY FOR EQUAL SIZE

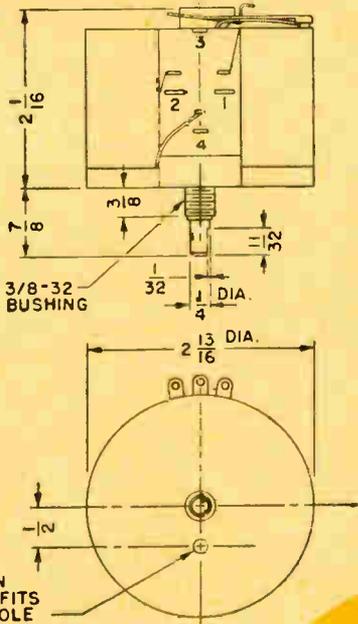
MODEL VTIR5—1.5 AMPERES. The rating of 1.5 amperes represents a continuous current rating at any brush setting even at full overvoltage! This "bonus" in current capacity is the result of a unique core design by Ohmite. This new component from Ohmite is made to the same high standards as the famous Ohmite resistors, rheostats, and other components. Other models in larger sizes will be announced soon.

Direct reading dial is calibrated to 120 on one side—132 on the other, for line or overvoltage connections respectively.



In addition to its greater capacity for equal size, the new Ohmite VARIABLE TRANSFORMER, representing industry's most advanced design, features the following quality features:

- *Heavily Plated Rhodium Brush Track . . .* Generous, nonoxidizing plating assures unsurpassed life under demanding conditions.
- *Positive Current Transfer . . .* The contact arm carries no current in this unit! A pigtail shunts the current from the brush, directly to a large copper-graphite slip ring which contacts a large area of the terminal. The spring-like contact arm provides its own completely independent pressure.
- *Rugged INTERNAL Stop* eliminates possibility of damage to contact arm and brush due to application of torque at rotation limits.
- *Ceramic Hub . . .* Mounts and aligns the contact arm, provides 3000 volts ac insulation between parts at line potential and shaft.



AVAILABLE FROM STOCK:
SPECIFICATIONS—MODEL VTIR5
 INPUT VOLTAGE—120V, 60 CYCLE.
 MAX. OUTPUT AT ANY BRUSH SETTING—1.5 AMPS. OUTPUT VOLTAGE—0-132-0-120.
 ANGLE OF ROTATION—320°.
 Includes knob, reversible dial plate, washer and nut.
 Tandem assemblies available soon.



BACK VIEW

WRITE FOR BULLETIN 151

A. Simmons & Sons
 100 Merton St., Toronto, Ont.
 C. M. Robinson Co.
 1550 Erin St., Winnipeg 3, Man.



OHMITE
 QUALITY Components

RHEOSTATS • RESISTORS • RELAYS •
 TAP SWITCHES • TANTALUM CAPACITORS •
 VARIABLE TRANSFORMERS

OHMITE MANUFACTURING COMPANY
 3689 Howard Street, Skokie, Illinois

For further data on advertised products use page 67.

RETMA Report



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

Recent RETMA Meetings

In early February the Board of Directors of the Radio-Electronics-Television Manufacturers Association of Canada met in Montreal. At the same time the Electronics Division and the Receiver Division also convened separately to discuss matters appropriate to their interests. The Components Division met in Hamilton on February 19 at which time a panel discussion on industrial relations was organized and presented by the RETMA Industrial Relations Committee.

The Receiver Engineering Committee met in January and the Components Engineering Committee convened on February 12. Both meetings were held at the RETMA Conference Room in Toronto.

The Components Executive Committee met on February 6 in Toronto.

RETMA Engineering Standards Available

Although one copy of the engineering standards adopted by RETMA for use by the electronic industry in Canada is supplied free to RETMA members, it may not be generally known that copies of these same standards, and other engineering data, are available to others on a charge basis. A list of all such engineering standards is available from the RETMA Office, 200 St. Clair Avenue West, Toronto 7, Ontario.

Statistical Subscription Service

RETMA has a subscription service, for its monthly radio and television statistical reports, which is available to non-members at a nominal annual fee. The statistical reports, for both radio and television, include a breakdown of monthly distributor sales to dealers by types of models and by provinces. Cost of this service is \$15.00 a year for either radio or television taken separately or \$25.00 a year for both the radio and television reports. Applications for this service should be made to the RETMA Office.

RETMA Speakers For OARAD

Breaking away from the more conventional type of annual meeting, the Ontario Association of Radio Television and Appliance Dealers (OARAD) recently started a series of one-day sales conferences for dealers in various centers. The first meeting was held in Hamilton on January 27 where the guest speaker was F. W. Radcliffe, RETMA General Manager. Other speakers in the series of panel discussions were from RETMA member companies. Mr. Radcliffe's address, which he also delivered to an OARAD sales conference in Kingston on February 12, was entitled "Ten Areas Where Radio and Television Sales Can be Increased in 1958".

The ten ways towards increased radio and television sales for 1958, dealt with in detail by the speaker, were (1) the television receiver replacement market; (2) the second set market; (3) selling the half-million wired homes which have yet to buy a television receiver; (4) the actual and potential UHF market; (5) transistorized radio receivers; (6) car radio sales; (7) the clock radio market; (8) FM radio receivers; (9) tape recorders; and (10) high-fidelity instruments and equipment.

Radio Receiver Sales Up In 1957

Radio receiver sales in 1957 by RETMA member-companies amounted to 577,930 units, an increase from the 577,205 units sold in 1956. When the sales of other manufacturers are added it is expected that the total radio receiver sales for 1957 will exceed 700,000 units.

Newsletter

Canadian Radio Technical Planning Board

Who's Who In The Planning Board

At the present time there are twenty contributing sponsors of the CRTPB. As a new regular feature of the "CRTPB Newsletter" it is planned to present a short biographical account of a contributing sponsor each month under the heading "Who's Who In The Planning Board". Sponsors will be written up in alphabetical order according to the CRTPB membership list. This month's "Who's Who" deals with:

No. 1 — American Institute Of Electrical Engineers

Founded in 1884, the American Institute of Electrical Engineers is a national organization representing the electrical engineering profession. Its objects are the advancement of the theory and practice of electrical engineering and of the allied arts and sciences, and the maintenance of a high professional standing among its members. All branches of electrical engineering are represented in the membership; there are Technical Committees for the Divisions of Communication, General Applications, Industry, Power, and Science and Electronics.

The organizational structure is based on the division of the North American continent into a number of districts, each represented on the Board of Directors by a Vice-President. Canada is District No. 10 and is represented by Professor G. F. Tracy of the University of Toronto.

Each district comprises a number of sections in electrical centers. Meetings for the presentations and discussion of technical papers and other matters of interest to electrical engineers are held by the sections and by student branches in engineering schools and universities. Three annual national conventions and many district meetings are held in various parts of the country.

The principal publications of the institute are the monthly "Electrical Engineering", the "Transactions", a year book, and various electrical engineering standards.

The Institute provides the opportunity for the interchange of ideas, the presentation, discussion and publication of technical papers, the formulation of standards and codes, and co-operates with similar engineering organizations for the advancement of the electrical engineering profession in the public interest. — F. F. Mathers, AIEE Main Representative on CRTPB.

Recent Executive Meetings

On January 17, January 28 and February 17 the Executive Committee met in Toronto. Under discussion at the most recent of these meetings were consideration of the revised draft of DOT Specification 112 as submitted for approval of the Fixed, Land and Maritime Mobile Committee, consideration of CRTPB representation in CE Code Part IV Committee of CSA, exemption of licensing of certain wire carrier systems, and a report by the General Co-ordinator on CCIR (Consultative Committees On International Radio) and on ITU (International Telecommunications Union). In addition, a revision to the draft of the constitution, organization and general procedure of the CRTPB was discussed. This matter has been discussed at past meetings and it will be at future meetings until the subject has been finalized.

Other Committee Meetings

The always active Fixed, Land and Maritime Mobile Committee met again on February 14 in Toronto.

DOT Promotions

Two senior appointments in the Telecommunications Branch of the Department of Transport were recently announced by Hon. George Hees, Minister of Transport. C. Mornington Brant, Controller of Radio Regulations, has been promoted to the newly-created position of Chief of Technical Co-ordination. William A. Caton, Chief of Inspections and Examinations, succeeds Mr. Brant as Controller of Radio Regulations.

The DOT says that continued rapid advances in the field of telecommunications, including radio and electronic aids, have made it important for the activities of the Telecommunications Branch to be co-ordinated and planned to meet the requirement of all services.

Mr. Brant went to the Department of Transport in 1949, where he was Controller of Aeronautical Radio. In 1937, when an employee of the Civil Aviation Branch of the British Air Ministry, he was sent to Newfoundland to supervise construction of radio communications to set the stage for trans-Atlantic commercial aviation, first at Botwood and later Gander. Runways and radio facilities were completed at Gander just at the time of the outbreak of World War II. From 1942-46, Mr. Brant was attached to the Royal Air Force as a Senior Signals Officer in the Caribbean area and later Telecommunications Engineering Officer, North Atlantic area, Headquarters 45 Group Transport Command, Montreal. From there he flew extensively, maintaining and building radio stations for military and civil aviation. He retired from the R.A.F. with the rank of Squadron Leader.

Since going to Ottawa, Mr. Brant has attended several international radio conferences for the Department, at Washington, Havana, Geneva and Montreal. In 1953, the new Technical Co-ordinator was appointed Superintendent of Radio Regulations and later Controller.

In his new position as Controller of Radio Regulations, Mr. Caton will be responsible to the Director of the Telecommunications Branch for the enforcement of the Radio Act and Regulations and the Radio Section of the Canada Shipping Act. Under him will also come the operation of Ionosphere and Monitoring Stations, development of technical standards for equipment and also research and development in radio interference operations.

Mr. Caton has been associated with the Department of Transport since 1924 when he joined as a radio operator and was stationed at Chebucto Head direction finding station. Since then he was engaged in radio inspection operations, first in Halifax in 1925 and for 11 years in the Toronto district. He was appointed to radio headquarters at Ottawa in 1937 and has held a number of increasingly important positions, the last of which is Chief of Inspections and Examination. Prior to joining the Department of Transport, Mr. Caton was engaged in private radio work at Napanee and later was with the Royal Canadian Corps of Signals.

Interesting events in Mr. Caton's career in radio included taking part in the technical arrangements for the first trans-Canada radio broadcast in 1927, being in charge of all radio arrangements in connection with the Royal visit in 1939, attendance as a senior delegate at the NARBO Conference at Montreal and Washington in 1949-50, survey of West Coast marine radio coverage in 1950, and in-flight inspection of aeronautical radio facilities on the South Pacific route to Australia in 1952.

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

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



FASHIONS CHANGE IN **STEEL** TOO

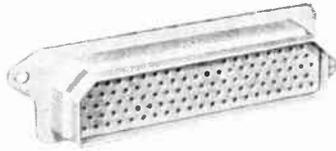
For almost half a century transmission towers have cable-crossed city and pasture alike to feed us electric power. Now inventive genius has added the fashionable and highly practical television and micro-wave relay tower to our horizon.

Central has fabricated and erected many towers in Canada similar to this one of several built for Eastern Telephone and Telegraph. Have Central Bridge quote on your next structural steel job.

CENTRAL BRIDGE *Company, Limited*
Tronton, Ontario

*For your structural steel requirements
call Central soon.*

What's *new* for you in **CANNON PLUGS**



DPJ-33S



DPG-34P

new



new



Available in square-flanged receptacle, Q02, and straight plug, Q06. Insert Diameters: 3/16", 1/8", and 1/4"

- ▶ **Vibration**
 - ▶ **Moisture**
 - ▶ **Pressure**
- ▶
- PROTECTION**

with new DPJ and DPG Connectors

New DPJ and DPG Connectors feature sealing by means of a rubber seal around the insert faces. Exceptionally good protection against vibration and undesirable pressure and moisture conditions is provided. The DPG currently is available in 5 different insert arrangements, the DPJ with 3 insert layouts. Write for Bulletin DP-101 TODAY!

"EX" SEALED CONNECTORS

- ▶ **No Potting Required**
- ▶ **Light weight**

New EX Connectors feature a monobloc silicone insert into which the contacts are inserted after wiring. When the endbell is tightened over the insert, the contacts are completely sealed . . . giving a sealed connector of minimum weight without potting.

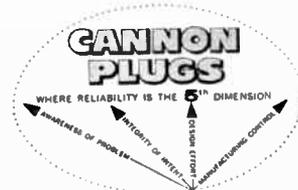
EX plug assemblies are currently available in four shell configurations with socket contact inserts . . . EX05, EX06, EXG06 and EX08. They are basically identical with the exception of endbell variations in each case. EX plugs mate and seal with standard AN, AN-E, and GS type receptacles, and are available in practically all AN layouts using #12 or #16 contacts from sizes 8S to 28. Write for Bulletin PR-EX TODAY!

"Q" MINIATURE CONNECTORS

- ▶ **Self-Locking**
- ▶ **Sealed**
- ▶ **Vibration Resistant**

Designed for control and instrumentation circuits of all types where space, vibration, moisture, or pressure conditions are limiting factors. Resilient grommets seal behind inserts . . . rubber sealing ring seals around the insert faces. Locking engagement accomplished by a beryllium copper latch within a spring loaded sleeve. Three shell sizes, with 7, 13, 19, 37 silver-plated brass 10-amp. contacts for #18 AWG wire. Alternate positioning. Cymel 592 insulators. External parts are cadmium plated aluminum. Hermetically-sealed, round-flanged receptacle, QH25, also available. Write for Q Miniature Bulletin TODAY!

CANNON ELECTRIC (CANADA) LIMITED, 160 Bartley Drive, Toronto 16
 Montreal Office, Montreal Airport, Dorval, P.Q.
 Factories also in Los Angeles, East Haven, London, Melbourne
 Licences in Paris, Tokyo



5805

For further data on advertised products use page 67.

the editor's page

*A commentary on affairs
pertinent to the electronics
and communications industries.*

The Electronic House of 1977

Recently Gwilym A. Price, chairman of the Westinghouse Electric Corporation, took a careful look into his crystal ball and predicted that living standards on this continent twenty years from now, in 1977, will be 50 per cent higher than they are today. Mr. Price said that the world of 1977 will see some of its most striking developments in the field of home appliances.

Well over 100 different appliances may be available then, some of which are already beginning to come on the market — and others which are still only a gleam in the eyes of the inventors.

The typical home of 1977, Mr. Price predicted, will utilize a heat pump for all-weather comfort. The house will be equipped with heat pumps to warm it in winter and cool it in summer. A single thermostatic control will govern the heating or cooling as needed.

Mr. Price said that when all these units are in operation across the nation on a hot day, they may consume more electric power than the entire country can provide in 1957.

In short, the heating-cooling peak load may come to a bigger total twenty years from now than the entire power load of the country today.

As to other developments, Mr. Price predicted that dusting the house will be done by 1977 with an electrostatic cleaning wand. The homemaker will simply wave the wand over a dusty surface and all the dust within several feet will be attracted to it electrostatically. When the wand is loaded, it can be washed off in the sink.

The entertainment center of the home of the future will include a hi-fi-set, flat-screen color television in three dimensions, a tape recorder, and a motion picture projector. Television will be shown on a screen resembling a framed picture, and one of these will hang from the wall of every room. Programs from all channels will be picked up in a central receiving unit.

The viewer will be able to select any channel from any room, simply by pressing a button. He will also be able to record and play back any television show he chooses.

Still basing his predictions on developments now in the laboratory or well along in development, Mr. Price said that in bedrooms of the 1977 home, complete pre-packaged units will provide conventional hanging storage for suits and dresses, and also a Laundro-closet that will clean clothing quickly without agitation or tumbling.

When one takes off a suit or dress and hangs it up, moving tracks will carry it into the wash chamber, then the rinse chamber, then the dry chamber. Within minutes it will be returned to the rack in the hanging closet, clean and ready to wear. Dirt will be removed by ultrasonic energy, by inaudible sound waves.

Owing to another promising new laboratory development, the kitchen of 1977 may be very differently organized from that of today.

Instead of concentrating all refrigeration in one cabinet or machine, the kitchen will contain a number of refrigerator drawers, each adjusted in temperature to the cooling task it is to perform. These drawers will be refrigerated without the aid of conventional motors or compressors. They will employ a new phenomenon (the Peltier effect) now undergoing study in the laboratory, in which a current, passed through the junction of two dissimilar metals, produces cold.

In an application of the principles of automation to

daily living, Mr. Price foresees combination food storage and cooking machines, in which complete meals can be pre-selected.

The foods will be preserved until the proper time, then passed into the cooking compartments, where they will be done to a nicety, and prepared ready for serving at a pre-selected hour.

A revolution in lighting will also take place in the next twenty years. Man's newest light source, based on a principle discovered by Professor George Destriau, a Westinghouse consultant, now makes possible the production of electric lighting panels no thicker than a pane of window glass. With these, lighting can be used architecturally, as a decoration. A dial will provide light of almost any intensity and almost any color.

Well there you have it, a preview of the house of 1977 and no doubt many or all of the developments forecast by Mr. Price will come to pass providing an ever-widening opportunity for Canadian industry — particularly the electronics industry — to participate in the production of these future commodities. This by reason of the belief that many of the commodities mentioned by Mr. Price will be based upon the application of electronic processes.

Science Attaches

Due to lack of funds the American State Department has neglected to fill many of its science attache posts since 1955, but recent reports indicate that new life will be breathed into this section of the State Department as a result of recommendations made to John Foster Dulles, United States Secretary of State. Now it is understood the sum of \$200,000 has been appropriated to cover the cost of manning many of the vacant posts at several of the more important American missions abroad.

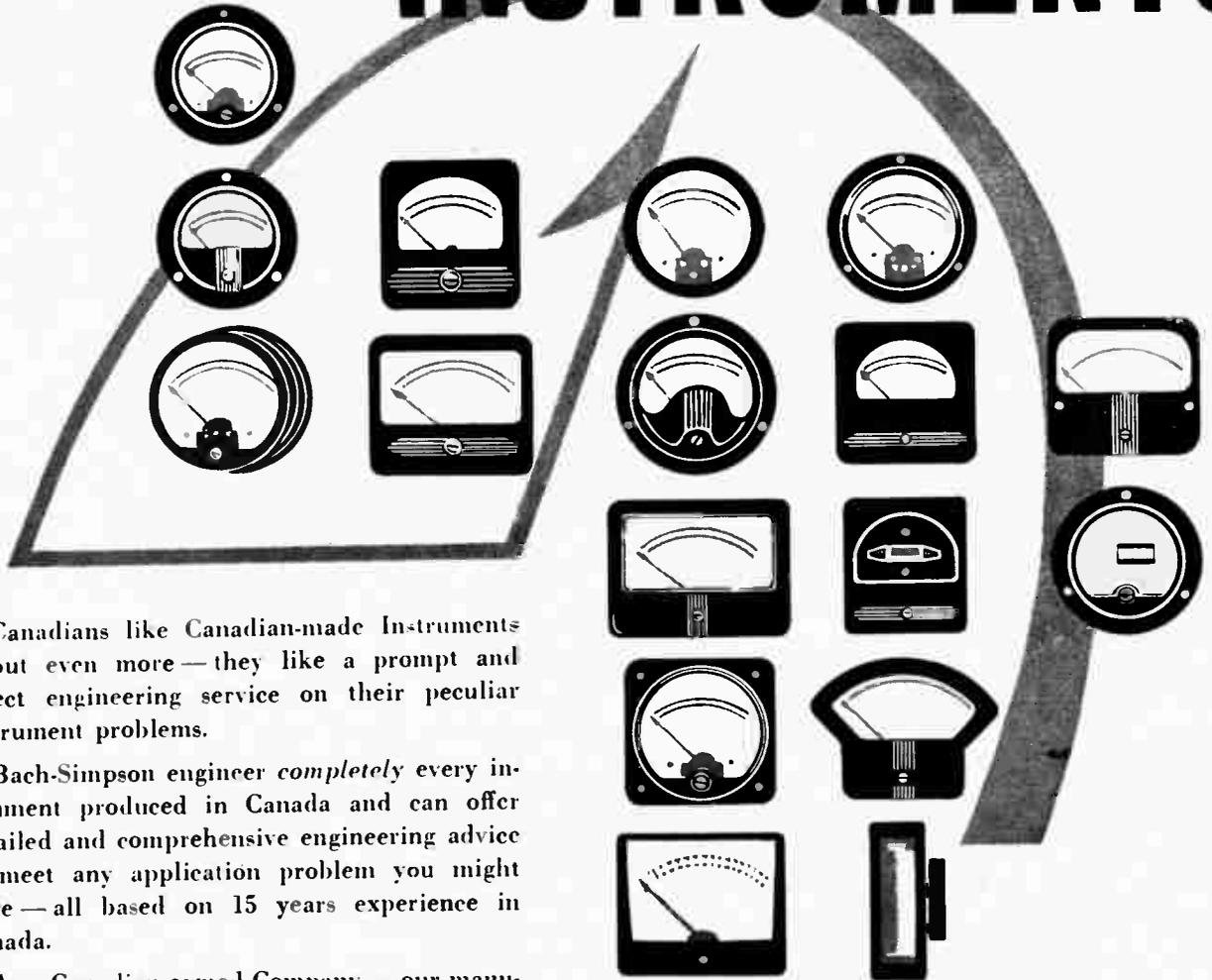
Due to the startling scientific developments abroad there is no doubt that the American decision to revitalize its information-gathering organization abroad will be generally approved and the appropriation of funds to defray the cost of such an organization in this age of rapid technological progress is well justified.

While the job category of science attache has long existed within the American State Department and recognition has long been afforded to the important role that science attaches can perform, it is rather surprising that similar job categories have never been established in the Canadian External Affairs Department, especially in view of the recent and rapid transition of the Canadian economy from that of an agricultural country to that of an industrial one.

While Canadian missions abroad have long maintained military attaches, their prime interest and function has been in exchanging and gathering information of a military nature and while many military attaches may possess some academic training, it is doubtful if their qualifications would permit them to effectively associate with top-level scientific authorities abroad for the purpose of discussing and exchanging high calibre scientific data.

Recent events have amply illustrated that there is much scientific information abroad which, if sought after through proper channels, could be made available and it is for this reason that Canadian authorities may well give some consideration to the appointment of science attaches to the staffs of her foreign missions if the interchange of scientific knowledge between countries is considered to be of any value by Canadian government authorities.

Simpson STANDARD PANEL INSTRUMENTS



Canadians like Canadian-made Instruments — but even more — they like a prompt and direct engineering service on their peculiar instrument problems.

Bach-Simpson engineer *completely* every instrument produced in Canada and can offer detailed and comprehensive engineering advice to meet any application problem you might have — all based on 15 years experience in Canada.

As a Canadian owned Company — our manufacture is complete from movement design, tool and mold manufacture, through case styling, dial printing to packaging — all in either commercial or military types.

Apart from the complete coverage of all electrical types and ranges — over 50 different case styles alone are available from Canadian production and tooling — and if you find your application calls for a new design — our engineering department is at your disposal.

Bach-Simpson Limited also produce Laboratory Test Apparatus, Radio Service Equipment, Automotive Service Test Equipment, Electronic Control Apparatus for Industry and Instrument components and accessories.

Bach-Simpson
LIMITED

1255 BRYDGES ST.,

LONDON, CANADA

IN U.S.A.: SIMPSON ELECTRIC COMPANY, 5200 W. KINZIE ST., CHICAGO 44, ILL.

INTRODUCING...

the first combined

G P C AND D D A



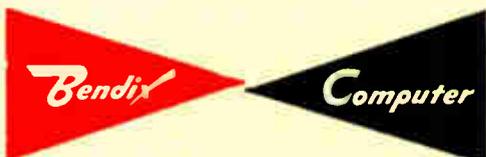
GENERAL PURPOSE DIGITAL COMPUTER AND DIGITAL DIFFERENTIAL ANALYZER



*ultimate versatility
in solving complex
technical
problems...*

The general purpose digital computer solves most scientific and engineering problems with speed and accuracy... yet easier programming makes the digital differential analyzer a superior choice for solving differential equations. Bendix now combines the advantages of both in the *new* G-15D Computer and its optional DDA accessory. Working together, and supported by a full complement of input-output equipment, these units provide the *best* means of solution. And the rental or purchase cost is far below that of most general purpose computers alone.

A new brochure tells the details of the G-15D's talent for conserving your scarce engineering manhours. Let us send you a copy.



5702

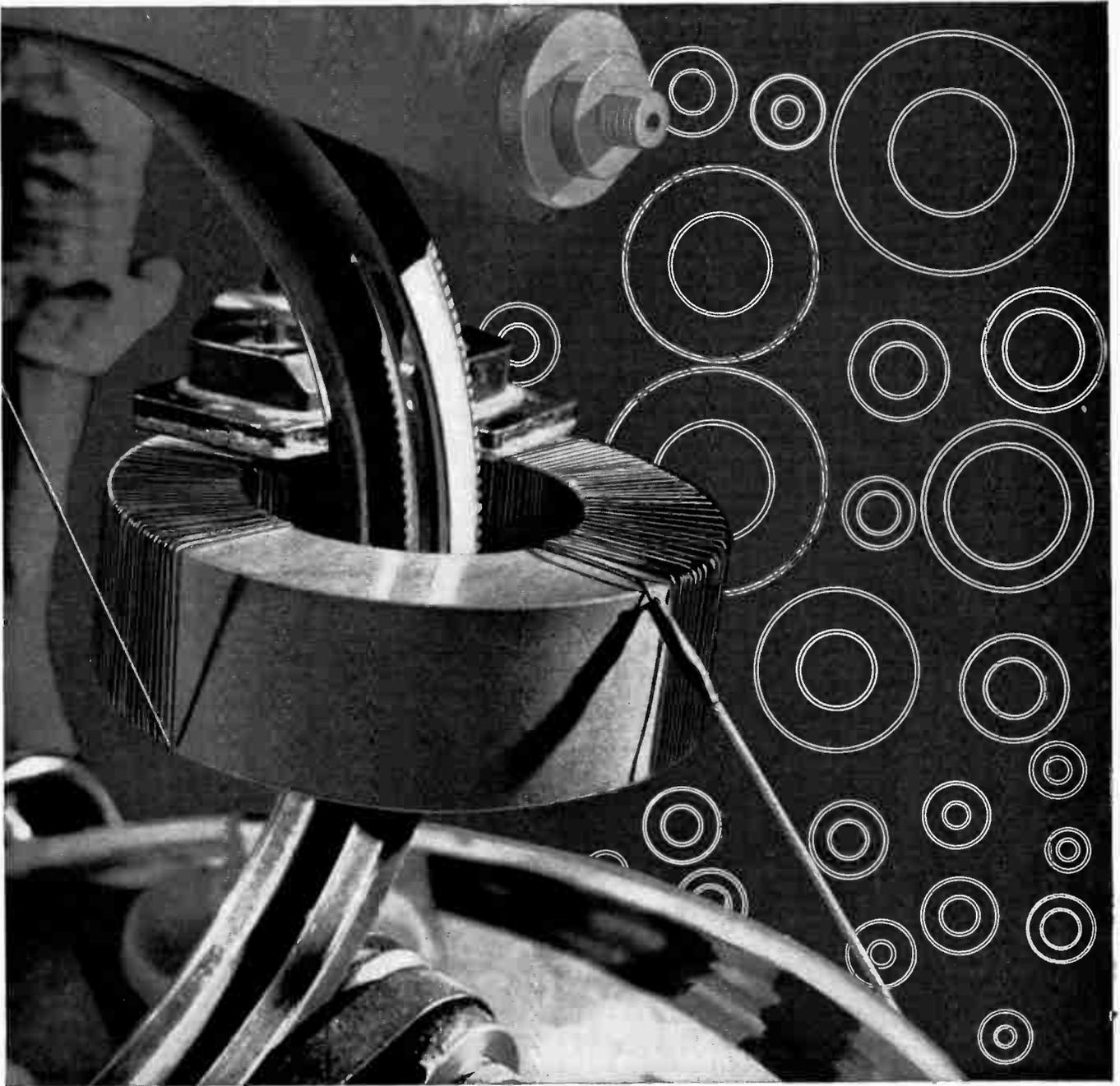


COMPUTING DEVICES OF CANADA LIMITED

P.O. BOX 508 • OTTAWA • CANADA

WESTERN DIVISION — Commercial Building, Edmonton, Alberta

KEEP UP-TO-DATE ON MAGNETICS



Here's how magnetic amplifier design will be affected by tape wound core standardization

If you design and manufacture magnetic amplifiers, you'll welcome news that standard sizes for tape wound cores have been proposed by the A.I.E.E.* You are going to benefit from a high in consistency of core performance, brought about by our being able to concentrate on your most important sizes. *Here's how . . .*

Magnetics, Inc. is now stocking all of the proposed standard core sizes in both aluminum and phenolic core boxes for immediate delivery. Consistency of core performance is increased because each size is made in large lots taken from the same alloy batch and dry hydrogen anneal. They all bear our exclusive Performance-Guarantee.

We shall be happy to send size, construction and magnetic material data upon request. Please write to Magnetics, Inc., Dept. EC-44, Butler, Pa.

MAGNETICS inc.

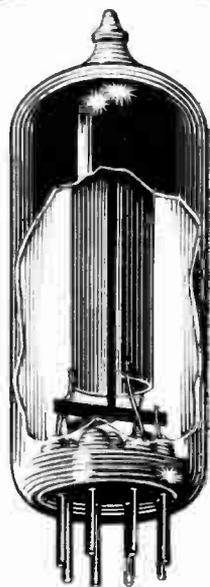
*Paper 57-206, Proposed Size Standards for Toroidal Magnetic Tape Wound Cores. Report of the Magnetic Amplifiers Material Sub-Committee, at the 1957 Winter General Meeting, A.I.E.E.

For further data on advertised products use page 67.

The Philips 85A2 is a Special Quality* 83-87V Voltage Reference tube with a maximum current rating of 10 mA. Its regulation is 4 volts over the range of 1 to 10 mA. and is no greater than 1 volt over the range of 1½ to 3½ mA.

Beyond the first 300 hours burning the variation in output voltage, with respect to time, is only 0.1%. Stability with temperature is $-2.7\text{mV}/^{\circ}\text{C}$. One of a line of Rogers Special Quality tubes, the 85A2 is a preferred replacement for such tubes as the OG3, 5651 and 5651WA.

**Although Rogers Special Quality tubes were developed for applications where dependability is of vital importance, they are finding more and more use in all types of professional equipment. In practice, their initial higher cost is more than compensated for by the greater reliability and lower maintenance cost of the apparatus in which they are used.*



ROGERS

electronic tubes & components

11-19 BRENTCLIFFE ROAD, TORONTO, ONTARIO / BRANCHES: MONTREAL, WINNIPEG, VANCOUVER

★Rogers Electronic Tubes are sold through Canada's Independent Electronic Parts Distributors

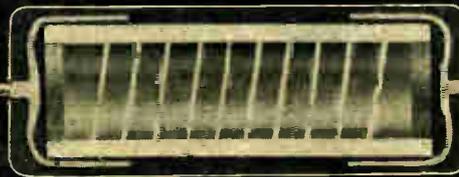
FOR HIGHEST STABILITY...

WESTON precision in a metal film resistor...

**PRACTICALLY FULL 1/2 WATT
ZERO T.C. AT 125 C**

WESTON
VAMISTOR

Actual Size



Enlarged Cutaway view

The Weston VAMISTOR offers you many advantages over wire wound or conventional film resistors, in critical applications. It is a sealed, metal-film resistor that provides greater stability than all previous types. Following are a few of its outstanding characteristics:

- Stable under temperature, moisture and load life
- Stable under vibration, acceleration
- Non-inductive
- Noise free
- Excellent HF performance

As shown on table at right, VAMISTORS meet or surpass MIL specifications. They are now available in the following types:

INITIAL TOLERANCE TEMP. COEFF.

Model 9851 — 1/2 watt at 85C 1% or .5% ± 50 or ± 25 ppm

Model 9852 — 1/2 watt at 125C 1% or .5% ± 50 or ± 25 ppm

Model 9853 — 1 watt at 70C 1% or .5% ± 50 or ± 25 ppm

all models available in resistance values from 1000 to 100,000 ohms

For complete information on VAMISTORS, return the coupon today.

WESTON VAMISTOR PERFORMANCE DATA
COMPARED WITH SPECIFICATIONS FOR OTHER PRECISION TYPE RESISTORS

Characteristic	Vamistor production units	MIL-R-19074A (ships) Style RI-94	Wirewound MIL-R-93A Style RB-52 Char. A	Film MIL-R-10509B Style RN-70 Char. A
Short Time Overload 2.5 Times—10 min	Average + .01% Low .00% High — .06%	.5% max.	.5% max.	.75% max.*
Load Life 1000 hr—85 C	Average + .15% Low + .10% High + .20%	.5% max.	.5% max.	1.0% max.**
Low Temperature —65 C—24 hours	Average .00% Low .00% High + .02%	.5% max.	(no test)	1.0% max.
Moisture Resistance MIL STD-202, Method 106	Average + .23% Low + .15% High + .36%	.5% max.	1.0% max.	3.0% max.
Salt Water Immersion 0 to 85 C—5 cycles	Average — .04% Low + .02% High — .10%	.5% max.	.5% max.***	(no test)
Temperature Cycle —55 to 85 C—5 cycles	Average + .04% Low + .02% High + .07%	.2% max.	.2% max.	1.0% max.
Insulation Resistance 100 v d-c	Greater than 10,000 megohms	100 megohms min.	50 megohms min.	10,000 megohms min.
Dielectric Strength 900 v rms—1 minute		.05% max.	.05% max.	.5% max.
Terminal Strength	Below measurable value—all samples	.5% max.	(no limit)	.5% max.
Effect of Solder		.5% max.	(no test)	.5% max.

*MIL-R-10509B test 2.5 times—5 seconds

**MIL-R-10509B test at 70 C ambient

***MIL-R-93A test not cycled, 25 C—24 hours

DAYSTROM LIMITED,

840 Caledonia Road, Toronto, Ontario.

Rush me full particulars on WESTON precision metal film resistors.

NAME

COMPANY

ADDRESS

WESTON VAMISTORS

precision metal film resistors



THINK OF MAGNET WIRE ... THINK OF PHILLIPS

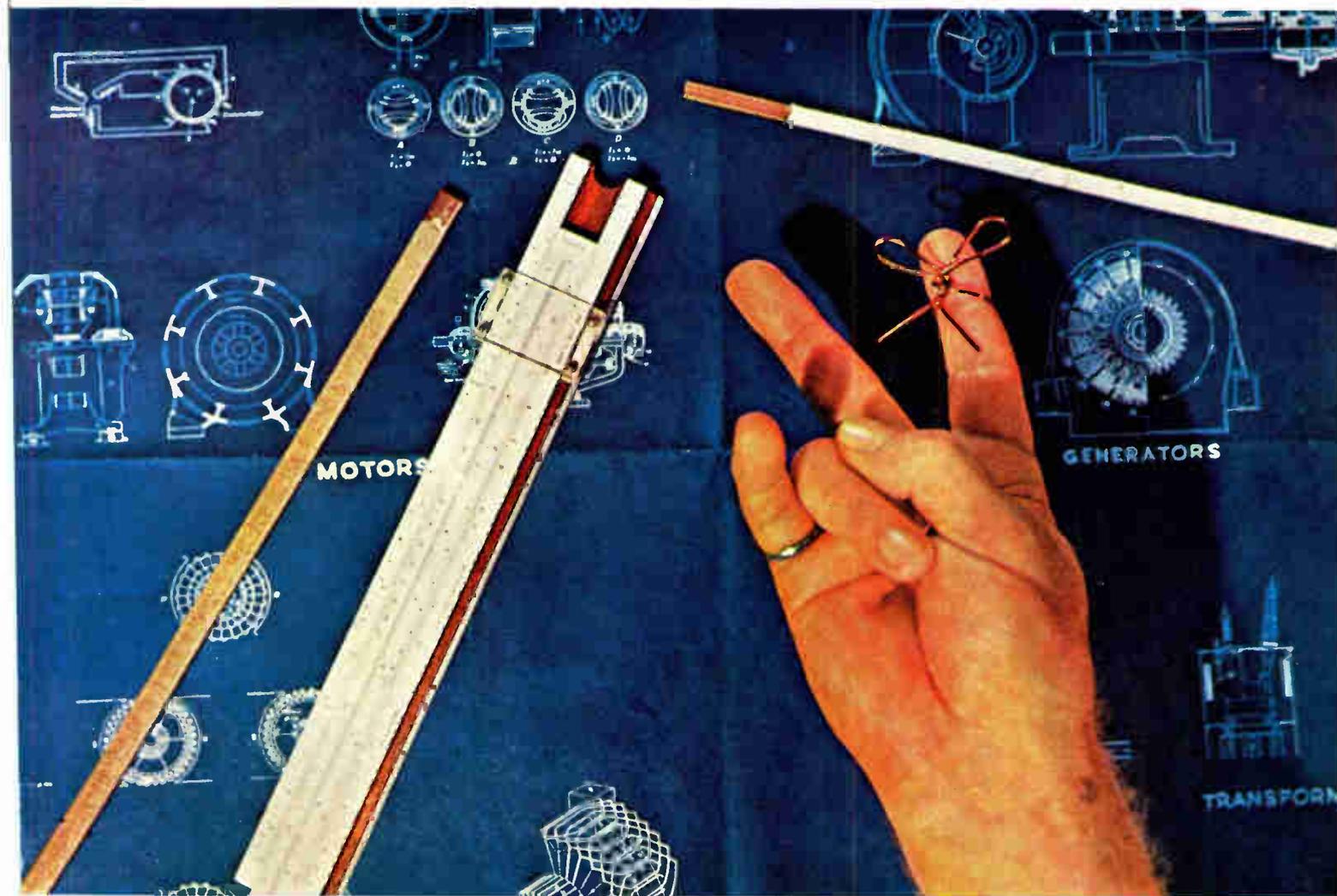
Significant changes are taking place in the Magnet wire field. Changes that may mark the beginning of a new era for magnet wire users. The successful development of Formel provided a reliable satisfactory wire for general winding purposes. Now, to meet the needs of industrial applications, the increase in Home Appliances, and the expansion in Electronics, a number of new and promising wires are being actively developed. These new types employ recently produced synthetics for their insulation, and are the result of months, even years, of painstaking research, selection, and testing.

