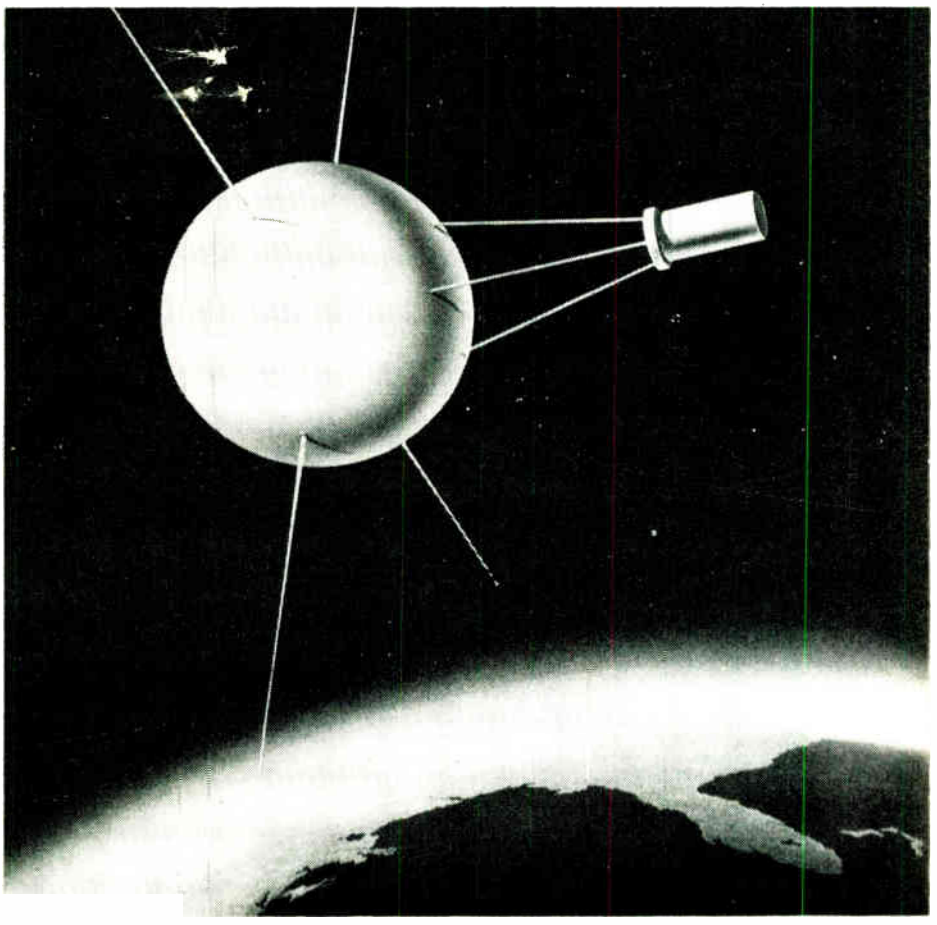
DESIGN MANUFACTURE ENGINEERING APPLICATION

ELECTRONICS AND COMMUNICATIONS

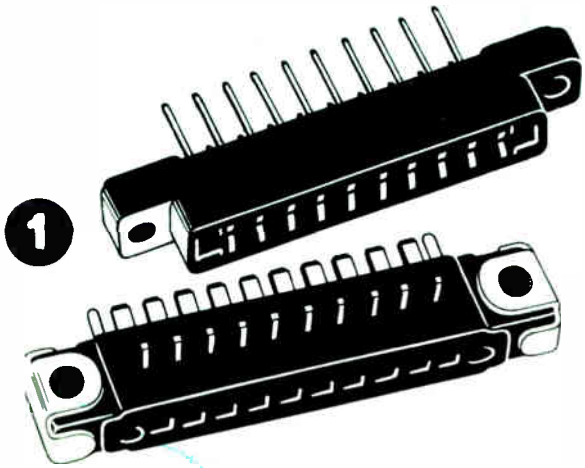


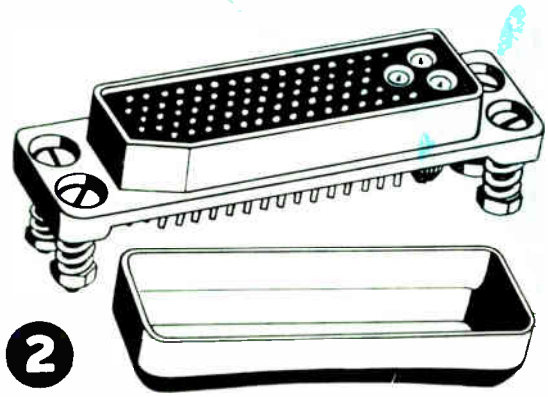
Artist's conception of Earth satellite carrying a minified model of Varian airborne magnetometer which will report data about the Earth's magnetic field above the ionosphere during the International Geophysical Year.

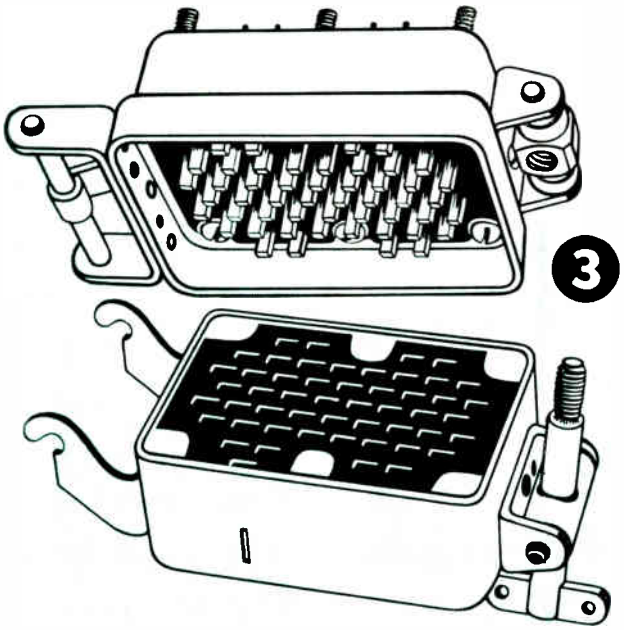
July, 1957

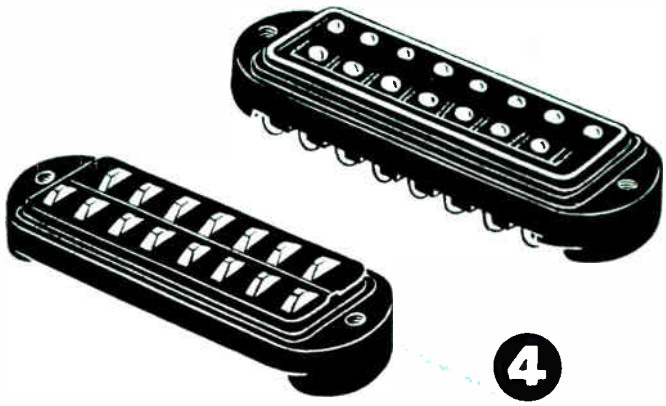
An AGE Publication
Toronto, Canada

Distribution Of This
Issue Over 10,000 Copies









AMPHENOL

PRODUCT DEVELOPMENT

FOR THE CANADIAN ELECTRONIC INDUSTRY

1 A new line of plugs and adapters to mate with present 143 Series Princirs for increasing reliability of printed wiring connections. Five different contact tail arrangements for use with board applications permitting right angle, stack-up and modular designs.
Temperature range: —80°F. to + 285°F.
Voltage breakdown: — 2300 (VRMS at sea level) (Average).

2 Environmentally sealed rectangular rack and panel connectors in die-cast Aluminum shells. Available in two different pairs — male and female connector with 57 contacts plus two coaxial connectors, male and female connector with 75 contacts plus three coaxial connectors. Used in any type of rack and panel application where an environmental seal is required; missile and aircraft applications.
Connector rating: 7½ amps at 600 V.D.C. 70,000 foot altitude when potted.
With captivated contacts accommodate RG-141 U cable with a nominal impedance of 50 ohms.
Temperature range: —65° to + 85°C.
Insertion force per contact is two ounces minimum and six ounces maximum.

3 Rectangular 50 contact plugs and receptacles similar to 115 Series 100 contact plugs and receptacles. Male and female inserts are interchangeable between both shells. Two contact styles can be furnished — solder pocket contacts and contacts for taper pins.
Used in circuit analyzers. Can be used in test equipment requiring up to 50 circuits.
Insert rating: 1,500 volts RMS sea level.
Temperature range: —54°C. to 85°C.
Knife blade contacts: 50 per connector, 20 amps.

4 Oblong 15 sliding butt-type contact connectors. New concept of sliding action eliminates relatively large area necessary for conventional plug-in applications.
Unique design of the connector allows inter-connecting boxes to be fastened via a sliding action. Typical uses are conventional rack and panel applications, quick disconnects, and module concepts. Lateral movement of the connector in either direction eases design problems of packaged equipments by offering secure electrical and mechanical contact.
Voltage rating — approximately 500 volts at 10 amps.
Contacts made of three sub-assemblies; the contact button is Bronze Alloy B, ASTM B140-52, spring loaded by a heat treated beryllium copper contact spring.

Write for Complete Information regarding these new Canadian Amphenol developments.

AMPHENOL CANADA LIMITED

300 CAMPBELL AVENUE — **TORONTO 9, ONT.**

5890 Monkland Avenue
Montreal, Que.

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

492 Somerset St. West
Ottawa, Ont.

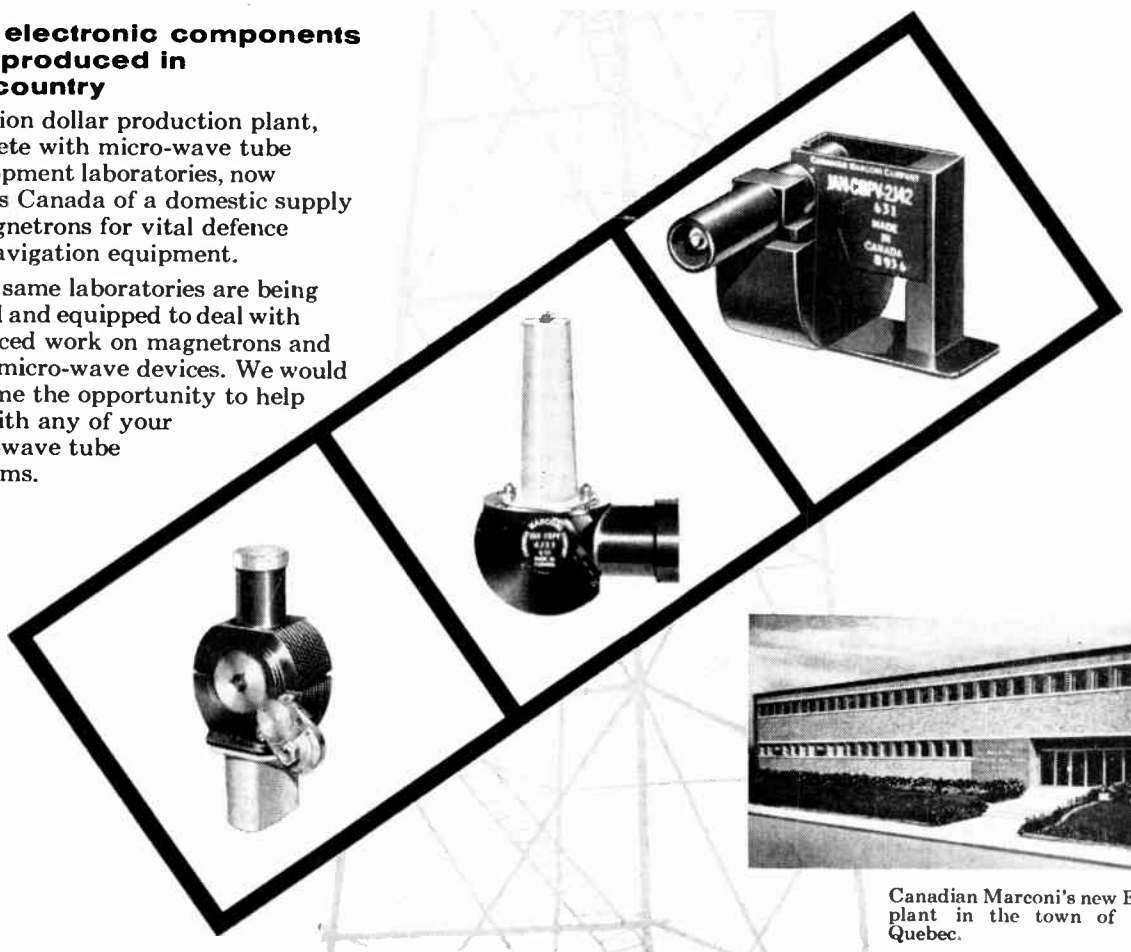
MAGNETRONS

FROM CANADIAN MARCONI

Vital electronic components now produced in this country

A million dollar production plant, complete with micro-wave tube development laboratories, now assures Canada of a domestic supply of magnetrons for vital defence and navigation equipment.

These same laboratories are being staffed and equipped to deal with advanced work on magnetrons and other micro-wave devices. We would welcome the opportunity to help you with any of your micro-wave tube problems.



Canadian Marconi's new Electronic Tube plant in the town of Mount Royal, Quebec.

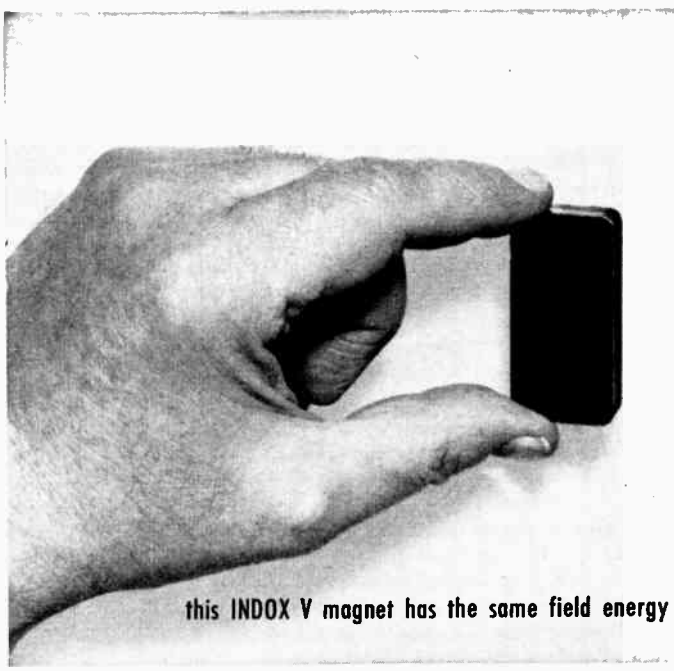
Electronic Tube and Components Division

CANADIAN **Marconi** COMPANY

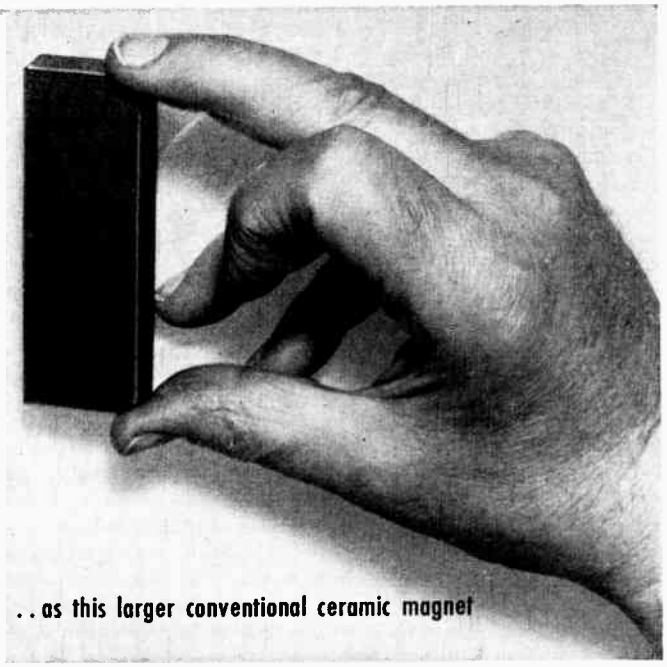
830 Bayview Avenue, Toronto, Ontario

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

For further data on advertised products use page 55.



this INDOX V magnet has the same field energy



. . as this larger conventional ceramic magnet

350% STRONGER... NEW Indox V ceramic magnet!

Indox V . . . another first from the research and development laboratories of The Indiana Steel Products Company . . . produces 3½ times greater energy than conventional ceramic magnets of the same weight or same size. This unique new permanent magnet material is now available. It offers these important advantages:

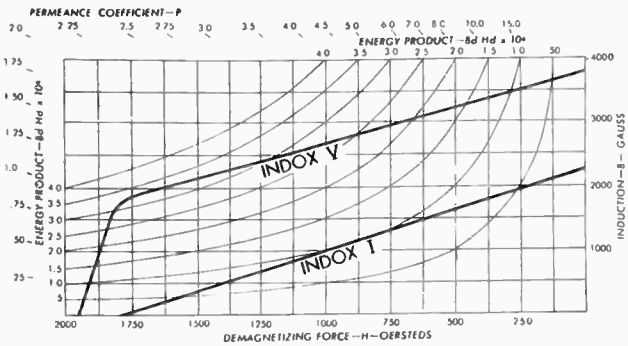
Indox V requires no critical materials. It is a highly oriented barium ferrite . . using inexpensive, noncritical, raw materials that are constantly available. Shortages in times of emergency cannot occur.

Indox V requires less space, weight to do same job. Volume and weight comparisons show that the energy of Indox V far exceeds Indox I . . and is comparable to Alnico V, the strongest permanent magnet material commercially available.

Indox V offers high resistance to demagnetization. Indox V magnets can be designed for applications where extremely high demagnetizing forces exist . . without irreversible losses occurring. This means it can be used where other types of magnets have been impractical . . for example, in stators of medium-size electric motors where electromagnets are now being used.

. . ideal for:

- D-C motors
- Synchronous drives
- Traveling wave tubes
- High-fidelity loud-speakers
- Eddy current drives
- Tractive devices where size is important



Comparison of demagnetization and energy product curve for conventional Indox I ceramic magnets and the new, high energy Indox V magnets.

JUST PUBLISHED! *This two-page data sheet gives detailed information on new high energy Indox V. Use this coupon to request your copy. Ask for Bulletin 16-A7.*

THE INDIANA STEEL PRODUCTS CO. OF CANADA LTD.
KITCHENER, ONTARIO
. . . the world's largest manufacturer of permanent magnets

Name .....
Company .....
Address .....
City ..... Zone..... Prov. .....
16-A7

INDIANA PERMANENT MAGNETS

For further data on advertised products use page 55.

A NEW QUALITY STANDARD...EIMAC'S CERAMIC 3CX100A5 ...SUCCESSOR TO THE 2C39 FAMILY

The Eimac 3CX100A5 Triode is Mechanically and Electrically Interchangeable With and Superior to the 2C39 Series.

HERE'S WHY: —

- Greatly increased life
- 10% more power output at 2500 mc.
- Full ratings to 60,000 feet
- Sustained performance at elevated temperatures
- Lower inter-electrode leakage
- Ruggedized, low-noise grid
- Fixed-tuned cold cavity resonance tested
- Long pulse cathode evaluation tested
- Positive grid voltage and current division tested
- Axial contact areas held within plus or minus .010"
- Tighter capacitance limits
- Critical dimensions held to close tolerances
- Provision for easy tube extraction

The 3CX100A5 overcomes every previous disadvantage of the 2C39 types. This planar premium quality ceramic triode withstands extraordinary thermal and mechanical shock. The long pulse cathode evaluation test guarantees electrical uniformity of every 3CX100A5. This new ceramic tube will give the lowest cost per hour of operation of any 2C39 type tube.

The 3CX100A5 is the tube of today, for future design as well as existing replacement. As a permanent member of the Eimac tube family, the 3CX100A5 is now available in any quantity.

For full details, consult our Application Engineering Department.

EITEL-McCULLOUGH, INC. SAN BRUNO CALIFORNIA

The World's Largest Manufacturer of Transmitting Tubes

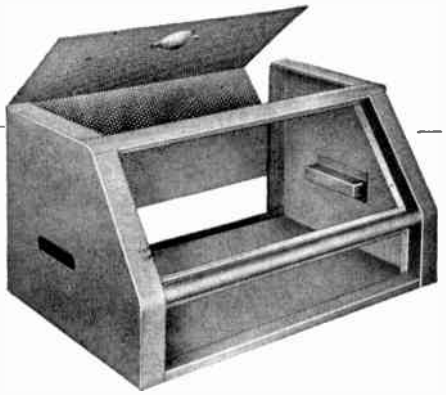
Represented in Canada by

THE AHEARN AND SOPER COMPANY LIMITED 384 Bank Street, Ottawa, Ontario

Eimac

TYPICAL OPERATION 3CX100A5

	CW	AM		CW	AM
DC Plate Volts	800	600	DC Plate Amps.	.080	.075
DC Grid Volts	—20	—16	Power Output, Watts	27	18

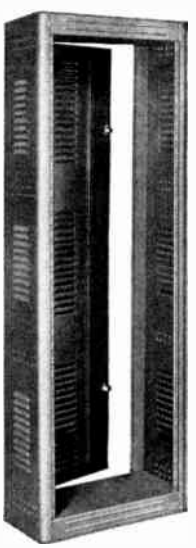


SLOPING PANEL PRESTIGE CABINETS

With the development of this new series, Bud continues its expansion of a custom line at a reasonable price. This sloping panel Prestige cabinet will meet the demand for a high-style housing for top quality equipment. In addition to the standard features of our original Prestige cabinet this unit has a top panel swept back for easy viewing and the panel trim bar is removable to permit easy withdrawal of chassis attached to either or both panels. Three sizes available. Vertical panel is 3½" high on all three sizes, while sloping panel may be 7", 8¾" or 10½" high. All panels are standard 19" width. Grey hammertone finish only.

BUD FIRST AGAIN with NEW sheet metal products

Now you have something new to show and sell your customers . . . sheet metal housings that fill a demand and increase your volume. You can always depend on Bud's progressive development to supply you with products that are soundly engineered, expertly fabricated and reasonably priced. Be the first in your city to stock and sell these exceptional, new housings.



HEAVY DUTY CABINET RACKS

Similar to our CR 1741 Series but with an overall depth of 17⅛" as compared with 10½". Designed for installations where increased depth is necessary. This unit is shipped knock-down to simplify your stocking problems. Furnished complete with hardware. Panel mounting rails are an integral part of the cabinet, thereby facilitating assembly of cabinet. For the first time in any cabinet rack of this type we are providing the Add-A-Cab feature. This means a rigid assembly in series of any reasonable size. Available in three sizes, panel space of these sizes are 19¼" x 19", 26¼" x 19" and 35" x 19". Grey hammertone finish only.

SPACE SAVER RELAY RACKS

Similar to our CR 1774 Series except that the overall depth is 10" instead of 17⅛", thus providing necessary panel height and width while saving on depth where required by space limitations. Here, too, the Add-A-Rack feature is available. Three standard sizes. Panel spaces are 42" x 19", 61¼" x 19" and 70" x 19". This unit is particularly adaptable for use with Bud Panel Mounting Chassis Series. Grey hammertone finish only.

Write today for literature and prices on these new Bud Products.

BUD — THE MARK OF PERFECTION

TENATRONICS, LTD.
Davis Drive, East — Newmarket, Ontario

Exclusive Canadian Representative for

BUD RADIO, INC.
2118 East 55th Street — Cleveland 3, Ohio

For further data on advertised products use page 55.

PLAN TO ATTEND IRE CANADIAN CONVENTION AND EXPOSITION

This is the one time during the year when all the electronics industry in Canada meets. Where the latest electronic and communication equipment will be on display. Where the latest Canadian electronic engineering achievements will be discussed by competent authorities. It is your opportunity to meet customers and friends.

Below is a view of the 1956 IRE Canadian Convention. The 1957 Convention will be bigger and better.

ELECTRONICS AND COMMUNICATIONS

RETMA Report

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

REPORT OF PRESIDENT AND CHAIRMAN OF THE BOARD, J. D. CAMPBELL, AT 28th ANNUAL MEETING, JUNE 21st, 1957, STE. ADELE-EN-HAUT, QUE.

A year ago today Mr. Carl Pollock, then President of RETMA, said "Canada's economic history will undoubtedly record 1956 as the year in which our country's business came of age". I think perhaps he has proven to be a better prophet than he imagined, although our industry in many areas has found it a painful process. However, a "shakedown" period is often required for many new things and certainly our Electronics Industry is "new" in comparison with other industry, and there can be no doubt that however painful the present the future progress of this industry is as certain as any manufacturing industry in the country.

During the last year two Royal Commissions studied aspects of our industries and their reports and findings have now been issued. Your Association acquitted itself well in its work with both, submitting briefs to each and providing much assistance in the form of detailed breakdowns and statistics. That your Association contributed much to the findings published, is easily apparent upon reading their respective reports.

The Gordon Commission's studies of the Electronics Industry and the Electrical Manufacturing Industry should, in my opinion, be studied closely by the staffs of every member company. Besides providing a very detailed analysis of all facets of our business, it does provide a more objective view of our industry and, in many respects, a more forward looking one than many of us have who are so closely connected with it.

