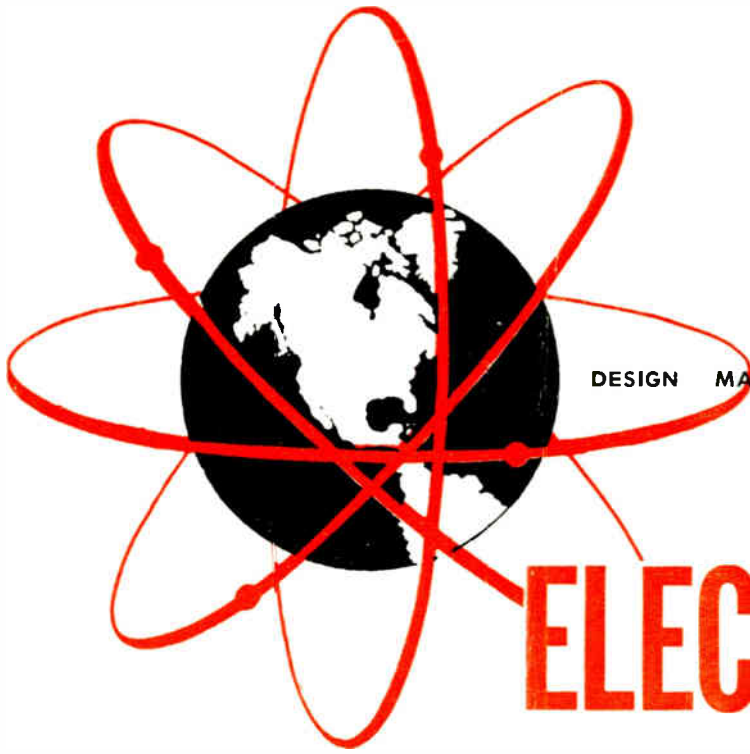


MR F W PREZIOSI
8 EASTGATE CRESCENT
TORONTO 16 ONT

EPM
QEL
FEM
7220



DESIGN MANUFACTURE ENGINEERING APPLICATION

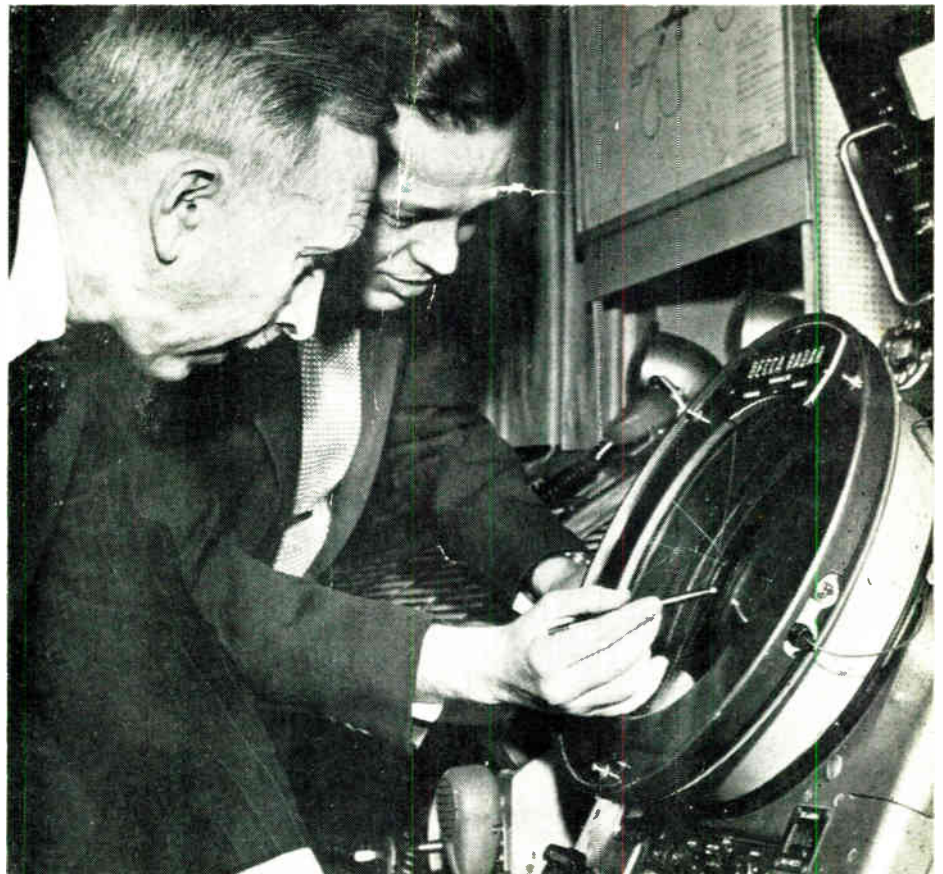
ELECTRONICS AND COMMUNICATIONS

May, 1957



An AGE Publication
Toronto, Canada

Distribution of This
Issue over 10,000 Copies

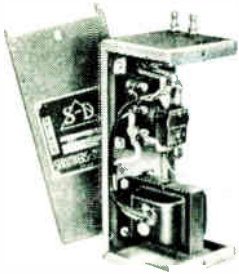


Transport Minister George C. Marler inspects newly installed radar at Montreal Airport which enables the speed up of departures and arrivals at a congested airport.



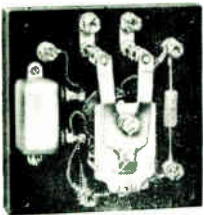
INSTRUMENT CONTROLLED

Relays



RELAY-TRANSFORMER SETS

ARS 71, RS73, BRS 239 and BRS 240 provide low voltage for the regulating instrument while controlling a standard 115 volt, 60 cycle, AC load. These sets consist of a relay and transformer mounted in a housing, completely wired and provided with handy external terminals for easy connection to the instrument. All sets are listed with Underwriters Laboratories, Inc.



RESONANT-CIRCUIT RELAYS

include a condenser and resistors in the coil circuit to make them suitable for use with mercurial thermostats. They limit the current on the instrument to 12 ma and yet provide contact ratings up to 30 amperes. The 8HXX55 is for heater control and the 84XXH55 for refrigeration control.



RELAY-RESISTOR SETS

convert three-wire instrument control to "on" and "off" two wire operation required by most loads. The "low" instrument contact operates the relay in series with the resistor, and the "high" contact short circuits the relay coil through the resistor. The BIMXX50 and A8MXX50 are used when the control and load circuits are common. The BIAAX50, BIBXX50 and 8BXX50 are recommended when a separate control circuit is used.



LATCH RELAYS

A54HXX and A54HXX502, when properly wired to a three-wire instrument, and a more or less constant load of more than 500 watts, can be used in universal service on 115 or 230 volts, AC or DC.

INSTRUMENT CONTROLLED RELAY SETS

are specifically designed for use with regulating instruments, to handle larger loads, protect instrument contacts and thereby increase instrument life.

Thermostats, pressure-stats and liquid level instruments usually have relatively delicate contacts requiring low current and/or voltage. In addition, many regulating instruments, provide three-wire control, which must be translated into two-wire "on" and "off" load control.

Relay sets combine relays with other devices, such as transformers, resistors, condensers and housings to accomplish a specific purpose. A few popular combinations are illustrated and described on this page, but it is obviously impossible to cover this rather specialized field in a general catalog.

For further information, and a complete description of available instrument controlled relays and relay sets, write for Data Bulletin 6100.



STRUTHERS-DUNN RELAYS

J. R. LONGSTAFFE CO. LIMITED

300 CAMPBELL AVE.

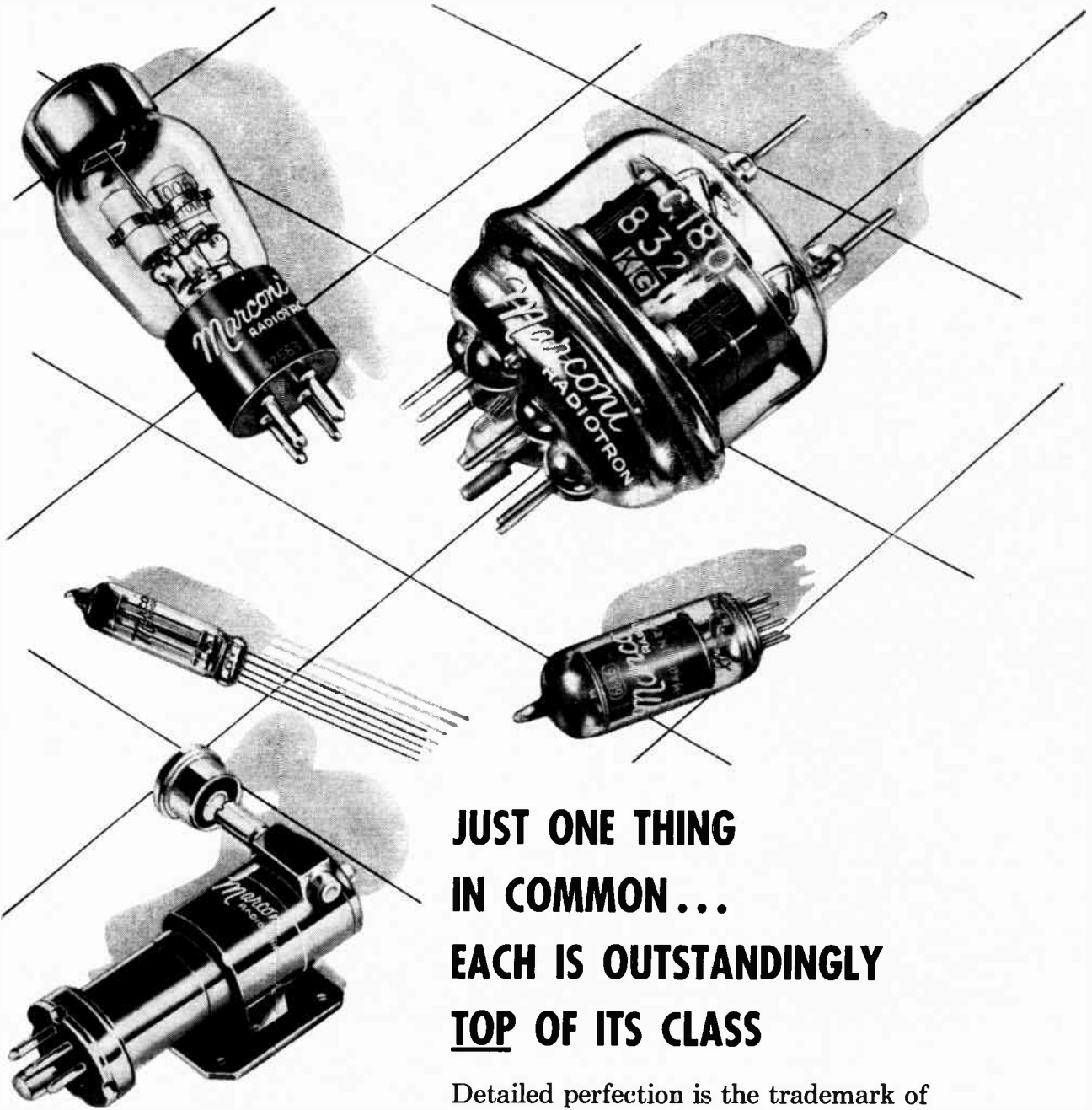
TORONTO 9, ONT.

BRANCH OFFICES

5890 Monkland Ave.
Montreal

492 Somerset St. W.
Ottawa

Radiovision Sales Ltd.
325 10th Ave., W., Calgary, Alta.



**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.

You can get **ALL** your **MIL-C-25A** Capacitors from **AEROVOX**

Now ... all your requirements for MIL-C-25A capacitors can be obtained from **ONE** source ... **AEROVOX**. No need to waste valuable time shopping around for approved sources when you can get quality and service automatically from **AEROVOX**.

Keep this handy reference chart for use in selecting your MIL-C-25A capacitor requirements. Remember ... always order by MIL-C number.

MIL-C-25A NO.	CASE STYLE	REMARKS
CP04 - CP05 - CP08 - CP09 - CP10 - CP11 -		Ratings 100-600 VDCW, available with insulated bodies, tangential brackets and threaded terminal mountings.
CP25 - CP26 - CP27 - CP28 - CP29 -		Ratings 200-1500 VDCW, insulated bodies, radial and tangential mounting brackets available.
CP40 - CP41 -		Ratings 600-1500 VDCW, grounded or insulated case construction.
CP53 - CP54 - CP55 -		Ratings 100-1000 VDCW. Available with terminals on top, bottom or side.
CP61 - CP63 - CP65 -		Ratings 400-1500 VDCW. Available with removable mounting brackets or with soldered mounting brackets for top or bottom terminal mounting.

MIL-C-25A NO.	CASE STYLE	REMARKS
CP67 - CP69 -		Ratings 600-1000 VDCW. Available with top or bottom channel mounting brackets.
CP70 -		Available in ratings from 600-12,500 VDCW. Type CP07 mounting brackets available.
CP75 - CP76 - CP77 - CP78 -		Available in ratings from 250-600 VDCW. All units supplied with machine screw stud mounting.
CP80 - CP81 - CP82 -		Available in ratings from 400-1500 VDCW. All units supplied with machine screw stud mounting.

AEROVOX
Capacitors

Standardize with AEROVOX

AEROVOX CANADA LIMITED HAMILTON, CANADA

Manufacturers of fixed capacitors for
all radio, TV and electronic equipment

WESTERN SALES Chas. L. Thompson Ltd., Vancouver, B.C.	IN U.S.A. Aerovox Corporation, New Bedford, Mass.
---	---

For further data on advertised products use page 71.

World Radio History

**PUBLISHER'S
VIEWPOINT**

A New Service

There's a dire need to provide both Canadian and American electronic equipment manufacturers with facilities for obtaining product planning information and potential Canadian sales market data for product applications. In view of this **ELECTRONICS AND COMMUNICATIONS** has established a Marketing and Research Division for the preparation of marketing report data to both clients and prospective advertisers in **ELECTRONICS AND COMMUNICATIONS**.

This division will prepare, upon request, marketing data on the prospective markets for electronic equipment in Canada, and will assist in the sales promotion of these products by giving up-to-date marketing information applicable to the Canadian market.

By establishing this Marketing and Research Division, it is anticipated that the data and survey information that will be issued to electronic manufacturers will provide another advertising and sales promotional service, a service which is being introduced by **ELECTRONICS AND COMMUNICATIONS** for the first time in Canada.

Those companies or organizations that are interested in availing themselves of this marketing service should direct their inquiries to W. Evan-Jones, Manager, Marketing and Research Division, **ELECTRONICS AND COMMUNICATIONS**, 31 Willcocks Street, Toronto 5, Ontario.

Proof Of The Pudding

The "proof of the pudding is in the eating" they say, and because of this age worn premise we are convinced that the editorial cooks of **ELECTRONICS AND COMMUNICATIONS** are turning out a readable diet of fare that includes what our patrons are looking for. Perhaps we have said it before, but we are so proud of the fact that we are going to keep on saying it just so long as we believe there is justification for doing so, and that is that the favorable readership response to the editorial features carried in our columns continues to mount month by month. And because we believe that our advertisers deserve to know, we dispense with the ethics that may say you should not mention advertising in a publisher's column to tell them of our conviction that, if the stories used by our editors are capable of evoking so many interested enquiries from all sections of the industry and all types of personnel, then it cannot help but follow that their advertising messages are being exposed to similar probing analysis.



**ELECTRONICS
AND
COMMUNICATIONS**

May 1957

Vol. 5, No. 5

EDITORIAL CONTENTS

FEATURES

	Page
"Memory" Systems in Electronic Computers	24
<i>by A. W. M. Coombs, Ph.D., B.Sc., A.R.T.C.</i>	
Monitoring Nuclear Plants	27
Electron Microscope In Photographic Research	27
Electronic Splicing Of Mylar Type Film	28
Remote Monitoring Of Demand Meters	28
Ultrasonic Level Sensor	29
<i>by Robert L. Rod</i>	
Doppler Navigation	33
<i>by William J. Tull</i>	
Electronic Infra-Red Analysis In Industry	35
Police Communications	40

DEPARTMENTS

Editorial	7
Business Briefs And Trends	11
Editor's Page	17
RETMA Report	21
New Products	45
News	51
Electronics In Business And Industry	61

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; Manager, Marketing and Research, W. EVAN-JONES; Production Manager, NEVILL A. CAMPLING; Business Manager, CLIFFORD A. SPARKS; Circulation Manager, PAUL A. IRWIN; Art Editor, WM. McREYNOLDS; Photo Editor, GUIDO MILANESI.

PUBLISHED BY AGE PUBLICATIONS LIMITED

Founded in 1923 by Norton W. Kingsland

Also Publishers of Restaurants and Institutions, Hotel and Tavern, Heating, Plumbing & Air Conditioning AGE, Oil & Gas Heat.

MONTREAL, QUE., CANADA
Room 504, Dominion Square Building
1010 St. Catherine Street West
Tel. UNiversity 6-7897

TORONTO, ONT., CANADA
31 Willcocks Street
Tel. WAlnut 2-3115

Subscription Rates: Canada, U.S.A. and British Possessions . . . \$ 5.00 per year
Foreign . . . \$10.00 per year

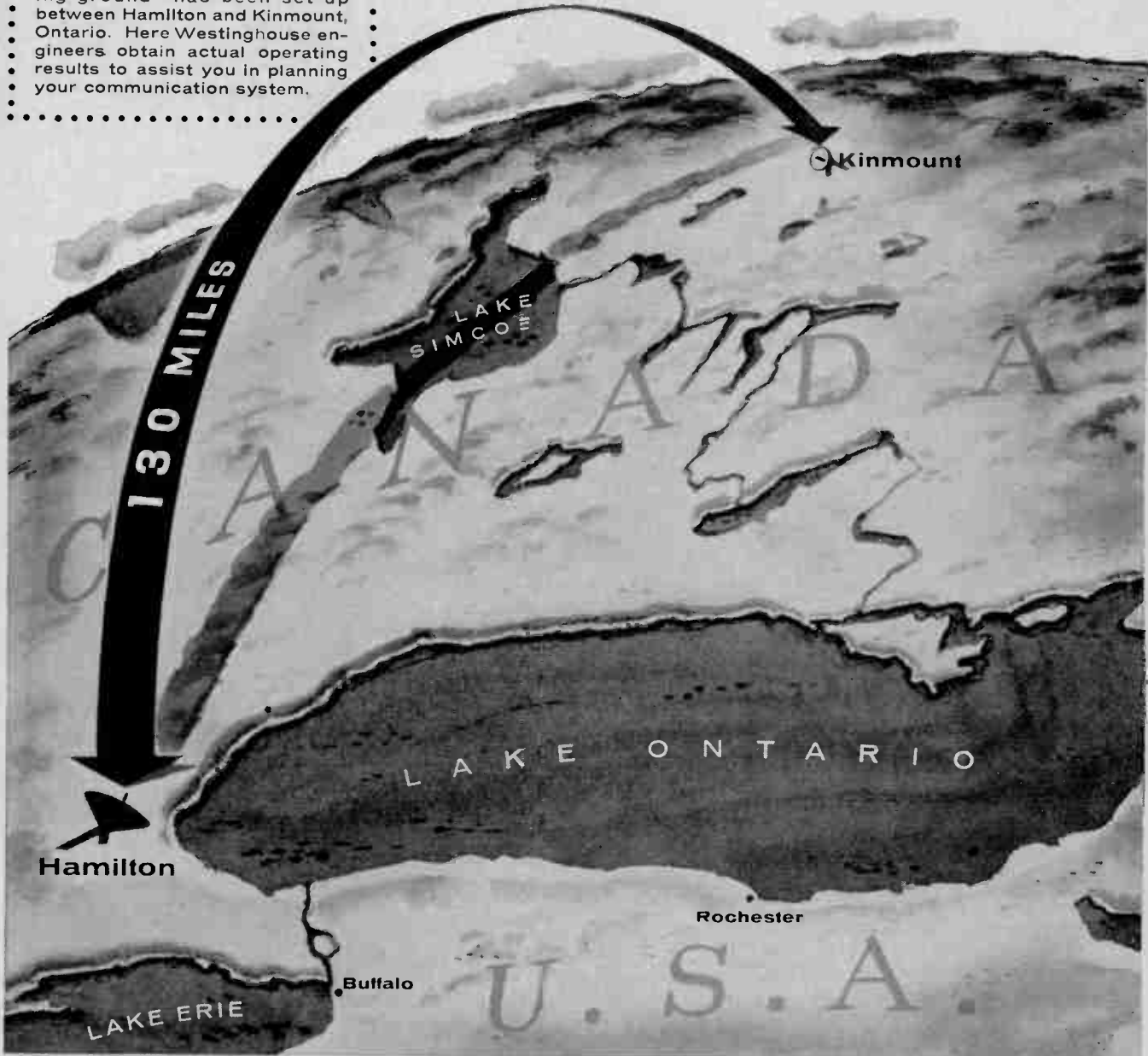
Authorized as second class mail, Post Office Department, Ottawa

Member Canadian Circulation Audit Board, Inc.



PRINTED IN CANADA

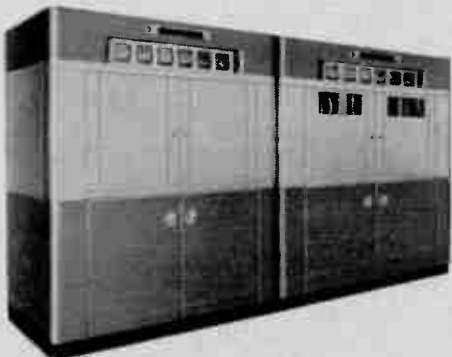
.....
 • A 130-mile Westinghouse "proving ground" has been set up between Hamilton and Kinmount, Ontario. Here Westinghouse engineers obtain actual operating results to assist you in planning your communication system.
 •.....



ANOTHER WESTINGHOUSE FIRST!

57-B-745

SHF "Scatter" Transmission



New Westinghouse 4400-5000 mc. Transmitting and Receiving Equipment is compactly and durably designed for truck mounting or fixed installation for either commercial or military application.

• Now for the first time in the communications field, scatter equipment for super-high frequency transmission for fixed or transportable operation has been introduced by Canadian Westinghouse.

• The new Westinghouse "Scatter" communications equipment is designed for high quality, high reliability transmission of voice, teletype, telemetering, facsimile, television and data signals over hops of 100 to 200 miles. Voice capacity for multi-channel operation extends to 120-150 channels.

• Contact your local Westinghouse Sales Office for Descriptive Bulletin H83-100 or write Canadian Westinghouse Company Limited, Electronics Division, Hamilton, Canada.

WATCH WESTINGHOUSE ELECTRONICS

... WHERE BIG THINGS HAPPEN FIRST

Enjoy Television's Top Dramatic Show, Westinghouse STUDIO ONE, every Monday at 10:00 o'clock

World Radio History

Export Market Merits Study

A specialized study prepared for the Gordon Royal Commission On Canada's Economic Prospects which has particular reference to the Canadian electronics industry estimates that the electronics industry in Canada will double its sale in the next ten years. The report goes on to say that: "An immensely successful future for electronics and the electronics industry can assuredly be predicted."

Although the report claims that long-term prediction for such a rapidly changing industry is difficult, it did indicate that the total volume of sales for the industry would be approximately \$800,000,000 a year by 1965 and that sales could amount to roughly \$1,600,000,000 by 1980.

We would suggest that the authors of this report are somewhat modest in their apparent conception of what long-term predictions may be, observing that the year 1980 is still twenty three years hence and for all practical intents and purposes is just about as long in terms of prediction as any present day business management would care to consider.

★ While the report in general sees a reasonably rosy future for the electronics industry, it terms the prospects for export as "not encouraging". This by reason of higher Canadian production costs than those prevailing in the United States. The report explains this situation as being due to the fact that the larger size of the American industry lends itself better to automation with its subsequent economies than the Canadian industry does. Because of this situation the report sees the cost difference between American and Canadian produced goods becoming wider in the future.

The authors of this report are apparently not aware of the high concentration of effort presently being devoted to the production of automatic equipment for small plant or small run production, a development which, if taken advantage of by the Canadian electronics industry, could well place it in a far more advantageous position than its giant American neighbor. This especially so in the matter of producing moderate size export orders which in all likelihood American producers would just as soon see awarded elsewhere.

★ If, however, the Canadian electronics industry shows no more interest in export business in the next twenty years than it has exhibited in the past, there is little point in any one concerning himself with the issue. If, on the other hand, the Canadian electronics industry could find time to relax its concentration on the domestic sales and potential sales of television and radio sets and cease for a while concerning itself with the dollar prospects of color television — which in all likelihood will be as sluggish a proposition in Canada as it has proved to be in the United States — and afford some study to existing export requirements, it would not be long in our opinion before a quickened tempo would result in the Canadian electronics industry.

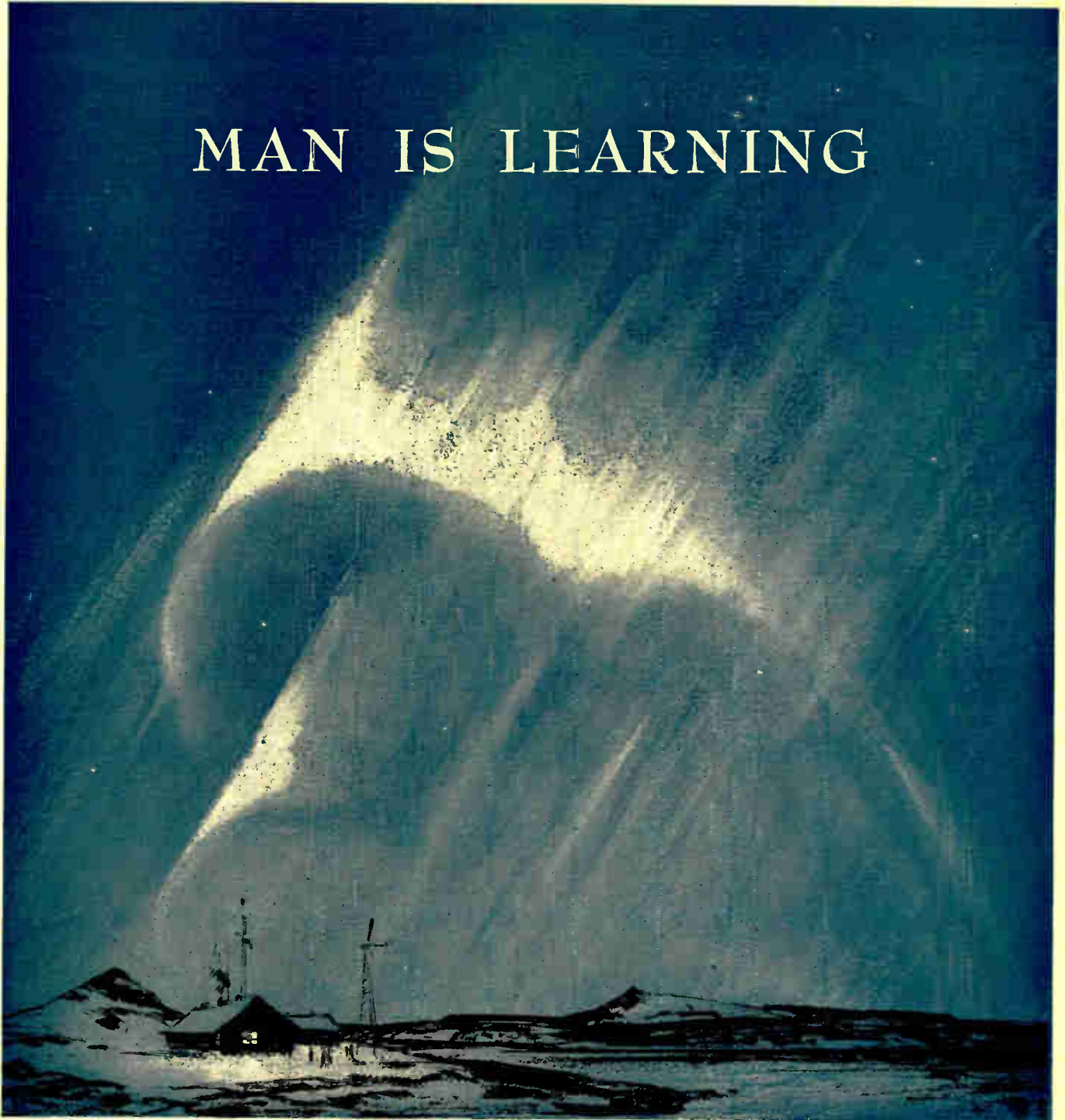
★ Before being accused of not knowing what we are talking about, we hasten to state our awareness — to some extent at least — of the problems and cost involved in developing export markets and our belief that many Canadian producers of electronic equipment are not aware that they are producing exportable merchandise. In this respect it is interesting to note that one Canadian company has recently reported the sale of a large order of television sets to Thailand, a commodity which constitutes the backbone of the Canadian electronics industry. The same company has also reported the sale of radio relay communications systems to Saudi Arabia, the Dominican Republic, Curacao, Mexico and even the United States.

Similar export potential surely exists in many other areas, particularly in the countries of South and Central America, countries where the reputation of Canadian produced goods has been firmly established in past years.

In our opinion it certainly could do no harm for the appropriate authorities in the Canadian electronics industry to investigate export possibilities in these countries through our Canadian trade commissioners. Sooner or later the domestic demand for television receivers will be satisfied notwithstanding the current ballyhoo about a second set market. When this time comes it would be advantageous for the Canadian industry to have a foothold in other markets. Certainly if, as predicted by the submission to the Gordon Commission, the Canadian electronics industry will be doing a \$1,600,000,000 annual business by 1980, then contrary to the Gordon report no small percentage of it will be realized from export trade made possible competition-wise through the use of automated systems specifically engineered for moderate rate production.

INTERNATIONAL GEOPHYSICAL YEAR BEGINS IN 1957

MAN IS LEARNING



MAN's unceasing quest for more knowledge of space and his world will continue with new vigour during the International Geophysical Year. Of the 43 countries uniting to make simultaneous observations, Canada's contribution will be significant for its studies of the ionosphere and of changes

in the earth's magnetic field. PSC Applied Research Limited is honoured to work with the Canadian scientists. Such new and unique instruments as the Auroral Recorder, the Stationary Magnetometer and a recording camera were engineered and produced for the project by Canada's leading instrumentation firm.

PSC APPLIED RESEARCH

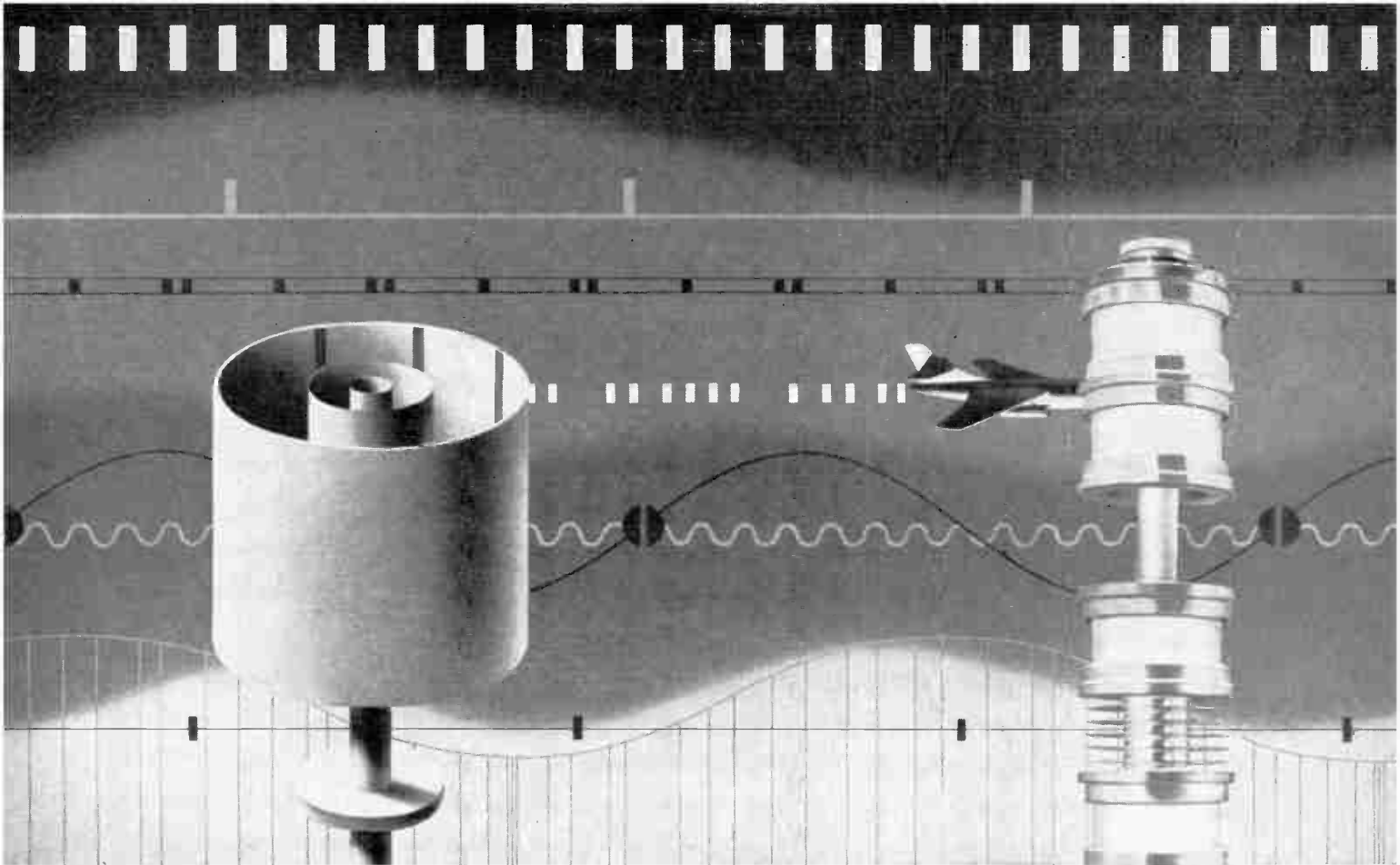
1500 O'CONNOR DRIVE, TORONTO

MEMBER : A. V. ROE CANADA LIMITED & THE HAWKER SIDDELEY GROUP



LTD.

For further data on advertised products use page 71.



Eimac X676 Modulating Anode Klystron

Shaped RF Pulse, 30 KW Peak Power Output for 955-1220 mc Air Navigation Systems

Designed for air navigation systems, the Eimac X676 three cavity, air cooled klystron will deliver 30 KW peak power output in the 955 to 1220 mc range. With a power gain of 35 db, this tube has an efficiency of 40 per cent.

A typical air navigation systems requirement is a shaped RF pulse output to eliminate spectrum interference in adjacent channels. The Eimac X676 klystron is ideally suited to this service. The modulating anode permits pulsing the beam current while keeping the accelerating voltage constant. Also, the modulator circuit for this application is quite simple.

The RF cavities are external to the vacuum system and detachable from the klystron. The user may purchase spare tubes without buying additional tuning and focusing assemblies.

For the design engineer, the features of the X676 simplify circuitry—for the equipment operators the X676 provides reliable, long-lived performance at moderate cost.

For further information about the Eimac X676 Modulating Anode Klystron, consult our Application Engineering Department. Also available are two highly informative booklets; "The Care and Feeding of Klystrons" and "Klystron Facts . . . Case Four".

EITEL-McCULLOUGH, INC. SAN BRUNO CALIFORNIA

The World's Largest Manufacturer of Transmitting Tubes

Represented in Canada by

THE AHEARN AND SOPER

COMPANY LIMITED P.O. Box 715, Ottawa, Ontario



Typical Pulse Operation X676

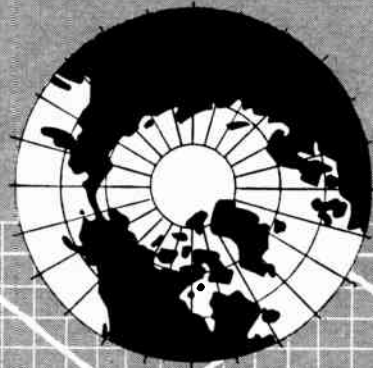
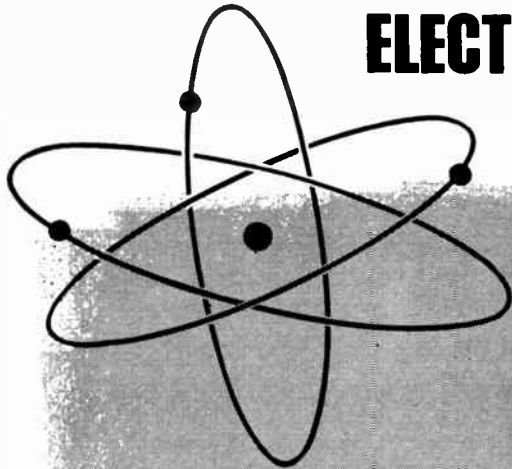
DC Beam Voltage	24 KV	Power Output	32 KW	Power Gain	35 db
DC Beam Current	3.3 Amps	Driving Power	10 watts	Average Power	1 KW
Power Input	80 KW	Efficiency	40%		

Announcing the second annual:

IRE CANADIAN CONVENTION AND EXPOSITION

*Automotive Building, Exhibition
Park, Toronto, Canada, October 16, 17, 18, 1957*

ELECTRONICS & NUCLEONICS



RESERVE YOUR EXHIBIT SPACE NOW!

Enlarged by 25 per cent to meet the demand for more exhibit space! The 1957 IRE Canadian Convention promises to draw an even larger attendance than last year's 10,038 engineers, technicians and buyers.

Now is the time to plan your company's exhibit participation in this great event. Write today for your copy of the brochure.



IRE CANADIAN CONVENTION

Sponsored by the Canadian

Sections of the Institute of Radio Engineers

Office: 745 Mount Pleasant Road, Toronto 7, Canada
Telephone: HUdson 8-7768

CANADA'S LARGEST SCIENTIFIC CONVENTION AND EXPOSITION

For further data on advertised products use page 71.

World Radio History

business briefs & trends

★ Silicon, the electronic metal which makes possible better transistors, rectifiers, computers and instruments, will increase from 10,000 lbs. in 1956 to an estimated 100,000 lbs. in five years, according to Aries Laboratories, Inc. of New York City. The ultra pure (99.999 per cent) silicon will be used in a myriad of applications from light meters to automobiles. It is estimated that six silicon rectifiers per car will be consumed in a few years.

* * *

★ Malcolm H. Hebb, manager of solid state physics research at General Electric's Schenectady laboratories anticipates that last year's 30 million dollar transistor business will jump to a 200 million dollar business within the next three years.

* * *

★ According to General Bronze Company vice-president Ira Kamen, the 30 foot uhf lateral antenna system designed and now in use on the DEW line is capable of scatter transmission over distances of 300 miles. With the use of appropriately spaced towers Kamen states that there is the possibility of transmitting TV picture signals between England and the United States.

* * *

★ Pleasure boating which has grown by leaps and bounds since the end of World War II has now become a profitable market for electronic equipment. An estimated 30 million people in the United States and Canada are boating enthusiasts with many of them taking advantage of and fitting out their craft with the latest radio and electronic aids. Boat makers expect a 30 per cent sales gain this year and accessory manufacturers are looking forward to a 40 per cent sales gain in the matter of fittings and equipment with a goodly proportion of this going to electronic equipment makers.

* * *

★ A recent survey reveals that 69 new books in the field of electronics were published in 1956 and publishers claim that the number anticipated for 1957 will reach over 80 in 1957. Leading publishers claim that the most popular of the electronic books are those which can be used as text and reference books.

* * *

★ A survey of over 28,000 top level executives in Canada and the United States shows that engineers' wage earnings increased at a higher rate than all others. Wages of engineers, scientists and other technical personnel showed a gain in average weekly earnings of 8.6 per cent over the period of May 1955 to May 1956. For a comparable period middle management earnings increased 5 per cent and top executives received a 5.9 per cent increase.

* * *

★ Undaunted by the size of the chore a firm by the name of Information For Industry Incorporated plans to catalog, classify and generally standardize the terms, words and definitions of the electronic language.

* * *

★ The production of transistors exceeded 11.5 million units in 1956 and according to industry spokesmen the limit will exceed 22 million transistors in 1957.

★ Radio Corporation of America reports the production of 102,000 color television sets since the Fall of 1955 at the time the 21 inch receiver was introduced to the market.

* * *

★ The Philco Corporation of Philadelphia are now guaranteeing their all transistor cordless home radio sets for a period of five years which is reported to be the first time that any manufacturer has made such a move in the history of the industry.

* * *

★ A recent analysis of the automobile industry indicates that it is looming larger every day as a factor in the electronics industry. A spokesman for the Ford Motor Company states that electronics is finding its way into virtually every manufacturing facility used in the automobile industry and at the present time is being used for temperature control, analysis of materials, dimensional control, counting, materials handling, and safety control.

* * *

★ John A. Hickey, of the Raytheon Manufacturing Company anticipates that as many as 30 million transistors will be used annually in automobile fuel injection systems.

* * *

★ The Canadian government has made known its willingness to build a \$650,000 forward scatter station near Gander Airport in Newfoundland as part of a communications network to facilitate trans-Atlantic flying. At the same time the Canadian government offered to assist in the joint financing of other stations in Greenland and Iceland.

* * *

★ The Canadian Marconi Company, Canadian representatives of the General Radio Company, have announced that a two year warranty on all General Radio Company's products purchased after March 1st, became effective on that date. This is the first time such a warranty has been offered in the precision laboratory instruments field.

* * *

★ More than half of Canada's households now have TV. Of an estimated 3.9 million homes in late 1956, 55 per cent had TV sets, compared with only 39 per cent a year earlier, according to the Dominion Bureau of Statistics. The percentage was highest in Ontario (69 per cent) and Quebec (66 per cent), and lowest in Saskatchewan (17 per cent) and Newfoundland (18 per cent).

* * *

★ According to Frank M. Folsom, chairman of the executive committee for Radio Corporation of America, RCA Victor's Canadian-built television receivers were the first to be imported by Thailand after the inauguration of TV there. Mr. Folsom pointed out that the quality of Canadian electronic products is so high that it has become the basis for a rapidly expanding export trade to all parts of the world. In fact, RCA Victor has exported Canadian-made radios, TV receivers and electronic products to 75 foreign countries and territories, he said.

Continued Overpage

business briefs & trends

★ Canadian General Electric Company Limited achieved a record level in sales during 1956, and set records also in employee earnings and payments to suppliers, President James H. Goss has announced. Mr. Goss said sales billed in 1956 reached \$248,168,551, an increase of 14 per cent over 1955. Net income for the year totalled \$10,822,183, representing 4.4 cents on the sales dollar compared to 2.8 cents in 1955 (\$6,077,267). Net income is calculated after deduction of all charges including \$5,560,794 for depreciation (\$5,356,143 — 1955) and providing an amount of \$9,800,000 for income taxes \$6,200,000 — 1955). Mr. Goss termed the company's 1956 performance "reassuring".

★ According to the Report of the Gordon Royal Commission on Canada's Economic Outlook the sales of electronic equipment in 1980, based on anticipated demands for increased automation and consumer items, will be four times what they are today. The Report points out that the output of the electronics industry in Canada in the postwar years has risen faster than the gross national product.

★ Business Briefs And Trends, Electronics and Communications, February 1957, erroneously reported that General Electric had announced increases up to 15 per cent in the prices of its two-way radios for mobile communications. This should have read: A price increase of 5 per cent, effective immediately, will apply to all models and accessories of the General Electric "Progress" line of mobile radio equipment.