Tests in which some of you may have participated. As a result, Daglas, Philsol, and Fuzel are now on the market, and others are coming.

You may be assured, that when new and improved magnet wires are needed—Phillips will have them.

Phillips Electrical Company Limited. Head Office—Brockville. Sales Offices—Montreal, Ottawa, Toronto, Hamilton, Winnipeg, Regina, Edmonton, Vancouver. The Canadian affiliate of the British Insulated Callender's Cables Group.

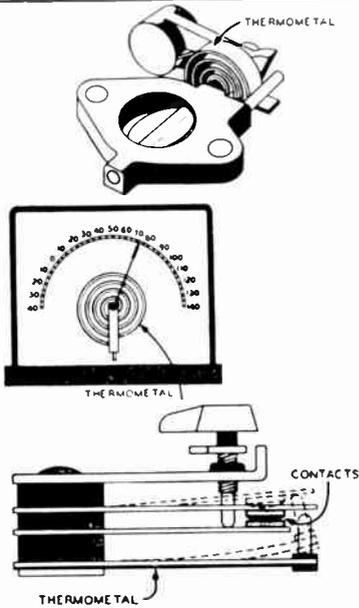
5718



PHILLIPS ELECTRICAL  COMPANY LIMITED

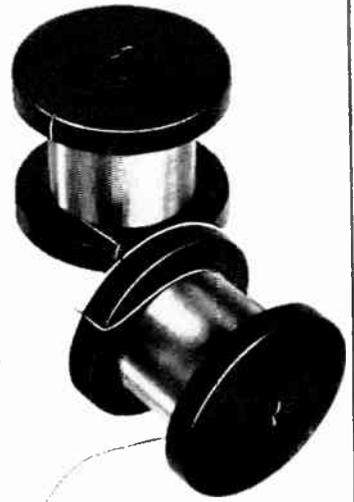
THERMOMETAL®

for use in electrical appliances, thermal cutouts, heating controls... in any application involving the indication and accurate control of temperatures, electrical currents, voltages, etc. Supplied in strip form, rolled and slit to close tolerances and tempered to meet specifications. Also supplied as elements and sub-assemblies, with or without contacts attached, fabricated in accordance with specifications.



FINE WIRE...

of ductile and non-ductile materials for every application requirement. BAKER research has developed processes for bare drawing wire as fine as .0004". Where smaller fine wire is required, the Wollaston process, for ductile metals, and the Taylor and Extrusion methods, for non-ductile materials, are employed.



- ▶ for controlling temperature...
- ▶ for fine wire...
- ▶ for precious metal contacts...
- ▶ for corrosion-resistant surfaces...

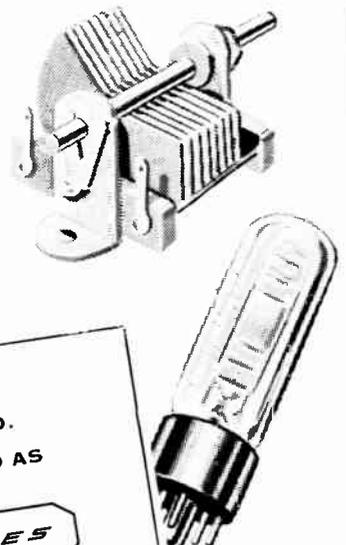
PRECIOUS METAL CONTACTS

for long operating life and unvarying performance. Available in pure or alloyed forms of Silver, Platinum, Palladium, and Gold. These contacts provide extremely high resistance to atmospheric corrosion, deformation, arc erosion, sticking and metal transfer. They are supplied as wire, rod, sheet, and as fabricated forms.



RHODIUM PLATING...

an economical, hard, white, corrosion-resistant surface. Extremely well-suited for many electrical and electronic applications. Resistant to corrosive atmospheres, oxidation, arc erosion. Reduces wear on moving surfaces, assures low noise level for moving contacts, no oxide rectification, low and stable contact resistance.

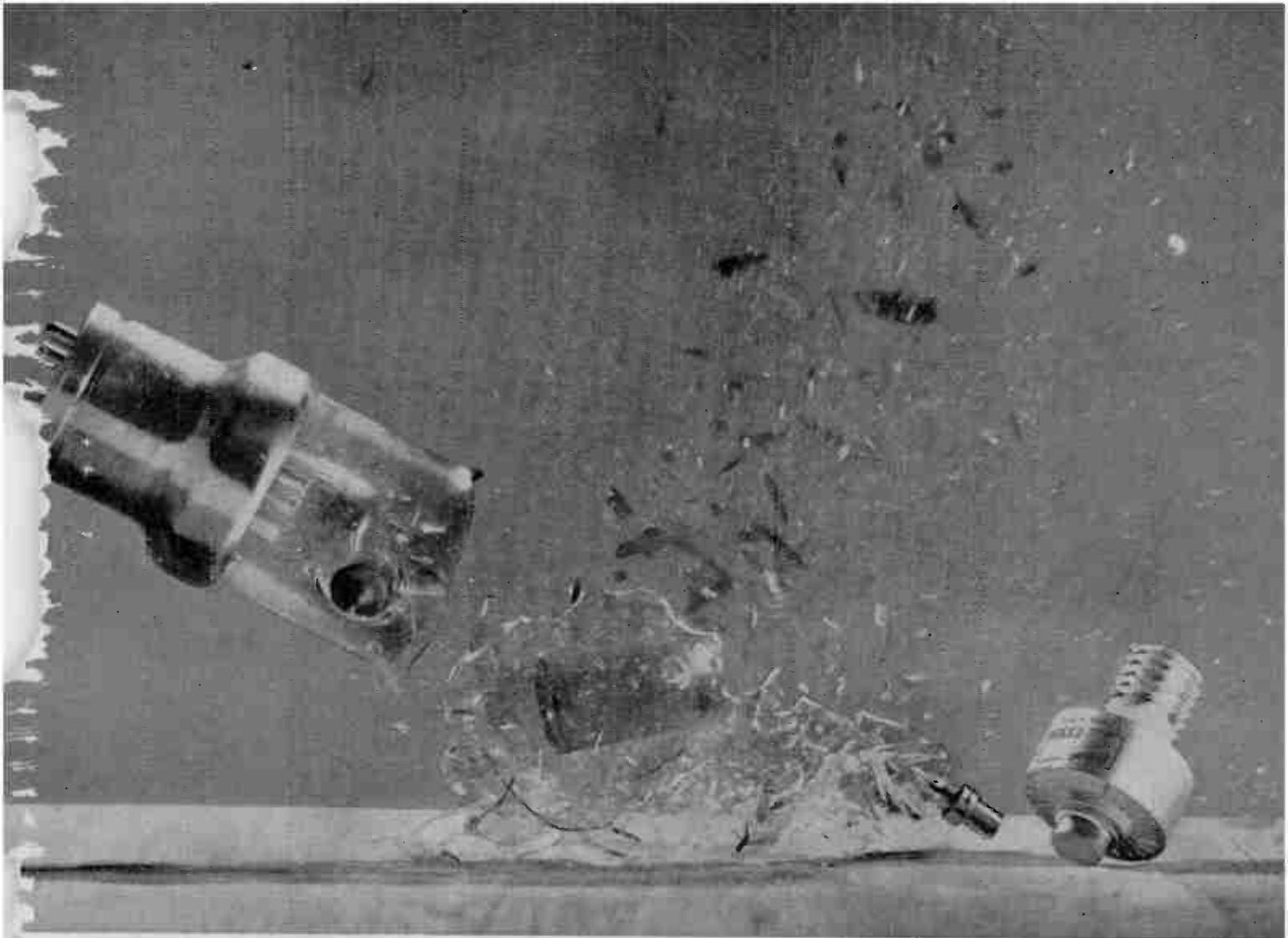


BAKER PLATINUM OF CANADA, LTD.
WILL HENCEFORTH BE DESIGNATED AS

ENGELHARD INDUSTRIES
OF CANADA, LTD.

512 KING STREET EAST
TORONTO, ONTARIO, CANADA

BAKER PRECI META



Surviving Impact is an Eimac Ceramic Tube Extra

Aeronautical electronics demands extras from vacuum tubes. Among them is the ability to withstand heavy impact without impairing electrical characteristics. The photograph dramatically shows what happens to a 250 watt glass envelope tube and an Eimac 300 watt ceramic tube when both are dropped from a height of seven feet. The ceramic tube "took it."

Other advantages of Eimac ceramic tubes are: resistance to damage by vibration and temperature; smaller size without sacrificing power; ability to undergo optimum processing techniques that lead to tube reliability and longevity.

The small Eimac ceramic 4CX300A, shown above, will withstand 50G shocks of 11 millisecond duration. It will operate in airborne or ground station service at full ratings up to 500mc.

In its new line of ceramic tubes, Eimac has the answer for the aeronautical engineer who needs a tube that will deliver full output under extreme environment.

EITEL-McCULLOUGH, INC.

SAN BRUNO CALIFORNIA

The World's Largest Manufacturer of Transmitting Tubes

Canadian Representative:

R. D. B. SHEPPARD

2036 Prince Charles Road, Ottawa 3, Canada



5806

4CX300A MAXIMUM RATINGS TO 500MC

	FM	AM	SSB		FM	AM	SSB
D-C Plate Voltage	2000	1500	2000	Plate Dissipation, watts	300	200	300
D-C Screen Voltage	300	300	400	Screen Dissipation, watts	12	12	12
D-C Grid Voltage	-250	-250	—	Grid Dissipation, watts	2	2	2
D-C Plate Amperes	.250	.200	.250				

Mr. Shields graduated from McMaster University in 1945, where he obtained his B.A. degree with Honors in Mathematics and Physics and obtained his M.A. degree in 1947. He was employed by the National Research Council on the Atomic Energy Project at McMaster until 1950 where he was engaged on instrumentation for Mass Spectrometry. He was transferred to the Electronics Branch at Chalk River in 1950, spending three years on component reliability and standardization with special attention to vacuum tubes. Mr. Shields has been in charge of the Electronic Instrument Section of the Engineering Services Division at Chalk River for the past two and a half years.



R. B. Shields

Fault Analysis Of Nucleonic Equipment

By R. B. Shields

Supervisor, Electronic Instruments, Chalk River Atomic Plant.

At Chalk River as at any Atomic Energy Project electronic equipment forms a very large part of the instrumentation. It is estimated that there are about 7500 electronic instruments in use consisting of roughly 300 types. The number is increasing steadily and the general tendency is towards greater complexity so that it is very important for everyone connected with the development and design of new instruments to strive for maximum reliability. The chief source of information is from the past records of existing instruments and one of

the most difficult problems is that of obtaining accurate data in a form that permits quick access to the many types of information whenever required.

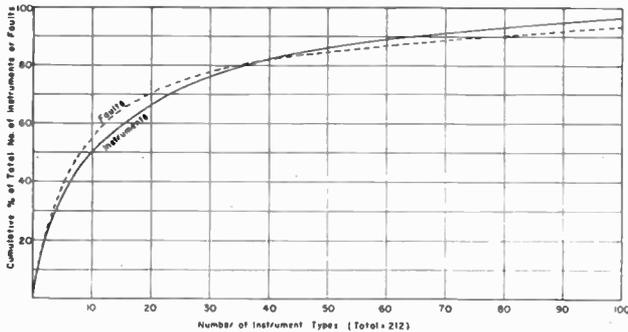
Records of faults in electronic equipment have been kept for many years but their usefulness has been limited because of the tremendous task of sorting through thousands of failure reports. It has been the practice to make tabulations about every two years of the failure rates of a few of the more numerous types, but this has not given a complete picture by any means and often

		SF 7 4 2 1 0					SF 7 4 2 1 0					SF 7 4 2 1 0					SF 7 4 2 1 0					SF 7 4 2 1 0					C56236
		COMPONENT					TYPE					MANUFACTURER					DEFECT										
O		EQUIP. A.E.P. NO. 1007										DATE May 29, 1957										COMPONENT FAILURE RECORD					M
Z		SERIAL NUMBER: 49 (Bldg. 300)										APPROX. COMPONENT HOURS:										EQUIP. OP. CONTINUOUSLY					N
A		CIRCUIT POSITION: V.5										COMPON - ENT					REPAIRED					O					
B		DETAILS OF FAILURE:										CAUSE OF EQUIP. FAILURE					REPLACED					P					
C		Replaced V.5 - 2 C 26A - Heater-cathode short.										- dated 439 -					DIRECT CONTRIBUTING NOT					Q					
D		MINUTES 10 20										EQUIP. DID NOT FAIL					RESULT OF FAILURE OF ANOTHER COMPONENT					R					
E		HOURS 1 2 4										ATOMIC ENERGY OF CANADA LIMITED										S					
F		DAYS 1 2 4																				T					
G		OUTER ROW - TIME TO REPAIR																				U					
H		INNER ROW - OPERATION DELAYED																				V					
I		UNITS TENS HUNDS THOUS.																				W					
J		OVER																				X					
K																						Y					
L																						Z					

● Fig. 1 — Component Failure Record Card

comes to hand a bit late for prompt corrective action. A continuous tabulation would help but this does not provide the complete answer because experience has shown that it is impossible to predict what kind of information may be required. For instance, it has been asked how many Selenium rectifiers have failed in the course of a year during thunder storms or, what is the type number of the transformer which failed in a particular scaler about the second week of July.

With this sort of thing in mind a system of record keeping has been set up at the Chalk River Atomic Plant using punched cards. This has been operating since Janu-



● Fig. 2 — Cumulative Percentage of Instruments and Faults as a Function of Number of Instrument Types.

ary 1956. It is the purpose of this article to describe the system and its many uses and also point out some of the difficulties.

Description Of The Card System

The maintenance mechanic fills out a report sheet for each service call, giving full details of all work done. These report sheets are sent to a central location where a clerk types the information on the cards and also codes and punches the important details. Figure 1 shows a typical card. The component and type, component manufacturer, defect and equipment type number and some other essential facts are coded and punched. The code also provides for faults not involving a component. Sorting of the cards may be done in terms of any of the coded information and it is done with a sorting needle leaving as little as possible to be done entirely by hand. It will be apparent at once that one card is necessary for each fault even though several faults may be corrected on a single service call. Any number of identical faults may be put on a single card and, of course, it is desirable to consolidate the file periodically by making a single card for all the identical faults during the period.

Originally it was felt that it might be necessary to limit the system to a selected number of instrument types. As it turned out it requires very little extra work to include them all. Figure 2 shows a plot of cumulative percentage of the total number of instruments in use as a function of number of types beginning with those with the largest population. It can be seen that 80 per cent of the instruments consist of only thirty-five types. On the same graph has been plotted the cumulative percentage of the total number of faults as a function of the number of instrument types in which they occur, this time beginning with those having the greatest number of failures. Although the instrument types are not necessarily in the same order as in the first case the curves are almost identical and it obviously requires only 20 per cent more cards to keep records of all 300 instruments than it does for the selected 35.

Larger organizations such as the U.S. services use IBM cards to advantage but at present at the Chalk River plant it is considered that the Keysort type is adequate for a system of its size which records between 600 and 800 faults per month. In some ways it is an advantage to have the cards filed near by in order to facilitate manual sorting. Often it takes only a few minutes to locate the required information.

Value To Designer

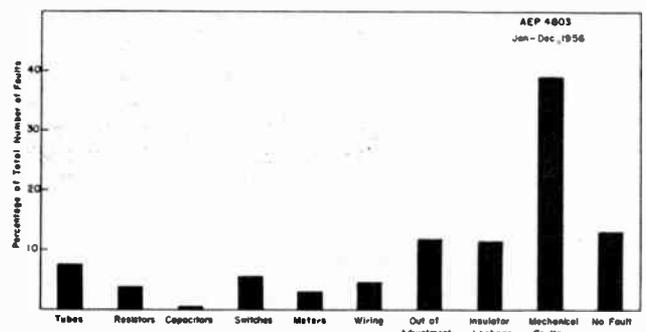
The chief use of the data is to determine the reliability of existing equipment and to point to cases which require investigation. The result may be a modification which will correct or improve the situation. In hopeless cases it may be noticed that a particular instrument type should be declared obsolete and retired at the earliest convenient opportunity. Equally valuable are the lessons that can be learned about the selection and use of components and circuits. The 7000 or 8000 electronic instruments on the project provide a life test facility of considerable size and cover an extremely wide variety of operating conditions.

The record system permits operators to evaluate very early the reliability of a new piece of equipment or the effectiveness of any improvements made to existing equipment. Engineers at Chalk River are convinced that efforts in this direction have been worthwhile. One significant result is the fact that, whereas the number of electronic instruments in use has increased considerably over the past five years, the number of service calls has not. This, it is felt, is due to the continuous picking away at the worst trouble spots and gradually reducing the relative number of failures. For example, the failure rate of a high voltage rectifier tube has been cut in half in one application by a simple modification to the circuit. The failure rate of Selenium rectifiers used to run anywhere from 6 per cent to 50 per cent per year depending upon the application.

Switching to the product of a different manufacturer reduced these ratings considerably and out of several thousand rectifiers put into service during the past two years only seven had failed up to the end of July 1957. A new numerator used in the scalers is more than twice as reliable as the old one. A new transistorized contaminator meter looks as though it may be more than a hundred times as reliable as the model it replaces. Some of these improvements do not seem very impressive but the saving in maintenance man-hours alone is considerable. It has been estimated that a service call costs in the neighborhood of \$30 in direct labor and material alone exclusive of overhead and the value of time lost by the user of the equipment.

It is probably only fair to state that one new instrument has turned out to be less reliable than its predecessor. But at least this was discovered early and it was learned precisely how bad it was.

A discussion of the many design problems which have come to light as a result of operating experience is beyond



● Fig. 3 — Distribution of Faults in AEP-4803.

the scope of this article. However, one or two observations from the maintenance standpoint are as follows.

There is a tendency for the design engineer to be extremely anxious to try out all the latest devices as soon as possible and incorporate them into instrument designs. It would be very unprogressive to discourage this tendency because experience with these new devices must be obtained by some means. However, extreme caution must be used in applying them to equipment which requires maximum reliability. There is a definite hazard in making unrestricted use of any new type of component

with anything less than five years' actual operating experience.

The second point is, as the reliability of components improves, other defects begin to assume greater proportions. Among these is the purely mechanical defect which is causing a great deal of concern in the case of portable equipment. These instruments have to withstand more rough usage than fixed equipment. They are occasionally dropped on the floor and, on occasion, have been run over by trucks. They are exposed to rain and are sometimes dropped into tanks of water. Figure 3 is the failure record of a particularly bad example. Only 20 per cent of the total faults were component failures and some of these were certainly the result of abuse. Most of the remainder were either direct mechanical faults or indirectly the result of inadequate mechanical design.

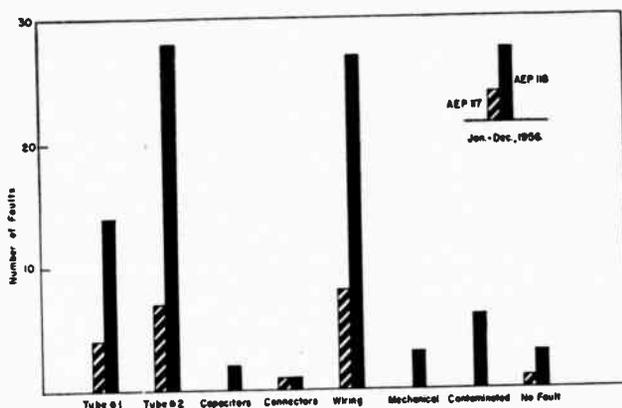
Some idea of the effect of conditions of use can be seen in Figure 4 which is a comparison of the faults in two instruments of essentially identical and reasonably good design. One is used in fixed locations and the other is used in the field. The latter has about five times as many faults. This may indicate the amount of improvement required.

Value To The Maintenance Department

Apart from the value of these records to the designer, a surprising amount of information has come out of them which is useful to the maintenance department. For instance they provide a more accurate record of the time consumed by mechanics on various job categories. They have pointed to several unsuspected trouble spots and have also served to put others in their true perspective. From previous tabulations it was concluded that the maintenance man spends between 70 per cent and 80 per cent of his time replacing tubes whereas now that the whole story is available this has to be revised to 35 per cent.

At one time there was a rumor that quite a large number of tubes (10 per cent or more) would not work in a particular instrument although they checked within limits in the tube tester. The specific defects of rejected tubes have been checked in this application and less than 1 per cent have been in this category.

The records also provide valuable information on the fault behavior of a particular instrument throughout its life and thereby form a sound basis for effective maintenance procedures. A plug-in decade scaler which is a particularly reliable unit began to show increased tube failure rates — about 11 per cent per year compared to only 0.6 per cent in 1950. The tube population of a sample of twenty units was investigated in terms of the acceptance date marked on the bulb. The result is shown in Figure 5. This confirmed the fact that more tubes had been replaced during the past year than in previous years but also showed that over 50 per cent of the tubes supplied with the units are still in use which is a very good indication that they have had a long life



● Fig. 4 — Comparison of Faults in AEP-117 and AEP-118.

indeed. However, a study of the dates on the tubes which were replaced in these units in recent months revealed that over 80 per cent of these were very old tubes. A simple calculation led to the conclusion that there comes a time in the life of an instrument when it is economical to replace all of the older tubes whether they have failed or not and thereby take advantage of the lower replacement rate.

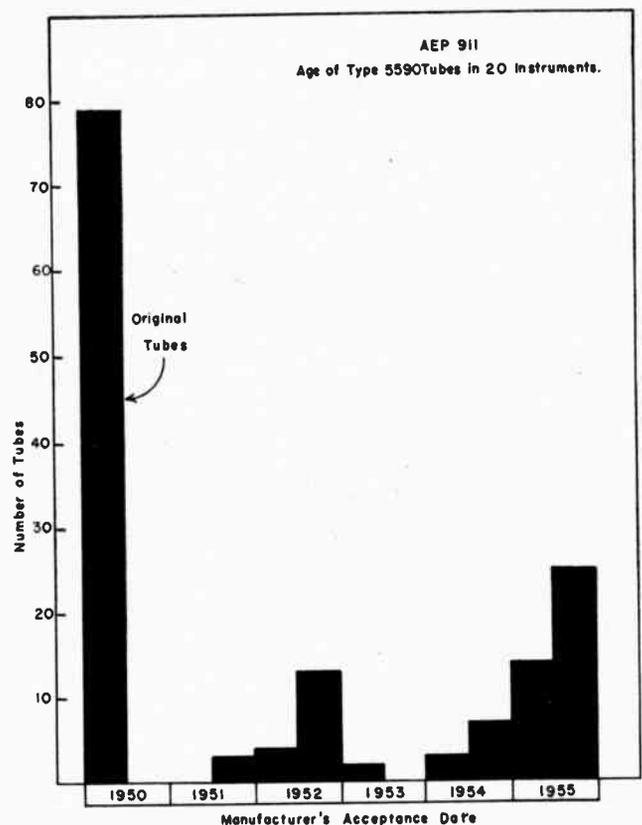
Another use of the records is in the preparation and revision of preventive maintenance schedules and the procedure is obvious if both the instrument reliability and the reliability requirements are known.

Following a year and a half of experience with the card system a few points in connection with operating it are worth mentioning. It is most important that a simple, unambiguous coding system be used and drawn up with special regard to the kind of information required and with a fairly good knowledge of the kind of information which will be supplied. Otherwise there will be an undue number of entries under the miscellaneous code with a consequent increase in hand sorting.

The education of the mechanics to be accurate in their reporting is equally important. They should be taught to be specific and avoid expressions like "weak" or "worn out". The use of nick-names for instruments is colorful and sometimes descriptive, but it is easier for a clerk to code the actual serial number of a component than it would be for him to identify "Rudolph" as the counter with the red nose.

The most common omission in fault reports is the failure to specify component type and size. Frequently the only information provided reads "replaced C21" or "replaced zero-pot". This condition, however, has been eliminated with the development of the system.

Finally, if the reporting is to be anywhere near complete and accurate it is absolutely essential that the record system be sold to the maintenance staff so that they are thoroughly convinced that its main aim is to make their life a bit easier.



● Fig. 5 — Age of type 5590 Tubes in AEP-911.

In this paper, originally presented to the Canadian Management Council, Sir Robert Watson-Watt reflects briefly on the development of Information Theory and points out its importance as a tool of modern management in the form of electronic processing installations.



● Sir Robert Watson-Watt, C.B., F.R.S.

Tools Required By Management In A Changing World

By Sir Robert Watson-Watt, C.B., LL.D., D.Sc., F.R.S.*

TODAY'S discussions have been directed primarily to the distribution between institutions and individuals of the responsibility for developing competence in management. I am now venturing to cite certain specific areas of subject matter which seem to me to be in urgent need of attention for the educator, be he a professorial, a corporate, or a self-educator. I am not particularly qualified to deal with the current, accepted and familiar techniques of management; I am not fully qualified to deal with techniques which are still knocking at the door of management, but that doesn't prevent my identifying some of the candidates. I assume that an essential part of education for management is that the student should be constantly aware that management, like the rest of the world, is non-static, that he should be alert to any cloud, be it no bigger than a man's hand, appearing on the horizon, and that he should be diligent to discriminate between the rose-colored and the leaden hued.

It has been said that the scientist is the man who makes your securities insecure; it should be added that it has always been basically the technologist (in the broad sense of the term) who makes new securities possible. The tools of which I have to speak, for which I have to claim a place in the mind of the man who is being educated for management, are much more deserving of description as tools of scientific management than were many of the somewhat naive tools which put the name Scientific Management in danger of becoming what Mrs. Malaprop described as an "opprobrious epitaph".

It is nearly a platitude to say that the crucial need of management is to have the right figures in the right form

in the right hands at the right time; we might put this in a negative form by saying "evil communications corrupt good management".

The three scientific tools of which I have to speak are all tools of communication in the wide but precise sense which is now attached to that previously loose word. Communication Theory used to concern itself with little more than the machinery for the undistorted transport of verbal and numerical messages, with but little concern for their inner content. Now "Communication Theory" has produced a child greater than itself in "Information Theory", deeply concerned to ensure that the recipient of the message is enabled, as economically as may be, to form a mental conception which is identical with, which contains no more and no less than the conception which was in the mind of the sender. I would go so far as to say that this is the concern of Information Theory even when the sender is himself the recipient; I mean that the application of the Theory may even provide means for keeping the management man from fooling himself into believing that he is getting what he really needs when he is getting only what he thinks he needs.

In the retrospective light of this recent development, it now seems quite natural that all three of the tools I am to mention emerged from the telecommunication laboratory. The facts and the ways of thought and action which we learn in improving radiotelegraphy led us naturally (although, as I keep on monotonously emphasizing, not inevitably) to radar, the troubles we experienced

* Sir Robert Watson-Watt is Chairman of the Adalia group, consultants in radar, telecommunications and electronic data processing.

in developing radar led us to Operational Research and the audacities we learned in developing radar, and in facilitating good use of the information it provided, led us to Electronic Computers and to Electronic Information Processing systems.

Trio Of Tools

My chosen trio of tools are, then, Telecommunications, Operational Research, and Electronic Information Processing. The first I do not discuss, but the management man must learn a good deal about its powers and its defects. The second may be reminiscent of M. Jourdain's epoch-making discovery that he had been talking prose all his life without knowing it. It is often claimed that Operational Research is only an old process with a new name; but it is more fair to say that Operational Research is the Poetry which goes far beyond Mr. Jourdain's Prose, (though in the same general direction) precisely because it is Prose which has been carefully organized and oriented.

In the regrettable absence of sufficient Operational Research on Operational Research, I have no neatly packaged definition of O. R. to give you. Nor can I believe that a recent suggestion is very helpful as a description. "Operations Research" is the activity carried on by members of the Operations Research Society, its methods are those reported in our Journal. This is like the inversion of an older glimpse of the putatively obvious, making it say that "Archdeaconal functions are those performed by an archdeacon". But as a guide post rather than as a definition it is valuable. So, perhaps, is my very early and partial description of Operational Research, soon after I invented the name: "Quantitative scrutiny of what the user wants, what he ought to want, what he gets, what he makes of what he gets, and what he ought to have and to do in order to get what he ought to want out of what he gets." The operational researcher must feel himself to be an integral part of the policy-forming team and of the process-devising-and operating teams alike; he must know that he is a part only of an association of scientific workers; he must be undisciplined, he must go on gossiping terms with all men, he must have a universal and insatiable curiosity, he must be a productive busy-body, he must roam at large without being able to explain, even to himself, just why. He must have the privilege of the Court Jester who is paid to be irreverent so long (and only so long) as he is wise.

Management is the resident physician whose job it is to ensure the healthy growth of an organization which in its complexity is more like a biological organism than a mere mechanical system. Just as the average human suffers from a multiplicity of minor ailments rather than from one organic disease in an otherwise perfectly healthy body, so does the management physician find in his patient a variety of minor diseases and derangements. He cannot usefully treat them all simultaneously, which should he try to cure first? The choice is seldom obvious and inevitable. The physiologist of business is the Operational Researcher, who can give him advice — based on careful observation, on sound reasoning, and often on laborious calculation — as to the overall improvement in health that would be achieved by curing one or another among the specific derangements of the patient. The advice is advice only, to be followed or rejected, but the physician has the blame if the patient dies untimely. There will be perfect organization just as seldom as there is perfect health, but Operational Research can guide the physician towards the most worthwhile treatment to bring the patient into a general state "not incompatible with a long and useful existence."

And just as the physiologist has to acquire and improve his techniques by practicing his specialization on a wide range of diverse cases, so, I believe, must the operational researcher maintain his expertise by studying a wider range of comparable but far from identical cases than will present themselves within one normal organization however big and diversified. This is why I believe that Operational Research must in part be done by outside consultants and not wholly by members of the staff of the

organization under study. But if management does not understand the reasons for this, if their education does not include an understanding of the aims, principles and objects of organizational research, this aid from outside may not be invoked, or may be invoked too little and too late.

The modern operational researcher — and it must be remembered that even the label "Operational Research" is now nearing its twentieth birthday — cannot do his best work without the aid of the modern electronic computer; that both these tools of management were born into the same family was no accident, there is an inherent kinship. And so there are two different groups of reasons why education for management must include education on what electronic computers and their associated devices in information processing can do — not by a count of relative numbers of tubes, transistors, diodes, cores, flip-flops and delay lines, but by study of what management information comes out of a wisely chosen system when it is fed with the raw ingredients of a payroll, an inventory or material control system, a whole life policy, a gas distribution program, or a St. Lawrence Seaway project. Too often, up-to-date, have we seen sales engineers who talk to possible users only the Chinese of circuitry to management men who speak only the Arabic of accountancy — but that is a different story.

Too Much And Too Little

What I was saying a moment ago was that when the first stage of O.R. has been completed, it is very often possible and desirable to put into numerical form several possible decisions on the course to be pursued, and to calculate which is likely to give the best results in the circumstances of the particular case. But the calculations tend to be very laborious, and it is usually desirable to hand them over to an electronic computer. Thus our number two tool itself makes demands on number three tool.

A great deal too much, and a great deal too little has been said and written about "giant brains"; too many generalities, too few examples of what the lawyers call "acute analysis" of their role in particular management jobs; too much about the million dollar machine in its isolation; too little about the hundred thousand dollar system centered on a modestly priced medium capacity G. P. Computer; too much about data processing in the giant industrial unit, too little about services, direct or indirect, to the moderate and small management bloc; too much about saving clerical labor costs, too little about saving top management time, and top management frustration, in the crucial decision-making job. I am not to attempt to redress the balance here; I here only repeat some of the generalities and say that, like all platitudes, they are said frequently because they are true. But I am convinced that many of the largest organizations will follow, with appropriate variations, the example of Sylvania Electric Products, Inc., who are setting up an electronic computing center remote from head office and form any of the numerous plants, in a position determined by the quality and quantity of the line communications available at the center to link it to the plants or to the center of policy formation.

The project is justified wholly on the provision of accurate and up-to-the-minute figures about the factors on which decision has to be based; any economy in personnel at the desk and manipulative levels is unimportant in comparison with timely decision based on "hot" accurate comprehensive and comprehensible data from the electronic information processing system.

I am convinced, too, that all but the smallest business offices will each have within a period of five to ten years from now, its own electronic information processing installation.

And I am convinced that all but the die-hards (and how liable they are to die hard!) among the smallest offices will utilize the services of an electronic information processing bureau.

Ethical Responsibility A Crucial Tool

Education for management must, from yesterday, be devised to include two-way educational processes in relation to those three tools, telecommunications, operational research, and electronic information processing. I say two-way because here, as always, the teacher must learn from the student. Here the student, within management, will learn from his teacher in the technical field how management can be helped by these scientific tools; the teacher will learn from the student what kind of help management most needs. And in another two-way aspect I believe that in the actual practice of O.R. under a gifted O.R. leader the young man who is being educated for management would find a most valuable education for management.

I now propose to take a base advantage of my privileged, if precarious, position at this rostrum, and to say something about bits of education for management which I regard as far more important, and far more difficult to achieve, than education on the base mechanic arts of communications, operational research, and electronics in management.

In the course of my professional work as an adviser and consultant to scientific and technical industries I have, within the years 1954-1955, had to deal with three major crises. In no one of the three was there any important

deficiency in scientific or technical knowledge or performance; in each one of them there was a lamentable deficiency in business ethics. The individuals, who had gone a long way towards wrecking the organizations which were giving them wide scope for expressing their individualities, were basically well-instructed but ill-educated products of major universities; no one had convinced them that the highest altruism and the basest self-interest meet in the injunction to "do unto others as you would have them do unto you".

Dishonesty, myopic self-seeking, charlatanism conscious and unconscious, the promotional balloon inflated with nothing better than hot air, in sum, deficiencies in "ethics and arithmetic", have done far more harm in management than have deficiencies in "techniques and mathematics". The indispensable tools of good management include imagination and sensitivity alike to people and to things; the crucial tool I believe to be a keen-edged ethical responsibility. I know an alarming proportion of graduates emerge from science and engineering schools with an "x" in their "principal" subjects, but without the shadow of a test for their ability to rate so much as a "y" in ethical principles. And this makes me wonder what happens in the management schools. Is there over their portals the vital motto "The Proper Study of Management is Man!"

A fascinating instrument, the electronic leak detector is being used by manufacturers of metal sealed containers, valves, vacuum tubes, refrigerators, and other components and products to assure leak-proof, trouble-free seal. Leak detection is a quality control method that assures top-notch performance in products, cutting customer complaints and prolonging life of many components.

Electronic Detection In Industry

HIGHER pressures, vacuums, and hermetic sealing of components in a number of industries demand a method of rapidly checking even the tiniest leaks. To test for these leaks, engineers have adapted the electronic mass spectrometer as an extremely sensitive leak "hunter".

The mass spectrometer is in wide use in chemical and petroleum industries as an analytical instrument. It is in effect, an atom sorter and counter. The special mass spectrometer is "focused" on mass 4 (helium) only and is thus known as the helium leak detector.

Several electronic component manufacturers use these leak detectors to check aviation switch enclosures for tightness. To insure safe electrical contact performance when subject to condensation resulting from changes in altitude, these switches are sealed with an internal pressure slightly above that of sea level.

Extreme care is taken in the factory to make certain that each switch enclosure is entirely leakproof. A Consolidated Electrodynamics Leak Detector is connected to the pumping and filling equipment. This equipment has ten stations with couplers which can be switched to any one of four positions — "loading," "rough pumping manifold," "finish pumping manifold," and "filling manifold." The switch enclosures, complete with three glass bead seals for electrical connections and an open tube for filling, are connected to each of the manifold stations through a short section of flexible tubing.