The Fowler Commission included some disappointments.

A continuing delay in the start of color and lack of stronger support for more private stations has not helped our market growth. However, at least now we can look forward to color and some more stations with a greater degree of confidence, and if the new Parliament will act on their recommendation for financing the CBC, we should soon be relieved of the burdensome 15% excise tax.

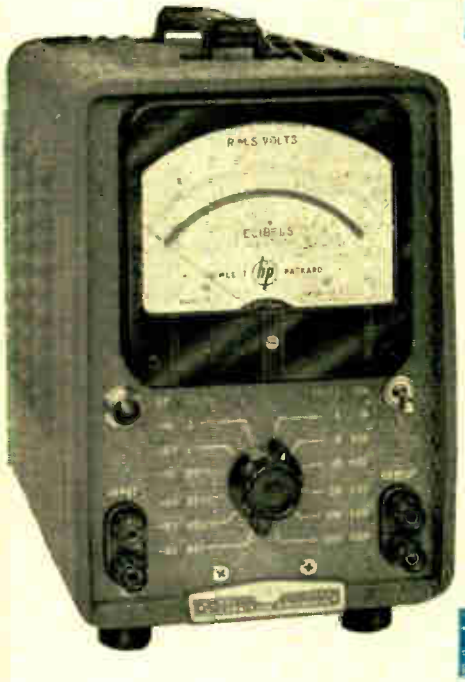
The outlook for the balance of this year is, I believe, most encouraging. The economy remains strong, and the industry is in a good position to capitalize on it. T.V. and Radio set manufacturers, with their inventories in a much improved condition, will enter the market this fall with better styling, new features, more compact sets due to the 110° picture tube. Prices, I believe, will be firmer, and in the face of continuing increased costs, this is essential if the industry is to prosper. I really believe that this swing to greater emphasis on styling, features and quality is the "growing up" of this part of our business.

A volume of close to 500,000 sets will be attained and while this is less than the last two years, it is still a very healthy volume to participate in.

The radio business, which for the past few years has been relegated to second place, with the advent of T.V., is showing that it is as strong as ever (a trend that augurs well for T.V. as well). The growing importance and acceptability of Hi-Fi shows that an increasing number of consumers are sufficiently individualistic to want to exercise their choice in what and when to listen. Also, it is demonstrating that the three forms of electronic entertainment – T.V., Radio and Hi-Fi – are compatible, and are required to satisfy all needs.

The commercial, industrial and defense side of our industry also continues to grow and to provide more efficiency and help in industry and greater security in defense. It is amazing how this division of our industry has grown in the last 5 years and the capability it has shown in tackling the most complex problems. There need be no fear for its future.

(Continued on page 65)



1% accuracy, 0.1 mv to 300 v!

-hp- 400H High-Accuracy Vacuum Tube Voltmeter

New! 1% accuracy 50 cps to 500 KC
Frequency range 10 cps to 4 MC
10 megohm input resistance
12 ranges, 0.1 mv to 300 v
Direct readings in volts or db
Functions as stable amplifier

OTHER -hp- QUALITY VOLTMETERS

-hp- 400AB, for general ac measurements. Covers 10 cps to 600 KC, 0.3 mv to 300 v. Accuracy ± 2%, 20 cps to 100 KC. 10 megohm input impedance plus 25 μμf shunt insures circuits under test against disturbance. Readings direct in volts or dbm. $200.00

-hp- 400D, highest quality, wide range, maximum usefulness. Covers 10 cps to 4 MC, 0.1 mv to 300 v. New amplifier circuit provides 56 db of feedback, (mid-range) for ultimate stability. 10 megohm input impedance prevents disturbing circuits. Sealed or long-life electrolytic condensers; rugged, trouble-free. $225.00

-hp- 410B, industry's standard for vhf-uhf voltage measurements. Wide range 20 cps to 700 MC, response flat within 1 db full range. Diode probe places 1.5 μμf capacity across circuit under test; this plus 10 megohm input impedance prevents disturbance. Instrument combines highest quality ac voltmeter with dc voltmeter (122 megohm input impedance) and ohmmeter covering 0.2 ohms to 500 megohms. $245.00

New -*hp*- 400H Vacuum Tube Voltmeter combines broadest usefulness with wide voltage and frequency coverage, and the greatest accuracy ever offered in a multi-purpose voltmeter.

On line voltages of 103 to 127 v, accuracy is ± 1% full scale, 50 cps to 500 KC; ± 2%, 20 cps to 1 MC, ± 5%, 10 cps to 4 MC. Readings are direct in db or volts on 5" mirror scale meter; 12 ranges cover 0.1 mv to 300 v. High 10 megohm input resistance minimizes loading to circuits under test. Stabilized amplifier-rectifier with feedback loop gives high long-term stability; line voltage changes as great as ± 10% cause negligible variation. Overvoltage protection is 600 v on all ranges. Highest quality, rugged construction throughout. $325.00.

HEWLETT-PACKARD COMPANY
3691G Page Mill Road • Palo Alto, Calif.
Cable: "HEWPACK"

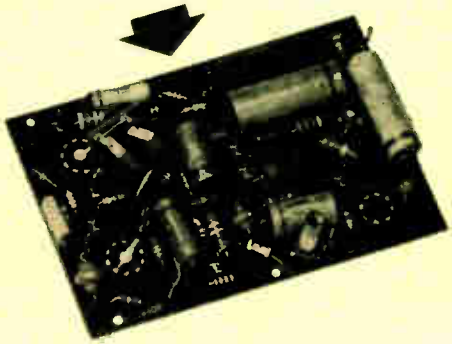
Represented in Canada by
ATLAS RADIO CORPORATION, LTD.
50 Wingold Avenue, Toronto 10, Ontario
505 McIntyre Bldg., Winnipeg, Manitoba

Quality, value, complete coverage in voltmeters

For further data on advertised products use page 55.

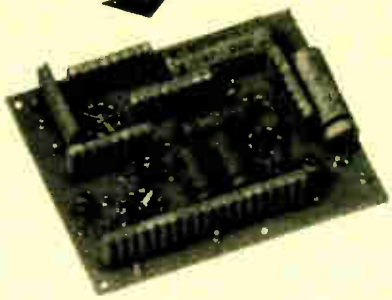
with ERIE PAC*

THIS IS REPLACED WITH



THIS

* PACKAGED ASSEMBLY CIRCUIT



PAC will drastically reduce the number of component insertions in TV, radio, computers, and other electronic equipments by combining up to 90 components into one PAC Module.

Drastically reduce costs of storage, handling, purchasing and insertion time

Write for Engineering Bulletin No. 450-1 on PAC-Facts, how packaged assembly circuits reduce costs and assembly area and increase flexibility.

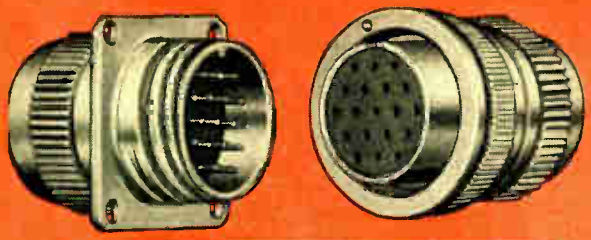
ERIE electronics

See us at the Canadian IRE

ERIE RESISTOR of CANADA LTD.
Sales Office: 4972 DUNDAS ST. W., TORONTO
HEAD OFFICE AND FACTORY — TRENTON

BIG NEWS ABOUT A LITTLE PRODUCT

(ACTUAL SIZE)



Bendix "PYGMY" Electrical Connectors

- Gold Plated Contacts
- Closed Entry Sockets
- Resilient Scinflex Insert
- Alumilite or Cadmium Plate Finish
- Two Quick Disconnect Couplings—Double Stub Quick Action Thread or Three-Point Bayonet Lock
- Light Weight
- Small Envelope Size
- Maximum Serviceability
- Can be pressurized to current MIL-C-5015 specification
- High Strength Aluminum Shells
- Variety of Styles Available—General Duty, Environmental Resisting, Potting Types, Jam Nut Receptacles, Hermetically Sealed Receptacles
- Wide Choice of Insert Patterns (1 to 55 contacts)
- Designed especially for miniaturized Electronic Equipment

New "PYGMY" Connectors for Miniaturized Electronic Equipment Installations

Although the newly developed "Pygmy" line of miniature electrical connectors is approximately one third smaller in size and weight than the standard Bendix* AN connector, they provide the same outstanding qualities of serviceability, ruggedness, reliability and resistance to vibration, moisture and corrosion for which all Bendix connectors have become world famous.

If you have an application for miniaturized electronic equipment requiring lighter and smaller connectors than standard AN types, you'll find Bendix "Pygmy" connectors the best possible solution. Write for complete detailed information. SCINTILLA DIVISION OF BENDIX AVIATION CORP., SIDNEY, N. Y.

*REG. U.S. PAT. OFF.

PYGMY

Scintilla Division
SIDNEY, NEW YORK

Bendix
AVIATION CORPORATION

For further data on advertised products use page 55.

PUBLISHER'S VIEWPOINT

Engineering Articles

It is naturally the objective of every publisher to satisfy the interests of the readers of his publication and to strive for perfection in the matter of publishing top quality material and it is only through the expression of opinion on the part of readers that editors and publishers can gage whether or not they are producing a package that is fulfilling the requirements of their readers.

Observing the foregoing, and in the matter of publishing engineering articles, we have been gratified recently to learn that ELECTRONICS AND COMMUNICATIONS magazine has been selected as one of those publications to be listed in the International Index of Electronic Sources as carrying one of the world's top electronic engineering articles during the month of February. We mention this fact with what we hope will be accepted as an excusable sense of pride and in order that our readers and advertisers may share with us the satisfying knowledge of our modest distinction in the field of publishing engineering articles.

The author of the article which has gained this distinction for us is Mr. Frank H. Edwards, of the United-Carr Fastener Company of Canada Limited, and the title of Mr. Edward's article was "The Quality Control Of Printed Circuit Board Manufacturing" which appeared in the February 1957 issue of ELECTRONICS AND COMMUNICATIONS magazine.

Canadian IRE Convention

As publishers of ELECTRONICS AND COMMUNICATIONS magazine we believe that we have occupied one of the best vantage points during the past five years to watch and study the growth of the Canadian electronics industry. In the five years that we have been associated with this industry it has been our business to chronicle the events, both large and small, that have comprised the phenomenal expansion of the Canadian electronics industry in its many and varied forms. We have watched it develop to the point where it has achieved international recognition and we have watched the Canadian electronics industry stage its first Convention and Exposition in 1956, an event which, perhaps more than any other, has emphasized the significant part that this industry plays in the industrial economy of the country. It is now but a few short weeks before the second Canadian IRE Convention and Exposition will be held in Toronto, an event which, if we are any judge of the tempo of the industry, will once again command broad recognition for the industry both at home and from abroad.

ELECTRONICS AND COMMUNICATIONS

July 1957 Vol. 5, No. 7

EDITORIAL CONTENTS

FEATURES

DEPARTMENTS

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CCAB

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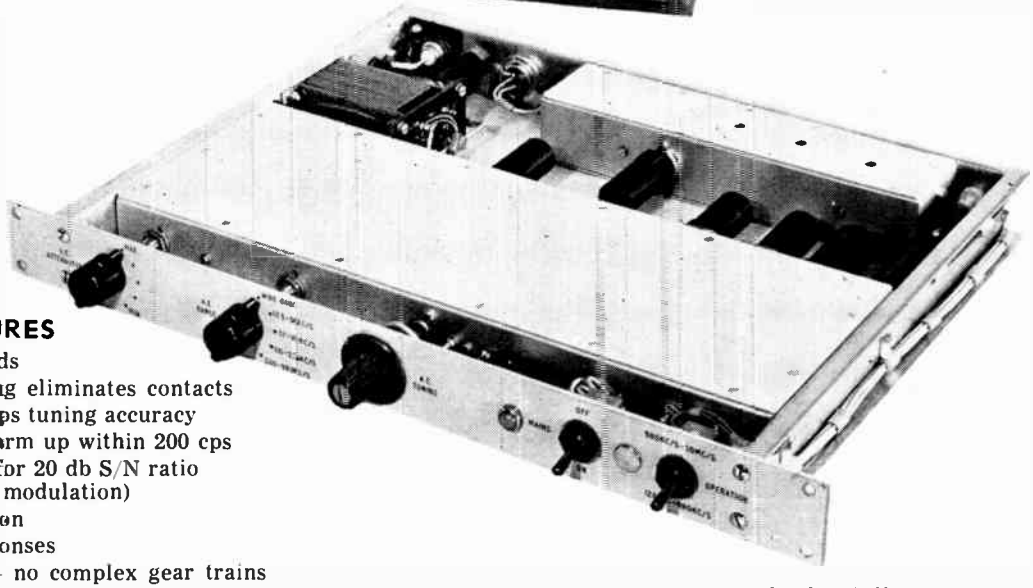
60

MORE THAN A RECEIVER
it's a REVOLUTION!

If you use H.F. communications equipment, the RACAL type RA. 17C will interest you.



Low Frequency Adapter type RA. 37 extends tuning range to 12.5 KC/s.

CHECK THESE SENSATIONAL FEATURES

- 0.5 to 30 MC/s in 30 bands
- Electronic band switching eliminates contacts
- 60" film scale gives 200 cps tuning accuracy
- Overall stability after warm up within 200 cps
- Extreme sensivity: 3 uv for 20 db S/N ratio (30% modulation)
- Extremely low re-radiation
- Negligible spurious responses
- Mechanical simplicity — no complex gear trains
- Cast chassis gives exceptional rigidity
- Excellent cross modulation characteristics
- Unique design insures minimum and simple maintenance
- Signal meter and sensitivity check

USERS INCLUDE

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- Canadian Army
- Royal Canadian Air Force
- Defence Research Board
- Department of Transport

LINSTRONICS LIMITED

PRECISION ELECTRONIC EQUIPMENT

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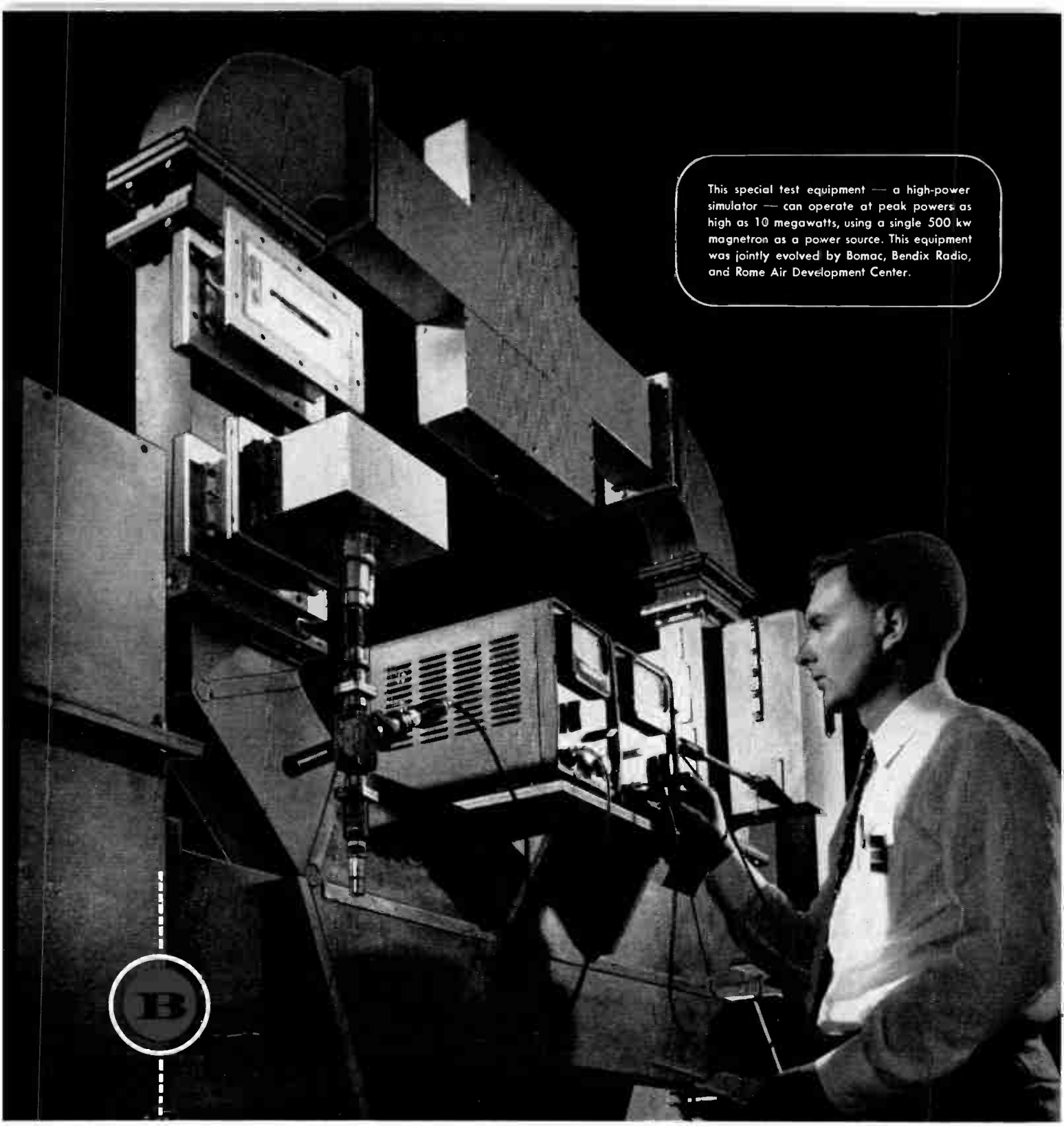
TEL. HAZELDEAN 56
(T.C. OTTAWA)

TORONTO OFFICE
21 BENLEIGH DRIVE
TEL. AXMINSTER 3-7806

For further data on advertised products use page 55.



10,000,000 WATTS OF PACKAGED POWER!

This young Bomac engineer has 10,000,000 watts of power at his fingertips.

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ELECTRONICS & COMMUNICATIONS — VOLUME 5, NUMBER 7 • JULY, 1957

Attendance Makes The Show...

Plans for the second Canadian IRE Convention and Exposition to be held in Toronto, October 16, 17 and 18, are now well in hand and if bookings for exhibit space may be used as an advance measure of success of the occasion, then there is little doubt that the affair will exceed the expectations of all concerned.

At the time of writing, 157 firms engaged in the electronics and communications business and representative of Canada, the United States and overseas countries have contracted to exhibit their products at the exhibition. The array of products to be exhibited by these firms will require a total of 309 booth spaces to accommodate them which, in all, amounts to an increase of 25 per cent more floor space than was required to house the exhibits in the 1956 exhibition. By this measure alone indications are that the forthcoming October exhibition will present a more diversified and interesting array of products and equipment for prospective user and purchaser.

In the field of engineering 116 papers will be presented at 25 technical sessions. The papers will cover a wide field of research and development in electronics and communications and will bring to the fore the latest Canadian achievements in these sciences.

However, despite the painstaking plans which have been made by exhibition officials to assure the success of the occasion — success in the final analysis will depend largely on attendance and it is in this respect that management throughout the electronics and communications industries, as well as the management of business generally in which the products of the electronics and communications industries may be used, should assure that adequate representation from their firms be in attendance at the exhibition.

According to convention officials it is anticipated that attendance at this year's convention will top last year's mark of 10,038 and we have little doubt that this expectation will be realized.

In this respect we quote from our editorial of March, 1957 in which we prophesied as follows:

"Last year more than 10,000 persons attended and although it means suspending ourselves on a limb of prediction we believe it reasonable to assume that the 1957 show will attract in the neighborhood of 15,000 to 20,000 visitors.

"This prediction is based on the assumption that additional thousands of visitors will be attracted to the convention through the widespread and favorable publicity gained by the 1956 convention and by the public interest in electronics that will be aroused during the months ahead by the influence of publicity concerning the International Geophysical Year. . . ."

We have already predicted editorially that exhibit space would be at a premium well before the show date, a prediction which, with only nine booths available at the time of writing, substantiates our opinion that attendance-wise this year's Canadian IRE Convention and Exhibition will certainly leave nothing to be desired.

How to be a magnetic tape recording expert

Introducing a useful new brochure on tape in instrumentation

Tape is the stuff of which memories are made – the versatile data memories for a jet propelled age of electronic miracles. If you are one who keeps up with times and techniques, it is a field well worth knowing. This new brochure gives a wide-angle view of the whole subject.

Typical pages

What kinds of applications do you think of when magnetic tape recording is mentioned? Sound recording, of course, and telemetering, if you are in that business. But what about simulating a rough road to test truck axles, controlling a milling machine to cut an aircraft wing section out of a solid billet, monitoring for a sudden occurrence that may happen only once in a year or two, recording data that can be reduced to graphs and tabulations without ever being touched by human hands? These and many more are described.

How significant is the fact that magnetic tape recording reproduces data in the same electrical form in which it was recorded? Enormously important, when you realize all the things the reproduced data can do that couldn't be done with the original signals or with the common forms of visual recording. For example the data can be slowed down to look at fast transients. It can be speeded up for wave analysis. It can be read out in any form. A tabular comparison between original signals and taped signals gives the full story. And a step-by-step pictorial demonstration of magnetic tape recording and reproduction puts the electrical-data idea into tangible, easily visualized form.

What does the data on magnetic tape look like? You can't see it, but the brochure will give you an idea of what it would be like if you could. And incidentally this may help to clarify the differences between various magnetic-tape-recording techniques.

Do you talk in tape's language? When is a tape recorder not a recorder? What is the difference between a channel and a track? What is a servo speed control? A much needed glossary gives the consensus of our views on terms.

For whom did we write this booklet . . . the expert, or the man for whom the whole subject is new? Both. It is written and illustrated so that any engineer or technically trained person can readily grasp the concepts and gain a broad understanding of the subject. If you are one of those who has already worked extensively with tape, you will find some new twists in the way the subject is explained, and perhaps ideas on new areas you hadn't explored. And incidentally, a copy of this brochure in some handy file will give you a good start in indoctrinating that new man in the department.

For your copy, write us today on your company's letterhead. Address your request to Department

MAGNETIC TAPE APPLICATIONS BY AMPEX

5

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INSTRUMENTATION CAMERA

The Perfect Answer to Film Recording

HERE is the perfect answer to the problems of film recording. The Mark 7 Instrumentation Camera is completely flexible through the entire field of instrumentation and aerial survey positioning photography. The shutter is a focal plane type, the basic exposure speed of which is 1/100 second. The camera may be cycled from 3 frames per second to any desired longer interval. Interchangeable apertures permit photographs of 18x25, 25x25 or 25x36 mm. A high degree of accuracy is achieved in respect to lens alignment, focusing and format positioning. Main components designed on the "module" system make conversion from one camera type to another relatively simple should customer requirements change. Write for literature and quotations.

SPECIFICATIONS

INSTRUMENTATION CAMERA TYPE T232 Mk7

Size:	7½" x 5⅞" x 6½"
Weight:	13½ lbs.
Power:	28 volts DC; constant demand, .4 amperes; intermittent up to 1.8 amperes. The Type T232 DC power supply, which operates from 110v 60 cps, is available to power the camera
Lens:	28mm Augenieux F3.5, or to customer specification
Magazine:	100 ft. 35mm standard sprocketed film, No. 10 daylight loading spool. 400 ft. magazine available on special order
Picture Formats:	18x25, 25x25 or 25x36 mm.
Exposure:	1/100 second, or longer with intervalometer control
Interval Time:	3 cycles per second maximum

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For further data on advertised products use page 55.

business briefs & trends

★ During his address before the World Trade Conference of the Canadian Manufacturers Association in June, George L. Wilcox, president of Canadian Westinghouse Company Limited, described the United States as the largest exporter of goods and services in the world today, with an export value of $19 billion in 1956. Second in position is Great Britain, with annual exports of $9.2 billion. The Federal Republic of Germany runs third with a 1956 value of nearly $7.3 billion. Canada ranks fourth with 1956 exports of $6.4 billion. Mr. Wilcox pointed out, however, that Canada far outranks all other major exporters on a per capita basis and leads all other major world trade nations in percentage of Gross National Product marketed abroad.

* * *

★ John F. Rider Publisher, Inc. of New York City has published the third supplement to the Receiving Tube Substitution Guidebook by H. A. Middleton, containing over 200 European to American tube substitutions and more than 230 American to European tube substitutions. Instructions for necessary wiring changes are included, making the book invaluable to service technicians working on imported radio receivers. Another service aid is the provision for 830 receiving tube and over 200 picture tube substitutions.

* * *

★ An industrial report emanating from France on the subject of automation — its development, applications and effects — points out some salient facts about our industrial civilization. In 50 years, the average work week has been cut from 72 hours to 47 hours; the demands made on workers have been reduced by 50 per cent to 80 per cent, depending on the profession; minimum working age has risen from 13 to 17; and many products which were formerly considered luxury items are now in current use universally. Each day new activities come into being to absorb the personnel who have been replaced by automation.

* * *

★ The Board of Directors of RETMA in the United States has recommended changing the name of that body to Electronic Industries Association, and the membership will shortly be voting on the question. This recommendation was made by the Directors of RETMA with a view to simplifying the title and by reason of the ever widening interests of the members of the organization.