★ Manufacturers of air conditioning equipment are presently selling from \$6 to \$10 million worth of electronic air filters annually. It is expected that the domestic demand for this equipment will boost the dollar volume of the industry up to \$40 million annually in the next few years.

★ The Alberta Government has awarded an \$800,000 contract to the RCA Victor Company for the construction of a microwave system extending from Edmonton to Peace River and Grande Prairie.

★ Long distance telephone circuits between Vancouver and Victoria have been increased by 33 per cent. The increase results from the installation of new carrier equipment designed specially for the 73 mile all-cable route between the two cities.

★ The Canadian Board of Transport Commissioners has authorized the B.C. Telephone Company to market 200,000 ordinary shares of the company's capital stock at a minimum rate of \$38.00 per share. The purpose of the issue is to provide the necessary funds for the company's expansion program for 1956-1957 which calls for an estimated expenditure of \$68 million.

★ Gwilym A. Price, chairman-president of the Westinghouse Electric Corporation, predicts that \$6.3 billion will be spent on industrial research and development in the United States in 1957.

★ The new Bristol Britannia transports, ordered for the Northeast Airlines' Boston-New York-Miami run, will be fitted with extensive Bendix airborne electronic equipment.

★ The annual report of the British Radio and Electronic Component Manufacturers' Federation states that the output of the British radio and electronic component industry was valued at \$644 million last year.

★ The use of platinum as a temperature measuring element in guided missiles is expected to increase the consumption of this metal in the very near future. The metal glued to the skin of missiles is capable of measuring skin temperatures from 1320°F. to 950°F.

★ The Saint-Gobain glassmaking company, established by Louis XIV of France in 1665, is now reported to be a 75 per cent pushbutton automated factory.

★ Britain's General Post Office claims that it is leading the world in the mechanization of letter handling. Recently the General Post Office ordered 20 electronic letter sorting machines at a cost of \$560,000. Delivery of the new machines began in April.

★ The B.C. Telephone Company bought 9,665 telephone poles in 1956 at a cost of \$150,000. There are approximately 40 poles to a mile, which means that a pole line from Vancouver to Merritt, a distance of 240 miles, could be built with the poles.

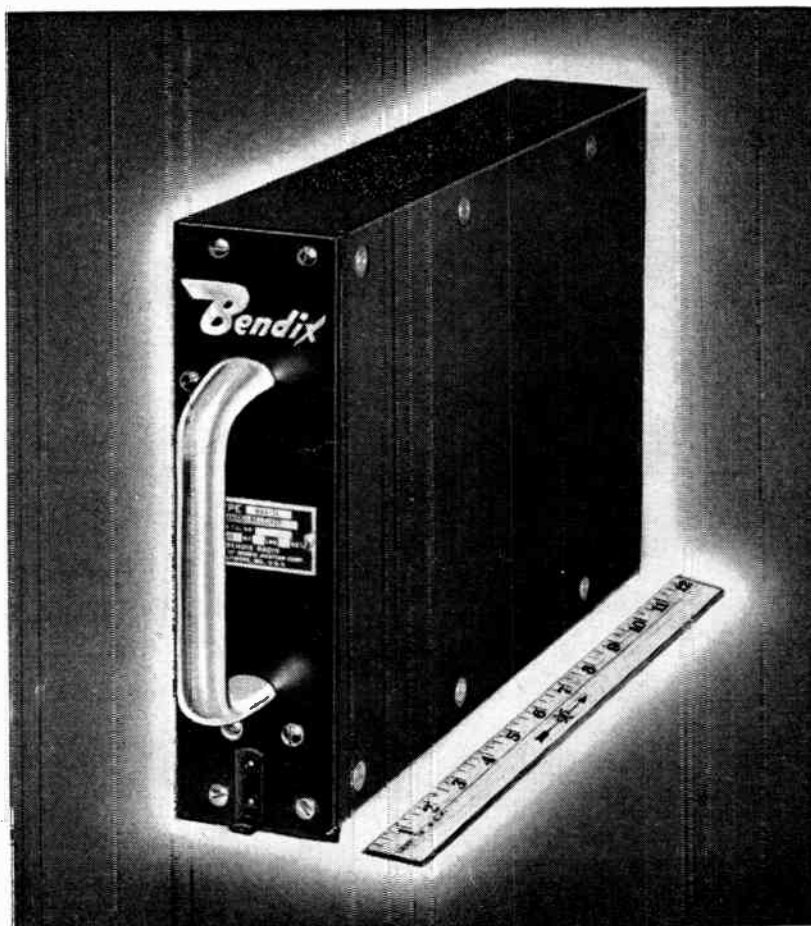
★ A moldable sheet material which is claimed to eliminate etching or plating processes in mass-producing printed circuits was demonstrated last month in New York. The basis of the new process is a phenolic impregnated cellulose sheet material which permits curing and forming into three-dimensional shapes, thereby providing increased design flexibility.

★ First production models of the Ampex videotape recorder are expected to come off the production line in November. The company now has in excess of 100 orders for the new equipment which, according to R. Snyder, manager of the special products division, will be very similar to the prototypes of the equipment.

★ A mobile radio telephone installation by the North-west Telephone Company at Mount Begbie, B.C., provides local and long distance telephone facilities to sawmills, resorts and ranches within a 25 to 30 mile radius of the station.

NEW Bendix MARKER RECEIVER

(1/4 ATR)



Compact... Rugged... Weighs only 8½ pounds!

Now from Bendix*, makers of the world's standard in Marker-Receivers, comes a big advancement—the MKA-7A. Completely new from chassis to case, the Bendix MKA-7A Marker-Receiver is designed for dependable, trouble-free reception of signals from airways fan markers, station locator Z markers and ILS approach markers.

Smaller in size, lighter in weight, it is scheduled for use in Pan American Airways new fleet of DC-7C's.

Operating on a fixed frequency of 75 megacycles, the MKA-7A features improved circuitry that performs a two-fold function:

- (1) Greatly reduces the chance of television or FM interference.
- (2) Stabilizes gain under wide ranges of environmental conditions and line voltage fluctuations.

For further information, contact your Bendix Aviation Radio representative or write the factory direct. Address below.

*Reg. U. S. Pat. Off.

SPECIFICATIONS

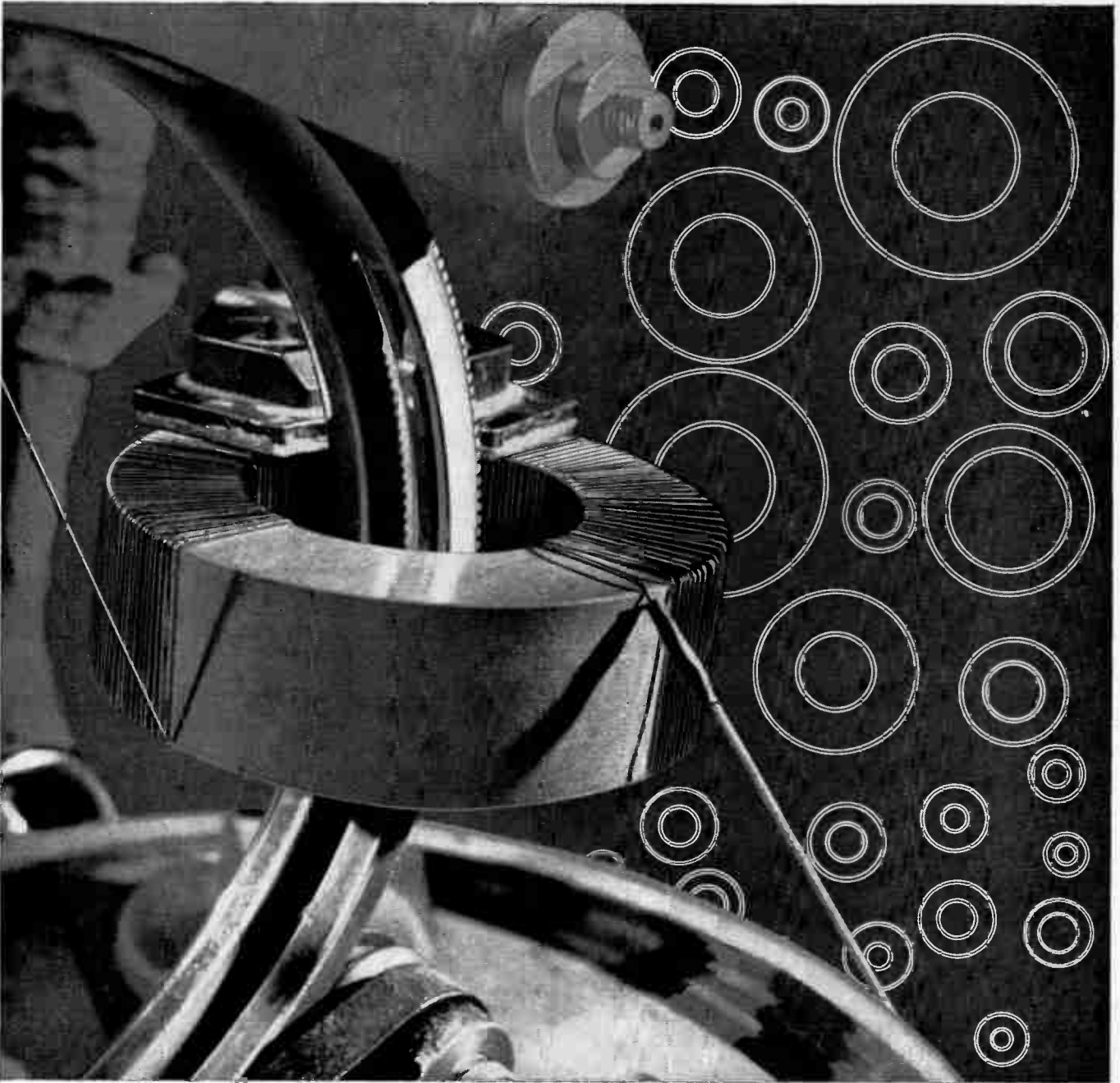
●	Antenna transmission line input impedance	52 ohms. Voltage standing wave ratio less than 1.2 to 1.
●	AVC characteristics	Audio output is within a 6-db range at r-f input levels from 400 to 200,000 microvolts.
●	Selectivity	Attenuation 6 db 60 db
●	Frequency stability	Total Bandwidth more than 40 kc less than 250 kc
●	Undesired response rejection	± 10 kc under all service conditions.
●	Audio output impedance	Interference from adjacent channel television signals will not produce lamp threshold at input levels up to 3.5 volts.
●	Power requirements	500 ohms, nominal.
●		AC Power Supply 115 volts ac, 300-1000 cps, 35 VA with 27.5 volts dc for ON-OFF relay control, or
●		DC Power Supply 27.5 volts dc, 36 watts.
●	Altitude performance	Operates at barometric pressures equivalent to 30,000 feet altitude.
●	Ambient temperature rating	−40°C to +70°C (−40°F to +158°F).

Specifications subject to change without notice.



COMPUTING DEVICES OF CANADA LIMITED
P. O. BOX 508 · OTTAWA · CANADA

5716



How will tape wound core users be affected by new size standards?

If toroidal core winding is a familiar sight in your plant, 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.

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.

You can find all specifications for these AIEE-standardized tape wound cores in Catalog TWC-200, a new publication

which, incidentally, is the most comprehensive tape wound core text published anywhere by anybody. Your copy of this Catalog-Design Manual may be obtained by writing on your letterhead to Magnetics, Inc., Dept. EC-34, 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 71.



The
R19400A & B
**VIDEO
MONITORS**

utility monitors
with master monitor
performance

BRIGHT HIGH CONTRAST PICTURE from 17" Aluminized Tube.

SIZE SWITCH with preset height & width controls permits full screen picture or all four edges showing with no change in linearity or aspect ratio.

600 LINE RESOLUTION is obtained by wide bandwidth video amplifier & excellent beam focus. No focus control is required.

AUTOMATIC SYNC SWITCHING. A front panel switch permits use with composite or non-composite signals manually, or in the remote position, automatic control from video switching facilities.

PERFECT INTERLACE without fine adjustment of vertical hold control.

REGULATED POWER SUPPLY provides steady plate supply voltage and prevents changes in picture size with power line changes.

HIGH GAIN AMPLIFIER will produce full contrast picture with composite signals as low as $\frac{1}{2}$ volt peak to peak.

KEYED CLAMP CIRCUIT Maintains stable black level independent of picture or sync. signal amplitude.

The R19400A & B Video Monitor is designed for use in TV Studios, control rooms, line company control centres, closed loop systems and in any other application where a high quality 17" video monitor is required.

The R19400A Monitor is complete with cabinet and may be mounted on a table or suspended by cables from a ceiling mount.

The R19400B Monitor (as shown above) is supplied less the cabinet for rack mounting installations.

A slide kit (R19400-140) is available as an accessory item to permit easy access for maintenance in rack mounted installations.

SPECIFICATIONS

Input Signal:	.5 to .20 volts peak to peak composite signal.
Video Response:	Within 3 db to 8 mc.
Resolution:	Better than 600 lines.
Internal High Voltage:	14 KV
Picture Size:	10 $\frac{3}{8}$ x 13 $\frac{3}{8}$
Power Input:	105 to 125V, 60 cps, 2 amps.
Size, Including Cabinet:	17" H x 17 $\frac{1}{8}$ " W x 20 $\frac{1}{2}$ " D Requires 16 $\frac{1}{2}$ " behind rack mounting surface.
Weight, Including Cabinet:	97 lbs.

Northern Electric

COMPANY LIMITED

HALIFAX MONCTON ST. JOHN'S, Nfld. SAINT JOHN, N.B. MONTREAL ROSEMONT MOUNT ROYAL CHICOUTIMI QUEBEC CITY SHERBROOKE TROIS-RIVIERES
VAL D'OR OTTAWA TORONTO HAMILTON KINGSTON KIRKLAND LAKE LONDON SUDBURY TIMMINS KITCHENER WINDSOR SARNIA ST. CATHARINES
WINNIPEG FORT WILLIAM REGINA SASKATOON EDMONTON CALGARY LETHBRIDGE VANCOUVER VICTORIA VERNON NEW WESTMINSTER
1057-6



**TINY
TOUGH
TERRIFIC**

**INEXPENSIVE
VERSATILE
EASY TO INSTALL**

HASLER PAX-12

Completely Automatic Telephone System

- No operator required
- Line length up to 3 miles
- Self contained power supply
- Operates from any standard 110-250 Volt AC supply
- Up to 12 independent lines
(PAX 27: PAX 45: up to 27 or 45 lines)
- Cut-in facility
- Easily installed — no special skill required

**PROFITABLE
DEALER
FRANCHISE
AVAILABLE IN
SOME AREAS**

**RADIO COMMUNICATIONS
EQUIPMENT & ENGINEERING
LTD.**

475 Metropolitan Blvd.
Lachine Montreal 32

RCE

For further data on advertised products use page 71.

the editor's page

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

A Perennial Problem

As usual at this time of year, the perennial hue and cry is heard abroad concerning the flow of Canadian graduated engineers to the United States for employment while domestic industry goes begging. According to those who should know, there is no marked difference at this time in Canadian and American salaries paid to engineers, therefore the old excuse of 'more money' cannot be blamed for the reported continual drain-off of Canadian engineers to the United States. Why then should Canadian engineers choose to bid farewell to their native heath for employment abroad?

According to the bulletin of the Association of Professional Engineers of Ontario, one means of inducing Canadian engineers to stay in Canada would be for management to afford more professional recognition to them. In this respect, the A.P.E.O. Bulletin has the following to say:

"... In a growing country like Canada, industry cannot afford to waste engineering talent. In this present period of national growth the emphasis has been heaviest upon development of primary or resources industries. It is in these industries that the professional engineer is presented with a special challenge to cap his academic knowledge with native bent and ingenuity. No small part of Canada's phenomenal growth must be credited to her professional engineers.

"At the same time, however, there is a challenge for engineers in secondary or established industry also. Here the professional engineer must find new means and new methods of keeping pace with the national growth. The engineer who is recognized as a professional man, who is given the responsibility and the opportunity to act as a professional member of management, is the one who is going to rise to the challenge and find satisfaction in worthwhile achievement.

"In many organizations the lack of professional recognition, coupled with the lack of opportunity, has built up a feeling of frustration among professional engineers who are willing and able to accept responsibility as creative members of a management team. These are the men who are being enticed into employment in other fields where they find that greater scope is offered, or who are being wooed by United States firms where their special professional skills are recognized, utilized, and appreciated..."

The A.P.E.O. Bulletin goes on to say that United States consulates across Canada have reported that the number of Canadians leaving for the United States is at an all-time high and Dr. John T. Henderson, recently appointed president of the Institute of Radio Engineers, the first Canadian to hold this post, is reported in *Electronics Magazine Business Edition*, as estimating that one third to one half of Canada's engineers go to the United States to work.

If then the lack of professional recognition for engineers on the part of Canadian business management is the underlying reason for their migration to the United States, then it is incumbent upon Canadian business management to pick up its collective socks forthwith and institute whatever measures are needed for the development of a professional climate within their engineering departments. It should be remembered, however, that business management is not made up of magicians and it is not within their power to transform mediocre development projects — capable of being handled by trained technicians — into projects worthy of the attention of professional

engineers. It follows, therefore, that, if business management is to encourage professional recognition among the engineering fraternity, business must be awarded development projects worthy of the hire of professionally qualified engineers.

With few exceptions, Canadian industry to date has been starved for worthwhile development work and has been used for the most part as a producer of other people's brain children. Until this condition is reversed then, or appreciably altered, economics notwithstanding, a goodly part of Canadian business management who are employers of professional engineers will have little to encourage them in the matter of developing a keener sense of professionalism among engineers. Until such time too, that Canadian industry is awarded significant development work, Canadian engineering schools may as well be regarded as training camps for American industry. This by reason of the very logical fact that Canadian engineers will be attracted to wherever they may engage in employment worthy of their training and interest — usually the United States.

Can TV Go This Far?

Dr. James Hillier, general manager of RCA's research laboratories in the United States, recently told a press gathering in Toronto that he could not foresee any further radical development of the television set as an entertainment medium. There will, of course, as Dr. Hillier pointed out, be the flat picture type screen that can be hung on the wall, remote tuning control and we suggest the blessed device that will permit viewers to adjust their sets for the automatic cut-out of commercials, which in itself could conceivably be the nemesis of television as a commercially sponsored medium of entertainment. Insofar as fundamental changes were concerned, however, television would remain pretty much as it is today and may to all intents and purposes be regarded as the ultimate in domestic entertainment devices. This viewpoint, of course, was expressed about two months ago and in this day and age science goes a long way in two months with the result that we are now hearing stories about the television of the future that will bring the characters into three dimensional realism, not on the screen of your television set, but right into the middle of your living room. Just how this electronic anamorphosis is to be performed is a little vague at this time, but it apparently has something to do with the ionization of a stipulated volume of atmosphere into which television actors of the future will be projected to perform their antics. The inventor of this device should drop dead for the sake of universal domestic harmony, for it is conceivable to see father, following a breakdown of emotional restraint, projecting himself headlong into the volume of ionized subatomic particles in frenzied and irrepressible pursuit of such characters as Gina Lollobrigida, Lana Turner or even our own Juliet, only to trip over the cat and bust his snoot on the sharp and inanimate edge of the mantel. Who knows, once inside the area of ionized particles, dad's own subatomic structure may itself become ionized, rendering him into a detached and ethereal ectoplasmic mass consigned for eternity to a fruitless pursuit through space after Lana Turner but, always and always, just a few megacycles behind her frequency.



a comprehensive
**Telecommunication
 Engineering Enterprise**

The largest telecommunication manufacturing organisation in the British Commonwealth **Standard Telephones and Cables Limited** covers the whole waterfront of telecommunication engineering and is engaged in the research, development, manufacture and installa-

tion of all types of communication and control systems.

The Company is in an unrivalled position to undertake, within its own organisation, the co-ordinated systems-planning of complete communication projects involving inter-dependent systems of various types.

'Standard' productions include:—

Telecommunication Line Transmission Equipment
Radio Broadcasting Equipment
Radio Communication Equipment
Air Radio Navigational Aids
Supervisory and Remote Control Systems
Railway Communication Apparatus
Railway Control Equipments
Telephone Cable
Sound-Reinforcement Systems
Public and Private Telephone Systems
 (Automatic and Manual)

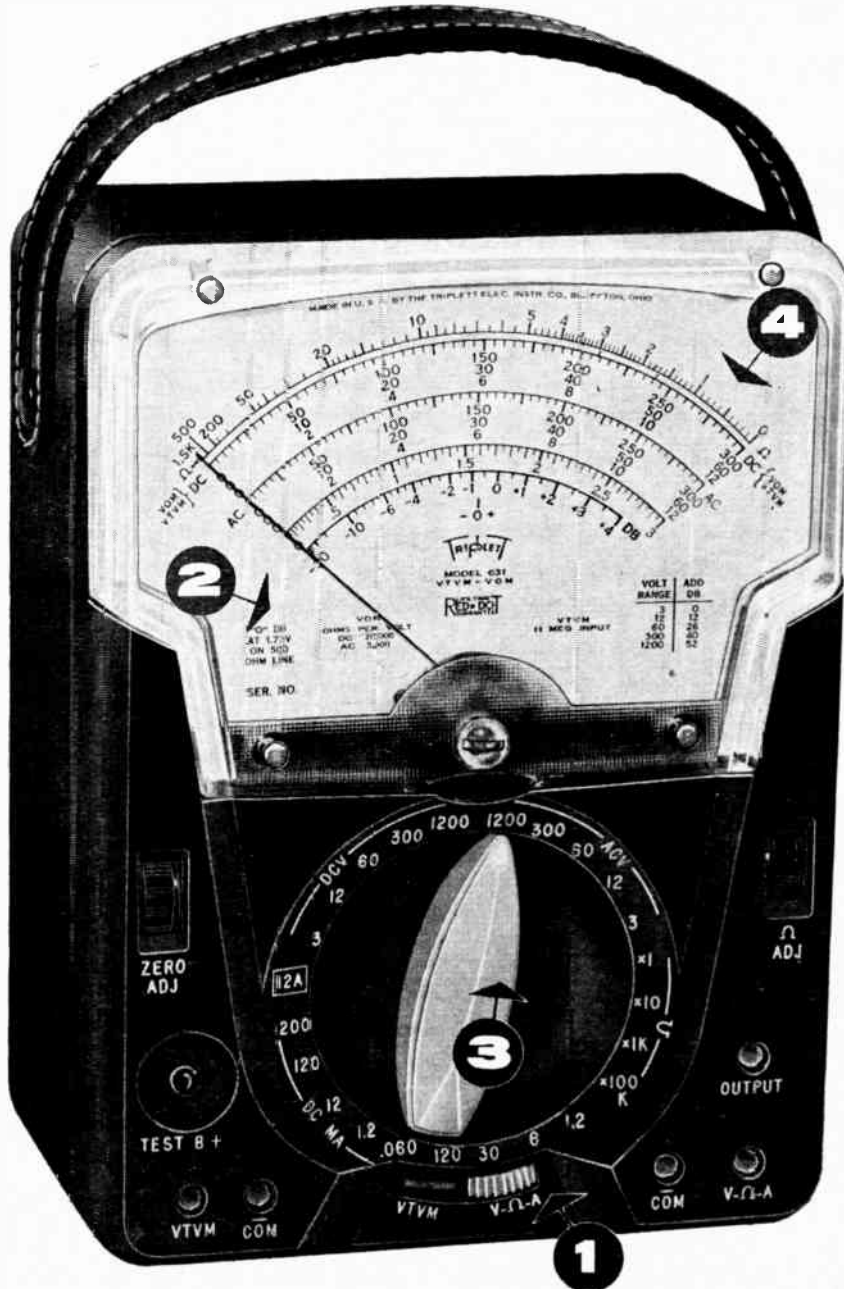


Standard Telephones & Cables
Mfg. Co. (Canada) Ltd.

9600 ST. LAWRENCE BLVD., MONTREAL 12, P.Q.

For further data on advertised products use page 71.

a **VOM** ■■■ plus a **VTVM** when you need it.
DOUBLE USE... HALF THE PRICE
TRIPLETT MODEL 631—In one year accepted as the
 standard **COMBINATION VOM-VTVM**



Battery operated

- 1** Just flip the switch.
- 2** Standard sensitivities as used in servicing manuals.
- 3** 34 ranges—with the famous Triplett single knob control.
- 4** Extra long scales—unobstructed visibility.

\$90.30

By using the Volt-Ohm-Mil-Ammeter for all general testing (90% of your testing) and the Vacuum Tube Voltmeter only when you need it, you have the advantage of a VTVM with extremely long battery life. Batteries are used only about one-tenth as much as in the ordinary battery-operated VTVM. Features: Ohms, 0-1500-15,000 (6.8-68 center scale. First division is 0.1 ohm.)

Megohms: 0-1.5-150 (6,800-680,000 ohms center scale.) Galvanometer center mark "—0+" for discriminator alignment. RF Probe permits measurements up to 250 MC. \$7.00 net extra. Featured by leading electronic parts distributors everywhere.

TRIPLETT

TRIPLETT ELECTRICAL INSTRUMENT COMPANY • 52 years of experience • BLUFFTON, OHIO

Triplett design and development facilities are available for your special requirements for meters and test equipment.

LEN FINKLER & CO.

330 Adelaide Street West

EMpire 8-5222

Toronto 2B, Ontario

C. M. ROBINSON COMPANY

189 Market Street, Winnipeg

325 10th Avenue, Calgary

550 Beatty Street, Vancouver

WorldRadioHistory

CKSL *proved it!*



STATION TECHNICIANS PLAYED A REEL OF "SCOTCH" MAGNETIC TAPE

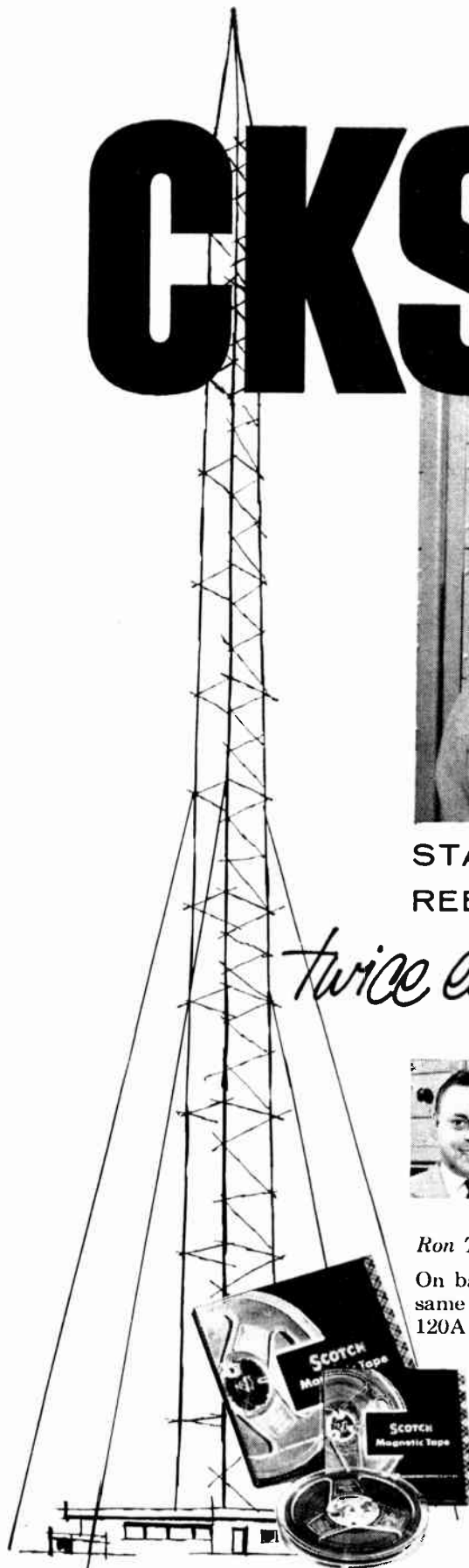
twice each day for nine months!



"It was the first time we had checked the life of a tape. Frankly, we were surprised at the punishment that "SCOTCH" Brand Magnetic Tape III-A can take. Each day the spool was played twice and rewound twice on high speed equipment. Yet no distortion could be detected and a low noise level was maintained. Another thing, it erased clearly and did not curl throughout this nine-month period."

Ron Turnpenny, Director of Engineering, CKSL, London, Ontario.

On battery-operated portable tape recorders, the technicians of this same station have also found that "SCOTCH" Brand Magnetic Tape 120A provides higher output and reduces noise and overload problems.



TRADE MARK
SCOTCH
BRAND
Magnetic Tapes



MINNESOTA MINING & MANUFACTURING OF CANADA LIMITED, LONDON • CANADA

Sales Offices: Halifax • Montreal • Toronto • Winnipeg • Calgary • Vancouver

Resident Salesmen: Moncton • Quebec City • Ottawa • Hamilton • North Bay • Regina • Saskatoon • Edmonton

For further data on advertised products use page 71.

RETMA Report



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

RETMA's 28th Annual Meeting

The 28th Annual Meeting of the Radio-Electronics-Television Manufacturers Association of Canada will be held on June 20th and 21st at Ste. Adele-en-haut, Quebec. The guest speaker at the annual dinner will be Robert C. Sprague, a past president of the United States RETMA, whose address will be entitled "Automation".

An interesting panel discussion on the subject of "Communications" will be held under the sponsorship of the RETMA Industrial Relations Committee on the second day of the annual meeting, June 21st.

Transformer Engineering Sub-Committee

On May 15th the RETMA Transformer Engineering Sub-Committee held a technical meeting at the Collins Hotel, Dundas, Ontario. The main item was a talk by D. C. Dieterly, Chairman of the American Society of Testing Materials Sub-Committee on Magnetic Materials Testing. For the first time in Canada, test equipment of a special type was set up and demonstrated during the course of the meeting.

Sponsored by El-Met-Parts Limited, a tour of the Appliance Division of the Canadian Westinghouse Company Limited at Hamilton took place in the afternoon, after which a reception and dinner were provided. Guest after-dinner speaker was Lawrence A. Stock, specialist on cost reduction, Canadian General Electric Company Limited, whose address was entitled "The Application of Cost Reduction in Industry".

1957 "Medal of Honor" Award in United States

Max F. Balcom was recently chosen recipient of the 1957 U.S. RETMA "Medal of Honor" by a unanimous vote of the U.S. RETMA Board of Directors. He received the award at the U.S. RETMA Industry Banquet held in Chicago in May during U.S. RETMA's annual convention.

The award, established in 1952, provides industry recognition of the person, company or organization which has made outstanding contributions to the advancement of the industry - the industry's highest award.

The nomination of Mr. Balcom was made by Paul V. Galvin, recipient of the 1956 "Medal of Honor", in his capacity as Chairman of the Annual Awards Committee.

Mr. Balcom, long affiliated and active in the affairs of the Association, was President in 1947-48, and in 1954-55 served as Chairman of the Board. He has been a Director of U.S. RETMA since 1942. He served as Chairman of the Tube Division for eight years and headed a number of important committees such as Television, Educational TV, and Surplus Disposal.

Continued Overpage

RETMA Report

U.S. RETMA Report on Manpower Shortage

Leading representatives of the United States electronics industry recently presented to the Department of Defense a detailed report on programs now being used to alleviate severe, current engineering manpower shortages.

The report, detailing a wide variety of programs used by almost 100 electronic manufacturing concerns, was given to the Director of the Office of Manpower Supply, Defense Department.

The U.S. RETMA report, compiled at the request of the Defense Department, measures the use and effectiveness of some 20 types of programs which the electronics industry has adopted to ease engineering manpower shortages and more effectively utilize such personnel.

The practices of sponsoring advanced study by engineers at degree-granting and post-graduate institutions and of offering summer employment to science teachers and students appear to be the electronic industry's leading means of furthering these scarce skills and of better utilizing them, the report said. About two-thirds of the 92 firms participating in the report indicated extensive activity in this field.

RETMA Committee Member Participates in Manpower Broadcasts

Richard Scott, member of RETMA's Industrial Relations Committee, was the speaker in a recent broadcast given under the auspices of the Federal Department of Labor. Under the title "Canada at Work", the broadcasts for the series were held May 5 to June 9. Local broadcasting program schedules should be consulted for stations and time of broadcasts.

Each talk will be given on aspects of the supply and demand of professional manpower. Each talk will be given by top executives in the related professional fields. Mr. Scott's talk was entitled "Where Does the Technician Fit Into the Picture?" and indicated where technicians came from, who they were, and pointed out some of the weaknesses of the present training systems and of the employment of technicians with suggestions for improving the situation.

Transistor Sales Increase in U.S.

According to RETMA of the United States, the sales of transistors in the U.S.A. are increasing at a fast rate. Factory sales of transistors in March, 1957 totaled 1,904,000 units with a dollar value of \$5,321,000 compared to 1,785,300 sold in February, 1957 with a dollar value of \$5,172,000.

Cumulative sales of the semi-conductor device during the first quarter of this year amounted to 5,125,300 units with a dollar value of \$14,612,000 compared with the sale of 1,898,000 units with a dollar value of \$5,688,000 during the corresponding quarter of 1956.

Corresponding figures for Canadian sales of transistors are not available but it can be assumed that this upward trend is being reflected in Canada.

TCC PRODUCTS win approval of Canadian Electronic Engineers

The establishment of the Canadian Company of T.C.C. brings a valuable addition to the Canadian Electronics Industry.

Industry-wide demands necessitate these increased Canadian facilities.

As leaders in the capacitor field, T.C.C. produce capacitors of all types, sizes. Now, in Canada, we envisage far-reaching development programmes — products not hitherto available from Canadian sources.

TCC

CANADA

Places at your service 50 years' experience,
and unexcelled technical skill.



THE TELEGRAPH CONDENSER CO. (CANADA) LTD.

SALES OFFICE:
44 Wellington St. E., Toronto
EMpire 6-5673

PLANT:
50 Barfald Rd., Toronto 15
ROger 6-6123

A CANADIAN VTVM KIT WITH CANADIAN COMPONENTS AND SERVICE



MODEL VMK-1: Provided with instruction book, test leads, probe, miniature tubes, parts packaged and identified, 90 day warranty on all parts.

PRICE \$39.20 In Kit Form
\$53.95 Factory Wired and Calibrated



MODEL VMK - 1 VTVM KIT

SPECIFICATIONS: Vacuum tube voltmeter kit — model VMK - 1
— A highly versatile unit.

Power Supply — 105 - 125 ACV 60 cycle.

Power Consumption — 20 watts at 115 volts.

Ranges: (a) DC volts 0-1.5, 3, 12, 30, 120, 300, 1200 (seven ranges)

(a) AC volts 0-1.5, 3, 12, 30, 120, 300, 1200 (seven ranges)

(a) Peak to Peak: 0-4, 8, 32, 80, 320, 800, 3200 (seven ranges)

(a) Ohms: 2 ohms to 1000 megohms in seven ranges.

Frequency: AC measurement to approximately 2 megacycles.

(RMS & Peak to Peak).

Input Impedance — (A) Volts DC 10.5 megohms.

(B) Volts AC approximately 10 megohms

shunted by 150 MMFD.

Meter: 5" unbreakable lucite front, sensitivity: 350 microamps.

Tubes: 12AU7 — Balanced Bridge.

6AL5 — rectifier.

Physical size: 8½" high, 5¾" wide, 4" deep — weight 4½ lbs.

HK-1 AMPLIFIER KIT

Frequency response — 20

C.P.S. to 20,000 C.P.S. ± 1 db.

Harmonic distortion — less

than 1% at normal operating

levels.

Intermodulation distortion —

less than 1% at normal

operating levels.

Hum level — 60 db below

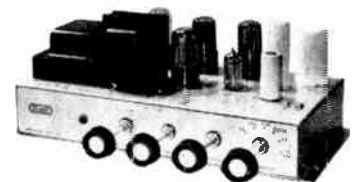
rated output.

Maximum power output —

10 watts, 15 watts at peaks.

Power consumption — 65

watts.



Price \$49.95

Write For Details On Other Stark Kits

STARK ELECTRONIC SALES CO.
AJAX, ONTARIO

PHONE AJAX 125
S572

"Memory" Systems In Electronic Computers

by A. W. M. COOMBS, Ph.D., B.Sc., A.R.T.C.

A high proportion of the research and development work on computing techniques is concerned with means for improving the "Memory" or "Store" which forms one of the most vital parts of digital computers.

LARGE-SCALE computing machines have now become very familiar objects both to the technical man, who refers to them as Digital or Analogue Computers, and to the layman, to whom they are still thought of as "Giant Electronic Brains." The inter-

esting details of the machines, however, remain largely unknown except to the expert, and even he tends to think in terms only of his own colossus. The design and understanding of computers is inevitably complex; the capabilities and limitations of the dif-

ferent types of machines can best be appreciated by considering the form and operation of their "Store" or "Memory" unit. It is in respect of methods of storage that digital machines differ most widely, and are least satisfactory. As a result of this, a very high proportion of research in the field of computers is at present concerned with improving and increasing the scope of storage techniques. In order to appreciate the significance of these developments, it is necessary, first of all, to consider the store in relation to the general working of digital computers. Given a mathematical problem to solve in numerical terms it is, in general, possible to proceed in two ways; that is to say by a graph or by carrying out an arithmetic sum. The first method is ideal if the parameters are continuously variable, the answer is desired quickly and accuracy is not vital. The second is more laborious, but given the time and patience it will yield the more accurate answer.

Analogue and Digital Computers

Very broadly the difference between an analogue and a digital computer is that between drawing a graph and doing a sum. The analogue computer "draws its graph" by providing a variable voltage, or a varying shaft rotation or some other physical manifestation directly related quantitatively to the variable required. The accuracy of the analogue computer depends on the

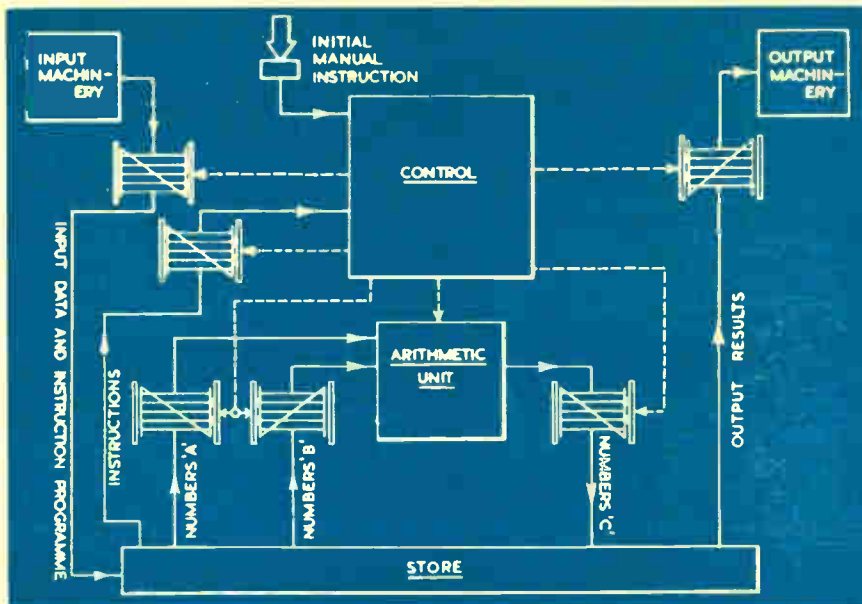


Fig. 1. In Mosaic, the "control" interprets instructions and sends corresponding signals to "gate" and selection circuits to govern the arithmetical processes taking place. It also controls the flow of instructions to itself after the initial manual instruction. The "Arithmetic Unit" adds, subtracts, multiplies and compares numbers "A" and "B" to give answer "C".

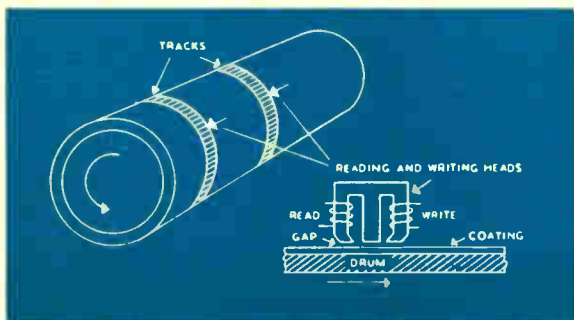


Fig. 2. The magnetic drum store which embodies the muttering technique. It is one of the most useful forms in use for storing large amounts of information compactly.

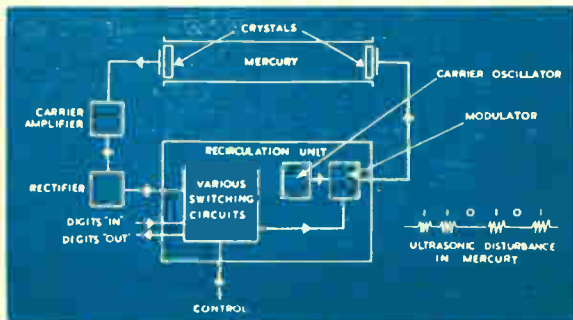


Fig. 3. Typical arrangement of mercury delay line store. A modulated carrier wave is shown bottom right.

skill with which such mechanical devices can be made, and the accuracy with which such voltages and movements can be measured. The digital computer, on the other hand, uses no accurate measuring techniques. It simply works on the numbers representing the parameters of the problem and applies the basic arithmetical processes of addition and subtraction, to which are added a few comparison operations of similar type. It naturally follows that analogue machines tend to be built to perform special single functions, for example, an anti-aircraft gunnery predictor, whereas modern digital machines are usually much more comprehensive in their application. A hundred-fold increase in accuracy in an analogue machine implies a hundred-fold increase in size. The corresponding increase of two decimal digits in a digital computer, however, may make very little difference to the overall size of the machine. The flexibility of the digital machine derives from the fact that it performs the same simple arithmetical operations on all problems submitted to it; only the sequence of the operations varies from problem to problem. Such a sequence is devised in advance for each complete problem by the mathematician in charge of the machine, and it is incorporated in a "program" of instructions for the machine to obey.

Basic Functions of the Store

The number of separate arithmetical operations in even a small calculation may, of course, be very large. The machine must, therefore, be designed to carry out any one such operation at a very high speed, and, in practice, it is not unusual for the addition of two 10-digit decimal numbers to be performed in a time of the order of 100 micro-seconds. Clearly, to use the machine time efficiently, it must be possible to feed the instructions in at a similar speed. Since this is well outside the scope of any human operator, it follows that the whole program of instructions must be fed into the machine in advance and held in store in some way so as to permit the machine to draw on it at high speed as the computation advances. Some savings of storage space may be — and always is — effected by the use of "sub-routines". Such routines are in the nature of cycles of operation which recur several times in the course of a major calculation, but which need only be stored once, the control circuits being arranged to

(Please turn to page 26)

● The author of this article has been Principal Scientific Officer at the General Post Office Research Station, London, since 1936. He has made a special study of electronic switching of all kinds, particularly of computers.