After the pumping is completed, and while the switch is connected to the "finish pumping manifold," a jet of

helium is directed at the enclosure. Should a leak exist, molecules of helium will be sucked into the manifold, pass through the oil-vapor diffusion pump and be drawn into the leak detector where the molecules are ionized and directed to a target in a mass spectrometer tube.

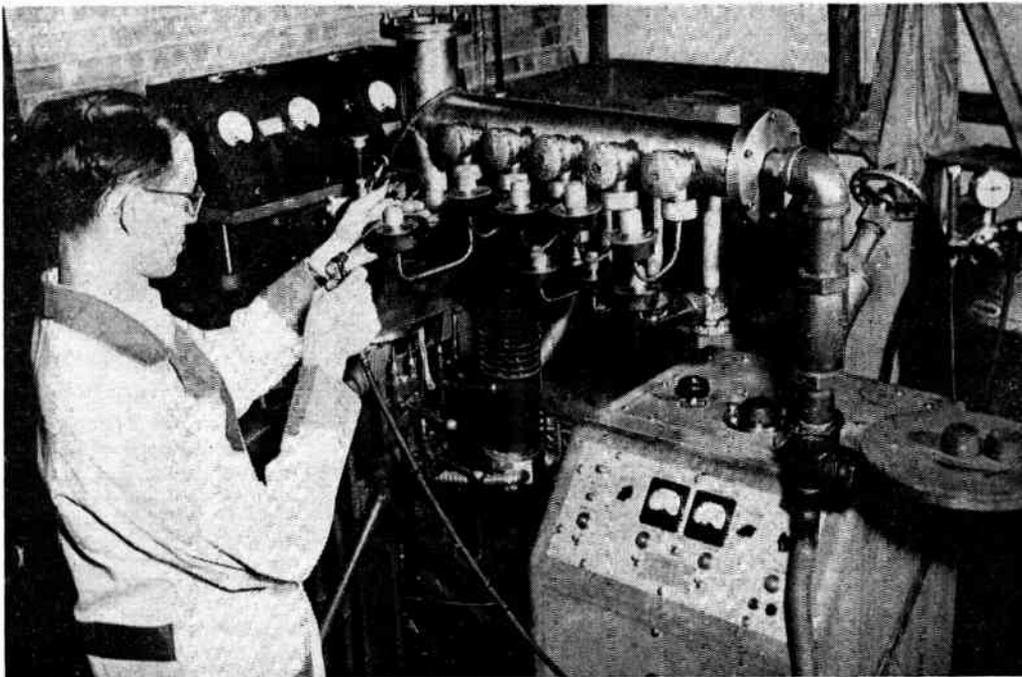
The presence of helium ions will be indicated on the leak detector both by a meter reading and an audible signal.

Following the check for leaks, the switch is transferred to the filling position and filled with pure dry nitrogen. After the filling tube has been sealed, the terminal block is installed, completing the switch.

The same principle of operation is followed in testing flexible metallic bellows for leaks at another firm. The bellows are used in many industries in steam, liquid, or gas lines. Proving that the bellows are leakproof is easy. The operator merely shoots a little helium gas around each bellow with a probe. As the bellows are attached to a manifold connected to the leak detector, any leakage of the helium into the bellows is quickly made known by the indicator and the audible alarm.

Leak Proof Valves Assured

Absolute absence of leaks is a requirement for valves produced by the Hammel-Dahl Co., of Providence, R. I., manufacturers of automatic control equipment. These valves must meet rigid vacuum-service conditions imposed by requirements of a special project the company is developing.



● Testing flexible metal bellows for leakage at the Flexonics Corporation.

To test the absolute tightness of the equipment, Hammel-Dahl uses eight leak detectors.

The leak detectors are connected to a common manifold in an assembly-line setup. Included in the manifold are an external pump for roughing out the system, an exhaust line for the leak detectors, a helium line for attaching the helium probes, and a nitrogen line for purging the leak detector to reduce the helium cleanup time.

A smaller manifold is mounted to the inlet flange of each instrument to increase valve testing efficiency. Located here are the vacuum seal for mounting the valves and the calibrated metal leak. Three vacuum valves allow each of these components to be isolated from the remainder of the system.

Indirectly, the leak detectors contribute to the maintenance of extraordinary cleanliness standards demanded by the customer because any speck of dust or foreign matter incorporated in the precisely-fitted valve assembly would be sufficient to cause leaks.

Detecting Leaks In Centrifugal Pumps

The Byron Jackson Company in Los Angeles is using a leak detector as a final inspection device on centrifugal pumps where no leakage can be permitted.

The pumps use no stuffing boxes. The wall sections of one of the components of the pump (a cylinder fabricated from .020" thick Inconel) are too thin to test under vacuum. To test the welds, inspectors partially evacuate the cylinder, back-fill it with helium and then use a probe connected to the leak detector.

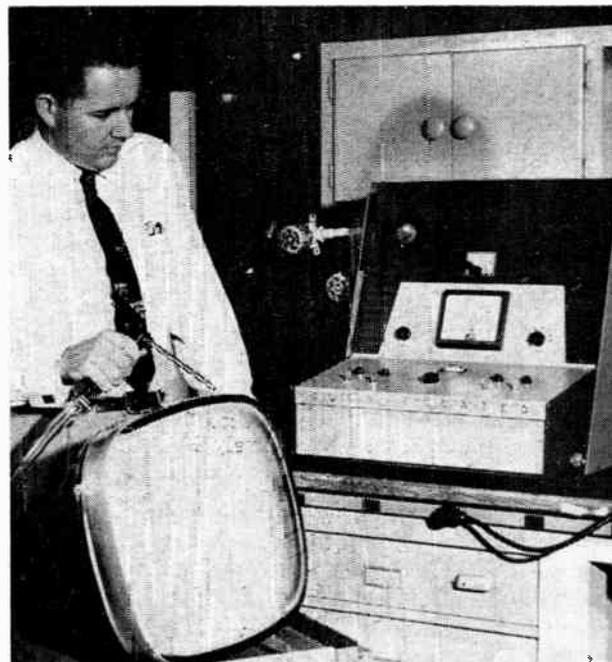
Leak-Testing Metal Vessels

Two large firms which had contracted with Research Welding Engineering Company of South Gate, California, for a quantity of metal vessels, specified the mass-spectrometer leak-detector-type of test.

The vessels being tested were made of drawn steel and were roughly jug-shaped. The only opening was a valve at one end. Two different leak tests had to be run. One determined the outleakage from the valve itself, and the other determined whether or not seams and joints were tight.

In the outleakage test, it was only necessary to run the leak detector probe around the valve itself, since, in the Heliarc process, welding itself is done in an atmosphere of helium. The valve was shut prior to welding, so the helium inside the vessel remained.

For the inleakage test, all helium was removed by flushing the vessel with hydrogen. The vessel was evacuated first by rough pumping (down to one micron pressure) and then connected to the leak detector for further evacuation. A small jet of helium was directed over the outside of the vessel, particularly on the seams and joints. If leakage exceeded specifications, the vessel was rejected.



● Using the new CEC Type 24-210 Leak Detector to check leaks in a TV receiving tube.

Where Water-Immersion Is Not Feasible

Meehanite cylinders used in the 10-lb. dry chemical fire extinguishers made by Walter Kidde & Co. are inspected for leaks with a leak detector.

The cylinder to be tested is charged with 150 p.s.i. of air mixed with 10 per cent of helium. It is then placed inside a chamber from which air is evacuated to 0.1 micron of mercury. Escaping gas, if any, is passed through the leak detector.

Cylinders which do not pass the inspection are set aside and are rechecked with a probe connected to the leak detector. This step locates the leak. About 60 per cent of the rejects can be salvaged, since many of the leaks are in the fittings or in the joints between the fittings and the cylinder. The method has greatly reduced inspection time, company officials report.

Checking TV Camera Tubes

Leak detectors serve as both quality control and research instruments at the Farnsworth Electronics Company, Fort Wayne, Indiana. This IT&T firm uses one leak detector in the production of TV camera tubes, and another in development work on welds and seals of experimental units.

Production men at the firm have found that the leak detector can locate leaks in tubes and other sealed units much faster and much more accurately than any other method. By checking a tube assembly before the exhaust operation, Farnsworth saves over 75 per cent of tubes.

These imperfect tubes can be repaired before evacuation and completion. The previously used "spark" method was not accurate and couldn't locate the exact location of the leak, the firm's production men point out.

Better Refrigerators

In testing refrigeration units, it is important to detect very minute leaks, the presence of which preclude a long, useful life for the units. The stringent requirements that the test be sensitive, rapid, and reliable are easily met with the leak detector.

In a typical application, units to be tested are evacuated, sealed, and "soaked" in an atmosphere containing 10 per cent of helium, as they are being transferred by a conveyor to the testing station. To test each unit the operator merely attaches an evacuation fitting and observes signal lights.

Testing Atomic Energy Equipment

Leak detectors are being used in a number of atomic energy projects. One of the uses which can be made



● Using Leak Detector to check special-purpose vacuum tubes at Farnsworth Electronics, Fort Wayne, Ind.

public is to test neutron counters of the trifluoride variety. These instruments are used for safety monitoring of neutron beams from nuclear reactors, for experimental work, and in controlling the start-up of nuclear reactors.

The shell of the counter must be vacuum tight. The Radiation Counter Laboratories, Inc. of Skokie, Illinois, are using leak detectors to test the shell for leaks. The shells are sealed onto a vacuum system and connected to the leak detector. Helium gas is applied with a probe.

Counters with leaks large enough to be detected by the leak detector are removed from the vacuum system, repaired and again leak tested.

Those counters which have proved vacuum-tight are evacuated and filled with BF_3 gas to a predetermined pressure.



● Using Leak Detectors at Walter Kidde & Co. plant for leak-inspection of fire extinguisher cylinders.

A piece of electronic equipment that could bring a long step nearer the day of the completely automatic factory, operated from a switchboard in the works manager's office, is nearing completion in a small factory in High Wycombe, England.

Looking something like a train position indicator in a railway signal box, the device will enable one man to control the operation of all the many production lines in the huge new British Motor Corporation plant at Sydney, in Australia.

The manufacturers claim it to be a control system that could be applied to many types of mass-production factories. They add that its application to the B.M.C. plant will provide an ideal indication of the way it can speed production and save money by cutting breakdown delays and saving staff.

Maintenance Control And The Automatic Factory

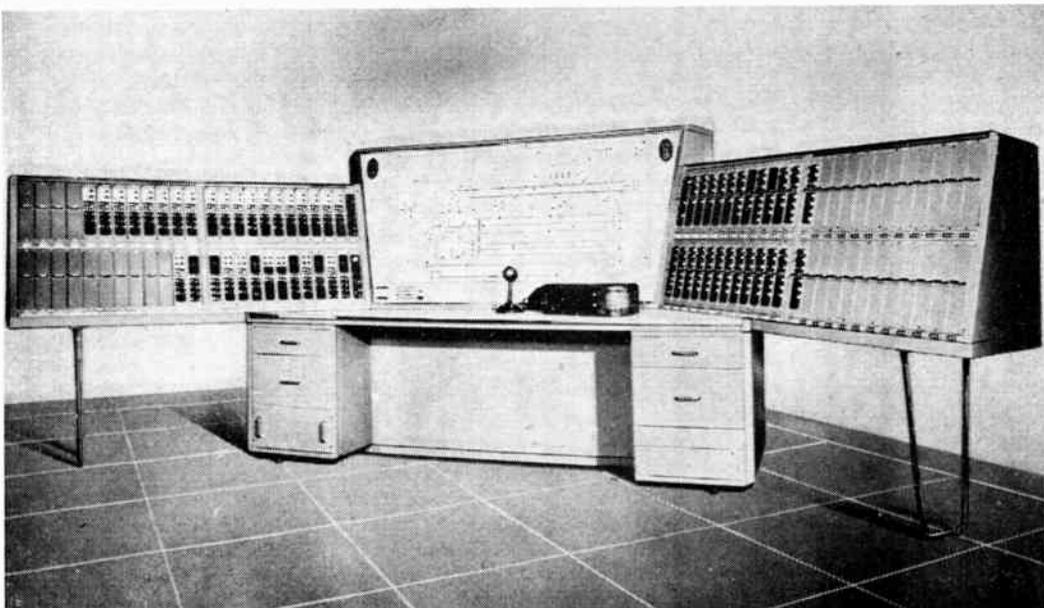
By Roland A. Cail†

THE problem of plant failure, and the attendant loss of production, is one which continuously engages the attention of production engineers. The penalties of plant failure are the heaviest in the case of flow line production where mechanical conveyors are employed to fullest advantage. Here, a failure at one station on the conveyor inevitably results in a shut-down of the conveyor, and where there is an integration of assembly lines, such as in a modern motor car assembly shop, the whole shop may well have to shut down too. Even a shut-down of a very short duration can prove costly when the entire production process stops, and in practice many minor stoppages are

encountered during the course of a working day in the larger assembly plants.

Any device which can result in a shortening of down time offers a tempting reward by reducing production costs. It is with this end in view that Bonochord Limited* and the British Motor Corporation have co-operated to develop a maintenance control system.

*The design and manufacturing resources of the automatic control division of Bonochord Limited have now been transferred to W. S. Electronics (Production) Limited, Acton, London, W. 3. Bonochord Limited and W. S. Electronics (Production) Limited are both wholly owned subsidiaries of K. G. Holdings Limited.



● Fig. 1 — View of the switchboard control position at which one man can control several operations of manufacture.

The principal item of the maintenance control system is the control console which is illustrated in Figure 1. The central feature is a large schematic diagram depicting the layout of the assembly plant. Colored lamps indicate the locations of the drive motors, potential sources of failure of the many conveyors and the emergency stop buttons which are required to be provided at strategic points throughout the plant as a safety precaution. Different colors are used to help to identify different kinds of failure and a legend giving the color coding appears at the bottom left hand corner of the diagram. An audible warning is given whenever a lamp lights, therefore indicating an emergency condition, although a switch is provided on the diagram to permit the audible warning to be silenced if this is desired. Alternative remote audible warnings can be provided.

On either side of the mimic diagram there are racks in which indicator and control panels can be fitted. The panel units are uniform in size and presentation and are employed to control the various conveyor drive motors and other drive motors associated with the assembly line.

The second illustration shows a typical motor control unit. It will be seen to provide means of starting and stopping a conveyor motor together with a switch enabling the control of that motor to be transferred to a local position on the shop floor. This is sometimes required for the convenience of a maintenance crew. Up to four warning lights can be provided in a motor control unit, giving indication of different kinds of trouble associated with the particular motor which may arise. Some kinds of fault condition are not associated with a particular drive motor and these are catered for by panels similar to the motor control unit, except that the motor control facilities are deleted.

A control unit or fault indicator unit is secured in the rack by two screws and all connections to the unit are by plug and socket at the rear of the unit. Removal of a unit for inspection or service is therefore a matter of moments.

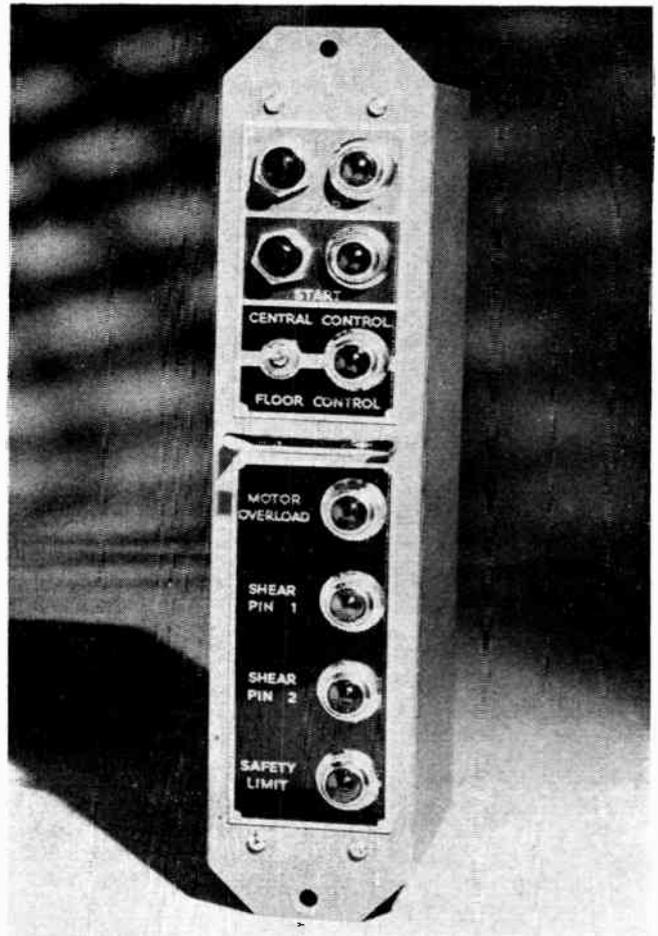
When a fault or breakdown occurs, a warning is given in three distinct ways. A buzzer sounds an audible alarm. A warning lamp lights on the mimic diagram showing where the trouble is and another warning lamp lights up on the appropriate motor control unit, or fault indicator unit, indicating the nature of the trouble.

Maintenance Control Flexibility

When an "incident" occurs, having diagnosed the location and nature of the trouble from the information displayed on the console, the controller summons the appropriate maintenance crew by means of a public address system. Maintenance crews are held in readiness and are dispersed at convenient places throughout the plant. The microphone of the public address system can be seen standing on the control desk in the illustration. The associated public address amplifier is contained in one of the desk pedestals and a duplicate amplifier is included for immediate use in the event of a breakdown of the main amplifier. On-off and change over switches are mounted on a control panel, similar to a motor control unit, which is mounted in the left hand wing.

At other convenient points throughout the plant, telephones are installed which are connected to a central switchboard. This can be seen in the illustration, standing on the console desk to the right of the microphone. Maintenance crews make use of the telephone

†Roland A. Cail joined Bonochord Limited as Chief Engineer in 1956 and was appointed Technical Manager of W. S. Electronics (Production) Limited when the companies became associated. Previously he was engaged in computer controlled machine tool development and was actively developing airborne communications equipment as a Technical Officer at the Royal Aircraft Establishment during the war.



● Fig. 2 — Shear pins are often fitted at vital points in the mechanical system of the conveyor so that they can fracture in the event of an overload or jam-up without resultant damage to the conveyor or motor. Above photograph shows panel array for shear pin control.

system to talk back to the central controller whilst they are at work. Two or more telephones may be connected together by the operator at the control desk to provide conference facilities between maintenance crews working at different parts of the plant.

As well as containing the public address amplifiers, the pedestals accommodate all the ancillary apparatus associated with the system. Drawers provide storage for spare control units, fuses, vacuum tubes, etc.

Several hundred lines are required to connect a control console of this size to the assembly plant which it serves. All the external connection points are grouped together and are accessible from the rear of the console on the large vertical panel occupying space underneath the desk.

It will be noticed that some of the positions to be occupied by motor control units are fitted with blank panels. This is to provide for further expansion of the system. The mating sockets associated with the blank panel positions are fitted and wired to the main connector panel. The minimum of work is therefore involved in fitting extra units and extending the system.

Contrary to lay expectation, the more complex and highly integrated a production or assembly plant becomes, the more frequently it is likely to be rearranged, and in the case of a really large plant, rearrangement is always occurring somewhere or other. This is just like the painting of a large bridge, where painting is always in progress somewhere on the structure. Rearrangement of the plant is necessary in order to introduce replacement machinery, new production techniques and new designs of products. It follows that a maintenance control console must be of a sufficiently flexible design so that it is easy to keep it up to date with plant changes. To make this possible,

building block techniques are used throughout and although the console illustrated is relatively large, catering for the requirements of one of the largest and most modern car assembly plants, the equipment may be scaled up or down according to the needs of the plant. At the bottom end of the scale, a single control unit could control a drive motor and provide indication for a number of faults which may occur.

Load Measuring Devices

Warning of any kind of trouble can be indicated providing that it can be anticipated or identified by automatic sensing methods when it occurs. In a large mass production plant, where extensive use is made of mechanical conveyors, the correct functioning of the conveyors usually demands first attention.

Conveyors can become overloaded or may become jammed. First indication of this kind of trouble is given by fitting the conveyor drive motor with a standard overload relay which operates when the motor draws excessive current. The relay serves to actuate the alarm and identification system in the console. Shear pins are often fitted at vital points in the mechanical system of the conveyor so that they can fracture in the event of an overload or jam-up without resultant damage either to the conveyor itself or to the drive motor. In association with the maintenance control console, such shear pins are made to provide part of an electrical circuit. This circuit controls the associated alarm and warning devices in the console.

Sometimes two or more motors may be used to propel a conveyor. Should a partial or complete failure of one of the motors occur, it is possible that an undue load may be placed on another driving motor. This may set up extraordinary tension at one part of the conveyor and where there is a danger of this occurring, load measuring devices are employed which measure the tension in the conveyor and close an electrical circuit when a pre-determined loading has been exceeded.

Where more than one motor is used to drive a conveyor, free wheeling devices are sometimes employed. This permits the drive motors to be started in sequence and so reduce the instantaneous starting current. In such circumstances it is customary to provide a centrifugal switch associated with each motor so that in the event of a power failure to one of the motors, and the consequent stopping of that motor, remote indication of the event can be provided.

Limit switches are employed extensively in most conveyor systems where reciprocating, or intermittent motions are imparted to part of the conveyor system. Normally it is sufficient to provide additional contacts on the limit switch to give an indication of a limit condition. Although this arrangement is usually adequate, it is not absolutely foolproof. It can happen that either the active limit switch contacts or the indicating limit switch contacts can be damaged or short circuited externally independent of the other contacts. This gives rise to misleading information at the control console or the faulty working condition of the conveyor. It is possible to arrange for the working contacts of the limit switch to provide the remote indication of the condition of the limit switch by the use of suitable circuit arrangements.

Where auxiliary conveyors conjoin with a main conveyor, it is often necessary to ensure that separate conveyors are in the right relative positions to transfer the conveyed merchandise without mishap. Positional switches are employed in a coincidence circuit which is arranged to give warning of lack of synchronization between the conveyors. In further consideration of the conditions of operation where an auxiliary conveyor feeds a main conveyor, it is often arranged that the main conveyor will stop if the auxiliary conveyor ceases to feed the main conveyor with parts. The simple reason for this may be that the auxiliary conveyor has not been fed with merchandise. The first evidence of this is likely to be the stoppage of the main conveyor and it is very often

impossible for the conveyor supervisor or the controller to be aware of the true reason for the stoppage. Suitable signalling arrangements have been developed, therefore, to give the controller full knowledge of this contingency.

Much can be done to detect an audible noise or an excess of vibration which may indicate abnormal operation of some part of the plant. This requirement does not usually arise in the application of maintenance control to car assembly plants, but in the textile industries, the replacement of bearings may be a frequent occurrence, resulting in a considerable down-time of the plant. Proper aural monitoring of a bearing can give early warning of trouble. Following up information given in this way, the maintenance controller can arrange that all bearings tending to become worn can be replaced at one convenient time, with a minimum of disruption to production.

Low Voltage Circuits

Another frequently recurring application is to use pressure operated switches in conjunction with the maintenance control console to indicate excess or loss of pressure in air or hydraulic lines. Similarly excess temperature warning devices and fluid flow monitors can be embodied.

Very often it is necessary to start or stop individual conveyors in a particular sequence. A typical example is an automatic paint shop, where, at the end of a shift, it is necessary to stop the conveyor supplying the spraying machines with unpainted products whilst permitting the conveyor serving the stoving booths to continue to operate until the last item has been stoved. Although the apparatus necessary to control this sequence of events cannot rightly be classed as maintenance control, since a maintenance control system operating in conjunction with an automatic paint shop provides all the basic conveyor control facilities, it has proved expedient and economic to incorporate the sequence controlling devices in the maintenance control console. In the general case, it is logical to provide sequence control in association with maintenance control.

Should a breakdown occur in part of a plant, or conveyor system which is sequence controlled, it is necessary for the maintenance team or controlling engineer to know the particular sequence of events which may be employed to restart the equipment after the fault has been rectified. The sequence of events may well vary according to the nature of the breakdown or the part of the cycle of operations in which the breakdown has occurred. In the example under review, indicator lamps light to show the order in which separate events may be restarted after a breakdown of a sequence controlled unit. Where alternative courses of action can be taken, these are so indicated.

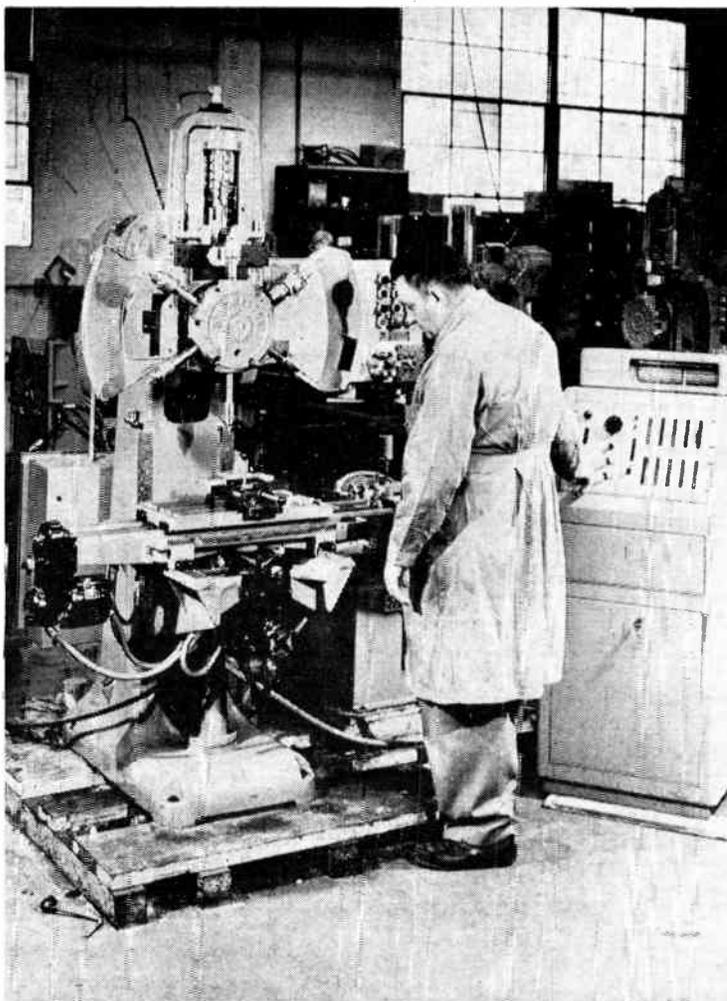
All control circuits operate from low voltage single phase supplies. This feature effectively minimizes the cost of installation wiring, which in the case of a large plant, can represent the major portion of the cost. Drive motors are switched through contactors locally situated. Connection between the console and the drive motor is via the low voltage contactor operating circuit.

Users of the equipment anticipate that capital cost of the equipment will break even with the saving of production costs in a very short time.

CORRECTION

In the article *Cast Resin Insulators In Mass Production* by Mr. A. Marshall which appeared in the January issue of *Electronics and Communications* the biography of the author failed to mention the present company affiliation of Mr. Marshall. Mr. Marshall is presently employed by the Northern Electric Company Limited as casting resins development engineer.

Engineers have succeeded in bringing automation into the realm of possibility for the small shop by the combination of several characteristics into one machine



● Tape controlled turret drill showing the electronic control used for drilling fiber glass laminated insulator parts. Two hundred and four drilling operations are performed in thirty minutes floor to floor, holding tolerances of $\pm .002''$.

A Numerical Position Control System

AUTOMATION is fast proving to be the most reliable means for obtaining the greatest possible production from a machine tool. One of the most recent advances in the field of automation is the Electropoint numerical position control system. This all digital system employing absolute non-counting position measurement is available for accurate control of a variety of machine tools.

As an example, the Electropoint control unit, manufactured by Electrosystems, Inc. of Burbank, California is currently being used on the Burgmaster six-spindle and eight-spindle drill presses. The Burgmaster is a product of Burg Tool Manufacturing Co., Gardena, California. Consisting of a drill press, automatic positioning table and Electropoint tape control unit, it is particularly suited for handling small-lot production. It automatically cycles operation sequences, work positioning, tool selection, cutting speeds and feeds selection and similar functions

— all within a single machine. No electronic computer is necessary and nothing is required from a code book.

The entire automated unit provides a machine with 12 pre-selective spindle speeds, infinitely variable pre-selective rapid approach and return. Setups are fast and easy because of simple controls. One man can operate one or more machines with no decrease in efficiency due to operator fatigue or error. Once the machine is set up, it thinks and acts for the operator. The unattended system will perform a complex cycle of drilling, tapping and reaming accurately and quickly. This has already been reliably demonstrated by performance in machine shops under actual working conditions.

In preparing 200 pieces of special work one large-production machine shop enjoyed floor-to-floor time savings of fifty per cent. The unit produced was an aluminum alloy gear housing requiring tolerances of $\pm .001$ in. Tool-

ing time from blueprint stage was under two hours. Programming the Electropoint control took slightly over one hour and tape preparation another fifteen minutes. Runoff time was three-and-one-half minutes per piece. Rework that would normally take up to six weeks was accomplished in approximately five minutes by merely repunching the control tape. Scrap and tool breakage that often occurs on small diameter work was virtually eliminated. Double drilling that would otherwise have been required was made unnecessary. Accuracy was increased as operator fatigue ceased to become a factor. This particular company has since been utilizing its Electropoint-controlled Burgmaster in many other areas of operation and has ordered more units, soon to be delivered.

In another instance, Cannon Electric Company of Los Angeles made a test run on .625 in. formica sheet insulators requiring drilling of twenty-nine holes. Where lead time would normally take three to four weeks — with an additional week for run-off — both tooling and production were accomplished within one week. By saving tooling time and eliminating jigs tooling costs on this one project were cut from approximately \$730 to a mere \$80. Further, one operator could efficiently run three to four machines. Tape preparation in this case was possible after less than five minutes of oral instruction.

Operational Sequence

The operational sequence is as follows. After the system power is turned on, a prepared tape loop is installed in the tape command unit and advanced manually to the start position. (How the tape is prepared will be discussed shortly.) A ready light indicates the system can accept a semi-automatic or automatic cycle. When the operate button is pushed, and the system is in automatic, the tape is advanced to the first position where the desired X and Y positions are read simultaneously by the machine, together with the turret sequence.

The positional data is fed to comparison units and the turret position to a turret control relay unit. The comparison units drive the positioning table in the correct direction until the desired position is reached. Automatically, table clamping is initiated and the first drilling operation is begun. Any further drilling operations at this position are performed in the sequence punched on the tape. After the final drilling operation, the tape advances to the next position, where the cycle is repeated. Alternatively, a stop command punched as part of a sequence command will hold the system at the existing position.

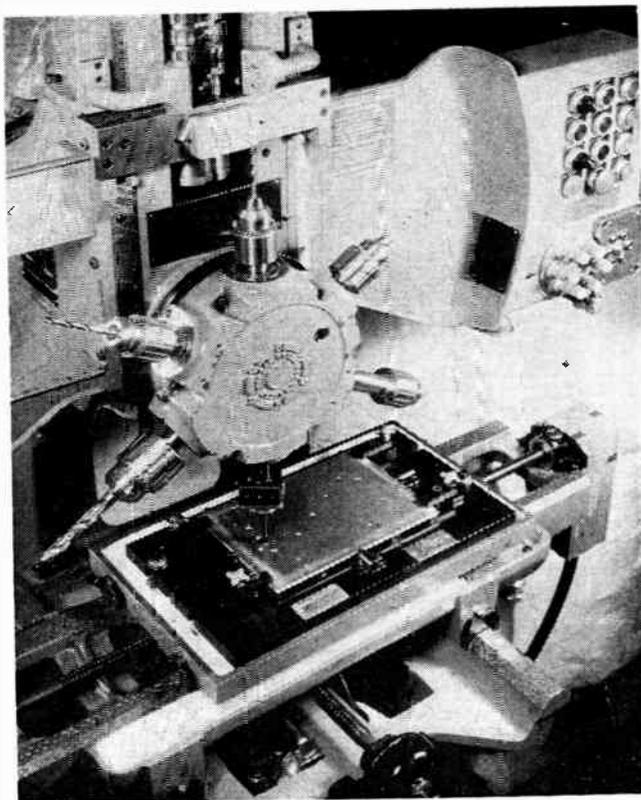
When the semi-automatic switch is used, the tape advance button must be depressed to advance the tape to the next command and the sequence advance button depressed for spindle advance. The semi-automatic switch is useful in checking individual operations, while still maintaining the advantage of a taped program.

Proper tape preparation, of course, is essential to the success of the operation. The method is as follows. Decimal information from a blueprint or table of dimensions is perforated in Mylar tape in two rows, one section for X position and one section for Y position, and in a third section to designate one through six turret sequences per position and/or stop command. Up to six spindle sequences can be programmed with one X and Y position without requiring tape advance, therefore decreasing preparation time and tape length. Each of the X and Y rows has five separate decade groupings so that each number of the five-decimal-place dimension has its own location. Coding or conversion tables are not needed.

Punching in the standard unit is accomplished by a hand punch inserted into the decimally numbered holes. An accessory which will further decrease time of tape preparation provides a manual keyboard similar to that of a calculating machine which punches the tape automatically when a particular set of keys is depressed.

Electronic Micrometer

The heart of the entire unit is the Electropoint control, as developed by ElectroSystems, Inc. Its positive position measurement of machine position assures accurate control



● Tape controlled turret drill showing close-up of an instrument base requiring 21 holes and utilizing six different tools. The part is held in a simple holding fixture, completely eliminating an expensive fixture and the use of drill bushings to maintain the tolerances required. The hole centers were maintained $\pm .001$ " and the parts were machined in lots of 12. Time per part was four minutes, floor to floor. Set-up time, including tape preparation, was approximately two hours.

without accumulative errors. Once the Electropoint table is fastened to the machine, there is no need for ever re-referencing the system.

Display of machine position is in direct-reading decimal form to 0.001 in. There is, in essence, an electronic micrometer which permits several things. One of them is manual setting of the machines. The table is moved either by the motor control switch on the console or the hand wheel on the table. The drill spindle is advanced by the sequence advance button. Direct read out of X and Y position and the active spindle is displayed at all times.

A second is that information for preparation of the tape from a prototype part is made possible by the display. The table is moved manually until the correct spindle is located in the appropriate hole of the prototype, whereupon the X and Y and spindle information is recorded by the operator. Third, manual control operations can be accurately interspersed with the tape program. And fourth, the tape and Electropoint system can be checked easily and accurately utilizing the display readout, both before the first part is machined and during an operating cycle.

Positioning of the table in each axis is accomplished with a servomotor whose speed is controlled by the positional error at each particular instant. This will produce the fastest achievement of the desired position with minimum mechanical wear.

Flexibility is designed into the system for future additions such as drill depth control so that the same drill size may be used to produce holes of varying depths.

By combining all these characteristics into one machine, engineers have succeeded in bringing automation into the realm of possibility for the small shop. Electro-systems is further aiding this trend by development of Electropath, an automatic control system for contouring operations.

business briefs and trends

★ A new mechanical system has recently been installed at the airports at Ottawa and Montreal which will permit altitude control between those two points. The device is a product of the General Railway Signal Corporation of Rochester, N.Y.

* * *

★ Routine paper work in banks will be absorbed to a far greater degree in the future by the introduction of electronic machines, according to John S. Proctor, president of the Imperial Bank of Canada. Questioned as to whether this trend toward automation would mean diminishing staffs, Mr. Proctor replied that the banks need all the experienced workers they can get.

* * *

★ The Bell Telephone Company is planning to build an extension to its Belmont Street Building in Montreal at a cost of approximately \$3 million. The new addition will augment the available space in the Belmont Building by almost half as much again and will be ready towards the end of September, 1959. The purpose of the enlarged building is to provide the central point for the continent-wide system of direct telephone communications now being installed.

* * *

★ When color television arrives in Canada, TV stations will be able to record programs on magnetic tape. A color video recorder, which will permit broadcasters to record and store programs for later use, has been developed by RCA and it is expected that it will be produced commercially by the end of the current year. Color signals, and signals for reproducing sound, are recorded on magnetic tape, and no reprocessing is needed.

* * *

★ A small electrical device, designed to save dairy farmers thousands of dollars annually, is being offered by Pye Canada Limited. The instrument, called a Milcometer, will enable farmers to make a rapid detection in its early stages of mastitis, a disease which greatly affects milk production.

* * *

★ It has been declared on authority that the Federal Communications Commission in the United States legally can exercise control over subliminal projection, a new technique of invisible advertising which has been tried out on television. Thus protection would be afforded a TV viewer who otherwise would have no chance to resist messages addressed to his subconscious mind.