* * *

★ It is reported that Japan is forging ahead in the rate of growth of its manufacturing industries and exports. With the aid of technological assistance from other countries, Japanese industry can now manufacture practically everything up to international standards. In the chemical field, Japan makes the purest titanium metal in the world, and the most refined silicon known commercially. Japan has 700,000 television sets, 22 million radios and 3 million telephones.

* * *

★ The recently published 1957 edition of The Isotope Index, a 100-page volume which collects data on all of the commercially available isotopes from suppliers all over the world, reports that the supply of isotope labelled compounds has increased 30 per cent during the last year. Widely used in industry, research, agriculture, and medicine, isotopes and isotope labelled compounds are now available from 53 suppliers chiefly in the United States, Canada, and Great Britain.

★ Whereas 2,394,264 television sets were produced and 2,036,808 sets were sold in the United States in the first four months of 1956, the records show that sales exceeded production of individual sets in the same period of 1957, sales being 2,020,876 sets and production being 1,835,975 sets. Sales of radios (apart from automobile sets) were up 19 per cent in the United States in the first four months of 1957 compared to the corresponding period in 1956.

* * *

★ At the 13th annual National Electronics Conference to be held in Chicago October 7-9 more than 90 papers, including a number of tutorial discussions aimed at stimulating cross-fertilization of ideas in related scientific fields, will be presented. The tutorial papers will cover new techniques that affect the electronics industry, engineering to improve electronic aids to the medical profession, radio astronomy, and geophysics. More than 80 technical papers will be devoted to the latest developments in transistor and computer research, electronic components reliability in extreme environments, and other areas of research. Attendance at the conference is expected to reach 10,000 persons.

* * *

★ Canadian Westinghouse Company Limited is reported to have spent half a million dollars on developing "Scatter" equipment, which is the only Canadian-developed equipment of this character. Three papers on the subject will be presented at the IRE Convention in Toronto in October next and these will cover design, exciter design and test facilities.

* * *

★ Engineers attending a meeting in San Francisco in June of The American Society of Mechanical Engineers were told that preliminary operation of America's first full-size atomic plant at Shippingport Atomic Power Station near Pittsburgh is proceeding satisfactorily. It is expected that the plant will begin producing usable power later this year.

* * *

★ Gulton Industries, Inc. through its subsidiary, the Glenco Corporation, has developed a new line of high temperature, glass-coated ceramic capacitors which allow components to operate in temperature environments up to 350°F. Dr. Leslie K. Gulton, president of Gulton Industries, Inc., claims that these new glass-coated capacitors have been found to provide greater moisture resistance, increased reliability of operation and better corona suppression.

* * *

★ Retail sales of high fidelity components and tape recorders used in home systems were estimated at approximately $160 million for the year 1956 — almost one-third as much again as in 1955 — according to figures compiled by the Institute of High Fidelity Manufacturers, Inc. in the United States. A survey was conducted among 138 manufacturers, two-thirds of whom were institute members.

* * *

★ TV fans in Regina, Saskatchewan, have recently been able to see programs relayed from Winnipeg by reason of the Saskatchewan Government Telephones' eastern section of the microwave network linking Regina to Winnipeg and the Eastern Canada network going into operation. Saskatoon viewers will shortly have a similar privilege as work on the system proceeds westward across the province.

(Continued Overpage)

business briefs & trends

★ A U.S. Army official in Washington recently described new army developments utilizing electronics including a "side-looking radar" which, when flown parallel to the front lines, takes pictures in enemy territory. Other developments include a long-range radio system offering splendid surveillance techniques and little susceptibility to enemy interference, and an electronic data processing system which will collate and reveal essential information on home and enemy forces.

* * *

★ The market for transistors continues to expand. The latest prediction is that the production of transistors will increase from an estimated 26 million units in 1957 to an anticipated 125 million units in 1959.

* * *

★ The Naval Research Laboratory of the United States has developed a television screen which will allow viewing in broad daylight with excellent results. Phosphor is deposited on the face of the tube in the form of transparent films into which sunlight penetrates and is lost in the darkened tube interior so that contrast is maintained even when the sunlight shines directly on to the tube. It is felt that the screen may provide a new and simplified approach to color television, and may lead to the development of three-dimensional television viewing.

* * *

★ At the recent annual shareholders' meeting of the Dominion Electrohome Industries Limited, Carl Pollock, president, announced that sales were up to an all-time high of $13½ million in fields of activities where national sales statistics indicated an overall drop in volume. Profits for the year 1956, amounting to $313,000, were second only to 1955's record.

* * *

★ The sixth annual Industrial Electronics Symposium will be held in Chicago on September 24 and 25, 1957. Major subjects to be considered will be development of transducers and other elements of industrial electronics systems, and integrated systems for industrial electronic control.

* * *

★ Eitel-McCullough, Inc. of San Bruno, California, reports a sales increase of 55 per cent in 1956. The heavy sales increase was due largely to the production and sales realization of new developments of the past few years.

* * *

★ In writing on the 1957 Electronic Parts Distributors' Show held in Chicago during May, Kenneth C. Prince, general manager and legal counsel for the Electronic Industry Show Corporation, said: "The electronics industry has grown so big and has branched out in so many directions that the average distributor may not find it possible to carry a representative stock of all the items needed to supply the varying customers such as radio-television servicemen, schools and industrial establishments, and high fidelity and sound business . . . The answer, and the key to future success, is specialization. The distributor, alert to the changing times, can grow with the industry by revamping his operation to offer a specialized service, within one of its varied fields, that cannot be found anywhere else."

★ Investors on Wall Street have been advised that the electronics industry as a whole probably will have a good year in 1957, although the outlook for TV set production is not promising despite the growth of portable TV sets. Earnings on commercial electronic products "should at least hold their own in 1957 and perhaps advance sharply again by 1958" is the prediction of a firm of management and economic consultants on New York's famous Wall Street.

* * *

★ A major step forward in facsimile development has been accomplished by the Meteorological Branch of the Department of Transport by increasing the speed with which weather maps can be transmitted over telegraph and radio circuits. The speed of the facsimile equipment in some sixty meteorological centres has been increased from 60 revolutions per minute to 120 RPM enabling the transmission time for weather maps to be cut in half. Simultaneously the Meteorological Branch teletype circuits and equipments have been successfully converted from a speed of 60 words per minute to 75 per minute. It is interesting to note that the method of increasing the speed of facsimile transmission in Canada is being studied by other countries.

* * *

★ The Royal Canadian Navy's aircraft carrier HMCS Bonaventure, although built in Northern Ireland, has been equipped to a large extent with material and equipment of Canadian manufacture, including some $3 million worth of electrical and electronic equipment. The cost of radar units, ordered in Canada, was more than $2 million, and orders for radio transmitters and receivers, together with many other items of radio equipment, were placed with Canadian firms.

* * *

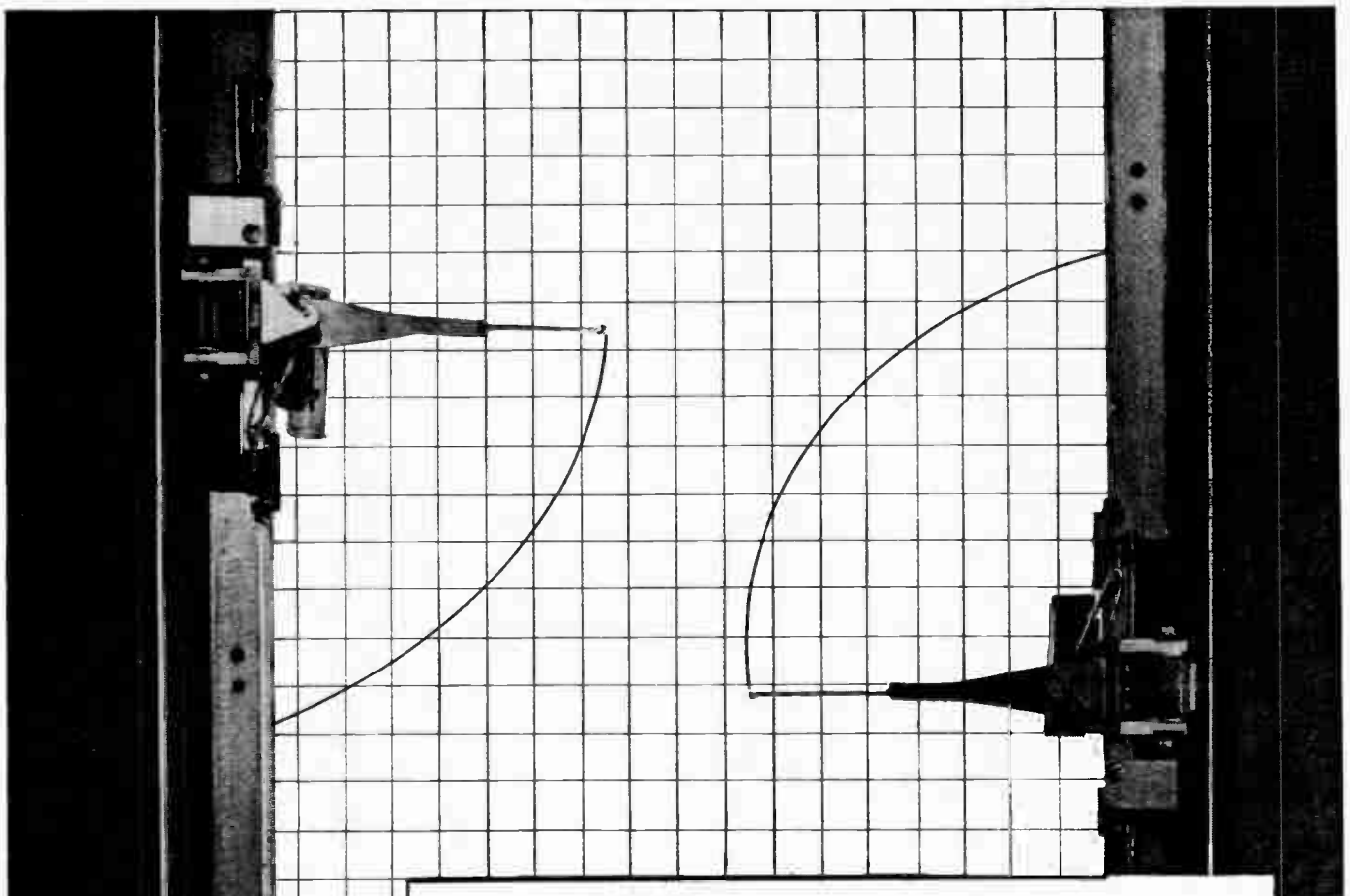
★ The Canadian Labour Congress, through its research director, Dr. Eugene Forsey, suggests that automation may bring higher living standards to Canadians, but it calls for combined action by governments, management and unions to regulate and control the situation.

* * *

★ J. Herbert Smith, vice-president, Canadian General Electric Co. Ltd., Toronto, emphasized recently that Canadians "will see an acceleration in the present trend to automation in industry, and the years immediately ahead will produce a greater rate of innovation than has been experienced by the industry to date." Referring to the technical requirements of the industry, Mr. Smith stated that only by an "evolution of existing products and the development of new products," will it be possible for the electrical "utility industry to handle the anticipated growth in power consumption."

* * *

★ Cable containing 227,272 miles of wire — almost enough to reach the moon — 750,000 feet of underground conduit . . . 15,000,000 feet of duplex. These are only some of the $25,000,000 worth of materials the B.C. Telephone Company is ordering this year to carry out the $40,000,000 expenditure planned for 1957. This is the first phase of a three-year construction program in which a record $150,000,000 will be spent for expansion.



TO KEEP PACE A COMPLETE LINE OF PLOTTING AND RECORDING EQUIPMENT FROM EAI

With recent advances in simulating and computing techniques, the demand is greater than ever for the high speed, precise recording of output data

That is the reason why Electronic Associates, Inc , as part of its program of leadership, offers a complete line of plotting and recording equipment from multiple channel strip chart recorders to analog or digital X-Y plotting of 1 or more pairs of variables

In addition to this high speed, PACE Plotting and Recording Equipment assures you of an accuracy and reliability that has earned it the title of the "royal family of recording equipment"

For a demonstration or for rental of time, contact our Computation Centers There's a Center serving Eastern Industry in Princeton, N. J.—one serving Western Industry in Los Angeles, Calif —one serving European Industry in Brussels, Belgium. Please address all inquiries to. Electronic Associates, Inc., **Dept. EC-7, Long Branch, N.J.**

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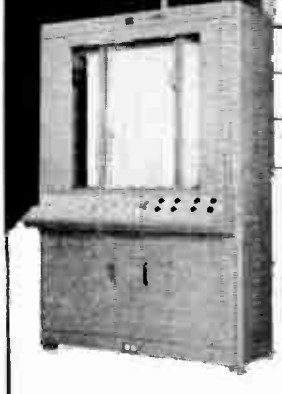
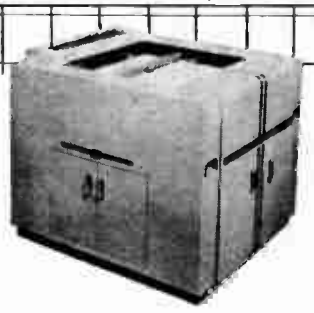


Variplotter Model 205N—for use when record must be viewed from remote location.

Six Channel Recorder. Model 1902A—a strip chart recorder with push-button controls.



Variplotter Model 205 K & L*—established leaders in large scale, high-accuracy recording.

Variplotter Model 1100D—versatile table-top X-Y Recorder.

*Variplotters: When equipped with a special function generator unit, all Variplotters will produce non-linear functions of one or more variables. Other accessories available. Information on request.

For further data on advertised products use page 55.

the editor's page

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

Complementary Events

Mr. E. I. Tolstikov of the USSR will talk at a world gathering of scientists in Toronto on the subject of Arctic and Antarctic investigations of the IGY (International Geophysical Year). His illustrated address will be given at the XI General Assembly of the International Union of Geodesy and Geophysics (IUGG) which meets in Toronto, September 3-14, 1957. Mr. Tolstikov is deputy head of the Russian Central Department for the Arctic Seaway by which ships pass north of Siberia from European Russia to the Bering Sea and Pacific Ocean.

Another feature lecture at the Assembly will be given by Dr. Lloyd V. Berkner, an American who is president of the International Council of Scientific Unions, the central world organization which sponsors the IGY. Dr. Berkner will describe the IGY rocket and satellite programs. Both these addresses will be open to the public. Other papers and discussions are on research which is of importance to such fields as aviation, exploration for oils and minerals, navigation, weather forecasting and radio communications.

The XI General Assembly of the IUGG will bring to Toronto about 1500 scientists from 45 countries in order to discuss the IGY, the vast 18-month project being undertaken by many nations to investigate the earth's natural phenomena.

At its September congress, the IUGG, which is one of the large international organizations sponsoring the IGY, will exchange latest information about the earth. A few of the subjects to be discussed are the earth's interior, its "polar wandering", its probable age, and its "water balance".

The earth's interior is investigated by studying shockwaves from earthquakes. These waves travel through the earth and like x-rays reveal facts about the liquid core, the intermediate layer of heavy rock, and the thin outer crust of surface rocks.

Another special study, that of rock magnetism, may hold the secret of the much debated problem of whether the continents have always been fixed or whether they have drifted slowly apart. One widely-held view is that, although the continents have remained in the same position relative to each other without any drifting, the earth's axis may have moved relative to the continents. If the north and south poles have "wandered" in this way, it would explain why the arctic and antarctic regions were once temperate or tropical and why there were once ice sheets in regions now warm.

Recent discoveries in dating rocks have been made from radio-active elements found in the rocks. During the past two years this technique has established the age of the earth to be about 4½ thousand million years.

The "water balance" is the natural equilibrium which restores to the air over the oceans the millions of tons of water which every day are carried inland to fall as rain over the continents. When the water balance is disturbed, unusual drought or floods may result.

Geophysics is the study of the whole earth. Its investigations include the solid earth, with its mineral wealth and fuel resources, its earthquakes and volcanoes. They also include the agencies which modify the earth — the oceans, the air, and the upper atmosphere.

The oceans and the air distribute the sun's heat from equatorial to frigid zones; they provide the rain clouds which moderate and refresh our climates, and protect us from intolerable extremes of heat and cold. The upper atmosphere shields us from intense radiation of ultra violet light and cosmic rays.

The stability of the whole earth is vital to us, and knowledge of its forces is of great importance. For this reason much interest is being shown in the world's largest gathering of geophysics in Toronto this year.

It is, we believe, significant to point out that much of the research into the nature of the earth is carried out with the assistance of electronic equipment, a variety and abundance of which will be exhibited at the second annual Canadian IRE Convention and Exposition which will be held the month following the world-wide gathering of scientists in Toronto. It is, therefore, reasonable to assume that the proximity of these two scientific events will complement each other in the matter of arousing public and professional interest in each other and it is genuinely believed that the XI General Assembly Toronto meeting of the International Union of Geodesy and Geophysics, scheduled as it is just a few weeks previous to the Canadian IRE Convention and Exposition will lend considerable impetus to the attendance at the latter event.

Does The Civil Servant Think Otherwise?

"Any industrialist could take the Federal payroll, cut it by 20 per cent and increase the efficiency of Government operations by anywhere from 30 to 40 per cent," says H. A. Toulmin, Jr., Board Chairman of The Commonwealth Engineering Company, in the May issue of COMPETITION, a monthly publication of the Dayton, Ohio, research organization.

"All of us hear a good deal about the inability to cut taxes, but no one goes to the core of the problem. That core is our excessive number of civil servants. They outdo even the most inept business organization in their ability to complicate the simplest matter and to hire the largest number of people to do the fewest things."

A chart accompanying the article stresses Mr. Toulmin's remarks by indicating that since 1951, the Federal payroll for civilians alone has exceeded the total Federal budget for all government operations in 1940 or 1941 !

Colonel Toulmin, whose connection with the military includes both World Wars, was Assistant Chief, U.S. Army Transportation Corps; and Staff Officer in Charge Atlantic and Pacific Overseas Commands, U.S. Air Force, during World War II. He cites specific examples out of his experience during the latter to show that war production was increased as much as 3600 per cent in one instance by reducing operating personnel to more workable and more efficient proportions.

Pointing out that the game of the civil servant is to acquire as many subordinates as possible, whether he needs them or not, because his pay depends upon how many people report to him, Toulmin insists that this situation could be improved virtually over-night, and both budget and taxes reduced by the stroke of a pen. "How? By a Presidential order to the effect that a civil service rating did not depend upon the number of people under a given person," he says.

"Our Armed Forces have already made great headway in drastically cutting their manpower by intensive mechanization of many operations," Toulmin points out. "Why cannot civilian Government departments make the same effort to cut their clerical forces in view of the availability today of so many electrical and electronic devices for mechanizing office operations?"

you can't match TRIPLETT model 630 VOM

for SPEED ACCURACY DURABILITY CONVENIENCE!

heavy molded case

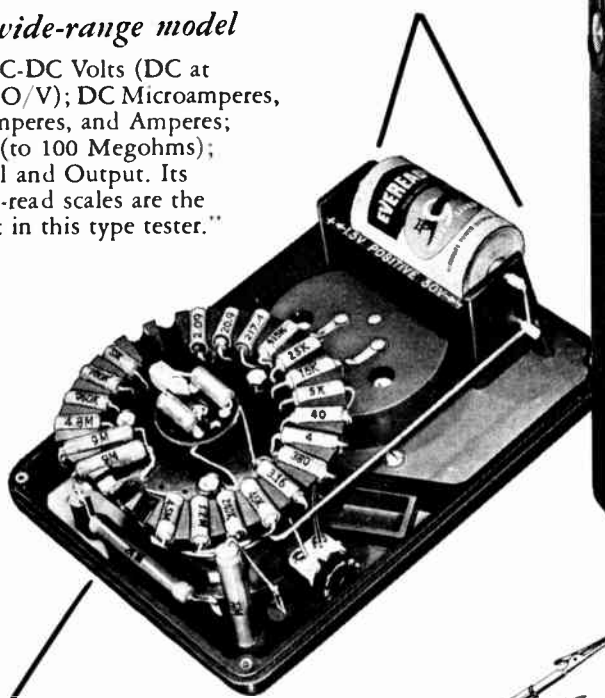
—¼" thick for high impact. Fully insulated.

sure grip battery contacts

Balanced double-spring tension grip assures permanent contact.

"this wide-range model

tests AC-DC Volts (DC at 20,000 O/V); DC Microamperes, Milliamperes, and Amperes; Ohms (to 100 Megohms); Decibel and Output. Its easy-to-read scales are the longest in this type tester."



streamlined design

No protruding knobs on switch or ohms control—both are flush with the panel.

king size recessed knob

—Only one switch; (fully enclosed) selects both circuit and range. Just turn the switch and make your reading.

for quick positive connections

—Banana jacks and plugs on test leads are best. Alligator clips are provided to slip on test prods for extra convenience.

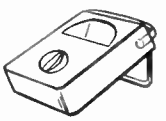
for most efficient meter use

—With every Model 630 you receive complete, simplified instructions on how to use and maintain most efficiently.

advanced engineering

—Molded mounting for resistors and shunts allow direct connections without cabling. No chance for shorts. Longer life and easy-to-replace resistors in their marked positions.

for convenience in reading



—Available as an extra (only 50c), this special stand tilts meter at best angle for easy reading

no slip feature

Four rubber feet furnished as standard equipment fit in back of the case to prevent slipping on smooth surfaces.

MODEL 630

$62.30
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THE MIGHTY NINE VOM LINE

631 Combination -O-M—VTVM

630-NA For Best Testing Around The Lab, Production Line or Bench

630 The Popular All-Purpose V-O-M

630-A A Good Lab and Production Line V-O-M

310 The Smallest Complete V-O-M With Switch

630-T For Telephone Service

666-HH Medium Size For Field Testing

625-NA The First V-O-M With 10,000 Ohms/Volt AC

666-R Medium Size With 630 Features

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Satellite Tracking

Antenna Requirements For Tracking Project Vanguard

Technical Appliance Corporation
Sherburne, N.Y.

PROJECT VANGUARD and the International Geophysical Year of which it is a part has created a tremendous amount of interest, appealing to the imagination of scientific and non-scientific people alike. It has been justifiably stated that this is the first major step in space travel. Where will it lead? How far will we go? What are the immediate benefits? How can we be a part of this program? Answers to all of these questions except the last, are purely speculative, but it is possible to help you become an active participant.

Early in 1956 TACO was called upon by the Naval Research Laboratory to help in the development of satellite tracking antennas for the Minitrack system. Later in the same year a production contract was awarded for the tracking antennas used in the Minitrack system. Reference 1.

With this background in tracking antennas, a selection of antenna systems which can be used for tracking the earth satellite on an individual- or group-basis in accordance with the simplified "Mark II Minitrack" which has been proposed by the Naval Research Laboratory, Reference 2, 3, 4, 5 is available. The Mark II Minitrack system *(Figure 1)* is based on the interferometer principle which is well known to radio astronomers and students of optics. Not only can the system, once set up, be used for tracking the satellite, it can also be used for radio astronomy study. Reference 6.

Data acquired on the satellite tracking will be of great value to the participants and also to the overall program when forwarded to the Vanguard Control Center at the Naval Research Laboratory. It will be possible to resolve any ambiguities which may be present in the simplified system by coordinating data through this Control Center and the associated Vanguard Computing Center.

The basic arrangement of the Mark II Minitrack system will consist of two antenna arrays operating at 108.0 MC on an East-West base line spaced 500 to 1000 feet apart. The site should be fairly level and the antenna arrays be adjusted in the horizontal plane to within one half inch of each other. They must also be in perfect alignment on the East-West axis. In general

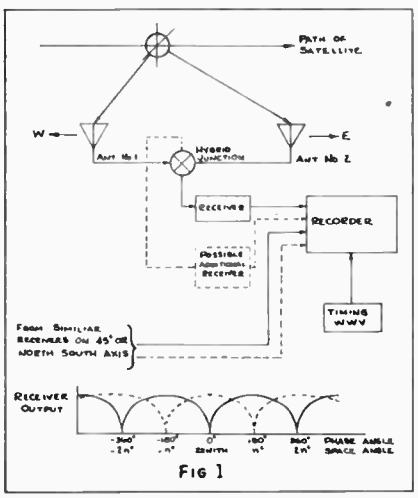

FIG 1

REFERENCES

1. "Tracking the Earth Satellite, and Data Transmission by Radio". John T. Mengel, Proceedings of the IRE, June 1956.
2. "Radio Tracking of the Earth Satellite", Roger L. Easton, QST, July 1956.
3. "A Low-Noise 108/144 MC Converter". A design suitable for earth satellite tracking by Mason P. Southworth, Nov. 1956 QST.
4. "A Low-Noise Preamplifier for Satellite Tracking", V. R. Simas, QST, December 1956.
5. "Latitude and Satellite Tracking Accuracy", Roger L. Easton, February 1956 QST Technical Correspondence, Page 43.
6. "Calibration of the Mark II Minitrack" using radio stars as signal sources by Roger L. Easton, April 1957 issue of QST.
7. "Receiver Bandwidth for Satellite Tracking". Paul E. Wilkins, Oct. 1956 QST, Page 46.