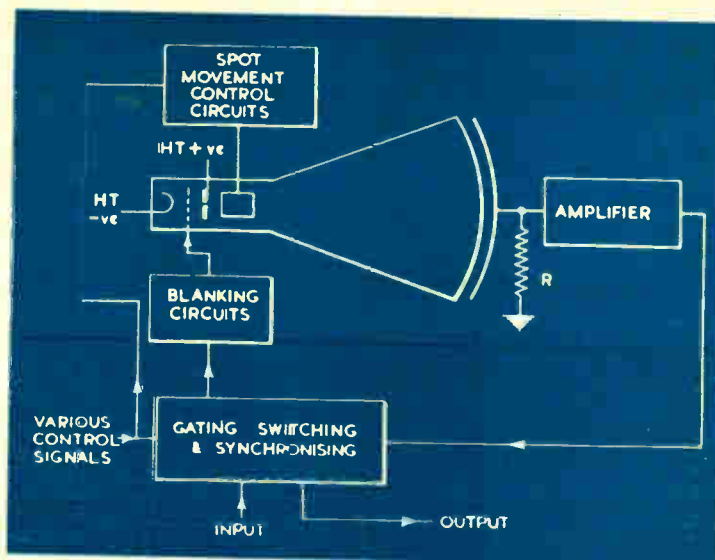


Fig. 4. The general arrangement of a Williams Cathode-ray tube form of store in which the information is stored as a two-dimensional array.

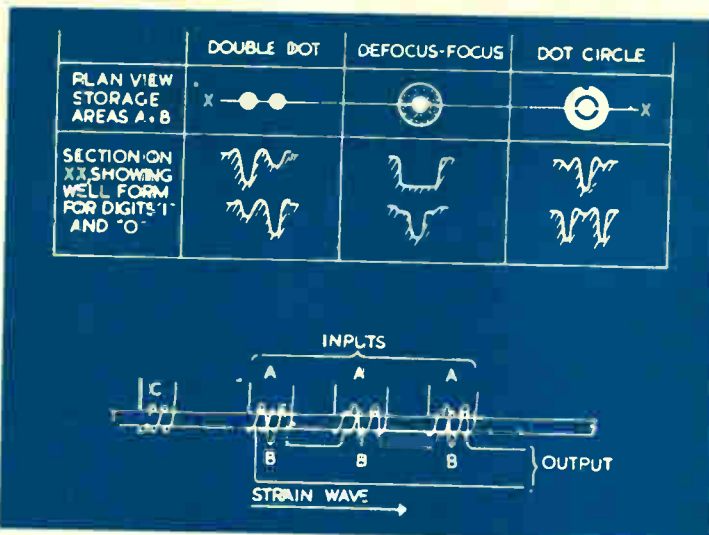


Fig. 5. Above. Various storage well forms. Below. Strainread static store in which magnetizable wire is used as the storage medium.

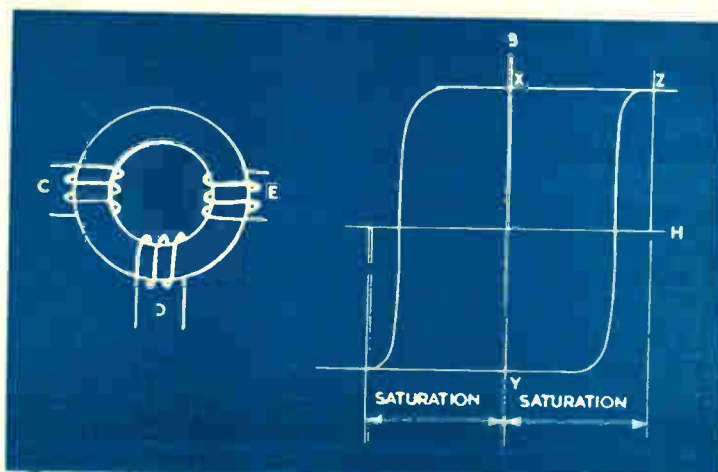


Fig. 6. Square hysteresis loop storage system, such as is used in "filing" systems.

"Memory" Systems (Continued from page 25)

incorporate each cycle into the main program as and when it is required. Even allowing for sub-routines, the number of instruction words in a given program may still run into several hundreds.

The store has uses other than the storing of instructions. It must also hold the data figures relating to the problem being solved, and possibly the numerical values of such physical constants as π and e . It must, in addition, hold interim results — the sort of figure one usually scribbles in the margin when carrying out a calculation — and it must also act as intermediary between the essentially slow-speed mechanical input and output gear and the high-speed computing circuits. The manner in which the operation of the store is linked with the other parts of the machine is indicated in the diagram in Fig. 1. This is a block diagram of the digital computer "MOSAIC" designed at the G.P.O. Research Station for the Ministry of Supply. The unit operation in this computer consists of taking two numbers A and B from the store, passing them to the arithmetic unit, or function box, operating on them in some way to produce a further number C and passing that number back to the store, where it becomes available for further operations. All operations are directed by the control unit which draws instructions from the store, each instruction itself containing information concerning the location in the store of the next instruction which will be required. The store, then, is a vital part of the digital computer. It is also usually the largest, using far more than half of the total equipment if the switching circuits be taken into account. Moreover, as already mentioned, it is certainly the part which varies most widely over the range of machines now in use. An attempt will now be made to describe some of the storage techniques which have been used to date, though it must be made clear that no comprehensive treatment can be attempted in the course of an article of this nature.

Essential Requirements in Storage Devices

The essence of a storage device is that it shall be capable of exhibiting more than one physical state, that its changes of state shall be reversible and that it shall be able to retain any one of its states for a finite time. For use in a high-speed computer, it is also necessary that the state shall — in some way — be readable at high speeds, and usually that it shall be possible to set it up or "write" it with equal rapidity. The latter condition certainly applies to that part of the store which accepts the result of a unit calculation, but could be relaxed, for instance, in the case of the instruc-

tion store. Thus, a capacitor could be made to store a decimal digit by charging it to one of 10 discrete levels of potential and, if the leakage were low enough, this voltage could be read as and when required.

Storing decimal digits in this or analogous ways is, however, very unsatisfactory. It is not easy to obtain a rapid and reliable answer to the question, "How much charge has this capacitor?" without altering the charge state in the act of reading it. It is much more convenient and practical if the only question to be asked is, "Has the capacitor a charge or not?" This binary manifestation runs right through the whole realm of possible storage devices. Thus, a valve is either conducting or cutoff, a piece of iron is either magnetized or not, a gas triode is either struck or not, and a mechanical strain is either there or not there. This fact has led practically all modern computers to store their information in the binary mode — as binary digits — rather than in the decimal mode. Even those machines which do store decimal digits do so with groups of two-state and thus essentially binary devices, in the form of dekatrons, rings of hard valves, or as "binary-coded-decimal." The adoption of binary techniques is usually extended into the computing circuits as well, for circuits to add or multiply binary numbers are far simpler than those to add or multiply decimal numbers.

It is clear that many different ways of storing binary digits exist. The major problem is that associated with the reading technique, by which the information standing in any part of the store may be obtained rapidly, either as a time sequence of pulses on a single lead — the usual method — or as a group of simultaneous pulses on separate leads, as would be required in a "parallel" machine. It is preferable to satisfy these conditions without mutilating any information in the store that may be required again. A human operator, faced with the problem of remembering a series of instructions, may aid his memory in three obvious ways. He may repeat them over and over again to himself till he needs them; he may make a note of them; or he may place them in a file with a suitable indexing system. Precisely the same methods, which we may call muttering, scribbling and filing, are employed by computing machines, and they will now be considered under those headings.

Muttering Systems

The technique of "muttering" consists in causing the binary digits representing the stored information to circulate in closed paths with a point of access in each path whereby

the digits may be read off as they pass. The reading equipment is, therefore, stationary and can, if necessary, be massive. The circulating digits may be of any form which provides an electrical signal at the access point. A well-known store embodying the muttering technique is the magnetic drum. Such a store is illustrated in Fig. 2. It is one of the most useful forms now in use, and certainly the best from the point of view of storing very large amounts of information compactly. The drum is coated with a magnetizable material which can take and maintain a magnetic pattern under the influence of the "writing" head. Thereafter, the pattern can be read off by the "reading" head on each rotation of the drum as a series of electrical impulses, but will, nevertheless, remain on the drum to be re-read until some other sequence of impulses is applied to the writing head. The spacing of the digits on any one track of the magnetic pattern can be made about 1/100th in.; anything less is liable to give cross-talk between adjacent digits, even with the reading head clearance down to 0.0005 in., which is about the lower limit of practicability. With a 6-in. diameter drum rotating at 3,000 r.p.m., this gives about 2,000 digits for peripheral track, with an output pulse frequency of 100,000 c/s. The tracks may be at 30-to-the-inch spacing, so a 6-in. diameter drum of 8-in. axial length could accommodate 500,000 binary digits, or 12,500 numbers and instruction words of 40 digits each.

Such a storage capacity is very large but is not obtained without a price. In practice, the extremely small clearance of the reading and writing heads calls for a drum with almost perfect balance, no wobble and no eccentricity. The heads themselves also call for skilled manufacture and assembly. But the worst inherent fault of the drum is probably its long access time. It may, for instance, be necessary to wait for a complete revolution of the drum in order to obtain a particular word — and 20 milli-seconds is a long time in a digital computer. Because of this, magnetic drums are usually employed only as "backing up" stores, whole groups of words being transferred at specific times to some other form of store, which may have more limited accommodation, but does, at least, provide for more rapid access. In this form, the drum is ideal, even though its use with a second form of store may complicate circuitry and introduce synchronization problems.

"Delay Line" Stores

Instead of rotating a mass of metal with digital information statically associated therewith, it is possible and practicable to hold the mass still and

(Please turn to page 30)

**Fast Reading Of Radiation
Level To Prevent Contamination
Of Atmosphere Is Important
Function In . . .**

Monitoring Nuclear Plants

ONE important function of a unique radiation monitoring system recently completed for the first American nuclear power plant near Shippingport, Pennsylvania, will be to prevent harmful radioactive material from entering the atmosphere.

The monitoring system will also have the following responsibilities:

1. Check for leakage in the reactor's water-cooling system.
2. Check the radiation accumulation in the boiler compartments, to make sure that the areas are safe to enter for maintenance during shutdowns.
3. Check for contamination in the ventilating and cooling air.
4. Keep a continuous chart record of radiation in the various areas of the plant.

If radiation levels in the selected areas exceed the preset limits, alarms will be actuated by contact meter-relays. If contamination is detected in the air systems being monitored, the meter-relays will also actuate solenoids. These in turn will operate butterfly valves to stop the circulation of air.

To insure precise monitoring of radiation at lower levels, and at the same time provide for a wide range, the dials of the meter-relays have three-decade logarithmic scales, instead of linear ones. Detectors used include GM tubes, ionization chambers

and air particle detectors.

All the equipment used in the monitoring system, including the meter-relays, was carefully chosen for reliability and maintenance-free operation.

The meter-relays chosen for the job offer a means of combining a constant visual indication of prevailing radioactivity with easily adjusted preset limits of radiation.

The radiation monitoring system will be housed in the auxiliary control room of the Shippingport power plant. This centralized location will not only permit quick reading of radiation levels but will also simplify maintenance. The electronic circuitry for each of the eleven channels is mounted in the equipment racks on "roll-out" type slides that allow immediate access. In the rear of each rack are large removable doors.

Basically, each channel in the system consists of a radiation detector which produces an electrical signal proportional to the activity present; an inter-connecting cable that feeds the signal to a computer-indicator; and a computer-indicator that converts the signal into an intelligible meter indication. With only one exception, each channel includes a background flasher to indicate channel operation when the radiation level is insufficient to cause a meter deflection. A DC signal is provided to drive a strip chart recorder.



● Westinghouse project engineer is shown adjusting one of the contact meter-relays in a nuclear power plant.

Other features of the system include etched wiring and plug-in circuits wherever practical; uniformity of circuits to the greatest degree possible; tubeless power supplies; ruggedized tubes; and two low voltage and filament power supplies in each equipment rack, with either unit being capable of supplying the entire rack in an emergency.

The nuclear power station is being built by the Duquesne Light Company and the United States Atomic Energy Commission and is due to go "on the line" in 1957. It will be operated by Duquesne Light.

Electron Microscope In Photographic Research

WITH the help of electron microscopes, pulsing light and electricity, scientists are probing into total darkness to discover the nature of the pictorial image on a piece of film — that is, the "latent image" which registers on film upon its exposure to light.

That this is an almost impossible job may be gathered from the fact that although any advanced amateur photographer can tell you something about the chemical composition of a piece of film, there's no way for anyone to see or chemically determine what subtle changes take place in the emulsion grains upon exposure to light because the latent image is completely destroyed by developing. Thus once the film is processed it is impossible to analyze just what did happen to the

grains of silver halides in film emulsions and the films on their brief exposure to light. Evidence of the change must therefore be found indirectly.

The way that research scientists at Eastman Kodak Company are approaching the "latent image" problem is to subject the crystals of silver halide to pulses of light of a millionth second duration — at a rate of 1,000 pulses per second — and, at the same time, to give the crystals simultaneous pulses of voltage of 4,000 volts.

This enables photographic scientists to study, for the first time, the motion of electrons in the crystals.

According to Dr. Cyril J. Staud, vice-president in charge of research at Kodak, the experiments have shown that the latent image follows the

movement of electrons in the crystals. This is demonstrated, he said, by the movement of what can be analyzed as the latent image to one side of photographic grains when the electrical field attracts electrons in that direction.

When completely known, such an understanding of the light action will undoubtedly aid in development of improved photographic emulsions and in research on specialized photographic materials and equipment.

With the new-found ability to study the various stages in this process, Kodak research "appears to have advanced the understanding of the fundamental characteristics of the photographic image to a much greater extent than was the case even 10 years ago," according to Dr. Staud.

Progress in Plastics Assists
Manufacturer in the Production
Of an

Electronic Splicer For Mylar Type Films

LAMINATED plastic has proved its superior electrical and physical properties in the development of a new electronic film splicer, shown in

Fig. 1.

The unit was developed by Shepard Laboratories, Inc., to solve the splicing problem of new non-acetate films such

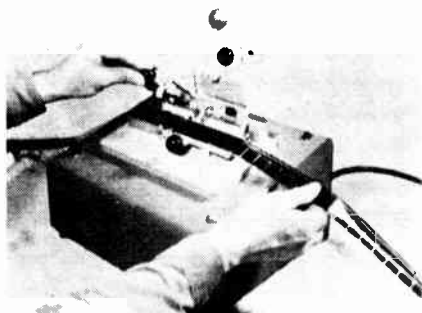


Fig. 1

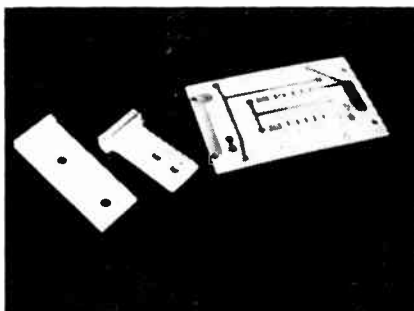


Fig. 2

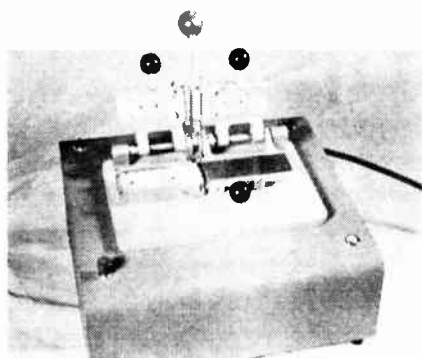


Fig. 3

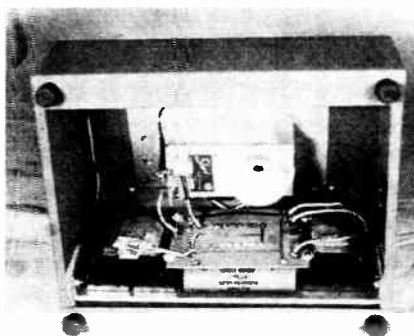


Fig. 4

as duPont "Cronar". These new Mylar type films cannot be joined by regular film-splicing adhesives.

Shepard's new approach to film splicing uses dielectric heat to form a bond between the two film ends to be spliced. Intense high-frequency energy is applied to the overlapped ends of the splice — fusing them so quickly that the original molecular orientation of the film is not disturbed. This bonding method retains the original high strength and durability of the film. Because of sharp energy reduction the instant the splice fuses, there is no danger of the film "burning". The Electronic Film Splicer can also be used on standard acetate films.

In manufacturing the splicer two pieces of Phenolite G-7-830, shown in Fig. 2, for electrode-supporting blocks of the new unit were supplied by National Vulcanized Fibre Co. The smaller piece is the clamping member of the middle block and is raised and lowered with the middle handle shown in Fig. 3. This part holds the film down during the splicing operation and does not interfere with the passage of high frequency current.

The larger piece, the lower left film block, supports the high frequency electrode without dielectric loss and, like the electrode-supporting blocks, does not interfere with the passage of high frequency current needed to form the splice. The phenolite used in this application was found to offer complete resistance against carbonizing and arcing and meets stiff requirements for dimensional stability.

A cold punching copper-clad material for printed circuits was also used by the manufacturer of the film splicer, see Fig. 2. This material was used as the base for the printed circuit in the power unit, as shown in Fig. 4, and according to the manufacturer, resulted in savings in labor and reduced manufacturing costs.

Remote Monitoring Of Demand Meters

BY using a closed-circuit television system, an industrial firm estimates it saves \$850 each month in electric bills.

The company, a manufacturer of zinc oxide products, is billed on a demand power basis by the electric power company, a type of billing used with many industrial concerns. This means that the electric bill for the month is based on the peak load used during this period, even if this peak occurs for just an instant. This method is used because the power company has had to install power lines and generating equipment capable of handling the peak loads of the manufacturer.

If the manufacturer could monitor the demand meter, he would be able to control power consumption by

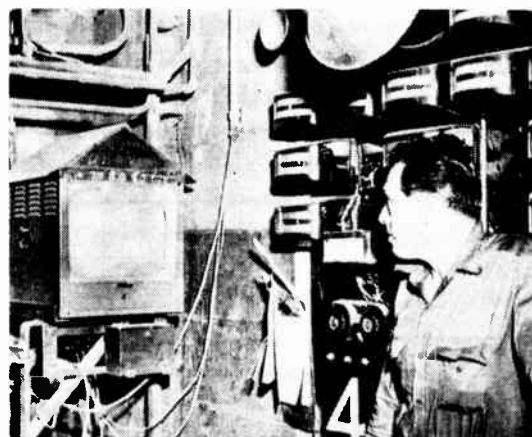
switching electric furnaces so that peak power demands far above the average could be avoided.

Since the power company does not permit tapping onto the demand meter for remote indication and placing a man in the company's sub-station for monitoring is both impractical and expensive, a small, five pound General Precision Laboratory TV camera is mounted to furnish a close-up view of the meter. Some 500 feet away in the plant control room, a plant engineer watches the meter reading on a

● Engineer watches picture of electric power company's demand meter located 500 feet away on television monitor installed in plant control room. Remote reading of meter permits control of power consumption to avoid peak demand.

TV monitor and makes the necessary load adjustments to keep the demand from exceeding certain limits.

The manufacturer, with an investment of only \$4,000 in an industrial TV system, now enjoys a savings of over \$10,000 annually.



A Device Ideally Suited To Critical Applications
In Airborne Gaging And Processing Control
Systems Requiring Highest Reliability And
Accuracy Is The

Ultrasonic Level Sensor

By Robert L. Rod

President Acoustica Associates, Inc.

THE ever present need for a reliable yet simplified liquid level sensor has been met by using a newly developed ultrasonic probe. Operating on the principle that an ultrasonic transducer in contact with a liquid presents a terminal impedance appreciably different than obtained when it is purely "air-loaded", the new sensor basically consists of a subminiaturized transducer appropriately mounted in a tank at a preset height. This change of impedance is not affected by characteristics of the liquid. A transistorized electronic control unit external to the tank energizes a relay when the level passes the sensitive face of the transducer with an accuracy of $\pm \frac{1}{32}$ inch. The complete level sensor, including the transducer and the electronic control, weighs under 12 ounces and consumes only 20 milliwatts during operation. Performance is stable when sensing virtually all liquids at temperatures of from -270°F to $+220^{\circ}\text{F}$. The sensor is impervious to foam and clinging droplets and is ideally suited to critical applications in airborne gaging and processing control systems requiring highest reliability and accuracy.

Technical Description:

From a technical standpoint, the sensor element consists of a solid cylinder of barium titanate approximately 1 inch long and 0.5 inches OD. This cylinder has a fundamental half-wave length resonance of about 90 kc. The titanate cylinder is bonded axially to a similarly dimensioned slug of stainless steel which has a model clamp at its midpoint. This clamp enables the entire titanate assembly to be supported within a surrounding sealed stainless steel case measuring 0.875 inches OD without restricting the motion of the vibrating element. When completely assembled the emergent end of the stainless slug is used as the sensitive face which is placed in contact with the liquid being gaged. The overall length of the probe including the protruding quarter-wave stainless slug is slightly over 2.5 inches. It weighs less than 5 ounces.

The mounting arrangement described eliminates the need for any pressure release material normally required to support a transducer. This approach reduces the number of dis-

similar materials used in the probe aside from wire to three; namely, barium titanate, stainless steel and a bonding cement joining the transducer to the coupling slug. In operation the probe operates reliably when immersed in liquids ranging from liquid nitrogen to boiling water. For higher temperature operations, a small magnetostriction transducer is employed in place of the titanate.

Using a construction as outlined for the probe it is possible to realize impedance changes up to 10:1 between conditions of air and liquid loading. With a titanate transducer, a reliable impedance change of at least 4:1 is achieved over the full temperature range of from -270°F to $+220^{\circ}\text{F}$. This impedance change is sensed by an extraordinarily simple electronic circuit consisting of a single silicon junction transistor, a relay and 8 subminiaturized components. The transistor is arranged in an oscillator circuit with the transducer placed between the emitter and ground in series with the operating coil of the relay. In the case where the sensor is unloaded out of a liquid, its impedance is of the order of 2.5K. Under this condition the transistor circuit oscillates at the natural frequency of the transducer. Immediately upon loading the transducer with liquid, the impedance rises above 10K thus causing the transistor circuit to cease oscillations instantaneously. The re-

sulting change in emitter current between the oscillating and non-oscillating conditions is more than sufficient to energize a sensitive relay which is wired in series with the transducer. Because of the choice of a proper operating frequency, clinging droplets adhering to the sensor will not cause false readings.

Power requirements for the level sensor are only about 20 milliwatts in the normal, unloaded condition and 100 milliwatts when the sensor is immersed and the control relay is operating. This power is ordinarily obtained from a 24-30 volt DC source, but for AC operation, an auxiliary rectifier is supplied. The phenomenally low power drain makes this sensor ideally suited for airborne applications.

Applications:

Applications for this versatile sensor are found in airborne systems and in virtually all process applications involving liquids and their control. As opposed to presently used thermistor probes, the ultrasonic sensor responds instantaneously rather than in 2 or 3 seconds and is entirely safe when used to gage hazardous, explosive liquids. No temperature correction circuits are required nor are any adjustments needed to compensate for any variables whatsoever. The sensor is completely sealed in stainless steel and can in no way contaminate foods and beverages. Operation is not dependent upon either the conductivity, pH, temperature, pressure or density of the liquid being monitored, and furthermore, there are no moving parts other than the relay contacts. Groups of these probes can be used at discreet levels to control filling and emptying operations, their spacings controlling the discharge or intake rates. In every case, reliable control will be achieved instantaneously at minimum of cost and, most important, with maximum reliability.

S O R R Y

If we didn't know before, we know now, that the front cover illustration of our April issue depicted a Bellini-Tosi D F Loop and not a "radar antenna" as stated in the caption to the picture.

We know now because we've been advised so by Marine Superintendents, Chief Engineers, Directors, General Managers and Presidents of several companies. We've been advised of our error by letters, telegrams, and even early morning 12:30 a.m. telephone calls.

Should have known better? Certainly! We've gazed at D/F Loops a thousand times from the bridge of Canadian destroyers. But alas, it's an ill wind that doesn't blow some good and our editing error (we didn't write the caption, it came with the picture) has proved to us that we're being read by some pretty top-level brass in the engineering and management categories of the Canadian electronics industry.

Thomas W. Lazenby, Editor

"Memory" Systems (Continued from page 26)

make the information rotate. This technique relies on the elastic properties of solids and liquids, and the information is stored as states of strain, which accordingly travel through or along the elastic medium with the speed of sound. An electromechanical transducer is required to change electrical signals to mechanical displacements, and vice versa. Moreover, the signal shape and amplitude inevitably deteriorate in transit, so periodic regeneration is required. Accordingly, such stores invariably take the form of an arrangement called a "Delay Line", in which the pulses are applied to one end, extracted at the other, and are then amplified, re-shaped, re-synchronized and re-inserted into the first end. Signals are tapped off at the point of re-entry, where their form and timing are correct, and such extraction need not interfere with the orderly circulation of the stored information.

The first store of this type used mercury as the carrier medium, the transducers being piezo-electric crystals (X-cut quartz) which, on being excited electrically, will vibrate in thickness. The arrangement is illustrated in Fig. 3. Thickness vibration is necessary since only compressional waves are possible in a liquid with no free surface. Because of variation of velocity with frequency, it is necessary to use a carrier wave modulated with the pulsiform digital information, and the form of waves is shown in Fig. 3. The speed of a compressional wave in mercury is about 1.5 km./sec. so the delay of a line 1.5 metres long is one milli-second. It is possible, therefore, to store 1,000 digits at a pulse repetition rate of 1,000,000 per second, and this is the order of frequency usually adopted. The carrier frequency itself is about 10 Mc/s, and the mercury introduces attenuation of some 10—12dB. The amplitude of the 10 Mc/s waves in the mercury is very small indeed, being of the order of 1.5×10^{-10} cm. per applied volt. Access time for a 1.5-metre line may be up to 1 milli-second. This is an improvement on the magnetic drum but it is still not good enough, and it is usual to employ long lines as a backing-up store with a limited number of short — temporary storage — lines each holding a single number for current computations. In addition, the program may be so arranged that the whole period of 1 milli-second is rarely required, a technique known as "Optimum Programming."

The mercury store probably gives the highest reading speed of any known practical store. It has, however, many drawbacks. In the first place this type of store is of such proportions as to require a considerable amount of installation space. The lethal qualities of mercury in bulk or in vapour form call for great

care during assembly and maintenance. Another problem is the difficulty of achieving and maintaining intimate quartz-mercury contacts, necessary in view of the small amplitudes of vibration involved. In addition, the temperature variation of velocity requires that the lines be kept under close thermal control ($\pm \frac{1}{2}^\circ\text{C}.$) or that a spare line be used to control the master-clock frequency as the temperature varies.

The first mercury-store computer in this country was "EDSAC" at Cambridge. The "MOSAIC" store, embodying the same basic design principle, uses 64 long lines — one to control the frequency — and 32 short lines, all mounted together in a thermally insulated container. The pulse frequency is 570 kc/s, and each long line holds 16 words of 40 digits each. The total capacity is thus about 1,000 words, which is adequate for most problems, but may require a second backing-up store on occasion. The whole store uses more than half-ton of mercury.

Other types of store using piezo-electric transduction have been employed mainly with the object of avoiding the bulky and poisonous properties of mercury. No other liquid, however, can compete in providing an acoustic match for quartz or in achieving uniformity of characteristics. There are, moreover, three inherent disadvantages to the solid line. One is the high speed of sound in suitable elastic solids, necessitating a much longer line for the same delay and storage capacity. The second disadvantage is the practical difficulty of achieving good contact between the quartz and the line, and the third is the possibility of waves being generated in other than the desired mode — shear, for instance, producing transverse waves. Such waves will travel with different velocity due to the different elastic modulus involved, and thereby cause interference and cross-talk between pulses. Nevertheless, at least two such forms are in use. One uses a bar of fused quartz with transducers arranged to give shear waves, and the other line compressed into a block with multiple internal reflections.

Magnetostriction and Electric Delay Lines

A second form of strain storage uses magnetostriction as a transducing phenomenon. The line is nickel wire, and the transducing elements are small coils placed co-axial with the wire at each end. An electrical signal applied at the transmit end produces a magnetostrictive disturbance in the wire, which travels along the line and can be made to produce an electrical signal at the receive coil. The wire may be coiled in the form of a spiral thus making the system very compact.

There is some complication due to the fact that the transducer responds to changes of applied voltage, but it is not difficult to cope with this. Absorbent end cells are provided, since the pulses travel right through the receiver, and must not be reflected back down the line. The pulse repetition rate is about 300,000 per second. The major problems appear to lie in the small size of the coils, it being necessary to accommodate 500 turns in a space no larger than a match head, and in the heat treatment of the nickel, on which there is no unanimity. It is also theoretically possible to use an electric delay line, that is to say, a cable with high inductance and capacitance, and consequently having a low velocity of propagation. However, the best-known cables do not exceed a half micro-second per ft. in delay. To store 1,000 pulses with lengths one micro-second each would thus require 2,000 ft. of cable. This would be far too bulky and expensive, and, indeed, would require several stages of pulse amplification, since the one attenuation of this cable is about 1 dB per ft. So far such cable has been used only to provide short delays at specific points in the switching circuits. These are the principal "Muttering" techniques currently in use. Except in the case of the magnetic drum, failure of power supply implies loss of stored information.

Scribbling Systems

In the "Scribbling" technique the stored information is held in static form, and the reading and writing members move. The implication is that the reading and writing members must be as nearly weightless as possible. The best-known store of this type is certainly the Williams Cathode-ray Tube, in which the data are stored as small areas of charge on the fluorescent screen, the cathode-ray beam itself both reading and writing. There is a backing plate attached to the face of the tube, to which plate all the small areas of the screen are thus capacitance-coupled. Any change in the total charge on the screen causes a flow of current to or from the backing plate, and, therefore, produces a voltage which can be picked off by a suitable amplifier. The general arrangement is shown in Fig. 4. The information is stored as a two-dimensional array, so time-base circuits are necessary to produce the beam movement, and the beam itself is blacked out while in transit between storage areas. These problems present no great difficulty. Of interest, however, is the manner in which a single digit is written, stored and read, and this technique will now be considered.

The tube is worked under secondary emission conditions, so bombardment

(Please turn to page 36)

BUSINESS END OF A LONG LINE OF WIRES

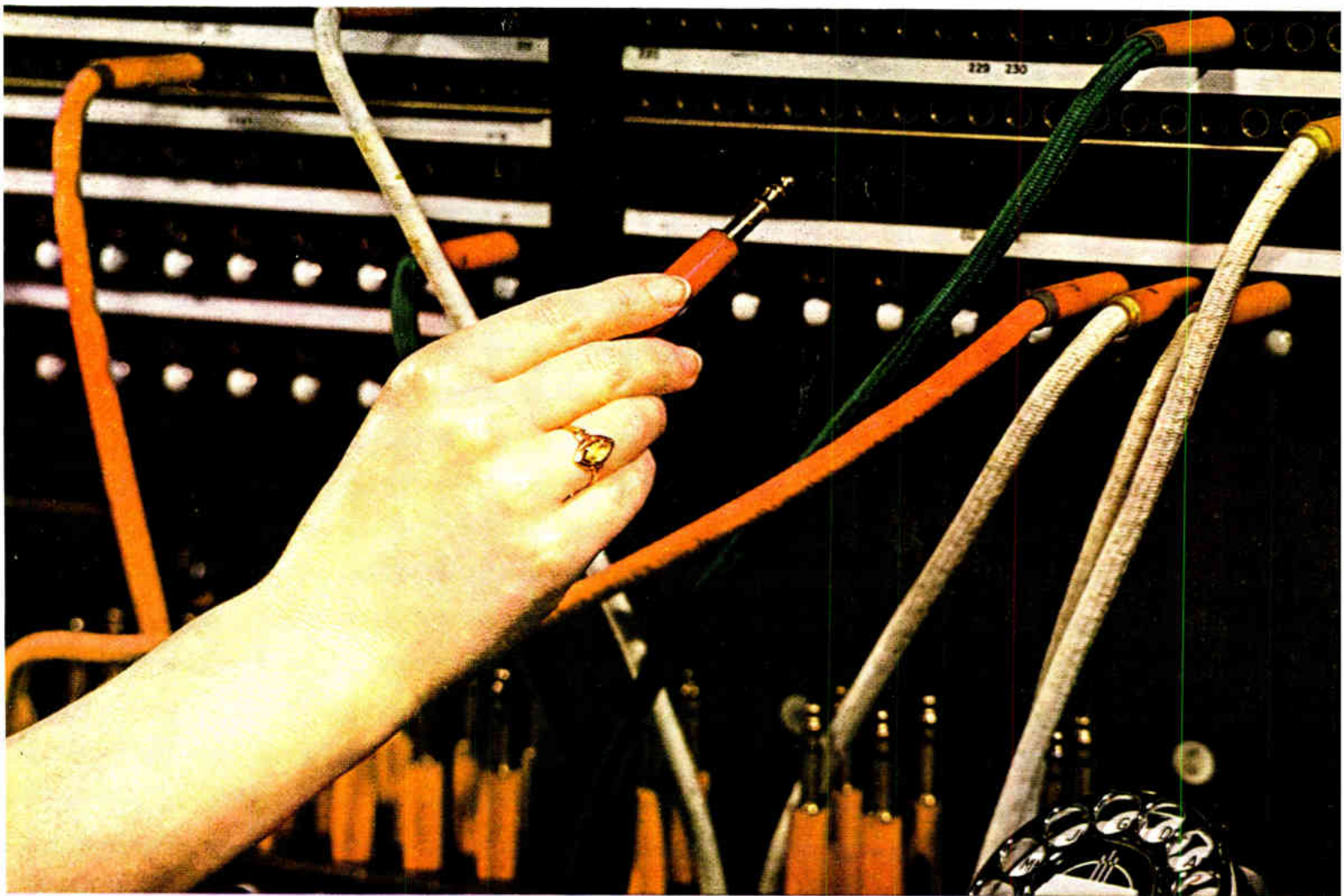
Back of this telephone jack, lies the complicated wiring of a modern switchboard, and all the connecting cables of a telephone system. Well over a hundred different wires are used to link one subscriber's phone with another. And every wire is individually designed to fill a specific need. Each one has been specially developed to meet the exacting requirements of the communications industry and the functioning of the whole system depends on these wires. That is why Phillips take such great care in their manufacture. That is why every wire must be tested before it leaves the Phillips factory. It is this insistence on reliability that has made

Phillips products a by-word throughout the communications industry. When you specify Phillips wires, you can be sure of both performance and quality.

Phillips Electrical Company Limited. The Canadian Affiliate of the British Insulated Callender's Cables Group. Head Office—Brockville, Ontario. Branch Offices—Montreal, Ottawa, Toronto, Hamilton, Winnipeg, Regina, Edmonton, Vancouver. Phillips Telephone Wires & Cables are also distributed throughout Canada by Automatic Electric Sales (Canada) Ltd.

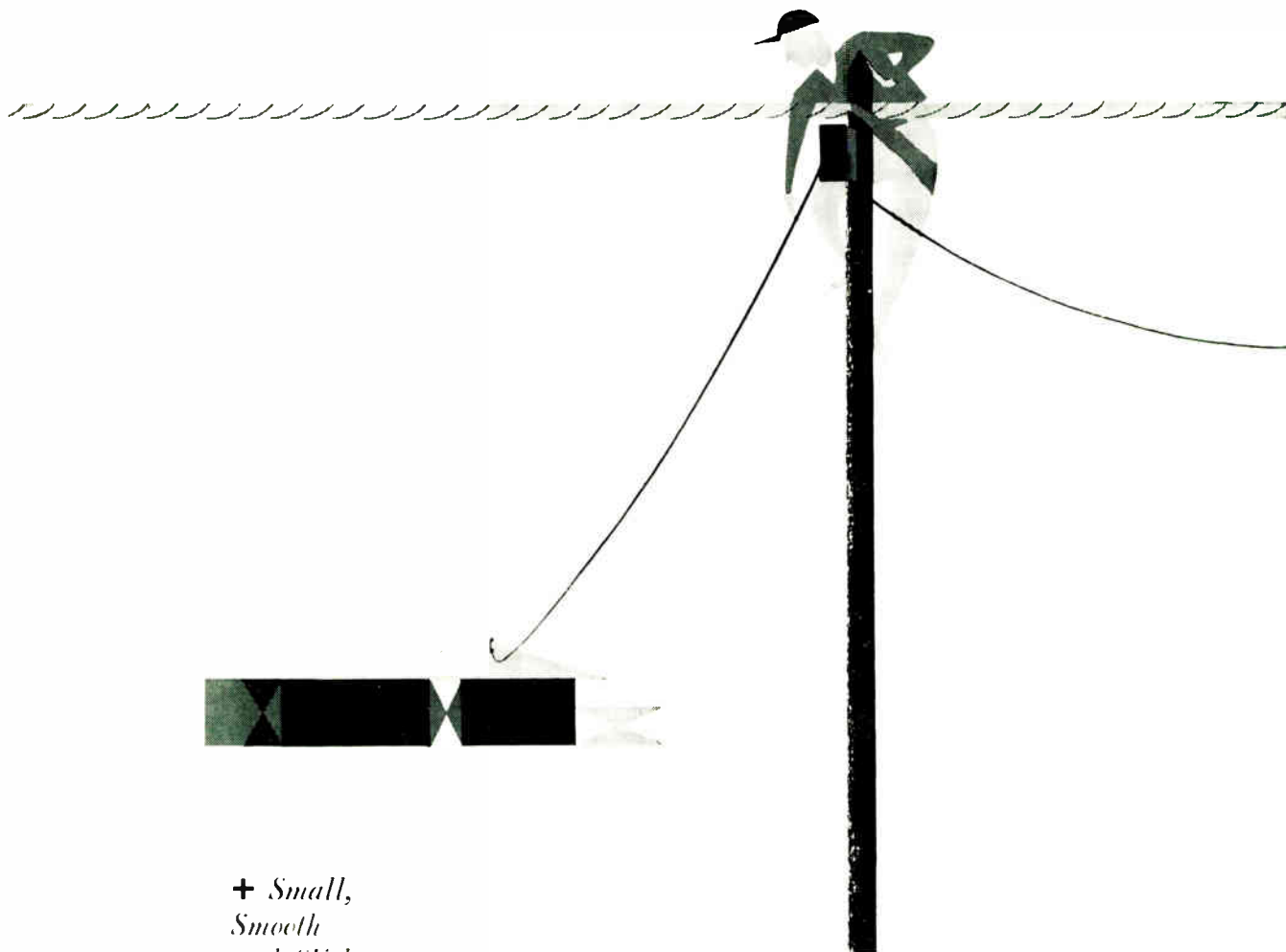
5629

SEE BACK OF THIS PAGE



Phillips

WIRES & CABLES



+ *Small,
Smooth
and Slick
to Handle*

**NEW
IMPROVED
PHILLIPS
DROP
WIRE**

With a new, improved insulation compound, Phillips Drop Wire now offers positive "extras" that cut installation time and costs.

- (1) Smaller diameter for lightness means safer handling.
- (2) Uncoils smoothly.
- (3) Pulls freely—faster to work with.
- (4) Easy-to-use with a one-man operation.
- (5) Neoprene jacket withstands extremes of weather and temperature.
- (6) Has mechanical strength and internal adhesion, to withstand compression of pole-line hardware.
- (7) Coil retains shape in storage and transit.
- (8) Tape bindings replace paper wrap for fast use.

Phillips Electrical Company Limited, Wires & Cables, The Canadian Affiliate of the British Insulated Callender's Cables Group. Head Office—Brockville, Ontario. Sales Offices—Montreal, Ottawa, Toronto, Hamilton, Regina, Edmonton, Vancouver. Phillips Telephone Wires and Cables are also distributed throughout Canada by Automatic Electric Sales (Canada) Ltd.

5610



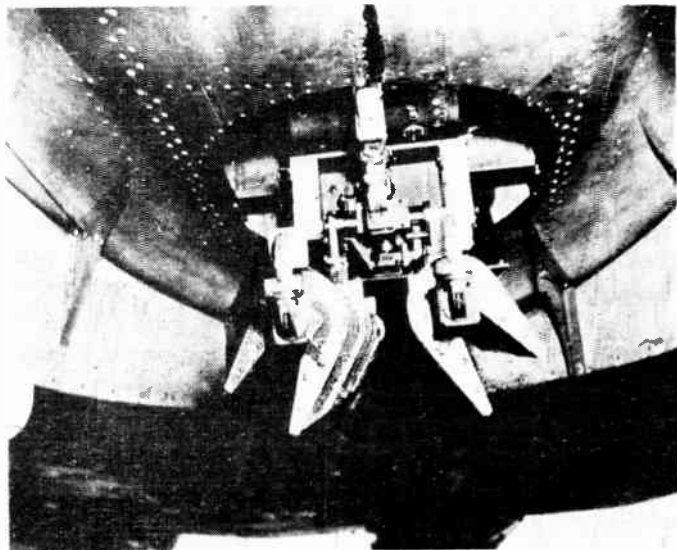


Fig. 1. GPL System No. 3. Antenna System.

In this article a brief history of work done to develop Doppler ground speed and drift angle measuring equipment is followed by a short dissertation on the fundamentals of Doppler radar. A discussion of dead-reckoning computers as used with Doppler equipment gives particular reference to the AN/ASN-7 and the AN/APA-95 navigational computers. The many advantages of Doppler navigation follow. The author suggests a number of uses which provide military aviation, civil air lines, and aircraft designers with an important tool having far-reaching effects in all areas of future flight.

Doppler Navigation

By William J. Tull

*Vice-President and Director Avionic Sales Division
General Precision Laboratory.*

SINCE December 17, 1903 when man first flew, those who have been actively associated with aviation have at one time or another been concerned with the problem of how to determine ground speed and drift angle of an aircraft without aid from the ground. Through the years a number of devices have been proposed; most of them, however, have fallen by the wayside as time progressed. The optical drift sight has, of course, been widely used for the determination of

drift angle. In addition, by double drift techniques it has been possible to determine ground speed with a drift sight.

Other self-contained means of obtaining ground speed and/or drift angle have been:

- a. Norden bombsight
- b. Radar bombsights
- c. Bellamy drift techniques
- d. Pilotage, etc.

The principal shortcomings of these

devices or techniques have been that they required clear weather to see the ground, they were inoperable over water, or they lacked sufficient accuracy. Of course, many of them also call for a great deal of skill and a large amount of equipment. The Bellamy drift technique has been one of the better recent contributions to this field of navigation. It is, however, limited in its application.

It is the purpose of this paper to
(Please turn to page 34)

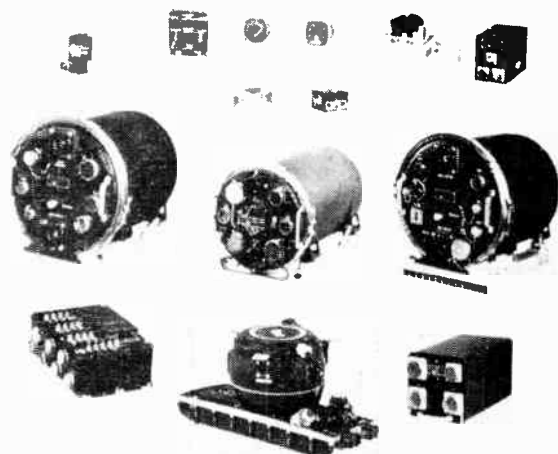


Fig. 2. Radar Set, AN/APN-81

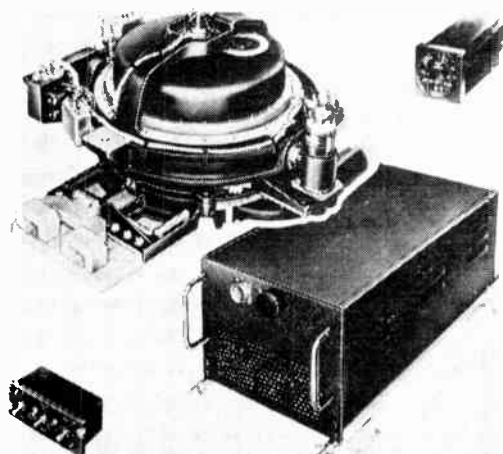


Fig. 3. Radan Navigation System Model PC-201

Doppler Navigation (Continued from page 33)

describe a new technique for measuring ground speed and drift angle without celestial or terrestrial assistance. It is now possible to do this with a high degree of accuracy, in all kinds of weather, over both land and water, completely automatically, and with equipment of practical size and weight. The basis for this development is a new sensing element, never before available for airborne use.