* * *

★ A car radio, which can be used alternatively as a portable model or in mobile service, is proving to be gaining popularity. The radio, which is fully transistorized, uses the 12-volt car battery when being used in the automobile, but when pulled out and used as a portable it uses 6 volts from heavy-duty penlite cells.

* * *

★ Engineering students in the United States reached almost 300,000 by the fall of 1957, with more than 10 per cent of them receiving engineering degrees. However, figures emanating from Russia show that three years ago students graduating from engineering courses numbered over 50,000, and this figure increases year by year.

* * *

★ Alertness to the need for increasing education along the lines of science and technical subjects has uncovered a vast market for electronic equipment among the schools of the nation. Some 3,000 Canadian public and private high schools and almost ten times that number in the United States offer possibilities for not only teaching the pupils by means of electronics, but also for aiding the teaching staff in recording attendance, marking papers and other tedious tasks.

* * *

★ Countries showing deep interest in the advancement of missiles over aircraft include the United States, Great Britain, Italy, France, Switzerland and Japan.

business briefs and trends

★ Frank M. Folsom, chairman of the executive committee of the Board of RCA, recently declared that the present \$12 billion volume of the electronics industry would be doubled by 1965.

* * *

★ A new television station, Canada's 39th, will shortly open in the town of Matane, Que., and is scheduled to go on the air early in the coming summer. CKBL-TV, which is being equipped by RCA Victor, will reach large areas of the Gaspe Peninsula and the Quebec north shore.

* * *

★ West Germany is leading the world in radio exports, more than half of the estimated \$83 million going to European countries and one quarter coming to the Western Hemisphere.

* * *

★ The United Kingdom is enjoying an extensive export trade in electronic equipment, and its biggest customer is the United States.

* * *

★ A 12-week television course in basic Russian is to be given over General Electric's station WRGB-TV in Schenectady, N.Y., commencing February 4. This is designed to help solve a problem baffling U.S. scientists, namely, the rapid dissemination of Russian technical literature to American scientists and engineers.

* * *

★ It is encouraging to note that, in predictions on the labor picture for the future, speakers and writers seem to agree that additional personnel will be required in industry with the coming of automation, rather than the reverse. This opinion has been expressed by such authorities as James T. O'Connell, Under-secretary of Labor in the United States, who feels that steps have been taken to protect workers against "the vicissitudes of technological progress."

* * *

★ A new type of electronic radar navigational system was demonstrated recently before representatives of the world's major airlines. The test was planned and arranged by Canadian Marconi Company of Montreal, who devised the system, in conjunction with the Defense Research Board and Computing Devices of Canada, Ltd., Ottawa. The system, known as the Doppler Sensor, gives ground speed and drift angle by means of bouncing radar beams off the ground. The information thus obtained is fed into a computer which automatically calculates a continuous position.

* * *

★ The closed-circuit TV service, installed a year ago in a train in Great Britain by British Railways engineers in collaboration with Pye Limited of Cambridge, England, has proved to be successful to the point where it has been decided to make it a permanent installation. Passengers travelling in eight cars of the train are able to watch TV programs relayed to them from the studio situated in the rear section of the train.

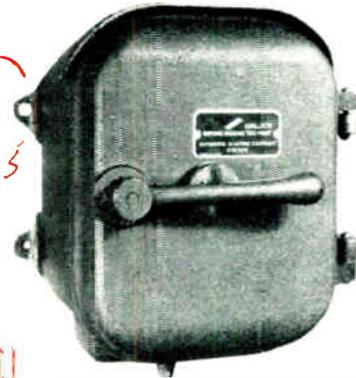
* * *

★ The largest group among EIA electronic manufacturer members consists of small businesses employing less than 500 persons or an average of 133 persons. This group constitutes two-thirds of the total membership. Twenty-five per cent of the membership may be classified as large companies, each with more than 1,000 employees. Medium sized companies, with personnel averaging 700, constitute less than ten per cent of the membership.

* * *

★ Three 21-inch Admiral color TV sets have been sold and shipped to Russia during the last few weeks. The U.S.S.R. is reported to have some thirty TV stations, including two in Moscow. The U.S.A. leads the world in TV sets with 44½ million in use. The United Kingdom is second with 7½ million and the Soviet third with 3 million. Canada and West Germany are next with 2,800,000 and 1,100,000 respectively.

AUTOMATIC ELECTRIC **Telephones** *for outdoor use*

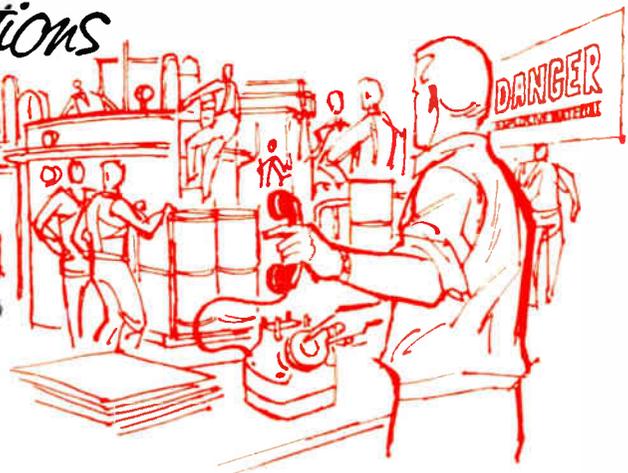


The Outdoor Monophone

THE OUTDOOR MONOPHONE—Where you want a rugged, dependable telephone for exposed locations, Automatic Electric's Outdoor Monophone is your best choice every time. At taxi stands, lumber yards, loading docks, etc., the wettest weather can't hurt it, and the sturdy locking door limits use—and prevents abuse.

The Outdoor Monophone is readily mounted to pole or wall, and all connections are quickly and easily made. Wiring is rubber protected throughout. And for specially noisy locations, the Monophone can be equipped with anti-noise handsets and loud ringing, weatherproof bells or horn signals, as required.

for hazardous locations



The ETDA-20 Automatic Telephone, Desk Model.

EXPLOSION RESISTANT TELEPHONES—The risk of explosion isn't confined to large operations like mines and oil refineries. It exists in paint shops, cleaning establishments, metal finishing departments, etc., as well. Telephones specially designed for use in such locations have been developed jointly by Automatic Electric and Crouse-

Hinds. All components that could produce sparking, are sealed in special housings, and the housings are more than sturdy enough to contain any explosion if gasses should seep in and become ignited. The housings are only slightly larger than ordinary telephones, and both desk and wall models are available.

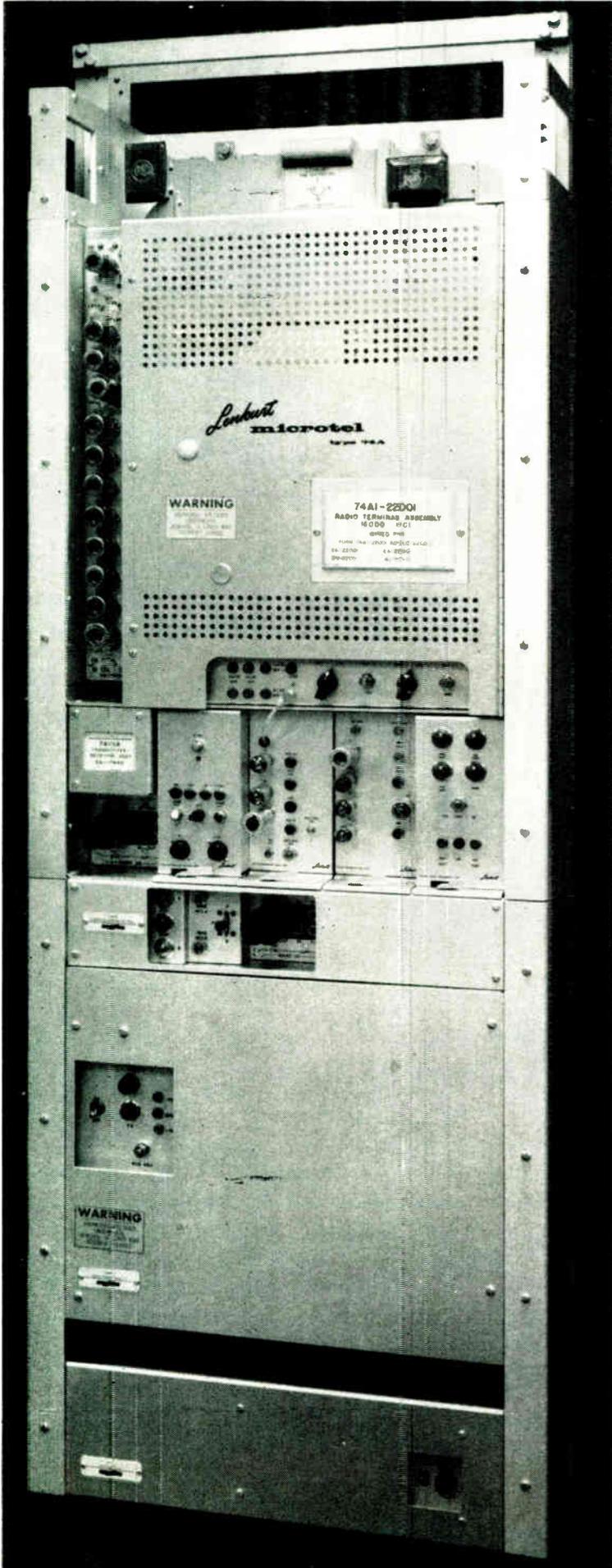
Call or write any Automatic Electric office for further information.

Automatic Electric Sales (Canada) Limited, 185 Bartley Drive, Toronto 16, Ontario. Branches in Montreal, Ottawa, Brockville, Hamilton, Winnipeg, Regina, Edmonton, Vancouver.

AUTOMATIC  ELECTRIC

ORIGINATORS OF THE DIAL TELEPHONE





Lenkurt

Microtel is *new* . . . the most advanced microwave radio equipment on the market. Designed for high quality transmission of telephone, telegraph, telemetering, and other types of information, it can be equipped to operate throughout the range 5925 to 8500 megacycles.

Microtel provides economical and reliable communications for the telephone industry, railroads, power companies, government agencies, etc. And it is equally satisfactory whether the need is for only a few circuits or for a high density network requiring as many as 720 voice channels.

All filament and high voltage sources are protected with fuses, and have associated circuit condition indicator lamps. Circuits are designed so that component failure will not damage either the transmitting or the receiving klystron. Major and minor alarms, indicating failure in circuitry, components or equipment, can be easily linked with existing building alarm systems. *Microtel is available as a complete package—engineered, supplied and installed—on one order—by Automatic Electric.*

THE BASIC TYPE 74A MICROTREL

microtel

NEW MICROWAVE EQUIPMENT for the 6000 mc. band

FEATURES

- **POWER OPTIONS**—Operates from standard office battery supplies or from 115-volt a-c mains.
- **LOW POWER CONSUMPTION**—Unique design, including transistors, permits economical office battery operation.
- **EASE OF INSTALLATION**—Standard 19-inch rack mounting; compact plug-in construction; space-saving—no rear access required.
- **EASE OF MAINTENANCE**—Components accessible from front; built-in test facilities fully alarmed.
- **STABLE OPERATION**—Use of reference cavity and heat sinks eliminates conventional ovens and blowers.
- **ECONOMICAL EXPANSION**—With Lenkurt 45BX carrier, a single terminal can accommodate up to 240 channels; with r-f circulator, 2, 3 or 4 terminals can be added to same antenna system.
- **REPEATERS**—Back-to-back terminal equipment permits dropping and reinserting of channel groups; automatic switching permits unattended operation.

For complete information write or call your nearest Automatic Electric office.

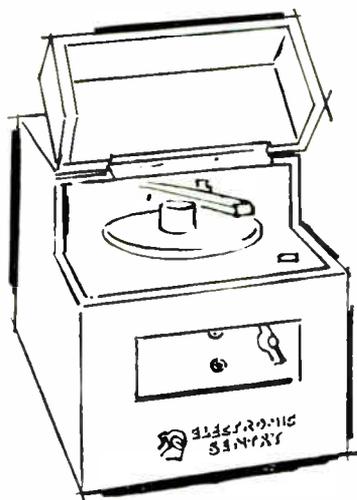
AUTOMATIC ELECTRIC (CANADA) LIMITED, 185 Bartley Drive, Toronto 16, Ontario. Branches in Montreal, Ottawa, Brockville, Hamilton, Winnipeg, Regina, Edmonton, Vancouver.

5816

AUTOMATIC  **ELECTRIC**

ORIGINATORS OF THE DIAL TELEPHONE





Telephone
companies
earn

EXTRA RENTAL REVENUE WITH THE NEW "ELECTRONIC SENTRY" WARNING UNIT



The Electronic Sentry is the very latest advance in safety and security engineering. It will soon be a "must" in every type of industrial and commercial building. Now available from Automatic Electric, it will provide telephone companies with an important source of additional revenue.

Triggered by ordinary detection devices such as thermostats, intruder alarms, etc., the Electronic Sentry connects itself to a telephone line, dials the plant manager, supervisor, or any other prearranged person, reports what the trouble is and where it is located, and repeats the message until it is clearly understood. If the dangerous or abnormal condition is not corrected within a given time, the Sentry calls again and again until it is. From start to finish, operation is completely automatic.

Apart from its more obvious uses, the unit will be of particular interest to banks, jewellery stores, paint shops, cleaning establishments etc., since it can be set to dial the police in the event of a break-in. (it operates silently), or the nearest fire department in the event of fire.

Write to Automatic Electric for further details, illustrated literature, etc. Put the Electronic Sentry to work earning extra revenue for you!

Automatic Electric (Canada) Limited, 185 Bartley Drive, Toronto 16, Ontario. Branches in Montreal, Ottawa, Brockville, Hamilton, Winnipeg, Regina, Edmonton, Vancouver.

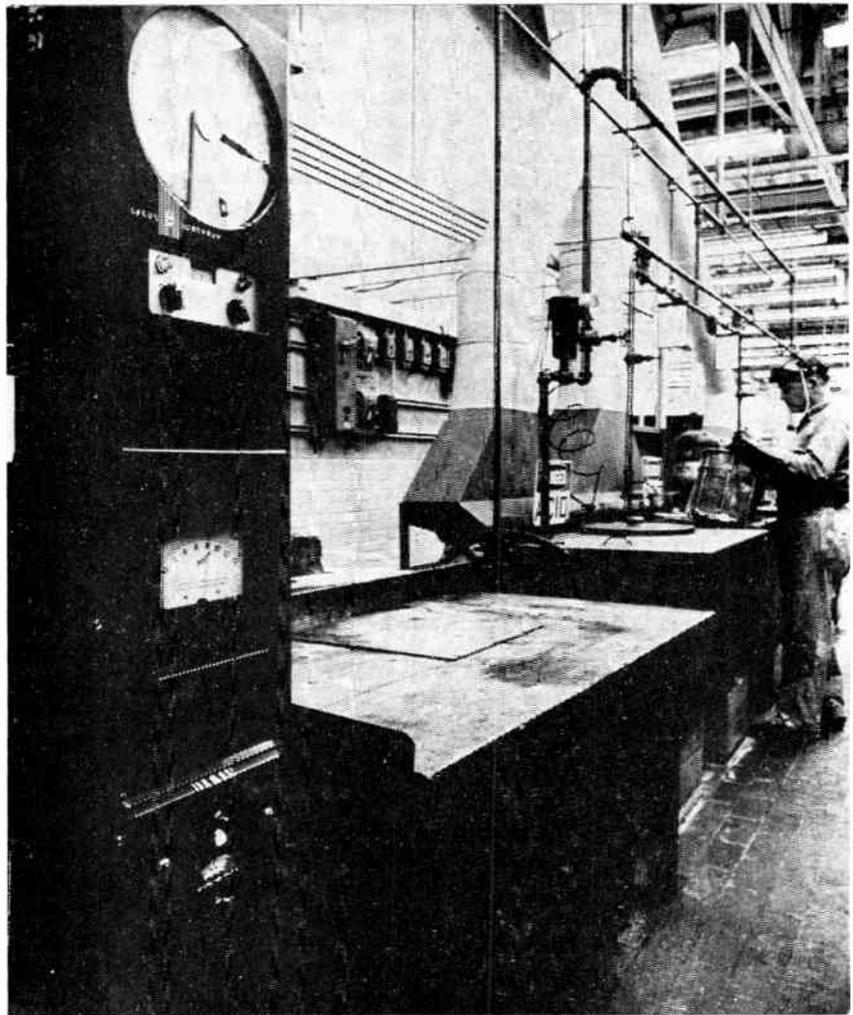
AUTOMATIC ELECTRIC

SALES (CANADA) LIMITED

5823

For further data on advertised products use page 67.

**pH Control Of Bright
Dip-Rinse Conserves Water
Neutralized Effluent To Legal
Discharge Level**



● Conductivity controllers and a pH controller shown at left conserve water and neutralize acid wastes in this acid bright dip installation. Worker is shown dipping parts to be cleaned in one of several acid baths.

A pH Control System For Bright-Dip Rinsing

THE pH control in the acid bright dip installation of the Leeds & Northrup Co.'s new North Wales plant, conserves water and neutralizes acid wastes before they are discharged into the municipal sewage system.

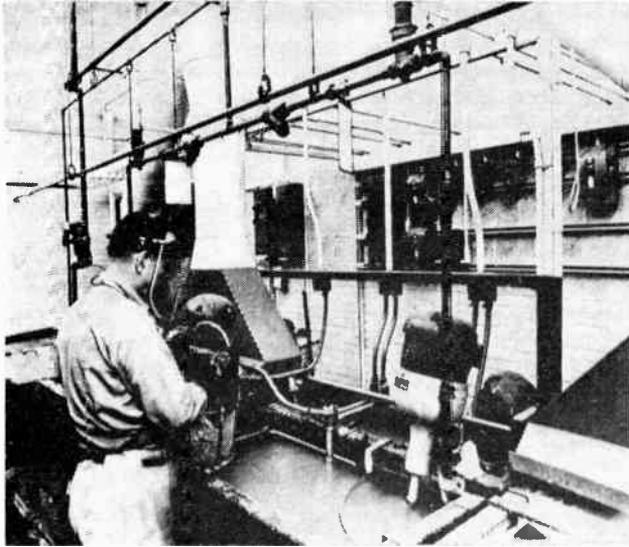
Many soldering operations are necessary at this plant, where the company's recording instruments are manufactured. Before parts are joined, they must be completely free of grease, dirt or oxides. This cleaning is accomplished by the bright dip process. In this process, parts are loaded into a stainless steel basket and dipped, first into a hot sulfuric acid bath and then into a cold 50-50 mixture of sulfuric acid and nitric acid. After these baths, acid is removed by dipping the basket into three water rinses — two cold, and one hot.

Two conditions had to be met before the bright dip process was installed. One was the need to minimize the amount of make-up water used to keep the rinse water sufficiently neutral. Throughout the metalworking and

electronics industry, the most common way to neutralize water baths is to allow a continuous flow of water through the tank. However, this was not practical at North Wales. Water supply from the company's own wells was too limited and borough water too expensive to allow such free usage. The second requirement was that effluent had to be neutralized to a legal pH level before it could be discharged directly into the borough sewage system.

Both of these requirements were met in the system designed by the company's own application engineers, who have had many years of experience in applying pH controls to all types of industrial waste installations.

The make-up problem was solved by a system that continuously measures conductivity in each of the cold rinse tanks. Two Electromax controllers are used in this service. When either bath becomes too acid, its controller opens a solenoid valve in the make-up supply line. This adds water and brings the acidity back into line. By

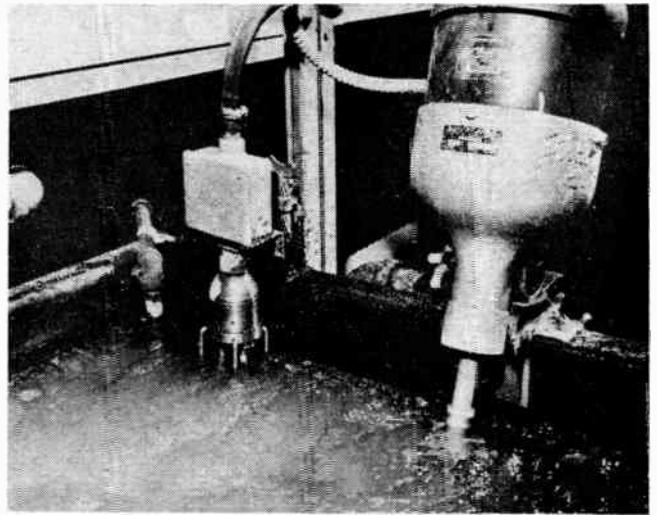


● After repeated rinses, water in rinse tanks in foreground becomes acid-laden. Conductivity cell in center of rinse tank sends signal to an Electromax controller which senses the acidic condition and opens a solenoid valve (at top) to admit just enough make-up water to restore acceptable neutrality level.

adding make-up only when needed, instead of continually, this system holds water consumption to an absolute minimum.

To solve the problem of how to neutralize process effluent, the company's application engineers conducted a Controllability Analysis, studying such factors as allowable pH limits, flows, and tank capacity requirements. This analysis of controllability factors is the same engineering technique that has been instrumental in the widespread success of L&N control systems throughout industry.

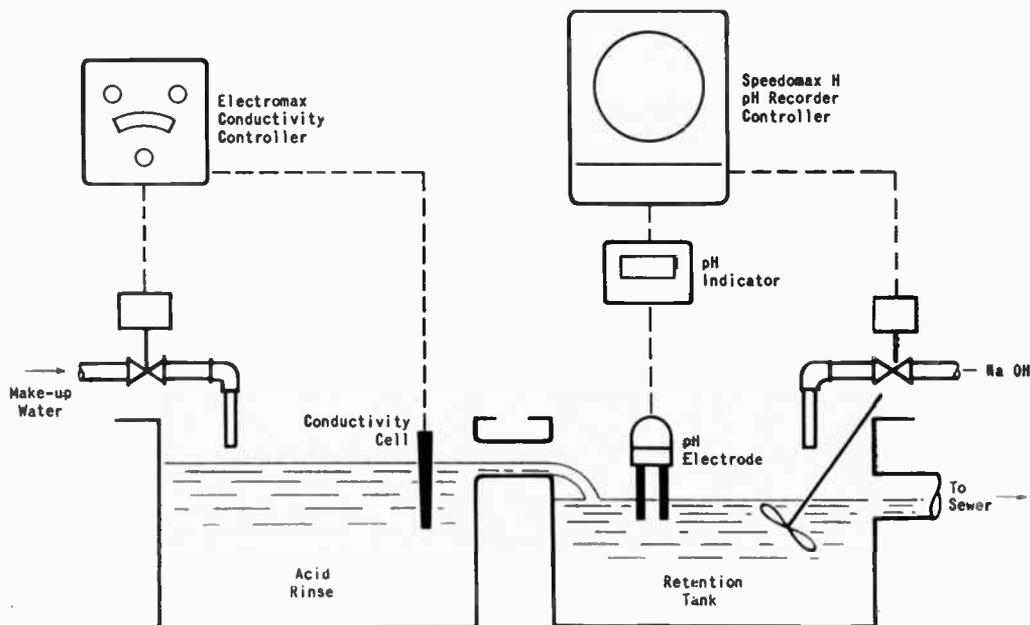
Based on the results of the Controllability Analysis, a system was developed that effectively neutralizes process effluent. Before the acid rinse water is discharged into the sewer lines, it flows into a 6 x 3 x 2 ft. retention tank installed behind the rinse tanks. Here, pH is continuously



● Leeds & Northrup stainless steel dip-type pH cell at left senses effluent acidity in the retention tank and sends a proportional signal to the panel-mounted recorder-controller. Mixer at right agitates solution to assure representative sample.

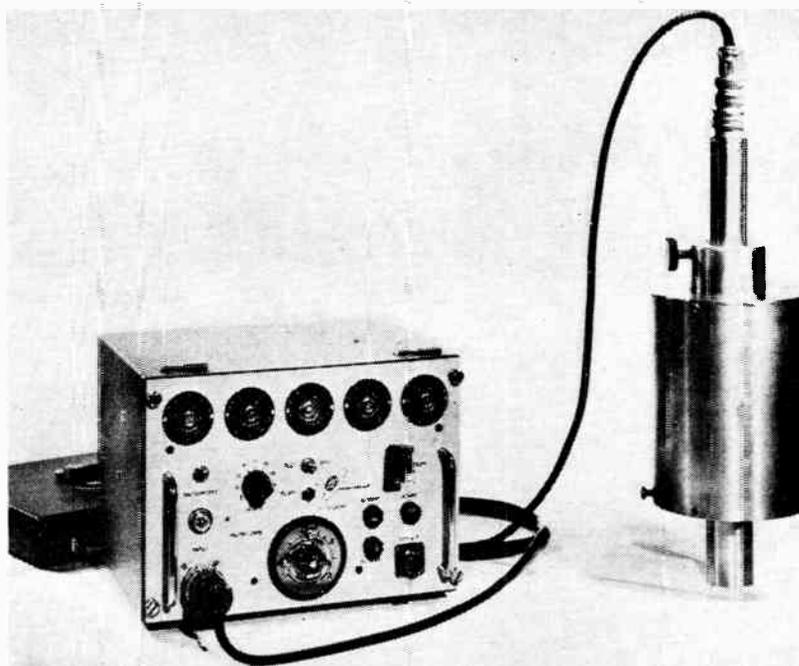
detected by a stainless-steel-mounted dip-type pH electrode assembly, which translates pH into a proportional millivolt output. This electrode output is fed to an industrial-type continuous pH indicator which amplifies the voltage and feeds it to a Speedomax Type H recorder-controller. The recorder-controller plots a 24-hr. record of effluent pH and feeds a control signal to an L&N valve drive mechanism that regulates the addition of caustic soda to the rinse water in the retention tank. Mixers agitate the solution so that the caustic soda reagent is evenly distributed in the tank to bring the pH of the final effluent to a legal level of 7.5.

This system not only holds the pH of the effluent within required limits, but also plots a graphic record of its performance — providing permanent proof of conformance with legal standards.



● Diagram shows how conductivity controller and pH controller are connected to measure and control acidity. When acidity of rinse becomes excessive, conductivity controller opens valve to add make-up water. Rinse tank then overflows into retention tank where caustic soda is added to neutralize the effluent before it is safely discharged directly into the borough's sewage system.

● Basic units of the d/M-Gage. Dual purpose, 1-1/2" x 15" probe (right) contains radioactive source and detector system. Larger cylinder around probe is safety carrying shield. Battery or a.c.-operated scaler (left) counts and records impulses from the probe, registers total count in dots of light on five circular glow tubes. Timer at bottom of scaler is normally set for 1 or 2 minute operation.



A d/M Gage For The Measurement Of Moisture

A "d/M-Gage", a new completely portable field instrument for rapidly measuring moisture content or density in a wide range of organic and inorganic materials has found wide acceptance in varied fields of industry.

Simplicity of operation and speed of measurement are primary advantages of the new system. Time-consuming laboratory procedures necessary with conventional methods have been eliminated and the d/M-Gage provides immediate measurements at the site of application. A single operator using the gage can obtain accurate moisture or density determinations in two minutes — less than 1/10th the time required by other systems.

Operational principle of the gage is based on the varying degree that radioactivity is "scattered" when placed in contact with masses of different moisture content or density. Measurement of this scatter provides a precise measurement of moisture content or density. Application of this principle is made through the use of either a moisture probe containing a radioactive radium-beryllium source of fast neutrons, or a density probe containing a cesium-137 gamma ray source. The probes are used interchangeably with a radioactivity counting instrument (scaler).

Measurements are obtained by inserting the desired probe into the material being tested and reading the scaler for a visual scatter "count" which varies with moisture or density variations. This count is located on a calibration chart and the moisture content or density of the material is read directly from the chart itself.

An outstanding feature of the system is the substantial volume of material analyzed in a single operation. The probes normally measure a spherical volume of material with an average diameter of 14 inches. Moisture or density measurements can be made at any depth within

a material, ranging from the top 12 inches to 60 feet below the surface.

Accuracy of the system is within 2 lbs./ft.³ for density determinations over the range from 50 to 150 lbs./ft.³. Moisture determinations are accurate to within 3/4 lb./ft.³ over the range from 0 per cent to 100 per cent moisture content.

The gage, easily transportable and requiring a minimum of effort by the operator, offers a new approach to the problem of obtaining moisture and density measurements under difficult field or industrial conditions. In the soil compaction control tests required during highway construction projects, for example, an operator of the gage can obtain moisture or density data at a rate that formerly required the efforts of 5 to 10 technically trained personnel.

The gage makes possible continuous studies of the same volume of material over an extended period of time by use of an access tube which is driven into the material and left in place for future measurements. Either the moisture or density probe can be inserted in the tube for measurements at any depth. Since the sample of material is chemically and physically unchanged by the testing process, such measurements provide an accurate basis for determining the effects of purely environmental changes on a particular volume of material.

The savings in time and labor provided by the d/M-Gage make the system well suited to moisture-density determinations in many industrial processes, such as the manufacture of raw materials, chemicals, and fertilizers. The gage is equally adaptable to all sub-soil moisture or density measurements associated with highway construction, railway roadbed construction, agricultural research, and waterways or irrigation control systems.

New Products

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

E-Type Negative Impedance Repeaters

Item 1853

Pye Canada Limited are marketing the Hallamore E-Type Negative Impedance Repeaters which are designed to compensate for transmission losses in exchange cables.

These repeaters provide compact plug-in design for efficient installation, maintenance and testing, and DC continuity for signalling without the need for auxiliary equipment.

Using either AC or DC type tubes, the repeaters employ an amplifier and network which counteracts and compensates for conditions which cause the transmission losses. These are available for both series and shunt connections.

These repeaters are interchangeable with Western Electric E-2 and E-3 Series Type Repeaters. Bell System standard practices for use of E-Type repeaters are directly applicable to Hallamore Negative Impedance Repeaters.

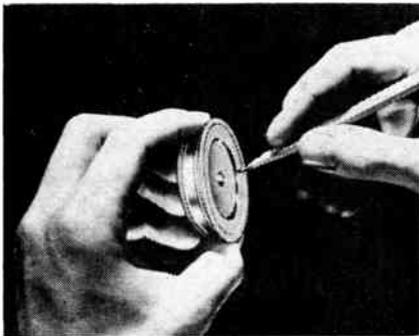
Power supplies and package units also available.

For further information, contact the Telephone Division, Pye Canada Limited, 82 Northline Road, Toronto 16, Ontario.

Largest Single Crystal Germanium Junction

Item 1854

The International Rectifier Corporation 500 ampere germanium power junction pictured is the largest single crystal junction commercially available. A large active area results in a low current density in the crystal, in spite of the very high current rating. This conservative rating provides an added capacity in all cases of over-temperature and overload. All-welded and hermetically sealed, this junction is alloyed during the hermetic sealing without the use of active chemicals. This procedure infinitely reduces the possibility of contamination during processing; hence, long-term reliability may be expected.



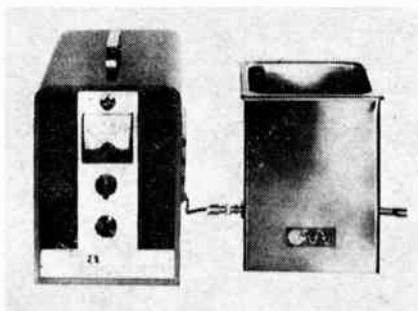
The application of advanced ceramic techniques to semiconductor devices of this type has evolved a junction free of internal stresses, with the resulting advantage of superior ability to withstand acute thermal shock associated with excessive surge loads. This junction is the heart of the 500 ampere air-cooled junction and the 670 ampere liquid-cooled junction now available for applications in the electrochemical, metal refining and other industries requiring heavy current at voltages from 26 to 66 volts.

For complete technical details, ask for Bulletin GPR-2 from International Rectifier Corporation, El Segundo, California, U.S.A.

Acoustica Associates, Inc. Ultrasonic Cleaning Equipment

Item 1855

Illustrated below is Acoustica Associates, Inc. Model DR 50 AH Portable Ultrasonic Cleaning Unit. The 50 watt generator will power the transducerized 1/2 gallon capacity stainless steel tank for cleaning small tools, electronic components like relays, potentiometers, switches, bearings, optical, horo-



logical, and other precision parts. A second tank can be alternately driven by use of the built-in selector switch.

Standard larger Ultrasonic units from 1 gallon capacity are also available.

Write for descriptive literature, telling us your individual cleaning problems, to: Acoustica Associates, Inc., 26 Windsor Ave., Mineola, Long Island, N.Y. Canadian Representative: Mr. R. Billings, X-Ray & Radium Industries, Ltd., 261 Davenport Rd., Toronto 5, Canada.

Solderless Test Prods

Item 1856

A new test prod that is both solderless and automatically connected has just been marketed by General Cement Mfg. Co., Rockford, Illinois. The handy new contacts are called "Trigger Qwik" and are designed for easy and instant connections. Russell D. Gawne, G.C. general sales manager, says the new solderless contact is the simplest method of preparing wires for test leads.

The tips are made of molded styrene and are of a modern design to facilitate use in most standard test sockets. Savings can be realized by making your own test leads in this handy modern way. To make a connection, simply pull the trigger on the gun shaped body and insert the stripped end of the wire. Release the trigger and a solid contact is made. Completely automatic and neat looking are the primary features incorporated.

The new "G. C. Trigger Qwik Test Prods" are available in red and black and in pairs or individually. Further information is available from Charles W. Pointon Ltd., 6 Alcina Avenue, Toronto 10, Ontario, Canada.

Ultra Stable Audio Oscillator

Item 1857

Development of an ultra stable subminiature adjustable audio oscillator was announced recently by Frank Hoover, vice president, CG Electronics Corp.

CG Electronics Corp., a wholly-owned subsidiary of Gulton Industries, Inc., Metuchen, N.J., is a producer of radio control equipment for hobbying and modelling applications. The company recently announced the marketing of its complete line

of radio control equipment for industrial applications.

The new oscillator, latest addition to the company's growing line of industrial radio remote controls, can be used as a stable tone modulator for energizing frequency sensitive relays in remote locations. Additional applications include its use as remote frequency audio decoders.

According to Mr. Hoover, the oscillators are mounted for plug in construction and are available in frequency ranges from 200 to 1,000 cps. Characteristics included short period drift of 0.1 cycle and less than .5 per cent drift over a temperature range of 0° to 150°F.

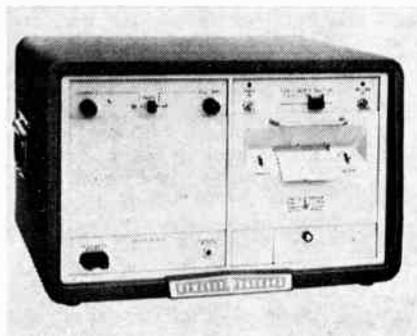
Additional characteristics are: distortion, less than 5 per cent; RMS output, 0 to 30 volts and Voltage Drift Tolerance, 0.1 per cent shift range 33 per cent.

Canadian representative, Lake Engineering Co. Ltd., 767 Warden Avenue, Scarborough, Ont.

Fast Digital Recorder

Item 1858

The Hewlett-Packard Model 560A Digital Recorder prints 11 column digital information at rates to five prints per second. Although primarily designed to make a permanent record of electronic counter read-outs, the manufacturer states that the 560A can be used with two or more counters simultaneously, digital voltmeters, time recorders, flowmetering equipment and systems, such as telemetering installations and engine test stands.



In addition to the printed tape record, the Model 560A provides an analog current or voltage output to drive a galvanometer or potentiometer strip chart recorder or to provide a servo control.

Model 560A is priced at \$1,390 but may be purchased for 6 column operation for \$1,265, adding the other columns later. The print mechanism is available separately for \$600.

For information write Hewlett-Packard Company, 275 Page Mill Road, Palo Alto, California.

T & B Connector Bulletin

Item 1859

Thomas and Betts Limited have just published a new bulletin that describes three crimping tools and a complete line of taps and splices for aluminum and copper conductors.

The bulletin features the new Thomas and Betts UT2 Shure Squeezer. This pocket size tool (9½" overall length) installs a wide range of distribution connectors sizes and types. For complete details, write for the new brochure "UTS". Thomas and Betts Limited, 759 Victoria Square, Montreal, Quebec.

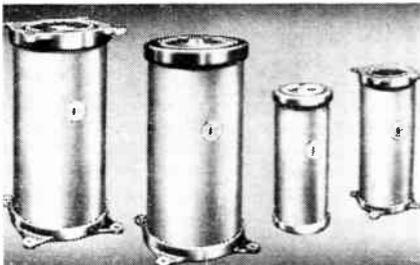
New Products

Ultra-High-KV Tubular Capacitors

Item 1860

Designed expressly for ultra-high-voltage DC filtering, pulse network, voltage doubler, and high-voltage DC energy-storage applications, the new Cornell-Dubilier series of UHV capacitors are available in voltage ratings from 25KV to 200KV.