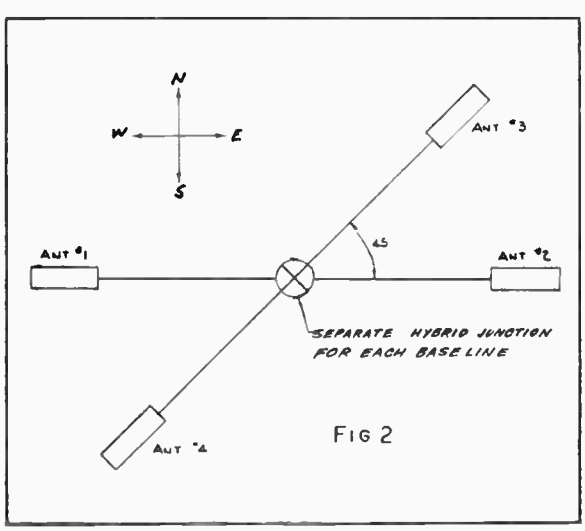

FIG 2

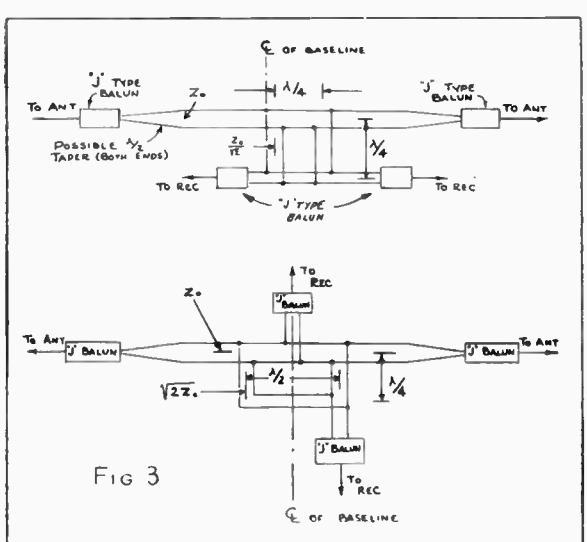

FIG 3

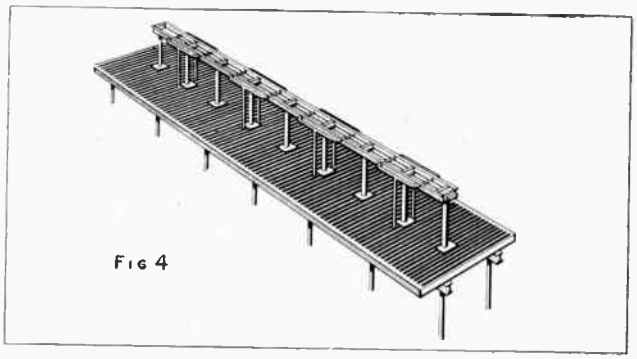

FIG 4

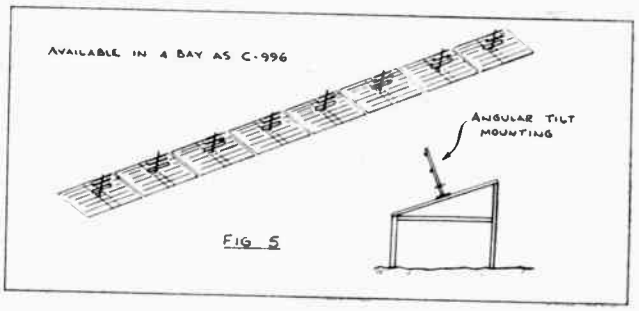

FIG 5

● G-979 Antenna. This is the array (Fig. 4) in the prime Mark I Minitrack system operated under direction of the Naval Research Laboratory. Manufactured by TACO, there will be eight of these arrays per tracking system. See Reference 1. C-995. This consists of an array of eight three-element yagis (Fig. 5) on individual forty inch by eighty inch aluminum screens. The eight antennas comprising the array are furnished complete with interconnecting harness, terminating in a single 52 ohm type N Connector. This antenna offers the advantages of a self-contained screen of rigid aluminum framework. It has a wide North-South beamwidth enabling it to track the satellite as it passes either north or south of the station. For applications at the edge of or outside of the 36° North/South belt, this antenna may easily be mounted at an angle in the direction of anticipated orbital paths. C-996. This consists of an array of four three element yagis on individual forty inch by eighty inch aluminum screen same as C-995 except only four antennas are used in the array. It has the same general characteristics as C-995 except for lower gain and wider beamwidth in the East-West axis.

the number of maxima and minima per unit of time in the interference pattern and thus the accuracy of the system can be improved by increasing the antenna base line.

For more resolving power in determining the center of the interference pattern and thus the time of satellite zenith the total number of maxima and minima should be kept as small as possible, (approximately 10). This may be accomplished by decreasing the antenna beamwidth in the East-West direction (increasing antenna gain). This requirement is also compatible with the additional transmission line loss that must be overcome by virtue of the longer base line.

The satellite will be travelling a path from West to East and is expected to be confined to within the 36° North/South latitudes. This means that the antenna pattern should be relatively narrow in the East-West direction with a much broader pattern allowable and desirable in the North-South direction. As a matter of fact for people located between the 36° latitudes, the wide North-South pattern is highly desirable since in this case tracking data can be obtained when a satellite is on either side of the array. People located outside this range of latitudes, will find it advantageous and practical to tilt the antenna axis in a direction toward this band of latitudes.

Additional resolution is attained with a more elaborate system employing antenna arrays located on a second base line oriented along a line 45° to the East-West base line as shown in *Figure 2*. With this system it may therefore be possible to acquire more information regarding the orbital paths.

The transmission line associated with the base line system must be stable in phase. The amount of loss tolerable in this line is a function of a number of things such as antenna gain, signal-to-noise ratio requirement, predetection bandwidth, etc. The desirable cable should have high phase stability and low loss such as an air dielectric or some of the reliable semi-air dielectric cables. In certain applications a solid dielectric cable can be used depending on the antenna and/or receiver characteristics. Another type of cable which has been suggested is the open wire line. The loss characteristics of this line are very attractive provided care in installation is used to insure phase stability. In the open wire line system either of two hybrid junctions can be effectively used as shown in *Figure 3*. In both instances, "J" baluns can be used both at the antenna output and the receiver input.

To get the proper gain, it is necessary to use an array of interconnected antennas. The individual antennas must be carefully designed for maximum uniformity, low VSWR, high gain and proper impedance. These specially designed antennas must in turn be interconnected by suitable harnesses specially matched to insure that they are all of the same electrical length. It should be noted that cable of identical physical lengths may have different electrical lengths. Only in this way can proper phase relationship and accuracy be maintained.

In summary, the following factors pertaining to the antennas are extremely important for an accurate system.

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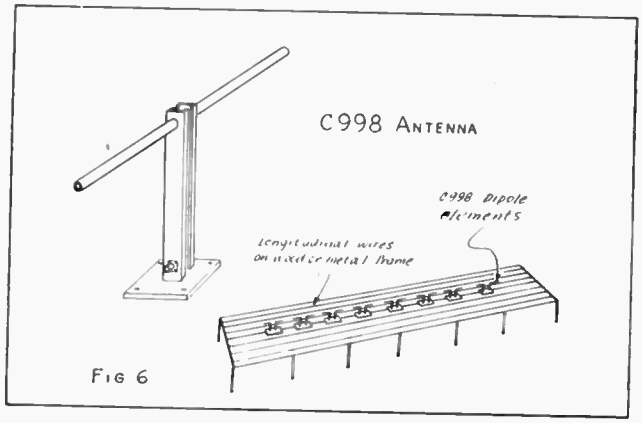


FIG 6

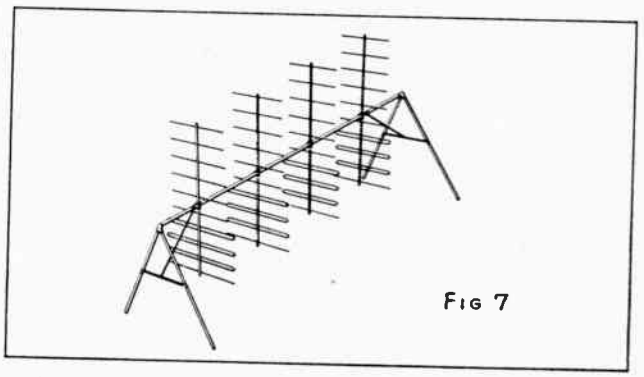


FIG 7

● C-998. This is an antenna of the cylindrical dipole type (Fig. 6) utilizing a split-tube balun. It has been developed specifically for use in conjunction with the simplified Mark II system. Reference 2. The array consists of eight individual dipoles arranged colinearly above a screen, interconnected with coaxial type cable and terminating in a 52 ohm type "N" connector. Because of its wide North/South pattern, this antenna is particularly advantageous for use well within the 36° North/South latitude belt. A rigid metal or wood frame for support of dipoles and ground screen must be constructed at the observation site, and is not furnished. As shown in illustration, the screen must be drawn taut and maintained in proper relationship to the dipoles. Full particulars are supplied with the antennas. C-997. The array shown in Fig. 7 consists of four ten element coaxial output yagi antennas furnished complete with phasing harnesses (mounting framework not included). Tandem mounting of the antennas lends itself to tilting of the array making this model especially desirable for location outside of the 36° North/South latitudes. Pivoting of the mounting support makes this design especially effective in tilting the array to anticipate the next pass of the satellite.

Contribution To Project Vanguard

● Dr. Martin Packard, left, director Varian Associates Instrument Division Research, and Dr. Russell H. Varian, inventor of the magnetometer booked for satellite flight, examine graphic tape recording of instrument's findings. Joyce McCabe examines "hat" of a model satellite, an appendage which will carry the coil or sensing element of the Varian magnetometer on its space trip.

A TINY new moon, man-made and earth launched, with expected greatest visibility about an hour after sunset and an hour before sunrise will soon be wheeling around the earth once every 90 minutes according to calculations of scientists engaged in the U.S. Navy's Project Vanguard.

Varian Associates, Palo Alto electronics firm, will participate in this dramatic chapter in scientific progress since their magnetometer, a device which measures the earth's magnetic field, will be one of the instruments carried in a 21½ pound satellite launched in the Vanguard program. The "artificial moon" is expected to describe an elliptical orbit around the earth from 200 to conceivably 1500 miles out in space. It will circle the earth 15 times each 24 hours, its path crossing the United States in 10 minutes.

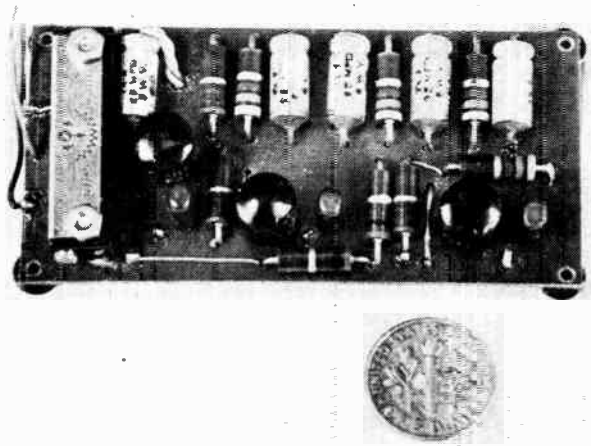
A Varian magnetometer in the satellite will provide a time record of the earth's magnetic field above the ionosphere and is expected to answer many important questions concerning magnetic disturbances which have a common origin with disturbances in vital radio communications. Commercially, the Varian magnetometers are used principally by geophysicists to help locate oil and mineral deposits.

Already being used in high altitude rockets for scientific research, Varian's proton free precession airborne magnetometer was selected by the Naval Research Laboratories for their Project Vanguard for its three primary advantages in applications such as installation in a rocket or satellite. Insensitive to orientation, the Varian magnetometer can be used in any position; needs no calibration; and is the only magnetometer able to transmit its measurements in the form of precession frequency which can be measured and recorded on the ground.

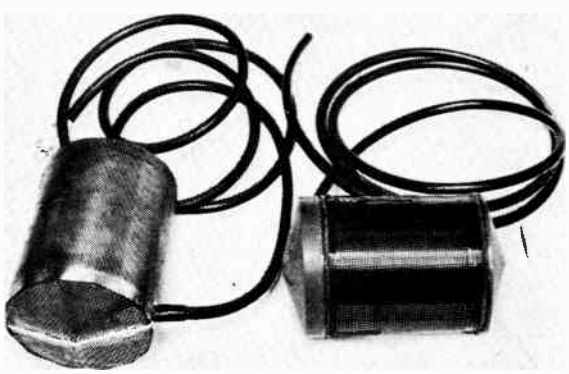
The Varian magnetometer was invented by Dr. Russell H. Varian and constitutes a unique method of utilizing the gyromagnetic properties of the nucleus of an atom. The device itself is ingeniously simple consisting essentially of a coil of wire immersed in a bottle of liquid containing hydrogen atoms such as water, kerosene, gasoline or alcohol. A light hydrocarbon with low freezing point will be used for the satellite flight.

Since protons act as if they were tiny spinning bar magnets, their function can be compared to that of the armature of an electric generator. As they precess like gyroscopes about the earth's magnetic field, these protons induce a current in the coil of wire surrounding them just as the rotating magnet or armature of the generator induces a current in its coil. Actual measurement of the magnetic field is made by determining the frequency of the current induced in the coil by the spinning hydrogen nuclei. This frequency is directly proportional to the strength of the earth's magnetic field. The current induced in the Varian magnetometer in the satellite is expected to range in frequency between 800 to 2200 cycles while circling at varying heights above the earth.

(Turn to page 26)



● Comparative size between a dime and Varian transistorized magnetometer amplifier for satellite.



● Coil dimensions for Varian satellite magnetometer.

Ultrasonic Technique For Drilling Ceramic Tube Spacers

A unique ultrasonic technique for drilling ceramic tube spacers has just been developed. The new process offers electronic manufacturers broader freedom of design by making possible, for the first time, volume production of close-tolerance ceramic parts with intricate configurations.

The C-Mar ultrasonic drilling process employs an electro-mechanical transducer that converts alternating current into mechanical force to vibrate the impact tool at 25,000 cycles per second. Particles of abrasive, introduced as a slurry between work and tool face, are driven with tremendous impact to reproduce an exact counterpart of the tool face in the workpiece. As a result, intricate orifices, multiple arrangements of holes and slots, and other complex configurations are cut into the workpiece in a single operation. Because the work is not chipped, spun, stressed or distorted, parts can be shaped to close tolerances with high piece-to-piece reproducibility.

A typical example of dramatic product design improvement resulting from the process is the case of a leading manufacturer of ruggedized tubes. Through the use of alundum spacers developed and machined by C-Mar, the company has reduced tube noise and has tripled the life of its tubes.

Formerly, the company used conventional mica spacers in tubes for radar, aircraft, guided missiles, submarines, television, and other critical applications. In addition to the mica spacers, ruggedized tubes contained an alundum (aluminum oxide) splash disk. These splash disks held up so well that a study was made of the feasibility of replacing the mica spacer disks with alundum.

The melting point of alundum was found to be 3750 F — far in excess of the 1757 F melting point of mica. For this reason, ceramic spacers would allow higher internal tube temperatures, more complete degassing, and quieter, longer life. The problem was to find a way to produce the disks, with their intricate configurations of slots and holes, at a reasonable cost. Molding was attempted, but was too expensive because of the high reject rate resulting from the inability to maintain close tolerances.

The tube manufacturer then employed the C-Mar contract ultrasonic machining service. C-Mar originally manufactured precision fluid flow meters using a unique ultrasonic method to machine clean, extremely accurate orifices in glass tubing. The service proved so successful that the

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● *Fig. 1.* All slots and holes are cut simultaneously as the tool drives abrasive into the ceramic spacer at the ultrasonic rate of 25 kc.

● *Fig. 2.* Skilled operator at C-Mar Corp. machines intricate configurations into alundum tube spacer disks. While the operator's right hand tunes the ultrasonic generator, his left hand controls tool feed into the work piece.

● *Fig. 3.* Life of this ruggedized tube is tripled by replacing conventional mica spacers with ceramic spacer disks. Aluminum oxide spacer at left was produced by C-Mar Corp., specialists in developing and manufacturing hard-to-machine ceramic components.

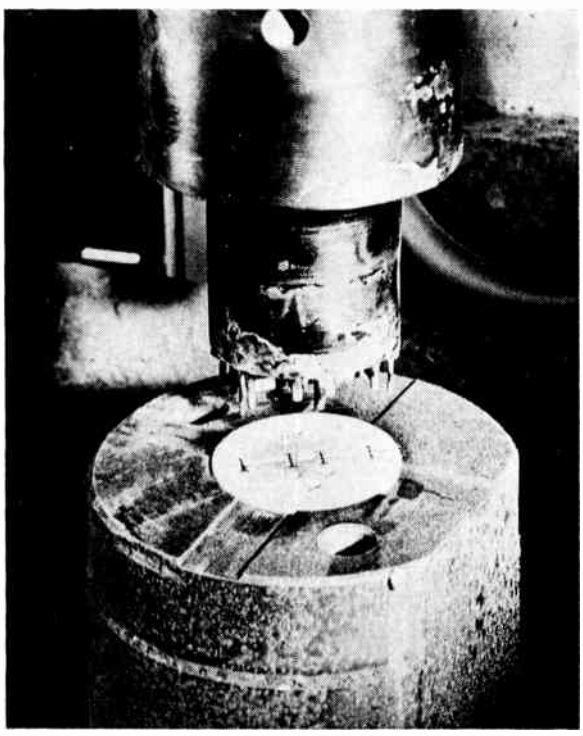


Fig. 1

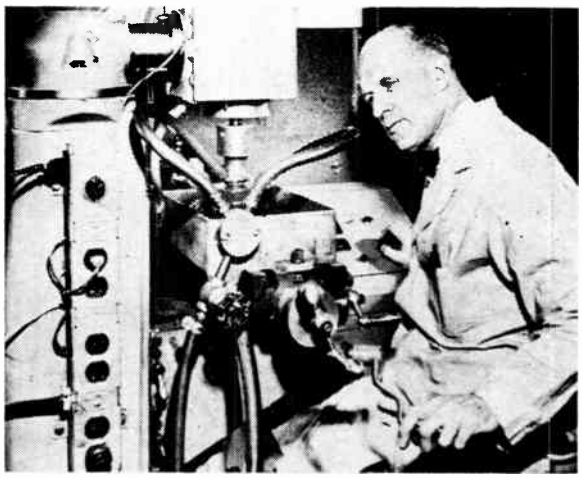
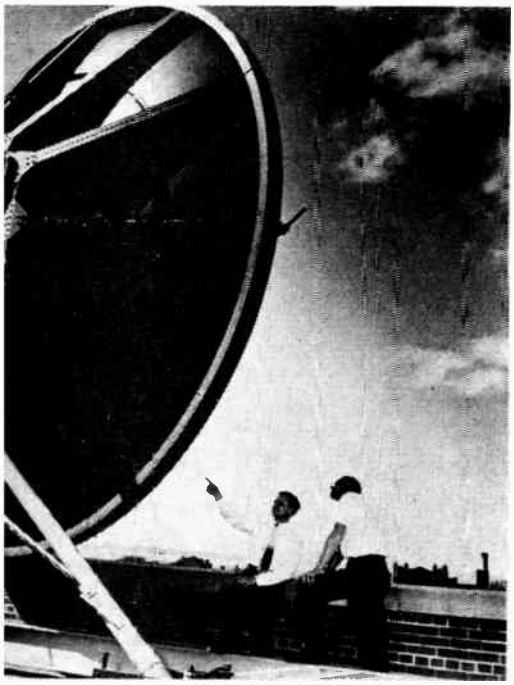


Fig. 2

Fig. 3



● Canadian Westinghouse electronics engineers who worked on year-long project to develop new communications system check positioning of transmitting antenna. It is aimed at Kinmount, Ont., 130 miles away from Hamilton. Tests were carried out between Hamilton and Kinmount.

Scatter Propagation

The First System To Be Completely Designed And Built In Canada

A CANADIAN-ENGINEERED electronics project recently made public by the Canadian Westinghouse Company, Hamilton, has produced a significant forward stride in the world of long-range communications. The development is a versatile new system of long-distance, multi-channel communication that sends signals far beyond the horizon by beaming them off the lower atmosphere.

First Canadian venture into the "scatter propagation" field of communication, the new system can be used for long-hop television, voice, teletype, facsimile or data transmission.

Company officials revealed conclusive performance tests have been completed between the Hamilton, Ont., electronics division and a portable unit operating 130 miles away in the vicinity of Kinmount. The erection of saucer-shaped transmitting antennas high atop the division building at Hamilton and the appearance at Kinmount of the portable unit generated wide speculation as to the purpose of the equipment.

Electronics division manager W. J. Cheesman said the development is considered a vital new key for Canadian northland communications. In addition, he said, it will mean increased efficiency and economy in transmission across long spans of remote territory throughout the world.

Result of a year-long concentrated engineering program, the system is the first to be completely developed, designed and built in Canada.

Mr. Cheesman stated that long range and transportability mark the new system as ideal for use in rugged and normally inaccessible regions. Microwave radio now employed is limited to line-of-sight transmission and costly relay stations must be used to cover appreciable distances. The new system can provide reliable, many-channel communication across 100-200 mile hops and requires no repeater stations within the span.

Essence of the "scatter propagation" technique is that when a very powerful radio beam is directed toward the horizon, some of its power is scattered to the earth, even hundreds of miles distant. Signals reach around the earth's curvature to receiving stations in much the same manner that the glow from oncoming headlights is seen over a hill. Scientists, however, are not in complete accord as to the cause of the phenomenon.

The technique has seen limited use but high costs and cumbersome equipment sharply restricted its practical application in isolated northern regions. The new Canadian-developed system overcomes both these limiting factors, according to Westinghouse engineers.

Previous scatter equipment has required antennas as large as 60 feet in diameter and weighing as much as 60,000 pounds. Typical antennas for the new system are 18 feet in diameter and may be as small as 12 feet. A complete transmitter-receiver unit is small and light enough to be helicopter-lifted.

The potential of this newest Canadian communication achievement as a tactical wartime device is estimated as significant. Performance is improved by fog and its sharp directive qualities, because of extremely narrow-beam transmission, provide a high degree of secrecy.

Contribution To Project Vanguard *(Continued from page 24)*

The United States Air Force presently has three Magnetic Observatories on the ground equipped with Varian magnetometers. These instruments are recording important information on the daily variations of the earth's magnetic field and in conjunction with the measurements obtained from the satellite will provide a valuable tool for determining location and strength of the currents responsible for magnetic storms at the ground level.

Varian's airborne magnetometer has already undergone one drastic size reduction from the original 150 pound model to about 22 pounds for the Aerobee Rocket tests where it is performing successfully in providing magnetic data obtained in the upper atmosphere.

The satellite installation of the Varian magnetometer will weigh approximately three pounds exclusive of the battery. It will consist of two parts; the "coil and sample," or sensing head, reduced to approximately two pounds in weight and half the size of the Aerobee magnetometer and the minified, transistorized, electronic portion designed to weigh about one pound.

Several ground stations will receive the telemetered data from the satellite on magnetic tape and will later use this information to give the magnetic field value at the position of the satellite when it is interrogated. The cycle of measurement from ground signal to recording of the telemetered data will be four seconds of each 90 minute cycle.

According to Dr. Martin E. Packard, director of research for Varian Associates' Instrument Division, the research group directly responsible for this most recent achievement in the magnetometer development includes: T. L. Allen, engineer in charge of the magnetometer group; Dolan Mansir, engineer in charge of the satellite magnetometer project; John Drake and Kelsey Robinson. Dick Derus is magnetometer applications engineer.

DR. GEORGE SINCLAIR

Technical Program Director
Canadian IRE Convention and Exposition

The Technical Program of the Canadian IRE Convention is without doubt one of the finest to be made available to the Canadian engineering fraternity and provides an opportunity for all engineers to acquaint themselves with the latest developments in the science of electronics.

The following program which outlines the 25 technical sessions comprised of 116 papers to be presented at this year's Canadian IRE Convention is a program that is worthy of the attention of every engineer.

Technical Program

Canadian IRE Convention, Oct. 16th to 18th, 1957

WEDNESDAY AFTERNOON, OCT. 16

Electronics for Guided Missiles

Paper No.

56 **Electrical Power Supply Units for Guided Missile Borne Electronic Equipment.**
D. B. Cannon, The De Havilland Aircraft of Canada Ltd., Toronto.

61 **Space Stabilization of Small Tracking Systems for Missile Guidance.**
Philip A. Lapp, The De Havilland Aircraft of Canada Ltd., Toronto.

77 **A Simple C. R. T. Presentation for a Flight Simulator.**
A. B. Johnson, Canadair Ltd., Montreal.

78 **The Importance of Simulators in the Design and Checkout of Guided Missiles.**
John E. A. Mortimer, Canadair Limited, Montreal, P.Q.

40 **A Rugged Telemetry System for Ballistic Ranges.**
David L. Duff, Canadian Westinghouse Co. Ltd., Hamilton.

Television Receiver Techniques

99 **A Television Signal Strength Meter of Novel Design.**
S. J. Gabzdyl, Canadian Radio Manufacturing Co., Toronto.

76 **A Television Pattern Generator.**
A. B. Johnson, Canadair Ltd., Montreal, P.Q.