History

The technique which makes possible the sensing and measurement of ground speed and drift angle utilizes what is commonly referred to as the "Doppler effect". The Doppler phenomenon itself has, of course, been well known for many years. The equipment which utilizes this phenomenon at microwave frequencies and which comprises the necessary instrumentation for its measurement is commonly referred to as Doppler Radar equipment. Efforts aimed at putting the Doppler effect to work, measuring ground speed and drift angle, began in relatively recent years. The Navy showed an interest as early as 1933 and personnel of the Naval Research Laboratory actually flew experimental equipment as early as 1945. These early experiments were concerned primarily with the detection of a Doppler Frequency. About the same time, personnel of Radiation Laboratory, MIT were measuring drift angle employing the so-called "NOSMO effect", which is a Doppler phenomenon. This technique was used in conjunction with AN/APS-15 search Radar equipments and saw service in the last days of World War II with the 15th Air Force. At the end of the war, the Air Force undertook an active program with General Precision Laboratory with the objective of securing a completely automatic, self-contained navigation system. As a result of this program, G.P.L. became the first group to fly navigation equipment capable of measuring both ground speed and drift angle automatically and accurately. The first such flight occurred in April, 1948. We feel extremely fortunate that we were able to participate in this historic achievement.

Since that date there has been considerable progress in the evolution of Doppler equipment. This progress can perhaps best be illustrated by photographs showing the chronological development of equipment. The following figures are indicative of the advances made in the past few years.

Figure 1. The antenna system of original G.P.L. system number 3, which was the first system to ever measure ground speed and drift angle automatically and accurately.

Figure 2. The APN-81 equipment, currently in high quantity production for the Air Force, which weighs 380

pounds and takes 16 cubic feet of space.

Figure 3. The G.P.L. commercial RADAN model PC-201 weighing 85 pounds and taking 4.4 cubic feet of space. The RADAN system is currently in low quantity production. From these photographs, then, it is obvious that Doppler equipment is now available as a practical and producible device for use on board all types of aircraft.

Theory of Operation

At this point a technical discussion of how a Doppler Radar System measures the ground speed and drift angle of an aircraft should be dealt with but unfortunately, in view of the security restrictions, it is not permissible to do so in detail.

However, at this time the following will illustrate in a very brief manner and to the extent permissible, how these measurements are made.

Let us now examine figure 4. On the left we have a stationary transmitter — receiver A. The transmitter is emitting a signal at a frequency f . The signal is reflected from the truck B back to the receiver A. Since the truck is moving with a velocity v , there will be a Doppler shift in the frequency of the reflected signal. The equation relating the several quantities involved is shown in the upper right hand side of the figure. This equation is an expression for the difference in frequency between the signal transmitted and the signal received at location A. The difference frequency Δf is:

$$\Delta f = - \frac{v}{c} f$$

The quantity c is the velocity of propagation of the electromagnetic signal.

In figure 5, the transmitter receiver A is now located in an aircraft flying over the ground. The transmitter is sending out a beam of energy from the aircraft to the ground. The beam is transmitted at an angle γ from the direction of the aircraft velocity vector, v . The equation relating the several quantities in this illustration is shown in the upper right hand side of the figure. The equation for the difference frequency Δf is in this case:

$$\Delta f = \frac{v}{c} f \cos \gamma$$

It is evident from this equation that Δf is a measure of the velocity v , since the other quantities occurring in the right hand member of the equation are known.

It should be noted that in the above equation all energy reflected or back scattered from the ground at the angle γ undergoes the same Doppler frequency shift, Δf . Now let us draw the intersections with the ground of families of beams having constant γ angles. These intersections are hyperbolas,

assuming a plane earth. These hyperbolas are conveniently thought of as contours of equal Doppler frequency shift.

Now let us consider figure 6. Here we are observers looking straight down from above on the airborne transmitter A. The transmitter is travelling in the direction indicated by the velocity vector, v_g . In the center we see the constant frequency contour for a γ angle of 90 degrees. This is a zero Doppler frequency contour because in this case there is no relative velocity between the transmitter A and the ground. That is, for $\gamma = 90^\circ$ the frequency shift is $\Delta f = 0$. The other contour lines on the illustration are for values of γ of magnitude less than 90° . The lines ahead of the transmitter represent the loci of echo sources having an increased frequency over those transmitted. That is, there is a closing velocity between the transmitter and the ground ahead. The contours behind the transmitter correspond to echo sources having decreased frequency from those transmitted. The transmitter has a velocity of recession from all elements of the ground behind the aircraft. Obviously the smaller the angle gamma, the further ahead (or behind) the beam intersects the ground. Correspondingly, the smaller the value of gamma, the greater the value of Δf , the Doppler frequency shift.

Now let us project a small pencil beam from the transmitter at A to the ground at B. The energy is essentially confined inside the ellipse at B. It is evident that the signals within the beam B scattered from the ground nearest the transmitter are characterized by a larger gamma angle and a lower Doppler frequency shift than those further out. This is illustrated in the spectral power density plot in the lower right hand corner of the figure.

As we now go to figure 7, you will see that we once again have plotted the same constant frequency hyperbolae. However, in this case we have transmitted two beams of energy in two different directions. It can be seen from an examination of this figure that if one beam of energy is confined to the region L, the corresponding return signal has a spectrum as shown in the diagram at the bottom of the figure. Similarly one can picture the spectrum corresponding to the energy from region R. Let us now maintain the angle Θ between the L and R regions constant, while the whole beam forming assembly is rotated about a vertical axis. The frequencies associated with the beams L and R will change accordingly. In figure 8 we see what the situation would be when the beam assembly has been rotated until the frequencies from L and R are equal. In this situation it is

obvious that the bi-sector of the angle Θ lies in the direction of the velocity vector v_g .

In brief then, by the measurement of the frequency M we can determine the ground speed of an aircraft — and by servoing a two-beam antenna system until equal Doppler frequencies are received from each, we can measure drift angle. It is also possible to determine drift angle with a fixed two-beam system by measuring the Doppler frequency shift associated with each antenna beam. In this case, the drift angle must be calculated from the data rather than coming directly from a null measurement.

It is suggested by the above discussion that there are many ways of measuring the desired quantities and that there are many pros and cons with respect to various proposed instrumentation. Of course, any individual or group interested in using Doppler Radar equipment must obtain a satisfactory answer as to the merits of each of the several ways of performing the measurements. Unfortunately, such detail consideration is beyond the scope of this paper and cannot be discussed because of military security.

Computers

Thus far we have limited our discussion to the basic sensing element of an autonavigator system, namely the Doppler Radar drift angle and ground speed measurement equipment. If these measurements can be made it is apparent that the information can be combined with heading information to provide continuous dead reckoning, thus presenting a continuous display of position in any desired coordinate system. For those of you not familiar with this process, it is shown in figure 9. The process is as follows:

1. Drift angle is added to true heading giving true ground track direction.
2. Ground speed is resolved about this ground track angle giving north-south and east-west components of velocity. These components are $v_g \sin \Theta_T$ and $v_g \cos \Theta_T$.
3. By integrating the component velocities the distance travelled in both the north-south and east-west directions can be computed. This provides data on position.
4. By multiplying the east-west data by the secant of the north-south data (latitude) the east-west grid data becomes longitude.

If the above process is carried out continuously the computer would determine position continuously relative to point of departure. If the point of departure were known and the relative position were continuously added to it, present position would be continuously known.

At the present time, many dead

(Please turn to page 38)

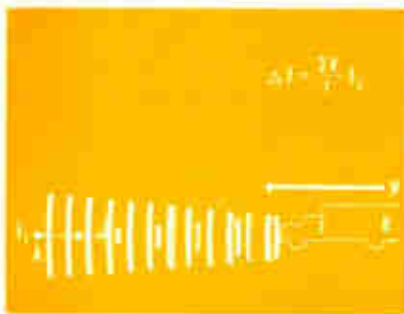


Figure 4



Figure 5

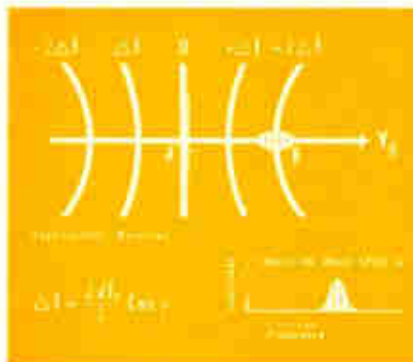


Figure 6

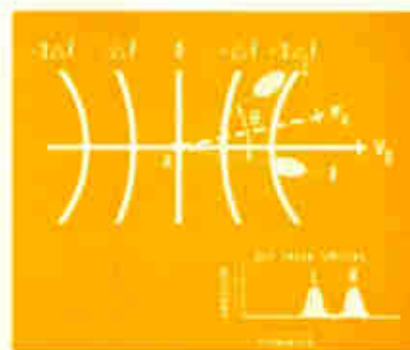


Figure 7



Figure 8

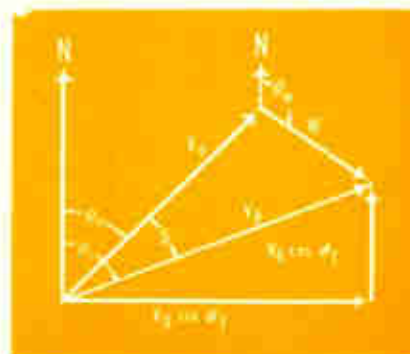


Figure 9

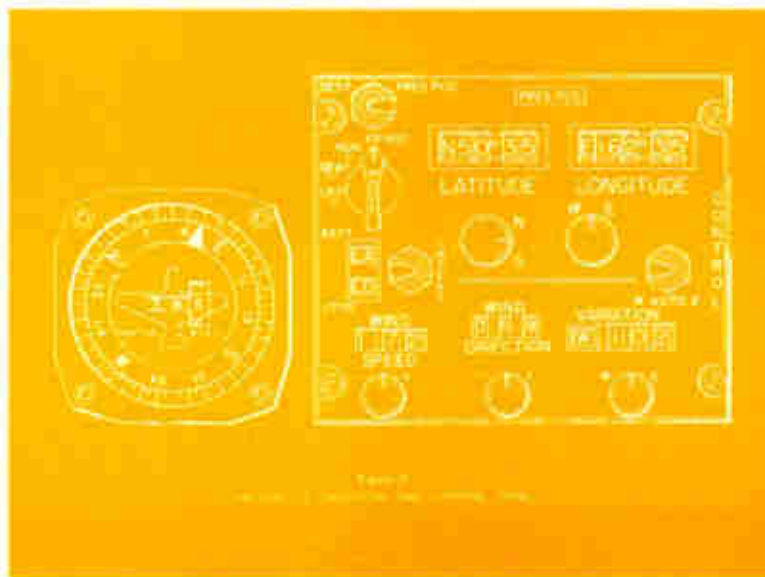


Fig. 10. AN/ASN-7 Indicator and Control Panel

Product Quality Control In
Petro-Chemical, Chemical,
And Metallurgical Processes
Aided By The Use Of Electronic . . .

Infra-Red Analyzer

AN electronic infra-red analyzer, designed to fill the need for a moderately-priced instrument for most continuous-flow chemical analysis problems, provides instantaneous analysis of flowing chemicals with an accuracy that can only be duplicated by chemists after hours of careful laboratory work.

The analyzer is a simplified modification of an earlier unit, which was designed to meet most industrial process requirements at low cost.

While the earlier model was able to solve very complex problems, the new, less-expensive instrument will solve the great majority of problems where there is a need for quick and accurate analysis of a single component in a simple or complex mixture of gases or liquids.

The accuracy of measurement is the same in both instruments, one per cent of full scale, but the new model has been designed to provide a much higher speed of response. It operates on the principle of direct deflection rather than electrical-null-balance and, according to company officials, can be used with an integral indicating meter as well as a recorder.

It can be used to detect any variation in the composition of a flowing liquid, as in a chemical processing plant, in order to "trigger" automatic corrections where necessary. It is useful in the petro-chemical, chemical, petroleum and metallurgical industries, as well as in industrial hygiene for air pollution problems. In addition

to the foregoing, it is capable of playing a vital role in the direct control of process stream composition, the control of heat-treating atmospheres and combustion, and the measurement of toxic materials such as carbon tetrachloride, methyl bromide, sulphur dioxide and phosgene in air.

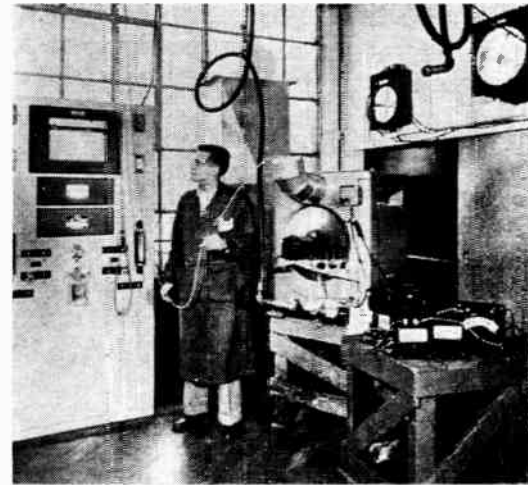
Completely automatic and continuous in operation, the equipment can be used in the control of either continuous or batch processes, to determine and control product quality.

A five-position sensitivity test switch, part of the instrument's front panel, permits checking without the necessity of exposing the chassis. Also part of the panel is a five-position voltage test switch which provides readings of the B-plus, oscillator and plate voltages of the first amplifier, as well as the infra-red source and cathode voltages of the amplifier's output tube.

There is no need for a separate voltmeter. Both the sensitivity and voltage test switches facilitate fast, easy "trouble shooting".

The indicating meter, a six-inch wide illuminated gage, is also on the front panel and is easily visible in either the explosion-proof or non explosion-proof models. In the new equipment it is usually supplied in a single case 16 and one-half inches wide, 11 and three-fourths inches high and 12 inches deep. The explosion-proof case is slightly larger.

Highlighting the unitized construction of the M.S.A. instrument is the placement of amplifier, optical bench



● Gas-fired space heaters and furnaces often must meet the stiff requirements imposed on gas equipment by Gas Association rules. To assure that heaters burn gas safely and efficiently, Reznor Manufacturing Company and the Gas Association each tests them with a sensitive LIRA instrument. This infra-red gas and liquid analyzer detects and records the presence of any CO or CO₂, even in minute quantities.

power supply, zero and calibration controls in easily accessible and removable units.

In the new analyzer, the signal from the detector cell is fed directly to an indicating meter and/or a recording potentiometer. This permits compact assembly and provides essentially the same versatility of application as the earlier model, with a degree of sensitivity that is entirely adequate for most problems.

Response of the unit is 90 per cent of final reading in five seconds with an accuracy of plus or minus one per cent of full scale. The instrument, unaffected by plant vibration, warms up in 30 minutes and requires only 200 watts. A constant voltage transformer compensates for line voltage variations from 95 to 125 volts.

"Memory" Systems *Continued from page 30*

of a spot on the screen produces a local positive charge surrounded by a ring of negative charge — due to the return of the secondary electrons to the screen in the vicinity of the spot. The potential picture suggested is that of a volcanic crater, with positive potential increasing downwards. There is no change of total charge on the screen, merely a surface re-distribution, but the positive "well" is excavated rapidly whereas the negative "ridge" is built up more slowly. The result is that the external circuit measures a positive pulse of voltage followed by a smaller but longer negative pulse of voltage. Equilibrium conditions are established during the spot bombardment when the effect of

the positive well has reduced the secondary emission ratio to unity, since no further positive accumulation can then occur.

Such is the mechanism of storage. Subsequent bombardment of a well, previously excavated, will produce no output pulse, whereas bombardment of a blank spot will yield the two pulses described above. It is clear, however, that the system so far described is not adequate, for there is no way of restoring a well once it is excavated. Thus the charge pattern cannot be restored to zero, that is to say erased, or superseded by a "re-write" pattern. Indeed, the action of reading would itself fill the store uniformly with wells. The difficulties

are overcome by having two adjacent areas, close enough to interact, for each storage position. Such areas we may designate A and B. The A areas form the true information pattern. If the reading beam detects a "no-charge" condition at a given area A, a pulse is produced and a charge is placed at A. The circuits, however, are arranged so that area B is, in this event, bombarded and the A charge is obliterated by B's secondary electrons. In other words, the well at A is re-filled. Under all conditions, digging a well at A fills any previously dug well at B, and vice versa.

(Please turn to page 67)

connect with CANNON PLUGS



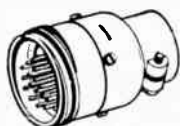
For Aircraft,
Electronics, Instruments

AN



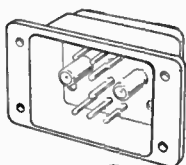
For Aircraft
Vibration Resisting—Moisture Proof

AN-E



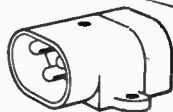
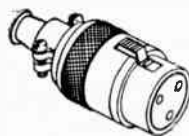
For General Circuitry in
More Bugged Applications

K, RK



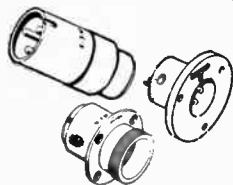
For Rack-and-Panel
Applications

DP



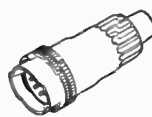
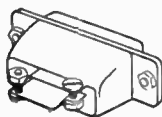
For Audio

P, O



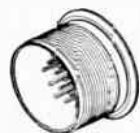
For Low Level Circuits

X, XK, XL



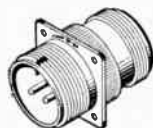
For Portable Radio and
Other Audio Circuitry

D, U



For High Pressure
Applications

GS



For Open Flame Protection

STEEL SHELL FIREWALL

for better aircraft and electronic equipment

AN Series... conforming to Specification MIL-C-5015B. 15 diameters and 260 insert layouts. 6 shell styles, AN3100 to AN3108.



AN-E Series... environment resisting. Meets Specification MIL-C-5015B. Completely sealed from cable to cable. Integral cable clamp. New grounding lugs. Improved sealing grommet and new grommet follower. Resilient inserts.

K, RK Series... *Special Acme thread*. Rugged. 8 basic shell shapes, 8 diameters, and 204 catalogued insert layouts. The all-purpose line.



DP, DPB, DPD, DPD2, DPD2R, DPR, DPA (miniature), and DPM Series... rectangular in shape with many insert layouts in DPB and DPD.

P and O Series, the original microphone series... 22 shell styles and 7 insert layouts.

X, XK and XL Series... 23 basic shell styles and 8 insert layouts for cord-end or wall mounting.

Sub-Miniature Connectors... The D and U Series for cord-end, rack-and-panel, or wall-mounted applications. The D Series has 3 basic shapes, up to 50 contacts. The hermetically-sealed U Series, cylindrical with 4 basic shell sizes, accommodates up to 12 contacts in 12 insert layouts. DH Types used for hermetically-sealed miniature components.

Hermetically-Sealed Connectors... with steel shells and contacts to withstand high pressures. Available in the GS, KH, DH, and U Series. Insulation is a vitreous material, fused under high temperature to shell and contacts, thus forming a true hermetic seal.

AN-K and Cannon K Firewall or High Temperature Connectors... offer you the greatest variety of this type of connector. Cannon made the first firewall connector and is still the leader in the field. Wall- or box-mounting receptacle. Straight or angle 90° plugs. Crimp-on contacts... no solder to melt. Inserts of asbestos-filled or glass-filled material.

CANNON ELECTRIC CANADA LIMITED, 160 Bartley Drive, Toronto 16, Ontario
Montreal Office: Montreal Airport, Derval, P.Q.
Factories also in Los Angeles, Salem, London, Melbourne.
Licences in Paris, Tokyo.

CANNON ELECTRIC

ELECTRONICS & COMMUNICATIONS, MAY, 1957



Since 1915



Send for a copy of the Cannon Plug Guide. Be sure to see Cannon's informative 16mm technical film "Contact."



5507-R

For further data on advertised products use page 71.

Doppler Navigation (Continued from page 35)

reckoning computers are in existence which can, in theory at least, accommodate Doppler input data. In actual fact, only a few of these computers have been designed to accept this data. One such computer is the AN/ASN-7, designed and built by the Ford Instrument Company for the Air Force. Interconnection of a Doppler radar with this computer provides the following: latitude and longitude of present position, and course and distance to each of several desired destinations. A picture of the indicator and control panel of ASN-7 is shown in figure 10. The ASN-7 is operated as follows:

1. With switch labeled Dest-Pres Pos in the Pres Pos position — insert coordinates of point of departure.
2. With above switch in Dest position — slew counters to desired destination ± 1 . LA and LO flags will appear indicating data stored.
3. Press the insert switch until both the LA and LO destination insert flags disappear. This inserts destination ± 1 into the computer where it is used for course and distance to destination calculations.
4. With the switch labeled Dest-Pres Pos in the Dest position and the insert switch in the storage position — slew counters to desired destination ± 2 causing LO and LA flags to appear indicating data stored.
5. Return Dest-Pres Pos switch to Pres Pos position and fly to destination ± 1 reading course, distance to go, and present position from appropriate indicators.
6. When destination ± 1 is reached push insert switch until LA and LO flags disappear, indicating destination ± 2 is inserted.
7. Fly to destination ± 2 same as ± 1 and set up destination ± 3 same as ± 1 and ± 2 .

Another computer for this purpose is shown in figure 11. This computer is the AN/APA-95. Just for a moment, let us go through very briefly the operation of this system in order to show why it is so easy to train a navigator with equipment such as this.

First, latitude and longitude of the point of departure are inserted on the present position counters; next, the latitude and longitude of the desired destination are inserted on the destination counters. The aircraft takes off, the auto-pilot is coupled in and the aircraft is flown automatically to the destination on a great circle course. Meanwhile ground speed, air speed and wind speed are continuously available to the operator on the speed dial. Likewise the direction dial provides true heading, drift angle, magnetic

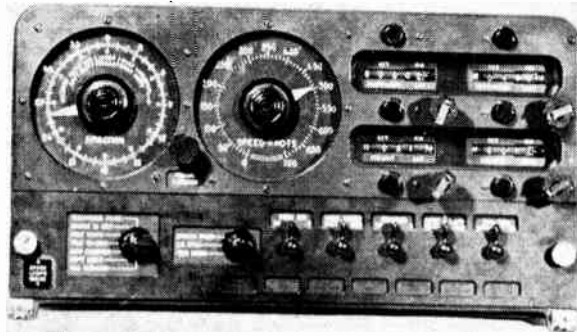


Fig. 11. ID-348/APA-95 Indicator, Position and Course.

variation, true ground track, transverse track, course to destination and wind direction at all times.

One feature that both the ASN-7 and the AN/APA-95 computers have is "Present Position Storage". This is a feature which allows the present position counters to be stopped for reading or setting. During the time they are stopped for this purpose aircraft travel is stored. At the end of the period of counter stoppage the stored travel returns the counters to the proper coordinates with no lost position information. The advantage of such a feature is quite evident.

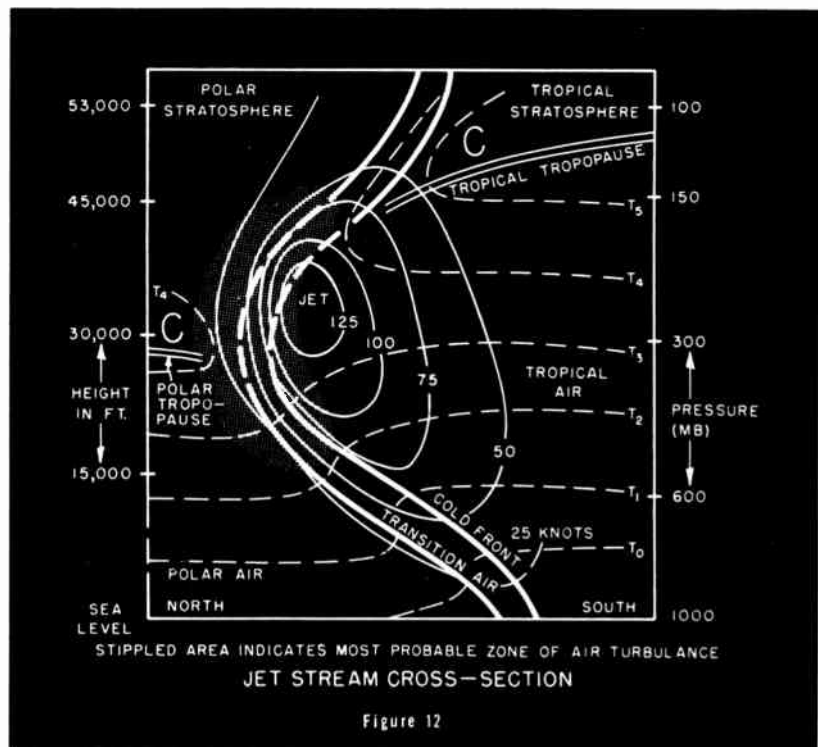
These computers illustrate that once the basic input data are available, it

is possible to make a navigation system capable of providing almost any information desired. The Doppler input data can also be used with simpler navigation devices such as AN/ASN-9 or the PHI computers which provide simple Rho-Theta courses to the destination.

Advantages

At this point you may well be thinking that this is all well and good — but just how accurate is it? Unfortunately, much as we would like to discuss this subject, it is still classified and must be bypassed. There are, however, a number of comments that can be made now that Doppler equipments

(Please turn to page 70)





Now! HAMLYN

5 and 10-channel HF Radio Equipment

PLUS a Low-Cost HTR-5 Conversion Kit*



ANTENNA CAPACITOR
Model HTRC-5



TRANSMITTER-RECEIVER
Models HTR-5 and HTR-10



CONTROL UNIT
Models HRC-5 and HRC-10

The new HTR-10 Model is the same size, weight and style as the popular HTR-5, but provides 10 preset channels. The new HRC-10 control unit has a 10-position frequency switch.

**For the many HTR-5 models now in use there is a new low-cost conversion kit, making it easy to change the HTR-5 into an HTR-10 Model.*

These HTR-5 and HTR-10 units are ideal for Canadian operations . . . have exceptionally rugged construction, long range and superior trouble-free performance in helicopters, light and medium-size aircraft. Built to military specifications, they are accepted as standard equipment in US Coast Guard helicopters . . . designated as AN/URC-13.

Low price includes unit complete with coils, cable connectors and crystals but less microphone and headset. Delivers from stock. Complete units, service and spares available.

For further information write:
200 Laurentien Blvd., Montreal,
Aviation Electric Limited



FREQUENCY RANGE — 5 or 10 preset channels between 2 and 12 mc.

REMOTE CONTROL — Simultaneous selection of transmitting and receiving frequencies.

HIGH POWER OUTPUT — Conservatively rated from 30 to 50 watts depending on antenna and frequency . . . ensuring maximum range.

LIGHT WEIGHT — Only 31 lbs. complete, including remote control and self-contained power supply.

MODULATION — 100% with speech clipping . . . ensures maximum performance.

ANTENNA TUNING — Either PI or L networks . . . permits set to be tuned into wide range of antennas.

ANTENNA CAPACITOR — A unique antenna terminating capacitor greatly improves antenna loading, thereby improving performance over conventional equipment.

RECEIVING SENSITIVITY — Better than 3 microvolts for 100 milliwatts output.

LOW POWER REQUIREMENTS — At 27.5 VDC input, only 2.8A for receiving and 9.8A for transmitting.

AVIATION ELECTRIC
LIMITED

HALIFAX • MONTREAL • TORONTO • CALGARY • VANCOUVER

For further data on advertised products use page 71.

**The Bell Telephone Company, Industry
And Toronto's Metropolitan Police
Department Combine To Produce
Efficiency In**

Police Communications

A ONE-NUMBER arrangement, engineered by The Bell Telephone Company of Canada, is part of an intricate police communications system employing a six-position switchboard, a private dial exchange, answering turrets, a conveyor-belt arrangement and a complex radio network that will shortly include 410 radio-equipped vehicles. A number of companies and organizations, including the Police Department's Communications Division, have contributed specialized skills and effort to make the various components of the whole system function as a unit.

When routine inquiries or business calls reach the switchboard, they are immediately trunked out over a tie line or off-premises extension line to the appropriate district station, where the necessary action is taken.

However, any call which requires action by a police officer is routed to a "radio complaint desk," staffed by police personnel. Twelve special key-and-lamp answering turrets, designed for operation behind a multiple or non-multiple cord switchboard associated with a manual or dial system, are installed at the desk. Each turret is equipped with three keys. When an attendant at one of the turrets plugs his set into the jack at his position, the relay in the two-line circuit operates and lights an availability lamp over the associated jack at the switchboard. On an incoming call from the switchboard the availability lamp goes out when the switchboard plug is inserted. Upon application of the ringing current, the attendant at the answering turret hears the signal by means of a leak through a vacuum tube in the telephone circuit. The key equipment (1A type) causes the red line lamp on top of the turret associated with Key No. 1 to flash. The attendant then operates this key to answer, and having recorded the complainant's information, places the report on a conveyor belt which passes it to an adjoining, glass-enclosed section where four radio dispatchers are located.

Hot Shot Calls

On a "hot shot" call — the police word for "emergency" — the switchboard operator alerts the complaint desk and the radio dispatchers' room over loudspeakers. Then the complainant is connected with an available turret attendant, who can extend the

call to a radio dispatcher by depressing Key No. 2, which causes the associated line lamp on the 100-Key boxes at the four dispatch positions to light. The signal alerts the dispatchers, and so long as two keys at the turret (either No's. 1 and 2, or 2 and 3) are moved to the "talk" position, the person making the emergency call, the turret attendant and the dispatcher can be on the line at the same time.

Where necessary, the dispatcher may cut in on the microphones of the other three dispatchers and make instant contact with every radio-equipped police vehicle on patrol. A panel of lights, known as a "disposition board", indicates which vehicles are available, and their locations.

In order that calls from extension telephones serving the various police services may reach the complaint desk, six consecutive extension lines are connected to Key No. 3 of the

● One telephone number now serves the Metropolitan Toronto Police Force. To reach the police in any of the 13 municipalities comprising "Metro" one need only dial EMpire 2-1711. Prior to the change to the "one-number" plan on March 17, this year, 13 telephone numbers were in use. They were the numbers of the 13 municipal police forces which were amalgamated into one on January 1st.



● The "radio complaint desk". There are 12 positions like this one in the Toronto Police Communication System.

answering turrets — one line multiplied to two turrets. The lowest numbered extension is connected to the highest numbered turrets. Calls from extensions within the police telephone network are answered by the highest numbered turrets. Calls from the public are answered by the lower numbered turrets. The attendant staff is arranged accordingly.

Lines to Key No. 3 are equipped with line and busy lamps similar to those associated with Key No. 1. As in the case of Key No. 1, calls answered on Key No. 3 can be extended to a radio dispatcher by means of Keys No's. 2 and 3 being moved to the "talk" position. Key No. 3 also enables the answering turret attendant to make an outgoing call.

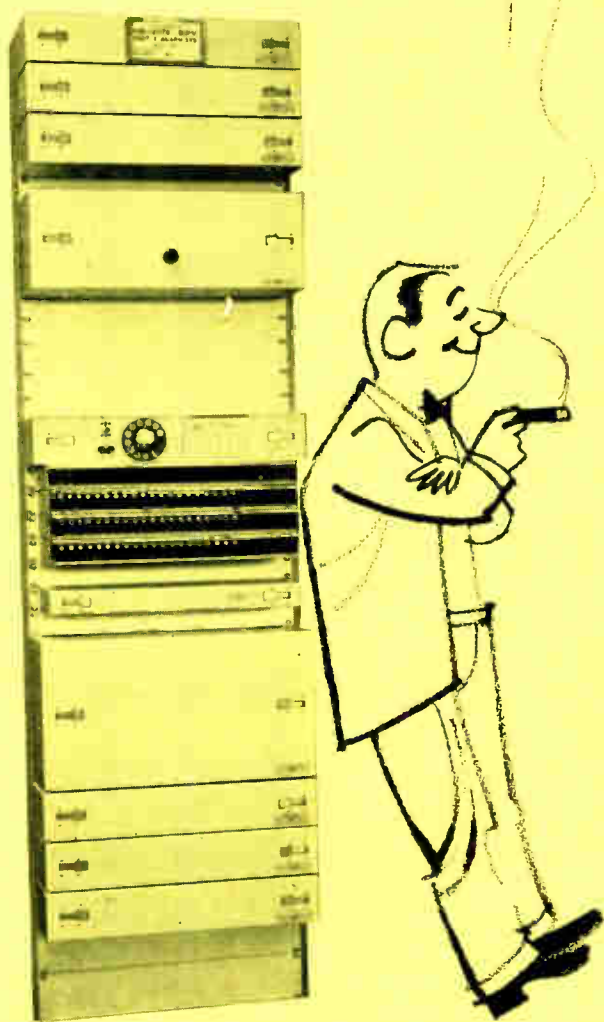
For monitoring, taps from the answering turret telephone circuit are terminated on a double six-line, key box (100 type) modified to permit 12 lines to be connected to the keys. The availability lamps associated with each answering turret are also associated with the keys connected to each of the telephone circuits at the complaint desk.



● A radio dispatcher, like the above officer, plays an important part in the rapid transmission of information.



● This is one of six positions where operators answer calls from the 13 municipalities comprising Metropolitan Toronto.



**He doesn't worry
about
remote, unattended stations**

... he's leaning against

Lenkurt **51B**

**Supervisory and Control
equipment**

Long distances between headquarters and remote, unmanned stations are no longer a cause for concern.

Now up to 80 supervising and alarm functions and 90 control and operating functions can be handled over one voice circuit with Lenkurt's 51B Supervision and Control System.

HOW IT WORKS

When a condition changes at a remote point, a relay is activated. This automatically "dials" a reporting lamp (and alarm bell) at the control centre and then disconnects—leaving the circuit free for other signals.

The operator at control then dials a 2-digit number to correct conditions at the remote

station. The circuit is again released after the corrective function has been started.

Every time a change condition is reported a scanning operation automatically checks all other supervised functions. This check may also be initiated at the control.

The equipment is available in standard pre-engineered package units. It works over wire cable and radio. Familiar telephone type relays are used, for easy servicing. If your operation involves remote stations, investigate the efficiency and the savings offered by Lenkurt Type 51B Systems.

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

P.S. This equipment will be on display at the AAR Convention, Toronto, May 21-22-23.

AUTOMATIC  ELECTRIC

ORIGINATORS OF THE DIAL TELEPHONE




STROWGER
AUTOMATIC
TOLL TICKETING

SATT

*a profitable investment now—
and for the future!*

NOW Strowger Automatic Toll

Ticketing is ready to speed short-haul tolling

— eliminating toll tickets and many other
costly manual operations.

IN THE FUTURE — Any SATT system installed now can be readily linked with Nationwide Customer Toll Dialing when it becomes a reality.

Strowger Automatic Toll Ticketing Systems are designed to store, translate and re-transmit dialed information. Backed by years of actual service in Independent exchanges, SATT Systems keep an automatic "ticker tape" record on every completed toll call—everything you need to prepare a customer's toll bill. Calling and called station directory numbers, date, time and length of each call are all stored, and swiftly recorded the instant the call is completed.

SATT Systems are designed to provide all the economies of completely automatic bill processing—preparing toll bills "without the touch of a human hand" if desired. Or if a manual method of billing is desired to coordinate with your existing accounting practices, SATT can print a complete toll ticket on each call . . . even the toll charge can be computed and shown on the card. If, at a later date, you desire to change your billing operation to use automatic accounting machines, no change in the SATT equipment is required.

Using automatic accounting machines, the same call data used in billing can be made available also to your traffic and commercial departments.

SATT Systems fit the needs of any network—from 100 stations to the largest possible—and they expand easily!

For full information, contact

AUTOMATIC ELECTRIC SALES (CANADA) LIMITED

Head Office: 185 Bartley Drive, Toronto 16

Montreal • Ottawa • Brockville • Hamilton

Winnipeg • Regina • Edmonton • Vancouver

AUTOMATIC  ELECTRIC

ORIGINATORS OF THE DIAL TELEPHONE



For further data on advertised products use page 71.

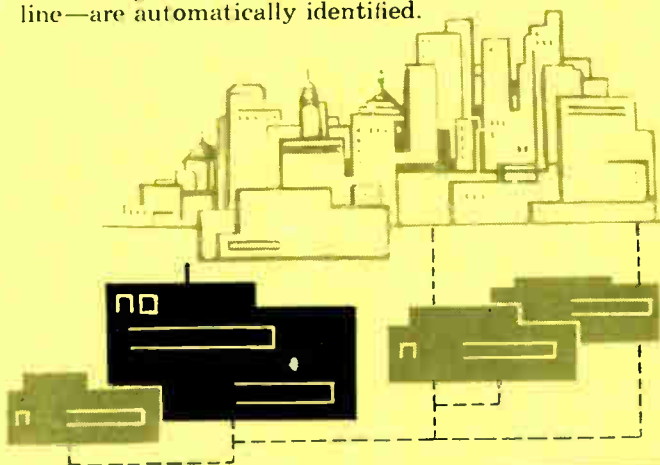
SATT TYPE A

For the Large Metropolitan Network
(Provides automatic identification of calling party)

Where switching into a large metropolitan area involves intricate trunking arrangements, this SATT System increases customer service, lowers operating company costs.

The Type A System with its associated step by step metropolitan network, is now working with panel, crossbar and other step-by-step networks.

Type A is the most completely automatic of all SATT Systems; for any short-haul call, the subscriber dials only the called party's directory number. His call is automatically routed and extended to the called party; the calling line—and the calling station, on a party line—are automatically identified.

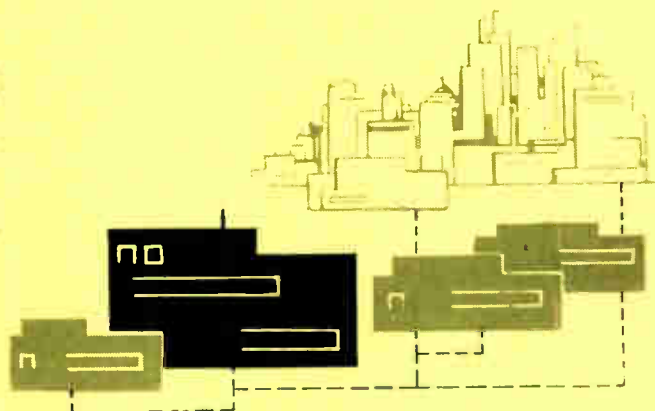


SATT TYPE B

For the large central exchange, or
medium-sized multi-office network
(Provides automatic identification of calling party)

For exchanges where the Director is not needed to route traffic to neighboring areas, SATT Type B offers the same improved service and automatic operation which are provided by Type A—but at a lower initial investment.

In the Type B system, the subscriber dials a SATT "access code" of two or three digits, then dials the called party's directory number. Identification of calling line and party is automatic.



These 5
SATT SYSTEMS
Meet Every Need

SATT TYPE BD

A combination of the B and D Systems
(Provides automatic detection of individual line and
operator identification of party line stations, in
the same ticketing centre.)

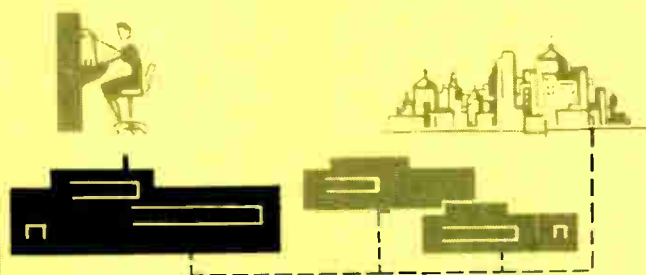
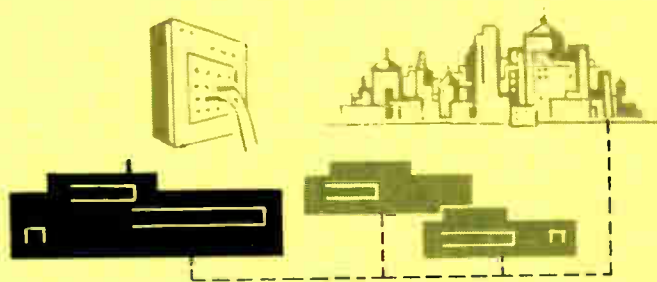
It also provides for operator identification of all calls from outlying office areas that have been arranged for customer dialing.

SATT TYPE C

For Smaller Systems where Operators are not Available
(Calling number is dialed by subscriber)

Calling party dials a SATT access code, his own directory number and the number he wishes to call. (In networks not using universal numbering, it may be necessary to dial a directing code before dialing the called number). Automatic verification of the calling line number is provided.

574



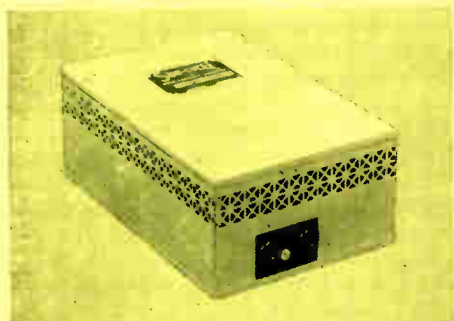
Lorain R.T.

ringing-talking power units for PBX and switchboards

END ALL MAINTENANCE!



The R.T.2, one of 7 Lorain ringing-talking power units to meet all needs. The R.T.2 operates on 115-125 volts, 60 cycle supply. It has heavy overload capacity.



The BX-60, one of a complete range of Lorain ringing machines. It operates on 105-125 volts, 60 cycle supply. Lorain also make high quality auxiliary transformers, stand-by generators, ringing converters etc.

With Lorain R.T. Units there are no moving parts. No lamps, vibrators or brushes to cause service interruptions . . . to be continually replaced. An inductance containing a saturable magnetic core and a capacitor connected in the circuit, handle the frequency conversion. The stable circuit elements operate without any mechanical movement. They do not wear out. And there is no change in their characteristics—even after long use.

Lorain R.T. Units give absolutely reliable ringing and talking currents year after year—without maintenance, lubrication or replacements—without inspection of the ringing generator!

Write us today for your copy of Bulletin 159A. It gives you full details of the complete Lorain range of ringing-talking power units for PBX and switchboards.

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

Exclusively Distributed by

AUTOMATIC ELECTRIC

SALES (CANADA) LIMITED

5747

For further data on advertised products use page 71.

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 71. Just mark the products you are interested in on the coupon on Page 71 and the information will be in your hands within a few days.

● D-897-A Universal Bridge

Item 1533

This new, completely self-contained instrument measures resistance, capacitance, dissipation factor, inductance and magnification factor over wide ranges. Its principal features are extreme simplicity of operation, direct reading of all five quantities and good overall accuracy. It includes a built-in 1000c/s oscillator bridge supply and a tuned amplifier detector. The latter can be employed tuned to 1000c/s or as a linear amplifier. An external bridge supply and detector



may be used for measurement at frequencies other than 1000c/s. The accuracy of measurement is greatly enhanced by an electronic earth-balancing device which ensures almost complete immunity from errors due to the earth capacitance of the bridge. A mechanical system of slides associated with the circuit switches ensures that the appropriate bridge controls for each class of measurement are indicated at windows in the panel adjacent to each control.