Employing the widely-known Cornell-Dubilier "double-end" design, with cast aluminum end caps serving both as mounting means and electrical terminals, these tubular capacitors permit easy, economical installation in compact banks. This type of construction provides a long creepage path, and eliminates terminal flashover. Seven end-cap style combinations are offered to meet various requirements.



Higher capacitance can be readily obtained by connecting additional units in parallel, while higher voltage ratings, for higher than 200KV, are gained by connecting units in series. Series-parallel combinations will provide higher joule ratings.

These heavy-duty tubular capacitors are widely used in military, industrial and scientific research equipment employing high-voltage circuits. Applications include betatrons, energy storage, nuclear accelerators, impulse-test apparatus, also as capacitors for pulse network application with external coil, and in X-ray and other voltage doubler circuits.

For further information, write for Bulletin No. 183 to Cornell-Dubilier Electric Corp., South Plainfield, N.J., U.S.A.

Thin Section Molding Of Ceramoplastics

Item 1861

Perfection of new molding techniques by Mycalex Corporation of America, Clifton, N.J., has made possible precision molding of thinner ceramoplastic sections than ever before, according to an announcement by Jerome Talshoff, president. Sections as thin as .018", to tolerances of $-.001$ " have been precision-molded of Supramica 555 ceramoplastic, offering new possibilities for designers of miniature components for high-temperature applications.

Development of the new molding procedures opens up significant design possibilities in high-temperature, miniaturized components, and the potential use of Supramica ceramoplastics for parts which have hitherto been moldable only by injection molding of organic plastics materials. The higher temperatures achieved with Supramica ceramoplastics are thus made available to designers of high temperature relays and similar components in which size and weight are of critical importance.

Supramica ceramoplastics, made from Synthamica synthetic mica, are manufactured exclusively by Mycalex Corporation of America who, through a wholly-owned subsidiary Synthetic Mica Corporation, are the only commercial producers of Synthamica synthetic mica.

For further information write Mycalex Corporation of America, Clifton, N.J., U.S.A.

3-Voltage "Megger" Insulation Testers

Item 1862

Two new instruments just introduced by the manufacturer, Evershed & Vignoles Ltd., are the well-known Series 2 insulation testers, but each provides three testing voltages. Model 54029 generates 1000, 500 and 250 volts with a resistance range of 0-200 megohms. Model 54038 delivers 500, 250 and 100 volts resistance range 0-100 megohms. Both have constant pressure generators. Another feature of these instruments is that the scale range remains the same for each of the three testing pressures selected — no need to divide or multiply when switching voltages — direct reading, no confusion.

In the 60-odd years that "Megger" testers have been on the market, Evershed & Vignoles Ltd. have offered only instruments of proven design. That is why the Series 2 testers are not made with generators that deliver more than 1000 volts — the proven safe limit. Higher voltages, up to 10,000 volts, are obtainable in the larger series 1 testers only.

Further information available from Canadian representatives: R. H. Nichols Limited, 2781 Dufferin Street, Toronto, Ont., Canada.

Frequency Counter

Item 1863

One of the most portable lightweight frequency counters obtainable is the "Ring" Frequency Counter, Model 350, a product of the Dynapar Corporation of Skokie, Illinois.

This instrument is available with 4 and 5 digits for frequency coverage from 10 cycles to 100 kc per second. The time basis is 1/10 and 1 second. The application of this instrument requires no elucidation; it can be used for tachometry, measuring of frequency, testing of crystals, calibration of oscillators, the measurement of flow and as secondary frequency standard, a.o.

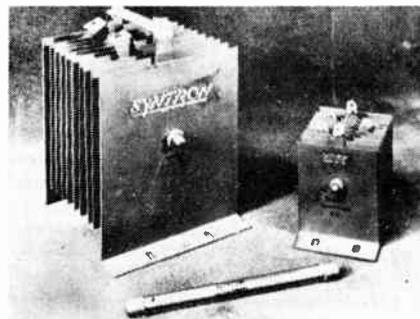
The device weighs between 10 and 15 lbs. subject to the number of digits and measures 7" x 12" x 13".

For further information apply to the Canadian Sales Representatives — Electro-design, 736 Notre Dame St. W., Montreal,

Selenium Rectifiers

Item 1864

Syntron Selenium Rectifiers offer a wide range of cell sizes from .280-inch diameter to 12 inches by 16 inches and provide versatility for stack assembly. The larger cells reduce the number of parallel paths needed for higher current applications.



Cell voltages of 15, 18, 22, 26, 33, 40 and 45 volt RMS ratings are available. The higher cell voltages permit fewer cells in series for high voltage applications. The lower voltage cells may be operated at current densities of twice the 26 volt cell ratings, thus reducing the stack size and cost.

Recommended stacks are the smallest, most economical size that will handle the required operation without sacrificing quality of performance or length of operation.

For additional information, write to Syntron Company, Dept. "K", 12 Main Street, East, Stoney Creek, Ontario, Canada.

Self-Filling Draftsman's Pen

Item 1865

A draftsman's pen that fills itself at the touch of a button, with no ink on the outside of the nib, has been made possible by a new cartridge-loading design. The cartridge contains enough ink for 55,000 in. of ruled lines. The draftsman fills the pen by pushing the button with his thumb. When exhausted, the cartridge can be replaced in a matter of seconds. Time is saved and neatness promoted.

Clover House, Dept., Box 1107, Santa Monica, California, U.S.A.

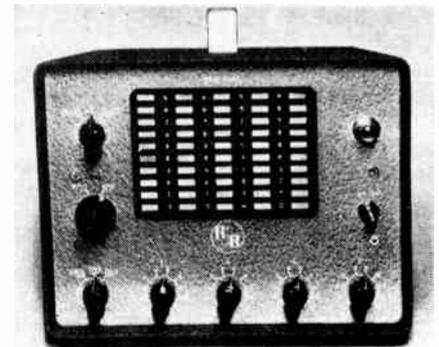
Wave Timer

Item 1866

The Ransom Model WT-1 Wave Timer measures electrical signals from one event per second to 500,000 per second with five-place accuracy. It may be used as an events-per-unit-time meter. Preset count capacity is up to 9999 and the precision timer range extends up to one second in increments of 100 microseconds.

The wave timer utilizes transistorized plug-in computer elements, thus eliminating all tubes and relays. The instrument consists of a time base, an amplifier, a logic for correctly starting, stopping and recycling the wave timer, a four decade preset counter with no display, and a five decade counter with display.

The instrument is designed to operate with a minimum input pulse of 5 volts or a minimum sine wave signal of 10 volts. Input impedance is 10,000 ohms and power requirement is only 20 watts.



Technical bulletin C-25 describing the Wave Timer is available from the manufacturer: Ransom Research, 323 W. 7th Street, San Pedro, California, U.S.A.

Power Factor Correction Coils

Item 1867

A new series of power factor correction coils for reducing capacitive current in filtered power lines of screen rooms has been introduced by the Filtron Company of Flushing, N.Y. and Culver City, California. Designated as Series FSR-800 the correction coils are designed for use where limited generator output requires a reduction in reactive current. This problem usually arises when 400 cycle (or higher) power line frequencies cause an excessive reactive-capacitive load component to be applied to the generator.

Because screen room filters apply a fixed capacitive reactive load to the power line there is a possibility of no-load current problems when high attenuation is required in the range of 14KC to 1000 MCS due to the large capacitive component. If the power source has enough reserve to furnish this additional reactive current, there is no difficulty. On the other hand, if the course is limited, power factor correction coils must be employed to cancel the undesired capacitive-reactive load component.

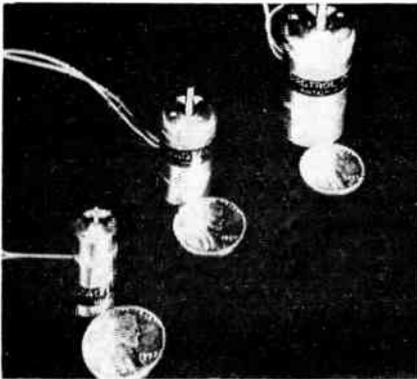
In addition to providing the Series FSR-800 Power Factor Correction Coils other special situations requiring an inductive type solution can also be accommodated. For additional information, contact Canadian representative, Aircraft & Appliances & Equipment Ltd., 585 Dixon Side Road, Toronto 15, Ontario.

New Products

Sub-Miniature Magnetic Clutches And Brakes

Item 1868

Found Bros. Aviation Ltd. at Malton, Ontario, Canadian Licensee for Magtrol Inc., have available a wide line of magnetic clutches, brakes and clutch brakes of the friction type shown in the illustration and also of the hysteresis type, that produce a force linear with current without friction surfaces, independent of slip speed and that will drive in synchronism.



Also available is a line of high quality precision dynamometers for fractional horsepower motors of all types including shaded pole, torque meters to determine torque required to overcome static friction as well as at desired speeds, and speed indicators recording shaft speeds without imposing a load. The above friction brakes produce forces of $\frac{3}{4}$ " oz., 4" oz. and 10" oz. on 24 to 28 v. DC Typical control power required is under 3 watts.

The hysteresis devices are employed as proportional torque controllers, zero backlash actuators, tension controls for wire, tape and film winding. The magnetic friction units are used in computers for on-off actuation, potentiometer drives etc. Standard hysteresis units develop maximum torques from 6" oz. to 45" lbs.

Found Bros. Aviation Ltd., Malton, Ontario, invite inquiries regarding requirements.

Stereo Tape Recorder

Item 1869

The new Tandberg Model 3-266 Stereo Tape Recorder was recently introduced into Canada from the Tandberg Radio Factory located in Oslo, Norway. Units were demonstrated both at the New York Hi Fi Show and at the Hi Fi Exposition held in Toronto last Fall.

The special big sound performance from this equipment is made possible by many contributing factors, some of which are: (1) A precision tape transport mechanism having Flutter and Wow below .15 per cent at $7\frac{1}{2}$ i.p.s.; (2) Crosstalk between head halves better than 60db due to special Mu-Metal shielding; (3) Hum level extremely low due to D.C. heating and Mu-Metal shielding of preamplifiers; (4) Tape is entirely removed from heads in "Fast Forward" and in "Rewind" modes, reducing head and tape wear.

Two well-balanced power playback amplifiers are built-in. Distortion of each amplifier is under 1 per cent.

This is not only a stereo system but also a tape recorder and playback unit which by its light weight, compactness and professional quality can be used for any application, whether commercial, industrial, broadcast, or Hi-Fi. The weight of the recorder-playback unit is only 27 lbs. for easy portability.

The factory representatives in Canada are The Tandberg Division of Engineered Sound Systems Limited, located at 169 Kipling Ave. S., Toronto 18, Ontario.

Captivated Connectors Item 1870

Amphenol Canada Limited announce the availability of Captivated Contact Improved Series "N" right angle plug for use with RG-8, 9, 10, 87A and 115A/U type cables. Amphenol part number is 82-326.

These connectors have a 50 ohm impedance, 500 volts peak rating and will meet the test requirements of MIL-C-71A. They are designed to mate with all other 50 ohm Series type "N" connectors and replace all right angle plugs. They provide added reliability in applications where environmental conditions, imposed mechanical strains and the relief of inherent cable stresses cause dielectric and/or center conductors to recede.

Captivated contacts prevent contact recession, thereby preventing circuit discontinuity. They are designed for low VSWR.

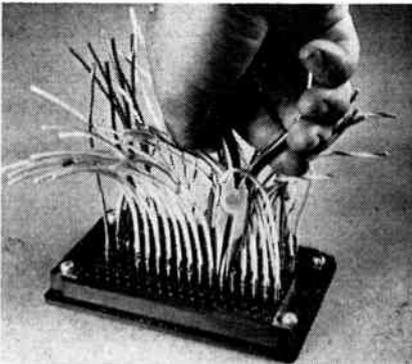
For further information write: Amphenol Canada Ltd., 300 Campbell Avenue, Toronto 9, Ontario.

Taper-Pin Panel Assembly

Item 1871

A compact, unusually versatile taper-pin panel assembly has been developed by Burndy engineers for a missile launcher's electronic equipment which requires a high degree of flexibility in connections. This feature is expected to make the panel assembly especially valuable in circuit testing and development. The panels take the new "Stapin" solderless taper pins developed by the company.

Versatility is achieved with an aluminum frame in which shielded panels are snapped and locked. While a frame will accommodate as many as five or eight panels, no more need be used than each application requires. In addition to standard panels,



frames can also take bussed panels, panels for coaxial cable, or grounding inserts. Feed-through panels have been designed for some users, commoning panels for others.

Stapin sockets are molded, not clamped, into the panel. Stapin pins are crimped on cable sizes from No. 28 through No. 12 by Burndy-developed manual or automatic installation tools.

Insertion of Stapin-terminated wires into the panel is speeded by an insertion tool in which the pin is locked by a twisting action and from which it is released only when the inserting cycle is completed. Uniform, tool-controlled impact secures the pin in the panel socket, from which it can be removed with a pair of needle-nose pliers. Stapins are made from solid stock, eliminating seams that might be opened by the impact of insertion, or weak points that could easily bend and break.

For further particulars, write Burndy Canada Ltd., 1530 Birchmount Road, Scarborough, Ontario.

Cradle Rotates Chassis 360°

Item 1872

A new aid for TV repairmen, electronic equipment manufacturers and installers has been made available by General Cement Mfg. Co., Rockford, Illinois. The new tool is a Chassis Cradle that rotates equipment 360° to simplify repairs. It is said that the new Chassis Cradle will eliminate a good deal of lifting and handling with possible chassis damage during repair operations.

The cradle will take any size chassis and hold it securely in place or rotate it 360° for any angle of exposure. Speed clamps are provided which allow the chassis to be quickly mounted or removed. Its space saving and light weight construction make the cradle a valuable asset to any repair or assembly operation.

For further information write direct to General Cement Mfg. Co., (division of Textron Inc.), 400 South Wyman Street, Rockford, Illinois, or Charles W. Pointon Ltd., 6 Alcina Avenue, Toronto, Ontario.

Electronic Temperature Controller

Item 1873

This indicating, fully automatic, tubeless, Electronic Temperature Controller maintains working temperatures with perfect accuracy and is used for temperature control processes such as: hardening, tempering, smelting, boiling, drying, extruding, etc., in various industrial and laboratory processes, utilizing for heating electricity, gas, oil, steam, hot-water or air, also for cooling processes.

As primary temperature detecting elements, thermocouples, resistance thermometers or radiation tubes are used.

Controlling means: contactor (for electric operation), solenoid, servo-motor or air operated valves (for gas, oil, heating, etc.)

For further information contact Thermovolt Instruments Limited, P.O. Box 43, Toronto 18, Ontario.

Three-Turn Potentiometer

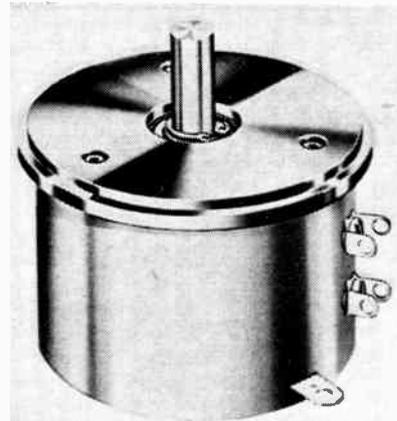
Item 1874

Latest high precision, three-turn potentiometer to be developed by Hellpot Corporation of Newport Beach, California, is the Model 9303 for servo mounting.

Model 9303 is $1\frac{1}{4}$ inches in diameter and weighs but 3.75 ounces. New design principles and careful selection of materials assure a potentiometer of exceptional stability, with standard independent linearity of $\pm 0.25\%$, and minimum noise characteristics.

The ambient temperature range is from -55° to $+80^{\circ}\text{C}$, with a power rating of 3 watts at 40°C . The pot may be readily modified, however, for a power rating of 3 watts at 60°C , derating to 0 watt at 125°C .

Full use of potentiometer resistance range is possible since 90° overtravel is available at each end of the coil. The one-piece Resinox molded housing is highly resistant to moisture as well as being a good insulator. Application of a V-groove lathe-bed technique in design of the rotor and slider results in maximum precision, essentially zero backlash and low torque.



For dependable performance and precise mechanical conformity, stainless steel ball bearings are used, and critical machined surfaces in the housing are turned in one setup. As many as 14 taps can be added during manufacture. Two-gang units are available as a standard.

Hellpot is a division of Beckman Instruments, Inc. Canadian sales representative is R-O-R Associates, Ltd., 1470 Don Mills Rd., Don Mills, Ontario.

New Products

Omnidirectional Antennas

Item 1875

With the introduction of Andrew Type 212 and 213, Omnidirectional Antennas, an entirely new principle in antenna design is employed. New Andrew "Suppressor" elements used in these antennas produce the high gain characteristics of a stacked array and are energized from a single feed point. Prior disadvantages of low coupling between elements have been eliminated. The result is high aperture efficiency, controlled illumination, and high-gain across the operating band.

Coverage patterns of Types 212 and 213 are omnidirectional with a measured gain of 10 db over a half-wave dipole.

Application, two models are available. The only differences are in the input connections and power ratings.

Type 213 is designed for systems using pressurized air dielectric cable. The connection is a $\frac{3}{8}$ inch EIA (RETMA) flange. The power rating of this model is 250 watts.

Type 212 may be used for systems with solid dielectric lines. This input connection is a Type N (UG 21 D/U) plug. Type N Junction is included. Power rating of Type 212 is 200 watts. Air dielectric cables are recommended when cable length is greater than 35 feet.

Broadband — Each type covers the full 20 MC range without tuning adjustments. The maximum VSWR is 1.5.

Fiberglass Radome assures dependable performance under unfavorable weather conditions. Windload rating is 30 lbs. per sq. ft., with $\frac{1}{2}$ inch of radial ice.

Installation is simplified by the three-section mast design of this 23 foot antenna which is easily assembled. The longest section is 12 feet. Antenna, including ground plane and support tube, weighs 54 pounds. Shipping weight is 102 pounds. May be mounted to 4 inch IPS pipe or installed in antenna tower.

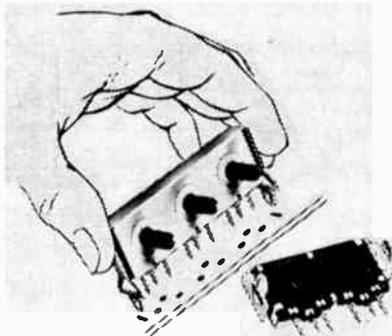
Andrew Antenna Corporation Ltd., 606 Beech St., Whitby, Ontario.
* Patent Pending.

Side-by-Side Controls

Item 1876

New 2- and 3-unit Side-by-Side variable resistors equipped with plug-in mounting brackets have been announced by the Electronic Components Division, Stackpole Carbon Company, St. Marys, Pa.

Available in twelve basic types, each with 17 shaft lengths, for TV receivers and other electronic assemblies, the new Stackpole controls eliminate many of the production operations needed to mount separate conventional controls. Printed wiring terminals and sturdy snap-in metal mounting brackets provide firm support for the multiple control assemblies. As a space-saving feature for today's compact



receivers, the controls have been designed with sufficient clearance to allow wires or small cables to pass under the control.

All Stackpole Side-by-Side Controls have

screwdriver-slotted phenolic shafts adjustable from both sides. The longer shaft extensions on one side are available in standard lengths from $-.024$ " to 1.270 " from mounting surface.

Solder dipped printed wiring terminals on all types are spaced in accordance with proposed EIA standards. Types are available with terminals either parallel or perpendicular to shafts to meet individual requirements.

Plug-in mounting brackets can be furnished for chassis or panel mounting regardless of the terminals or shaft styles selected, thereby affording unusually flexible design convenience.

Full details on new 2- and 3-section Stackpole Side-by-Side Controls are available in Bulletin RC-11B from the **Electronic Components Division, Stackpole Carbon Company, St. Marys, Pa.**

Temperature Control

Item 1877

A new precision temperature control has been designed by Measurement Engineering Ltd., Arrnprior, Ontario, using thermistor type of sensing element. Accuracy of control is $\pm 0.1^\circ\text{F}$ over the temperature range 0°F to 500°F . Coarse and fine adjustments are provided and the probe may be located hundreds of feet away from the control.

The instrument is housed in a NEMA-1 steel enclosure $8" \times 5\frac{3}{4}" \times 5\frac{1}{4}"$. It operates from either 115 volt or 230 volt 60 cycle power lines, is fully CSA approved and has power relay rated at 10 amperes, 115 volts non inductive.

Write for further details to **Measurement Engineering Ltd., Arrnprior, Ontario.**

Switching Reactors

Item 1878

A standard line of eight switching reactors, offering the ultimate in simplicity of static control, has been introduced by CONTROL, a division of Magnetics, Inc., Butler, Pa.



Switching action in these Control reactors is based on impedance changes, eliminating contacts and moving parts used in conventional relay systems. Multiple purpose control coils enable the reactors to translate inputs to plain logic operations through external connections to normal control voltages.

These units can be used as basic control components to drive such loads as solenoid valves, motor contactors, magnetic clutches, and annunciator indicator or alarm systems.

Other CONTROL switching reactor features are: 1. They serve as replacements for relay systems; 2. Operation is completely static; 3. Inherent power switching ratios are 10,000 to 1 for "off" to "on" states with nominal supply voltage; 4. Control windings are provided for logic inputs; 5. Control coils permit zero to maximum output with 20 milliamperes of control, but each winding can withstand 80 milliamperes; 6. No preamplifier is required for control signals; 7. Units are not sensitive to extremely varying atmospheric conditions in plants; 8. No special power supply is required.

The eight models of CONTROL switching reactors are offered in four nominal volt-ampere ratings of 15, 75, 150 and 300 for switching either a-c or d-c loads. One "family," with the above VA ratings, operates directly from nominal supply voltages; the other delivers standard load voltages.

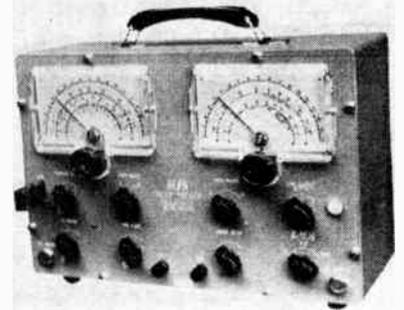
For further information, write to **CONTROL, Butler, Pennsylvania.**

Sweep Marker Generator

Item 1879

The SMG-57 Generator is specifically designed for television service and alignment work. Professional appearance, unusual accuracy, and versatility, have been combined in this fine instrument, to provide the radio and television technician with the kind of equipment he can use to speed up difficult troubleshooting and alignment.

The SMG-57 is a combination sweep and marker generator, with frequency ranges of exceptional width, permitting front-end as well as I.F. alignment. Each instrument is individually calibrated on marker frequencies, clearly showing exact setting for all key I.F. markers. The experienced technician will quickly realize the advantages of this time-saving feature.



An internal, crystal controlled 4.5 Mc. oscillator is provided for accurate alignment of Sound I.F. and demodulator circuits. Please note that the Marker Frequency Range of the SMG-57 extends down to 3 Mc., thus allowing the instrument to be used to align F.M. receiver I.F. at 10.7 Mc., as well as providing an option of marker or crystal oscillator at 4.5 Mc.

Specifications: Sweep Frequency Ranges, 2 Mc. to 260 Mc.; Marker Generator Ranges, 3 Mc. to 225 Mc.; Marker Generator Accuracy, better than 1%; Sweep Deviation, variable to 12 Mc.; Output Impedance, 75 ohms; Output Voltage, over 100,000 microvolts in three steps; Crystal Oscillator Accuracy, 0.002%.

For additional information and catalog data write: **Stark Electronic Sales Co., Ajax, Ontario.**

Transistor Portable Radio Kit

Item 1880

Heath engineers set out to develop a "universal" AM radio, suitable for use anywhere. Their objective was a portable that would be as much "at home" inside as it is outside, and would feature top quality components for high performance and long service life. The model XR-1 is the result of these efforts.

Six name-brand (Texas Instrument) transistors were selected for extra good sensitivity and selectivity. A 4" by 6" PM speaker with heavy magnet was chosen to insure fine tone quality. The power supply was designed to use six standard size "D" flashlight cells because they are readily available, inexpensive, and because they afford extremely long battery life (between 500 and 1000) hours. Costs no more to operate from batteries than would be paid for operating a small table-model radio from the power line.

An unbreakable molded plastic was selected for cabinet material because of its durability and striking beauty. Circuit is compact and efficient, yet components are not excessively crowded. Transformers are prealigned so it is ready for service as soon as construction is completed. Has built-in rod-type antenna for reception in all locations. Cabinet dimensions are 9" L. x 8" H. x 3 $\frac{3}{4}$ " D. Comes in holiday gray, with gold-anodized metal speaker grille. Shipping weight 4 lbs.

Heath Company (A Subsidiary of Daystrom, Inc.), Benton Harbor, Mich., U.S.A.

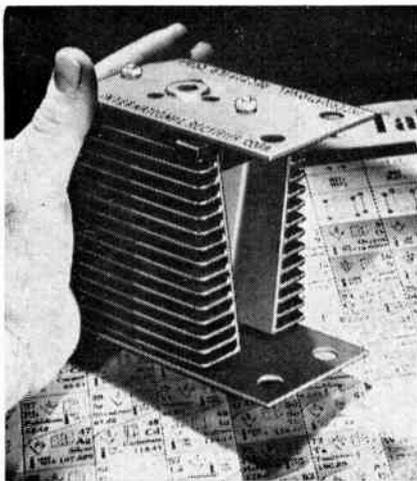
New Products

200 Ampere Silicon Rectifier Junctions

Item 1881

Exceptional ability to withstand shock, and a mechanical design that integrates the junction and heat exchanger into one small package, thus permitting quick, simple installation, are primary features of the air-cooled 200 ampere silicon rectifier junctions recently announced by International Rectifier Corporation.

These qualities, plus hermetic sealing within an anodized-cast-aluminum housing highly resistant to extremely corrosive environmental conditions, ideally suit these self-contained junctions to applications in the traction, mining, machine tool and other industrial fields where rugged heavy power rectification is required.



Rated at 200 amperes rectified dc output current in PIV voltages of from 100 to 400 volts, this series of junctions has been designed to withstand shock and vibration far in excess of that encountered in the most severe installations. Installation simplicity stems from the fact that the rectifying junction and efficient cast-aluminum airfoil type heat exchanger are combined — in contrast to types which must be fin-mounted or otherwise provided with a cooling system prior to application. Sturdy design, conservative rating, and the highly efficient cooling system of these junctions all contribute to uninterrupted equipment operation. When adequately protected from high surge currents and applied in accordance with factory recommendations, these high reliability characteristics will reduce equipment "down time" to the absolute minimum.

Request Bulletin SR-158 from International Rectifier Corporation, 1521 E. Grand Avenue, El Segundo, California, U.S.A.

Phase Angle Voltmeter

Item 1882

Phase-sensitive null indication with less than 5 microvolts of "noise" is possible in control systems with the new Model 201 BR rack mounting Phase Angle Voltmeter now in production by the developer North Atlantic Industries, Inc., Westbury, N.Y. The multifunctional instrument has other uses in the electronics and electro-mechanical fields, according to the company, specialists in components and systems for avionics, automation and instrumentation.

The instrument, in portable and "rack" versions, provides 10 microvolt sensitivity as a phase-sensitive null indicator, with less than 5 microvolts of "noise". Harmonic rejection exceeds 55db, when used with internal filters. Nulling is accomplished at any phase angle by means of a convenient switch and calibrated phase shifter. The dual filter, phase angle voltmeter performs equally well as a meter

for direct measurement of magnitude of signal fundamental, phase angle, quadrature and in-phase components.

Full-scale voltage ranges of from 1 millivolt to 300 volts, in twelve separate scales, are available for measuring the signal magnitude, quadrature, or in-phase component of a signal. Full-scale voltage measurement of quadrature can be made to ± 6 degrees, allowing angular measurement to 0.1 degrees. Substitution measurements of phase angle can also be made, using the built-in, calibrated phase shifter.

Among major applications can be included: phase-sensitive null indicator, ratio-meter, detector for synchro bridges, amplifier alignment, and transducer zeroing. These and other applications are described in new, "Application Notes", now available from Instrumentation Division, North Atlantic Industries, Inc., 603 Main Street, Westbury, L.I., N.Y., U.S.A.

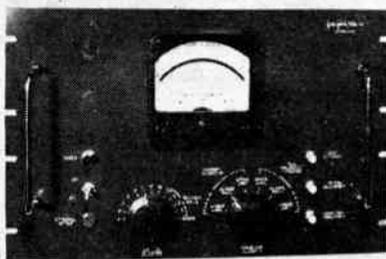
Frequency Calibrator

Item 1883

Fenske, Fedrick & Miller, Inc., 12820 Panama Street, Los Angeles 66, California, announces the introduction of its Model 521 Frequency Calibrator. This is a revolutionary new instrument which for the first time provides the ability to: 1. Calibrate oscillators and discriminators in FM-FM telemetering systems in a fraction of the normal calibration time; this is accomplished with an extremely high degree of accuracy. 2. Provide calibrated input voltage to each voltage-controlled oscillator in the transmitting system and by use of a center scale frequency meter, continuously measure deviations from standard frequencies. 3. Check alignment of each discriminator in the receiving system by a standard frequency generated in the Calibrator. 4. Allows direct frequency readings in terms of percentage deviation.

The ability of the Frequency Calibrator to accomplish the above in FM-FM telemetering systems is the result of a new proprietary circuitry which for the first time permits the direct, highly accurate, comparison of two frequencies. Basically, the circuitry derives the difference frequency and the sign of the difference without need for frequency restrictions or selective filtering. The panel meter presentation gives an easily interpreted reference, thus making possible a simplified calibration procedure.

An accurate stable frequency reference is provided by means of internal crystal oscillator and a set of crystals. Highly accurate, direct readout, of subcarrier oscillator deviation with respect to the internal crystal frequencies is thus provided, and indicated on a six inch rectangular zero center meter. All deviations are expressed in percentage of center channel



frequency and are continuously and instantaneously indicated on the meter. If desired, an external meter is available for remote indication. Two frequency deviation ranges are provided for each channel:

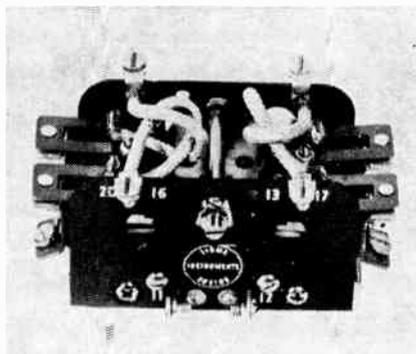
$\pm 7.5\%$ full scale on numbered IRIG channels, and $\pm 15\%$ full scale on letter channels, both relative to center frequency. A second range $\pm 1\%$ full scale on numbered channels and $\pm 2\%$ full scale on letter channels shows deviation relative to these test frequencies to indicate errors in calibration.

For further details write to the Canadian representative: Radionics Limited, 8230 Mayrand St., Montreal 9, Que., Canada.

Polarized Latching Power Relay

Item 1884

This DC polarized relay is designed to switch 1-2 kilowatt loads in response to momentary $\frac{1}{4}$ - $\frac{1}{2}$ watt signals. The Sigma Series 61 relay uses a permanent magnet latch in place of mechanical latching devices. This eliminates all but one moving part and thus lengthens the life of the relay and increases its resistance to shock and vibration. Typical equipment in which Series 61 relays are used include machine control panels and battery energized control systems, where contactors must withstand extensive shock and wear.



The 61 is a DPDT relay with four separate contact circuits, and is available in two forms: 61Y (single coil only), two-position, magnetic bias; 61Z (single or dual coil), two-position, magnetic latch-in. The armature of the 61Y is normally closed. A signal of given polarity and magnitude transfers it to the opposite position; removal of the signal, or a change in polarity, returns it to the normal position. The 61Z switches as a result of a momentary coil signal of given polarity. The armature remains magnetically latched until a signal of opposite polarity returns it to the original position; in a dual coil 61, a pulse in the reset winding resets the switch without changing the other coil circuit conditions.

Nominal contact rating is 20 amperes (resistive) at 28 VDC or 120 VAC, with standard sensitivities of 225 or 450 milliwatts. Minimum life is 100,000 operations when operated not more than once per second. Smaller loads give much longer life.

Further data on the Series 61 is available on request from Sigma Instruments, Inc., 48 Pearl Street, South Braintree 85, Mass., U.S.A.

Printed Circuit Tip Kit

Item 1885

The Gregg Electric Mfg. Co., Inc., manufacturers of the Gregg single pole instant heat soldering gun, announces the introduction of the first and only printed circuit tip kit, aimed directly at solving the printed circuit repair and maintenance problem for the dealer.

In testing, these features have definitely shown themselves as advancements in soldering technique, i.e.: 1. Gregg printed circuit kit eliminates the danger of component injury to printed circuit board; 2. Gregg printed circuit with its four different tips is practical for use in every printed circuit soldering problem from the socket to the continuous in line components.

No need to clip the rigid leads or to wipe clean each individual soldering joint. There is a Gregg tip in the printed circuit kit which will do the job in a matter of seconds.

These tips in the printed circuit kit are standard and inter-changeable for immediate use in the regular Gregg 250A single pole gun without need for adaptors. Just simply unscrew the regular tip and screw on one of the printed circuit tips.

Represented in Canada by Atlas Radio Corporation Limited, 50 Wingold Avenue, Toronto 19, Ontario.

News Report

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

CGE Tube Section Widens Activities

The establishment in Canada of a facility for the manufacture of specialized receiving tubes for industrial and military applications has been announced by the Tube Section of Canadian General Electric Company Limited. This action has been taken to cater to the rapidly growing market for high reliability receiving tubes, which was virtually non-existent in Canada three years ago, and which is expected to double within the next three years.

This facility will be fashioned after the renowned "Operation Snowwhite" with which the General Electric Company pioneered the production of "5-Star" tubes in the U.S. In the design of such tubes the emphasis is on reliability rather than economy and features such as slotted double micas and cathoretically coated heaters, are included which could not be justified in entertainment types. Production of industrial and military versions requires such things as a much closer control of tolerances, provision of immaculate conditions to avoid contamination, 48-hour burn-in to stabilize characteristics and to weed out early failures, and special testing to maintain highest quality levels.

Buckleys Of England Appoint Canadian Rep

Criterion Instruments Division of Canadian Research Institute, 46 St. George Street, Toronto 5, Canada have just been appointed Canadian sales and service representative for the British firm, Buckleys (Uvral) Limited, Putney, London S.W. 15, England, manufacturers of high tension high frequency spark testing equipment.

Canadian Born Engineer Promoted By Du Mont

The appointment of Donald M. Christie as manager of the Equipment Manufacturing Division of Allen B. Du Mont Laboratories, Inc. has recently been announced by Major Gen. Raymond C. Maude (U.S.A.F. Ret.), vice-president of the division, located in East Paterson, New Jersey.

A native of Canada, Mr. Christie served in the RCAF in World War II as a radar technician, taking special courses in electrical engineering under the RCAF at Ottawa, and Clinton, Ontario.

In 1951 Mr. Christie joined the Du Mont Laboratories as a project coordinator on government contracts, and prior to his new appointment Mr. Christie had become assistant manager of the Equipment Manufacturing Division.

CESCO Appointments

M. I. Rosenthal, president of Canadian Electrical Supply Co. Ltd. of 275 Craig Street West, Montreal, P.Q., has announced the appointment of Robert Villiard and Joseph Pascal as vice-presidents of the company.

Mr. Villiard has been with the company for over 14 years. He served during the war as navigator with commissioned rank in the R.C.A.F. On leaving the Air Force he returned to Cesco as manager of the mail order department. Since that time he has held several other executive positions including purchasing agent, branch coordinator, merchandising manager and is today Montreal branch manager. Mr. Villiard has full experience in radio with knowledge gained in the various positions he has held with the company and is well known to the electronics industry.

Mr. Pascal has been associated with electronics since 1929 and is experienced in all fields of the electronics art. He has served with Cesco for 18 years and has held several executive positions. At the present time he is Coordinator for Cesco's four branches, as well as industrial manager and supervisor of purchasing for the company.

K. R. Patrick Studies Electronics Problems

The former president of Canadian Aviation Electronics Ltd., K. R. Patrick, resigned recently to make a special study of electronics problems with particular regard to Canadian defense and economics.

Mr. Patrick, who was instrumental in founding Canadian Aviation Electronics Ltd. some 11 years ago, will remain a director of the company.

Canadian Admiral Appoints Branch Managers

Edwin Whittaker, vice-president and general sales manager of Canadian Admiral Corporation, Ltd., recently announced the appointment of new managers at the company's Toronto and Ottawa factory sales branches.

Manager of the Toronto branch at 1350 Jane Street, is Andrew Hause, formerly Ontario regional manager. Appointed manager of the Ottawa sales branch at 202 Queen Street, is Tom Kelly. He has been with Canadian Admiral since 1953, as sales representative in central Ontario and manager of the London sales branch.