100 **Design Considerations for a 21" Color TV Receiver.**
W. Kurz, Canadian Radio Manufacturing Co., Toronto.

35 **The Application of 110 Degree Picture Tubes.**
S. F. Love, Radio Valve Co. Limited, Toronto.

4 **The Property of Television Sync Separator Without and With Interference Pulses in the Composite Signal.**
E. Luedicke, RCA Victor Co. Limited, Montreal, P.Q.

Human Engineering

117 **Information Rates on Keyboards. Part A — Human Factors in the Design of Keyboards.**
M. Humphries and J. C. Ogilvie, Defence Research Medical Laboratories, Toronto.

118 **Information Rates on Keyboards. Part B — Experiments With a Ten-Key Keyboard.**
D. K. Ritchie, Ferranti Electric Ltd., Toronto, and H. C. Ratz, formerly Ferranti Electric Ltd., now Fischer and Porter, Toronto.

119 **Transfer Function Models For Human Operators.**
J. M. Ham, University of Toronto, Toronto, Ont.

120 **Changes in Parameters of an Equation Representing Human Perceptual-Motor Performance with Changes in Direction of Movement of Controls.**
A. H. Shephard, Dept. of Psychology, University of Toronto, Toronto.

High Frequency Components

27 **Small Size Microwave Duplexers and Filters for Airborne Equipment.**
B. Vural and J. A. Snitke, Canadian General Electric Co. Ltd., Toronto.

26 **Some Considerations on the Development and Design of Wide-Band Microwave Mixers Using Microstrip-line Components.**
B. Vural and J. Cappon, Canadian General Electric Co. Ltd., Toronto.

10 **Microwave Modulator Using Polarization Rotation.**
J. E. Bryden, Canadian Marconi Co., Montreal, P.Q.

36 **Video Ferrite Delay Line — Ferrite Phase Modulator.**
J. MacHill, General Electric Company, Auburn, N.Y.

63 **Graphical Method of Calculating Cascaded Microwave Networks.**
C. Adkar, Aircraft Div., Canadair Ltd., Montreal, P.Q.

Propagation

87 **Investigation of Horizontal Drifts in the E-Region of the Ionosphere in Relation to Random Fading of Radio Waves.**
B. Ramachandra Rao, Ionosphere Research Laboratories, Andhra University, India, and, M. Spriramo Rao, National Research Council, Ottawa.

93 **Effect on Short Wave Propagation of the Nature of Reflecting Ground.**
M. P. Bachynski, RCA Victor Company Ltd., Montreal, P.Q.

92 **Diffraction of Short Em Waves by Natural Obstacles with Smooth Crests.**
H. E. J. Neugebauer — and — M. P. Bachynski, RCA Victor Co. Limited, Montreal, P.Q.

49 **Path-Loss Testing of the Trans-Canada TD-2 Route.**
W. Von Hagen, A. N. MacDiarmid and L. V. Goldenberg, The Bell Telephone Co. of Canada, Montreal, P.Q.

131 **Measurement and Shielding of Electromagnetic Fields.**
J. Miedzinski, Department of National Defense, Ottawa, formerly, British Electrical and Allied Industries Research Association (ERA).

THURSDAY MORNING, OCTOBER 17

Canada's Part in the International Geophysical Year (IGY)

124 **The International Geophysical Year.**
Frank T. Davies, Defense Research Board, Ottawa.

112 **The IGY Auroral Program in Canada.**
Peter M. Millman, National Research Council, Ottawa.

111 **The Canadian Ionospheric Physics Program for the IGY.**
P. A. Forsyth, Defense Research Board, Ottawa.

125 **The IGY Radio Astronomy Program in Canada.**
D. A. MacRae, Dept. of Astronomy, University of Toronto, Toronto.

Computers and Data Processing

39 **An Analog Memory.**
Walter S. Kozak, Canadian Westinghouse Co. Ltd., Hamilton.

45 **New Components of Datatron System: Cardatron and Datafile and Their Applications.**
George Glinski, Burroughs Adding Machine of Canada Ltd., Ottawa.

2 **Altrec.**
S. Gould, Canadian Marconi Company, Montreal, P.Q.

55 **A Hysteresigraph for Testing Magnetic Materials Using Analog Computer Techniques.**
G. A. Charasz — and T. J. F. Pavlasek, Dept. of Electrical Engineering, McGill University, Montreal, P.Q.

129 **The Tacan Data Link.**
John F. Sullivan, Standard Telephones & Cables Mfg. Co., Montreal, P.Q.

Design for Manufacture

32 **Design for Manufacture.**
Maurice Conklin, Canadian General Electric Co. Ltd., Toronto.

31 **What! Another Engineering Change?**
G. L. King, Canadian General Electric Co. Ltd., Toronto.

Canadian IRE Convention — Technical Program

43 An Effective Material and Standards Programme Is a Management Responsibility.
M. J. McKerrow, Canadian Westinghouse Co. Ltd., Hamilton.

17 Some Fundamental Considerations in Starting a Quality Control Program.
J. B. Pringle, Bell Telephone Co. of Canada, Montreal, P.Q.

33 The Obtaining of Maximum Customer Acceptance of Electronic Equipment.
B. E. Davies, Canadian General Electric Co. Ltd., Toronto.

Medical Electronics I

121 Electronic Recording of Sensory Responses Resulting From Stimulation of the Organs of Balance.
W. H. Johnson, Defense Research Medical Laboratories, Toronto.

85 An Electronic Heart-Beat Simulator and a Cardiac Tachometer.
O. Z. Roy, National Research Council, Ottawa.

110 Oximetry.
William Paul, University of Toronto, Toronto.

Electronic Tubes

8 Factors Contributing to the Increase in Life Expectancy of Gaseous Discharge Visual Indicators.
John McCauley, Burroughs Corporation, Plainfield, N.J.

67 The Characteristics of Evaporated CdS and CdSe Photoconductive Cells.
D. A. Anderson, Canadian Marconi Co., Montreal, P.Q.

68 Applications of Photoconductive Cells in the Visible Light Range.
Z. Szepezi, Canadian Marconi Company, Montreal, P.Q.

65 A Direct Method of Investigating Pulsed Magnetron Stability.
N. J. Taylor, Aircraft Div., Canadair Ltd., Montreal, P.Q.

102 High Power Klystrons for Single Sideband Operation.
George M. W. Badger, Eitel-McCullough Inc., San Bruno, Calif.

THURSDAY AFTERNOON, OCT. 17

Panel Discussion on Engineering Education

Panel Members:
J. D. Ryder, Dean of the College of Engineering, Michigan State University, East Lansing, Mich.
Frank Noakes, Head of the Dept. of Electrical Engineering, University of British Columbia, Vancouver, B.C.
K. F. Tupper, Ewbank and Partners (Canada) Ltd., Toronto, Ont.
G. F. Tracy, Head of the Department of Electrical Engineering, University of Toronto, Toronto.

Communications Systems

16 The Status of Radio in Canada in the Common Carrier Telephone Field.
S. Bonneville, The Bell Telephone Co. of Canada, Montreal, P.Q.

48 The Use of Radio to Provide Telephone Service in Bush Country.
E. O. Tunman, The Bell Telephone Co. of Canada, Montreal, P.Q.

47 Restricted Common Carrier Mobile Radio Telephone Service.
R. Fortier, The Bell Telephone Co. of Canada, Montreal, P.Q.

46 Diversity Reception in UHF and Microwave Radio Systems.
A. J. Dinnin, The Bell Telephone Co. of Canada, Montreal, P.Q.

50 Practical Considerations of Combining Television and Telephone Signals on a Broadband Microwave Channel.
U. C. P. Strahlendorf — and A. J. Wade, The Bell Telephone Co. of Canada, Montreal, P.Q.

Symposium on Numerical Control of Machine Tools

132 Nultrax, a Very High Precision Linear Displacement Transducer and Some Applications.
F. Brouwer, Canadian Westinghouse Co. Ltd., Hamilton.

133 A Numerically Controlled Machine-Tool System.
E. C. Johnson and R. C. Sims, Bendix Aviation Corporation, Detroit, Mich.

134 A New Numerical Control Concept for Data Reduction in Aircraft Design.
D. E. Nuttall, Ferranti Electric Limited, Toronto.

135 Numerical Control in the Canadian Aircraft Industry.
Co-authors to be announced.

Medical Electronics II

122 A New Six-Channel Electromyograph for Studies on Muscle.
J. V. Basmajian, Dept. of Anatomy, University of Toronto, Toronto.

83 The Application of Transistors to a Portable Electrocardiograph.
R. S. Richards, National Research Council, Ottawa.

38 A Sensitive System for Measurement of Brain Responses in the Intact Human.
John F. Davis, Dept. of Electrophysiology, Allan Memorial Institute, Montreal.

Antennas

74 Duplexers or Decoupled Antennas?
A. H. Secord — and W. V. Tilston, Sinclair Radio Laboratories Limited, Toronto.

109 Dual Polarization Feed Horn.
D. J. LeVine — and L. A. Juhas, Standard Telephones and Cables Mfg. Co. (Canada) Ltd., Montreal, P.Q.

62 A Slotted Waveguide Antenna for Marine Radar Applications.
M. Katchky, Canadian Arsenals Ltd., Toronto.

19 The Radiation Characteristics of a Zig-Zag Antenna.
D. Sengupta, University of Toronto, Toronto.

80 A Two-Dimensional Array of Circular Holes.
G. C. McCormick, National Research Council, Ottawa.

FRIDAY MORNING, OCTOBER 18

Audio and Acoustics

6 Measurement of Audio Amplifier Internal Resistance.
W. H. Anderson, Toronto.

98 A New High Impedance Audio Output Circuit.
J. R. de Miranda, Phillips, Eindhoven, Holland.

114 A New Approach to Programme Sound Systems for Schools, Hospitals and Industry.
R. H. Tanner, Northern Electric Co. Ltd., Belleville, Ont.

127 The Acoustical Design of the Permanent Stratford Theatre.
R. H. Tanner, Northern Electric Co. Ltd., Belleville, Ont.

115 Acoustical Design of the Alberta Jubilee Auditoria.
T. D. Northwood, Division of Building Research, National Research Council, Ottawa.

Symposium on Professional Business Management

136 The Changing Concept of the Professional Manager.
W. A. Dimma, Asst. to Pres., National Carbon Company, Div. of Union Carbide (Canada) Ltd., Toronto.

137 The Skill of Functional Management.
C. R. Miner, Manager Monochrome TV Product Engineering, General Electric Company, Syracuse, N.Y.

138 Selecting Potential Professional Managers.
H. Moore, Ph.D., Director, Psychological Service Centre, Toronto.

139 The Kind of Management Which Stimulates Professional Growth.
P. Humeniuk, Manager, Radio and TV Operation, Canadian General Electric Co. Ltd., Toronto.

Radio Astronomy

79 Solar Radio Astronomy.
A. E. Covington, National Research Council, Ottawa.

14 Lunar Radar Echoes.
B. C. Blevis, D.R.B., Defence Research Telecommunications Establishment, Shirley Bay, Ottawa.

126 Scintillation Measurements.
W. D. Ryan, Royal Military College of Canada, Kingston, Ont.

60 The Design and Construction of a K-Band Spectrometer for the Measurement of Absolute Intensity.
J. A. Fulford and J. H. Blackwell, Dept. of Physics, University of Western Ontario, London, Ont.

Radio and Television Techniques

3 Video Recording Tape.
L. F. Bennett, Department of National Defense, Ottawa.

23 System Design of Large Television Stations.
A. L. Reeve, Canadian General Electric Co. Ltd., Toronto.

22 Modular TV Transmitter Design.
M. L. Falk and C. C. Nicholson, Canadian General Electric Co. Ltd., Toronto.

5 The Vapotron.
H. G. Towlson, General Electric Co., Syracuse, N.Y.

24 Design of Single-Layer Coils for Transmitters.
J. Soul, Canadian General Electric Co. Ltd., Toronto.

Nucleonics I

59 Characteristics of an Electron Synchrotron for Atomic Research.
H. Janzen, Queen's University, Kingston, Ont.

58 Electronics of the McGill Synchrocyclotron.
W. H. Martin, Radiation Laboratory, McGill University, Montreal, P.Q.

103 Proposed Experimental Use of a 10-MEV Tandem-Style Van de Graaf Accelerator.
H. E. Gove, Atomic Energy of Canada Ltd., Chalk River, Ont.

104 Electronics in Reactor Operations.
A. Pearson, Atomic Energy of Canada Ltd., Chalk River, Ont.

130 The Atomichron: An Atomic Frequency Standard.
J. H. Holloway, National Company, Inc., Malden, Mass.

FRIDAY AFTERNOON, OCTOBER 18

Symposium on Brainstorming

Panel discussion under Mr. C. Watt, Canadian General Electric Co., Toronto, Ont.

Transistor Electronics

94 The Equivalent Circuit of the Drift Transistor.
J. Almond, RCA Victor Company Ltd., Montreal.

9 A Transistor Controlled Susceptance.
M. L. Blostein & H. W. Baumans, Canadian Marconi Co., Montreal, P.Q.

116 A Transistorized Regulated Power Supply Design.
D. J. McLean, G. E. Reesor and S. V. Soanes, Ferranti Electric Ltd., Mount Dennis, Ont.

57 A Regenerative Type Frequency Divider Using Semiconductor Devices.
D. P. Henderson, Defense Research Board, Ottawa.

44 The Design of a Transistorized 60 Watt Low Frequency Amplifier.
D. G. W. Mace and R. N. Blunt, Canadian Westinghouse Co. Ltd., Hamilton, Ont.

Nucleonics II

106 Some Gas-Filled Radiation Counters Used in Reactor Instrumentation.
I. L. Fowler, Atomic Energy of Canada Ltd., Chalk River, Ont.

Canadian IRE Convention — Technical Program

107 An Automatic Sample Changer and Printing Scaler.
W. D. Howell, Atomic Energy of Canada Ltd., Chalk River, Ont.

108 Some Applications of an Analog Computer in Nuclear Reactor Studies.
J. G. Bayly, Atomic Energy of Canada Ltd., Chalk River, Ont.

105 A Fast Gray Wedge Analyzer for High Input Rates.
J. T. Flynn and F. A. Johnson, D.R.B. Suffield Experimental Station, Suffield, Alberta.

128 Fault Analysis of Nucleonic Equipment.
R. B. Shields, Atomic Energy of Canada Ltd., Chalk River, Ont.

Microwave Measurement Techniques

53 A Broadband Standing Wave Ratio Analyser.
S. Presentey, T.M.C. (Canada) Limited, Ottawa.

84 Laboratory Method of Constructing Lossy Microwave Components.
A. Staniforth, National Research Council, Ottawa.

81 Absolute Microwave Power Measurement in the Milliwatt Ranges.
R. F. Clark, National Research Council, Ottawa.

54 An Automatic Phase Plotter for the Measurement of Microwave Fields.
T. J. F. Pavlasek, Dept. of Electrical Engineering, McGill University, Montreal, P.Q.

28 A Method of Calculating the Characteristic Impedance of a Microstripline to a Given Degree of Accuracy.
R. G. deBuda, Canadian General Electric Co. Ltd., Toronto.

Components

69 Gina — An Automatic Test and Recording Apparatus for Rotational Noise of Variable Resistors.
F. J. F. Osborne and H. J. Moody, Canadian Marconi Company, Montreal, P.Q.

71 Performance and Reliability of Fixed Carbon Composition Resistors.
H. J. Moody and F. J. F. Osborne, Canadian Marconi Company, Montreal, P.Q.

113 A New Metal Film Precision Resistor.
R. C. Langford, Weston Electrical Instrument Corp., Newark, N.J.

73 Quartz Crystal Units in Glass HC-6/u Style Holders for Improved Performance and Reliability.
D. M. Eisen, Canadian Radio Manufacturing Corp., Ltd., Leaside, Toronto.

18 Automatic Electronic Boiler Control.
M. Gladden, Newfoundland Light & Power Ltd., St. John's, Nfld.

Date and Time	SESSIONS				
	Room 1	Room 2	Room 3	Room 4	Room 5
Wednesday October 16 2:30 p.m. - 5:00 p.m.	ELECTRONICS FOR GUIDED MISSILES	TELEVISION RECEIVER TECHNIQUES	HUMAN ENGINEERING	HIGH FREQUENCY COMPONENTS	PROPAGATION
Thursday October 17 10:00 a.m. - 12:30 noon	CANADA'S PART IN THE IGY	COMPUTERS AND DATA PROCESSING	DESIGN FOR MANUFACTURE	MEDICAL ELECTRONICS I	ELECTRONIC TUBES
Thursday October 17 2:30 p.m. - 5:00 p.m.	PANEL ON ENGINEERING EDUCATION	COMMUNICATIONS SYSTEMS	SYMPOSIUM ON NUMERICAL CONTROL OF MACHINE TOOLS	MEDICAL ELECTRONICS II	ANTENNAS
Friday October 18 10:00 a.m. - 12:30 noon	AUDIO AND ACOUSTICS	SYMPOSIUM ON PROFESSIONAL BUSINESS MANAGEMENT	RADIO ASTRONOMY	RADIO AND TELEVISION TECHNIQUES	NUCLEONICS I
Friday October 18 2:30 p.m. - 5:00 p.m.	BRAIN-STORMING	TRANSISTOR ELECTRONICS	NUCLEONICS II	MICROWAVE MEASUREMENT TECHNIQUES	COMPONENTS

Facts about the Institute of Radio Engineers

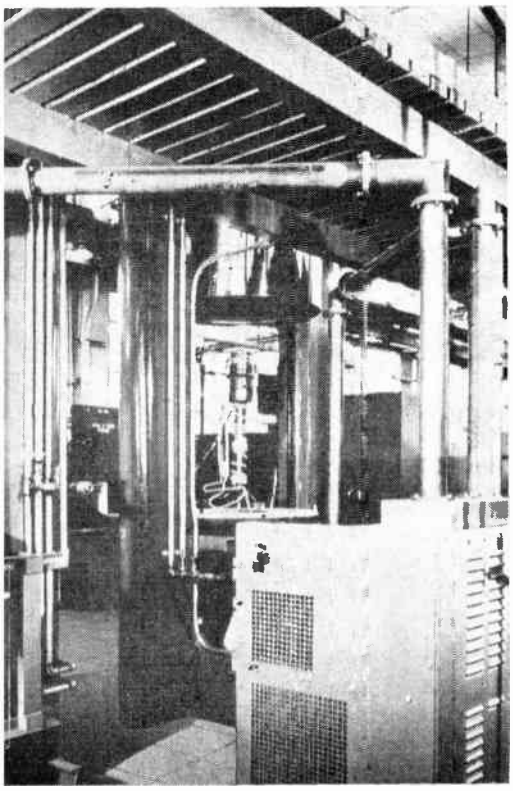
The IRE, founded in 1912, is an international technical society established for the advancement of the theory and practice of radio and electronics, including allied branches of engineering and the related arts and sciences.

The headquarters is in New York but Canada has always been well represented on the Board of Directors and various committees. In fact, this year a Canadian engineer, Dr. J. T. Henderson, is President of the Institute.

There are over 55,000 members of IRE of which some 2100 are residents in Canada. The first Section in Canada was formed in Toronto in 1925. There are now twelve Sections (and two sub-sections) distributed from Vancouver to St. John's, Newfoundland.

The first International IRE Convention was held in Toronto in 1930. In 1949 the Canadian Region of IRE held a technical convention with exhibits also in Toronto, followed the next year by a technical meeting in Montreal The attendance at this 1949 meeting was 700.

In 1956, to commemorate the 30th anniversary of IRE in Canada, a very successful convention was held in Toronto at which the attendance exceeded 10,000. Details of the organization and functions of this meeting are available elsewhere, suffice it to record here that its success was so outstanding that it has been decided to hold an IRE Canadian Convention annually. This year it will be held again in the Automotive Building at the C.N.E. on October 16th, 17th and 18th and plans are already afoot for succeeding conventions in Toronto and elsewhere in Canada where IRE activity is increasing.



● An installation in which coaxial cable has been used to effectively solve many of the inherent electrical problems previously encountered in induction heating.

The Use Of Coaxial Cable In Induction Heating

Induction heating is now being used for a wide variety of industrial applications. A typical example is found in the electron tube production area of Hughes Aircraft Company in California, where this principle is used to heat the metal elements inside the cathode-ray tube, thereby driving off the gases. The heating is done with the tube placed in a vacuum device which removes these gases from the envelope.

Induction heating requires high power and relatively high frequency. This combination creates problems in power transmission. Hughes Aircraft engineers, working with Andrew Corporation, manufacturers of transmission lines, found that coaxial cable can be used to effectively solve many of the inherent electrical problems previously encountered.

The frequency of operation is usually 10 KC or higher. At these frequencies, the current is concentrated near the surface of the conductors. Currents of 300 to 400 amperes are common. With this combination of high frequency and high current, the reactance of the transmission line system becomes a very important factor. It is important to choose transmission line having minimum reactance because large voltage drops may be frequently experienced in the line.

Andrew coaxial cable has a lower reactance than the commonly used bus bars or open-wire lines and therefore provides a more efficient electrical system.

This is illustrated by the following test results obtained by various cables carrying 220 amperes:

500 MCM size std. strand varnished cambric cable,

2060 watts loss, 144 volts drop

250 MCM size std. strand varnished cambric cable,

2170 watts loss, 311 volts drop

=0 size std. strand varnished cambric cable,

1870 watts loss, 74 volts drop

500 MCM size coaxial cable,

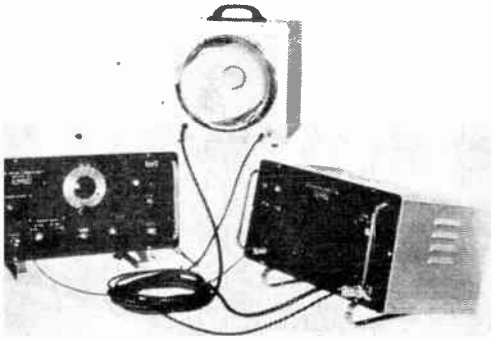
1520 watts loss, 28 volts drop.

It should also be noted that bus bars and open-wire line couple large amounts of energy to nearby metallic supports, structural members and other lines, causing undesirable heating and additional loss of power. This is completely eliminated by the use of coaxial cable.

A further factor to be considered is the radio frequency interference that may be produced by an induction heating installation. Due to the high power involved, harmonics of the operating frequency, with spurious noise, can be propagated over distances of several miles. This can seriously interfere with radio, television, microwave and other electronic systems in the vicinity. The use of coaxial cable virtually eliminates such radiation from the transmission line system.

Slow Motion Stroboscope In Vibration Testing

The Slow Motion Stroboscope is a wide range, high intensity stroboscope enabling resonances in equipment under vibration test to be viewed in slow motion, independent of the drive frequency.



The equipment consists of a variable frequency oscillator and a high intensity stroboscope. The oscillator provides a sine wave output to drive a separate power amplifier and vibration generator.

When the stroboscope is triggered at precisely the same frequency as the signal used to drive the vibrator generator, the component under test will appear to be quite stationary. Thus resonances will show up in one phase only and may be difficult to detect.

If the stroboscope is triggered at a constant difference frequency which is slightly less than the vibration frequency, the component will be viewed later in each cycle and will appear to move slowly in the normal direction of travel.

The constant difference frequency required to achieve this slow motion effect is obtained by using a motor-drive, continuously variable phase-shifter between the oscillator and the stroboscope trigger circuit.

To provide a difference frequency of one cycle per second independent of the main oscillator frequency, the phase-shifter is arranged to introduce 360° per revolution and is driven at one revolution per second.

This facility is of particular value in the examination of components and assemblies subjected to vibration tests where it is necessary to observe in detail the individual resonances which may arise over a wide band of frequencies.

A further feature of the equipment is the very high repetition rate of 500 c/s, which is achieved by the use of a special circuit to operate the flash tube.

news of the industry

RETMA Elects Executive Officers

The electronic manufacturers elected their executive officers for 1957-1958 at the 28th annual meeting of the Radio - Electronic - Television Manufacturers Association of Canada held on June 21 at Ste. Adele-en-haut, Quebec.

W. H. Jeffery was elected president of the Association. Mr. Jeffery is vice-president and general manager of Philco Corporation of Canada Ltd. and has been in the Canadian electronics industry for nearly 30 years.

Other executive officers for the year are: Vice-President and Chairman of Receiver Division - S. D. Brownlee, Canadian Admiral Corp. Ltd.; Vice-Chairman of Receiver Division - W. F. Wansbrough, Canadian General Electric Co. Ltd.; Vice-President and Chairman of Components Division - A. L. Stopps, El-Met-Parts Ltd.; Vice-Chairman of Components Division - J. Key, Aerovox Canada Ltd.; Vice-President and Chairman of Electronics Division - W. Jones, Pye Canada Ltd.; Vice-Chairman of Electronics Division - R. M. Robinson, Canadian General Electric Co. Ltd.

R. A. Hackbusch of Hackbusch Electronics Ltd. was re-appointed Director of Engineering and F. W. Radcliffe continues as General Manager and Secretary.

←

● *Top:* Robert C. Sprague, Chairman, Sprague Electric Co., North Adams, Mass., is shown addressing the annual gathering of RETMA at Ste. Adele-en-haut, P.Q.

● *2nd:* John D. Campbell, Past President, shown delivering his annual report.