The instrument is contained in a metal cabinet with a conveniently sloping front panel on which the bridge controls are mounted and the test terminals are placed on a bakelite-faced top panel.

The power supply is 190-250V, 40-60c/s (D-897-A), 95-125V, 40-60c/s (D-897-A, 100). The overall measuring ranges and middle-range accuracies are:

Resistance: 0.001 Ohm-1M ohm, $\pm 0.5\%$
 Capacitance: 1pF-100uF, $\pm 0.5\%$
 Dissipation Factor: 0-1.2 at 1000c/s $\pm 10\%$,
 or ± 0.002
 Inductance: 1mH to 1000H, $\pm 0.5\%$ -1%
 Magnification factor: 0-60, at 1000c/s $\pm 10\%$,
 or $\pm 0.2\%$

This instrument is more fully described in Publication 3750-A, obtainable from Muirhead Instruments Ltd., Stratford, Ontario, Canada.

● Phenolite Polyester Resin Laminates

Item 1534

A new arc and flame resistant grade of Phenolite is available from National Vulcanized Fibre Company. Identified as GP-9204, it is the newest addition to National's recently developed line of polyester glass mat laminates.

Although all these sheet laminates have dimensional stability, exceptionally high impact strength and above average arc resistance, each grade features one outstanding property. New Phenolite grade

GP-9204 features Underwriters' laboratory approval as a flame resistance material. It is approved for the sole support of current carrying parts at temperatures up to 150°C. This new laminate also has good dielectric loss properties under dry conditions and reasonably good dielectric strength under wet conditions.

Grade GP-9204's dimensional stability and impact strength suggests important uses in mechanical applications, such as supports, panels, and cams. Its electrical and flame resistance make it applicable for armature slot wedges, spacers, switchboard panels, switch insulators and arc chutes.

Like the other National Phenolite polyester resin laminates, Grade GP-9204 has good chemical resistance to most acids and solvents, such as carbon tetrachloride, toluene, gasoline and ethyl alcohol and fair resistance to weak alkalis. This chemical resistance is useful for application in areas of high humidity and around chemical fumes of an acid nature.

Further information on Phenolite grade GP-9204 and complete line of polyester glass mat laminates is available from National Vulcanized Fibre Co., 1056 Beech Street, Wilmington 99, Delaware, or National Fibre Company of Canada, Ltd., 107 Atlantic Avenue, Toronto, Ontario, Canada.

● Memory Core Bobbins For Computers

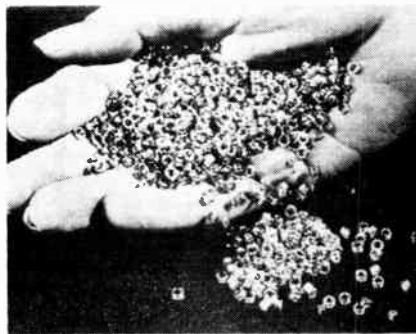
Item 1535

Memory comes high these days, as is testified by the handful of stainless steel memory core bobbins for computers shown in the accompanying illustration. When wrapped with $\frac{1}{8}$ -mil (0.000125") tape, and annealed, these bobbins will represent approximately \$1000 worth of cores for computers.

Tape wound cores on stainless steel bobbins have very rectangular hysteresis loops under pulse conditions, resulting in high values of residual magnetism.

It is this characteristic of the high permeability, ultra-thin magnetic tape — along with the ability of the small core to switch from positive to negative saturation in a very few microseconds — which makes such cores suitable for use as memory cells for electronic computers.

The use may be in the form of a shift register, a coincident-current matrix, a core-diode memory system, a harmonic generator, or a pulse transformer.



Because of temperature stability, low coercive values and high saturation densities, these Magnetics, Inc. "Performance-Guaranteed" tape wound bobbin cores prove superior to other types of cores for these applications.

Magnetics, Inc., Butler, Pa., U.S.A.

● Control Guide — Pocket Edition

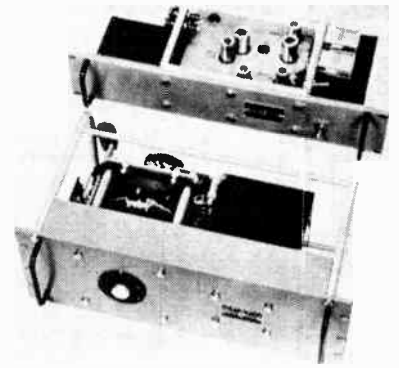
Item 1536

Centralab, a division of Globe Union Inc., announce the availability of their Pocket Control Guide No. 4. This handy control cross reference guide is published semi-annually to make the latest and most up-to-date replacement control information available to everyone. As in the past, this 3-3/4" x 8-1/2", 96 page guide will fit neatly into your pocket or repair kit. Priced at 20 cents it will be available at all Centralab distributors or by writing direct to Centralab, a Division of Globe Union Inc., 900 E. Keefe Avenue, Milwaukee 1, Wisconsin, U.S.A.

● Automatic Voltage Regulator

Item 1537

Designed to meet or to exceed the general requirements of MIL-E-4158A, the General Radio Type 1570-ALS15 Automatic Voltage Regulator is offered for use in military or critical industrial applications by Canadian Marconi Company, General Radio's Canadian distributors. Typical applications for which it is suited include those with high ambient temperatures or for portable installations where mechanical shock or vibration is encountered. Particular emphasis in the design has also been placed on flexibility, ease of maintenance, reliability, and long life.



Basically, the regulator consists of a Variac autotransformer that adjusts the output voltage, a "buck-or-boost" step-down transformer that effectively multiplies the power rating of the Variac and a servo-mechanism that positions the Variac. For flexibility and ease of maintenance the Type 1570-ALS15 Regulator has been built into two units. The larger unit contains the motor-driven Variac and hermetically sealed "buck-or-boost" transformer. The smaller unit contains the electronic control circuit.

The type 1570-ALS15 Automatic Voltage Regulator is normally supplied to handle a maximum of 6 kva at 115 volts with input line variations of $\pm 10\%$. A $\pm 20\%$ range connection is also available with a maximum capacity of 3 kva. Accuracy of output voltage (adjustable over a $\pm 10\%$ range) is $\pm 0.25\%$ for the 6 kva connection. Frequency range is 55 to 65 cycles or from 45 to 55 cycles, as selected by a switch.

Literature and additional information on the Type 1570-ALS15 Automatic Voltage Regulator can be obtained by writing Commercial Products Division, Canadian Marconi Company, 6035 Cote de Liesse Road, Montreal 9, Quebec, Canada.

(Please turn to page 46)

NEW PRODUCTS

● Freed Transformer Products Catalog

Item 1538

The newest line of electronic components manufactured by the Freed Transformer Co., Inc., Brooklyn, N.Y., is featured in a 48-page catalog just off the press.

Transformers (audio, power, pulse), filters and discriminators, toroids, magnetic amplifiers and ultrasonic components are all pictured and described in detail, including 128 graphs showing the performance of many of these units. Complete data on transformers for military and commercial applications is also included. These units are available open, hermetically sealed or encapsulated.

Freed products are the result of years of research and are unsurpassed for quality, accuracy and dependability.

For catalog No 571 write **Freed Transformer Co., Inc., 1716 Weirfield St., Brooklyn (Ridgewood) 27, New York, U.S.A.**

● "k-Volt Standard"

Item 1539

A new high-stability voltage source that provides constant DC output through ambient temperatures as low as -55°C and up to 100°C has been announced by Avien, Inc., 58-15 Northern Blvd., Woodside 77, N.Y., manufacturers of instruments and control systems.

Known as the "k-Volt Standard", the unit is designed to replace the chemical cell and VR tube as an absolute reference, constant output working supply or precision voltage regulator in airborne, laboratory, and other instrumentation requiring extreme stability over widely varying environmental and operating conditions. A range of models for various application requirements permits operation from either an AC or DC source.

Design of the unit utilizes a voltage regulating network based upon special types of double anode silicon diodes selected for stability of conduction characteristics. Using neither tubes nor moving parts, it is unaffected by position, vibration or mechanical shock, and conforms to MIL-E-5272A for military applications. Uniformity of output is maintained through repeated on-off switching.



The unit, which measures 1-1/2 inches high, and 1-1/4 inches diameter, weighs less than three ounces. It is available for operation from 26.5 volts DC, or 117 volts AC, with DC output of 6 volts or 1 volt, at 1 ma. or 10 ma. Power consumption is less than 1.8 watts. Case is hermetically sealed and employs a 7-pin miniature plug-in base.

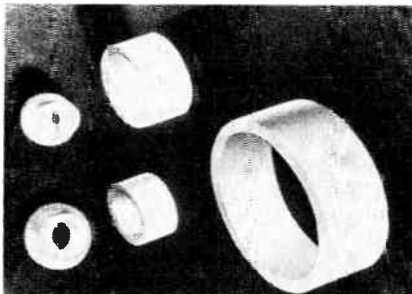
Other features include life expectancy in excess of 10,000 hours and random drift less than 0.1% over 1000 hours of operation. Temperature hysteresis is so low as to be unobservable.

Complete specifications and performance data of the k-Volt Standard can be obtained upon request to the Canadian distributor — **Brian Engineering Limited, 5275 Van Horne Avenue, Montreal, Quebec, Canada.**

● Nylon Engineering Materials

Item 1540

The availability of nylon gives designers a wider selection of engineering materials from a single dependable source. Now National offers more than 100 grades of three versatile engineering materials. They are: (1) National vulcanized fibre, (2) Phenolite laminated plastic, and (3) National nylon.



Nylon is available as extruded rod or finished fabricated parts. Rod sizes range from 1/4-in. through 2-in. diameter in 3-ft. to 6-ft. lengths. Other sizes are available on special order.

National's extensive fabricating facilities turn nylon into mechanical parts as bearings, gears, cams, rollers, spools, worm wheels and bushings. These parts are used in textile, automotive, aircraft, electrical, household appliance and business machine manufacturing.

Nylon is a superior thermoplastic engineering material that combines good mechanical and electrical properties with excellent chemical resistance. Its toughness, low coefficient of friction and resistance to wear and abrasion have been successfully proved in use.

Additional information on National Nylon is available from **National Vulcanized Fibre Co., 1057 Beech St., Wilmington 99, Del., U.S.A., or National Fibre Co. of Canada, Ltd., 107 Atlantic Avenue, Toronto, Ontario, Canada.**

● Nuclear Products By Baird-Atomic, Inc.

Item 1541

A new radiation survey meter and a non-overloading linear amplifier are among the nuclear products manufactured by Baird-Atomic, Inc., Cambridge, Mass., U.S.A., and distributed by Canadian Marconi Company, their exclusive Canadian representative.

The radiation survey meter, MODEL 414, features a single logarithmic scale which provides accurate measurement from 3.0 to 3000 mr/hr. This instrument, incorporating a new one-tube circuit design to assure unmatched reliability and long battery life, can detect and measure x-ray, gamma and beta radiation. Uses include radiation monitoring in hot laboratories and at reactor installations.

Baird-Atomic's MODEL 215 non-overloading linear amplifier is widely used for amplification of pulses from scintillation detectors used in the measurement of radioactivity. This unit is designed to amplify faithfully small pulses in the presence of much larger frequent overload pulses, and it is therefore especially recommended for pulse height analysis of x-rays in the presence of high energy gamma rays.

For qualitative or quantitative analysis of one or more isotopes in mixture, is the Baird-Atomic MODEL 513 single channel scintillation spectrometer. Because the unit substantially reduces background count, this instrument can be used effectively for measurement of low concentration or low energy samples.

Further information and literature on these instruments can be obtained by writing the **Commercial Products Division of Canadian Marconi Company, 6035 Cote de Liesse Road, Montreal 9, Quebec, Canada.**

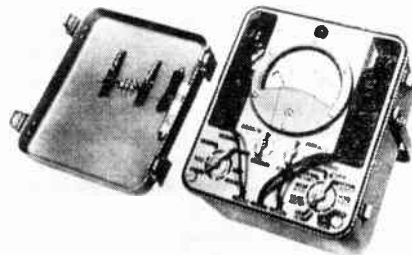
● Electronic Multimeter

Item 1542

The model NE No. 7-20-M Electronic Multimeter made by Northeastern Engineering Inc., is a compact, portable multirange meter identical to the Military Model TS-505B U for measuring the rms values of ac voltages from 0 to 150 volts, dc voltages from 0 to 1000 volts and dc resistance from 0 to 1000 megohms. An rf adapter is furnished to extend the range into the values of rf voltages up to 40 volts rms with frequencies up to 500 mc. The overall accuracy of the unit $\pm 4\%$ in ohms, $\pm 5\%$ in dc volts and $\pm 6\%$ in ac volts. An added feature is a plus or minus dc position which enables the user to quickly check the polarity of dc voltages or for zero voltage.

The unit is housed in a gasket-sealed aluminum case with removable gasket-sealed cover claimed to make the instrument impervious to damage by excessive humidity or even water immersion. The carrying handle folds under the case and serves as a support to hold the meter at a convenient angle for reading the meter while the instrument is in use.

All components are mounted on sub-chassis which are secured to the cast aluminum front panel. Loosening of six captive screws allows the front panel, complete with all components attached, to be removed from the case for servicing or replacement of tubes.



Minimum resistance range is 0 to 1000 ohms, minimum voltage ranges are 0 to 2.5, ac and dc. Maximum voltage ranges are 0 to 1000 dc, and 0 to 250 ac, with frequencies from 30 cycles to five megacycles. Input impedance is six megohms shunted by two mmf at audio frequencies, 40 megohms on the 500 and 1000 volt dc ranges, and 20 megohms on all other dc ranges.

Power supply is 98 to 132 volts, single phase, 50 to 1000 cycles. Weight is 14 lbs.

Sold in Canada by **Computing Devices of Canada Limited, P.O. Box 508, Ottawa 4, Ontario.**

● Kodascope Pageant Sound Projectors

Item 1543

Kodascope Pageant Sound Projectors will offer great operating convenience and versatility as a result of a single-switch film reversing mechanism on new models announced by Canadian Kodak Co., Limited. This enables a projectionist to run off as much film as necessary in checking for proper focus, loop, sound volume, etc., and then with a flick of a switch reverse the film to starting position. Time previously taken up by re-threading the projector can now be saved and film life prolonged by elimination of the extra handling.

This feature makes the new models especially valuable to schools, churches, and similar groups who frequently must depend on comparatively inexperienced projectionists.

As a result of this improvement in the new Pageant projectors, sections of the film can be rerun as often as desired for review purposes. Organizations producing films will also find the new Pageants an aid in editing, since sequences can easily be rerun for timing and review, without having to re-thread the projector.

Canadian Kodak Co. Ltd., Toronto 9, Ontario, Canada.

● Danbridge Universal Bridges

Item 1544

The three models made by A S Danbridge claim to cover all normal field and shop requirements of R-C-L measurements. Type UB1 is a laboratory model requiring an external supply and detector, Type UB3 is a self-contained mains operated model, Type UB2 is a self-contained, battery operated portable field model.



Type UB3 contains the requisite standards (a varying balancing resistor 3000 ohms, a set of seven ratio resistors from 1 ohm to 1 megohm, a 1000 ohms standard resistor and a 0.1 microfarad standard capacitor), batteries (1.5 and 90 volts) and a 1000 c.p.s. oscillator, a galvanometer as null indicator for DC resistance measurements, etc. Terminals are provided for an external detector and for an external generator.

In seven ranges resistances from 0 to 3 megohms, min. 5 milliohms, inductances from 0-300 Henrys, min. 0.5 microhenry and capacitances from 0-300 microfarads, minimum 0.5 micromicrofarad, can be measured. Two dissipation factors ranges 0-0.1 and 0-0.01 and two Q-factor ranges 1-10 and 0.1-1 are provided.

For particulars write to The J. W. Ellis Industries, 42 Lombard Street, Toronto 1, Ontario, Canada.

● Loctite Liquid Sealant

Item 1545

Users of nuts, bolts, screws, in fact threaded fasteners of all kinds, can now obtain whatever locking torque they desire by using Loctite Sealant.

Standard threaded fasteners treated with Loctite Sealant provide maximum resistance to vibration consistent with the type of application. Studs can be permanently secured without the use of interference threads, and they can be sealed fluid tight. Ordinary nuts and machine screws can be locked with a grip that is 60-70% of the torsional strength of the fastener, providing maximum resistance to vibration, without danger of breaking the fasteners in disassembly. For delicate adjustment screws or nuts, Loctite Sealant provides a holding power that will give the proper compromise between resistance to vibration and ease of adjustment in use.

Loctite Sealant wicks into the engaging threads and hardens automatically to form a tough heat and oil resistant plastic. This hardened plastic provides a gripping action which extends over the entire surface of engaged threads, resulting in a grip proportional to the engaged length.

The grip of the fasteners can also be controlled by the grade of sealant used. Loctite Sealant is available in four strengths, with grade A ten times the strength of grade H. Thus, by either varying the engaged length or changing the grade of sealant, the user can control gripping torque to meet his specific requirements . . . from the most delicate adjustment screws, to cap screws, to studs.

These same properties which make Loctite so useful as a thread locking device are also being utilized to lock dowel pins, to solder and seal tubing, and to seal joints against dirt and corrosion.

For further information on the use of Loctite Sealant, write J. S. Parkes & Company Limited, 220 St. Paul Street West, Montreal, Canada.

● Ultrasonic Transducers

Item 1546

Two new additions to the line of ultrasonic "building block" transducers offered by Acoustica Associates, Inc., Glenwood Landing, Long Island, New York, manufacturers of ultrasonic cleaning and processing systems, have been announced. The new transducers are designed for use in high temperature environment, (i.e. - irradiating high temperature solutions, degassing molten metals), for developing high amplitude ultrasonic motion, (i.e. - drilling, grinding, particle disintegration) and for many other cost savings industrial applications.

Featuring internally biased, water-cooled, 400 watt average - 1600 watt peak power magnetostrictive driving elements operating at 25 kilocycles per second, these highly stable transducers can be driven singly or in groups by appropriately rated standard ultrasonic generators from 400 watts to 10 kilowatts and above.

Model AT-1600 B features a cylindrical stainless steel coupling slug measuring 2" OD x 4" long. A water cooling jacket integral with the transducer cooling system extends up 2" to the nodal point where the slug is supported at the point of zero motion. This cooling allows the transducer to be used with the emergent face directly in contact with liquids at temperatures up to 900°C. Alternatively the emergent face may be used as a vibrating platform for ultrasonic soldering and welding operations.

Model AT-1600 C features a tapered stainless steel amplitude multiplier having an emergent face 1/4" OD fitted with a tapped hole. This unit may be used for many different kinds of ultrasonic work where large peak-to-peak amplitudes are required. When mounted in a suitable drill stand or tool holder, the transducer can be used for drilling, blanking, shaping, and grinding.

These two transducers extend the scope of low-cost ultrasonic processing to such industrial applications as heat treating, quenching, ore beneficiation, reduction of running friction, soldering and machining, mixing high temperature solutions, degassing molten metals and hot liquids, and many other unique applications.

Canadian Representative: X-Ray and Radium Industries Ltd., 261 Davenport Road, Toronto 5, Ontario, Canada.

● Ceramic 250 Watt Tetrodes

Item 1547

Two new 250 watt ceramic and metal tetrodes have been added to the Eimac line, it has been announced by Eitel-McCullough, Inc., San Bruno, California. Designated the 4CX250K and 4CX250M, each of these new external anode radial beam power tetrodes employs concentric UHF terminals, and represents the continued emphasis being placed on ceramic and metal construction in new tube design.



The 4CX250M has a 26.5 volt filament, while the 4CX250K has a 6 volt filament. Both tubes have a 250 watt plate dissipation rating. For further information, contact Application Engineering Department, Eitel-McCullough, Inc., San Bruno, California, U.S.A.

● 100 Wiring Clips In One Handy Form

Item 1548

Critchley Bros. Ltd., Brimscombe, Stroud, Glos., England, manufacturers of BETA electrical products, have issued a brochure on items which comprise "The Beta System of Cable Fixing and Marking".

Among these items is featured BETA STRIP — the new, completely flexible harnessing fixative that is made-to-order with a snip of the cutter. BETA STRIP is actually a hundred wiring clips in one handy form. It comes in handy coils ready to cut-to-size right on the job for quick, perfect-fit wiring clips.

BETA STRIP comprises an aluminum strip covered with flexible P.V.C. and can be used without further protection to the cable covering. It supersedes metal saddles since no fixing screws are used, and is equally effective in securing cables against sag in "mid-air" crossings. A special tool is supplied to close the strip against the cable after bending to shape.

Further information and a sample mounting may be obtained upon application to the Canadian distributor — Electrovert Ltd., Radio City Buildings, 265 Craig St. West, Montreal 1, Canada.

● McIntosh Amplifiers

Item 1549

McCurdy Radio Industries, Toronto, Canada, have announced that they are now manufacturing the McIntosh line of Amplifiers in Canada. Incorporating the patented McIntosh output circuit with unity coupling, these units perform up to their rated maximum power output with negligible distortion. Featuring a complete line of amplifiers and preamplifiers with complete record



compensation control, this equipment lends itself for either commercial or hi-fidelity sound applications.

The MC-30 amplifier will deliver 30 continuous watts of audio power at less than 1/3% harmonic distortion between 20 and 20,000 cycles and less than 1/2% intermodulation distortion for any combination of frequencies 20 to 20,000 cycles. Also available is a 60 watt amplifier with similar distortion ratings.

McCurdy Radio Industries, Toronto, Canada.

● Pamphlet On High Speed Motion Pictures

Item 1550

Information about recent advances in film sensitivity which have extended the scope of high speed movies for industry is included in "High Speed Motion Pictures at the Service of the Engineer," a new Kodak pamphlet now ready for distribution.

Five illustrated case histories are used to show how major firms have used such movies to solve engineering problems. Data on Kodak films for black-and-white movies in the visible spectrum, in full color, and by infrared radiation are also given.

Facts on lighting, speed selection, and lenses for the Kodak High Speed Camera are part of the publication.

Copies of the pamphlet are available without charge from Canadian Kodak Sales Limited, Toronto 9, Ontario, Canada.

(Please turn to page 48)

NEW PRODUCTS

● Hermetic Seal Terminals

Item 1551

IRC announce the availability of bulletin LT-1 on Fluorocarbon Hermetic Seal Terminals.

These terminals are miniature units for the hermetic sealing of all types of electrical components and are designed to meet military and commercial requirements. The LT Terminal is a solder-seal type terminal with a body of moulded fluorocarbon plastic (polymonochlorotrifluoroethylene) insulating the solder-seal ring from the feed-through lead.

There are four body sizes and six lead types available in any combination. The IRC Type LT Terminal is specifically designed and recommended for hermetic sealing of electrical components where the following conditions are required: Superior insulation resistance; zero moisture absorption; high Arc-Over resistance; wide temperature range and thermal shock; miniaturization.

The four-page LT-1 bulletin outlines complete specifications, construction features, installation suggestions and recommended soldering procedures together with complete details of the many types available. Write International Resistance Co. Ltd., 349 Carlaw Avenue, Toronto 8, Ontario, Canada.

● High Speed Stroboscope

Item 1552

The Model 1210-B Stroboscope can be used to measure speeds from 480 RPM to 72,000 RPM without the use of submultiple frequencies which always degrade the result. A major feature of this unit is the location of the light source at the end of a 4 foot cable which allows the light source to be placed in close proximity to the work. The lamp probe and cable fit into the top of the instrument. The probe handle then becomes the carrying handle for the instrument.



A resonant reed actuated by the 115 volt power line is provided to enable the user to check the calibration on 60 cycle multiples and sub-multiples. This test is accomplished by placing the probe in the cabinet and adjusting the frequency until the reed, which is visible through the porthole above the dial, appears to stand still.

SPECIFICATIONS

Speed Range: 4 ranges with panel switch control: Range 1, 480-1800 RPM; Range 2, 1700-6000 RPM; Range 3, 5500-21,600 RPM; Range 4, 20,000-72,000 RPM. (ALL ON FUNDAMENTALS).

Calibration: 285 Degree dial rotation with 100 division linear scale. Each range individually hand calibrated. Calibration chart curves can be read to 1%. Overall accuracy better than plus or minus 3% over long periods of time.

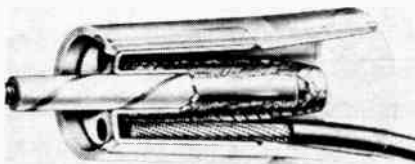
Communication Measurements Laboratory, Incorporated, Plainfield, New Jersey, U.S.A. Represented in Canada by Measurement Engineering Limited, Arnprior, Ont.

● One-Piece Cable Tap Connector

Item 1553

A fully insulated, one-piece tap connector for shielded or coaxial cable has been developed by Burndy of Canada Limited.

Called UNIRING, the connector offers a saving in installation time over any previous method of connecting or grounding. Composed of a one-piece combined inner and outer ring and nylon insulation, the inner ring slides under the shielded braid as the tap wire is held between the braid and the outer ring (see illustration).



The UNIRING is constructed so that the inner ring remains unaffected by the crimping process, insuring maximum protection of the cable.

Single or multiple taps, from either the front or the back of the connector, can be accommodated. A single crimp with a basic Burndy Hytool completes the assembly. The nylon insulation is color-coded for size and identification and extends beyond both ends of the UNIRING, eliminating metal-to-metal contact and preventing wire chafing in tight locations.

Samples and full details available from Burndy of Canada Limited, 381 Greenwood Ave., Toronto 8, Ontario.

● Dawe Ultrasonic Generator

Item 1554

Literature describing Dawe Type 413 Ultrasonic Generator and its many industrial uses, is now available.

By means of ultrasonic bombardment this Dawe generator can be used to speed up most conventional cleaning procedures. The company claims it quickly pays for itself in savings on labor costs, reduction of rejects, etc. The Dawe Ultrasonic Generator has been used to clean ball-bearings, complex castings, radioactive soils, jewelry, and many other parts, products and materials. It has also been successfully applied in plating, quenching, pickling, dyeing and emulsifying.

The type 413 generator has an adjustable frequency from 36 to 40 kc/s. Output averages 125 watts. Dimensions are 17 ins. x 7 ins. x 10 ins. high. Weight is 38 pounds.

For free copies of the literature, write to Dawe Instruments Ltd., (Canadian Division) 1654 Bank Street, Ottawa 1, Ontario.

● Marine Radio-Telephone

Item 1555

A compact, powerful marine radiotelephone capable of 52 watts R.F. power output has been announced by Pye Canada Limited.

Offering six crystal-controlled channels, the Pye "Starfish" PCL-50 can also be adapted for use as an HF land station. With a frequency range of 1.6 to 6.5 mc., the "Starfish" design incorporates a non-blocking input circuit and a unique clipping and filter system allowing close range communications and greater voice power.

Type-approved under specification 110 for compulsorily-fitted vessels, the "Starfish" is available for 12, 32, 110, 220 volts DC and 117 volts AC.

The "Starfish" is suitable for bulkhead or table mounting and has a separate power supply. This radiotelephone is 12½" wide by 17" high by 8" deep and weighs just 53 pounds. Chassis swings forward exposing all components for easy serviceability.

Pye Canada Limited, 82 Northline Rd., Toronto 16, Ontario, Canada.

● Ultra-High-Voltage Capacitors

Item 1556

Designed specifically for DC filtering and DC storage for high-energy-discharge circuits, these Cornell-Dubilier Ultra-High-Voltage Capacitors have wide application in military, industrial and scientific equipment such as Betatrons, Nuclear Accelerators, Impulse-Test Apparatus, Pulse Networks, Radar, X-ray Units, etc.

Ratings of individual units range from 25,000 to 200,000 volts DC. Higher capacitances and/or DC voltage ratings are easily obtained by connecting additional units in parallel, series or series-parallel combinations.

The capacitors are housed in extra-strong special phenolic composition cases that provide a long creepage path and maximum safety from flashover between terminals. The cast aluminum end caps serve both as the electrical terminals and the mounting means. This design permits economical installation and saves space where the capacitors are banded.

For further information write for Bulletin No. 183 to Cornell-Dubilier Electric Corporation, South Plainfield, New Jersey, U.S.A.

● Rotating Cylinder Viscometer

Item 1557

A new rotating cylinder Viscometer featuring electrostatic restoring torque has been announced by the Scientific Instruments Division of Polarad Electronics Corporation, 43-20, 34th Street, Long Island City 1, New York.



The unit is designed for making viscosity measurements at shear rates as low as 0.2 seconds without extrapolation and is useful for studies of high molecular weight polymers, proteins and nucleic acids. The company reports that the instrument is free from varying velocity gradient and that the electrostatic restoring torque provides essentially a frictionless suspension which eliminates torsion wire problems.

Scientific Instruments Division of Polarad Electronics Corporation, 43-20, 34th St., Long Island City 1, New York, U.S.A.

● Lenkurt's 45BN1 Cable Carrier System

Item 1558

Lenkurt Electric Co. of San Carlos, California, and Vancouver, B.C., has recently issued a bulletin featuring engineering considerations for the Type 45BN1 Carrier Telephone System. The publication furnishes the engineering information required for considerations of route selection, equipment location, and other factors affecting performance.

This bulletin supplements Engineering Letter 40, published in October 1955 and which covered the use of 45BN terminals when used with type N repeaters.

For further information contact Automatic Electric Sales (Canada) Limited, 185 Bartley Drive, Toronto 16, Ontario, Canada.

● 10 Channel HF Radio Equipment

Item 1559

Aviation Electric Limited has announced a new Hamlyn HF Radio unit. This new HTR-10 model is the same size, weight and style as the popular HTR-5, but provides 10 preset channels. The HTR-10 control unit has a ten position frequency switch.

For the many HTR-5 models now in use there is a new low-cost conversion kit, making it easy to change the HTR-5 into an HTR-10 model.



These HTR-5 and HTR-10 models are ideal for Canadian operations. They are ruggedly constructed and offer long range, superior trouble-free performance in helicopters, light and medium sized aircraft. Built to military specifications, they are accepted as standard equipment in U.S. Coast Guard Helicopter — designed as AN/URC-13.

Frequency Range: 5 or 10 preset channels between 2 and 12 mc.

High Power Output: 30 to 50 watts . . . ensuring maximum range.

Light Weight: Only 34 lbs. complete, including remote control and self-contained power supply.

Modulation: 100% with speech clipping.

Receiving Sensitivity: Better than 3 microvolts for 100 milliwatts output.

Low Power Requirements: At 27.5V. D.C. input, only 2.8A for receiving and 9.8A for transmitting.

Plus many features such as remote control, special antenna tuning and unique antenna capacitor.

For full particulars and descriptive literature, write to Aviation Electric Limited, 200 Laurentien Blvd., Montreal, P.Q., Canada.

● Pulse, Sweep, And Time-Delay Generator

Item 1560

The new General Radio Type 1391-A Pulse, Sweep, and Time-Delay Generator distributed in Canada by Canadian Marconi Company, is a pulse source and measuring device designed to meet the diverse requirements of laboratories engaged in time-domain measurements. It produces pulses of medium power and good rise-time over an extremely wide range of durations and repetition rates, and it generates time delays and saw-tooth sweeps over comparably wide time intervals. Accuracy, reliability, and convenience are important features stressed in the design of this instrument.

The time-delay generator has a calibrated range from one microsecond to 1.1 seconds; the linear sweep generator produces saw-tooth waveforms ranging in duration from 3.0 microseconds to 0.12 second. The start and stop times of pulses, which are continuously adjustable in duration from 0.05 microsecond to 0.1 second, can be precisely set at any point along this sweep by amplitude comparators. The pulse repetition rate is set by an external generator, which may have almost any waveform.

Further information and literature on the Type 1391-A Generator can be obtained from Commercial Products Division, Canadian Marconi Company, 2442 Trenton Ave., Montreal, P.Q., Canada.

● Environment-Free Sealed Switch

Item 1561

Electro-Snap Switch & Manufacturing Company announce the availability of an environment-free sealed subminiature switch.

This switch, type EF-3, is sealed by placing a standard sub-miniature switch inside a drawn anodized aluminum can. (The basic switch is approved under MIL-S-6743.) The base of this unit is then potted with epoxy casting resin. Termination is brought through the epoxy by means of 6" leads using a #20 wire, approved under MIL-W-5086. It is actuated through a silicone diaphragm of silastic material. Through the center of the diaphragm there is a stainless steel pin which extends through the diaphragm to the basic switch button.

The switch is environment-free and sealed and is good up to 50,000 ft. Actually we have tested it up to 65,000 ft. with no leaks detected. Switch rating is 2 1/2 amp. inductive, 5 amp. resistive at 30 VDC.

Type EF-3 Electro-Snap Switch has many applications in missiles, aircraft, electronic gear, vending machines, etc. Applications are almost unlimited where the need is for a small sealed switch with high current carrying capacity.

For further details write J. R. Longstaffe Co. Ltd., 300 Campbell Ave., Toronto 9, Ontario, Canada.

● Portable Automatic Screw Driver

Item 1562

New portable pneumatic screwdriver for mass assembly operations is loaded with a cartridge that holds sixty No. 8 screws or slightly fewer No. 10 screws. The cartridge itself is loaded automatically from an elec-



tric hopper. The screwdriver operates automatically at any angle as fast as the operator can pull the trigger. Weight is 6 1/2 pounds. The Sempak is an all-inclusive unit — not an attachment. It will not mar work surface as jaws never contact surface, does not 'shoot' screws, but will drive screws from any angle. For further information or an illustrated folder, write to: Shakeproof-Fastec Division, Canada Illinois Tools Ltd., 177 Front Street East, Toronto, Ontario, Canada.

● Mass Spectrometer Leak Test Station

Item 1563

Vacuum-Electronic Engineering Co. of New Hyde Park, Long Island, N.Y., has issued a bulletin on its MS-9 Series Mass Spectrometer Leak Test Station, which is an extremely sensitive system for detecting leaks, using helium as the "tracer". The "sensing element" is the Veeco Mass Spectrometer tube, which "sorts out" the helium from all the other system gases.

Electronic amplification is then used to make possible detection of minute quanti-

ties of helium and therefore extremely small leaks. The Mass Spectrometer tube operates under high vacuum and because of that is provided with its own pumps, vacuum gages and electronic supplies, to comprise an assembly referred to as a Mass Spectrometer Leak Detector.

This is a brand new product and is the only completely self-contained mobile mass spectrometer leak test station commercially available not requiring auxiliary roughing equipment.

Literature or data on this system is available from the Canadian representatives, Radionics Limited, 8230 Mayrand St., Montreal 9, Quebec, Canada.

● High Vacuum Rectifier

Item 1564

Eitel-McCullough, Inc., San Bruno, California, manufacturer of Eimac power vacuum tubes, has announced a new high vacuum rectifier. Designated the 2-450A, the new rectifier is intended for use in rectifier units or special applications whenever conditions of extreme ambient temperatures, high operating frequency, or high peak inverse voltages prevent the use of gas-filled tubes.

The 2-450A has a maximum d.c. current rating of 1 ampere and a maximum peak inverse rating of 25,000 volts. Maximum peak plate current rating is 8 amperes.

Overall height of the 2-450A is 14 3/32" and the diameter is 4 1/2". Maximum plate dissipation is 450 watts.

Eitel-McCullough, Inc., are represented in Canada by The Ahearn and Soper Co. Ltd., 384 Bank St., Ottawa, Canada.

● Light-Weight Frequency Converter

Item 1565

Model 400A, a new and improved low-cost, light-weight Frequency Converter delivering 100 v.a. of 400-cycle power, has been announced by the Tel-Instrument Electronics Corporation, Carlstadt, N.J. for general use in electronics, aviation, laboratory and other industrial fields.

The Model 400A occupies little more than a cubic foot of space in either bench or rack-mounted designs and weighs only 60 pounds. It has no moving parts, uses standard components and has only eight tubes. Voltage regulation, no load to full load, is 1/4%; frequency regulation, no load to full load, is better than ± 1 cps; total harmonic distortion is better than 2% and all three performance characteristics are independent of power factor.

By use of panel controls the output frequency of the Model 400A is continuously variable from 380 to 420 cps and the output amplitude is continuously variable from 90 to 130 volts. Use of external condensers increases variable frequency range 200 to 1700 cps. The frequency of oscillation is completely determined by the resonant frequency of a tuned circuit. Amplitude of oscillation is limited by non-linear elements in a bridge circuit.



Complete technical information can be secured by writing to Canadian Factory Representatives: Atlas Radio Corporation Ltd., 50 Wingold Ave. Toronto 10, Ontario, Canada.

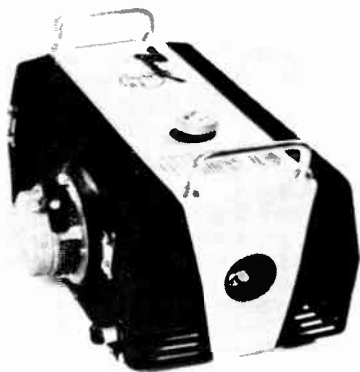
(Please turn to page 50)

NEW PRODUCTS

● Portable Electric Generator

Item 1566

Bendix announces a new compact portable electric generator. Weighing only 55 lbs., this unit can be easily transported to any location and can offer the many advantages of electricity wherever it is taken.



Known as the Model 110, this generator is powered by a 2 cycle, 2 hp air cooled engine. The 60 cycle, 110 AC model will produce power of over 800 watts for use in emergencies, in trailers and for camping, hunting and fishing trips. Owners of boats with AC power will find this unit a valuable emergency source of power at times when the main source is inoperative. The Bendix Model 110 generator will provide a convenient source of power for lighting, radio communication, etc., in Civil emergencies or for industry in remote 'on location' areas where regular power is not available.

The engine is equipped with a rewind starter and is mounted on a specially Bendix designed muffler which has numerous diverting fins and sound absorbing material to minimize engine noise. The tank holds a 1/2 gallon of fuel which operates the generator from 2 to 3 hours, depending on load, without refilling.

For complete information write to (Bendix Canadian affiliate) Aviation Electric Limited, 200 Laurentien Blvd., Montreal, P.Q. Canada.

● Solenoid-Powered Free Gyro

Item 1567

An extraordinary free gyro with a solenoid-powered caging system has been introduced by Humphrey Inc., San Diego manufacturer of electro-mechanical instruments.

Designated as Series FG01-0203-1, it is already in use on new missile systems and is being used in flight test operations where remote caging and uncaging is essential. The caging system has a minimum number of parts and is positive and reliable in operation. Precision potentiometer pickoff can be furnished with taps if desired.

The new instrument is extremely small and light. Its length is 5 1/2 inches, its diameter 3 inches, its weight but 2 1/2 pounds. These factors make it ideal for missile and aircraft instrumentation.

Other outstanding features of the Series FG01-0203-1 besides its simplicity and ruggedness are its cage indicating switches, precision potentiometers on both gimbals, and flexibility in choice of motor — 400 cycle 115 V (three-phase or single phase), or 28 V DC.

Humphrey Inc., 2805 Canon St., San Diego 6, California, U.S.A.

● Synchro Test Equipment

Item 1568

Muirhead Instruments Limited, Canada, announce that a range of precision test equipment, similar to the equipment used in their own synchro test rooms, is now available. The equipment is specially designed to perform the electrical accuracy and residual voltage tests specified in U.S. Navy Bureau of Ordnance Specification MIL-S-16892 and in addition provides facilities for zeroing, transformation ratio measurements, and current and power measurements. The main features of the test equipment are:—

A delta network comprised of precision resistors and low contact resistance switches which facilitate selection of any desired electrical angle in ten degree steps.

A phase sensitive detector having high input impedance and high gain; but with an A.G.C. characteristic which eliminates the necessity for frequent gain control adjustments.

A comparator type valve-voltmeter with built in filter for fundamental component and total residual voltage measurements.

A standard transmitter complete with positioning fixture for tests on CTs and differentials.

A mechanical positioning fixture accurate to 1/2 minute and with a scale reading synchro error directly without the use of lenses or microscopes.

A power amplifier which supplies 400c's power to the synchro under test.

A fork controlled oscillator to provide an accurate 400c/s signal to the power amplifier. The latter two items eliminate the need for a 400c/s test alternator. The whole equipment can be operated from either 50c/s or 60c/s mains.

Muirhead Instruments Limited, Stratford, Ontario, Canada.

● Microvolt-Ammeter Amplifier — Model 203

Item 1569

The KIN TEL Model 203 is a new improved combination DC microvoltmeter, microammeter and amplifier. It employs KIN TEL's chopper amplifier circuit to provide exceptionally good stability and accuracy. Fifteen voltage ranges cover from 100 microvolts to 1000 volts full scale, and ten current ranges cover from 100 micro-microamperes to 100 milliamperes full scale. A zero-center meter indicates polarity on two mirrored scales which cover all ranges. Output terminals on the front panel allow the instrument to be used as a lowdrift DC amplifier with up to 80 db gain and very high input impedance. Input impedance on the 100 microvolt to 10 millivolt ranges is 10 megohms, on the 30 millivolt range, 30 megohms, and 100 megohms on the 100 millivolt and above ranges. Impedance accuracy is 1.5 per cent. Output impedance is less than 2 ohms and output voltage is 1 volt full scale across 1000 ohms or more. Drift after 15 minutes warm-up is less than 10 microvolts and accuracy is 3 per cent on all meter ranges. The unit is available in either cabinet or 19" rackmount models.

The Model 203 is an extremely versatile tool for electronic research and development laboratories or wherever it is necessary to measure accurately very small DC voltages or currents. It is also useful as a recorder driver where the recorder does not have the required high input impedance or sensitivity.

The Model 203 is manufactured by KIN TEL (Formerly Kay Lab.), 5725 Kearny Villa Road, San Diego 11, California, U.S.A.

● Model 802 Frequency Meter

Item 1570

An increase of frequency range from 2400 to 10,200 megacycles to 2350 to 10,500 megacycles is a significant improvement in the new Narda Model 802 Frequency Meter covering the range of the most-used microwave frequencies. The redesigned instrument, developed by The Narda Corporation, Mineola, L.I., New York, also provides greater accuracy and better legibility.

The principal design change in the new Model 802B is the elimination of the two micrometers and the substitution of a Veeder-Root digital counter system for indicating frequency readings. In the earlier model the micrometers were mounted below the panel and were read through a plastic lens. Greater accuracy and easier, more dependable readings are provided by the counter.

In the new design the two cavities are tuned by turning a precision lead screw with ground threads, each cavity having its own screw or tuning shaft. Both tuning shafts are driven, through a set of bevel gears, by a single knob on the front panel. In addition, the two tuning shafts are geared, by means of precision spur gears, to the digital counter, so that the single knob actually tunes both cavities while actuating the counter. The counter reading is referred to a universal nomograph-type calibration chart. Frequency in megacycles is obtained without calculations or written interpolation at any point in the entire frequency range to the rated accuracy of 0.2%. The calibration chart is laminated in plastic and incorporated in the instrument's lid.

For further information contact Measurement Engineering Ltd., Arnprior, Ontario, Canada.

● The Multiwhistle RD Ultrasonic Generator

Item 1571

A new ultrasonic device which promises to solve the problem of fog dissipation of airports and highways and improve industrial processes such as radio-active waste disposal, concentration of fissionable ores, precipitation of aerosols and dust particles, cleaning, sterilization, and mixing of paints, has been developed by Dr. Raymond Boucher of Paris, France.

The instrument — a Multiwhistle RD Air-Jet Ultrasonic Generator — is being manufactured and marketed in the United States by **Gulton Industries, Inc., Metuchen, New Jersey**, under terms of an agreement with the Societe d'Applications Supersoniques, Paris.