CANADIAN ELECTRONICS LTD. OPEN NEW PLANT

Canadian Electronics Ltd., an Edmonton firm which opened for business almost eight years ago with little more than a few dollars invested in resistors, condensers and tubes, recently celebrated the official opening of its new \$250,000 building by inviting Premier Manning of Alberta to perform the opening ceremony.

Approximately 400 guests attending the opening were able to see on

display several new electronic devices including industrial television systems, miniature transistor radios, office dictation equipment, and a new type of inter-office communication system.

From its humble beginning, the organization has enjoyed a rate of growth which today places it out in front as a major participant in the highly competitive electronic equipment market.



● The new premises of Canadian Electronics Ltd. have a floor area of 16,000 ft. and parking space provides for 50 cars. The value of stock carried is estimated at \$250,000.

News Report

Atlas Radio Sales And Technical Seminar

Atlas Radio Corp. Ltd., manufacturers' representatives in the electronics industry, began preparing for 1958 with their first annual sales and technical seminar for their inside and outside sales force.

The keynote of the week long seminar was improved product knowledge, and many of the American firms represented in Canada by Atlas Radio sent their own people down to conduct special technical and sales sessions.

One important highlight of the seminar was a specially produced film series designed to develop sales personnel to a greater degree of effectiveness.

"Because our salesmen sell at every level of the electronics industry, distributor, industrial and manufacturer, we felt it absolutely essential that they receive and continue to receive thorough training in product knowledge, professional selling technique and the psychology of understanding people," stated J. R. Bass, general sales manager of Atlas Radio, who was in charge of this year's seminar.

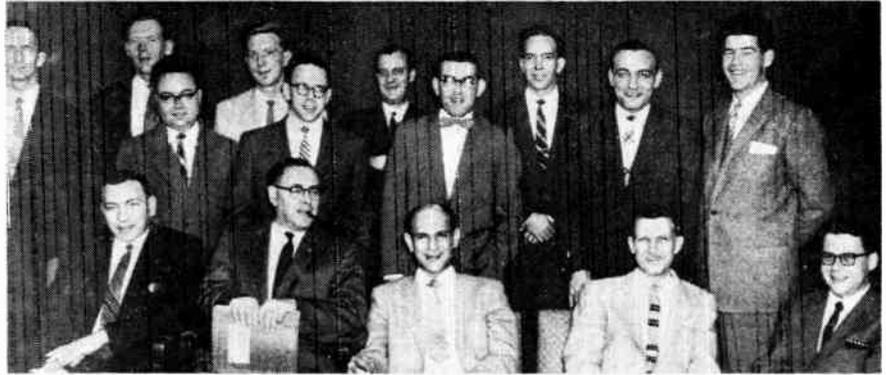
Inventors Set 1957 Disclosure Record

For the third consecutive year, engineers and scientists of the Canadian Westinghouse Company have established a new record for submitting patent disclosures. R. H. Fox, patent manager with the company's legal department, said 1957 disclosures were 20 per cent above the total for 1956, which had been the previous high mark.

Commenting on the new record, H. N. Muller, vice-president, engineering, said: "The inventions of engineers and scientists help our company maintain its position of leadership in a highly competitive market. But more than this, their inventions contribute to industrial expansion and benefit both the industry and the eventual customer".

Out of a total of 13 engineering locations, Mr. Fox said more than half had exceeded their goal for the year. The Electronics Division leads the company field, having contributed 33 per cent of all company disclosures.

Canadian Westinghouse "Inventor Awards" program makes monetary payment for inventions as a means of encouraging engineers to put their thoughts on paper. Additional recognition is given company employees who create some particularly useful development. The effectiveness of the company's system has been proved by a 2000 per cent increase in the number of disclosures since the year prior to the establishment of the program.



● Shown above is the sales force attending the first annual sales and technical seminar held by Atlas Radio Corporation Ltd., Toronto. Standing (left to right) — A. Rosenthal, F. Sargeant, N. Curtis, N. Duncan, S. Hoffman, L. Bradford, A. Hoffman, T. Keenan, J. Bass, J. D. McCormick. Seated (left to right) — J. R. Bass, S. L. Janikun, J. Goodhart, A. E. Ogg and R. Henderson.

Canadian Admiral Subsidiary Gets General Manager

Stuart D. Brownlee, executive vice-president of Canadian Admiral Corporation, Ltd., recently announced the appointment of Edward John Mullen as General Manager of Ensign Acceptance Corporation. Ensign is a wholly owned subsidiary of Canadian Admiral Corporation and offers a complete financing service for Admiral dealers in the Toronto and London areas.

Mr. Mullen was formerly Internal Auditor of Canadian Admiral and has had many years of experience in the financial field.

A. C. Wickman Represents Edin Company Inc.

A. C. Wickman Limited, of Toronto, has assumed the agency of Edin Company Inc., of Worcester, Massachusetts, according to an announcement by B. McGregor, (P. Eng.), sales engineer, Electronics Division. This new line consists of oscillographs and amplifiers for industry and the medical profession.

Supplies are stocked in Toronto and the Canada-wide Wickman organization is offering full service facilities. Consultation on, and the supplying of, complete instrumentation systems are provided for industrial and medical requirements, as well as the sale of individual oscillographs, amplifiers, and galvanometers.

Students Honored By A.P.E.O.

The Association of Professional Engineers of Ontario recently presented its Gold Medal award to the two engineering students who graduated with the highest standing from the University of Toronto and Queen's University, Kingston respectively.

The two recipients were John A. Norton of Toronto, a graduate of University of Toronto who is currently taking a postgraduate course at Princeton University; and Peter W. McBurney of Ottawa, a graduate of Queen's University, who is employed at Canadian General Electric Company in Toronto.

Mobile Radio For Toronto Vehicles

Mayor Nathan Phillips of Toronto recently signed a contract with the Canadian General Electric Company Limited to supply, install and service a civic two-way mobile radio system. The contract provides for installation of mobile radio sets in 79 vehicles of the Public Works, Parks and Recreation and Property Departments. A service contract has also been awarded C-G-E for service of the equipment for five years.

The new mobile radio system for city-owned vehicles will use the same base station and antenna installed by C-G-E several years ago for the Toronto Fire Department in its Balmoral Ave. firehall. This results in a saving of several thousand dollars to taxpayers, company officials point out. Fire Department calls can be transmitted and received simultaneously with those of the civic department vehicles, with no interference.

Dow Corning Silicones Rep For Alpha-Molykote

Announcement was recently made by D. C. R. Miller, vice-president and general manager of Dow Corning Silicones Limited, of his firm's appointment as the Canadian distributor of Alpha-Molykote products. Already established as a leader in the field of molybdenum - disulphide lubricants, Alpha-Molykote offer a complete range of lubricants as oil dispersions greases, pastes and dry films.

These lubricants will complement Dow Corning's extensive line of silicone lubricants.

The comprehensive research facilities of the Alpha-Molykote Corporation of Stamford, Conn. for the testing and application of lubricants under boundary conditions will now be available to Canadian industry through Dow Corning Silicones, as will be the special testing equipment.

The Toronto head office of Dow Corning Silicones Limited is located at 1 Tippet Road, Downsview, Ontario.

1958

is the year to make certain
your copies of
ELECTRONICS & COMMUNICATIONS
will continue without fail.

Sometime this year you will receive a post-card. This card will ask you whether or not you wish to remain on our permanent mailing list.

If you do, please complete the card *in full* and return it promptly. Our circulation list auditors require us to have an up-to-date record of your name, address and occupation.

WITH YOUR PROPERLY COMPLETED CARD ON FILE YOU ARE UNCONDITIONALLY ASSURED OF RECEIVING ALL FORTHCOMING ISSUES OF

ELECTRONICS & COMMUNICATIONS

where lack of space
is the problem

Try this for size

For guided missiles,
airborne equipment,
portable and mobile
ground equipment

Miniature Ceramic
Switch... Series M

Single pole style has 18 shorting type contact positions. 2 or 3 pole types may also be obtained. Additional decks may be added. Flash-over voltage at 60 cycles is 1000 volts peak . . . current carrying capacity is 2 amperes.

- * Coin silver contacts, rotors, slip rings
- * Silicone impregnated ceramic parts
- * Sturdy solder terminals

Write today for further information



THE **DAVEN** CO.

Livingston, New Jersey, U.S.A.

WORLD'S LARGEST MANUFACTURER OF ATTENUATORS
In Canada: ADAMS ENGINEERING LTD., Montreal and Toronto

ELECTRONICS & COMMUNICATIONS, FEBRUARY, 1958

New HI-SPEED MUTUAL CONDUCTANCE TUBE TESTER



STARK Model 8-77
Portable — Only 16 lbs.

Exclusive: NEW METHOD OF CALIBRATION

Voltages are precision calibrated, thus assuring the testing of tubes with professional accuracy, with the time-proven Stark-Hickok method of Dynamic Mutual Conductance — in line with the approved Canadian Armed Forces accepted methods.

Exclusive: NEW SOCKET DESIGN

Supplied with snap-in master socket panel, easily and quickly removed to expose new type 11-pin socket that saves time in replacing worn out sockets, and will take other adaptors for checking foreign and older, seldom used, types.

Exclusive: NEW HIGH SPEED EXTRA SENSITIVE SHORT TEST

(12 times more sensitive)

Five neon lights automatically indicate shorts or leakage between elements and identify which are shorted.

Exclusive: NEW GRID CURRENT (GAS) TEST

The gas content (grid current) is measured very accurately in terms of microamps.

NEW FILAMENT CONTINUITY TEST — As soon as the tube is plugged into test socket, depressing of Filament Continuity button, immediately determines if filament "open" or not.

RESERVE CATHODE CAPACITY TEST — Reserve capacity of tube under test can be determined to weed-out tubes which could cause trouble in the near future.

FILAMENT VOLTAGES—In 18 steps from 0.6 to 117 volts.

SCALE READING IN MICROMHOS — Read directly on the 3-range micromho scales (0 to 3,000, 6,000, 15,000)

Write for full particulars



STARK ELECTRONIC INSTRUMENTS LTD.
Factories and Sales Office: Ajax, Ont.
Foreign Division: 276 West 43rd Street
New York 36, N.Y., U.S.A.

S581

For further data on advertised products use page 67.

News Report

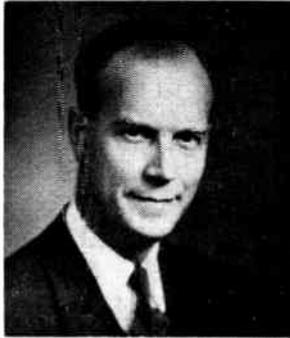
Canadian Firm Uses Bell Lab Patents

Taylor-Leslie Mining & Engineering Corporation Limited, P.O. Box 312, Terminal "A", Toronto, announces that it is preparing a facility for the manufacture of silicon transistors, diodes, rectifiers and photo transistors. The company also expects to manufacture solid tantalum capacitors.

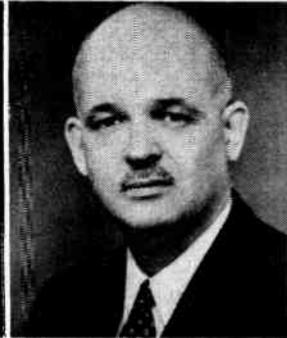
These items will be of Canadian manufacture utilizing current United States designs.

The firm has been licensed by Western Electric Company to utilize all the Bell Laboratory patents applicable to semi-conductors.

NORTHERN ELECTRIC CO. APPOINTMENTS



J. E. Milburn



A. J. K. Griffiths



H. C. Way

● Northern Electric Company Ltd. has recently appointed J. E. Milburn and A. J. K. Griffiths as manager and assistant manager respectively of its Pacific Zone. Mr. Milburn has been successively manager of the company's Edmonton branch, manager of the central district, and marketing manager for the sales division. Mr. Griffiths, a native of Newport, Wales, has seen much of his service in Vancouver. The appointment of H. C. Way as marketing manager of the sales division of Northern Electric Company, with headquarters in Montreal, is also announced.

SOUNDMASTER AMPLIFIERS

15 MODELS AVAILABLE FOR
PUBLIC ADDRESS AND HI FIDELITY

FOR TONE • POWER
AND DEPENDABILITY

SOUNDMASTER EQUIPMENTS

OTTAWA 283 BANK ST. CANADA



F. V. TOPPING • *Electronics Ltd.*

DESIGN • PRODUCTION • ELECTRONICS

- RADIO FREQUENCY CONTROL EQUIPMENT
- COMMUNICATIONS ACCESSORIES
- CAREFUL CUSTOM PRODUCTION
- TRANSISTORIZED EQUIPMENT
- SILICON RECTIFIER SUPPLIES
- STABLE AIRBORNE AC SUPPLIES

A CANADIAN COMPANY WITH NEW IDEAS

94 LAIRD DRIVE

HU. 9-4325

TORONTO 17, ONTARIO

Use Your
ELECTRONICS
and
COMMUNICATIONS
DIRECTORY and
BUYERS' GUIDE
It Is Valuable



Bring your SMALL MOTOR problems to **ALLIANCE**

For small motors of all types . . . for skilled engineering advice and assistance . . . for special applications and variations . . . your best bet is *Alliance Motors*, Canada's foremost designer and manufacturer of small motors and Canadian engineering representatives of Howard Industries Inc., Motor Manufacturers of Racine, Wis. Just write or phone



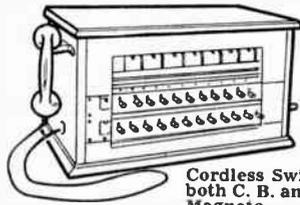
ALLIANCE MOTORS • SCHELL AVE • TORONTO (10) ONT. RE 6124

It pays to keep in touch!

In the rural areas of Canada, T.M.C. Magneto Telephone Equipment has been keeping open vital communications for almost a decade. Suppliers to many of the world's major telephone users for over forty years, T. M. C. equipment has the features for which you are seeking. Rugged construction, stylish appearance, easy maintenance, highly competitive initial cost. Telephone EM. 6-5314 or call at our showroom to discuss your problems with our engineers.



Magneto Telephone Switchboards



Cordless Switchboards both C. B. and Magneto



Magneto Wall Telephone



MAGNETO TELEPHONES

TELEPHONE MANUFACTURING CO. LTD.
Saxony Building, 26 Duncan Street, Toronto

Write For Technical Details
To Department EC

COMPACT, LOW COST POWER for Hundreds of Uses

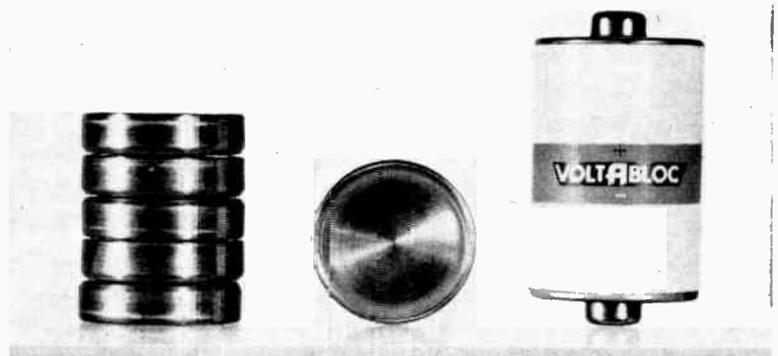


"VOLTABLOC" BUTTON CELLS

NICKEL-CADMIUM • SINTERED • Hermetically Sealed • RECHARGEABLE

2 TYPES
VO - .250 VO - .500
CAPACITY
(2 hour rate)
250 mah 500 mah
DIAMETER
1.375" 1.375"
THICKNESS
.1875" .3125"
WEIGHT
(ounce)
.5 .75
VOLTAGE
1.2 V per cell

Button cells are the latest addition to Saft's extensive line of "Voltabloc" hermetically sealed, nickel cadmium sintered-plate batteries. Smaller than a silver dollar, these miniature batteries offer unlimited possibilities in *electronic* and electrical applications.

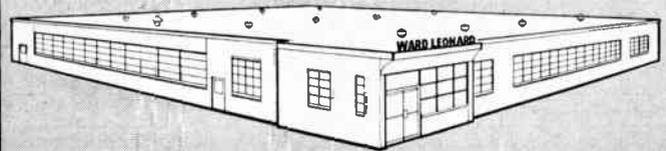


5806



**WARD LEONARD
OF CANADA LIMITED**

1070 BIRCHMOUNT ROAD TORONTO 16



CANADIAN FACTORY AND HEAD OFFICE

Resistors • Rheostats • Relays • Motor Controls • Dimmers • Switchboards • SAFT Batteries • Bakelux Switches • Kenco Pumps

ELECTRONICS & COMMUNICATIONS, FEBRUARY, 1958

For further data on advertised products use page 67.

immediate delivery
on all
POWERSTAT
variable
transformers
1 AMP. to 100 AMP.
call WA 4-9301
write
ELECTRO SONIC
SUPPLY CO. LTD.
543 YONGE ST., TORONTO
your one stop for
all automatic
control components

Use Your
**ELECTRONICS and
COMMUNICATIONS
DIRECTORY and
BUYERS' GUIDE**
It Is Valuable

SPECIAL PRODUCTS
Sales Engineer - Electronics
Large Electronic Sales and Engineering organization located in Edmonton requires a creative application engineer who can talk intelligently to industry at management and engineering level. This man will be given a free hand to develop waiting market for the sale of custom electronic systems for control, instrumentation, data transmission, etc.
Reply giving full occupational history.

Box 17E
ELECTRONICS & COMMUNICATIONS
31 Willcocks St. - Toronto 5, Ont.

We have on hand a
UNIVERSAL WINDER
in good condition which we would like to dispose of . . .
Machine can be seen at
6595 St. Urbain St., Montreal

News Report

R.C.A. Co. Announces Divisional Appointments

RCA Victor Company, Ltd., Montreal, has recently announced three Technical Products Division appointments.

Wally Evan-Jones will be attached to the Commercial Marketing Department handling RCA Victor Carfone Land-Mobile Radio Equipment Sales.



W. Evan-Jones

Mr. Evan-Jones has been associated with the communications and electronics field for the past 18 years, having been previously employed by the Hydro Electric Power Commission of Ontario, Rogers Majestic

Ltd., Canadian Marconi Company and Canadian Westinghouse Co., Ltd. Mr. Evan-Jones holds membership in the American Institute of Electrical Engineers and the Institute of Radio Engineers.



T. B. Thomson



D. C. Tucker

D. C. Tucker, B.Sc., has been appointed to the position of Marketing Administrator, RCA Victor Company, Ltd. Mr. Tucker has worked in airline communications both in Canada and the United States. In World War II he spent more than three years in army communications, and was seconded to the British Admiralty for point-to-point and ship-to-shore communications. Prior to joining the RCA Victor Company, Mr. Tucker was with Canadian Marconi Company.

T. B. Thomson, B.A.Sc., has been appointed Marketing Administrator, Broadcast Equipment Group. Mr. Thomson, who graduated in June 1957 from the University of Toronto with honors in Electrical Engineering, communication option, has since that time worked in the Broadcasting Engineering Group of RCA Victor Company.

Canadian Radio Week

Canadian Radio Week will be observed from May 4 to 10, 1958.

A similar promotional effort during May, 1957 proved to be so successful that the 1957 June and July set sales were increased 20 per cent over the same months in 1956.

 **WELWYN**

*Hermetically Sealed
Deposited Carbon Resistors*

WELWYN
CANADA
S12 1%
WELWYN

High stability resistors sealed into glazed and vitrified ceramic shells for complete protection against ambient humidity changes. Silicone oil filled. Acts as efficient convective medium for improved heat dissipation. Also serves as infallible quality control for detecting seal leakage defects.

Each resistor is subjected to sustained pre-load test at 1½ times rated wattage. Insures against catastrophic failures under normal operating conditions.

Designed to meet military specifications.
MIL-R-10509 (current issue)

for complete data, write to:

WELWYN CANADA LTD.

1255 BRYDGES ST.

LONDON, ONT.

For further data on advertised products use page 67.

MOLONEY

Specialists in transformers

NO CORE TOO SMALL



NO TRANSFORMER TOO LARGE



For larger and higher voltage electronic components, consult MOLONEY

MOLONEY
ELECTRIC COMPANY OF CANADA LIMITED

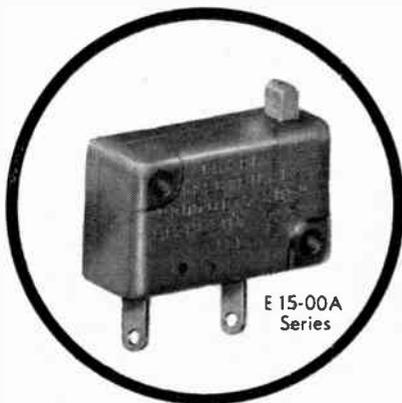
FACTORY & HEAD OFFICE: 213-219 STERLING RD., TORONTO

REGIONAL OFFICES: MONTREAL, CALGARY

Sales agents across Canada

5804

Need a Sensitive Switch?



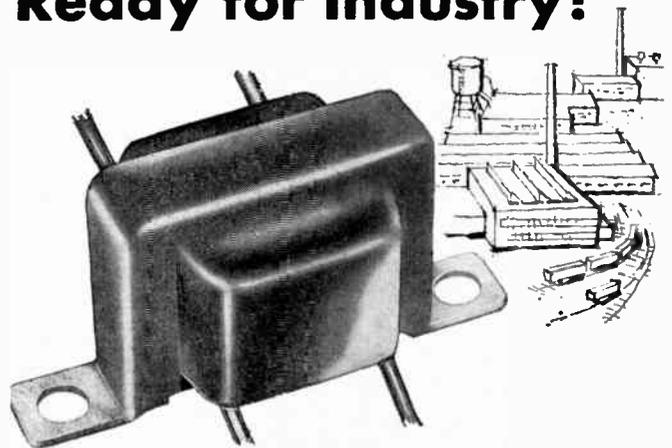
E 15-00A
Series

- Small size—precise—dependable
- 50 grams nominal operating force
- Wear resistant nylon button
- Solder, quick disconnect or wired terminals
- Rated: 6 amps @ 125 V a-c.

CALL OR WRITE

C HERRY ELECTRICAL PRODUCTS CORP.
1659 Deerfield Rd., Highland Park, Ill.
Phone: Idlewood 2-8182

Ready for Industry!



HAMMOND TRANSISTOR TRANSFORMERS

Over the past few years Hammond has developed numbers of miniature transformer prototypes for use in the communications, aviation, and instrumentation industries. Now . . . thoroughly tested and proven in use . . . Hammond presents:

the New "44 THOUSAND SERIES" featuring

- encapsulation
- low insertion loss
- low distortion
- wide frequency response
- four different mountings
- a core size for each power level
- 56 impedance ratios from stock

Complete electrical and mechanical specifications available with cross reference guide to exact equivalents of currently popular American types. Write for Bulletins 5200/5202/5203.

SOME HAMMOND (MINIATURE) SPECIALS



"clinch lug"
mounting for
production use.



for printed circuit work under adverse environmental conditions.



for printed circuit applications.

Let Hammond undertake the design, development, and precision manufacture of your Audio . . . Power . . . Pulse . . . and High-Frequency Transformers. If your requirement is not met by a stock item the factory will build a "transformer" to your specifications. Enquiries for large or small quantities are invited.

STANDARD ITEMS STOCKED BY JOBBERS COAST TO COAST
HAMMOND MANUFACTURING COMPANY LIMITED
H/57/8 GUELPH, ONTARIO, CANADA

Since 1927 - Canada's Transformer Specialists

For further data on advertised products use page 67.

**WHAT DO
YOU
WANT
IN A TESTING METER**



The
MODEL
8

AvoMeter

GIVES YOU ...

- Automatic cutout protection
- 20,000 ohms per volt movement
- 4 ac current ranges to 10 amps.
- 7 dc current ranges to 10 amps.
- 14 ac-dc voltage ranges to 2500 v.
- 3 resistance ranges zero to 20 megohms
- 4 easy-to-read scales
- polarity reversing button
- anti-parallax mirror
- external accessories for increased ranges.

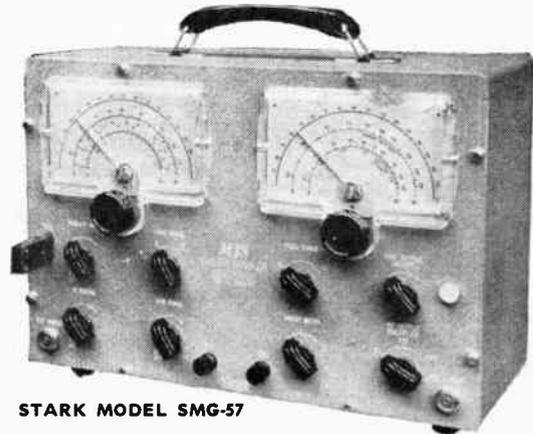
ACCURATE • PORTABLE • LIGHTWEIGHT

For detailed bulletin write to Dept. EC2

542A

R.H. Nichols LIMITED
2781 DUFFERIN STREET • TORONTO

**HIGH in accuracy HIGH in quality
LOW ONLY IN PRICE**



STARK MODEL SMG-57

NOW! Available at a price everyone can afford. A complete single unit TV Sweep-Marker Generator engineered to provide all the necessary functions for servicing, testing, and alignment of TV, RF as well as IF circuits. The MJS sweep marker generator surpasses in performance, reliability and accuracy many instruments that sell for twice the price. The SMG-57 is extremely easy to operate.

SPECIFICATIONS

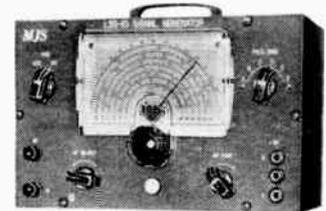
Sweep: 3 MC—260 MC in 2 bands
 Marker: 3 MC—225 MC in 2 bands
 Marker Accuracy better than 1%
 Crystal supplied 4.5 MC plus or minus 0.002%
 Sweep Method—Vibrating capacitor sinesoidal
 Sweep Deviation—0-12 MC or more
 Output Impedance—75 ohms balanced
 Output voltage—over 100,000 microvolts
 Controls—RF output multiplier 3 step X1, X10, X100.
 Fine output adjustment . . . Sweep width . . .
 Horizontal phase . . . Blanking OFF-ON . . .
 Marker Amplifier . . . Crystal socket . . .
 External Marker input . . . Accessory cables—
 75 ohm RF output, Ext. Marker input.

Write for full particulars

"You can't get more for less, NOR AS MUCH for so little"



BJ-1—Checks all kinds of condensers for capacity, leakage, opens, shorts or intermittent conditions. Direct reading .00001 to 1000 MFD. Resistance from 100 ohms to 5 megohms. \$34.95



LSG-10—Compact, handy, high quality RF signal generator suitable for service technicians, amateurs, instructors and etc. Frequency up to 130 MC. fundamental. 260 MC harmonic; AF output 2-3 volts at 400 cycles; RF output over 100,000 microvolts. \$39.95



PD-3—Compact 2000 ohms volt pocket multi-tester. Measures AC and DC to 1200 Volts. DC current, resistance, capacity and inductance. \$13.95



MT-6D—Versatile compact 20,000 ohms volt millimeter. Measures AC volts to 1200. DC volts to 6000. Current; resistance; capacity and inductance. Proven dependability. \$24.95

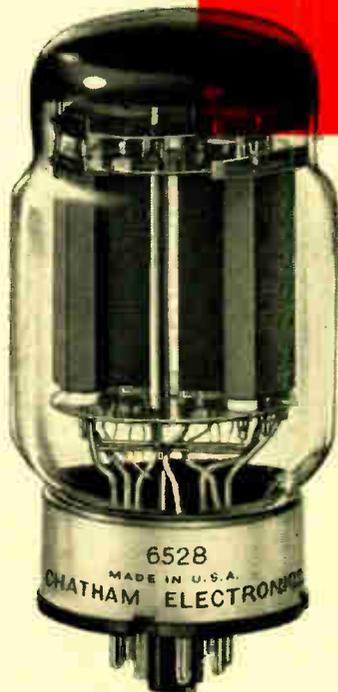
Distributed and serviced by

STARK ELECTRONIC SALES CO.
A JAX ONTARIO

S 574 M



**RESEARCH, DESIGN, DEVELOPMENT
AND QUALITY PRODUCTION IN VOLUME**

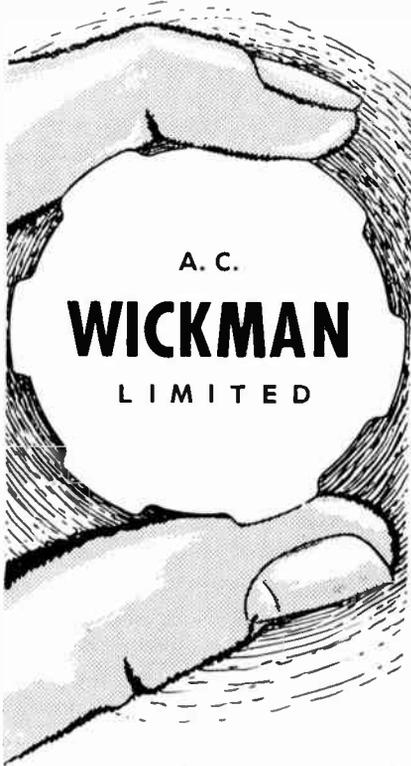


TUNG-SOL®

ELECTRON TUBE DIVISION TUNG-SOL ELECTRIC INC., NEWARK 4, N. J.

IN CANADA: ALPHA ARACON RADIO CO., LTD., TORONTO, ONT.

Instrumentation
for Canadian
**INDUSTRY
LABORATORIES
HOSPITALS**



- * Complete Instrumentation Systems
- * Amplifiers
- * Oscillographs
- * Resistive Transducers
- * Inductive Transducers

Send your problem to:
Electronics Division



THE QUEENSWAY, TORONTO, 14,
ONTARIO

Going to New York for
the IRE Show? See the
equipment we handle at
the Edin Booth No. 3069

News Report

Radionics Ltd. Represents Baird-Atomic, Inc.

The appointment is announced of Radionics Limited of 8230 Mayrand Street, Montreal 9, Que., as exclusive representatives for Baird-Atomic, Inc. of 33 University Road, Cambridge 38, Massachusetts. Baird-Atomic manufactures radioactivity measurement instrumentation as well as industrial counting instrumentation.

First Adler TV Translators Approved For Canada

Following approval by the Canadian Broadcasting Company's Board of Governors at their December 6 meeting, Adler Electronics recently announced that the first UST-10 TV Translator-Transmitters for Canadian installation will be shipped within two weeks. The operation of this repeater equipment will mark the beginning of regular UHF television broadcasting in Canada.

Station CFCM-TV, Quebec City, will be repeated by the Channel 75 Translator serving Clermont, Quebec. The Channel 70 Translator at Estcourt, Quebec, will repeat CJBR-TV, Rimouski, Quebec.

Benco Television Associates, Ltd., Rexdale, Ontario, the Adler distributor for Canada, is handling both installations.

APPOINTMENT

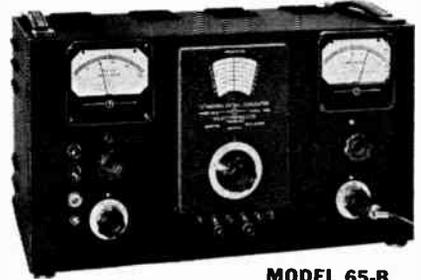


N. R. SPENCER

● The appointment of N. R. Spencer as western regional engineer of Canada Wire and Cable Company, Limited, is announced by Frank Ashworth, manager, product engineering and product control. Mr. Spencer will be located at the Vancouver sales office, 1494 Powell St., Vancouver, B.C.

MEASUREMENTS' Standard SIGNAL GENERATOR

75Kc to 30Mc



MODEL 65-B

Provides test signals for measurement of sensitivity, selectivity, overload, distortion, noise and stage gain characteristics. Meets most exacting requirements for laboratory use and production testing.

WRITE FOR BULLETIN

Laboratory Standards



MEASUREMENTS

A McGraw-Edison Division
BOONTON, NEW JERSEY

H. ROY GRAY LTD.
46 Danforth Rd., Toronto, Ont.

why wait for
delivery
TEFLON
Insulated
HOOKUP WIRE
IS IN STOCK

call WA 4-9301
write
ELECTRO SONIC
SUPPLY CO. LTD.
543 YONGE ST., TORONTO

your one stop for
all automatic
control components

For further data on advertised products use page 67.

ADCOLA

GLDUCLES LIMITED
REGD. TRADE MARK

MAKERS OF HIGH QUALITY SOLDERING INSTRUMENTS, HAND PYROMETERS, ETC.

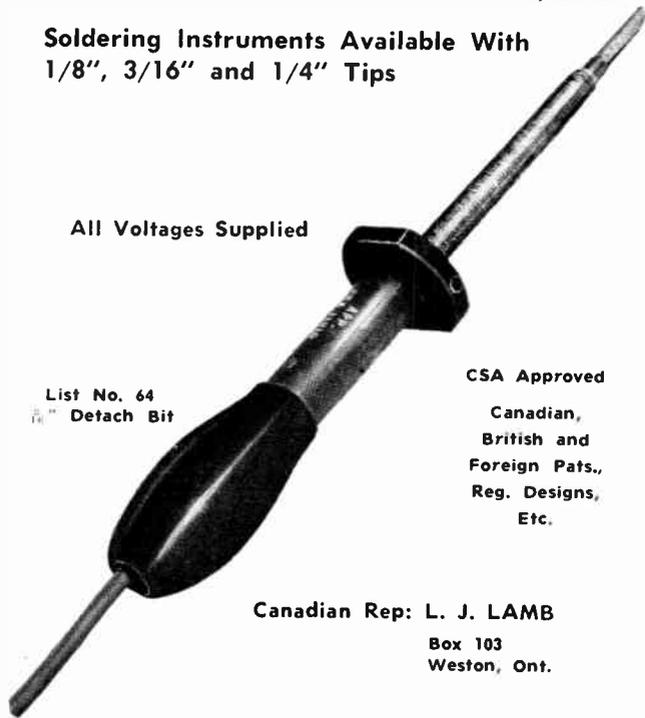
Soldering Instruments Available With 1/8", 3/16" and 1/4" Tips

All Voltages Supplied

List No. 64
1/4" Detach Bit

CSA Approved
Canadian,
British and
Foreign Pats.,
Reg. Designs,
Etc.

Canadian Rep: L. J. LAMB
Box 103
Weston, Ont.



SPECIFY Hoyt METERS

FOR
EVERY
APPLICATION



No. 647 illustrated

High-visibility 3-3/4 and 4 inch scale AC or DC Panel Meters in handsome black bakelite cases feature quick response and good damping under all conditions. For original equipment component or replacement use.

Be sure of the highest accuracy, dependability, and readability PLUS economy with HOYT precision AC and DC instruments — the complete line of Panel Meters. Moving coil, rectifier, and repulsion types available in a wide variety of sizes, ranges, cases, and colors. Also, custom-designed (including 400-800+ cycle applications) to meet your most rigid specifications for a quality instrument.

Write Export Manager — new illustrated literature contains descriptions, engineering data, and prices.



Prompt Delivery — M/A Forms mailed on day of shipment.

Service Facilities — strategically located in Canada.



ELECTRICAL INSTRUMENTS
Soles Div.: BURTON-ROGERS COMPANY
42 Carleton Street, Cambridge 42, Mass., U.S.A.

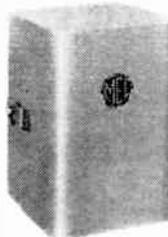
IS

Automation

YOUR PROBLEM?

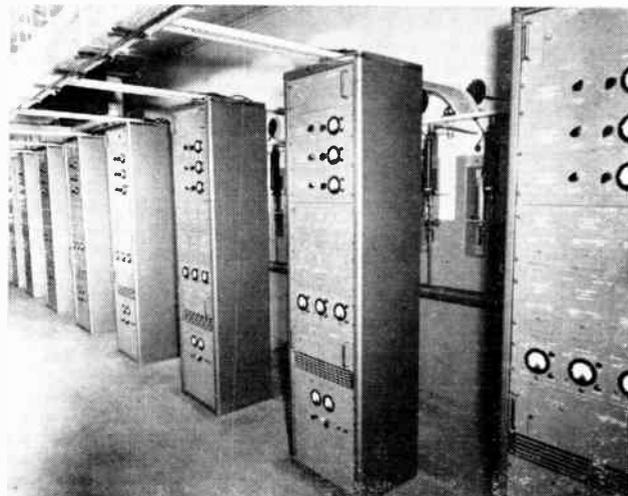
USE A MELTROL FOR YOUR

Building BLOCK



MELTROLS are available as photoelectric controls and counters, temperature controls, liquid level controls, sensitive relays, overload controls, speed relays and a wide variety of timers.