● *3rd:* W. H. Jeffery, newly-elected President of the Association, presents Mrs. Campbell with a bouquet of flowers.

● *4th:* R. A. Hackbusch, re-appointed Director of Engineering of the Association, is shown addressing the banquet gathering.

● *Bottom:* W. H. Jeffery is shown making presentation to J. D. Campbell, retiring president.

←

J. R. Longstaffe Co. Represents Pace Inc.

J. R. Longstaffe Co. Ltd., of 300 Campbell Avenue, Toronto 9, Ontario, recently announced their appointment as Canadian representatives for Pace Incorporated of Mansfield, Ohio.

Pace Incorporated manufacture all types of thermostats, both adjustable and non-adjustable.

Canadian IRE Convention Plans Progress

Engineers and scientists from the U.S. and abroad, as well as from coast to coast in Canada, will attend the 1957 IRE Canadian Convention being held in Toronto October 16-17-18, C. A. Norris, P.Eng., General Chairman, announced.

"The Convention Committee has organized a most interesting and comprehensive program of technical papers and exhibits, which make it by far the largest scientific event in the country. We are confident that this year's attendance will surpass the 1956 total of 10,038," said Mr. Norris.

Dr. George Sinclair, Chairman of the Technical Program Committee, announces that there will be 25 sessions in all, embracing 116 papers, covering the interests of all IRE members. The majority of the papers are by Canadian engineers.

The feature session will be devoted to a description of Canada's part in the International Geophysical Year, with emphasis on the interests of the radio engineer. One session which is expected to draw considerable attention is a symposium on professional business management, which will deal with the new concept of the professional manager.

A closely related symposium will include a demonstration on the techniques of idea generation by "brainstorming", as applied to specific problems in the electronics industry. Two sessions on nucleonics will focus attention on the part Canada is playing in this important field.

All Convention activities, with the exception of the banquet, will be held in the Automotive Building at Exhibition Park, Toronto. Providing an exhibit area of 120,000 square feet in addition to meeting halls, restaurant, cocktail lounge and ample parking, the facilities equal any to be found on the continent for this type of program. The opening of two new hotels in Toronto since the last convention assures delegates of ample first class accommodation.

WacLine, Inc. Appoints Canadian Representative

Radionics Limited, of 8230 Mayrand St., Montreal 9, Quebec has been appointed exclusive Canadian representative for WacLine, Inc. of Dayton, Ohio.

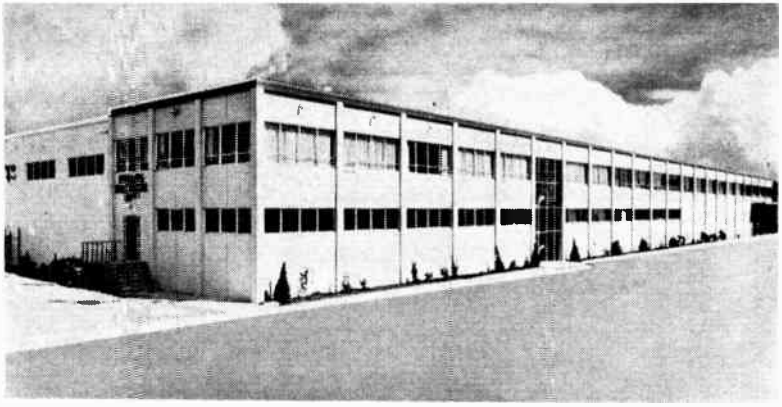
WacLine manufactures a broad range of ruggedized and hermetically sealed 2½" and 3½" meters, tachometer generators, adjustable speed drives and dummy loads, most being manufactured in accordance with military specifications.

NEWS

Phillips Electrical Company Open Vancouver Plant

The new Vancouver plant of the Phillips Electrical Company was officially opened on July 4. Situated at 8330 Chester Street, at the intersection of Fraser Street and Marine Drive in Vancouver, the new plant will manufacture wire and cable for the Electrical, the Communications (telephone and telegraph), and the Construction Industries. The plant will be all plastic, i.e. - it will apply Polyvinyl Chloride (PVC) or Polyethylene insulation or jackets to the wires and cables made. Phillips was the first Canadian company to recognize the tremendous importance of this change to plastics from the rubber, paper, and cotton insulation of the past. The recent rapid developments in the plastics industry are providing more and better varieties of plastics insulation all the time.

Phillips has been interested in the development of the west coast for many years. Following the war, Phillips began to consider the possibility of establishing a plant in Vancouver to provide prompt service and deliveries for their many customers without involving the long delay and costs encountered in operating at a distance of 3200 miles away. This plant would be of value to Prairie and Pacific Coast consumers alike. It would also be used to manufacture for export to the Orient. After weighing these considerations carefully the decision was made to locate the plant in Vancouver.



● New Phillips factory in Vancouver City.

National Electric Products Appoints Canadian Rep.

A. R. Robinson and Associates, Toronto, has been named exclusive sales agent for the distribution, in Canada, of part of the extensive line of electrical raceway systems, floor boxes and fittings manufactured by National Electric Products Corporation of Pittsburgh, Pa.

A. A. ROBINSON

The agreement was made public in a joint announcement by L. D. Shank, general sales manager, and A. A. Robinson, head of the Canadian distribution firm.

A. A. Robinson and Associates maintain offices at 132 Front Street East, Toronto, with branch offices in Montreal, Winnipeg, Ottawa, Calgary and Vancouver.

Mr. A. A. Robinson has been a manufacturer's representative in the Canadian electrical industry for a number of years.

Pye Canada Limited Widens Representation

W. Jones, managing director of Pye Canada Ltd., has recently announced new appointments that his company has received to represent United States firms in Canada.

The complete line of television studio equipment manufactured by Conrac Inc., of Glendora, California, will be sold exclusively in Canada by Pye Canada Limited, who will be responsible for all sales promotion and national advertising.

Wickes Engineering and Construction Co. of Camden, N.J., engaged in the development, manufacture and sale of color studio equipment to television stations, has appointed Pye Canada Limited on an exclusive basis to represent it in Canada.

A further appointment is by Nems-Clarke, Inc. of Silver Springs, Maryland, manufacturers of television transmission equipment including video jack panels, television rebroadcast receivers and field intensity meter and test sets. All sales promotion and advertising will be handled by the Canadian company.

All the above appointments are effective immediately.

Westinghouse Delegate To European Conferences

Harry Thomasson, manager of the metallurgical-mechanical research laboratory at Canadian Westinghouse, was recently honored by selection as a delegate and speaker to the first British Commonwealth Welding Conference held in London, England.

During June Mr. Thomasson represented Canada at the important conference that brought together metals experts from throughout the Commonwealth for a study of problems and research.

Technical papers presented to the conference covered all phases of metals joining. Mr. Thomasson's paper, "The Boundary Zone Factor in Arc Welding", dealt with significant research recently carried out at the Canadian Westinghouse laboratory. Under his direction, the metallurgical-mechanical laboratory serves to help overall company manufacturing processes by keeping production trouble-free and attempting to anticipate production problems.

Instronics Ltd. Appoints Sales Manager

Instronics Limited announces the appointment of Ronald W. Price to the position of Ontario sales manager.

Effective July 1st, Mr. Price opened an office at 21 Benleigh Drive, Scarborough, and will be responsible for the Ontario area exclusive of the Ottawa Valley.

R. W. PRICE

Mr. Price brings to Instronics broad experience in the fields of engineering, procurement, and sales. He leaves the post of Canadian sales manager of C. P. Clare and Company — a position he has held for the past two years — prior to which he was associated with Measurement Engineering Limited and Canadian Arsenals.

"Empress Of England" Uses Canadian Decca Chain

Newest ship of the Canadian Pacific Steamship fleet, the "Empress of England" was the first commercial user of the "Moose" West Decca chain recently installed on the south coast of Newfoundland.

The "Moose" West chain is the first of four chains being set up in Eastern Canada by Computing Devices of Canada Limited, and Decca Navigator (Canada) Limited. Others, to be completed late this summer, will cover most of the east coast and the St. Lawrence River as far as Montreal.

Bendix-Decca is an area coverage navigation system, operating from fixed land stations providing a grid of accurate position lines covering one million square miles with the currently planned four chains of stations. It gives continuous position and track information to ships and aircraft without the need for taking conventional fixes. Accuracies are of the order of yards.

Also a first for the "Empress of England" on this voyage was the sea trial of Dectra, a long range version of Decca. Though intended primarily for aircraft use, Dectra gives continuous coverage across the Atlantic, and so is expected to have applications to ships as well.

NEWS

Canadian Admiral Corporation Appointment

Stuart D. Brownlee, executive vice-president of Canadian Admiral Corporation Ltd. recently announced the appointment of J. Albert Reed as branch manager of the Montreal sales office.

Mr. Reed joined Canadian Admiral in 1952 as sales representative. He was appointed sales manager of the Montreal branch in 1954.

Daystrom Limited Open Canadian Plant

The establishment of Daystrom Ltd., to handle sales, service assembly and manufacture of Daystrom electronic products in Canada has been announced by William Westphal, president of Daystrom International Division of Daystrom, Inc.

Mr. Westphal outlined a program that will lead to the establishment of a manufacturing facility in the Toronto area employing several hundred people and capable of turning out a large volume of electrical and electronic instruments for use by Canadian industry.

"We are now established here to provide sales and service facilities for all of Daystrom. Our next step will be the assembly of Daystrom equipment and this will be started as quickly as possible. By 1960, we plan to have a large-scale Canadian manufacturing operation here to supply the growing Canadian market," Mr. Westphal said.

Daystrom Ltd. has also established a sales and service center in Toronto for customers of Daystrom's Heathkits. Electronic "do-it-yourself" kits for amateur radio fans, high fidelity enthusiasts and radio and TV servicemen are now available directly from Daystrom Ltd., either by mail order or in person at the service center, Mr. Westphal announced.

Daystrom's Weston electronic products will still be handled in part by Northern Electric, Mr. Westphal said. "However, Daystrom Ltd., will sell to original equipment manufacturers and handle special orders." Aircraft equipment made by Daystrom Pacific and Daystrom Transicoil will also be sold through Daystrom Ltd. The manufacture of such highly technical aircraft and guided missile items as gyros and accelerometers is contemplated as an early development in Canada.

Westinghouse Engineering Appointment

The appointment of G. P. Adamson as engineering manager for the Canadian Westinghouse Company's Electronics Division, Hamilton, Ont., has been announced by division manager, W. J. Cheesman.

Mr. Adamson, who was formerly manager of electronics defense contracts, will now be responsible for all divisional engineering and research facilities.

G. P. ADAMSON

Prior to joining Canadian Westinghouse, Mr. Adamson served with the Canadian Army and for several years was engaged with the Directorate of Armament Development in design, development and production of electronic equipment.

He succeeds S. S. Schneider who has been named manager of the newly-formed switchgear products division at Westinghouse.

CGE Appointments Announced

Two important appointments have recently been announced by Canadian General Electric Company Limited.

Vice-president Charles A. Morrison, formerly general manager of the Wholesale Department, will report to Board Chairman Harold M. Turner and in his new capacity will be concerned with broad company marketing problems, working in close cooperation with the nine operating departments and departmental sales organizations on a national scale. Mr. Morrison, who was elected a vice-president in 1951, has had over 25 years of marketing experience in all the company's major product lines.

Walter G. Ward succeeds Mr. Morrison as general manager of the Wholesale Department. Mr. Ward, who is a widely-known electrical industry executive with extensive management experience in the electronics, appliance and apparatus segments of the industry, will report to CGE President James H. Goss.

Both Mr. Morrison and Mr. Ward will have their headquarters at the company's head office in Toronto.

Battery Company Enters Canadian Field

Mallory Battery Company of Canada Ltd. with premises at 228 St. Helen's Avenue, Toronto, will shortly be introduced in Canada. Announcement was made by Alex McGill, president of the new company, which was formerly General Dry Batteries of Canada Limited. Although the latter company name has been discontinued, Mr. McGill said that General Dry Batteries as such will continue to be manufactured along with the new Mallory label.

The Mallory name, although unfamiliar to the average Canadian, is respected by those in the electronic field in Canada. Since its establishment in the United States in 1916, P. R. Mallory & Co. Inc. has had an important part in the development of products and technology in the basic sciences of electronics, metallurgy and electro-chemistry.

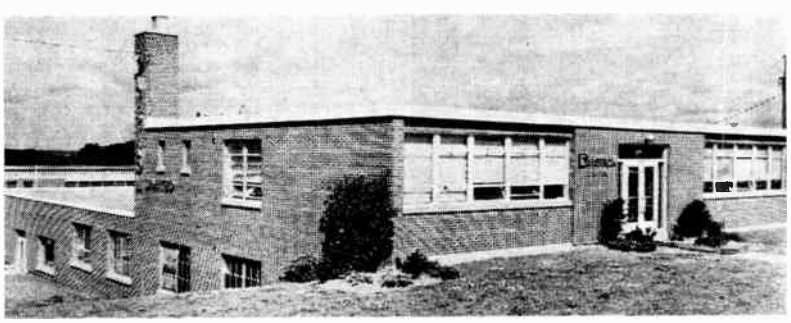
Although future plans for sales, development and marketing of Mallory Batteries in Canada have not yet been announced, Mr. McGill reports that the new company will play an active and influential part in the Canadian market.

West Coast Radio Interests Form Council

Formation of a Western Canada Telecommunications Council was recently announced by A. J. Spilsbury, president of Spilsbury & Tindall Limited, Vancouver, on behalf of a group of West Coast radio users and manufacturers.

Mr. Spilsbury, chairman of the new organization, says the new Council will provide a much needed vehicle for co-ordinated representation of West Coast communications problems to the authorities at Ottawa, especially the Department of Transport. It will also provide a forum for the exchange of information and discussion of problems affecting use and manufacture of radio in Western Canada.

With an estimated 75 per cent of all radiotelephones in use in Canada being used in British Columbia, an important function of the Council will be to deal with matters of licensing, regulations, frequency allocations and technical design specifications which are continually being handed down by the Federal Government.



● The recently completed manufacturing plant of Daystrom Ltd. at 840 Caledonia Road in Toronto in which Daystrom Ltd. plan the manufacture of aircraft and guided missile components.

NEWS

New Division For Beckman Instruments

The formation of a new Systems Division has recently been announced by Dr. Arnold O. Beckman, president of Beckman Instruments, Inc., as the result of expansion prompted by increasing sales of electronic data systems for industrial automation. Dr. Beckman reported that sales of industrial systems had doubled for his organization in the last fiscal year and that a three-fold increase in orders is expected for the coming year.

The new Systems Division will have its headquarters and manufacturing facilities at Anaheim, California, in addition to a plant in Richmond, California. This unit will bring to seven the number of divisions operated by Beckman in California. Beckman Instruments Inc. is represented in Canada by R.O.R. Associates Limited of Toronto.

JOHN GHIKAS

● The appointment of John Ghikas as contracts manager, Sperry Gyroscope Company of Canada Ltd., is announced. Mr. Ghikas has had extensive sales and contract administration experience in both industrial and government fields.

New TelePrompTer Engineer

Bruce Emonson has recently joined the engineering staff at TelePrompTer of Canada Ltd., 447 Jarvis St., Toronto 5, Ontario.

A recent arrival from England, Mr. Emonson has had wide experience in television service, specializing in TV projection.

At TelePrompTer Mr. Emonson will handle electro-mechanical servicing of the firm's Canadian installations, and assist in their extensive closed-circuit activities.

Northern Alberta Railroad Tests New Cable

Field tests, conducted under severely adverse conditions including heavy wet snow and the actual collapse of a number of poles, have been completed on the first 130 miles of A. C. S. R. polyethylene coated cable supplied to the Northern Alberta Railroad by Western Wire & Cable Co. of Vancouver. Although in places the cable was lying in the snow during the tests, communications were not interrupted and transmission losses were less than over a conventional copper circuit tested under ideal conditions.

This section of 130 miles of cable is part of a 250 mile installation running north from Edmonton. The use of this new cable is of special benefit to the isolated northern communities where dependable communications are vital.

The initial cost is lower than for copper, and additional benefits result from reduced maintenance costs and the continuity of revenue made possible by the elimination of interruptions in service.

IRE London Section Visits Varian Plant

The London Section of the Institute of Radio Engineers combined its May meeting with a field trip to the plant of Varian Associates at Georgetown, Ontario, manufacturers of Klystron tubes.

Some thirty odd members were welcomed on behalf of their hosts by Jim Court, general sales manager. Following dinner, a tour of the plant pointed up many novel and ingenious production methods, particularly those directed to maintaining the exceptionally high level of cleanliness in all stages of assembly.

After some discussion by the engineering staff on design problems of current and proposed types, the meeting concluded with a summary by Mr. Court of the various types in production and their uses.

Ohmite To Build Plant Addition

Construction of a new addition to the Ohmite Manufacturing Company's plant, at 3601 Howard Street, Skokie, Illinois, begins in July.

According to Mrs. D. T. Siegel, president, the new company will increase manufacturing facilities by 42,000 square feet. The expansion is the third in fifteen years for this company, a leading manufacturer of electrical and electronic components.

The increased space provided by the new addition will be used for expanding production on the standard Ohmite products and for manufacturing new products recently developed by the company.

Vitramon, Inc. Appoints Canadian Distributors

Vitramon, Inc. of Bridgeport, Connecticut, manufacturers of vitreous-enamel capacitors, has broadened its service to manufacturers by appointing jobbers in the principal industrial market centers of the United States and Canada.

Primarily a customer service, this new policy will enable industrial users to get immediate delivery of small orders for research, prototype, pilot and small-production runs of electronic equipment requiring the stability, physical ruggedness and immunity to environmental conditions provided by Vitramon porcelain capacitors.

Among the group of seven distributors whose appointment was announced by Mr. Cliff Tuttle, Vitramon sales manager, is Electro-Sonic Supply Company Ltd. of Toronto, Ontario.

L. G. HARDAKER

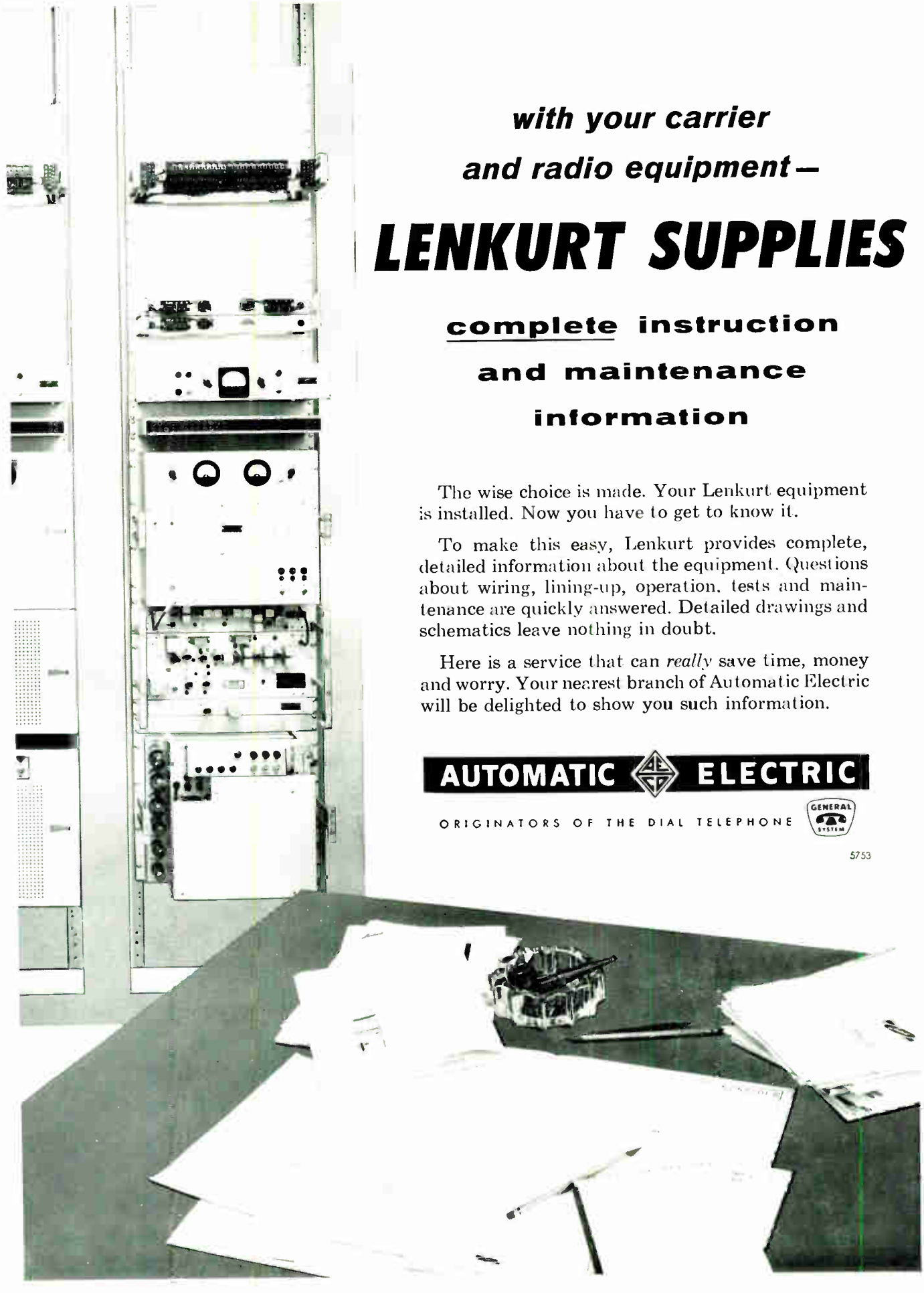
● The appointment of L. G. Hardaker as Ottawa district manager has been announced by J. H. Pryce, general sales manager, Canada Wire and Cable Co. Limited. M. C. Irwin, for many years Ottawa district manager, has assumed less arduous duties for the company in the Ottawa area due to his health.

Manson Joins Measurements Corporation

Walter B. Manson, Jr., has been named assistant to Harry W. Houck, president of Measurements Corporation, Boonton, New Jersey, manufacturers of electronic test equipment.

Mr. Manson has acquired broad experience in the engineering, manufacturing and merchandising of electrical and electronic products of Thomas A. Edison Industries of McGraw-Edison Company. He joins Measurements in connection with its program of expansion to fill the growing need for laboratory standards.

(Turn to page 40)



with your carrier

and radio equipment—

LENKURT SUPPLIES

complete instruction and maintenance information

The wise choice is made. Your Lenkurt equipment is installed. Now you have to get to know it.

To make this easy, Lenkurt provides complete, detailed information about the equipment. Questions about wiring, lining-up, operation, tests and maintenance are quickly answered. Detailed drawings and schematics leave nothing in doubt.

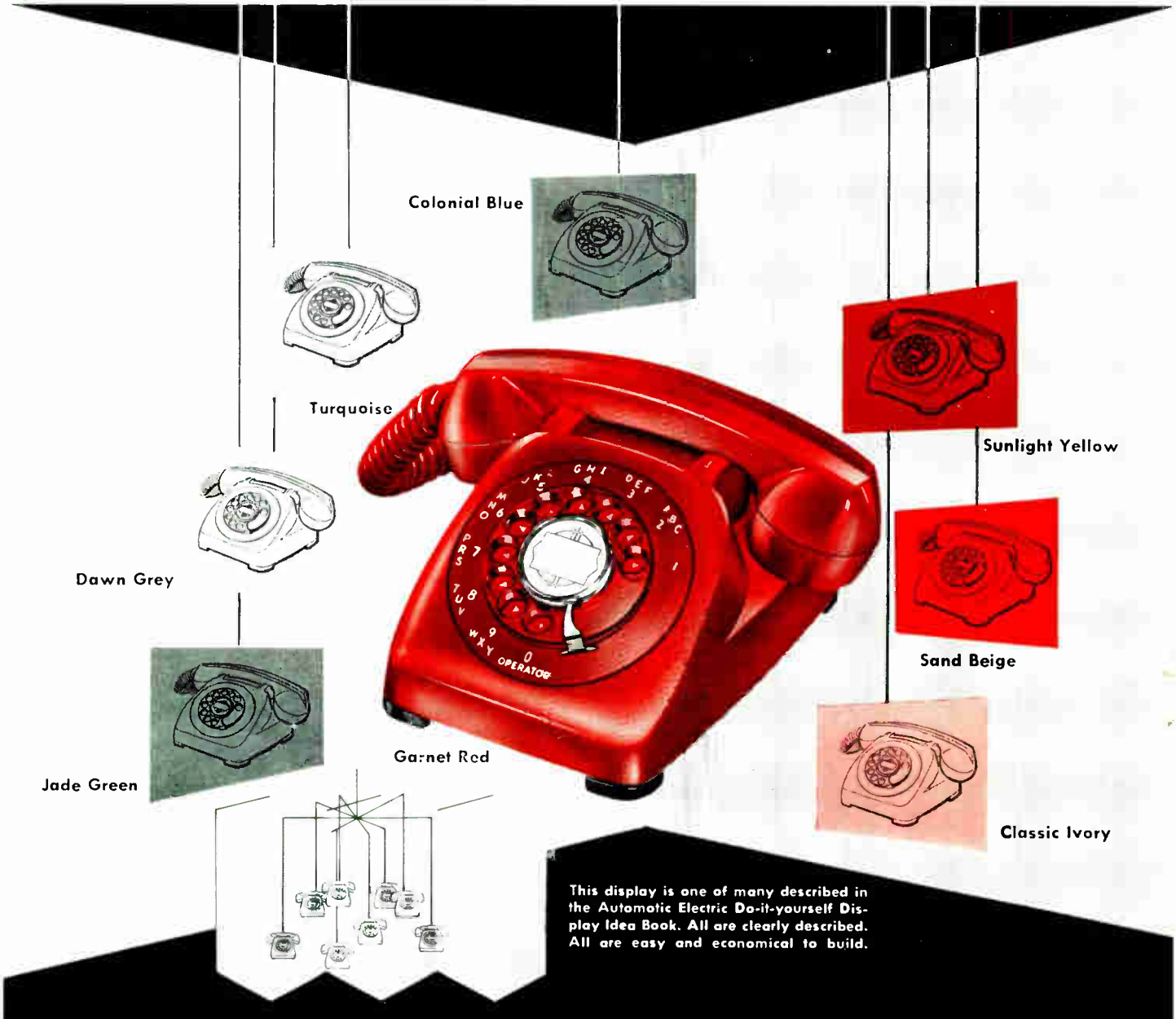
Here is a service that can *really* save time, money and worry. Your nearest branch of Automatic Electric will be delighted to show you such information.