The Multiwhistle RD is being used extensively in Europe as a high intensity source of sonic energy ranging from 4 to 40 kilocycles, and its application for fog dissipation is currently being investigated by Dr. Boucher under sponsorship of the French Air Force. The device can be operated in either gas or liquids and may be used in corrosive atmosphere or in temperatures as high as 700°C. An air compressor or steam generator furnishes the driving power which is converted to ultrasonic energy with an efficiency greater than 20 per cent.

Gulton Industries, Inc., 212 Durham Ave., Metuchen, New Jersey, U.S.A.

news of the industry

Latest Appointments At Atlas Radio Corp.

D. Lou Harris, president of Atlas Radio Corporation Limited, Toronto, announces the following appointments effective May 1st, 1957: Fred Harris, formerly general sales manager becomes general manager; J. R. "Joe" Bass is promoted from manager, Western Canada division, to general sales manager; Jack Bass is promoted from sales representative to manager,



FRED HARRIS

Western Canada; Roy Henderson has recently joined the company as sales representative for Western Canada; J. D. "Doug" McCormick becomes sales representative for the company's industrial and manufacturer sales division in Eastern Canada; Jacques "Jack" Goodhart will represent the Eastern Canada sales division; A. T. "Terry" Keenan becomes executive assistant in charge of sales liaison.

Radio Telephone Service For Hamilton

The Canadian General Electric Co. Limited have announced the signing of a contract with Hamilton Telephone Answering Service Ltd., Hamilton, Ontario for the supply, installation and maintenance of two-way radio equipment to be used in their new Radio Dispatch and Message Relay Service.

The new service, which will be offered by Hamilton Telephone Answering Service in addition to their present facilities of telephone answering service, has been licensed by the Department of Transport recently.

The Hamilton Telephone Answering Service Ltd. is owned and operated by Mr. and Mrs. H. W. Hilder.

The Canadian General Electric Company who installed the first system of this type in Canada for Western Radio Dispatch in Vancouver will be supplying their new Progress Line of Communication Equipment to Hamilton Telephone Answering Service Ltd.

H.T.A.S. will shortly inaugurate their radio dispatch service over the 400 square mile Hamilton operational area.

Installation of an estimated one hundred General Electric Mobile radio units will commence this month. The G.E. 50 watt base station will be located on Hamilton Mountain.

Instronics Represents Two More U.S. Firms

An agreement has recently been signed whereby Instronics Limited will act as exclusive Canadian representative of Millivac Instrument Corporation, P.O. Box 997, Schenectady, N.Y.

Millivac manufacture a complete line of sensitive and wide range vacuum tube voltmeters for the mea-

surement of AC, DC and RF voltage, current and ohms.

In addition to Millivac, Instronics Limited will represent the sister company, Volkers and Shaffer Inc., P.O. Box 998, Schenectady, N.Y. Products currently marketed include broad band, exceptionally low noise amplifiers using hushed transistor or hushed pentode techniques. Volkers and Shaffer products are widely used in geophysical and medical research.

First Canadian Wins David Sarnoff Fellowship

James McCook, an engineer with RCA Victor's engineering products department, becomes the first Canadian to be awarded a David Sarnoff Fellowship enabling him to complete his Master's degree in Business Administration at Harvard University.

The Scholarship and Fellowship plan, instituted by Radio Corporation of America's Board of Directors in 1945, extends to students of science, industrial relations, dramatic arts and music. During the 1956-57 terms, more than \$100,000 will have been awarded through 33 scholarships and 20 fellowships. Since 1945, this plan has aided 230 individuals in the advancement of their education. These scholarships and fellowships were first made available to Canadians, in competition with American applicants, in 1956.

Mr. McCook, one of the two successful applicants in his classification, was born in Calgary and educated in Ottawa and English schools and is a graduate of McGill University, Montreal, with a Bachelor of Science Degree in Physics and Mathematics. In 1952, he joined RCA Victor Company, Ltd., in Montreal. He entered Harvard Business School in 1956 on leave of absence from the company and plans to resume his work in Canada on completion of his degree.

ATLAS RADIO APPOINTMENTS



J. R. Bass



Jack Bass



J. Goodhart



R. Henderson



A. T. Keenan



J. D. McCormick

NEWS

IRE Exhibition Space 90 Per Cent Sold Out

More than 90 per cent of available space for the Institute of Radio Engineers' Canadian convention-exposition to be held in Toronto, October 16th, 17th and 18th, was sold within three weeks from the date that bookings opened, Clare Norris, P.Eng., general chairman, has announced.

Britain's Board of Trade has earmarked a big section for British participation in this largest Canadian electronics exposition. Canada's own National Research Council and the Department of National Defense have booked space for the second time. Exhibits will include radio and television transmission equipment, radar, control mechanisms, computers, aeronautical and navigational aids, nuclear industry supplies and service and many other electronic devices.

In addition to the exhibitors already booked, further applications are expected to include more overseas participation, due partly to the active co-operation of Canadian government trade commissioners, who report considerable interest among foreign electronics manufacturers, as well as those in the United States.

Last year's exhibitors booked 262 booths and although this space has been upped to 309 booths, the chairman reports that it may not be enough to meet exhibitors' needs. Eighty-seven per cent of last year's exhibitors have already re-booked. In addition, numerous applications from new exhibitors are in hand.

Dr. George Sinclair, professor of electrical engineering at the University of Toronto, and chairman of the convention's technical paper program, is planning for the reading of 100 papers. One session will be devoted to "Human Engineering", and will deal primarily with the designing of machinery (such as jet planes) where humans are a limiting factor in performance, thus affecting design.

The I.R.E. convention is offering a

number of student travel awards to each of its student branches across Canada registered by October 11th this year, says chairman Norris. The award will pay student's travel and hotel expenses while in Toronto during the convention. As many as eleven students could so benefit, if registered by October.

Canadian Admiral Corp. Makes Board Appointment

Vincent Barreca, president of Canadian Admiral Corporation, recently announced the election of Edwin Whittaker to the company's board of directors.

Mr. Whittaker has been vice-president and general sales manager of Canadian Admiral since January 1956. His service with the company began in 1951 when he was appointed manager of the Toronto branch. In 1952 he became a vice-president of the company's sales subsidiary, Canadian Admiral Sales Ltd., then supervisor of all sales branches.

Before joining Canadian Admiral, Mr. Whittaker was sales manager of the TV and radio division of Cochrane-Dunlop Hardware Ltd.

Union Carbide Silicones Division Exhibit

Silicones Division, Union Carbide and Carbon Corporation, was represented at the 24th national convention of the National Industrial Service Association (NISA) in Buffalo, N.Y., May 12-16, with an exhibit of its varnishes for high-temperature electrical insulation.

The display featured "Union Carbide" R-620 impregnating varnish for Class H insulation. The advantages of Class H insulation and of this resin were illustrated.

"Union Carbide" Silicones are distributed in Canada by Bakelite Company, Division of Union Carbide Canada Limited, 40 St. Clair Avenue East, Toronto 7. Mr. Gordon Ball, product manager, was on hand at the exhibit to give technical assistance for Canadian customers.

Kitchener-Waterloo Subsection, IRE

The first meeting of the Kitchener-Waterloo Subsection of the Institute of Radio Engineers was called for Tuesday, May 7th, 1957, at the Amphitheatre — Waterloo College, Waterloo, Ontario.

The agenda for the meeting included the election and installation of officers, a paper entitled "The Technical Facilities of Television Station (CKCO-TV)" by Sandy Day, chief engineer of CKCO-TV in Kitchener, and conducted tours of the studios of that TV station and of the transmitter situated near Baden, Ontario.

T. D. Cushing Joins Lenkurt Electric Co.

Thurb D. Cushing, former radio project engineer with the North-West Telephone Co., Vancouver, B.C., has joined the product planning division of Lenkurt Electric Co., San Carlos, Calif.

In his new position as radio communications engineer, he will do research in communications methods and in analysis of new products to serve the industry.

During his eight years with North-West, Mr. Cushing was responsible for major radio engineering projects, including the British Columbia portion of the Trans-Canada TD/2 system.

In a previous affiliation, Cushing was with Electronic Laboratories of Canada at Vancouver. During the war he was with the Department of National Defense at Ottawa, working on projects in conjunction with the National Research Council. He has been associated with major pioneering work in radio.

Cushing studied at the University of Vancouver, and is a member of the Institute of Radio Engineers.



T. D. Cushing

Expansion Of Automatic Electric (Canada) Ltd.

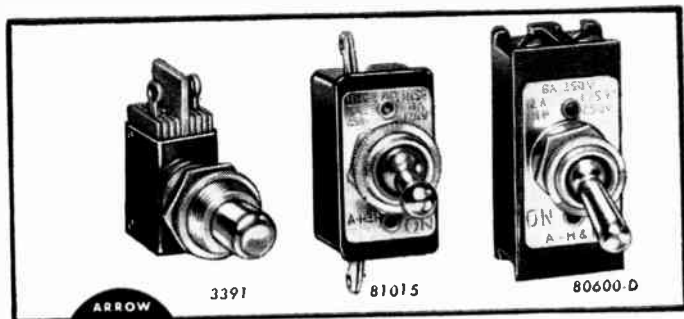
Construction work on the million and a half dollar expansion of the Automatic Electric (Canada) Limited factory has begun in Brockville, Ont.

The factory, which manufactures communication equipment and electrical control apparatus, will be almost doubling its present floor space, from 125,000 to 211,000 square feet.

C. R. Hughes, president of the company, says "work should be completed at the end of 1957". At that time the factory will be employing approximately 1,000 people.



● Planned expansion of Brockville, Ont. plant of Automatic Electric (Canada) Ltd.



**NEW
ARROW-HART
Switch Controls**

Stronger . . . More Compact

A complete new range of one-hole mounting, quick make and break switches for vacuum sweepers, fans, power tools, etc., and radio and electronic equipment.

Send for your copy of the new illustrated Bulletin Z-2, today. Ask us for any additional advice and information you may need.

**ARROW-HART & HEGEMAN
(CANADA) LIMITED**

Industry Street, Toronto 15, Ontario
Telephone RO. 2-1101



Representatives:

Cochrane Stephenson (Western) Ltd., Winnipeg, Calgary, Edmonton, Vancouver; George C. Robinson, St. John, N.B.

5703



**New helpful data on
NYLAFLOW® Pressure Tubing**

... the strong, flexible
polyamide tubing with

- high burst rating at low cost
- almost unlimited flex life
- crush resistance
- corrosion and chemical resistance
- low cost installation

SEND FOR YOUR FREE COPY TODAY

Information on characteristics, properties, application, tubing accessories and tools.

Distributors and Sales Engineers:
Peckover's Limited:

115 McCormack St., Toronto
2052 St. Catherine St. W., Montreal
C. M. Lovsted & Co. (Canada) Ltd.:
Vancouver • Edmonton • Calgary

POLYPENCO, INC.

2150 Fairmont Ave., Reading, Pa., U.S.A.



CLM DARCY RELAYS

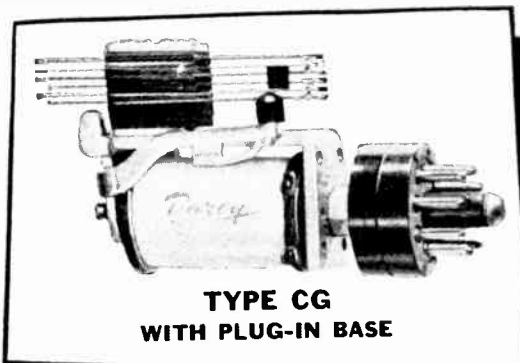
Now you can get fast delivery with Canadian made relays. All standard types are available and all are electrically and mechanically interchangeable with other makes.

Illustrated are only a few telephone type relays. Other spring and coil combinations are available.

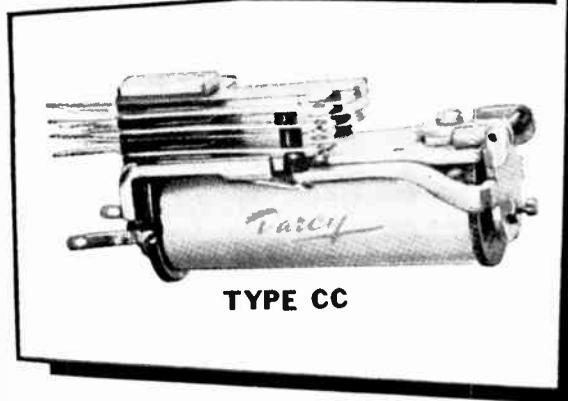
For full information call or write Jack West, Sales Manager, Rectronic Division, Canadian Line Materials Limited, Toronto 13, Canada.

SALES OFFICES AND WAREHOUSES

ST. JOHN'S Nfld. • HALIFAX • SAINT JOHN • MONTREAL • OTTAWA
FORT WILLIAM • WINNIPEG • REGINA • CALGARY • VANCOUVER



**TYPE CG
WITH PLUG-IN BASE**



TYPE CC



CLM-DARCY RELAYS

MORE ACTIVE! EFFECTIVE!



KESTER
"RESIN-FIVE"
CORE
SOLDER

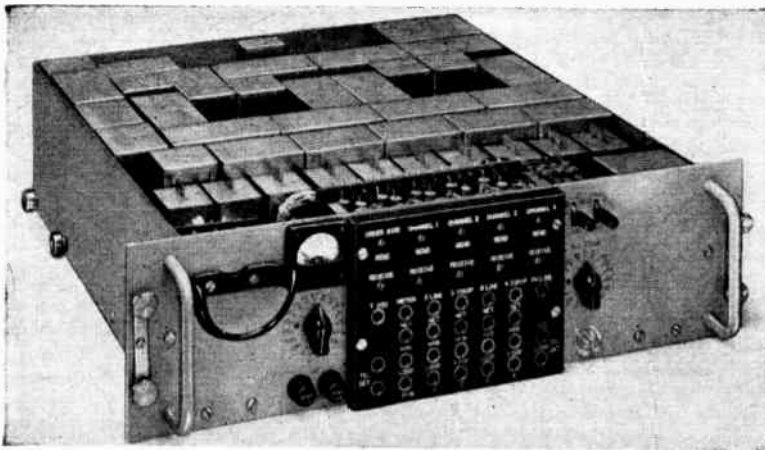
THE BEST FOR TV-RADIO WORK ...
EVERYTHING ELECTRICAL—Kester "Resin-Five" Core Solder is better and faster than any solder ever developed. It has an activated flux-core that does a perfect job on all metals including zinc and nickel-plate. The flux residue is absolutely non-corrosive and non-conductive.

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



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

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



FOUR-CHANNEL CARRIER-TELEPHONE TERMINAL FOR RADIO LINKS

This is a miniaturized unit of advanced design which provides four voice channels on a frequency-division basis above a voice-frequency order-wire channel. Each of these five channels is provided with a 4-wire 2-wire termination and a voice-frequency ringing circuit for d-c or 20-cycle signals. Adjustable attenuators are provided in the 4-wire side of all channels, and a built-in test oscillator and meter permit complete line-up, maintenance and trouble-shooting checks to be made. Channel levels are from -9 to 0 dbm and line levels from -30 to 0 dbm. Channel width is 300 to 3500 cycles within 1 db.

This unit is only $5\frac{1}{4}$ " high by 19" wide by 14" deep. It mounts on a standard rack and operates from 115 volts 50-60 cycles a.c.

RADIO ENGINEERING PRODUCTS
1080 UNIVERSITY ST., MONTREAL 3, CANADA
TELEPHONE CABLES
UNiversity 6-6887 RADENPRO. MONTREAL

NEWS

Dominion Electrohome Opens New Factory

Canada's electronics industry took an important step forward on April 11th with the official opening of a new factory by Dominion Electrohome Industries Limited, which this year is celebrating its 50th anniversary.

Dr. Sidney E. Smith, president of the University of Toronto, officiated at the ribbon-cutting ceremony, with Electrohome President Carl A. Pollock and a large number of guests representing the electronics industry from England, United States and Canada.

Located on the outskirts of Kitchener, Ontario, an intensely industrial community, this new television, radio and high fidelity plant has been equipped with every conceivable modern device to produce ideal working conditions throughout the factory and offices.

Production capacity of the plant will be one-quarter million dollars weekly in television, high fidelity and radios, to be marketed across Canada under the famous Electrohome brand name, with Deilcraft cabinets, another product of this company.

PSC Applied Research Appointments

The appointment of E. D. Rushbrook as secretary-treasurer of PSC Applied Research Limited has been announced by J. M. Bridgman, managing director of the company.

Mr. Rushbrook comes to PSC Applied Research Limited from A. V. Roe Canada Limited, where he served as assistant comptroller for 15 months.

The appointment of Roy L. Adams as chief product design engineer of PSC Applied Research Limited has also been announced by Mr. Bridgman.

Mr. Adams joined PSC Applied Research in November 1955 and has served the company as assistant production manager, electrical and electronic equipment, since November 1956.

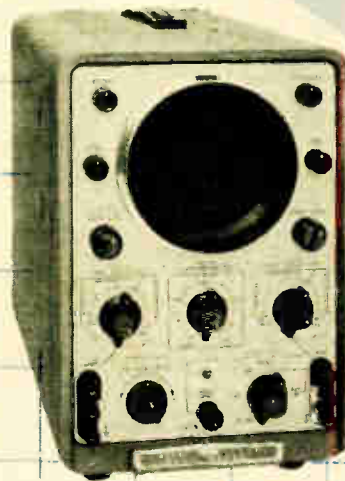
In directing the operations of the product design group, Mr. Adams will ensure that equipment developed by engineering meets the requirements necessary to efficient production. Prototype models of equipment will be produced by this group, and complete, accurate drawings, parts schedules, assembly procedures, will be prepared before the product enters into the final production stage.

One of Canada's leading designers and manufacturers of electro-mechanical instruments and systems, this company was recently added as the sixth member of the A. V. Roe Canada Limited Group.

(Please turn to page 56)

For further data on advertised products use page 71.

not just "new"
but
a new
KIND of
OSCILLOSCOPE



-hp- 130A Low Frequency Oscilloscope

High sensitivity, dc to 300 KC

21 direct reading sweep times

Sweeps 1 $\mu\text{sec}/\text{cm}$ to 15 sec/cm

Easy to use

"Universal" automatic triggering

5% voltmeter, millivoltmeter

This totally new production and laboratory instrument obsoletes previous concepts of oscilloscope convenience, usefulness and reliability.

Horizontal and vertical amplifiers are similar. Sensitivity is 1 mv/cm or 10 mv full scale deflection. Amplifiers have wide pass bands, dc to 300 KC. Input circuits are balanced on 5 most sensitive ranges. Single-ended input may be dc or ac coupled. Amplifiers are stable; gain may be standardized by an internal 1,000 cycle square wave. Sweep times are highly linear, may be set and read directly! In most cases -hp- 130A needs no preamplification to present transducer signals as a brilliant, high resolution trace.

A special feature is the "universal" automatic triggering system where one preset condition provides optimum triggering on almost all input signals.

Brief Specifications

Input Amplifiers: (Similar Vert. and Horiz. Amps.) Sensitivity 1 mv/cm to 50 v/cm ; 14 calibrated ranges, 1-2-5-10 sequence plus continuous vernier. Pass band dc to 300 KC; ac or dc coupling. Balanced input on 1, 2, 5, 10 and 20 mv/cm ranges.

Sweep Range: 1 $\mu\text{sec}/\text{cm}$ to 15 sec/cm. 21 sweeps: 1-2-5-10 sequence, 5% accuracy.

Triggering: Internal, line voltage or external 0.5 v or more. Pos. or neg. slope, +30 to -30 v trigger range.

Preset Trigger: Optimum setting for automatic stable triggering.

Amplitude Calibration: 1 KC square wave. 5% accuracy.
Price: \$650.00

For the complete story on a really new oscilloscope, call your -hp- representative, or write direct.

HEWLETT-PACKARD COMPANY

4054D Page Mill Road • Palo Alto, California, U.S.A.

Cable "HEWPACK" • Davenport 5-4451

Represented in Canada by

ATLAS RADIO CORPORATION, LTD.
50 Wingold Avenue, Toronto 10, Ontario
505 McIntyre Bldg., Winnipeg, Manitoba



also offers -hp- 150A High Frequency Oscilloscope, dc to 10 MC, sweeps 0.02 $\mu\text{sec}/\text{cm}$ to 15 sec/cm. Rise time 0.035 μsec .

MEASUREMENTS' MEGACYCLE METER

**Gives You Extended
Coverage from
100 Kc to 940,000 Kc**

PRECISION GRID-DIP METERS



**MODEL
59**
Power Supply
\$75.00

MODEL 59-LF OSCILLATOR UNIT

Frequency Range:
100 Kc to 4.5 Mc.
Price - Oscillator Unit
(Head) only \$98.50
with Power Supply
\$168.00



MODEL 59 OSCILLATOR UNIT

Frequency Range:
2.2 Mc to 420 Mc.
Price - Oscillator Unit
(Head) only \$98.50
with Power Supply
\$168.00



MODEL 59-UHF OSCILLATOR UNIT

Frequency Range:
420 Mc to 940 Mc.
Price - Oscillator Unit
(Head) only \$123.00
with Power Supply
\$198.00



Measurements' Megacycle Meter is now available in a choice of three oscillator heads providing frequency range coverage from 100 Kc to 940,000 Kc. Thus, the utility of this versatile instrument has been extended, making it, more than ever, indispensable to anyone engaged in electronic work; engineer, serviceman, amateur or experimenter.

In Canada — M. Roy Gray, Ltd.
46 Danforth Road, Toronto, Canada

Laboratory Standards 

MEASUREMENTS CORPORATION
BOONTON • NEW JERSEY

NEWS

Heath Company's New Plant

Ground has been broken for the construction of a new 142,000 square foot plant for Heath Company, world's largest manufacturer of electronic equipment in kit form, Robert Erickson, president, announced recently. Heath is a subsidiary of Daystrom, Inc.

The modern one-storey building will house all of Heath's operations and, upon completion, will be one of the largest plants in the nation devoted to specialized direct mail selling. It will be located on a 16 acre tract in St. Joseph, Michigan, the twin city adjoining Benton Harbor.

Heath manufactures a wide line of electronic kits for amateur radio enthusiasts, high fidelity fans, television and radio servicemen, and small boat owners. Facilities in the new plant will include specialized equipment for handling mail orders, a product research department with a new anechoic chamber for research with all types of sound equipment and a branch U.S. Post Office.

Electrohme Announces Scholarship Plan

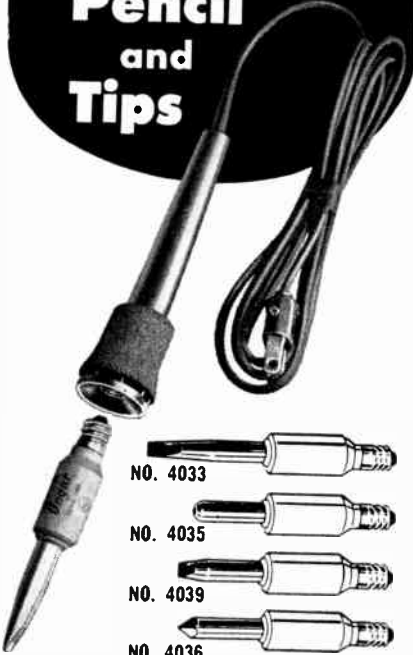
Announcement was made by C. A. Pollock, president of Dominion Electrohome at Kitchener, during the opening ceremony of their new plant in April, of a Scholarship Plan designed to encourage high school students to further their education through attendance at a Canadian university.

Mr. Pollock, in his remarks, stated the company had awarded a \$1,600 Scholarship last year to a student graduated from the Kitchener-Waterloo Collegiate. The award was to be paid out in successive years on the basis of \$600 the first year, \$400 the second year, and \$300 per year for the last two years. The Electrohome Electronics award will be continued in 1957, 1958 and 1959, until there are four students from the local high schools attending university.

Mr. Pollock referred to the fact that giving scholarships was only a partial gift because students did not pay their way at university, and sending more students for a higher education only further increased the debt of the school attended by the scholarship winner. With this in mind, Electrohome had decided not only to give awards to high school students, but also to donate up to \$500 per year, depending on the faculty enrolment, for each student attending university on an Electrohome Scholarship. The Electrohome Plan will be administered through the company's Industrial Relations Division.

Ungar

SUPER HI-HEAT Soldering Pencil and Tips



NO. 4033

NO. 4035

NO. 4039

NO. 4036

Ungar pencil soldering irons and interchangeable tips for every soldering job! Featherlight, less than 5 inches long, the Ungar iron has been designed to speed soldering production and reach hard to get at soldering points. Cool and comfortable, the new heat deflector head reflects heat AWAY from the handle.

The 400 Super HI-HEAT series tips are engineered especially for production line soldering and extra heavy duty service. A searing 850° to 1000° of actual tip temperature is at your command, yet only 47½ watts! Special processing eliminates maintenance chores. Change from one tip to another in less than 5 seconds!

Ungar

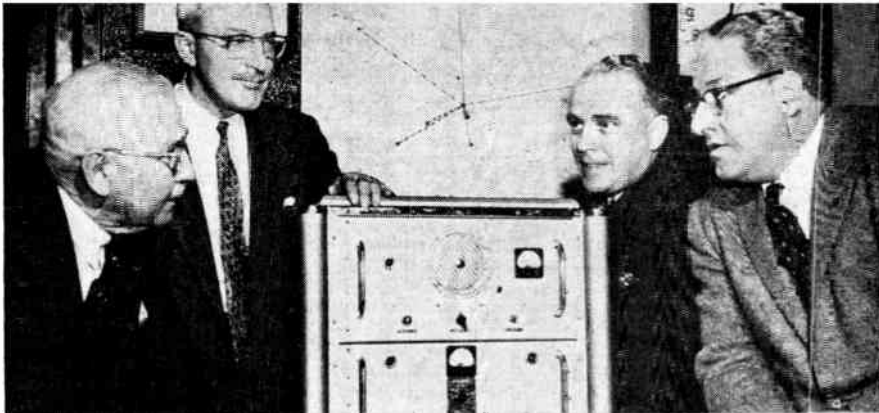
**ELECTRIC TOOL CO.
OF CANADA**
44 DANFORTH ROAD
TORONTO 13, CANADA

Civil Defense Radio Ham Contest

Radio College of Canada, Toronto and Montreal, is offering a prize to the Ham operator who, in the opinion of the officially appointed contest judges, submits the best answers to a Test Paper concerning the establishment and maintenance of emergency communications. The contest is open to all registered Ham radio operators in Canada who are officially enrolled in Civil Defense for communications purposes, particularly in the event of a national emergency.

Radio College will give to the winning candidate a handsome chronometer for use in radio shack. In addition, Radio College proposes to donate to the same winning candidate the "gift" of a full year's tuition in any one of the 25 courses and plans at Radio College of Canada, in Toronto or Montreal, or in some study.

Entries to the contest should be sent, with full name and address, before July 31st to: Major General F. F. Worthington, Federal Civil Defense Co-Ordinator, 4th Floor, Daly Building, McKenzie Avenue, Ottawa, Ont.



● Major-General Worthington of Ottawa, Federal Civil Defense Co-ordinator for Canada, discussed the role of radio communications in the event of a national emergency with left to right, R. C. Poulter, P.Eng., director of education for Radio College of Canada, W. F. Choat, chairman of Amateur Radio Emergency Corps and M. I. Coombes, communications officer for Civil Defense, Ontario, at Civil Defense headquarters, Toronto. Also discussed was a dominion-wide contest for civil defense ham radio operators scheduled to be held May to July. Major-General Worthington is just back from NATO talks in Europe.



G. L. GARDINER

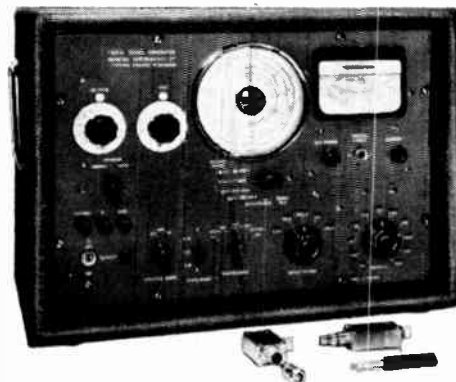
● J. S. Dewar, president, National Carbon Company, Division of Union Carbide Canada Limited, has announced the appointment of G. L. Gardiner as sales manager — Battery and Lighting Carbon Products. Mr. Gardiner was previously assistant to the sales manager — Automotive Products.

CORRECTION

In the article "A Survey Of Shock Test Procedure" *Electronics and Communications*, April, 1957, page 36, column 1, paragraph 5 should read: In many cases in practice however, one is only interested in frequencies up to 500 cps. etc., etc., etc. . . .

**MARCONI
SIGNAL
GENERATOR**

**FOR CONTINUOUS
F.M./A.M. COVERAGE**



*Marconi F.M./A.M.
Signal Generator TF 995A/2.
From 1.5 to 220 Mc/s.*

Accurate, a.c. operated, portable — this Marconi Signal Generator offers continuous frequency coverage from 1.5 to 220 Mc/s in five bands, and built-in crystal standardization from 13.5 Mc/s upwards. Open-circuit output level is variable in 1-db increments, from a minimum of 0.1 μ V to a maximum of 100 mV at 52 ohms and 200 mV at 75 ohms. Output may be continuous, frequency modulated, amplitude modulated or simultaneously both frequency and amplitude modulated.

Modulation, obtained either from an internal 1,000-c/s oscillator or from an external source, is variable to maximum limits ranging from 25 to 600 kc/s for f.m. and 50% for a.m.

Frequency Range: 1.5 to 220 Mc/s

Output Level: Variable from 1 μ V to 200 mV in 2-db attenuator steps and additional 1-db meter calibration.

Modulation: F.M.: Normal deviation continuously variable from 0 to 75 kc/s on all bands. High deviation up to 600 Kc/s is provided, depending on the band in use. A.M.: Internal at 1,000 c/s to a depth variable up to 50%.

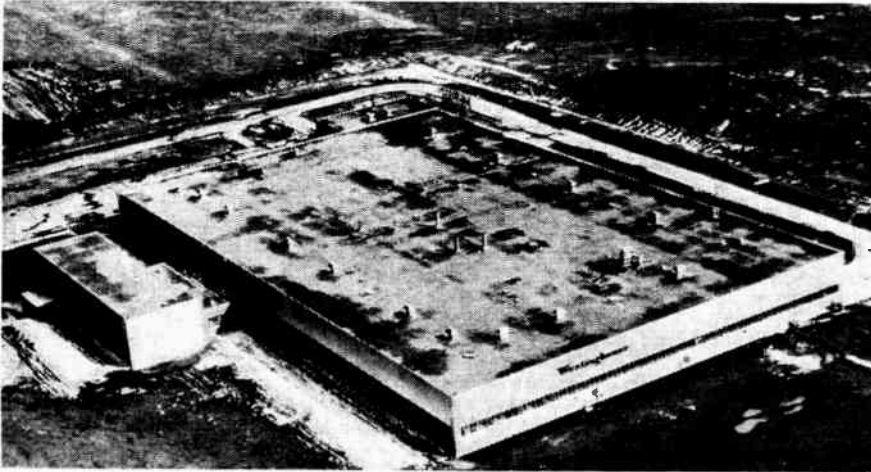
*For further details, write: Marconi Instrumentation Dept:
6035 Cote de Liesse Road
Montreal 16, Quebec.*

Marconi



CANADIAN MARCONI

COMPANY — Canada's Largest Electronic Specialists



● Aerial view of the new London, Ont., plant of the Canadian Westinghouse Co.

Westinghouse Opens Distribution Apparatus Plant

The opening of a new plant for the manufacture of distribution transformers and allied equipment has been announced by the Canadian Westinghouse Company. Located at London, Ontario, the plant is now operating on limited production.

It is expected that peak production will be reached by the end of the summer, and more than 300 people will be employed, including design, engineering, administrative, and manufacturing employees.

Manufacturing space is approximately 120,000 square feet with an additional 12,000 square feet for office facilities. The two storey administrative office area is separate from the manufacturing facility, joined by a service area housing the medical, employment and supervisory departments. Cost of the plant is approximately \$3 million.

Larger Montreal Premises For Pye Canada Ltd.

Effective April 1st, Pye Canada Ltd. moved to larger offices in Montreal. The expansion was the direct result of increased sales in the province which demanded greater staff and facilities for efficient service.

Directing the telephone, television and communications divisions will be Quebec sales manager Jean Bilodeau, who has had many years of experience in the telephone equipment field. Mr. Pierre Allard will be field sales engineer for Quebec.

Located in a newly constructed office building, Pye's new address is 170 Dorchester Street East, Room 409, Montreal, P.Q. Telephone number is UNiversity 6-9050.



CLM RECTIFIERS nurse your batteries

You'll protect your investment in station-type batteries when you install CLM Electronic Regulated Selenium Rectifiers.

CONSTANT OUTPUT VOLTAGE. In a CLM rectifier the output voltage is kept constant from no load to full load which increases battery life.

SELF-PROTECTING. CLM rectifiers are self-protecting on overload as the voltage curve drops off rapidly after 115 percent load is reached. CLM electronic regulated rectifiers are convection cooled, noiseless and require a minimum of maintenance.

FREE BULLETIN. For your *free* copy of Bulletin SR-14 which describes in detail, the performance characteristics of CLM rectifiers for station-type batteries write: Jack West, Sales Manager, Rectronic Division, Canadian Line Materials Limited, Toronto 13, Canada.



SELENIUM RECTIFIERS



L. T. BIRD

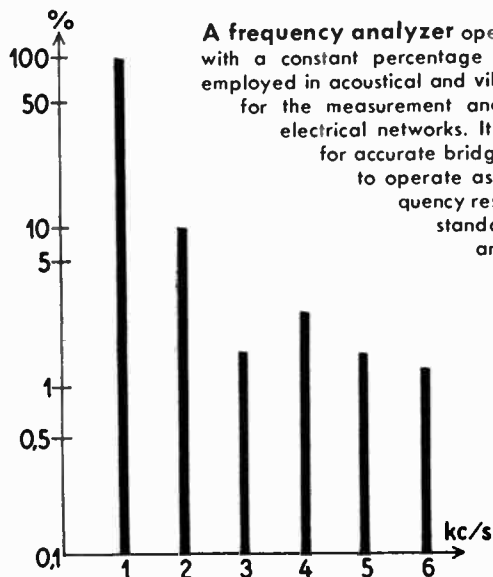
● L. T. Bird has been appointed United Kingdom representative for Canadian Marconi Company, as announced by J. J. Kingan, vice-president and general manager. He succeeds W. Victor George who returns to Canada to assume new duties.

For further data on advertised products use page 71.

BRUEL & KJAER

FREQUENCY ANALYZER

TYPE 2105



A frequency analyzer operating on the degenerative principle, with a constant percentage bandwidth. The instrument can be employed in acoustical and vibration-technique research, as well as for the measurement and analysis of distortion voltages in electrical networks. It is an excellent indicating instrument for accurate bridge measurements, and can be switched to operate as a linear amplifier, or to show a frequency response according to the internationally standardized characteristics at 30-60 phon and 60-130 phon.

Specification:

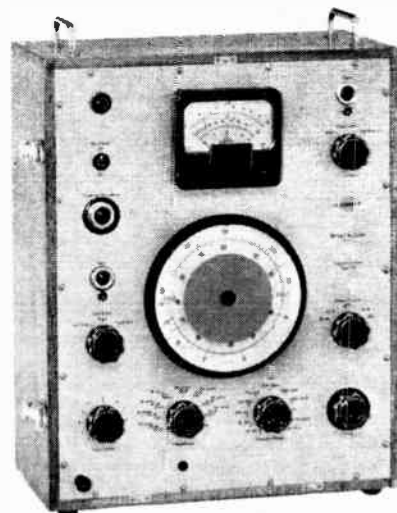
Frequency Range: 47-12000 c/s in 8 ranges. Frequency accuracy is better than 1%.

Selectivity: Variable in four steps, from 20 db to approx. 40 db attenuation of frequencies one octave off the frequency being measured. Harmonic distortion as low as approx. 1% can be measured directly. By employing a refection filter (Type 1602) distortion components of 0.01% are measurable.

Sensitivity: Max. sensitivity is 100 μ V for full scale deflection.

I. C. hum: Approx. 2 μ V, referred to the input terminals when the instrument is switched for max. gain.

Indicating Meter: Logarithmic, perfectly safeguarded against overloads.



TYPE 2105



R-O-R field engineers can help with your problems—ask for details.

R-O-R ASSOCIATES LIMITED

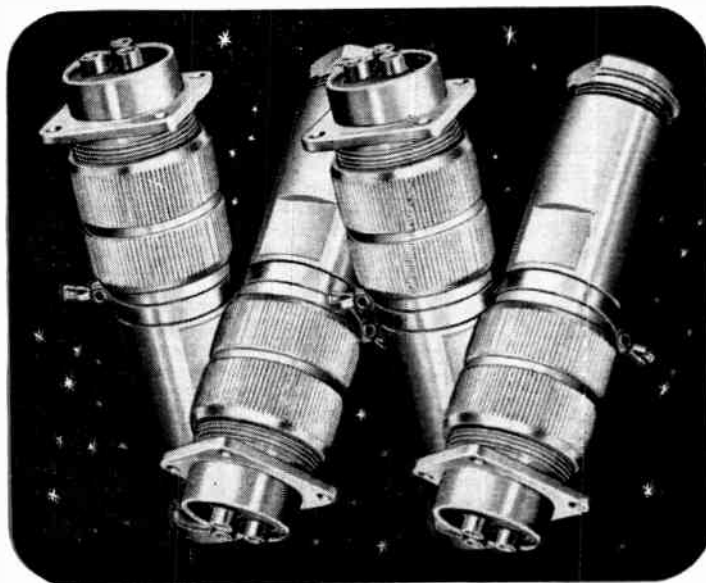
290 LAWRENCE AVE. W. TORONTO 12

**For long life under extreme conditions
of shock, vibration, corrosion,
humidity and temperature**

Bendix W TYPE

HEAVY-DUTY

ELECTRICAL CONNECTOR



Intended for use with jacketed cable and not requiring ground return through mating surfaces, this connector incorporates sealing gaskets at all mating joints.

W-Type Bendix* Connectors also incorporate standard Scinflex resilient inserts

in established AN contact arrangements. Shell components are thick sectioned high-grade aluminum for maximum strength. All aluminum surfaces are grey anodized for protection against corrosion.

It will pay you to remember that for

the really tough jobs, where ordinary electrical connectors just won't do, be sure to specify the W-Type Connector.

Complete specifications and details on request.

* TRADE-MARK



**SCINTILLA DIVISION of
SIDNEY, NEW YORK**



Export Sales and Service: Bendix International Division, 205 East 42nd St., New York 17, N. Y.

FACTORY BRANCH OFFICES:

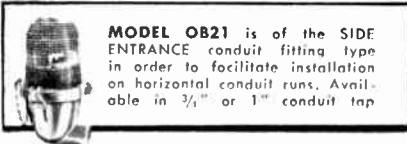
117 E. Providencia Ave., Burbank, Calif. • Paterson Building, 18038 Mack Ave., Detroit 24, Mich. • 545 Cedar Lane, Teaneck, N. J. • 5906 North Port Washington Rd., Milwaukee 17, Wisc. Hulman Building, 120 W. Second St., Dayton 2, Ohio • 2608 Inwood Road, Dallas 19, Texas • Boeing Field, Seattle 8, Washington • 1701 "K" Street, N.W., Washington 6, D. C.

World Radio History

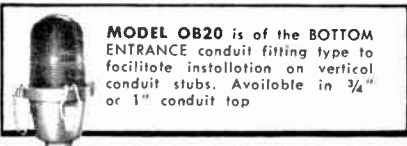
NEW! OBSTRUCTION LIGHTS

HIGH QUALITY — LIGHT WEIGHT
SIMPLE — POSITIVE LATCH
FOR EASIER MAINTENANCE

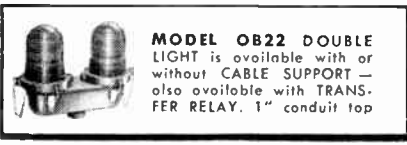
In accordance with CAA Spec. L-810
by HUGHEY & PHILLIPS, INC.
— your most dependable source of
Obstruction Lighting Equipment
— the widest selection of Control and
Alarm Apparatus in the Industry.



MODEL OB21 is of the SIDE ENTRANCE conduit fitting type in order to facilitate installation on horizontal conduit runs. Available in 3/4" or 1" conduit top



MODEL OB20 is of the BOTTOM ENTRANCE conduit fitting type to facilitate installation on vertical conduit stubs. Available in 3/4" or 1" conduit top



MODEL OB22 DOUBLE LIGHT is available with or without CABLE SUPPORT — also available with TRANSFER RELAY. 1" conduit top

Request Descriptive Bulletin HPS-138

HUGHEY & PHILLIPS, INC.

Manufacturers of

300 MM Beacons, Construction lights, Photo-Electric Controls, Beacon Flashers, Special Junction Boxes, Microwave Tower Light Control & Alarm Systems, Remote Lamp Failure Indicator Systems, and Complete Kits for: Tower Lighting, Sleet Melter Power & Control.

3200 NORTH SAN FERNANDO BLVD.
BURBANK, CALIF.

NEW ELECTRONIC MATERIAL AT SURPLUS PRICES

- Megger** — Winslow Model 5G-1000 Insul. Resistance Test Set — 0-1000 Megohms 500VDC — w Case and Leads \$129.50
- Variac** — Superior 2.4 KVA Powerstat — Input 115 230V 60 cy — Output 0-270V 9 Amp. \$ 39.50
- Choppers** — Stevens-Arnold CH-268 6 Volt 0-500 CPS. \$ 9.75
- Time Delay Relay** — Kurman R300B 115V 60 cy — Adj. Delay 30-60 Sec. \$ 5.95
- 10 Turn Precision Potentiometer** — Van Dyke Miniature 50,000 ohms 0.5% Linearity \$ 8.50
- Synchros** — 115V 60 cy Transmitters and Receivers (per pair) \$ 39.50
- Allen-Bradley Potentiometers** — type JU Full Range of RETMA Values — Std. Shaft \$ 1.20
- Allen-Bradley Resistors** — Full Range of RETMA Values — 1/2w 10% 4c; 1w 10% 6c; 2w 10% 9c ea. 1/2w 5% 8c; 1w 5% 12c; 2w 5% 18c ea.
- Transformer** — 5 Volt 190 Amp. Sec. 115V 60 cy Pri. — 35KV RMS Insul. Test. Wt. 80 lbs. \$ 29.50

POLYSTYRENE CAPACITORS

- 1MFD 1% tol. \$12.10
- 0.5MFD 1% tol. \$ 7.50

IMMEDIATE DELIVERY FROM STOCK

Bargain Filled Surplus Bulletins Available on Request

ELECTRONIC RESEARCH LABS

715-C Arch St., Phila. 6, PA., U.S.A.
Phone MA. 7-6771

NEWS

New Appointments By CAE

The appointment of R. W. Cooke as vice-president-engineering products and of C. J. Konzuk as general manager-eastern division has been announced by K. R. Patrick, president and managing director. The new positions were created to support the company's expansion in the military and commercial electronics field.



R. W. Cooke



C. J. Konzuk

Mr. Cooke will direct CAE's research and development program and as a member of corporate management, will assume policy responsibility for engineering products activities. These include design, development and production of flight and weapons system simulators, repair, overhaul and modification or armament control equipment, and the manufacture of precision gears and parts for electro-mechanical devices.