INSTRUMENTATION BY MEL



TYPICAL INDUSTRIAL INSTALLATION FOR AN OUTSTANDING CANADIAN COMPANY

MEL can supply —

Counters for production and batch counters; smoke indicators and recorders; turbidimeters; brightness meters; metal detectors; programmers; radiation monitors and controls; thickness gauges; speed feed meters and tachometers; ultrasonic cleaners; colour matching instruments; humidity controls; operation recorders; indicating instruments and recorders.

Custom built instrumentation a specialty.
Write for literature.

Measurement Engineering Ltd.

ARNPRIOR, ONTARIO. PHONE 400

Montreal, Phone RI. 8-9553
P.O. Box 189
Postal Station "O"

Toronto, Phone HI. 4-8172
P.O. Box 50
Don Mills

new

Achievement in Communications
Antenna Design!



10 DB GAIN ANTENNA

FOR 450-470 MC.

ANTENNA INTRODUCES NEW SUPPRESSOR ELEMENT CONCEPT

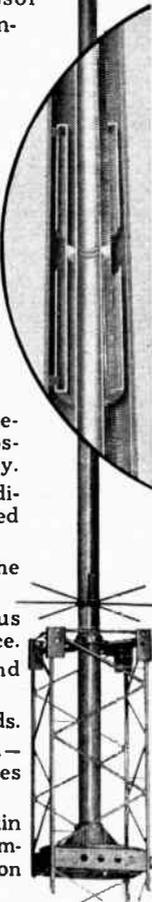
This radically new ANDREW antenna uses a single radiator, extending the full length of the antenna. Radiation occurs throughout the length, *except* at the suppressor elements. This new principle makes possible for the first time, high gain in a single feed point antenna. The simplicity of the design permits a *sectionalized* construction for easy handling and installation.

New sleeve elements suppress unwanted radiation, give new high efficiency in single feed-point design.

CHECK THESE FEATURES

- The feed system is reduced to the lowest possible degree of complexity.
- Proper radiation conditions secured with rugged low cost elements.
- One antenna covers the entire operating band.
- Freedom from serious detuning by snow and ice.
- Reliable lightning and corona protection.
- Light weight—54 pounds.
- Sectionalized design—longest section measures only 12 feet.

Write today for Bulletin No. 8442 describing complete systems installation and performance.



Andrew
ANTENNA
CORPORATION LTD.
WHITBY, ONTARIO

ANTENNAS - ANTENNA SYSTEMS - TRANSMISSION LINES



MANUFACTURED IN CANADA

News Report

Director Of Air Materiel Command

Air Vice-Marshal Clare Annis has been appointed by the R.C.A.F. to take over the direction of its Air Materiel Command at Rockcliffe, Ottawa. His training and experience, prior to, during and since World War II have adequately prepared A/V/M Annis for undertaking his task of keeping the R.C.A.F. abreast of electronic development by keeping his supply base stocked with equipment which might be required for any contingency.

R.E.T.S. Announces Advanced Technician Course

Radio Electronic Television Schools of Canada Limited announces that a new advanced technician course will be available in the near future.

This course has been created as an intermediate stage between Basic Electronics and an Electronic Engineering Course, giving all the advantages of a minimum practical training combined with a maximum of physics and mathematical theory.

Dr. Leslie Hill is Director of Education for Radio Electronic Television Schools of Canada Ltd.

K. E. Heller Appointed Sales Manager

Appointment of Karl E. Heller as sales manager for the Helipot Division of Beckman Instruments, Inc., Newport Beach (Calif.), is announced by D. C. Duncan, division general manager.

Heller, who reports directly to D. C. McNeely, assistant division manager, served as assistant sales manager of the division for the past 18 months. He joined the Beckman organization in 1955 as a product line sales manager at Helipot's Mountainside, N.J., plant. Previously,



K. E. HELLER

Heller had been area sales manager for the export division of Wallace and Tiernan, Inc., Belleville, N.J., and design engineer for General Aniline Co., Grassell, N.J.

Heller holds a degree in mechanical engineering from Rutgers University and is completing advanced studies under the National Sales Executives' graduate school of sales management and marketing program.

TELEVISION TUNERS

Switch Type
Licensee of Sarkes-Tarzian Inc.

LOUDSPEAKERS

Domestic and Military Types

WIRE WOUND RESISTORS

Cement and Vitreous Enamelled
Coatings - MIL Approved

VARIABLE TUNING CAPACITORS

Radio Tuning Types - Special
Units For Military Application

TRIMMER CAPACITORS

Conventional Air Dielectric
Glass and Ceramic
LEDEX ROTARY
SOLENOIDS AND
SELECTOR SWITCHES

PERMEABILITY TUNERS
PRECISION GEARS AND
GEAR TRAIN ASSEMBLIES
SERVO-LOOP SYSTEMS
MICROWAVE
COMPONENTS
Filters, Antennas

ALL SYSTEMS
AND
COMPONENTS
ENGINEERED

TOOLED AND
MANUFACTURED IN
OUR KITCHENER
PLANT



marsland
ENGINEERING
LIMITED
KITCHENER, ONT., CANADA

For further data on advertised products use page 67.

Varian Strip Chart Recorders

POTENTIOMETER PERFORMANCE* AT MODERATE COST



Varian G-10 — Portable for laboratory or bench use where chart accessibility is of prime importance. Base price \$340.

Varian G-11 — For panel, rack or portable use; designed for OEM, lab or field for long-term monitoring. Base price \$470.



The servo-balance potentiometer method has long been used in expensive recorders to achieve superior stability, sensitivity, ruggedness and high input impedance. Use of servo balancing systems assures full realization of these inherent advantages by providing ample power independent of the source being measured. Now Varian offers you recorders of moderate cost using this time-proven principle.

VARIAN SPECIFICATIONS:

- Spans as low as 10 mv
- Limit of error 1%
- Maximum source resistance 50K ohms or higher
- Balancing times: 1 second or 2.5 seconds on G-10; 1 second on G-11

THE
MARK OF
LEADERSHIP



VARIAN associates

OF CANADA, LTD. • GEORGETOWN, ONTARIO

KLYSTRONS, TRAVELING WAVE TUBES, BACKWARD WAVE OSCILLATORS, LINEAR ACCELERATORS, MICROWAVE SYSTEM COMPONENTS, R. F. SPECTROMETERS, MAGNETS, MAGNETOMETERS, STALOS, POWER AMPLIFIERS, GRAPHIC RECORDERS, RESEARCH AND DEVELOPMENT SERVICES

ELECTRONICS & COMMUNICATIONS, FEBRUARY, 1958

For further data on advertised products use page 67.

ANTENNA TOWERS

for TV — AMATEURS
— COMMUNICATIONS

Check these features — they're found in all Aermotor Steel Antenna Towers.

SELF-SUPPORTING — no cumbersome guy wires needed.

HEAVILY GALVANIZED AFTER FABRICATION — completely protected against rust.

EASILY ASSEMBLED

STRONG — towers safely sustain loads of 1500 lbs. — safe in winds to 85 MPH.

← **TYPE MI-98**

For TV Antenna up to 6 square feet of projected area. Heights to 100'.

TYPE MP-5 →

For Amateur Beams up to 20 square feet of projected area. Heights to 97'3".

TYPE MP-9 (Not illustrated)
Meets "RETMA" Standard TR-116 Specifications. Heights to 123'5".

TYPE MP-15 (Not illustrated)
In heights up to 149' for heavy duty radio and TV applications.

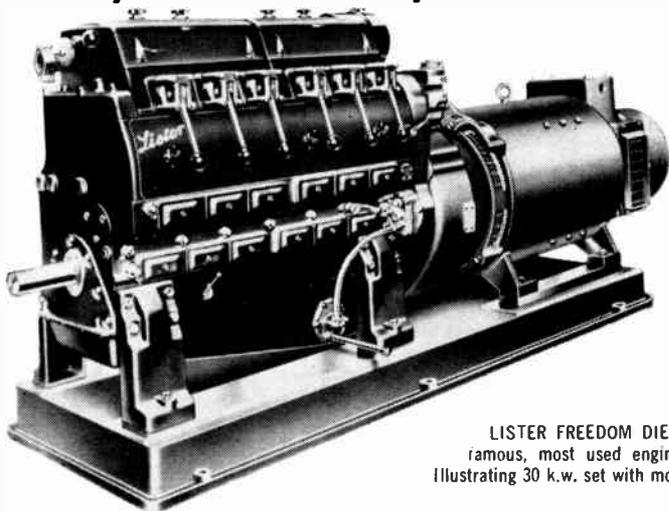
TYPE MP-29 (Not illustrated)
In heights of 40 - 80 and 100' for heavy duty Microwave Antenna applications.

Write today for complete information on Aermotor Steel Antenna Towers and an Aermotor Franchise in your territory.

AVIATION ELECTRIC
LIMITED

200 Laurentien Blvd., Montreal
Halifax • Toronto • Calgary • Vancouver

RELIABLE, LIGHTWEIGHT, PORTABLE POWER



LISTER FREEDOM DIESELS—the most famous, most used engines in industry. Illustrating 30 k.w. set with model FR6 Engine.

Built in a tradition of reliability, Lister-Blackstone engines incorporate the very latest improvements in Diesel design. The full line includes engines from 3½ to 1300 h.p. and there are models for every purpose. Ease of maintenance and economical operation are assured when you specify Lister-Blackstone. Service and spare parts are available from coast to coast.

Write us for the name of your nearest Distributor.

CANADIAN LISTER-BLACKSTONE LIMITED

1921 EGLINTON AVE. E., TORONTO 13 • 3135 WEST BROADWAY, VANCOUVER
25 ST. JAMES ST., VILLE ST. PIERRE, MONTREAL

In the U.S. — Lister-Blackstone Inc., 42-32, 21st St., Long Island City 1, N.Y.

DISTRIBUTORS: B.C. Equipment Co. Ltd., 551 Howe Street, Vancouver; Bruce Robinson Electric (Edm.) Ltd., 10056-109th Street, Edmonton; Medland Machinery Limited, 576 Wall Street, Winnipeg; Russel-Hipwell Engines Ltd., Owen Sound; Consolidated Engines & Machinery Co. Ltd., 5645 Pare Street, Town of Mount Royal, P.Q.; Russel-Hipwell Engines Ltd., 1298 Barrington Street, Halifax; Clayton Construction Co., Ltd., P.O. Box 118, Muir Bldg., St. John's, Nfld.

News Report

U.S. Tests Navigation System

An air and sea navigation system already in use over a million square miles in Eastern Canada will be evaluated in the United States by the Airways Modernization Board.

Installation of a Bendix-Decca Navigator chain in the New York area follows installation during the past year of four chains covering the area from east of Newfoundland to Montreal. Though the Canadian chains are being evaluated for both marine and air applications, emphasis on the New York chain will be for helicopter use. Evaluations operations in New York will start in the Spring. Airborne Bendix-Decca equipment will be carried on scheduled helicopter flights of New York Airways. These units will give the pilots a pictorial map presentation of their position with relation to the established tracks for the NYA routes, on a map scale as large as 850 feet to the inch. It is expected, according to the Airways Modernization Board, that this presentation will enable the pilots to navigate with pin point accuracy.

A spokesman for the Airways Modernization Board emphasized that the dramatic growth and potential of helicopter operations demands intensive effort to provide adequate navigational and air traffic control capabilities for these aircraft.

Officials of Computing Devices of Canada Limited, the firm responsible for Bendix-Decca in Canada, predict that helicopter operations will ultimately become an important use of the system in Canada, though current interest in Canada is directed more at conventional air and marine uses, and such specialized applications as forest spraying.

Objective of the New York tests is to determine to what extent a hyperbolic system will expedite helicopter operations in a high density terminal area. Bendix-Decca was selected because it is the only such system now in a state of operational readiness.

Canadian Agency Awards Contract To Servo Corp.

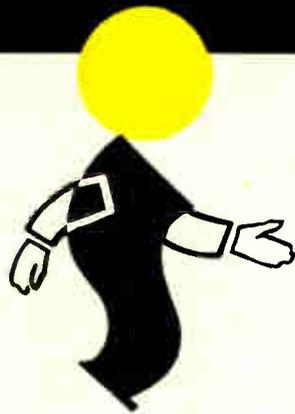
Computation of upper air winds to aid weather reporting will be facilitated by a radiotheodolite purchased by the Department of Transport of the Government of Canada from Servo Corporation of America, New Hyde Park, N.Y.

This \$33,260 instrument will be used to explore the upper atmosphere by indicating and recording elevation and azimuth angle data. The radiosonde transmitter will telemeter the temperature, humidity and pressure measurements of the air through which the radiosonde passes.

No SOLDERING TROUBLES Here!

1

Wire leads of Stackpole resistors first receive the conventional tin-lead coating before being inserted in the molds.



TOPS FOR PRINTED CIRCUITRY . . .

Ease of soldering is a "must" in printed circuitry applications. Stackpole fixed composition resistors provide it in full measure!

2

Then, as an EXTRA protective step, all leads are hot-solder dipped *after* the resistors have been formed and color-coded. Any tarnish that may have formed on the original tin-lead coating is nullified.

3

The effects of soldering heat on Stackpole resistors is negligible. Resistance change due to normal or recommended soldering is on the order of 1% . . . far less than the amount of change permitted, even by the most stringent specifications.

FAST, STOCK DELIVERIES . . .

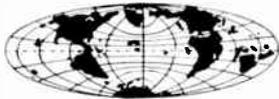
Made in Canada, by Canadians, to serve the Canadian market. 1/2-, 1-, and 2-watt molded composition types in all RETMA preferred values.

CANADIAN STACKPOLE LIMITED
550 Evans Avenue - Etobicoke, Toronto 14, Ontario.

STACKPOLE

FIXED
COMPOSITION RESISTORS

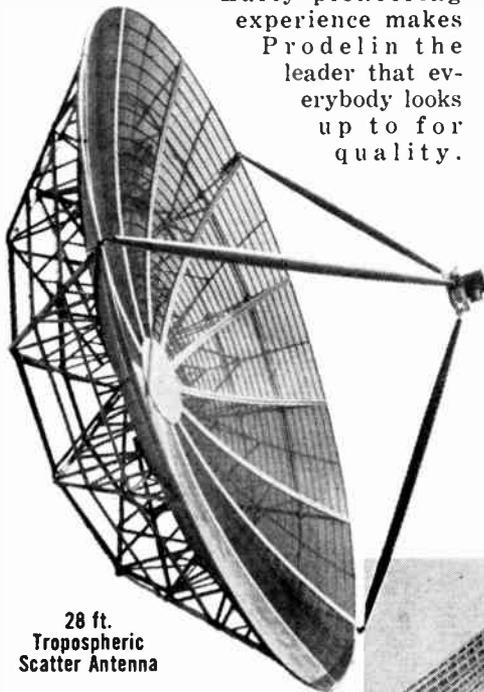
EVERYBODY looks up to Prodelin



Leading Worldwide Supplier of Parabolic Antenna Systems for Communication Services

There's much to be gained by using a Prodelin Parabolic Antenna . . . whether your application is for line-of-sight, point-to-point microwave communication, or for over-the-horizon tropospheric scatter service for long distance communications.

Early pioneering experience makes Prodelin the leader that everybody looks up to for quality.



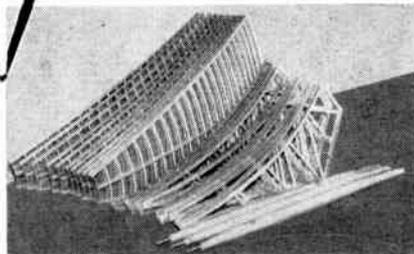
28 ft.
Tropospheric
Scatter Antenna

28 ft. antenna
knocked down for
air freight shipment

Prodelin manufactures field proved parabolic reflectors with associated feeds providing the most complete antenna line in 2, 4, 6, 8, 10, 14, 18, and 28 foot diameters for every type of communication requirement.

If there is not a stock Prodelin antenna to suit your specific needs, Prodelin will design one for you. In active service throughout the world are rugged Prodelin aluminum mesh antennas that withstand 150 mph windloads fully iced . . . economical spun aluminum reflectors for similar services . . . and the new sectionalized plastic reflectors . . . all designed for low cost, long distance transportation by land, sea, or air. Remember, a Prodelin antenna costs *less* than any other part of your system . . . and with *larger* antennas, you can achieve greater gains at lower maintenance costs!

No wonder everybody looks up to Prodelin . . . it's head-and-shoulders above the crowd.



Write today!

Get complete technical information on Prodelin Parabolic Antenna Systems including associated transmission lines and other RF network devices all terminating with industry's latest RETMA standard fittings.



307 Bergen Avenue, Kearney, N.J., Dept. EC.

News Report

C.A.E. Awarded Air Force Contract

Canadian Aviation Electronics Ltd. in Montreal has received a contract from the RCAF for the design, development and manufacture of an Operational Flight Trainer for the giant aircraft built by Canadair. The Trainer will familiarize the Argus crew while on the ground with the operation and characteristics of the engines and aircraft in flight, which will result in more efficient training at reduced cost. At the same time, Canadian Aviation Electronics Ltd. will also make a design study for a Tactical Procedure Trainer for the training of the air crew in the use of the CL-28's complicated radar and weapons system.

The company has previously produced flight simulators for the RCAF's CF-100 All-Weather Interceptor. Recently it completed manufacture of the first commercial simulator to be built in Canada. This was the DC-6B passenger airliner simulator ordered by C.P.A.

Zenith Radio Corp. Forms New Division

As part of an extensive expansion program, Zenith Radio Corporation of Canada Ltd. recently announced formation of a radio-TV-electronics division and the appointment of Lloyd B. Kiely as the division's general manager. Announcement was made by Hugh Robertson, executive vice-president of the Canadian corporation and of the parent organization, Zenith Radio Corporation of Chicago.

The new division, from headquarters now being established by Mr. Kiely in Toronto, will franchise independent distributors to sell Zenith radios, television receivers, phonographs and high-fidelity instruments to dealers in the provinces of Nova Scotia, Newfoundland, Prince Edward Island, New Brunswick, Manitoba, Saskatchewan, Alberta and British Columbia. Distribution to dealers in Ontario and Quebec will be handled by the division itself, Mr. Robertson said.



L. B. KIELY

Mr. Kiely, who is a native of Toronto, has been engaged in the radio, television and appliance business for almost twenty years in Canada and has a wealth of experience at the managerial level in merchandising, sales promotion, sales training, advertising agency direction and allied fields.

For further data on advertised products use page 67.

INDEX TO ADVERTISERS

Page number is on the right. Key number for use with READER SERVICE CARDS is on the left.

Key No.		Page No.
1.	Adcola Products Ltd.	61
2.	Alliance Motors	54
3.	Amphenol Canada Ltd.	2
4.	Andrew Antenna Corp. Ltd.	62
5.	Automatic Electric Sales (Canada) Ltd.	39
6.	Automatic Electric Sales (Canada) Ltd.	40-41
7.	Automatic Electric Sales (Canada) Ltd.	42
8.	Aviation Electric Ltd.	64
9.	Aviation Electric Ltd.	76
10.	Bach-Simpson Ltd.	16
11.	Burndy Canada Ltd.	6
12.	Burton-Rodgers Co.	61
13.	Canadian Lister-Blackstone Ltd.	64
14.	Canadian Marconi Co.	3
15.	Canadian Stackpole Ltd.	65
16.	Canadian Westinghouse Co. Ltd.	4
17.	Cannon Electric (Canada) Ltd.	14
18.	Central Bridge Co. Ltd.	13
19.	Centralab Canada Ltd.	74
20.	Cherry Electrical Products Corp.	57
21.	Computing Devices of Canada Ltd.	17
22.	Control Products Inc.	72
23.	Daven Co., The	53
24.	Daystrom Ltd.	20
25.	Eitel-McCullough, Inc.	23
26.	Electric Chain Co. of Canada Ltd., The	8
27.	Electro Sonic Supply Co. Ltd.	56
28.	Electro Sonic Supply Co. Ltd.	60
29.	Engelhard Industries of Canada Ltd.	22
30.	Ericsson Telephone Sales of Canada Ltd.	69
31.	General Radio Co.	78
32.	Hammond Mfg. Co. Ltd.	57
33.	Helipot Corp.	77
34.	Hewlett-Packard Co.	9
35.	Magnetics Inc.	18
36.	Marsland Engineering Ltd.	62
37.	Measurements Corp.	60
38.	Measurement Engineering Ltd.	61
39.	Moloney Electric Co. of Canada Ltd.	57
40.	Muirhead & Co. Ltd.	71

(Continued overleaf)

ATTENTION CIRCULATION MANAGER

Please ADD my name to the mailing list for **ELECTRONICS & COMMUNICATIONS** (no obligation).

My Name
(Please print)

Mail copies to my home, or business address as noted below.

Street

City Prov.

If you have recently **CHANGED** your address for receiving copies of **E & C** please note former address here:

Company Nature of Business

Signature Position
2-58 (For card to be valid it must be completed in full, including signature)

PLEASE SEND FURTHER INFORMATION ON THE FOLLOWING NEW PRODUCT ITEMS AS NUMBERED BELOW — USE PRODUCT ITEM NUMBERS

- | | | | | | | | | | |
|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| <input type="checkbox"/> 1853 | <input type="checkbox"/> 1854 | <input type="checkbox"/> 1855 | <input type="checkbox"/> 1856 | <input type="checkbox"/> 1857 | <input type="checkbox"/> 1858 | <input type="checkbox"/> 1859 | <input type="checkbox"/> 1860 | <input type="checkbox"/> 1861 | <input type="checkbox"/> 1862 |
| <input type="checkbox"/> 1863 | <input type="checkbox"/> 1864 | <input type="checkbox"/> 1865 | <input type="checkbox"/> 1866 | <input type="checkbox"/> 1867 | <input type="checkbox"/> 1868 | <input type="checkbox"/> 1869 | <input type="checkbox"/> 1870 | <input type="checkbox"/> 1871 | <input type="checkbox"/> 1872 |
| <input type="checkbox"/> 1873 | <input type="checkbox"/> 1874 | <input type="checkbox"/> 1875 | <input type="checkbox"/> 1876 | <input type="checkbox"/> 1877 | <input type="checkbox"/> 1878 | <input type="checkbox"/> 1879 | <input type="checkbox"/> 1880 | <input type="checkbox"/> 1881 | <input type="checkbox"/> 1882 |
| <input type="checkbox"/> 1883 | <input type="checkbox"/> 1884 | <input type="checkbox"/> 1885 | <input type="checkbox"/> 1886 | <input type="checkbox"/> 1887 | <input type="checkbox"/> 1888 | <input type="checkbox"/> 1889 | <input type="checkbox"/> 1890 | <input type="checkbox"/> 1891 | <input type="checkbox"/> 1892 |

PLEASE SEND FURTHER INFORMATION ON THE FOLLOWING ADVERTISEMENTS AS NUMBERED BELOW — USE KEY NUMBER

- | | | | | | | | | | | | |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 | <input type="checkbox"/> 7 | <input type="checkbox"/> 8 | <input type="checkbox"/> 9 | <input type="checkbox"/> 10 | <input type="checkbox"/> 11 | <input type="checkbox"/> 12 |
| <input type="checkbox"/> 13 | <input type="checkbox"/> 14 | <input type="checkbox"/> 15 | <input type="checkbox"/> 16 | <input type="checkbox"/> 17 | <input type="checkbox"/> 18 | <input type="checkbox"/> 19 | <input type="checkbox"/> 20 | <input type="checkbox"/> 21 | <input type="checkbox"/> 22 | <input type="checkbox"/> 23 | <input type="checkbox"/> 24 |
| <input type="checkbox"/> 25 | <input type="checkbox"/> 26 | <input type="checkbox"/> 27 | <input type="checkbox"/> 28 | <input type="checkbox"/> 29 | <input type="checkbox"/> 30 | <input type="checkbox"/> 31 | <input type="checkbox"/> 32 | <input type="checkbox"/> 33 | <input type="checkbox"/> 34 | <input type="checkbox"/> 35 | <input type="checkbox"/> 36 |
| <input type="checkbox"/> 37 | <input type="checkbox"/> 38 | <input type="checkbox"/> 39 | <input type="checkbox"/> 40 | <input type="checkbox"/> 41 | <input type="checkbox"/> 42 | <input type="checkbox"/> 43 | <input type="checkbox"/> 44 | <input type="checkbox"/> 45 | <input type="checkbox"/> 46 | <input type="checkbox"/> 47 | <input type="checkbox"/> 48 |
| <input type="checkbox"/> 49 | <input type="checkbox"/> 50 | <input type="checkbox"/> 51 | <input type="checkbox"/> 52 | <input type="checkbox"/> 53 | <input type="checkbox"/> 54 | <input type="checkbox"/> 55 | <input type="checkbox"/> 56 | <input type="checkbox"/> 57 | <input type="checkbox"/> 58 | <input type="checkbox"/> 59 | <input type="checkbox"/> 60 |

Name Position

Company Nature of Business

Company Address City Prov.
2-58

PLEASE SEND FURTHER INFORMATION ON THE FOLLOWING NEW PRODUCT ITEMS AS NUMBERED BELOW — USE PRODUCT ITEM NUMBERS

- | | | | | | | | | | |
|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|-------------------------------|
| <input type="checkbox"/> 1853 | <input type="checkbox"/> 1854 | <input type="checkbox"/> 1855 | <input type="checkbox"/> 1856 | <input type="checkbox"/> 1857 | <input type="checkbox"/> 1858 | <input type="checkbox"/> 1859 | <input type="checkbox"/> 1860 | <input type="checkbox"/> 1861 | <input type="checkbox"/> 1862 |
| <input type="checkbox"/> 1863 | <input type="checkbox"/> 1864 | <input type="checkbox"/> 1865 | <input type="checkbox"/> 1866 | <input type="checkbox"/> 1867 | <input type="checkbox"/> 1868 | <input type="checkbox"/> 1869 | <input type="checkbox"/> 1870 | <input type="checkbox"/> 1871 | <input type="checkbox"/> 1872 |
| <input type="checkbox"/> 1873 | <input type="checkbox"/> 1874 | <input type="checkbox"/> 1875 | <input type="checkbox"/> 1876 | <input type="checkbox"/> 1877 | <input type="checkbox"/> 1878 | <input type="checkbox"/> 1879 | <input type="checkbox"/> 1880 | <input type="checkbox"/> 1881 | <input type="checkbox"/> 1882 |
| <input type="checkbox"/> 1883 | <input type="checkbox"/> 1884 | <input type="checkbox"/> 1885 | <input type="checkbox"/> 1886 | <input type="checkbox"/> 1887 | <input type="checkbox"/> 1888 | <input type="checkbox"/> 1889 | <input type="checkbox"/> 1890 | <input type="checkbox"/> 1891 | <input type="checkbox"/> 1892 |

PLEASE SEND FURTHER INFORMATION ON THE FOLLOWING ADVERTISEMENTS AS NUMBERED BELOW — USE KEY NUMBER

- | | | | | | | | | | | | |
|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| <input type="checkbox"/> 1 | <input type="checkbox"/> 2 | <input type="checkbox"/> 3 | <input type="checkbox"/> 4 | <input type="checkbox"/> 5 | <input type="checkbox"/> 6 | <input type="checkbox"/> 7 | <input type="checkbox"/> 8 | <input type="checkbox"/> 9 | <input type="checkbox"/> 10 | <input type="checkbox"/> 11 | <input type="checkbox"/> 12 |
| <input type="checkbox"/> 13 | <input type="checkbox"/> 14 | <input type="checkbox"/> 15 | <input type="checkbox"/> 16 | <input type="checkbox"/> 17 | <input type="checkbox"/> 18 | <input type="checkbox"/> 19 | <input type="checkbox"/> 20 | <input type="checkbox"/> 21 | <input type="checkbox"/> 22 | <input type="checkbox"/> 23 | <input type="checkbox"/> 24 |
| <input type="checkbox"/> 25 | <input type="checkbox"/> 26 | <input type="checkbox"/> 27 | <input type="checkbox"/> 28 | <input type="checkbox"/> 29 | <input type="checkbox"/> 30 | <input type="checkbox"/> 31 | <input type="checkbox"/> 32 | <input type="checkbox"/> 33 | <input type="checkbox"/> 34 | <input type="checkbox"/> 35 | <input type="checkbox"/> 36 |
| <input type="checkbox"/> 37 | <input type="checkbox"/> 38 | <input type="checkbox"/> 39 | <input type="checkbox"/> 40 | <input type="checkbox"/> 41 | <input type="checkbox"/> 42 | <input type="checkbox"/> 43 | <input type="checkbox"/> 44 | <input type="checkbox"/> 45 | <input type="checkbox"/> 46 | <input type="checkbox"/> 47 | <input type="checkbox"/> 48 |
| <input type="checkbox"/> 49 | <input type="checkbox"/> 50 | <input type="checkbox"/> 51 | <input type="checkbox"/> 52 | <input type="checkbox"/> 53 | <input type="checkbox"/> 54 | <input type="checkbox"/> 55 | <input type="checkbox"/> 56 | <input type="checkbox"/> 57 | <input type="checkbox"/> 58 | <input type="checkbox"/> 59 | <input type="checkbox"/> 60 |

Name Position

Company Nature of Business

Street City Prov.
2-58

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in Canada

5c POSTAGE WILL BE PAID BY

ELECTRONICS AND COMMUNICATIONS

31 - 35 Willcocks Street

Toronto 5, Ontario



BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in Canada

5c POSTAGE WILL BE PAID BY

ELECTRONICS AND COMMUNICATIONS

31 - 35 Willcocks Street

Toronto 5, Ontario



BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in Canada

5c POSTAGE WILL BE PAID BY

ELECTRONICS AND COMMUNICATIONS

31 - 35 Willcocks Street

Toronto 5, Ontario



INDEX TO ADVERTISERS

(Continued)

Key No.		Page No.
41.	Narda Corp., The	75
42.	Nichols Ltd., R. H.	58
43.	Ohmite Mfg. Co.	10
44.	Phillips Electrical Co. Ltd.	21
45.	Prodelin, Inc.	66
46.	Radio Communications Equipment & Engineering Ltd.	73
47.	Rogers Majestic Electronics Ltd.	19
48.	Stark Electronic Instruments Ltd.	53
49.	Stark Electronic Instruments Ltd.	58
50.	Soundmaster Equipments	54
51.	Tektronix, Inc.	70
52.	Telephone Mfg. Co. Ltd.	55
53.	Topping Electronics Ltd., F. V.	54
54.	Tung-Sol Electric Inc.	59
55.	Varian Associates of Canada Ltd.	63
56.	Ward Leonard of Canada Ltd.	55
57.	Welwyn Canada Ltd.	56
58.	Wickman Ltd., A. C.	60

**ACTIVE
CIRCULATION**

It costs us a lot of active dollars annually to keep our circulation lists up-to date and it's important enough to us that we have them audited every year by CCAB (Canadian Circulations Audit Board Inc.).

Advertisers trust CCAB audited figures so we get more advertisers and YOU get the high standard of editorial you have always wanted to read.

**ELECTRONICS and
COMMUNICATIONS**

is a



audited publication

News Report

Canadian Licensee For Du Mont TV Receivers

An exclusive license to manufacture and sell Du Mont television receivers, high fidelity phonographs, and radios in the Dominion of Canada has been executed with Electrical Products Manufacturing Co., Ltd. of Mount Royal, Quebec, according to Ernest A. Marx, director of the International Division of Allen B. Du Mont Laboratories, Inc. and vice-president of Du Mont Television and Electronics, Ltd. of Canada.

Electrical Products Manufacturing Company is a long established electronic manufacturer and marketer in Canada and was first established in 1945. It is headed by Myer F. Pollock, president and Samuel Sokoloff, secretary and treasurer. The company occupies a newly completed mechanized 100,000 sq. ft. plant at 5785 Paré St. in Mount Royal.

Bogen-Presto Expands Sales Representation

David Bogen Co. and Presto Recording Corp., Divisions of the Siegler Corporation, have announced the appointment of exclusive sales representatives in Canada.

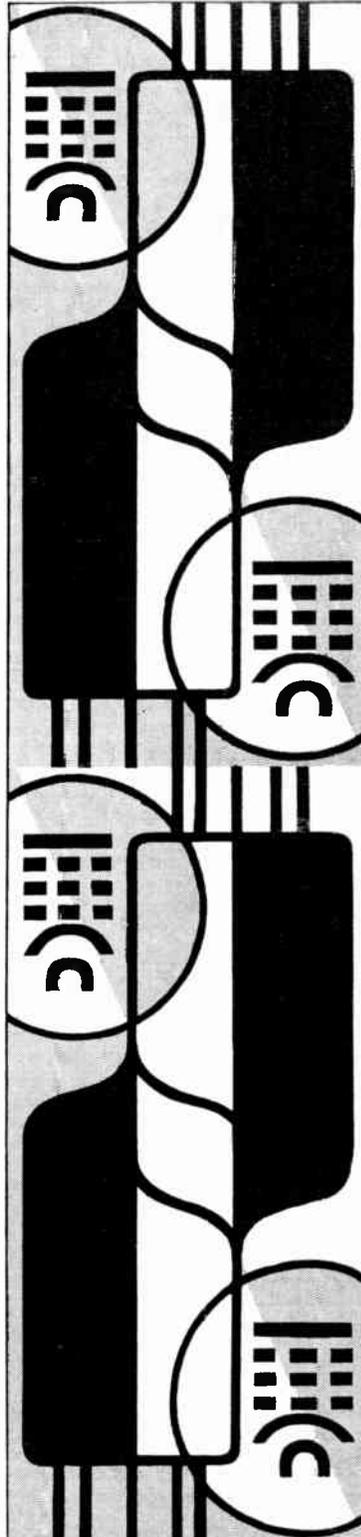
Charles L. Thompson, Ltd., 3093 Woodbine Drive, Vancouver, B.C., will cover the entire western half of Canada, including Manitoba, Saskatchewan, Alberta, and British Columbia.

A.P.E.O. President



C. T. CARSON

● Charles Terry Carson, P.Eng., of Windsor is the 1958 president of the Association of Professional Engineers. He succeeds John H. Fox of Toronto. Mr. Carson is vice-president and production manager of Hiram Walker & Sons Ltd., Walkerville, Ontario.



AVAILABLE FROM STOCK!

L M ERICSSON

MINIATURE, LONG-LIFE
ELECTRONIC TUBES

- 10,000 hours warranty with much higher life expectancy far most types.
- Mechanical properties far superior to international standards.
- Ruggedized and specially tested for stability, vibration output, glass strain, etc.

some of the Ericsson tubes now available:

TWIN TRIODES

2C51/396A, 407A, 5842/417A

H.F. PENTODES

5590/401A, 5591/403B,
5847/404A, 6028/408A

POWER AMPLIFIER PENTODES

6760, 6761, 6AQ5L, etc.

- For complete Electronic Tube Data Sheets, sign and mail this coupon with your letterhead today!

ERICSSON

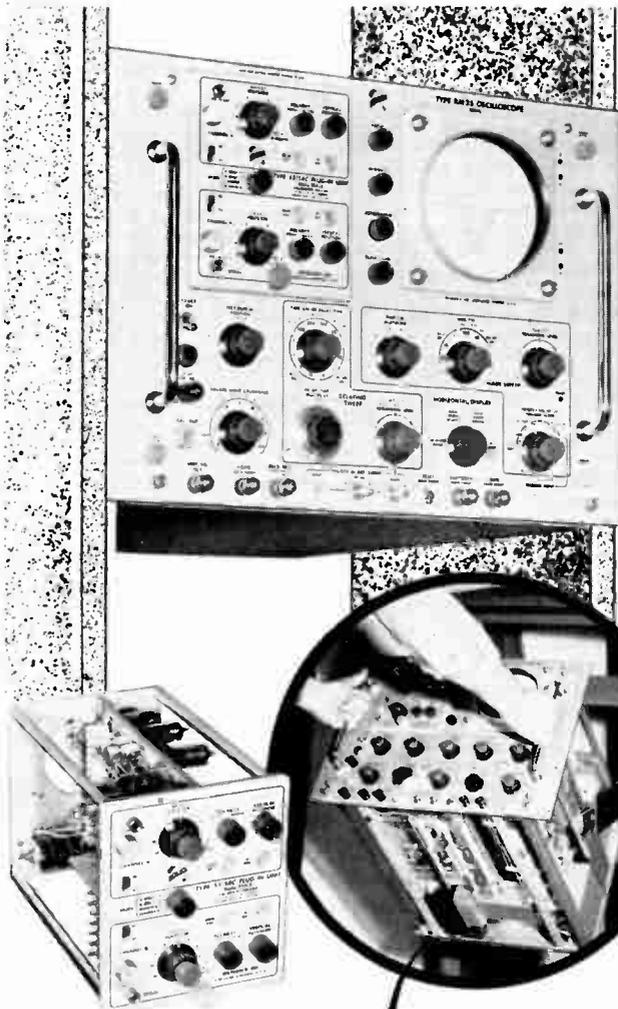
TELEPHONE SALES
OF
CANADA LIMITED

ERICSSON TELEPHONE SALES OF CANADA LIMITED

MONTREAL: 130 Bates Road — REgent 1-6428

Please send data sheets on your long-life electronic tubes to:

Name: _____



5 NEW RACK-MOUNTING OSCILLOSCOPES

all
with the Tektronix
Plug-In Feature

These five new compact rack-mounting oscilloscopes offer the unmatched performance and versatility of their bench-type counterparts, having corresponding electrical characteristics. The cabinets of the rack-mounting models mount in a standard instrument rack, with chassis supported on slide-out tracks. Chassis can be pulled forward, tilted, and locked in any of seven positions for servicing convenience. All five have the same dimensions: 14" high, 19" wide, 22½" rack depth, 24" overall depth. All ten Type 53/54 Plug-In Units can be used in the vertical-deflection systems of these five new oscilloscopes.