AUTOMATIC ELECTRIC

ORIGINATORS OF THE DIAL TELEPHONE

GENERAL SYSTEM

5753



This display is one of many described in the Automatic Electric Do-it-yourself Display Idea Book. All are clearly described. All are easy and economical to build.

to sell MORE telephone service sell COLOUR!

You can sell more telephone installations, more extensions . . . when you offer your subscribers 8 harmonizing telephone colours to choose from! In modern homes, stores and offices people use colour to create new dimensions in living. Telephones in decorator colours that blend or contrast with desks, counter tops, kitchens, dens, bedrooms, and living rooms are literally "causing a sensation". So to sell more telephone service, sell colour!

these valuable aids from AUTOMATIC ELECTRIC will help you sell the new type 80 Monophone in all eight colours!

COUNTER OR WINDOW STAND-UP DISPLAY

Features the Type 80 Monophone, in full colours. Sells subscribers (when they pay their bills) and passers-by! Available free.

TELEPHONE COLOUR SELECTOR

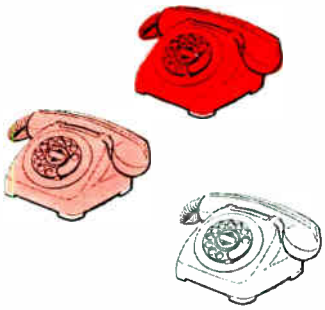
Outline of Type 80 on clear plastic—with all eight Automatic Electric decorator colours attached. Easily carried in wallet. Price 25¢ each.

DIRECT MAIL LITERATURE

A 4-page brochure *in full colour*. Lets your subscribers see the complete range of Type 80 Monophones. Available free.

INVOICE STUFFERS

that double as easily-pocketed counter literature. In full colour. Does a strong sales job. Available free.



MINIATURE TYPE 80 PHONES

in all eight Automatic Electric Colours—Sand Beige, Garnet Red, Dawn Grey, Sunlight Yellow, Turquoise, Classic Ivory, Colonial Blue and Jade Green. Use these miniatures as counter or window display material—or as samples to subscribers who are seriously thinking about coloured units. $15.00 for a set of eight.

DO-IT-YOURSELF DISPLAY IDEA BOOK

Contains many practical ideas for eye-catching window displays you can build yourself. Available free.

5754

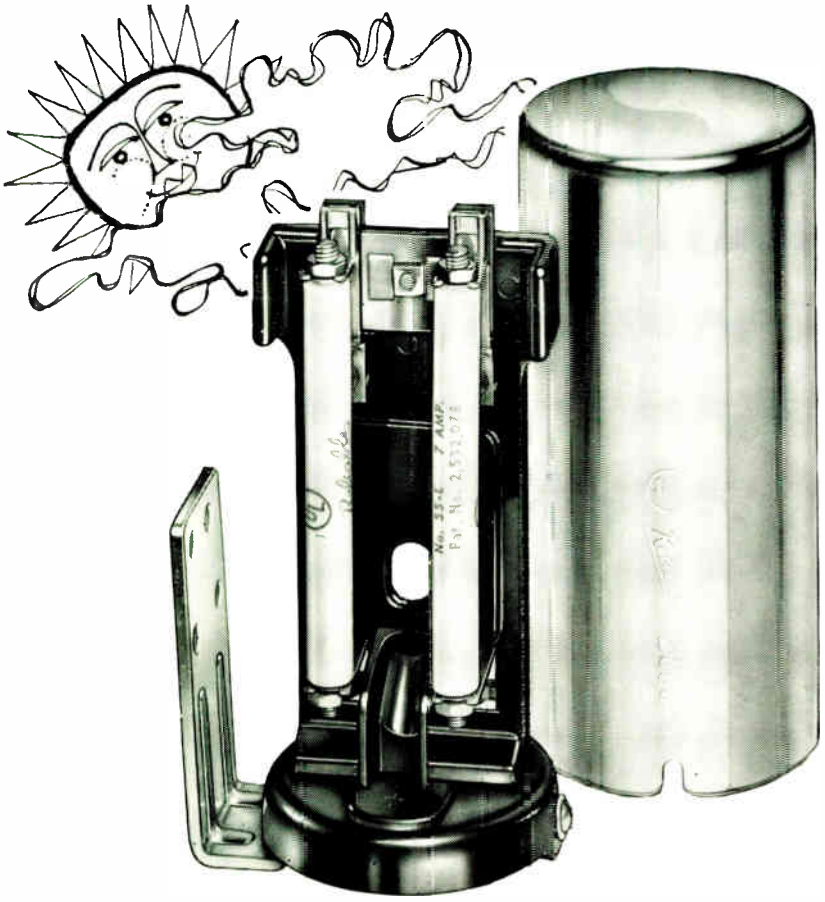
*For full information about these useful sales aids or the new, coloured Type 80 Monophone, write our nearest branch office. **Head Office:** Automatic Electric Sales (Canada) Ltd., 185 Bartley Drive, Toronto 16. Branches in Montreal, Ottawa, Brockville, Hamilton, Winnipeg, Regina, Edmonton, Vancouver.*

MADE IN CANADA BY

AUTOMATIC ELECTRIC

ORIGINATORS OF THE DIAL TELEPHONE

GENERAL SYSTEM



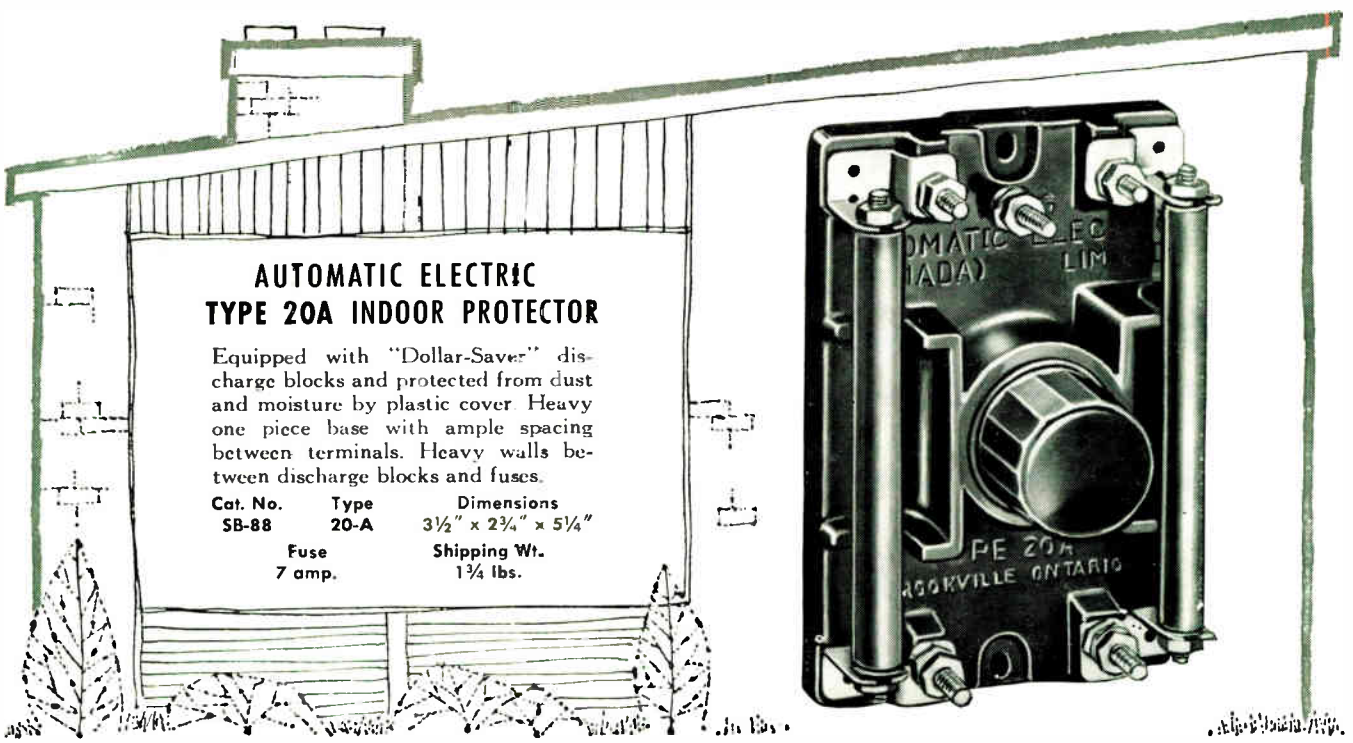
ECONOMICAL SUBSTATION PROTECTORS

RELIABLE 2000 SERIES OUTDOOR PROTECTOR

Provides simple, neat installations. Can be wired and mounted without removing fuses or brackets. Unbreakable, bakelite fuse mount. Neoprene base with entrance sealing slots combine with rustproof aluminum cover to keep out insects, dust, rain and moisture. Available with either P-495 Sawtooth block —or Type 70 "Dollar-Saver" Discharge block. Please specify when ordering.

Cat. No. S-8290
Type 2000
Dimensions 3½" x 3" x 7"
Fuse 7 amp.
Shipping Wt. 1¼ lbs.

FOR OUTDOOR AND INDOOR INSTALLATIONS



AUTOMATIC ELECTRIC TYPE 20A INDOOR PROTECTOR

Equipped with "Dollar-Saver" discharge blocks and protected from dust and moisture by plastic cover. Heavy one piece base with ample spacing between terminals. Heavy walls between discharge blocks and fuses.

Cat. No.	Type	Dimensions
SB-88	20-A	3½" x 2¾" x 5¼"
Fuse		Shipping Wt.
7 amp.		1¾ lbs.

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

AUTOMATIC ELECTRIC
SALES (CANADA) LIMITED

5755

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 55. Just mark the products you are interested in on the coupon on Page 55 and the information will be in your hands within a few days.

• *Metal Film Precision Resistor* *Item 1600*

International Resistance Co. Limited announce the availability of a new molded Metal Film Precision Resistor.

This resistor, presently available in two sizes (½ watt MEC and 1 watt MEF) has a metallic resistive film firmly bonded to a specially compounded ceramic core.

It is designed to surpass the requirements of MIL-R-10509B, characteristic A, and is particularly suitable for the following applications:

1. Where a low controlled temperature coefficient is required.
2. Where the application calls for low inductance, and/or shunt capacitance.
3. Where the size of precision wirebound resistors is not tolerable.
4. Where a low noise resistor is necessary.
5. Where the application calls for a combination of high stability on load in addition to temperature coefficient requirements as in (1).
6. Where close tracking of the resistance values of two or more resistors over a wide range of temperature is desired.
7. Where the application requires good high frequency performance combined with accuracy and stability.
8. Where application calls for high stability under severe humidity conditions.

Type MEC ½ watt is available from 100 ohms to 0.5 megohms and type MEF 1 watt is available from 100 ohms to 2.0 megohms.

For complete details with regard to these new Metal Film Precision Resistors write for catalog Bulletin B3, **International Resistance Co. Ltd., 349 Carlaw Ave., Toronto 8, Ontario, Canada.**

• *D-729-B Low Frequency Phasemeter* *Item 1601*

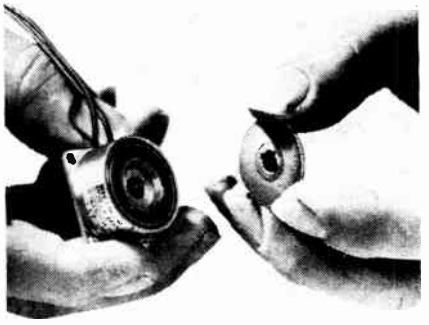
The requirements of the rapidly expanding field of servo engineering and the subsequent interest in frequencies below 1 c/s are met by the D-729-B Low Frequency Phasemeter which has a lower frequency limit of 0.5 c/s. The design is very similar to the D-729-A Phasemeter, the only marked difference being the change in frequency range. Measurements of the phase change and gain of passive and active networks and the input/output characteristics of servo systems may be made with the D-729-B Low Frequency Phasemeter without imposing any appreciable load on their sources. Direct indication of the phase angle and the difference in level, between two substantially sinusoidal voltages, is made possible by arranging that the two voltages are adjusted to the same predetermined level — the vector sum then becoming a function of phase angle only. Both voltages may be measured and, for distorted wave-forms, sockets are provided between which a frequency selective device may be connected. With this arrangement, the fundamental (or other specific frequency) may be selected and phase, level and voltage measurements may be made using the phasemeter indicator in the normal manner.

The D-729-BS Power Supply Unit is mounted in a separate case and connected to the D-729-BM Phasemeter by a flexible multi-core cable, which enables the power unit to be stowed beneath the bench, thereby reducing the amount of working space required by the instrument.

Muirhead Instruments Limited, Stratford, Ontario, Canada.

• *Electro-Magnetically Operated Clutch* *Item 1602*

A new electro-magnetically operated miniature clutch designed for use on low torque drive of instruments and miniaturized control mechanisms is announced by Warner Electric Brake & Clutch Company, Industrial Division, Beloit, Wisconsin. The model designation for the clutch is SF-100. The unit gives instantaneous, positive engagement and release of loads up to two lb. in. (static torque rating). Axial length of the unit is only ⅞ in. and diameter is 1⅛ in.



No slip rings or brushes are required for the SF-100 clutch since the flange-mounted field is connected through pigtail leads to a 28- or 90-volt d-c source. In the clutch, torque is transmitted through the rotor to the armature which may be keyed to the driving or driven member. Power required is 6 watts maximum.

Mounting requirements for the flange-mounted unit are extremely simple. All that is required are four holes for ⅛ in. capscrews, equally spaced on a 1⅝ in. bolt circle.

Warner Electric Brake & Clutch Company, Industrial Division, Beloit, Wisconsin, U.S.A.

• *Three High Frequency Transistors* *Item 1603*

The General Electric Company has disclosed the development and initial commercial production of three new high frequency transistors that are expected to extend the applications for transistors into equipment now limited to vacuum tubes. Included among some of the possible applications are TV sets, radar, and two-way radio transmitters and receivers.

The three new transistors are germanium tetrodes, that is they have four leads for connecting to an electronic circuit. One of the new transistors is designed to amplify a 120 megacycle radio signal — the highest frequency yet attainable in a mass-produced transistor, according to General Electric engineers.

The new tetrodes are produced by the meltback process invented by scientists at G.E.'s Research Laboratory in Schenectady, N.Y., and developed by engineers in the company's Semiconductor Products Department at Syracuse, N.Y.

The secret of the very high frequency performance of these transistors lies in the use of this process. Layers of "p"-type germanium are produced which are so thin that twenty such layers would be required to equal the thickness of a single magazine page. Thus connections to this layer must be made by means of a very fine wire. The special wire used is one-quarter the size of a human hair. However, the transistor can still withstand many times the amount of shock required to render a vacuum tube inoperative.

The tetrode transistors are hermetically sealed in an all-metal case of welded construction and having glass-to-metal seals for highest reliability. The transistor package is designed for use on printed wiring boards without need for outside mechanical support.

The three new transistors have been designated 3N29, 3N30 and 3N31. With a common base connection and a bandwidth of 2 megacycles, they are rated for a minimum of 10 db. gain respectively at 30 megacycles, 120 megacycles and 15 megacycles.

Maximum collector dissipation for all three units is 50 milliwatts at 25°C. They are rated for operation at a maximum junction temperature of 85°C. The allowable collector voltage for the three devices is 7 volts. For receiver local oscillator use, the 3N29 has an oscillating frequency of 50-60 mcs; the 3N30 will oscillate at over 200 mcs., and the 3N31 at 30 to 40 megacycles.

For complete information concerning Semiconductor requirements, contact **Canadian General Electric Co. Ltd., Tube Marketing, 189 Dufferin Street, Toronto, Ontario.**

• *Two-Pole Mercury Plunger Relay* *Item 1604*

An increasing demand for the new SPST MiniRelay MR-10 recently announced by Ebert Electronics Corp. of Queens Village 28, N.Y. indicated a wide need for a DPST version. The MR-14 MiniRelay is the fulfillment of that demand, offering high load capacity and compactness of construction in a low cost mercury plunger relay. Each contactor tube of the MR-14 is rated at 1.5 Hp. or 20 Amperes at 115 volts, 10 Amperes at 230 Volts and 5.2 Amperes at 440 Volts, A.C. In D.C. operation they are rated for loads up to 6.5 Amperes at 120 Volts and 3.5 Amperes at 220 Volts, or ⅓ Hp. Any combination of normally open or normally closed contacts is available. Actuating coils are supplied in most standard voltages.

The Ebert MR-14 combines rugged construction and compact design with the many advantages of Ebert's own simple, silent, service-free mercury-to-mercury contact action. The MR-14 was created for those power control applications where the use of a DPST relay is advisable or required due to space, circuitry or economy factors.

Carefully designed for space economy in single or multiple installations, the overall size of the MR-14 is only 4½" H x 2⅜" W x 1¼ " D. All terminals are up front and easily accessible. Meeting approved electrical and spacing standards, the MR-14 has been tested and proven in use in control of varied general purpose, motor and resistive loads, without de-rating.

For further particulars and prices write to the Canadian representative: **Leonard Electric Ltd., 346 Bering Ave., Toronto, Ont.**

(Turn to page 43)

A. E. TROLLOPE

H. E. SOULIS

R. G. SNYDER

R. A. TAYLOR

• Thomas A. Edison of Canada Limited announce the following new appointments at their Toronto district office, 32 Front Street West: Howard E. Soulis, account executive; Ronald G. Snyder, sales representative; Roderick A. Taylor, sales representative; Arthur E. Trollope, sales representative. Mr. Soulis has come to Edison after a number of years as president and general manager of Soulis Limited. Halifax-born, he is a past director for the Maritimes Office Machine Dealers Association. Mr. Snyder, a graduate of Toronto Central Technical School, was formerly branch sales manager of Home Provisioners. Mr. Taylor was formerly assistant manager of Industrial Acceptance Corporation Limited. Mr. Trollope, a graduate of the University of Toronto, was formerly director of accommodation, Inspection Department of the Dominion Automobile Association.

Field And Noise Intensity

Empire Devices Products Corporation have announced plans to hold a noise and field intensity seminar in Ottawa September 9th. The seminar will deal with techniques and instrumentation in the frequency range 14 KC/s and up. For reservations and details contact Instronics Limited, P.O. Box 51, Stittsville, Ontario.

McMaster Appoints PR Counsel

Clifford W. Hale has been appointed by McMaster University as public relations counsel, according to an announcement by Dr. George P. Gilmour, president of the university.

For further data on advertised products use page 55.

NEWS

Aviation Electric Appoints Sales Manager

The appointment of C. Durham Garbutt as sales and service manager of Aviation Electric Limited has been announced by A. Bandi, president of the company.

Mr. Garbutt takes over the duties formerly carried out by D. R. Taylor, recently named director of Engineering Products Division.

C. D. GARBUTT

Mr. Garbutt, who joined Aviation Electric Ltd. in 1951 as a sales and service representative, brings to his position more than twenty years of experience in the aviation industry, ten of which were spent in the production, maintenance and inspection branches of B.O.A.C., during which time he became well acquainted with fleets of United States and British aircraft on both sides of the Atlantic.

Engineering Professors' Conference

Department heads of electrical and mechanical engineering faculties at thirteen Canadian universities recently met in Peterborough to attend an Engineering Professors' Conference arranged by Canadian General Electric Company Limited.

The two and one half day program featured an engineering symposium in which recent developments in motors and generators, switchgear and industry control, power transformers, electronic equipment and general applied research were discussed.

Electronic Enterprises Representation Appointments

J. C. Conway of Electronic Enterprises Regd., 551 Oakwood Avenue, Toronto 10, Ontario, has announced that Electronic Enterprises Regd. have been appointed representatives in Canada for the Universal Transistor Corporation, Westbury, Long Island, N.Y. The products manufactured by the company include a comprehensive range of standard transistorized power supplies. Much of this company's activity is devoted to the production of specialized power supplies to customers' specifications, and these are being used in large quantities in both missile and aircraft applications in the United States.

Electronic Enterprises Regd. have also been appointed representatives for Dawe Instruments Ltd. of England for Toronto territory.

Western Division For Bogen-Presto

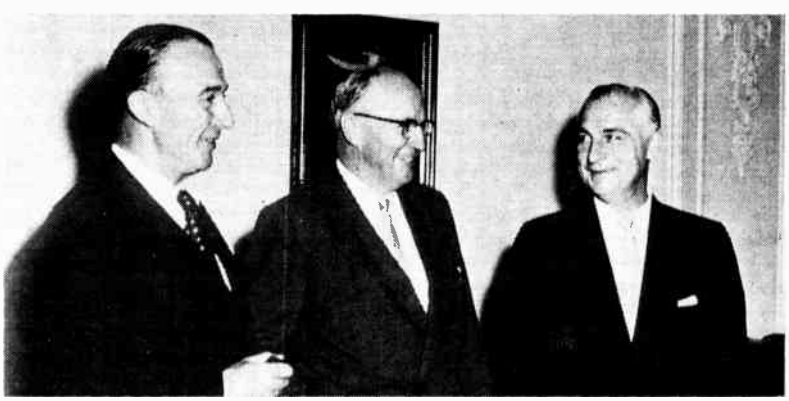
Chas. L. Thompson, president of Chas. L. Thompson Ltd., North Vancouver, B.C., has announced the appointment of his company as sales representatives in Western Canada for David Bogen Inc. and Presto Recording Corp. of Paramus, N.J.

The territory to be covered is a new sales division recently set up by Bogen-Presto and consists of the four western Canadian provinces — Manitoba, Saskatchewan, Alberta and British Columbia.

David Bogen Inc., which is celebrating its 25th anniversary in the sound industry this year, has specialized in that field with public address amplifiers, inter-communication and school sound systems and high fidelity equipment.

Presto Recording Corp., also a division of Unitronics Corp. and now associated with Bogen, has a long record in the manufacture of high quality turn-tables and recording equipment.

"Creation of this new territory by Bogen-Presto," says Mr. Thompson, "points out the rapidly increasing importance of Western Canada as a separate marketing area. The establishment of a sales office in the territory should result in a healthy increase in the sales of both brands."



● Triple alliance in electrical industry — represented by the three smiling gentlemen above — has been formed by three companies with interest in Telecables & Wires Ltd., Fort Garry, Manitoba, the first plant to manufacture telephone cables in western Canada. Attending the first annual meeting of the company in Toronto was (left to right) Sir John Dean from the U.K. company, the Telegraph Construction & Maintenance Co. Ltd.; O. W. Titus, president, Telecables & Wires Ltd. and Canada Wire & Cable Company Limited, Toronto; and J. R. MacDonald, president, General Cable Corporation of the U.S. The association of the three leading wire and cable firms in the world, provides an unparalleled access to the finest technical and research facilities of two continents.

For further data on advertised products use page 55.

NEWS

Appointment

W. W. LANGLEY

W. W. Langley has recently joined R. H. Nichols Limited as sales representative, specializing in supervisory control equipment. He was formerly associated with Amalgamated Electric Corporation Limited and Northern Electric Company Limited, having previously attended the University of Manitoba. During the past 20 years, Mr. Langley has concentrated on the sale of electrical distribution equipment and power apparatus, and during the war, served with the Royal Canadian Electrical and Mechanical Engineers.

Appointment

MICHAEL K. SCHURTER

The appointment of Michael K. Schurter as assistant chief engineer, Federal Wire and Cable Division is announced by Harold F. Nunn, vice-president, H. K. Porter Company (Canada) Limited. Mr. Schurter joined the plant engineering staff at Federal Wire and Cable in 1948 as assistant plant engineer after graduating from the University of Toronto with the degree B.A.Sc., in Electrical Engineering.

For further data on advertised products use page 55.

NEW PRODUCTS

• *Transistor Inverter Power Supply*

Item 1605

Using modern power transistor technique and applying packaging experience gained in guided-missile engineering, the Canadian Westinghouse electronics division has developed a rugged, lightweight transistor inverter power supply. It is particularly valuable in the field of airborne electronics and other highly mobile equipment, for the transistor inverter can be used as a direct replacement for mechanical inverters as a source of ht voltage from low voltage dc supplies.