A graduate in physics and mathematics of the University of Western Ontario, Mr. Cooke had wide experience in the electronics field — both military and civilian — before joining CAE in 1952 as assistant chief engineer. He has been in charge of CAE's engineering projects for the past several years.

Mr. Konzuk, a graduate of McGill University in electrical engineering and a wartime radar officer in Canada and overseas, has been with CAE since 1951 as, progressively, manager of the Repair and Overhaul, Electronics Maintenance and Manufacturing Departments and lately as manager operations division at the main plant in Montreal.

30th Annual Meeting Of CSA, May 31st

"Standards and Savings are Synonymous" will be the theme this year for the 30th Annual Meeting of the Canadian Standards Association which will be held at the National Research Building, Ottawa at 11:00 a.m. on Friday, May 31st, 1957. J. L. Gray, vice-president, Atomic Energy of Canada Ltd., will be the guest speaker at the luncheon following the meeting and his subject is "Recent Developments in Industrial Uses of Atomic Energy".

The CSA has completed its thirty-eighth year of service to Canada as the nation's clearinghouse for voluntary standards.

Frequency Detectors for Telemetering and Control

Magmeter detectors deliver output currents that are linearly proportional within $\pm 1\%$ to frequency. Used to monitor frequencies from 0 to 5 KC or in electronic tachometers and speed controls. Available for wide bands or for bands as narrow as $\pm 5\%$ of center frequency.

- ✓ Units are available for use in transistorized circuits.
- ✓ They operate directly from 115-volt power lines.
- ✓ Can be driven by vacuum-tube amplifiers.

AIRPAX PRODUCTS COMPANY
DESIGNERS ENGINEERS
ENGINEERING DIVISION
MIDDLE RIVER
BALTIMORE 20
MARYLAND

For further data on advertised products use page 71.

electronics

in business & industry

banking

A five-fingered machine, capable of counting one hundred bank notes in seven seconds, has been developed by Thomas De La Rue & Co., Ltd. of Regent St., London, England. The manufacturer reports that initial orders for the equipment have been received from British and overseas banking houses.

• • •

traffic control

The Newark, N.J., fire department have installed in their fire trucks radar equipment capable of changing traffic lights in advance of the approach of the fire trucks.

• • •

extrusion machines

An equipment which provides a means of accurately measuring the lengths produced and speed of output of extrusion machines has been developed by B. & F. Carter & Co., Ltd. of Bolton, England. The equipment is of particular value in the electric cable, wire rope, rubber and plastic industries.

• • •

aviation

The Federal Telecommunications Laboratories of the International Telephone and Telegraph Corporation have developed an automatic electronic air traffic control system for commercial aviation claimed to be capable of coping with the air traffic control bottle-necks that will result from the use of supersonic jets in commercial aviation.

• • •

moisture measure

An equipment for the detection and extent of moisture in brickwork, timber, plaster and other materials is one of the latest products of Protim Ltd. of London, England. The device is known as a protimeter.

• • •

hair dryers

Women can now relax to soothing music while getting their hair done as the result of a recently developed system consisting of two miniature speakers, one on each side of the hair dryer. Each dryer is equipped with a control knob, operated by the customer, which can raise or lower the volume of music or turn it off entirely. The device is manufactured by RCA.

• • •

medicine

A powerful new ultra violet sterilizer, capable of producing completely safe, high-potency vaccines for immunization against polio and other diseases, has been invented by two scientists of the Michael Reese Foundation in Chicago, and is in course of production. Basic components of the sterilizer are a precision-balanced metal container 15 inches in height and an ultra violet element which fits inside. When the container is spun at 1800 revolutions per minute, the virus fluid works its way up the polished sides in a film one-twentieth the thickness of a human hair. Rays from the ultra violet element bombard each particle of the vaccine as it moves towards the container top. Precise control of the rays enables operators of the sterilizer to inactivate all virus organisms and at the same time retain highest potency of the vaccine.

electronics

in business & industry

atomic research

A British produced three-dimensional industrial television has been used to demonstrate the capabilities of another new device — the first remote controlled mechanical hand to be made in Britain for use in atomic research. The 3D television and the remote controlled hands were developed to the specifications of the United Kingdom Atomic Energy Authority for use jointly in the handling of deadly radioactive and toxic substances.

* * *

music

The world's first sun-powered radio phonograph has been developed by Admiral research engineers. The estimated value of the experimental unit is \$5,000. It is equipped with a 48-cell solar battery which cost \$1,000.

* * *

electronic larynx

Persons without vocal cords may now talk with the aid of an electronic larynx developed by the Rand Development Corporation. Two thousand of the units are being manufactured for the United States Veterans' Administration. The electronic larynx is the smallest artificial vocal cord in the world. They will retail for about \$300 each.

* * *

food preservation

Fresh foods for men in the front lines without need of refrigeration may become a routine part of the Army's feeding program as the result of a development contract awarded to Varian Associates for the construction of an electron linear accelerator to be used for the preservation of food.

* * *

security

A Doppler radar sentry capable of protecting a compartment up to 100 cubic feet in volume has been manufactured by Newport Instruments Ltd. The device is looked upon as being appropriate for the protection of art galleries, strong rooms or defense installations.

* * *

sport equipment

A radiation-cooled VHF transmitting triode is being used in a device known as the Pedomanotherm for warming the feet of chilly skiers. The skier's feet and hands rest on electrodes and are warmed by high frequency therapy techniques. The Pedomanotherm is now in use at a number of Austrian resorts. It is manufactured by Brown Boveri of England.

* * *

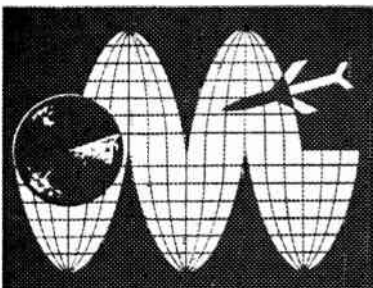
aerial navigation

An automatic direction finder designed to meet the requirements of modern high speed transport aircraft has been built by the Marconi Company of Chelmsford, England. Particularly suitable for pilot operation, it provides facilities for automatic direction finding, range reception and console reception.

* * *

farm equipment

A radio-operated tractor controlled by an 8-button remote transmitter control has been tested in Australia. TV supervision of the tractor is a possibility now being studied by the manufacturers.



CHANCE

DEW—line may never sight an enemy. But if it does . . . and if it fails . . . who will promise us a second chance?

The reliability of every component is crucial. That's why Sprague high reliability components are specified in critical military electronic equipment.

SPRAGUE®

CANADIAN MANUFACTURING REPRESENTATIVE

Micarta Fabricators Limited
18 Toronto Street
Toronto, Ontario
Phone EMpire 8-4251



Beatty Telemasts

FOR COMMERCIAL COMMUNICATIONS

Masts to 200 ft.—single, twin-H, and quadruple — designed to CSA specifications. Hot galvanized steel, resistance welded to Conodan Welding Bureau standards, in accurate jigs that insure easy and perfect erection. 10-foot sections completely hot galvanized after all fabrication. Galvanized hinged steel base and complete line of attachment fittings.

BEATTY BROS. LIMITED
Fergus, Ont. Est. 1874

WANTED

Going Business need not be profitable. Manufacturer desires to purchase small or medium size relay, transformer, instrument coil winding, small motor or allied plant within fifty miles of Toronto.

Box 319 DR
ELECTRONICS & COMMUNICATIONS
31 Willcocks St. • Toronto 5, Ont.

LEADERS IN QUALITY, AVAILABILITY

For a complete line of
RECEIVING AND PICTURE TUBES
POWER AND TRANSMITTING TUBES
TRANSISTOR, DIODES AND RECTIFIERS



Electronic TUBES

CANADIAN GENERAL ELECTRIC COMPANY LIMITED



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

NEWS

U.K.-Canadian Industrial Group Wins Contract

A \$124,000 contract for diesel electric equipment specially designed to withstand Manitoba temperature extremes ranging from 110° to "40 below" has been won by member-firms of a U.K.-Canadian industrial group in face of strong American competition.

The order — from the Montreal factory of the Radio Corporation of America — calls for power plant to supply energy to a Manitoba microwave telecommunications system. The

overall contract was awarded to J. & H. McLaren Ltd., Leeds, England, a subsidiary of the Brush Group Ltd.

The Group is represented in this country by Vivian Diesels & Munitions Ltd., Vancouver — Canada's only manufacturer of diesel engines — and by Brush Group Sales (Western Canada) Ltd., also of Vancouver. Strengthening of the Group's existing financial stake in Canada was foreshadowed recently in an announcement regarding a merger with the Hawker Siddeley Group, which already controls extensive Canadian industrial interests.

The latest contract called for five main standby plants — three at 10 Kw and two at 5 Kw — together with three duplicate stations, each consist-

ing of two 10 Kw diesel generator sets. Two of the air-cooled diesel engines required to complete the order were supplied by a second Brush Group Company, Petters Ltd., of Staines, England.

Further orders from the U.S. corporation, entailing more than a quarter of a million dollars' worth of additional equipment for an extended scheme, are to follow this first delivery.

The contract was obtained following a visit to Canada at the end of last year by the managing director of McLaren's, R. H. Hainsworth. Completion of the initial order, including the engine and switchgear building, was carried out in less than 10 weeks.

"... Trade journals are "must" reading for the businessman — he cannot afford to overlook them. There are rewards for those who obtain the information these trade journals contain; there are penalties for those who miss it."

*Parker L. Coddington, V.-P.,
The Reading Laboratory, in
an address to the NBP
Chicago Regional Conference.*

HOME STUDY COURSES in all branches of ENGINEERING



105 page book, "Engineering Opportunities" describes in detail over 90 courses in engineering and academic subjects — aeronautical A.F.R.Ae.S., Civil A.M.I.C.E. mechanical, A.M.I. Mech.E., radio, electronics, electrical industrial management, etc. courses compiled by world authorities. Individual or group training. Send for your copy free of cost or obligation to-day.

Canadian Institute of Science & Technology, Limited
Dept. #492, 263 Adelaide St. West, Toronto, Ontario.

NAME

ADDRESS



ADCOLA

PRODUCTS LIMITED
REGD. TRADE MARK

"SECUNDUS" SOLDERING INSTRUMENT

A neat and sturdy instrument specially produced for fine and delicate work.

Supplied in most voltages or to your own special requirements.

List No. 70
1/8" detach. bit
CSA Approved

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

U.S. Agents: Stratford Electronics Inc., P.O. Box 1114, New York 1, N.Y.



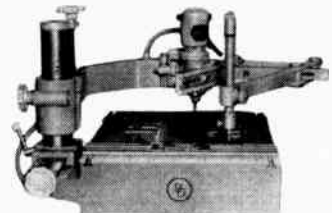
David

Dowling

ENGRAVING EQUIPMENT

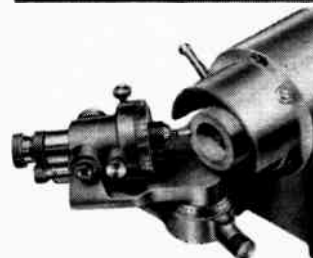
... moderate in price — high in performance

Model 713
Engraving Machine
Reduction range 1:2 to 1:8, with engraving at near writing speeds. Balanced pantograph has ball pivots and adjustable tension. Area for 1:2 reduction, 15 in. by 10 in., for 1:8 reduction, 15 in. by 4 in.



Model 858
Engraving Cutter
Grinder

Simplifies the grinding of special cutter forms. Universal cutter head with bold graduations and adjustable stops for profiles, compound angles, radii, blends, etc.



EMPIRE ENGINEERING CO.

738 Dundas Street East, Toronto, Canada. EM. 4-2928

NEWS

RETMA Sub-Committee Meeting, May 15

The Components Division's Transformer Engineering Sub-Committee of the Radio-Electronics-Television Manufacturers Association of Canada met at the Collins Hotel, Dundas, Ontario, on Wednesday, May 15.

The morning session was devoted to a talk by D.C. Dieterly, chairman of the U.S.A.-ASTM Sub-Committee on Magnetic Materials Testing. Mr. Dieterly's committee has spent many years developing advanced testing methods for magnetic materials. To facilitate these testing methods, a unique arrangement of test equipment has been recently installed in the plants of several of the leading producers of magnetic materials in the U.S.A. Similar equipment was set up in the Collins Hotel for this meeting to allow Mr. Dieterly to demonstrate these latest testing methods, the first equipment of this kind to be shown in Canada.

In the afternoon a tour was made through the Appliance Section of the Canadian Westinghouse Company's Appliance Division.

The day's program closed with a reception and dinner followed by a talk on "The Application of Cost Reduction in Industry" by Lawrence A. Stock, Specialist Cost Reduction, Canadian General Electric Company Limited.

Appointment



E. BATLER, B.Sc.

● The appointment of Emanuel Batler, B.Sc. as manager, Professional Products Division, was announced recently by Philips Industries, Limited. Mr. Batler will direct the expanded marketing program of Philips Scientific, Industrial and Medical Apparatus Divisions. Mr. Batler has had broad experience in technical and business areas in both the United States and Canada.



NOW made in Canada

**Designers and Engineers appreciate
their performance proven dependability**

- Syntron's unique vapor, deposit process and quality control methods provide rectifiers of extreme uniformity.
- Low forward voltage drop means longer life and lower operating temperature.
- High short circuit surge-current ability to 300 times normal rating.
- Withstand high transient conditions without damage.
- Largest range of cell sizes in the world. This permits Syntron to build rectifier stacks to any specifications or size.

Our applications engineers will gladly submit recommendations on request.

Builders of Quality Equipment for More than a Quarter-Century.

SYNTRON Selenium Rectifiers are now made in Canada.

Write for complete data — FREE

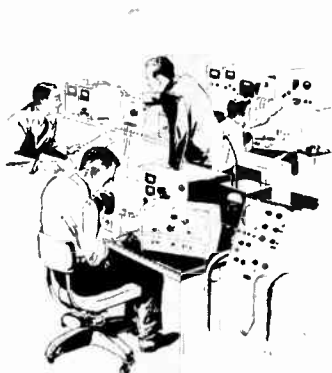
SYNTRON (CANADA) LIMITED
12 MAIN STREET EAST • Dept. K • STONEY CREEK, ONTARIO

NOW - PORTABLE

400 cycle power

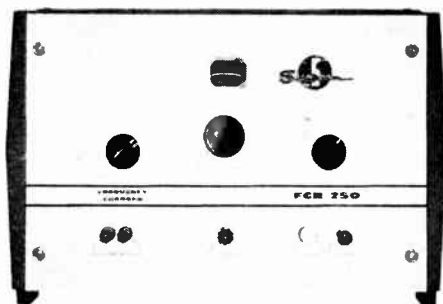
This new frequency changer makes it possible to provide well regulated 400 cycle power conveniently and quickly. This unit, Model FCR 250, is extremely useful in a wide variety of applications including testing, production, airborne frequency control, computers, missile guidance system testing, and in practically any application where the use of 400 cycle power is advantageous.

Model FCR 250 is only one of a complete line of frequency changers available from Sorensen . . . the authority on controlled power for research and industry. Write for complete information.



ELECTRICAL CHARACTERISTICS

Input	105-125 VAC, 1 phase, 50-65 cycles
Output voltage	115 VAC, adjustable 105-125V
Output frequency	320-1000 cps in two ranges
Voltage regulation	±1%
Frequency regulation	±1% (±0.01% with auxiliary frequency standard fixed at 400 cycles)
Load range	0-250 VA



MODEL FCR 250

Sorensen

SORENSEN & COMPANY, INC. • STAMFORD, CONN.

Stocked in Canada by our Sales & Service Representative:
BAYLY ENGINEERING, LTD., Ajax, Ontario.

NEWS

Crystallography Group Meeting In Montreal

New techniques for analyzing solids through the use of x-ray diffraction and associated equipment will be discussed and compared this summer when the International Union of Crystallography holds its Fourth General Assembly and International Congress at McGill and Montreal universities, July 10-17.

Scientists from Holland, Japan, Australia, Russia, Canada, the United States and many other nations will attend the meeting which is being held in Canada at the invitation of the National Research Council. The visitors will participate in two symposia covering physical techniques of crystallography and electron diffraction. They will also be able to inspect a broad array of new equipment exhibited by Philips Industries Limited, Philips of Eindhoven, Holland, and other electronics firms. Side-trips to the St. Lawrence Seaway Project, uranium and crystal mines in Ontario and Quebec will also be on the program.

McGill University will be the headquarters for the Congress and most of the discussions will take place in its lecture rooms. Large areas in the university's buildings have also been set aside for exhibits. Philips Industries Limited, the largest exhibitor at the Congress, will devote an entire class room to its displays of x-ray diffraction equipment. The company will also exhibit electron microscopes.

Marconi Appointment



T. MARSHALL

● The appointment of Thomas Marshall as manager, Production Department, has been announced by C. P. McNamara, manager of the Commercial Products Division of Canadian Marconi Company. Mr. Marshall, up to the time of this latest appointment, was production manager of the company's Broadcast and Television Receiver Division.

For further data on advertised products use page 71.

"MEMORY" SYSTEMS

(Continued from page 36)

The two charge areas A and B peculiar to one digit need not be the same shape, and it has been found that flaws in the screen material are rendered less serious if the two areas have maximum peripheral interaction; hence, the defocus-focus and dot-circle A and B displays illustrated in Fig. 5. Other modifications have recently been made but need not be elaborated here. The time taken to dig a well, and the rather elaborate movements to be executed by the spot for each digit limits the reading speed to 10 micro-seconds per digit, and there must be continuous regeneration of the stored pattern — which left to itself would otherwise leak away in about half-second. It is essential that the A and B patterns are close enough to interact, but that neither interferes with adjacent storage areas proper to other digits; it is practicable to store about 1,200 digits in one tube. Quite a wide selection of techniques has been tried for storing in a cathode-ray tube, some involving different gun assemblies for reading and writing, some using photo-electric effects and some rather complicated arrangement of grids, plates and screens. None, however, has achieved the popularity of the Williams tube.

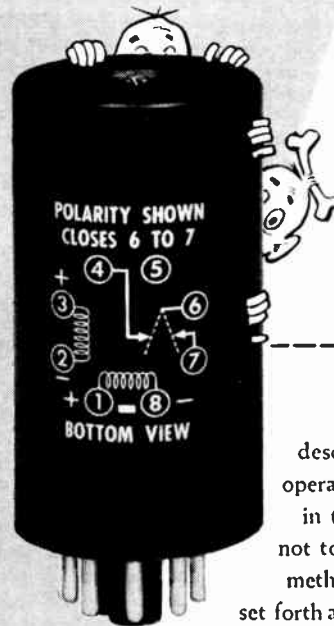
Other Types of "Scribbling" Store

There is a scribbling technique invented by Dr. Booth of Birkbeck College, London, in which a strain wave is the reading mechanism. A length of magnetizable wire is used as the store, and the digits are stored by means of the A coils (Fig. 5) statically as states of magnetization distributed along the length of the wire. Input can be either serial or parallel (simultaneous). When the information is required, a strain wave produced by magnetostrictive action at the coil C is transmitted down the wire, causing the individual magnets to move and produce voltage pulses in the output winding B in time sequence as the wave travels along. Such an arrangement partakes of the characteristics both of scribbling and muttering, in that the information is held statically, but once the extraction mechanism has been operated, it all pours out without a break. One is reminded of those little tags that one learnt parrot-fashion to assist in unravelling the intricacies of Latin grammar — "After ask, command, advise and strive, by *ut* translate infinitive."

Hard-valve stores may be used in this way, and were so used in "ENIAC" the first of the giant computers. "ENIAC" stored decimal digits in rings of 10 hard-valve triggers, one turned "on" and the rest "off." When the stored number was required, the ring was cycled around once (10 steps). In other words it acted as a "shifting register." The instant when

(Please turn to page 68)

WHAT'S BEHIND THE SIGMA SERIES 72 TELEGRAPH RELAY



The "72", as a polarized relay particularly suited to telegraph use, offers a combination of extremely worthwhile operating features. Among them are 500 pulse-per-second speed, freedom from maintenance for at least a half a billion operations (60 ma. 120 VDC inductive load), adjustable bias and sensitivity.

In addition, the usefulness of 72's in telegraph service is also substantially increased by the following three related items:



STANDARD REPAIR KIT for the 72 contains normally (and easily) replaceable parts: two contact screws and one ferro-nickel armature.

MAINTENANCE AND ADJUSTMENT

MANUAL for the 72 describes in detail all service operations likely to be needed in the field. What and what not to do, and the appropriate methods, are comprehensively set forth and illustrated in 18 pages. Available to 72 users.



MODEL 4501 TEST SET permits thorough operational checking and adjustment, using either or both coils, of the relay under test.* Measures operating ("trip") values (either manually or automatically), bias, percent-break, and insulation. Provision is also made for connecting an external drive directly on relay coils, and 'scope connection for observing contact performance in bias and percent-break tests. Standard relay rack panel mounting, 5 1/4" high, less than 6" deep. Case, socket adapters and instruction manual included.

*The Test Set is simply a useful — but not vital — accessory to telegraph relay use. It performs the described tests on not only the Sigma Series 72 relay, but on our Series 7, the WE 255A (which our 72AOZ-160 TS can replace), the WE 215, and similar relays.

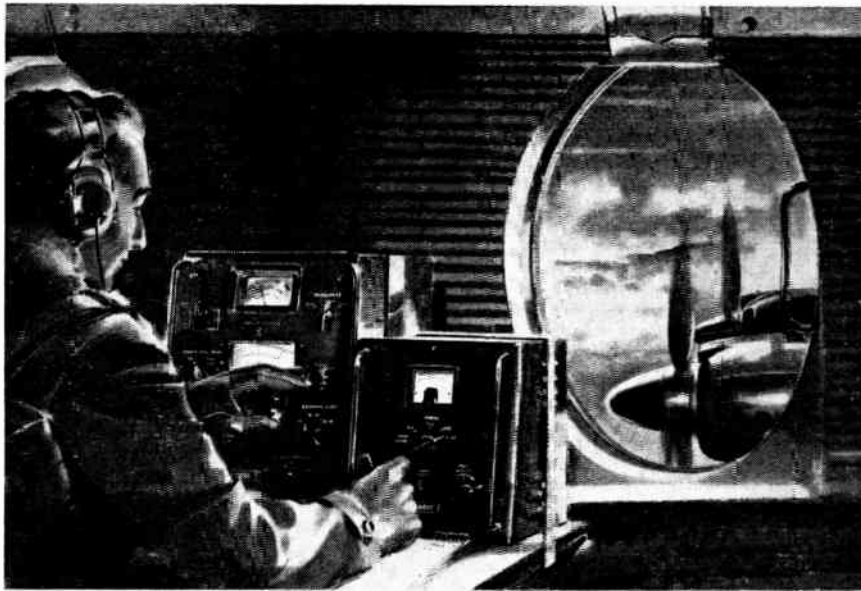
SIGMA

SIGMA INSTRUMENTS, INC.

85 Pearl St., South Braintree 85, Mass.

Canadian Representatives:

SAMUEL C. HOOKER (CAN.) LTD., Montreal and Toronto • RON MERRITT, Vancouver, B.C.

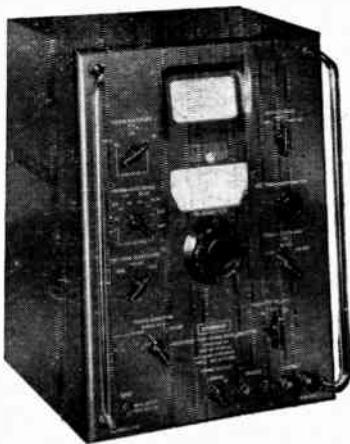


The Muirhead-Pametrada Wave analyser

The Muirhead-Pametrada Wave Analyser covers the frequency range encountered in vibration tests of aircraft engines—whether pure jet, turbo prop or piston.

Complete tests of airframes and airscrews for unwanted noise and vibration, and the tracing of spurious frequencies in aircraft electrical systems, are just normal applications for the analyser in the aircraft industry.

Learn more about the Muirhead-Pametrada Wave Analyser and how it is applied in the aircraft, automobile, electrical supply and shipbuilding industries. Write for our Brochure 'Vibration Measurement and Waveform Analysis'.



MUIRHEAD

Write for the brochure



MUIRHEAD INSTRUMENTS LIMITED · STRATFORD · ONTARIO · CANADA

"MEMORY" SYSTEMS

(Continued from page 67)

the "on" condition passed the output point of the ring provided an indication of the decimal number which was stored. "Shifting Registers" can be made in a variety of ways, for instance, by using transformers wound on cores having a "square hysteresis" characteristic. It is not, however, a very economic use of this transformer material.

Filing Systems

The essence of the "filing" technique is that the digital information is statically in a two-dimensional array, and that access to any single digit whatever can be obtained by the simple specification of row and column. The implication is that some physical form of storage must be found which requires the simultaneous application of current (or voltage) in each of two circuits to establish a change of state, but which is insensitive to a disturbance in only one of the two circuits. Such a physical form exists in square hysteresis magnetic material. Let it be supposed that the core of a transformer possesses a hysteresis loop as shown in Fig. 6 and that the two windings C and D are each capable of providing half the ampere-turns necessary for saturation. The normal unpulsed state of the core will then be one of those marked X or Y, depending on the previous history. The application of positive voltage pulses to both C and D windings will now cause the core to move to the state Z, with relaxation to state X when the pulses are removed. The third winding E will pick up a voltage pulse if the previous state was Y — due to the flux reversal — but not if the previous state was X, nor will pulses to either C or D singly produce a flux reversal and consequent output pulse. It is clear that a pulse is either produced or not produced in winding E depending on the previous state of the core material, so a storage system has been achieved. It is also apparent that the stored information is destroyed on read-out. Circuitry must, therefore, be provided to put it back, that is to say, simultaneous pulses of reverse polarity on windings C and D are required. The cores may be built up into a two-dimensional array, with horizontal and vertical bus-bars corresponding to the A and B windings, and an interlaced wire passing through all cores in series corresponding to winding C. Such a store to hold 10,000 digits — the "Myriabit" store — has been built by R.C.A. in America. The cores are manganese-magnesium ferrite, and are only 0.054 in. in outside diameter.

Recently, it has been suggested that "ferro-electric" materials might be used in an analogous way, these being materials which show a dielectric hysteresis. This implies that a voltage applied to a capacitor with such a dielectric may or may not produce

a pulse of current in the external circuit, depending on the polarity of the remanent charge in the dielectric. So far as is known, no computer has yet been built with such a store. Matrix-type stores may also be made using rectifiers, capacitors or gas diodes in combination, but they have so far achieved little popularity.

In general, it may be said that great ingenuity has been shown in inventing ways of storing binary digits in an accessible form. Nevertheless, it would probably be agreed by those skilled in the art that none is yet completely satisfactory, and that the really final method remains to be found. The ideal store should hold its information at a high energy level — high enough at least to be immune to random interference of a mechanical or electromagnetic nature — but it should not require the continuous dissipation of energy to maintain its content. It should be cheap and robust, avoiding corrosive or poisonous material. It should not use devices which deteriorate with age or are sensitive to temperature or humidity. Preferably, it should be static, to simplify synchronization problems, and it should be accessible for maintenance purposes. On the other hand, most digital computers are not sealed instruments; so bulk is of secondary importance. Its effect is to increase cabling-runs which will either slow the machine down or require signals from low impedance sources, with a corresponding increase of power consumption.

Acknowledgment is made to the Engineer-in-Chief of the General Post Office for permission to make use of some of the information contained in this article.

PLAN NOW

To Attend
The Canadian
IRE
CONVENTION

October 16 - 17 - 18
Exhibition Park
Toronto

Smallest, most versatile, multiple-circuit rotary switch

Centralab Series 100

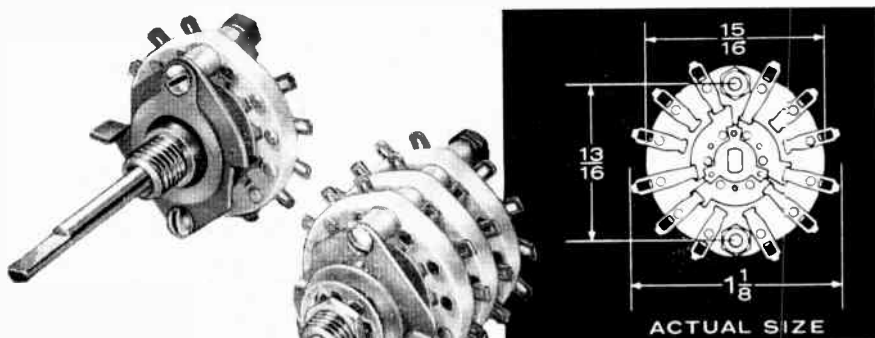
An ultra-small switch that measures less than 1" in diameter — weighs less than an ounce — yet has the electrical rating of larger, heavier switches.

Available up to 12 positions. Make and break, resistance load, .5 ampere at 6 volts d.c.; 100 milliamperes at 110 volts. a.c.; current-carrying capacity, 5 amperes.

Ideal for band switching in subminiature electronic equipment, transistor circuits, aircraft instruments, and guided missiles.

Features not found in
phenolic-type switches

Maximum voltage flashover
High Q — Low loss
Minimum inter-circuit capacity
Maximum circuit flexibility



Centralab Canada Ltd.

804 Mt. Pleasant Rd, Toronto 12, Ontario

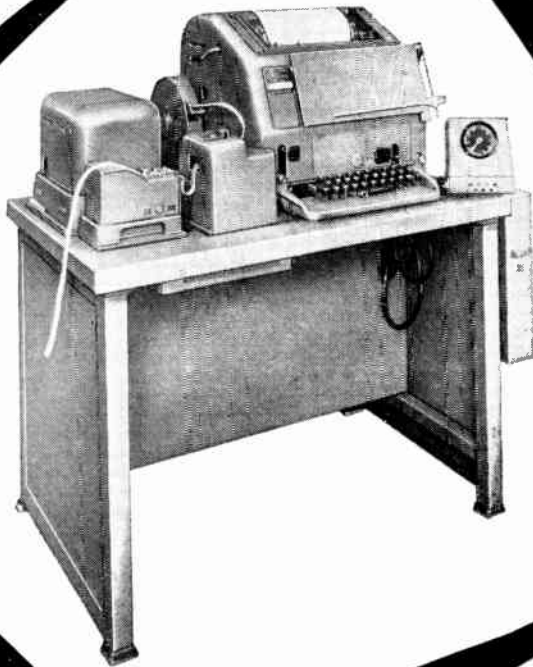
A DIVISION OF
GLOBE-UNION INC.
964E E. Keefe Ave.
Milwaukee 1, Wis.

In Canada:
804 Mt. Pleasant Road
Toronto, Ontario



New 36-page Switch Catalog

Provides specifications on the complete line of CRL switches capable of handling power from a kilowatt to a microwatt. Write for this catalog today.



IDP*

IDP is based on the modern mechanical languages that are common to or compatible with various business machinery. The punch tape shown here is such a common language — it can actuate many different types of business machines.

*Integrated Data Processing is a method of mechanizing business paperwork so that a single typing can be used over and over again. The resultant labor savings can be substantial. In addition, "paperwork lag" is cut down and accuracy is improved, since the reproduced data will always be identical.

Consult Bell Telephone communication specialists on how data processing can be integrated between offices, factories and warehouses. Bell Teletype equipment is a dependable communication component of IDP systems — maintenance service is as close as your local telephone office.

For the booklet "Bell Teletype's Place In Your IDP Program", write or phone (collect) to:

MONTREAL

G. R. Zwinge, Sales Manager,
1060 University St. — Tel.: UN 6-3911

TORONTO

J. A. Capell, Sales Manager,
393 University Ave. — Tel.: EM 8-3911



THE BELL TELEPHONE COMPANY OF CANADA

DOPPLER NAVIGATION

(Continued from page 38)

have seen many hours of reliable operational service in military aircraft in all parts of the world. As a result of these flights, the applications for Doppler systems are increasing continually. Some of the advantages of Doppler Radar — and consequently the advantages of Doppler Navigation — are:

1. It is available. (In production)
2. It is accurate (more accurate than any other means of measuring aircraft ground velocity).
3. It is simple to operate.
4. It is reliable.
5. It is easy to manufacture.
6. It is easy to maintain.
7. In the early models it required only a five-minute warm-up time, and in the new models only a 30-second warm-up time is necessary.
8. The altitude range of the equipment is greater than that of available aircraft.
9. The speed range is greater than that of available aircraft.
10. The equipment can be turned on and started when airborne and is self-aligning in flight.
11. A minimum of operator training is required.
12. It provides data regarding the flight vector of an aircraft, information never before available.
13. It can be used with a wide array of computers to provide data all the way from simple wind magnitude and direction to data needed for complete automatic navigation and bombing.
14. It provides a new accurate means of measuring winds continuously and automatically at any altitude.
15. It provides, for the first time, an accurate means of measuring and calibrating air speed meters at high altitude.
16. It provides a new means of eliminating image motion in aerial photographs, giving sharper, clearer pictures.
17. It opens new approaches in the field of aerial surveying.
18. It makes possible the use of new techniques in air traffic control.
19. It makes possible the avoidance of unknown head winds which endanger flight.
20. It makes possible the best utilization of tail winds and it reduces jet stream flying to extreme simplicity.
21. It provides one of the best means for accurately and automatically guiding an aircraft from a point of departure to a destination.
22. It makes intercontinental navigation possible with a minimum requirement for government supplied ground based navigation aids.

(Please turn to page 80)

INDEX TO ADVERTISERS

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

Key No.	Name	Page No.
1.	Adcola Products Ltd.	64
2.	Acrovox (Canada) Ltd.	4
3.	Ahearn & Soper Co. Ltd., The	9
4.	Airpax Products Co.	60
5.	Alliance Motors	63
6.	Arrow-Hart & Hageman (Canada) Ltd.	53
7.	Automatic Electric Sales (Canada) Ltd.	41
8.	Automatic Electric Sales (Canada) Ltd.	42-43
9.	Automatic Electric Sales (Canada) Ltd.	44
10.	Aviation Electric Ltd.	39
11.	Beatty Bros. Ltd.	63
12.	Bell Telephone Co. of Canada, The	70
13.	Bendix Aviation Corp.	59
14.	Bomac Laboratories Inc.	82
15.	Canadian General Electric Co. Ltd.	63
16.	Canadian I.R.E. Convention	10
17.	Canadian Institute of Science & Technology Ltd.	64
18.	Canadian Line Materials Ltd.	53
19.	Canadian Line Materials Ltd.	58
20.	Canadian Marconi Co.	3
21.	Canadian Marconi Co.	57
22.	Canadian Westinghouse Co. Ltd.	6
23.	Cannon Electric (Canada) Ltd.	37
24.	Centralab Div.	69
25.	Computing Devices of Canada Ltd.	13
26.	Eitel McCullough Inc.	9
27.	Electro Products Laboratories	79
28.	Electro Sonic Supply Co. Ltd.	78
29.	Empire Engineering Co.	64
30.	Freed Transformer Co.	79
31.	G-V Controls Inc.	78
32.	Heath Co.	73-77
33.	Helipot Corp.	80
34.	Helipot Corp.	81
35.	Hewlett-Packard Co.	58
36.	Hughey & Phillips Inc.	60

Mr. Circulation Manager:

My proper address is shown below.
Check

(My old address is _____ City _____)

Please add my name to your Electronics & Communications' mailing list.
Check (No obligation)

Name _____ Position _____

Company _____ Nature of Business _____

Company Address _____ City _____ Prov. _____

Signature _____
5-57 (Not valid without signature)

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

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

Company _____ Nature of Business _____

Name _____ Position _____

Street _____ City _____ Prov. _____
5-57

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

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

Name _____ Position _____

Company _____

Street _____ City _____ Prov. _____
5-57

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 — Continued

Key No.	Name	Page No.
37.	Kester Solder Co. of Canada Ltd.	54
38.	Kraeuter & Co. Inc.	78
39.	Kraeuter & Co. Inc.	79
40.	Leetronic Research Labs	60
41.	Longstaffe Co. Ltd., J. R.	2
42.	Magnetics Inc.	14
43.	Measurements Corp.	56
44.	Minnesota Mining & Mfg. of Canada Ltd.	20
45.	Muirhead & Co. Ltd.	68
46.	Northern Electric Co. Ltd.	15
47.	P.S.C. Applied Research Ltd.	8
48.	Phillips Electrical Co. Ltd.	31-32
49.	Polypenco Inc.	53
50.	R.O.R. Associates Ltd.	59
51.	Radio Communications Equipment & Engineering Ltd.	16
52.	Radio Engineering Products Ltd.	54
53.	Sigma Instruments Inc.	67
54.	Sorenson & Co. Inc.	66
55.	Specialized Patent Sales & Developments Ltd.	80
56.	Sprague Electric International Ltd.	63
57.	Standard Telephone & Cables Mfg. Co. (Canada) Ltd.	18
58.	Stark Electronic Instruments Ltd.	23
59.	Syntron (Canada) Ltd.	65
60.	Telegraph Condenser Co. (Canada) Ltd., The	23
61.	Triplett Electrical Instrument Co., The	19
62.	Ungar Electric Tool Co. of Canada	56

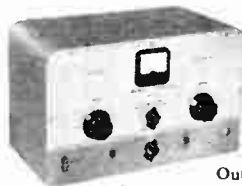
Your request for further information on New Product items or additional information concerning advertisements in Electronics and Communications will be promptly acknowledged.

world's finest
electronic equipment
in kit form...

HEATHKIT®

High Quality
Advanced Design
Reliable Performance
Real Economy

Heathkit AMATEUR CW TRANSMITTER KIT



MODEL AT-1
\$29.50
Shpg. Wt. 15 Lbs.

Outstanding dollar-per-watt value! 30-35 watts plate power input, bandswitching for 80, 40, 20, 15, 11, and 10 meters. Crystal or external VFO excitation. 52 ohm output—key click filter—copper-plated chassis—pre-wound coils. Uses 6AG7 oscillator. 6L6 final.

Heathkit PHONE & CW TRANSMITTER KITS

Both the DX-100 and the DX-35 are designed especially for you—with the features most important to efficient and practical amateur operation!



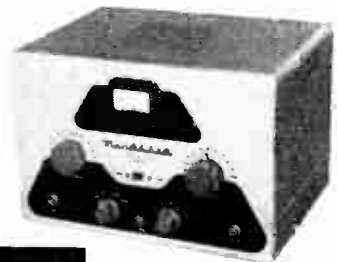
MODEL DX-100

\$189.50

Shpg. Wt. 120 Lbs.
Shipped motor freight unless otherwise specified.
\$50.00 deposit required on c.o.d. orders.

This transmitter is rapidly becoming the accepted standard in its price class. An outstanding dollar value!

100 watts RF output—built in power supplies—built in VFO and modulator—bandswitching on 160, 80, 40, 20, 15, 11, and 10 meters—phone or CW operation. 100 watts output on phone, and 120 watts on CW. TVI suppressed—pi network output coupling—extensive shielding—matches 50 to 600 ohms—VFO dial and meter face illuminated—high quality components used throughout. Uses 1625 tubes in push-pull to modulate 6146 tubes in parallel. Complete schematic diagram and technical specifications available on request.



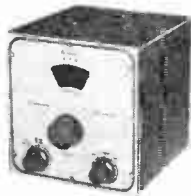
MODEL DX-35

\$56.95

Shpg. Wt. 24 Lbs.

This exciting new kit features phone and CW operation on 80, 40, 20, 15, 11, and 10 meters. Completely bandswitching. Plate power input up to 65 watts on CW, with controlled carrier modulation peaks to 50 watts on phone. Features built-in modulator, power supplies, pi network output circuit. Separate 12BY7 buffer stage assures plenty of drive to the 6146 final. Switch selection of three crystals, or may be excited from external VFO. Panel meter reads final grid or plate current. Complete schematic and specifications on request.

Heathkit VFO KIT



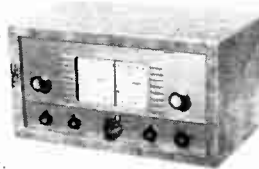
MODEL VF-1
\$19.50

Shpg. Wt. 7 Lbs.

Go VFO for added convenience and flexibility. Functions with Heathkit AT-1 or DX-35 or with most modern transmitters. Covers 160-80-40-20-15-11 and 10 meters. Three basic oscillator frequencies provide better than 10 volt average RF output. Plug provided for crystal socket of transmitter. VR tube for stability. Requires only 250 VDC at 15 to 20 ma. and 6.3 VAC at 0.45A.

Heathkit ALL BAND COMMUNICATIONS TYPE RECEIVER KIT

Unusual sensitivity and selectivity for price. Covers 550 kc to 30 mc in 4 bands. AC power supply—electrical bandspread—antenna trimmer—separate RF and AF gain controls—noise limiter—head-phone jacks—AGC—BFO. Cabinet available separately as shown.



MODEL AR-3
\$27.95

(less cabinet)
Shpg. Wt. 12 Lbs.

Heathkit "Q" MULTIPLIER KIT



MODEL QF-1
\$9.95 Shpg. Wt. 3 Lbs.

function with AC-DC receivers. Requires 6.3 VAC at 300 ma. and 150-250 VDC at 2 ma. Cable and plugs supplied for connection.

Adds selectivity and flexibility to your receiver, and rejects undesired signal or heterodyne. Tunes any signal within 1F of receiver with effective Q of approximately 4,000. Provides sharp "Peak" or "null." Surpasses crystal filter in flexibility of operation. Use with receiver having 450—460 kc 1F. Will not

Heathkit GRID DIP METER KIT



MODEL GD-1B
\$19.50

Shpg. Wt. 4 Lbs.

Use as a signal source, for determining unknown frequency, for checking resonance of tuned circuits, or for adjusting wave traps. Equally valuable in ham shack, service shop, or laboratory. Features 500 ua meter with sensitivity control, for indication. Covers 2 mc to 250 mc with five coils, supplied with kit. Coils pre-wound, dial scale pre-calibrated. Easy to build, and extremely valuable for literally hundreds of jobs.

Heathkit ANTENNA COUPLER KIT



MODEL AC-1
\$14.50
Shpg. Wt. 4 Lbs.

This coupler matches between the transmitter, and a long-wire end-feed antenna, and incorporates an L-type filter to attenuate signals above 36 mc and reduce TVI. 52 ohm coaxial input. Tapped inductor and variable capacitor for matching antenna. Neon RF indicator—copper-plated chassis—simple to build. Handles power up to 75 watts, 10 through 80 meters. Use with Heathkit AT-1 or DX-35.

Heathkit ANTENNA IMPEDANCE METER KIT

Use this instrument, with a source of RF signal, to determine antenna impedance, line impedance, and to solve impedance matching problems with fixed or mobile antennas or transmission lines. Also, will double as field strength indicator, or phone monitor. Uses 100 ua meter and features calibrated impedance scale on control knob. Covers 0 to 600 ohms. A valuable device in any ham shack.



\$14.50 MODEL AM-1
Shpg. Wt. 2 Lbs.

HEATH COMPANY A Subsidiary of Daystrom, Inc. BENTON HARBOR 3, MICH.

Heathkit HARMONIC DISTORTION METER KIT



MODEL HD-1
\$49.50

Shpg. Wt. 13 Lbs.

Use with low-distortion audio generator to measure harmonic distortion of audio amplifiers. Reads distortion on meter as percentage of input signal. Operates between 20 and 20,000 cps. High impedance VTVM built in for initial reference settings and final distortion readings. VTVM ranges are 0-1, 3, 10, and 30 volts full scale. 1% precision resistors employed. Distortion scales are 0-1, 3, 10, 30, and 100% full scale.