Plug-In Units

TYPE 53/54K Fast-Rise DC Unit \$125
TYPE 53/54L Fast-Rise High-Gain Unit 185
TYPE 53/54C Dual-Trace DC Unit 275
TYPE 53/54H Wide-Band High Gain DC Unit	175
TYPE 53/54G Wide-Band Differential DC Unit	175
TYPE 53/54D High-Gain Differential DC Unit	145
TYPE 53/54E Low-Level Differential AC Unit	165
TYPE 53/54B Wide-Band High-Gain Unit	... 125
TYPE 53/54A Wide-Band DC Unit 85
TYPE 53/54T Time-Base Unit 225
TYPE 53/54R Transistor Risetime Measurement Unit (to be available soon)	
All prices f.o.b. Portland, Oregon	

TYPE RM45

Electrically identical to Type 545

DC to 30 MC, 0.012- μ sec risetime with fast-rise plug-in units.

0.02 μ sec/cm to 5 sec/cm calibrated sweep rates.

Sweep Delay—calibrated, 1 μ sec to 0.1 sec. (other delay ranges available on special order).

Signal Delay—0.2 μ sec.

10-KV Accelerating Potential

Calibrator—0.2 mv to 100 v.

Electronically-Regulated Power Supplies

Price, without plug-in units \$1550

TYPE RM35

Electrically identical to Type 535

DC to 11 MC, 0.031- μ sec risetime with fast-rise plug-in units.

0.02 μ sec/cm to 5 sec/cm calibrated sweep rates.

Sweep Delay—calibrated, 1 μ sec to 0.1 sec. (other delay ranges available on special order).

Signal Delay—0.25 μ sec.

10-KV Accelerating Potential

Calibrator—0.2 mv to 100 v.

Electronically-Regulated Power Supplies

Price, without plug-in units \$1400

TYPE RM41

Electrically identical to Type 541

The Type RM41 is also electrically the same as the Type RM45, except that it is without provision for sweep delay.

Price, without plug-in units \$1245

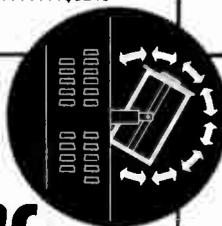
TYPE RM31

Electrically identical to Type 531

The Type RM31 is also electrically the same as the Type RM35, except that it is without provision for sweep delay.

Price, without plug-in units \$1095

Tilt forward-backward
for easy access.



TYPE RM32

Electrically identical to Type 532

DC to 5 MC, 0.07- μ sec risetime with wide-band plug-in units.

0.2 μ sec/cm to 5 sec/cm calibrated sweep rates.

4-KV Accelerating Potential

Calibrator—0.2 mv to 100 v.

Electronically-Regulated Power Supplies

Price, without plug-in units \$925

FIELD OFFICE IN CANADA

TEKTRONIX, INC.
3 Finch Avenue, East
WILLOWDALE, ONTARIO
Phone: Toronto, Baldwin 5-1138

Tektronix, Inc.

P. O. Box 831 • Portland 7, Oregon

Phone CYPRESS 2-2611 • TWX-PD 311 • Cable: TEKTRONIX

For further data on advertised products use page 67.

Book Review

Quantum Mechanics (Second Edition) by F. Mandl of the Atomic Energy Research Establishment, Harwell, Berks, England.

In this second edition of Quantum Mechanics the approach and scope of the first edition have not been altered. In particular, no attempt has been made to deal more comprehensively with standard applications of quantum mechanics which are treated well in existing textbooks. However, following several suggestions, two new topics are included: a section on partial wave analysis in scattering theory and a new chapter at the end of the book is devoted to the Dirac equation. This contains a discussion of the relativistic invariance of the theory which underlies the construction of interactions in beta-decay and field theories generally. In this chapter some knowledge of the special theory of relativity is pre-supposed on the part of the reader. In addition, a number of smaller changes and corrections have been incorporated. Of these the author specially mentions the re-definition of spherical harmonics (section 13) so that their phases now agree with those used almost exclusively in angular momentum problems.

Quantum Mechanics is published by Butterworth & Co. (Canada) Ltd., 1367 Danforth Avenue, Toronto 6, Ontario, contains 267 pages, hard cover bound, price \$7.00.

Installing Electronic Data Processing Systems by Richard G. Canning.

This new book deals with the important, high-cost aspects of installing electronic data processing systems. It covers the significant questions of fitting EDP (Electronic Data Processing) into the organization, selecting and training EDP personnel, programming, physical installation of the system, and the early phases of operation.

The volume tells what the important and expensive factors are for installing EDP systems, and shows how costs can be controlled effectively, based on actual cases. Studies of a number of companies in dissimilar fields have been synthesized into a single case history.

It is written in non-technical language and assumes that the reader is relatively unacquainted with electronic computers.

Installing Electronic Data Processing Systems is published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N.Y., contains 193 pages, hard cover bound, price \$6.00.

Handbook Of Basic Circuits TV - FM - AM by Matthew Mandl, Lecturer in Electronics and Television at Temple University's Technical Institute.

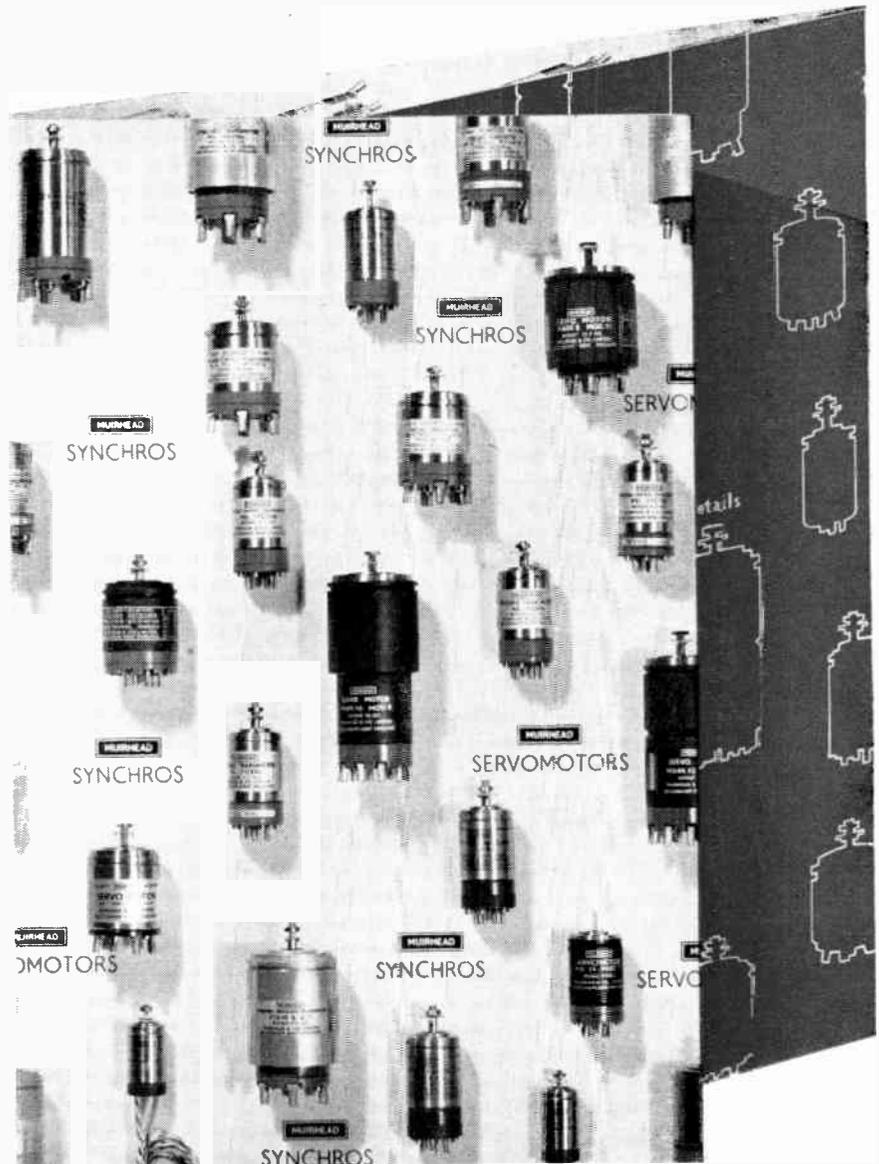
This volume has been prepared by the author to meet a long-felt need often expressed to him by students, instructors, technicians and engineers who have sought a single book that gives complete coverage of the various circuits found in television, radio and other applications of electronics.

The essential data on virtually every different type of circuit encountered in radio, television and audio will be found for the first time within a single volume.

One hundred and thirty-six circuits, representative of the different kinds of circuits used in the reception and transmission of television, frequency modulation, and amplitude modulation, were selected for inclusion in the book. Because many basic circuits are common to other branches of electronics, illustrations and descriptions in the volume are also applicable to such diversified fields as industrial and commercial electronics and to high-fidelity and public-address systems.

Handbook Of Basic Circuits TV - FM - AM is published by Brett-Macmillan Ltd., 25 Hollinger Road, Toronto 16, Ontario, contains 365 pages, hard cover bound, price \$7.50.

(Continued on page 72)



THE NEW MUIRHEAD SYNCHRO BROAD SHEET

This Broad Sheet presents the salient characteristics of Muirhead Synchros, Servomotors, Resolvers and Tachogenerators in production. The information is arranged for easy reference, and forms a useful key to the more detailed information contained in the Muirhead Synchro Data Sheets.

A MUST FOR ALL DESIGNERS

Write for a copy today!

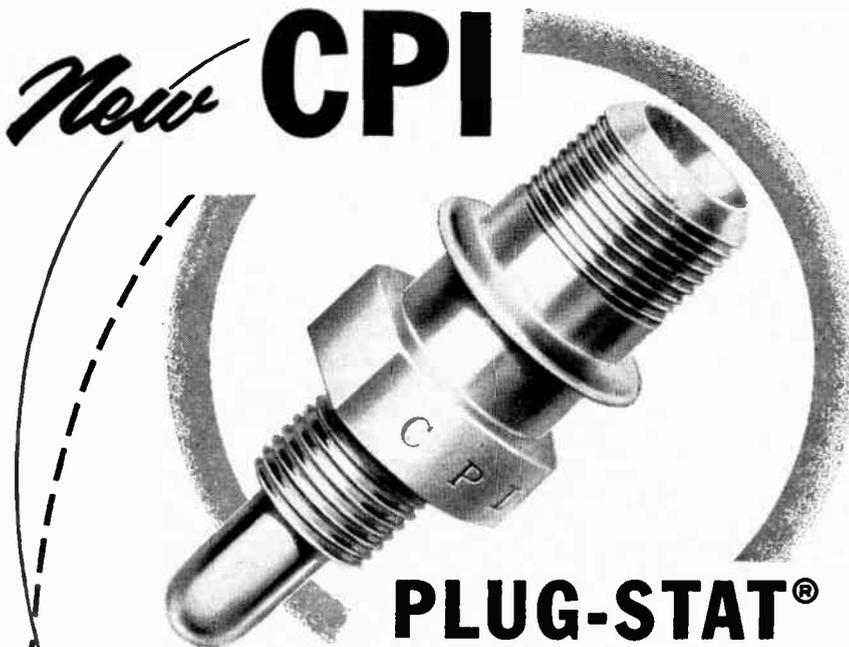
Additions to the range of Muirhead Synchros are listed in 'Technique', a quarterly journal of instrument engineering for scientists, research workers, engineers and technicians. 'Technique' is available on request.

MUIRHEAD

MUIRHEAD INSTRUMENTS LIMITED

STRATFORD · ONTARIO · CANADA Telephone: 3717 & 3718

323/3Ca



TWO WIRE HERMETICALLY-SEALED

- NO DRIFT
- RUGGED
- CLEAN MAKE AND BREAK

Extreme shock, vibration and other severe environmental conditions will not affect the precise thermal indication of this new CPI hermetically-sealed thermal sensing switch. The new Plug-Stat® is a two-wire, rugged unit with stainless steel welded body and special alloy contacts that make and break *fast* and *clean* at set limits *without drift of calibration.*

This new Plug-Stat® operates accurately in environmental temperatures from minus 65°F. to plus 700°F. and is capable of a 200°F. overshoot from the specified operating temperature. Calibration temperature range from minus 20°F. to plus 700°F. is factory set to a specified tolerance and sealed.

Where you require an extremely sensitive response to high or low temperatures, this new non-drift thermal switch will fit your needs.

Ask about the SINGLE-WIRE PLUG-STAT®, too



Another in the CPI family of thermal switches is this single-wire Plug-Stat® for applications where required temperature range limits are minus 20°F. to plus 600°F.

Write now for complete engineering data.
Ask for Catalog EI.

Control products, inc.

HARRISON, N. J.

For further data on advertised products use page 67.

Book Review

(Continued from page 71)

Transistor Electronics by David DeWitt and Arthur L. Rossoff.

This book gives the reader a thorough understanding of the properties of the transistor and its underlying physical mechanisms. Step-by-step, it brings the practising or beginning engineer a valuable working knowledge of quantitative transistor circuit design, based on a sound understanding of the internal workings of the transistor device. It assures useful design accuracy without requiring a prior knowledge of quantum mechanics.

Early chapters deal with semiconductor physics. They touch lightly upon quantum mechanics, energy band theory, and Fermi statistics, and provide a clear, complete picture of important semiconductor processes.

Later chapters provide a practical and up-to-date explanation of the transistor device, incorporating all reasonable approximations and relative device properties to physical theory.

The book grew out of a weekly series of tutorial lectures on the theory and application of transistors given by the authors when they were, respectively, Manager and Chief Applications Engineer of the Semiconductor Division of the Radio Receptor Company, for the benefit of its technical personnel.

Transistor Electronics is published by McGraw-Hill Company of Canada Limited, 253 Spadina Road, Toronto 4, Ontario, contains 381 pages, hard cover bound, price \$9.60.

Elements Of Mathematics For Radio, Television And Electronics by Bernhard Fischer and Herbert Jacobs.

This work is designed to serve as a methodical course in basic mathematics for students in radio, television and allied electronic fields.

The authors begin with the simplest arithmetic and show how the easy, basic mathematical procedures are used in increasingly complex calculations. They clearly explain each new step; give worked-out examples and many practice exercises in its use; and then show how it is applied to the everyday problems of radio, radar, television, and electronics.

The authors have included a number of technical topics not ordinarily found in radio mathematics texts, such as resistance and capacitance color codes, radio hardware, television channel allocations, physical dimensions of radio parts, preferred values of resistors and condensers, tube characteristics, television test patterns, time constants, temperature coefficients, wave traps, high-voltage probes, oscilloscopy, meter loading, television sweep circuits and radio business mathematics. These topics are in addition to the conventional subjects of electron-tube circuits, power supplies, a.c. and d.c. circuits, Ohm's law, Kirchoff's law and decibels.

Elements Of Mathematics For Radio, Television And Electronics is published by Brett-Macmillan Ltd., 25 Hollinger Road, Toronto 16, Ontario, contains 569 pages, hard cover bound, price \$6.95.

Use Your . . .

ELECTRONICS and COMMUNICATIONS

DIRECTORY and

BUYERS' GUIDE

IT IS VALUABLE!

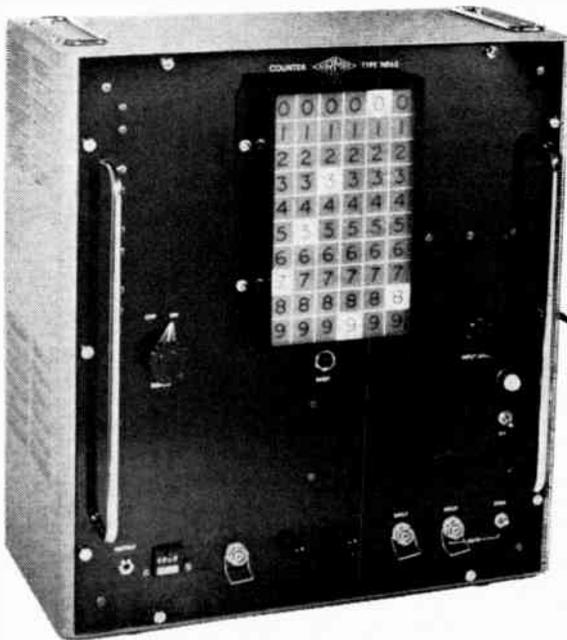


ELECTRONIC INSTRUMENTS

H. F. Wave Analyser

- Range: 30 Kc/s to 30 mc/s in seven bands.
- Frequency Calibration Accuracy $\pm 1\%$.
- H.F. - L.F. Coarse and L.F. Fine Attenuators with ranges from 0 to 60 db in 10 db steps, accuracy $\pm .1$ db in each step.
- Use it also as:

Selective Voltmeter
Transmission Measuring Set
Field Strength Meter
Bridge Detector
Heterodyne Wave Meter



Descriptive folders, catalog and specification sheets on request from

Electronic Counter

- Maximum Counting Speed:
1 million per second.
- Large, brilliant digit display.
- Range of Indication:
Up to 9,999 million.
- Input Signal Amplitude:
1.5 to 50 V.

Other products include:

Time & Frequency Meters	Electronic Batch Counters
Frequency Standards	Photocell Controls
Ionisation Testers	Temperature & Level Controls
Oscillators	Radio & TV Servicing Equipment
Signal Generators	
Electronic Tachometers	



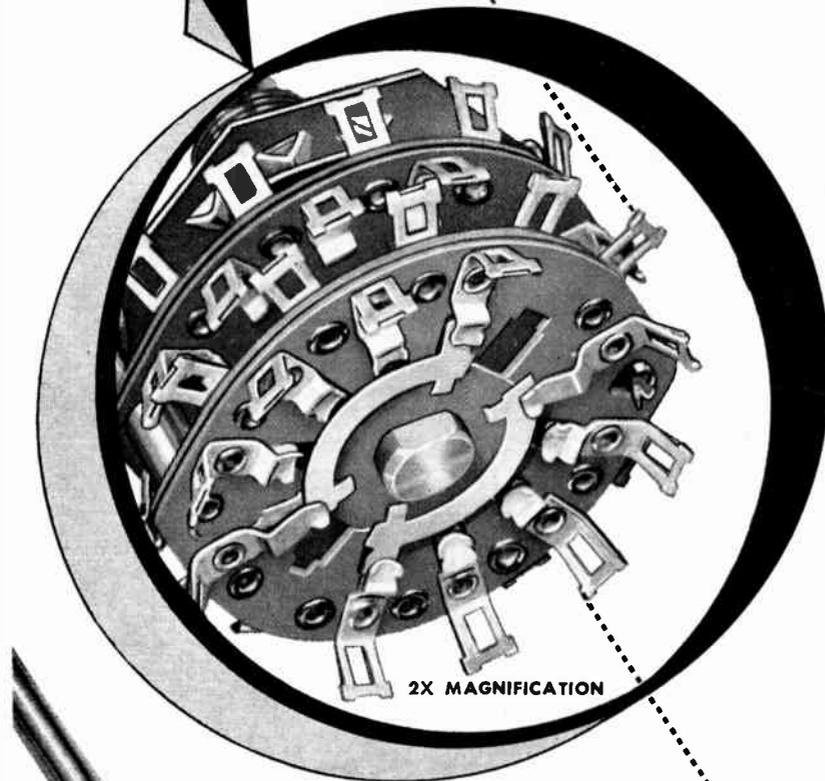
RADIO COMMUNICATIONS EQUIPMENT & ENGINEERING Ltd.

475 METROPOLITAN BLVD. • MONTREAL 32

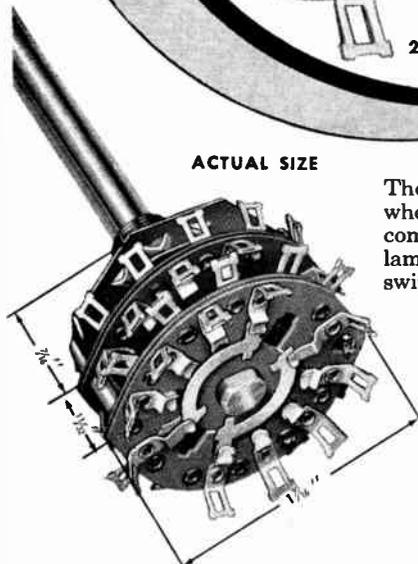
Economy and Quality with

NEW 22 Circuit **Centralab**®

MINIATURE SWITCHES



2X MAGNIFICATION



ACTUAL SIZE

These new switches are designed for application where costs must be kept to a minimum without compromising rigid electrical specifications. New laminated construction allows up to 22 separate switch points on a 1 $\frac{1}{16}$ " diameter.

- Voltage breakdown, 1000 volts R.M.S. Back to back insulated clips, 500 volts R.M.S. Laminated phenolic sections type PBE per specifications MIL-P-3115.
- Current rating 2 amp. at 15 volts DC; 150 milliamps at 110 volts AC (resistive load).
- Minimum life, 10,000 cycles.
- Supplied as single section, double section, or single section with line switch. 2-12 positions per switch.
- AC line switches for single section units in SPST, DPST and SPDT switching arrangements.

For detailed specifications, write for Bulletin EP-90 or contact your Centralab representative.

P-5808

Centralab Canada Ltd. 804 MT. PLEASANT ROAD
TORONTO 12, ONTARIO
Affiliated: CENTRALAB • MILWAUKEE 1, WISCONSIN

VARIABLE RESISTORS • SWITCHES • PACKAGED ELECTRONIC CIRCUITS
CERAMIC CAPACITORS • ENGINEERED CERAMICS • SEMI-CONDUCTOR PRODUCTS

Book Review

(Continued from page 72)

Progress In Semiconductors, Volume 2, carries the names of three editors: Alan F. Gibson, General Editor; Professor R. E. Burgess, American Editor; and Professor P. Algrain, European Editor.

Realizing the problem facing any one specialist even in his own particular field to read any more than a small fraction of the hundreds of papers on semiconductors and allied subjects which are published each year, if he is to leave any time for original work, the editors have planned an annual series of volumes to meet this difficulty. A limited number of topics taken from the whole field of semiconductors will be included each year. The articles generally will be critical reviews, giving an assessment of the present state of knowledge. Some, however, will contain significant amounts of original work and each volume will be fully international.

Subjects included in Volume 2 are: Semiconductor Alloys; Properties of the III-V Compound Semiconductors; Radiation Effects in Semiconductors; Lifetimes of Free Electrons and Holes in Solids; The Production of High Quality Germanium Single Crystals; Impurities in Germanium; High Electric Field Effects in Semiconductors; and Theories of Electroluminescence.

Progress in Semiconductors, Volume 2 is published by John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N.Y., contains 280 pages, hard cover bound, price \$10.50.

Closed Circuit TV System Planning by Morris A. Mayers and Rodney D. Chipp, P.E.

This book is the most complete and authoritative advisory source for all who are contemplating the use of closed circuit television, and especially for those who are faced with the responsibility of planning and evaluating closed circuit TV systems. It answers all questions relative to the organization of closed circuit TV systems such as space requirements, cost of equipment and its installation, types of equipment available and manpower needed to operate and maintain the equipment.

Closed Circuit TV System Planning is published by John F. Rider Publisher, Inc., 480 Canal Street, New York 13, N.Y., contains 250 pages, hard cover bound, price \$10.00.

Handbook Of Aluminum published by Aluminum Company of Canada, Limited.

This is the newest addition to the company's library of technical handbooks.

Profusely illustrated with photographs, charts and tables it includes in one volume of 266 pages much indispensable information. In brief it is a reference book on aluminum and its alloys, how they are produced and the principal industrial processes for working and finishing them.

Chapters are devoted to the various aluminum alloys, their tempers and specifications, physical, mechanical and corrosion-resistant properties. General coverage is also given to the fabrication and use of aluminum sheet, extrusions, tubing, wire, rod & bar, forgings and castings. Guidance is given on the choice of alloy and product suitable for various industrial uses.

The theory and practice of heat treatment is well covered and there is an extensive section on the many methods of joining aluminum which includes welding, brazing, riveting, adhesive bonding and fastenings.

It is an invaluable volume for those who work with the light metal.

Enquiries should be addressed to Aluminum Company of Canada, Limited, 1700 Sun Life Building, Montreal, Que.

For further data on advertised products use page 67.

Concerned with microwave test equipment?

Only NARDA offers you these

exclusive features!

TURRET ATTENUATORS

Only Narda offers you a UHF-only attenuator. This represents a considerable savings in cost for applications in this frequency range. Each of three models offers the Designer or Development Engineer 12 steps of attenuation from d.c. to 1,500 mc with a VSWR of 1.25. Designed for bench use or mounting into test equipment packages.

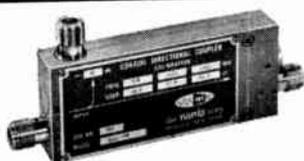


One unit can give a maximum of 30 db attenuation; two units can be used in series to provide a wide range of control in small steps.

- Model 705—0, 3, 6, 9, 12, 15, 20, 25, 30 db
- Model 706—0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 20 db
- Model 707—0, 3, 6, 9, 12, 15, 18, 21 INF db

ALL MODELS . . . \$275 each

COAXIAL DIRECTIONAL COUPLERS



10, 20 and 30 DB . . . 225 to 4,000 mc.

Only Narda offers coaxial directional couplers in 10 and 30 db values, as well as 20 db. In addition, all models offer such advantages as these:

1. Flat Coupling—values with 1 db of nominal over a full octave frequency range, with calibration provided to ± 0.2 db accuracy.
2. Machined from solid blocks of aluminum—hence, more rugged.
3. Directivity exceeding 20 db.
4. Frequency Ranges: 225-460, 460-950, 950-2000, 2000-4000 mc.

Write for complete specifications.

\$100 to \$225



S to X BAND FREQUENCY METER

Narda offers the only single instrument covering this complete band of frequencies—2,350 to 10,500 mc. In addition, no combination of other meters can cover these frequencies at a comparable price!

An easy to read nomograph type calibration chart, mounted in the lid, converts digital counter readings to frequency in megacycles—to the rated accuracy of 0.2%. No calculations or interpolations are needed.

The unit is completely self contained, with built-in detector and indicating meter. A sensitivity control allows use with strong signals; for signals below 5 mw., the external meter jack may be connected to an amplifier or oscilloscope.

Model 802B . . . \$785



UHF FREQUENCY METER DETECTORS . . . Direct Reading

The only direct reading frequency meter detectors available for the UHF range—and they're from Narda, of course! Absorption type meters, with 0.2 db insertion loss, each includes a resonant cavity, coaxial switch, crystal detector, current meter, sensitivity control and type N terminals.

SPECIFICATIONS

Frequency (mc)	Accuracy	Loaded Q	VSWR	Sensitivity for full scale deflection	NARDA Model	Price
200-500	0.5 mc	500	1.15	0.2 mw	804	\$375
500-1500	1 mc	700	1.15	0.2 mw	805	375
1500-2400	2 mc	500	1.25	0.5 mw	806	375

Complete Coaxial and Waveguide Instrumentation for Microwaves and UHF — including:

DIRECTIONAL COUPLERS
TERMINATIONS
FREQUENCY METERS
HORNS

TUNERS
ECHO BOXES
SLOTTED LINES
BENDS

ATTENUATORS
STANDARD REFLECTIONS
BOLOMETERS
THERMISTORS

 the narda
microwave corporation

160 HERRICKS ROAD, MINEOLA, N. Y. • PIONEER 6-4650

MAIL COUPON TODAY FOR
FREE CATALOG AND NAME OF
NEAREST REPRESENTATIVE

The Narda Microwave Corporation
160 Herricks Road
Mineola, N. Y.
Dept. EC-2.



NAME

COMPANY

ADDRESS

CITY ZONE..... PROV.



YOU GET GREAT VARIETY, PREMIUM ACCURACY, LOW COST, FAST DELIVERY WITH BENDIX SYNCHROS

When you buy synchros from Eclipse-Pioneer—the nation's largest producer—you enjoy several important benefits.

Because of our heavy volume, we produce . . . *as standard items* . . . just about any type of synchro you could want. Result: Cost to you is lower and delivery is faster—"right off the shelf" on many models. Yet this low cost and fast delivery do not mean the slightest sacrifice in performance. Bendix Synchros will equal . . . or exceed . . . the accuracy of any other synchros made today.

Because of our vast experience with synchros . . . including hundreds of applications in our own products . . . we are particularly well qualified to analyze your synchro needs and apply the most efficient answer. Write for complete details to the Canadian Affiliate of THE BENDIX AVIATION CORPORATION.

PRODUCTION MODELS

Frame Sizes: 8, 10, 11, 15, 22.

Types: Transmitters (1, 4, and 20 power). Receivers (Standard and Special Purpose). CT's (High Impedance, Low Impedance, Special Purpose). Differentials (Synchronous and Servoed Systems). Resolvers (High Impedance, Low Impedance, High Accuracy, Feedback, Compensated).

Electrical Connections: Flexible leads, terminal board, external slip rings.

Shaft Types: Single ended, double ended, straight, tapered, hollow, threaded.

Specifications: Military, Commercial, High Temperature, Corrosion Resistant.

AVIATION ELECTRIC
LIMITED

200 LAURENTIEN BLVD., MONTREAL

HALIFAX • TORONTO • CALGARY • VANCOUVER



TECHNICAL PERSONNEL AVAILABLE

ACOUSTICS and SOUND ENGINEER.

Age 34, — 1949 University of Budapest. Canadian experience in technical and radio electrical handling of sound recorders. Special experience in optical sound recording and projecting. Can handle Stancil Hoffman, Ampex, Bell, Bellendhauer and Western Electric Equipments with special magnetic tapes systems. Experienced in handling acoustical problems. Reply to Box 517, Electronics and Communications.

MANAGER. P.Eng., age 39. Bus. Adm. Graduate.

Available for responsible position in general management or marketing. Background: Communications, Automotive Batteries, Electrical Appliances, Industrial Electronics. Experience: Production Engineer, Product Sales Manager, Administrative Assistant, Marketing Manager, Commercial Research Manager-Market Research and Industrial Development. Reply to Box 518, Electronics and Communications.

ELECTRONIC ENGINEER: age 40,

sixteen years of experience in development of transmitters, pulse circuitry, installations, several years in supervisory and administrative position in charge of technical, product design and production units. Estimates, schedules, budgets, hiring and customer liaison experience. Salary \$9000 to \$10,000. Reply to Box 519, Electronics and Communications.

ELECTRONIC TECHNICIAN — age 26.

Received from the Ryerson Institute of Technology an Electronic Engineering Technicians diploma on completion of three-year course. Has had experience in field of Geophysics in Edmonton, Alberta, where duties involved the completion of Gamma-Ray and Neutron Logs on semi-completed oil wells. Also worked with Toronto firm in field of Aeronautics, servicing and testing the Altitude Controller and the Airspeed Compensator for the Auto-Pilot system of the CF-100 fighter aircraft. Reply to Box 520, Electronics and Communications.

ELECTRONIC ENGINEER — member IRE,

versed in radar, radio and telephone communications, systems facilities, in development, installation and maintenance, sales, supervisory-managerial phases. Especially strong in field or application work. Security clearance up to secret. Desires responsible, challenging position with progressive firm. Reply to Box 521, Electronics and Communications.

INDUSTRIAL EDITOR and WRITER:

age 43, ten years as editor of production management and chemical magazines, plus a year and a half as advertising manager of electrical manufacturer. Personal interest tends toward public and industrial relations, B.A. (mainly in science), (R.C.A.F. as navigator). Reply to Box 522, Electronics and Communications.

For further data on advertised products use page 67.

A pot you can bet on

When you're playing with a hot system and the stakes are high . . . raise!

Raise as high as 150° C . . . and HELIPOT® series 5000 precision potentiometers will still operate continuously with 1 watt dissipation.

Although it's only 1/2 inch in diameter and weighs but 0.3 ounce, on this pot you can bet the limit. You'll hold the winning hand with these five high cards off the top of the Helipot deck:

- stainless steel construction
- excellent linearity ($\pm 0.25\%$ best practical, $\pm 0.5\%$ standard)
- 500 to 100,000 ohms standard resistance range
- one-piece housing
- all-metal card for uniform heat dissipation

When the chips are down, these three standard models will strengthen your hand: the bushing-mount precision 5001, the servo-mount precision 5002, the trimming-type 5016.

There's a house full of specs the series 5000 meets or beats: JAN-R-19(7), MIL-E-5272A, NAS-710, MIL-R-12934A, MIL-E-5400, MIL-R-19518, MIL Std 202.

The straight inside story on the new series 5000 is available in data file 22E.

*Helipot Corporation, Newport Beach, California
a division of Beckman Instruments, Inc.
Engineering representatives in principal cities
Canadian Factory: No. 3 Six Points Road, Toronto 18, Ontario
Sales Representative: R-O-R Associates, Ltd.
1470 Don Mills Road, Don Mills, Ontario*

1342



Are You Sure of

Your Voltage Measurements?

MR F W PREZIOSI
8 EASTGATE CRESCENT
TORONTO 16 ONT

EPM
QEL
FEM
7220

Do you trust your Vacuum-Tube Voltmeter? Is its calibration still as good as when it was new? Does it still perform reliably within specifications?

If you check your voltmeters for calibration periodically, you will find that those bearing the General Radio trademark *remain* within specified limits. Each G-R voltmeter is backed by a two-year warranty which, in addition to certifying materials and workmanship, guarantees that the instrument will perform in *full accordance with specifications* for a minimum of two years. Why not buy G-R and get reliability as well as performance?



Type 1803-B Vacuum-Tube Voltmeter



Type 1800-B Vacuum-Tube Voltmeter

Ranges: AC; 0.1 to 150 volts in 5 ranges; attached 10:1 multiplier extends readings to 1500 volts.

DC; 0.02 to 500 volts in 6 ranges.

Accuracy: AC; $\pm 3\%$ of full scale, subject to frequency correction above 50 Mc (curve supplied); $\pm 4\%$ of full scale with multiplier.

DC; $\pm 3\%$ of full scale up to 50v, $\pm 4\%$ on 150 and 500 volt ranges.

Frequency Response: Flat within ± 1 db to 150 Mc, resonance at approximately

430 Mc. Multiplier response flat within $\pm 2\%$ up to 40 kc.

Input Impedance:

AC; 7.7 M Ω in parallel with 10 μ uf
DC; 111 M Ω . Open-grid input obtained by unsoldering internal connection.

Additional Features: Completely shielded probe — polarity switch — internal calibration control — probe cable stores inside instrument.

Price: \$225

Ranges: AC; 0.1 to 150 volts in 6 ranges

DC; 0.01 to 150 volts in 6 ranges.

Accessory multipliers available to extend a-c and d-c ranges to 1500 volts.

Accuracy: AC and DC; $\pm 2\%$ of full scale. Illuminated meter scale, knife-edge pointer, and mirror insure precise reading under all conditions.

Frequency Response: Flat within ± 1 db to 500 Mc without need of probe disassembly, or external capacitors. Resonance occurs at about 1050 Mc; frequency correction curve supplied.

Stability: Separate "balancing" diode insures stability on a-c ranges. Successively higher ranges are obtained by adding amplifier degeneration, making calibration essentially independent of

tube transconductance changes. These features are not found in many voltmeters.

Power Supply Regulation: No "wandering" zero — thorough two-stage regulation gives complete independence from line voltage fluctuations. Upon zeroing on 0.5v range, no further resetting required.

Input Impedance:

AC; 25M Ω in parallel with 3.1 μ uf
DC; 2 values, 10 M Ω and open-grid input.

Additional Features: Thoroughly shielded amplifier circuit and probe affords excellent accuracy in strong r-f fields — instrument may be grounded for safety in measurements above ground — probe plugs into standard binding posts; coaxial adaptor provided.

Price: \$435

GENERAL RADIO  **Company**
Cambridge, Massachusetts, U.S.A.

Canadian Office: 99 Floral Parkway, Toronto 15, Ontario

Arthur Kingsnorth

Richard J. Provan

Repair Service:

Bayly Engineering, Ltd.,
Ajax, Ontario

Telephone: CHerry 6-2171

WE SELL DIRECT

Prices are net, FOB Cambridge
or West Concord, Mass.

All G-R Products
are now covered by a

2-Year Warranty