Heathkit 6-12 VOLT BATTERY ELIMINATOR KIT

MODEL BE-4
\$31.50

Shpg. Wt. 17 Lbs.



Will supply either 6 or 12 volt output to take care of auto radios on even the most modern cars. Output voltage is variable from zero to 8 volts DC or 0 to 16 volts DC. Will deliver up to 15 amperes at 6 volts or up to 7 amperes at 12 volts. Two 10,000 microfarad output filter capacitors insure smooth DC output. Panel meters monitor output current and voltage. Will double as a battery charger.

HEATHKIT AUDIO TEST EQUIPMENT

You can equip your shop for complete analysis and test of high fidelity audio equipment by employing Heathkit instruments. Professional equipment you can afford!

AUDIO OSCILLATOR KIT (SINE-WAVE - SQUARE WAVE)



MODEL AO-1
\$24.50

Shpg. Wt. 10 Lbs.

Produces sine wave or square wave signals from 20 to 20,000 cps in three ranges. Designed for use in service shop, or home workshop. Employs thermister for output regulation. Features high level output, low distortion, and low impedance output. Produces sine waves for audio testing, or will produce good, clean square waves with a rise time of only 2 microseconds. Very simple to build from complete instructions supplied.

AUDIO GENERATOR

MODEL AG-9
\$34.50

Shpg. Wt. 8 Lbs.



This generator features low distortion (less than .1%). Ideal for use with Model HD-1, or in other applications requiring low signal distortion. Frequency accuracy within $\pm 5\%$. Features step-type tuning from 10 cps to 100 kc, with three rotary switches to provide two significant figures and a multiplier. Output monitored on a large $4\frac{1}{2}$ " meter. Meter calibrated for output voltage or db. Output ranges are—.003, .01, .03, .1, .3, 1, 3, and 10 volts.

AUDIO ANALYZER KIT



MODEL AA-1
\$59.50

Shpg. Wt. 13 Lbs.

This combination instrument provides the functions of an AC VTVM, audio wattmeter, and intermodulation analyzer. Includes built-in high and low frequency oscillators for intermodulation distortion tests. VTVM ranges are .01, .03, .1, .3, 1, 3, 10, 30, 100, and 300 volts rms. Wattmeter ranges are .15 mw, 1.5 mw, 15 mw, 150 mw, 1.5 w, 15 w, and 150 w. IM scales are 1%, 3%, 10%, 30%, and 100%. Provides internal loads of 4, 8, 16, or 600 ohms. An extremely valuable instrument for the audio engineer, or serious audiophile.

Heathkit HANDITESTER KIT

This compact model easily slips into tool box, glove compartment, or coat pocket. Valuable as "extra" instrument in service shop, and ideal for the home experimenter. Very popular with appliance repairmen and electricians. Measures AC or DC voltage at 0-10, 30, 300, 1000, 5000 volts full scale. Direct current ranges are 0-10 ma and 0-100 ma. Attractive black bakelite case. Ohmmeter ranges are 0-3000 and 0-300,000 ohms.



MODEL M-1
\$14.50

Shpg. Wt. 3 Lbs.

Heathkit VARIABLE VOLTAGE REGULATED POWER SUPPLY KIT

MODEL PS-3
\$35.50

Shpg. Wt. 17 Lbs.



Supplies regulated DC output that can be manually controlled from 0 to 500 volts. It will supply up to 130 ma at 200 VDC, and up to 10 ma at 450 VDC. Large panel meter monitors output voltage or current. Also provides filament voltage at 6.3 volts AC, up to 4 amperes. Filament and B+ sections are isolated from ground. Ideal lab power supply.

Heathkit "Q" METER KIT

The Model QM-1 measures the Q of inductances and RF resistance and distributed capacity of coils. Employs a $4\frac{1}{2}$ " 50 microampere meter for direct indication. Features built-in signal source for tests at frequencies of 150 kc to 18 mc in 4 ranges. Measures capacity from 40 mmf to 450 mmf within ± 3 mmf. Indispensable for coil winding, and for determining unknown capacitor values.



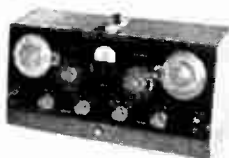
MODEL QM-1
\$44.50

Shpg. Wt. 14 Lbs.

Heathkit IMPEDANCE BRIDGE KIT

MODEL IB-2
\$59.50

Shpg. Wt. 12 Lbs.



Features a built-in oscillator and amplifier. Measures resistance, capacitance, inductance, dissipation factors of condensers, and storage factor of inductance. D, Q, and DQ functions combined in one control. Employs $\frac{1}{2}\%$ resistors and $\frac{1}{2}\%$ silvermica capacitors. 100-0-100 ua. meter indicates null. Two section CRL dial provides ten separate units with accuracy of .5%. Fractions of units read on variable control.

Heathkit CRYSTAL RECEIVER KIT



MODEL CR-1
\$79.50

Shpg. Wt. 3 Lbs.

This crystal radio covers the standard broadcast band from 540 to 1600 kc. It employs two high Q tank circuits that are tuned separately for the desired station. A sealed germanium diode is featured for detection. No critical "cat's whisker" to adjust. Kit includes a pair of high impedance head sets, and is easy to build, even for a beginner. Construction manual takes "educational" approach and explains theory of signal reception. Requires no external power for operation. Ideal standby unit for emergency reception of civil defense signals in case of power failure.

Heathkit BROADCAST BAND RECEIVER KIT

You can build your own radio receiver with confidence, even if you are a beginner. Complete step-by-step instructions insure success. Features transformer-type power supply, high gain miniature tubes, built-in antenna, $5\frac{1}{2}$ " speaker, and planetary tuning from 550 kc to 1600 kc.

CABINET: Fabric covered plywood cabinet with aluminum panel as shown. Part #91-9A, shipping weight 5 lbs. \$4.50.

MODEL BR-2
\$17.50

(less cabinet)

Shpg. Wt. 10 Lbs.



HEATH COMPANY A Subsidiary of Doystrom, Inc. **BENTON HARBOR 3, MICH.**

HEATHKIT HIGH FIDELITY AMPLIFIER KITS

Proven circuit designs and step-by-step instructions insure successful construction, even if you have never built a kit before.



KIT COMBINATIONS:

W-5M Amplifier Kit: Consists of main amplifier and power supply, all on one chassis. Complete with all necessary parts, tubes, and comprehensive manual. Shpg. Wt. 31 lbs. **\$59⁷⁵** Express only.

W-5 Combination Amplifier Kit: Consists of W-5M amplifier kit listed above plus Heathkit Model WA-P2 Preamplifier kit. Complete with all necessary parts, tubes, and construction manuals. Shpg. Wt. **\$79⁵⁰** 38 lbs. Express only.

Heathkit 25-WATT ADVANCED-DESIGN

This 25 watt amplifier incorporates the "extra" features required for really outstanding performance. Employs KT66 output tubes in push-pull, and features a Peerless output transformer. Response is within ± 1 db from 5 cps to 160 kc at 1 watt. Harmonic distortion only 1% at 25 watts, 20 to 20,000 cps. 1M distortion only 1% at 20 watts. Output impedance is 4, 8, or 16 ohms. Hum and noise are 99 db below rated output.

Heathkit 7-WATT

Using a tapped-screen output transformer of new design, frequency response of this unit is $\pm 1\frac{1}{2}$ db from 20 to 20,000 cps. It provides good sensitivity, with surprisingly low distortion. Transformer tapped at 4, 8, and 16 ohms. Push-pull output. Separate bass and treble tone controls. Shpg. Wt. 10 lbs.

MODEL A-7E: Same as Model A-7D, but with stage of preamplification. Extra gain for low-level cartridges. RIAA compensation. Shipping weight 10 lbs.



\$16⁹⁵ MODEL A-7D
\$18⁵⁰

Heathkit 20-WATT DUAL-CHASSIS WILLIAMSON TYPE

Features the famous Acrosound TO-300 "ultra linear" output transformer. Uses 5881 tubes and has a frequency response within ± 1 db from 6 cps to 150 kc at 1 watt. Harmonic distortion only 1% at 21 watts. 1M distortion at 20 watts only 1.3%. Output impedance is 4, 8, or 16 ohms. Hum and noise is 88 db below 20 watts.



KIT COMBINATIONS

W-3M: Consists of main amplifier and power supply for separate chassis construction. Includes all tubes and components necessary for assembly. Shpg. Wt. 29 lbs. **\$49⁷⁵** Express only.

W-3: Consists of W-3M kit listed above plus Heathkit Model WA-P2 Preamplifier described on this page. Shpg. Wt. 37 lbs. **\$69⁵⁰** Express only.

Heathkit 20-WATT SINGLE-CHASSIS WILLIAMSON TYPE



only 2.7%. Output at 4, 8,

The original low-priced Williamson Amplifier kit. A Chicago output transformer and 5881 output tubes are featured. Frequency response is ± 1 db from 10 cps to 100 kc at 1 watt. Harmonic distortion only 1.5% at 20 watts. 1M distortion or 16 ohms. Hum and noise 95 db below 20 watts.

KIT COMBINATIONS

W-4AM: Consists of main amplifier and power supply for single chassis construction. Includes all tubes and components necessary for assembly. Shpg. Wt. 28 lbs. **\$39⁷⁵** Express only.

W-4A: Consists of W-4AM Kit listed above plus Heathkit Model WA-P2 Preamplifier described on this page. Shpg. Wt. 35 lbs. **\$59⁵⁰** Express only.

Heathkit 20-WATT

This amplifier can provide you with high fidelity at a surprisingly low price. Preamplifier built into same chassis as main amplifier. Four switch selected, compensated inputs are available, as are bass and treble controls. Features full 20-watt output using push-pull 6L6 tubes. Frequency response is ± 1 db from 20 to 20,000 cps. Harmonic distortion only 1% at full output.



MODEL A-9B
\$35⁵⁰
Shpg. Wt. 23 lbs.

Heathkit HIGH FIDELITY PREAMPLIFIER KIT

MODEL WA-P2

\$19⁷⁵

(with cabinet)
Shpg. Wt. 7 lbs.



Designed for use with Heathkit main amplifiers. Features five separate switch-selected input channels, each with its own input level control. Four-position turnover and roll-off controls for record equalization. Separate bass and treble tone controls. Special hum control to insure minimum hum level. Will do justice to finest program sources. Beautiful satin-gold finish.

Heathkit ELECTRONIC CROSS-OVER KIT

The XO-1 separates high and low frequencies at selectable crossover points, to feed two separate power amplifiers, one for high frequencies and one for low frequencies. Speakers are then connected to the amplifiers directly, without the usual LC crossover. Separate level controls provided for both outputs. The XO-1 consumes no audio power. Crossover frequencies are 100, 200, 400, 700, 1200, 2000, and 3500 cps. Attenuation is 12 db per octave.



MODEL XO-1
\$18⁹⁵
Shpg. Wt. 6 lbs.

Heathkit TUNER KITS

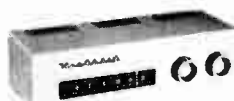
These tuners measure only 12 9/16" long x 3 5/8" high x 5 7/8" deep, and are finished in beautiful satin-gold enamel. Easily stack one over another to form compact control unit.

FM HIGH FIDELITY

MODEL FM-3

\$24⁵⁰

(With cabinet)
Shpg. Wt. 7 lbs.



This FM tuner offers sensitivity, selectivity, and stability, not expected at this price level. Efficient 7-tube circuit is entirely new, and incorporates AGC, cascade front end, temperature-compensated oscillator, built-in power supply, and other outstanding design features. Pre-aligned 1F and ratio transformers. Sensitivity is better than 10 microvolts for 20 db of quieting. Covers 88 to 108 mc.

AM BROAD BANDWIDTH

MODEL BC-1

\$24⁵⁰

(With cabinet)
Shpg. Wt. 8 lbs.



Designed for use with high fidelity systems. Low distortion voltage-doubler detector. Covers 550 to 1600 kc. 20 kc 1F bandwidth. Audio response ± 1 db from 20 cps to 2 kc. 6 db signal-to-noise ratio at 2.5 microvolts. RF and IF coils pre-aligned. Power supply built-in. Efficient, modern circuit. Matches WA-P2 and FM-3 in color and style.

Heathkit SPEAKER SYSTEM KITS

The models SS-1 and SS-1B are matched so that when the smaller unit is placed on top of the larger unit, the appearance of a single piece of furniture is achieved.

SS-1 HIGH FIDELITY

MODEL SS-1 **\$39⁹⁵**

Shpg. Wt. 30 lbs.



Employs two Jensen speakers to cover from 50 to 12,000 cps. Response is within ± 5 db. Built-in crossover functions at 1600 cps. System rated at 25 watts, with nominal impedance of 16 ohms. Enclosure is ducted-port bass reflex type. Merely assemble the cabinet, wire the speakers and crossover network, and finish to your taste.

SS-1B HIGH FIDELITY RANGE EXTENDING

Employs woofer and super tweeter to cover 35 to 600 cps, and 4000 to 16,000 cps. Extends frequency range of SS-1 at both ends of the spectrum, for total of ± 5 db from 35 to 16,000 cps. The kit includes necessary crossover circuits and balance control. Power rating is 35 watts for speech and music. Impedance is 16 ohms.



MODEL SS-1B
\$99⁹⁵
Shpg. Wt. 80 lbs.

HEATH COMPANY A Subsidiary of Doystrom, Inc. **BENTON HARBOR 3, MICH.**



NEW Heathkit PROFESSIONAL RADIATION COUNTER KIT

MODEL RC-1

\$79⁹⁵

Shpg. Wt.
8 Lbs.

- ▶ Completely modern design for maximum sensitivity and reliability.
- ▶ Both visual (4½" meter) and aural (panel-mounted speaker) indicators for radiation level.
- ▶ Meter calibrated in CPM and mR/hr. Four measuring ranges.
- ▶ Employs 900-volt Bismuth tube in beta/gamma sensitive probe.

This radiation counter provides design advantages found only in units costing several times its low kit price. It incorporates features essential to the serious prospector. High sensitivity is provided, with ranges of 0-100, 600, 6,000, and 60,000 counts per minute, and 0.02, .1, 1, and 10 milliroentgens per hour. A type 6306 Bismuth tube is employed in the probe, and the probe and a radiation sample are included in the kit price. The circuit employs 5 tubes (plus a transistor) to assure stable and reliable operation. High quality, 4½" 200 micro-ampere meter eliminates "guess work" and indicates radiation level directly in cpm, or mR/hr. In addition, transistor oscillator provides aural signal from panel-mounted speaker. High voltage power supply is "packaged" pre-built unit with reserve capacity above 900 volt level at which it is regulated. Merely changing regulator tube would allow use of scintillation probe if desired.

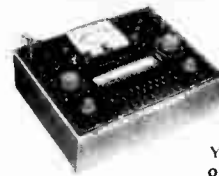
Fulfills requirements of those who want a prospecting instrument that can be relied upon. Has selectable time constant, to allow for different rates of travel over the area being investigated. Measures only 9½" high x 6½" wide x 5¼" deep, and weighs only 6½ lbs. Not to be confused with novelty radiation detection devices on the market. A top-quality instrument, yet simple to build.

Heathkit TUBE CHECKER KIT

MODEL TC-2

\$29⁵⁰

Shpg. Wt.
12 Lbs.



You can afford your own tube tester, even if you only do part-time service work. Uses a 4½" meter with 3-color meter face for simple "good-bad" indications of tube quality, on the basis of emission. Tests all tubes commonly encountered in radio and TV service work. 14 different filament voltages—built-in roll chart—ten 3-position lever switches for open or short tests on each tube element.

Heathkit CATHODE RAY TUBE CHECKER KIT

Indicates condition of CRT on large "good-bad" scale. Spring-loaded switches protect operator. Checks all electromagnet picture tubes normally encountered in TV servicing. Supplies all operating potentials and tests for shorts, leakage, and emission on the work bench, in the carton, or in the set. Features shadowgraph test to indicate tube condition.



MODEL CC-1

\$22⁵⁰

Shpg. Wt. 10 Lbs.

Heathkit VISUAL-AURAL SIGNAL TRACER KIT

MODEL T-3 **\$23⁵⁰**

Shpg. Wt. 9 Lbs.



Features a high-gain RF input channel for signal tracing and troubleshooting from the receiver antenna input clear through all RF and IF stages. Separate low-gain channel for audio circuit exploration. Built-in loudspeaker provides audio response, while electron beam "eye" tube gives visual indication. Ideal for signal tracing in AM, FM, and TV receivers.

IF stages. Separate low-gain channel for audio circuit exploration. Built-in loudspeaker provides audio response, while electron beam "eye" tube gives visual indication. Ideal for signal tracing in AM, FM, and TV receivers.

Heathkit TV ALIGNMENT SWEEP GENERATOR KIT

All-electronic sweep eliminates mechanical hum or vibration. Features improved linearity—effective AGC—flat output—0 to 40 mc sweep. Covers all frequencies in FM, monochrome TV and color TV. Plenty of RF output for alignment of tuners, IF strips, boosters, etc. Fundamental output from 4 to 220 mc in four bands. Incorporates crystal oscillator (4.5 mc and multiples thereof), and variable marker covering 19 to 60 mc on fundamentals—up to 180 mc on harmonics. Effective two-way blanking.

MODEL TS-4

\$49⁵⁰

Shpg. Wt. 16 Lbs.



Heathkit SIGNAL GENERATOR KIT

MODEL SG-8

\$19⁵⁰

Shpg. Wt. 8 Lbs.



This tried and proven generator covers 160 kc to 110 mc on fundamentals in five bands, and calibrated harmonics extend to 220 mc. Very popular in service shops, laboratories, and home workshops. RF output is in excess of 100,000 microvolts, controlled by a variable and a fixed-step attenuator. Output is pure RF, RF modulated at 400 cps, or 400 cps audio for amplifier testing.

Heathkit CONDENSER CHECKER KIT

Measures paper, mica, ceramic, and electrolytic capacitors in 4 ranges from .00001 to 1,000 microfarads. It indicates condenser value and quality. Also measures resistance from 100 ohms to 5 megohms. All values indicated directly on panel scale, after adjusting for null on electron beam "eye" tube. No calculations necessary. A valuable instrument in service or laboratory applications.



MODEL C-3

\$19⁵⁰

Shpg. Wt. 7 Lbs.

Heathkit LINEARITY PATTERN GENERATOR KIT



MODEL LP-2

\$22⁵⁰ Shpg. Wt. 7 L

of TV set. Panel provision for external sync if desired. Covers channels 2 to 13, 5 to 6 vert. bars and 4 to 5 hor. bars.

Supplies information for white dots, cross-hatch pattern, horizontal bar pattern, or vertical bar pattern. Use for adjustment of vertical and horizontal linearity, picture size, aspect ratio and focus. Dot pattern is a must for color convergence adjustments. Clip merely connects to antenna terminals.

Heathkit LABORATORY GENERATOR KIT

MODEL LG-1

\$39⁵⁰

Shpg. Wt. 16 Lbs.



This signal generator covers from 100 kc to 30 mc on fundamentals in 5 bands. 400 cycle modulation variable from 0 to 50% RF output up to 100,000 microvolts. Meter reads RF output or percentage of modulation. Fixed step and variable output attenuation. Voltage regulation, double copper-plated shielding for stability, and other "extras." Provision for external modulation. Output impedance 50 ohms.

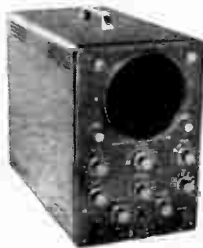
HEATH COMPANY A Subsidiary of Daystrom, Inc. **BENTON HARBOR 3, MICH.**

For further data on advertised products use page 71.

HEATHKIT ETCHED CIRCUIT OSCILLOSCOPE KITS

You may choose from three different oscilloscope models when you purchase a Heathkit scope. All three units employ printed circuit boards for increased circuit efficiency and simplified assembly. Construction time cut almost in half. Outstanding dollar values for you!

5" COLOR TV



MODEL O-10
\$69.50

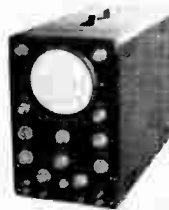
Shpg. Wt. 21 Lbs.

Amplifier response essentially flat from plus 2 db -5 db from 5

mc down to 2 cps without extra switching. Extended sweep oscillator range allows single-cycle observation of signals up to 500,000 cps, and will sync signals even higher. Uses etched metal circuit boards. Push-pull vertical and horizontal amplifiers—built in peak-to-peak calibrating source—step attenuated input—preformed and cabled wiring harness. A professional oscilloscope, ideal for color TV work in the lab or service shop. The 11-tube circuit features 5UPI CRT.

FULL SIZE 5"

The Model OM-1 with a 5", 5BP1 cathode ray tube has many big scope features—yet it is priced reasonably. Features etched-metal circuit boards. Incorporates 3-step input attenuator—phasing control—built-in peak-to-peak voltage calibrator—and push-pull vertical and horizontal amplifiers. Vertical amplifier flat within ± 3 db from 2 cps to 200 kc. Sweep circuit functions from 20 cps to 100,000 cps.



MODEL OM-1
\$49.50

Shpg. Wt. 21 Lbs.

3" PORTABLE



MODEL OL-1
\$29.50

Shpg. Wt. 14 Lbs.

Has many of the features of the Model OM-1, yet is smaller in physical size. Employs etched-metal circuit boards. Features vertical frequency response within ± 3 db from 2 cps to 200 kc. Sweep generator operates from 20 to 100,000 cps. The 8-tube circuit features a type 3GP1 CRT.

Heathkit AC VACUUM TUBE VOLTMETER KIT



MODEL AV-2
\$29.50

Shpg. Wt. 5 Lbs.

This VTVM combines high impedance, wide frequency range, and high sensitivity. It is designed especially for audio work. Frequency response is substantially flat from 10 cps to 50 kc. Sensitivity allows measurements as low as 1 mv at high impedance. Ranges are .01, .03, .1, .3, 1, 3, 10, 30, 100, and 300 volts rms. Total db range is -52 to +52 db. 1 megohm input impedance at 1 kc. An outstanding instrument for your laboratory, service shop, or home workshop.

Heathkit ETCHED CIRCUIT VACUUM TUBE VOLTMETER KIT



MODEL V-7A
\$24.50

Shpg. Wt. 7 Lbs.

The Heathkit Model V-7A features a 200 ua meter, 1% precision resistors, and an etched metal circuit board. Very simple to build. Measures DC voltage, ACV (rms) ACV (peak-to-peak), and resistance. AC (rms) and DC voltage ranges are 0-1.5, 5, 15, 50, 150, 500, and 1500 volts. Peak-to-peak ranges are 4, 14, 40, 140, 400, 1400, 4000 volts. Ohmmeter ranges provide multipliers of X1, X10, X100, X1000, X10K, X100K, and X1 megohm. DB scale also provided. 11-megohm input impedance.

Heathkit 20,000 OHMS/VOLT VOM KIT



MODEL MM-1
\$29.50

Shpg. Wt. 6 Lbs.

Multipliers are X1, X100, and X10,000. DB range from -10 db to +65 db.

This instrument is especially valuable for portable applications where AC power is not available. Sensitivity is 20,000 ohms-per-volt DC and 5,000 ohms-per-volt AC. Black bakelite case -4 1/2" 50 ua. meter-1% precision resistors. AC and DC ranges are 0-1.5, 5, 50, 150, 500, 1500, and 5000 volts. Direct current ranges are 0-150 ua., 15 ma., 150 ma, 500 ma, and 15 a. Resistance multipliers are X1, X100, and X10,000. DB range from -10 db to +65 db.

Heathkit DIRECT-READING CAPACITY METER KIT



MODEL CM-1
\$29.50

Shpg. Wt. 7 Lbs.

This unique measuring instrument indicates capacitor values in mmf, or mfd, directly on a large 4 1/2" 50 ua meter. It provides ranges of 0-100 mmf, 0-1,000 mmf, 0-.01 mfd, and 0-.1 mfd. Residual capacity less than 1 mmf. Scales are linear. Merely connect the capacitor to the instrument and read its value directly on the scale. Instrument not susceptible to hand capacity effects. Will measure even small value trimmers or variable air capacitors.

Heathkit ELECTRONIC SWITCH KIT



MODEL S-3
\$21.95

Shpg. Wt. 8 Lbs.

This new instrument design allows simultaneous oscilloscope observation of two input signals by producing both signals, alternately, at its output. The all-electronic circuit provides 4 switching rates, selected by a panel switch. Provides actual gain for input signals, and features frequency response of ± 1 db from 0 to 100 kc. Employs 7 miniature tubes. Sync output provided to control scope sweep. Functions at signal levels as low as 0.1 volt. Ideal for observing amplifier input and output simultaneously for comparison purposes.

ORDER BLANK

NOTE: All prices subject to change without notice.

Enclosed find () check () money order for _____

Please ship C.D.D. () postage enclosed for _____ pounds.

On Express orders do not include transportation charges — they will be collected by the express agency at time of delivery.

ON PARCEL POST ORDERS include postage for weight shown. ORDERS FROM CANADA and APO's must include full remittance.

Name _____

Address _____

City & Zone _____ State _____

(PLEASE PRINT)

SHIP VIA

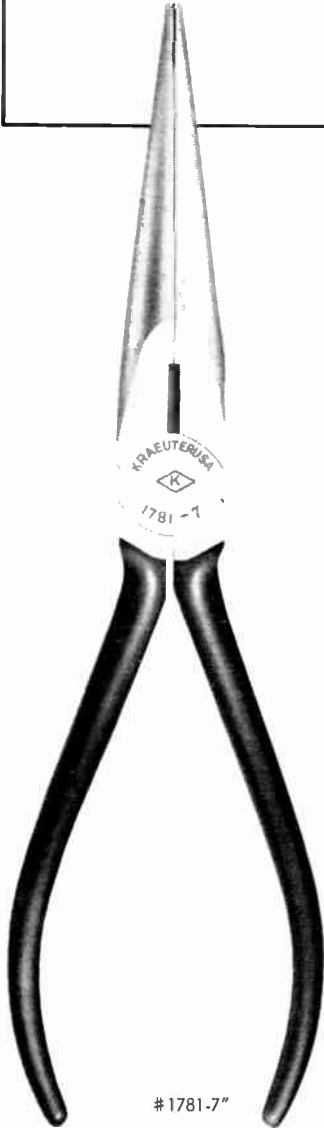
- Parcel Post
- Express
- Freight
- Best Way

QUANTITY	ITEM	MODEL NO	PRICE

HEATH COMPANY A Subsidiary of Daystrom, Inc. **BENTON HARBOR 3, MICH.**



**THE REACH IS RIGHT AND TIGHT
with KRAEUTER LONG NOSE PLIERS**



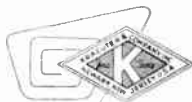
#1781-7"

You can depend on reach-ability and cutting power with Krauter's #1781 Long Chain Nose Pliers. And your reach will be tight and sure for those hard-to-get-at jobs with the extra long milled jaws of these pliers.

Buy the right line—Sell the right line. It's the Krauter line for electronic and electrical work. Krauter tools are unreservedly guaranteed.

Send for catalog #25 illustrating complete Krauter line.

**BUY THE FINEST
BUY KRAEUTER**



AS MODERN AS TOMORROW

krauter & co.,inc

FOR 100 YEARS THE FINEST IN HAND TOOLS 1860-1960 ● NEWARK, N. J

this
**G-V
time delay
relay**

does many jobs



*other thermal
relays
cannot do...*

- For military or industrial use
- Miniature and octal sizes
- Plug-in or flanged mounting
- Hermetically sealed
- Adjustable or non-adjustable
- Delay intervals 1/4 sec. to 5 minutes
- Unaffected by ambient temperatures -70° to 100°C

Our facilities assure prompt deliveries

Write for bulletin and help with your particular problems



G-V CONTROLS INC.

54 Hollywood Plaza
East Orange, N. J.

Represented in Canada by:
LEONARD ELECTRIC, LTD., 346 Bering Ave., Toronto 18

Spirap

ELIMINATES
TEDIOUS
CABLE
LACING!



NEW

A new concept in electrical cable wrapping! ONE size of SPIRAP is quickly applied to wire bundles of ANY size up to 2" diameter. Spirally cut, this unique polyethylene wrapping allows individual wires to be led in or out at any point — eliminates tedious lacing and pulling. Immediate delivery from stock in ANY quantity.

Write Today for FREE Sample!

ELECTRO SONIC
SUPPLY CO. LTD.
543 YONGE ST., TORONTO 5
WA. 4-9301



For further data on advertised products use page 71.

Electro
ADVANCED DESIGN
DC POWER SUPPLIES

0-32 V. up to 15 Amps.
Continuously Variable

ELECTRO DC POWER SUPPLY

Conduction-Cooled Selenium Rectifiers
Choke Input and Pi-Type Filters
Automatic Circuit Breaker
Pilot Light
Voltage Control
Precision Meters
Less than 3/4% Ripple at Top Load

\$263.40
STNIP

One . . . for all these applications

- 6-12 Volts. Auto Radio Servicing* • Transistor Circuit Design • Plating • Laboratory Work • Battery Charging • Marine • Aircraft • Mobile Communications
- 18-24 Volts. Tank Mobile Equipment • Aircraft Ignition • Relay Operation • Telephone Circuits
- 28-32 Volts. Aircraft Equipment • Farm Radio • Railroad Mobile Equipment
- *Both Transistor and Standard Sets



Send for New Bulletin NFA 856

ATLAS RADIO CORP., LTD.

50 Wingold Avenue Toronto 10, Ontario
7165

FOR PRECISION LABORATORY OR PRODUCTION TESTING

FREED 1110-AB INCREMENTAL INDUCTANCE BRIDGE AND ACCESSORIES

Accurate inductance measurement with or without superimposed D.C., for all types of iron core components.

- INDUCTANCE — 1 Millihenry to 1000 Henry
- FREQUENCY — 20 to 10,000 Cycles
- ACCURACY — 1% to 1000 Cycle, 2% to 10KC
- CONDUCTANCE — 1 Micromho to 1 MHO
- "Q" — 0.5 to 100
- SUPERIMPOSED D.C. — Up to 1 Ampere
- DIRECT READING — For use by unskilled operators.

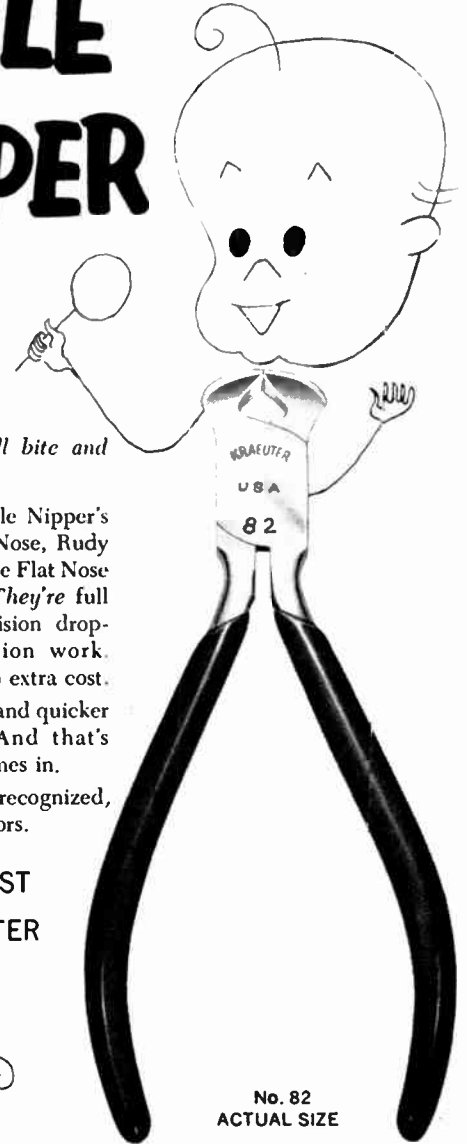
ACCESSORIES AVAILABLE:

1140-A Null Detector, 1210-A Null Detector — V.T.V.M.,
1170 D.C. Supply and 1180 A.C. Supply.

INSTRUMENT DIVISION
FREED TRANSFORMER CO., INC.
1716 Weirfield St., Brooklyn (Ridgewood) 27, N.Y.

This is KRAEUTER'S

LITTLE NIPPER



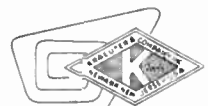
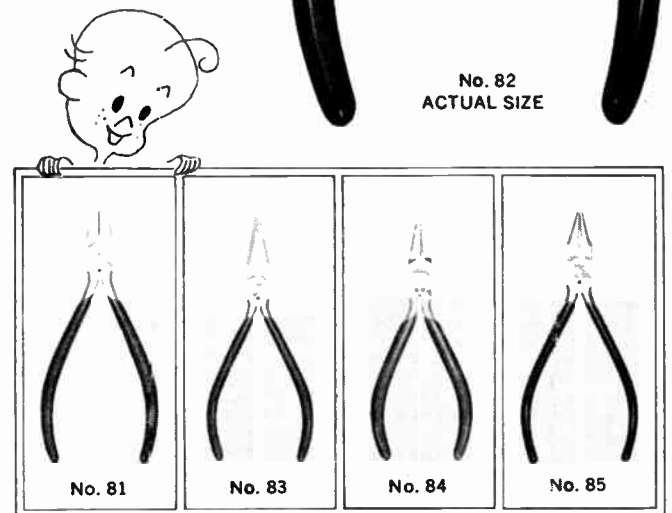
Only 4½" — but *all* bite and precision.

And below are Little Nipper's pals—Larry Long Nose, Rudy Round Nose, Frankie Flat Nose and Slick Cutter. *They're* full of fight, too. Precision drop-forged for precision work. Cushion grips at no extra cost.

The job goes easier and quicker with fine tools. And that's where Kraeuter comes in.

Sold *only* through recognized, legitimate distributors.

BUY THE FINEST
BUY KRAEUTER



AS MODERN AS TOMORROW

kraeuter & co., inc

FOR 100 YEARS THE FINEST IN HAND TOOLS 1860-1960 • NEWARK, N. J.

DOPPLER NAVIGATION

(Continued from page 70)

One interesting program which has made extensive use of the AN/APN-81 Doppler equipment is the Air Force "Jet Stream Project", designed to explore the characteristics of very fast air currents high above the earth. As a result of this program detailed cross sections showing the character of these high altitude jet streams have been measured. A typical jet stream section measured with the AN/APN-81 equipment is shown on figure 12. This curve and other data were presented in a report by the Air Force to the International Air Transport Association at its 8th annual technical meeting in San Juan, Puerto Rico in May, 1955. This is illustrative of one of the many applications of "Doppler radar".

In conclusion, let us summarize by saying — accurate ground speed and drift angle measuring equipment is now in operational use. It provides military aviation, civil airlines and aircraft designers with an important new tool which will have a far reaching effect in all areas of future flight.

Have You A Patent?

... and do you need
financial assistance for
its development?

For appointment call
or write

SPECIALIZED PATENT SALES & DEVELOPMENTS LTD.

660Z Eglinton Ave. E.,
Toronto,
HU. 8-5616

TECHNICAL PERSONNEL AVAILABLE

PROFESSIONAL ENGINEER, experienced in setting up merchandising operations and sales of new engineering products in Canada, is shortly available for new project. Reply to Box 502, Electronics and Communications.

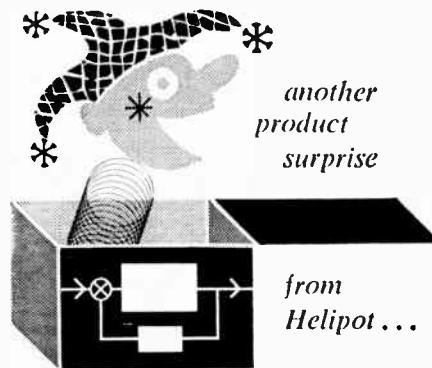
15 YEARS in electronics, P. Eng., presently employed at leading manufacturing company for 3½ years, design and manufacturing of TV sets, immigrant. Reply to Box 503, Electronics and Communications.

ELECTRONIC ENGINEER; 25 years experience on design, test, installation and specification of all types of communication equipment is open for offers as head of Quality Control or Reliability section. Specialist in Reliability and statistical quality control. Reply to Box 504, Electronics and Communications.

ENGINEER — Secondary education in London, England, followed by professional education with degree from London Electrical Training College, Manor Gardens, London N7. Also certificate proficiency wireless telegraph and telephony as signed by Postmaster General, London, England. Reply to Box 505, Electronics and Communications.

ENGINEER — Manager-Consultant: broad experience in technical personnel development; management assignments at top decision level; electrical and electronic engineering (holds several patents); economic analyses and engineering studies. Interest lies in management work requiring technical background. Sen. Mem. I.R.E., Mem. A.I.E.E., Assoc. Mem. O.R.S.A. and P.Eng. Reply to Box 506 Electronics and Communications.

ELECTRONIC & COMMUNICATION ENGINEER Member IRE with more than 15 years' experience in electronics, acoustics, ultrasound and telephone equipment, Excellent fundamental background in electrical and electronic engineering, able to do responsible design and development work. Speaking and writing fluently French, German and Italian. Expected to be Canadian citizen 1958. Good organizer, able to undertake new methods, is looking for a situation where his qualities may be utilized full. Reply to Box 507, Electronics and Communications.



another
product
surprise

from
Helipot...

Beckman Servomotor- Rate Generator

Snug as two bugs in their unitized stainless steel housing, motor and generator work hand-in-hand on the same shaft... to improve response characteristics of suffering servo systems.

Where the trouble is in the dynamics of your system components, watch this purposeful pair roll up their sleeves and go to work. The high torque-to-inertia motor, for instance, responds quickly and accurately to error signals... with acceleration at stall up to 100,000 radians/sec.². Signal-to-noise ratio of the linear generator is 25:1 or better. Aiding and abetting each other in their dedicated mission, they'll operate continuously at stall and at total unit temperature from -55°C to 200°C.

Right now, our corrosion-resistant, completely encapsulated Servomotor-Rate Generators are available in sizes 11, 15 and 18. (We'll soon add size 8; eventually, other sizes.) We've got descriptive literature available too. It's data file 537.

Beckman® Helipot
Corporation
a division of Beckman Instruments, Inc.

Canadian Factory:
No. 3 Six Points Rd., Toronto 18, Ont.
Sales Representative: R-O-R Associates, Ltd.,
290 Lawrence Ave. West, Toronto 12, Ont.

1037

For further data on advertised products use page 71.

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)
- 15,000 to 50,000 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 20.

The straight inside story on the new series 5000 is available in data file 527.

Beckman

®

Helipot Corporation

a division of Beckman Instruments, Inc.

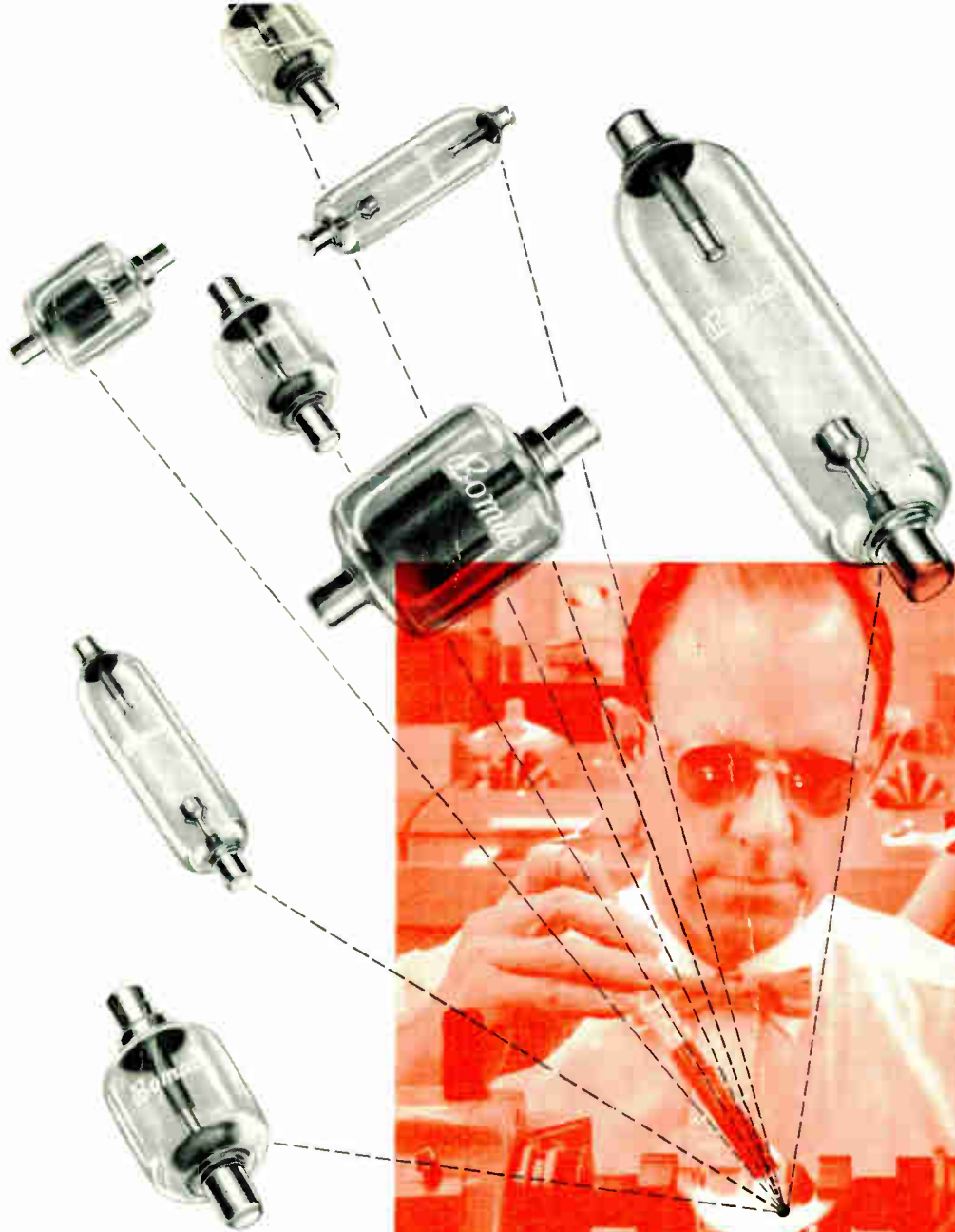
Canadian Factory: No. 3 Six Points Rd., Toronto 18, Ont.

Sales Representative: R-O-R Associates, Ltd.,

290 Lawrence Ave. West, Toronto 12, Ont.

987





BOMAC

... SURGE PROTECTORS

Here are three important reasons why engineers choose Bomac surge protectors to guard radar components against damage from voltage overload -- and to act as triggering switches in several types of electronic circuits:

1. *Bomac offers a wide choice* — tubes in breakdown voltages ranging all the way from 1000V to 33000V from stock . . .
2. *Bomac means "uniformly excellent"* — every surge protector is 100% tested for top performance and uniform efficiency before it leaves our plant . . .
3. *Bomac offers complete design and development services* — tailored to your specific applications . . .

Bomac

Complete information available.
LABORATORIES, INC.
 Dept. EC-5 Beverly, Mass.

Offices in major cities: — Chicago • Kansas City • Los Angeles • Dallas • Dayton • Washington
 Seattle • San Francisco • Toronto Export: Maurice I. Parisier, 1860 Broadway, N. Y. C.

Write for Bomac's 6-page, file-size folder containing details and specifications on more than 300 different microwave tubes and components.

R. O. R. ASSOCIATES LTD., 290 Lawrence Avenue West, Toronto 12, Canada • Tel. RUssell 1-9391

World Radio History