The absence of moving parts in the transistor inverter means fewer mechanical breakdowns and electrical breakdowns, and conservative design-rating of electrical components. It also offers weight and size-savings demonstrating a weight saving factor of as much as 10-1 and a volume-saving factor of 3-1 over conventional supplies.

In addition, the overall efficiency of the unit is approximately 60 per cent higher than the mechanical type and is capable of withstanding shocks up to 70 G's for 10 milliseconds on its three principle axis.

The output voltage can be designed from 500 to 1000 volts dc, and output power from zero to 150 watts under continuous operation. High pulse powers are available up to 400 watts depending on application and duty cycle. Standard operation is from 20 volts to 30 volts source. However, other input voltages can be accommodated if necessary.

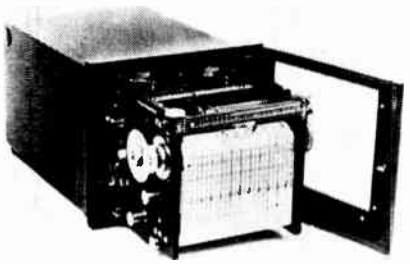
Output voltage regulation of five per cent from one-quarter load to full load standard on all output voltages. Input line voltage variations of plus or minus 10 per cent result is not greater than 10 per cent variations in output voltage at full load power. Improved regulation of 1% can be achieved if desired.

For additional information please contact **Electronics Division, Canadian Westinghouse Company, Hamilton, Ontario.**

• *Miniature Recording Potentiometer*

Item 1606

This new recording potentiometer features two pens, both writing margin to margin on a single 5-inch strip chart, producing two continuous records in a smaller space than that previously required for two 3-inch recorders and with better accuracy.



The recorder is available with one front set limit switch and three back set limit switches on each pen. The amplifiers are completely transistorized, requiring less volume and maintenance than ordinary vacuum tube amplifiers.

The instrument features such specifications as 0.5 per cent accuracy on each pen, sensitivity 0.14 per cent of scale span, maximum source impedance of 1000 ohms per MV of span, MV or TC calibration, case extends only 13 inches behind the panel face.

Optional features include transmitting slidewires, quick change or manual change gears for 3 speed chart drive, selsyn motor, or synchronous motor chart drive, automatic reference junction compensation, table or panel mounting and margin marker pens.

Westronics, Inc. 3605 McCart St., Fort Worth, Texas, U.S.A.

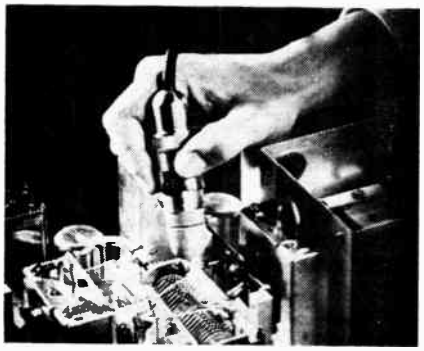
NEW PRODUCTS

• *Irradiated Polyethylene For Voltmeter Probe Tips*

Item 1607

Hewlett-Packard Company, West Coast electronics firm, has switched from polystyrene to irradiated polyethylene for the production of high frequency vacuum tube voltmeter probe tips. The switch was made to enable the tips to withstand cracking at low temperatures due to the different rates of expansion of the imbedded electronic components. This low temperature stress cracking exposed the internal parts to moisture and was the major limitation of the polystyrene material.

Polyethylene eliminated the low temperature cracking problem, however, the tendency of conventional polyethylene to flow at high temperatures restricted its use under high ambient conditions and in applications where the probe tips are soldered directly into the electronic circuits under test.



To provide a substantial increase in high temperature resistance Hewlett-Packard and Applied Radiation Corporation engineers bombarded sample polyethylene probe tips with high speed electrons from ARCO's eight-million volt linear electron accelerator. Tests indicated the high temperature resistance of the probe tips was increased to about 250°F with little effect upon the resistance to low-temperature cracking, afforded by the flexible properties of conventional polyethylene. As a result of these and other tests, Hewlett-Packard has adopted the improved irradiated tip as standard on its widely used line of vacuum tube voltmeters.

Represented in Canada by **Atlas Radio Corporation, Ltd., 50 Wingold Ave., Toronto 10, Ontario.**

• *Midget Relay For Printed Circuit Use*

Item 1608

The series GP was designed to fill the need for a small, general purpose, dependable control relay that would rest solidly and firmly in a printed circuit board. Sturdy ⅛ by ½ solid lugs inserted into printed circuit board give relay considerable rigidity which makes it an ideal relay for a multitude of printed circuit applications. Coils are available in all standard AC and DC voltages to 115 volts.

The same frame and printed circuit feature is available in the series PC as a sensitive plate circuit relay. Sensitivity is about 130 mW per pole, pre-set at factory, and coils are available in 2,500, 5,000 and 10,000 ohms. Both relays use selected silicon steel or magnetic iron. Contacts are self-wiping ⅛" fine silver rated 5 amperes for series GP and 2 amperes for series PC, non inductive. Board is NEMA grade LE and all insulation is tested at 500 V.A.C. minimum. Dimensions are 1" wide, 1¼" long and 1¾" high.

For additional information contact: **Hillburn Electronic Products Co., 55 Nassau Avenue, Brooklyn 22, N.Y.**

For further data on advertised products use page 55.

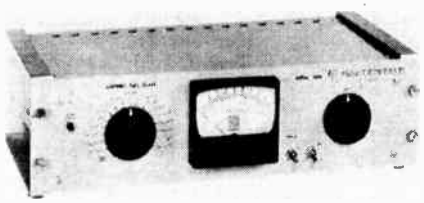
NEW PRODUCTS

• *New Micro-Microammeter*

Item 1609

The ultra-stable Model 411 micro-microammeter provides high resolution for a broad range of measurements from 10^{-3} to 10^{-11} ampere. It has no switching transients and covers eight decades with 17 ranges. The instrument is extremely stable with zero drift less than 2% of full scale per week from source voltages above 10 volts. Response time is less than one second on the 10^{-10} range and drops to 40 micro-seconds on the 10^{-3} range with 5000 mmf across the input. Input drop is less than five millivolts.

The Model 411 has important uses in long-term control, alarm and monitoring work, as in thickness gaging and reactor



installations. Other uses include measurements of micro-currents in ion chambers and photocells and in leakage testing of insulators, capacitors and resistors when used with a stable polarizing voltage.

Added features of the micro-microammeter include: simple operating controls, a 216-volt tap for polarizing ion chambers, and a 10-volt output to drive either 50 millivolt or 5 milliamp recorders. Available for relay rack mounting or with end frames for bench use.

Address enquiries to Canadian representative: **Measurement Engineering Limited, Arnprior, Ontario.**

• *Transcription Pickup Arm*

Item 1610

The Garrard Model TPA10 Transcription Pickup Arm is the result of very careful consideration of the requirements desired by the connoisseur of high fidelity record reproduction. The styling is ultra-modern, the pickup has many unique mechanical features and the number of pivots has been reduced to a minimum.

One great feature of this pickup arm is its adaptability to cover a wide range of requirements. The head will accommodate practically all available pickup cartridges and the arm is extendable in length from 7½" suitable for playing 12" records to 9½" for playing records up to 16" diameter.

A special balancing lever is fitted to give weight compensation as the pickup arm is extended. Adjustment is provided for the angle of the pickup head to enable it to be set to give the minimum tracking error. The height of the pedestal and rest are readily adjustable without the use of packing rings to accommodate variation in turntable height.

Supplied in an attractive box complete with template, fixing screws and manual containing full instructions.

Garrard is represented in Canada by **Charles W. Pointon Ltd., 6 Alcina Avenue, Toronto 10, Ontario.**

For further data on advertised products use page 55.

NEW PRODUCTS

• *Electric Power Absorber*

Item 1611

A new Electric Power Absorber is being marketed by Sun Electric Corporation. The Power Absorber is a small cylinder, which replaces 27 500 W stick resistors. It takes up only 1/25 of the space such a bank of resistors would occupy.

The Power Absorber operates at 13,500 W continuous duty, and yet its weight is only 1 lb. per kilowatt absorbed. Air is drawn in through circumferential slots in the casing, and flows over specially designed V-section resistors. The motor and fan can be operated either as part of the load, or from an independent power source. The Power Absorber is fully protected against overload.

Adaptations of this Electric Power Absorber, designed by Sun Electric Corporation, are at present in use in the "Redstone" and "Snark" missiles programs.

This Power Absorber is an exclusive product of the Sun Electric Corporation. For further information contact the **Aeronautical Division of Sun Electric Corporation, 6701 S. Sepulveda Blvd., Los Angeles, California or Sun Electric Corporation, 6323 North Avondale, Chicago 31, Illinois.**

• *High Vacuum Pumps*

Item 1612

Central Scientific Company, manufacturing subsidiary of Cenco Corporation, announces its completely redesigned line of noiseless and vibrationless high vacuum pumps known as Hyvac 2, Hyvac 7, and Hyvac 14, modern additions to the company's line of Hyvac, Megavac, and Hypervac pumps.

The well-known principle of gas ballast control is offered as standard equipment on Hyvac 14, and is optional on Hyvac 7. A vacuum pump employing this feature is able to pass water and other condensable vapors through the pump and exhaust them with virtually no internal condensation.

In addition to the low noise and vibration features, the pumps are much faster in operation than the older Hyvac, affording significant opportunities to industry to save time and cost in manufacturing processes.

All three models are highly compact and light-weight, assuring easy portability.

A special feature of the new line of pumps is extremely simple internal design. There are fewer moving parts, all machined to close tolerance. If maintenance becomes necessary, it can be done on the bench, eliminating the costly down-time required to send the pump back to the factory for repairs.

Other features of the new Cenco-Hyvac line include an "easy view" oil level window, a convenient oil drain which saves time in periodic flushings and oil changes, and dynamically balanced pulleys.

Different motor arrangements, suitable for most voltage and cycle requirements, are available, as well as explosion-proof and 3-phase motors.

For further information write to **Central Scientific Company of Canada Limited, 146 Kendal Avenue, Toronto 4, Ontario.**

For further data on advertised products use page 55.

NEW PRODUCTS

• *Ultrasonic Emulsifiers*

Item 1613

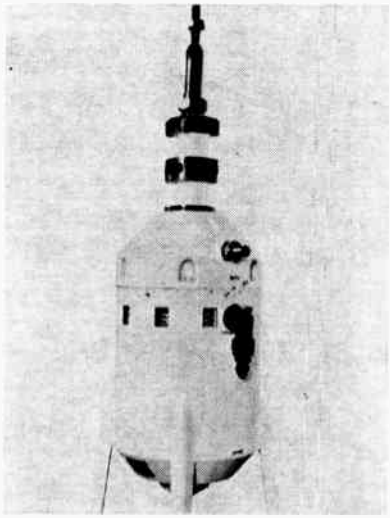
In a new line of ultrasonic emulsifiers . . . called the Rapisonic, the Autosonic, the Dispersonic and the Minisonic . . . an entirely new principle of operation is used which has resulted in considerably less expensive and easier-to-maintain machines compared with ultrasonic equipment heretofore available. It also offers faster and more complete emulsification.

Manufactured by Ultrasonics Limited of Yorkshire, England, this equipment is handled exclusively in Canada by Pye Canada Limited.

These machines use the fluid-dynamic forces of the liquids themselves to produce sound waves. This is accomplished by impinging the liquids in a jet stream on the edge of the blade which vibrates at about 22,000 c.p.s. Cavitation occurs continuously in the stream rushing past the blade. Energy is developed and used right in the liquids.

The Rapisonic has a gear-type pump and ultrasonic head driven by a 2 H.P. motor. Output is 350 gallons per hour. No premix is necessary and there is no aeration during sonification. Emulsions of high and low viscosity can be handled.

The Autosonic delivers a continuous supply of emulsion automatically geared to process volume. Three control valves and flow rate indicators adjust the proportion of oil, water and emulsificant in the final emulsion. Float switches maintain a balance in the reservoir by controlling the feed and discharge pumps as well as the emulsifying unit. The Autosonic incorporates the Rapisonic emulsifying unit.



The Dispersonic is designed to handle dispersions of powders in liquids of emulsions of an abrasive nature. While the Dispersonic uses the same type of ultrasonic head as the Rapisonic, the former uses a continuous cavity pump while the latter employs a gear pump. The cavity pump is better suited to resist the abrasive effects of the powders. Output is 350 gallons per hour.

The Minisonic is a batch-type machine with a capacity of one gallon and is used for laboratory use. Similar in principle to the Rapisonic, progress of the operation can be viewed through a transparent hose running from the ultrasonic head to the reservoir. Handles emulsions of high and low viscosity.

These emulsifiers have been accepted for use in: pharmaceutical, food, cosmetic, plastics, leather, chemical, lubricant, paper, rubber, photographic, automotive and textile industries.

All enquiries for further information to **Pye Canada Limited, 82 Northline Road, Toronto 16, Ontario.**

For further data on advertised products use page 55.

NEW PRODUCTS

• *Silicone Oil*

Item 1614

A drop of silicone oil placed under each transistor in the compact "Transidyne" d.c. transformer made by Nader Manufacturing Company, Monrovia, California, is credited with helping increase its efficiency. It is useful in many places where miniaturization is important. Particular uses are found in missile and other airborne systems.

The new Nader "Transidyne" Model 265R weighs only 12 ounces, but has an efficiency of 80%. Because of its transistorized circuitry, it can do the job previously done by rotary equipment 12 times as big and weighing 12 times as much.

Dissipation of heat is an important consideration in the "Transidyne". The transistors are very sensitive to heat, and it is necessary to dissipate it at all times that the system is in operation. The chassis itself serves as a radiator, so the problem was to increase the heat conduction between the miniaturized semi-conductor component and the chassis. It has been found that a drop of silicone oil placed under each transistor eliminated the film of air, and thereby increased the flow of heat to the chassis for dissipation. The type used is "Union Carbide" L-46 Dimethyl Silicone Oil, which has excellent electrical properties, stable viscosity over wide ranges of temperature and is non-flammable. The oil is painted on the transistor and chassis with a small brush. A thin mica washer is placed between them to assure electrical insulation.

"Union Carbide" Silicone products are distributed in Canada by **Bakelite Company, Division of Union Carbide Canada Limited, 40 St. Clair Avenue East, Toronto 7, Ont.**

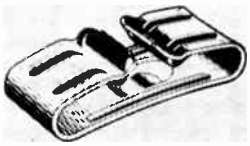
• *Twin U-Type Speed Clip*

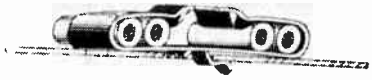
Item 1615

A new, twin U-Type Speed Clip, developed for the attachment of electrical wiring on household appliances, electronic equipment and other products was announced recently by Dominion Fasteners Limited, Canadian manufacturer and licensee of Speed Nut brand fasteners.

Employing Tinnerman's exclusive heel-and-toe principle of self-retention, the new Speed Clip is front-mounting and eliminates the need for nuts, bolts or auxillary fastening devices.

Ideal for use in hard-to-reach locations, the new clip's spring steel "toe" is merely inserted into a mounting hole in a panel and with slight finger pressure down and forward the clip snaps into wire-receiving





position. Electrical wires, firmly secured by twin spring steel fingers, can be removed for servicing or replacement without detaching the clip.

Embossed ribs in the base and wire-retaining portions of the new Speed Clip provide added rigidity and extra gripping power. The clip's edges are rounded to prevent chafing and wear on wire insulation.

Dominion Fasteners Limited, Hamilton, Ontario.

• *Klystron Facts Available*

Item 1616

A 24-page, 2-color brochure entitled Klystron Facts Case No. 4 has been published by Eitel-McCullough, Inc., San Bruno, California. Summarizing recent Eimac developments in the field of klystron design, it includes useful facts on super power klystrons, beam switch tubes, beam rectifier tubes, as well as information on depressed collector operation, use of klystrons in high power UHF SSB service, shaped pulse applications and other Eimac klystron developments.

Copies of the brochure have been mailed to all Eimac catalog holders. Others may obtain a new brochure by writing **The Ahearn and Soper Company Ltd., 384 Bank St., Ottawa, Ont., Canada.**

SATELLITE TRACKING

(Continued from page 23)

1—the phasing of the antenna in the array is very important and is the reason for using a coaxial type output on the antenna and coaxial type connecting harness between the individual antennas making up the array. An open wire phasing line between the antennas in the array would result in a lack of phase correlation and creates inaccuracies in the system due to coupling and lack of symmetry.

2—open wire can be used between the arrays provided precautions are taken to maintain symmetry and phase correlation.

3—all antenna arrays must be in one horizontal plane and the arrays on each axis in perfect alignment *(Figure 2)*. This is especially important when the antennas are tilted for tracking north or south of the station.

ULTRASONIC DRILLING

(Continued from page 25)

technique was applied to other materials, including aluminum oxide, ferrite, steatite, and carbide. Through this experimentation, C-Mar has developed what is claimed to be one of the most complete ultrasonic drilling services in the country.

At the tube manufacturer's request, C-Mar's specialized experience in this technique was applied to the problem of manufacturing the alundum tube spacers. Several pilot samples were drilled and costs were found to be reasonable. Furthermore, accuracy of the holes and slots was within .001 and .0005 in.

Tests proved that tubes made with these spacers more than lived up to expectations. Although alundum spacers cost more than the old mica spacers, this higher initial cost is more than offset by improved performance and greater durability. Noise is minimized and tube life has been increased threefold.

For further data on advertised products use page 55.

NEW PRODUCTS

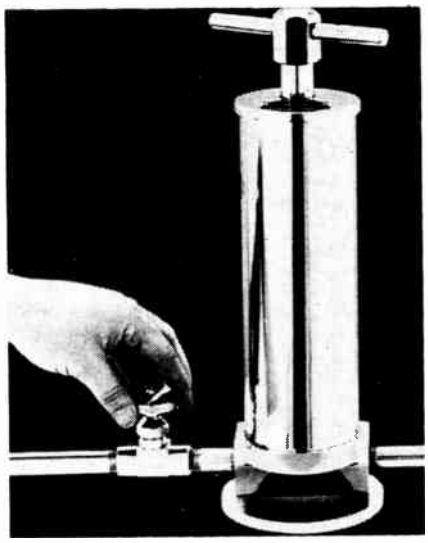
• *Heico MIK Filtration Units*

Item 1617

The new Heico MIK Filtration Units have been developed to meet the specific current needs of the lithographic industry for the removal of minute particles from water.

This new filtering technique is essential to quality control because it has been found that even highly purified water contains sub-microscopic particulate matter which, if present in water, reduces the quality of the end product and raises production costs.

The Heico MIK Permanent Cartridge makes possible the production of physically pure water that heretofore could only be produced on a very limited scale. Capacities range from 3 to 10 gallons per



minute and the filter removes all physical impurities larger than the rated density of the cartridge. Heico MIK Permanent Cartridges are available in the following densities: 25, 10, 1 and 0.1 microns. (A micron is 39/1,000,000th of an inch.)

In addition to general industrial uses, Heico MIK Filtration Units are available for filtration of demineralized waters, electronic wash waters, nucleonics, photography, analytical laboratories and for the removal of bacteria.

Technical Bulletin R-142 is available on request to **Heico, Inc., Dept. 69, 25 North Sixth Street, Stroudsburg, Pa., U.S.A.**

• *General Purpose Digital Computer*

Item 1618

The Bendix G-15D is a low cost general purpose digital computer especially adapted to engineering and scientific calculations. It is small and rugged enough so that it can easily be moved, and requires no elaborate installation. Weight is only 850 pounds, with an additional 175 pounds for the optional magnetic tape unit.

Applications of the G-15D range over the entire engineering and scientific field. It has been extensively used in earthmoving computations in highway construction, where a 30-fold reduction in cost of making "cut and fill" calculations has been demonstrated in practice. It is excellent for university use in graduate courses in physics and mathematics. It is useful in the design and operation of electrical transmission lines, and pipe lines carrying natural gas, oil, or water. It can be used for "real time" data processing in aircraft and missile testing. New applications are constantly being found for the G-15D where large amounts of repetitive calculations must be made quickly and efficiently.

(Continued on page 50)

For further data on advertised products use page 55.

NEW PRODUCTS

With the optional Digital Differential Analyser accessory, the G-15D becomes a powerful tool for solving problems in dynamic systems and automatic control.

The G-15D features simplified operation. Interpretive codes are presented in self-sufficient manual which enable a person without computer training or experience to prepare a problem for solution. Modern production techniques such as plug-in sub-assemblies, printed circuits, and dip soldering enable the manufacturer to offer large computing capacity at an unusually low price.

The G-15D is sold or leased in Canada by **Computing Devices of Canada Limited, Box 508, Ottawa 4, Ontario.**

• *Pressure Transducer*

Item 1619

Fischer & Porter Company, manufacturer of complete process instrumentation, is placing its Pressure Transducer on the market. Developed by the company for use in data reduction systems, the device converts a 3 - 15 p.s.i. signal to a-c millivolts directly proportional to the pneumatic input. When pressure is applied to the sensing element of the transducer, the resulting movement of an expandable capsule displaces an armature which induces opposing voltages in twin secondary coils. This voltage is linearly proportional to the pressure input. The output may be used to position an indicator, recorder or control device. Accuracy of the F&P Pressure Transducer is high: 0.25 per cent of the full scale.

Additional information is available from **Fischer & Porter (Canada) Limited, 2700 Jane Street, Toronto 15, Ont. Telephone: CHerry 1-8624.**

• *Microwave Pressure Windows*

Item 1620

A complete series of high power, broad-band, flange-mounted waveguide pressure windows has been introduced by Microwave Associates, Inc., Burlington, Mass.

The windows provide a vacuum-tight seal and protection against humidity, dust, etc. and are used to seal waveguide and antenna systems, gas switching tubes, power tubes and ferrite components. The windows are available at frequencies from 2.45 to 75 KMC. These cover-flange-mounted designs are normally mounted between two choke flanges in waveguide assemblies. Windows are available for direct insertion into radar waveguide, or test bench applications in S, C, X_L, X/2, X, Ke, Ku, K, Ka, and V band.

The manufacturer will furnish additional data on request. Write to **Microwave Associates, Inc. ,Burlington, Mass., U.S.A.**

• *Transistor Oscillator*

Item 1621

A battery-operated Transistor Oscillator that contains its own batteries — yet is small enough to be held in the hand, is being produced by Dawe Instruments Ltd. An illustrated leaflet describing the oscillator is now available. Known as the Type 420, the oscillator gives outputs at 400 and 1000 cycles. It incorporates a voltmeter and is said to be very simple to use. Also there is no "warming up" period. The oscillator can be used independently in audio system tests and as a bridge source. It is also said to be very useful where an ungrounded source is required. Measurements are 9¼ inches by 3⅛ inches by 2⅞ inches. Weight is 2½ lbs.

Detailed information is available by writing to **Dawe Instruments Ltd., Canadian Division, 1654 Bank Street, Ottawa 1, Ontario.**

• *Beatty Mast Catalog*

Item 1622

Beatty Bros. Limited, Fergus, Ontario, has recently issued a new catalog on "Beatty Masts and Supporting Structures for Television, Communications and Broadcasting".

This forty-eight page catalog has been designed and written to aid those engaged in the electronics and communications industries in the selection and erection of the Beatty Mast line. It features such types of masts as the Wall Support (no guy wires); the Single (Class A to 80 ft. - Class B to 200 ft.); the Twin (Class B only to 250 ft.); the 'H'-Type (Class B only to 250 ft.); etc.

Beatty Masts are of hot-galvanized steel and conform throughout to C.S.A. specifications. Included also is a complete line of accessories together with helpful engineering data.

Copies of this catalog are available upon request to **Beatty Bros. Limited, Fergus, Ontario.**

• *Nuclear Powered Electric Timers*

Item 1623

A small, light Nuclear Powered Electric Timer has been developed by the Patterson, Moos Division of Universal Winding Company, Inc., 90-28 Van Wyck Expressway, Jamaica 18, New York. Given the trade name BETACHRON by the Company, the timer has a shelf and use life of over 25 years and is capable of reliably operating over wide ranges of temperature, acceleration and vibration. The Electric Timer is suitable for use in weapon and missile systems where time delays from microseconds to forty hours are required with an accuracy of ±3%. Its performance has been proven in many applications for the past five years.

The Nuclear Powered Electric Timer, which is capable of delivering energy pulses up to 250,000 ergs, is supplied encapsulated in a metal case, and provided with standard connectors at the output. A timer for fixed time intervals is supplied in a cylindrical metal case 2½ inches in

For further data on advertised products use page 55.

NEW PRODUCTS

diameter, 1⅞ inches long. Settable time delays, up to 10 steps, are available in a variety of subminiature types depending on the number of time intervals desired. A switch, located within the case, initiates the time delay. Depending upon the application, either a snap action, pull wire, or external electrical signal type switch can be supplied without changing the physical dimensions of the unit. It is also possible to arrange the timer in many mechanical and electrical configurations, thus comprising a family of timers that can be supplied to meet specific requirements.

The heart of the Timer is a Nuclear Battery which has been in production at the Patterson Moos Division for the last few years. This battery converts nuclear energy directly into electrical energy. It is made with current ratings from 50 to 5000 micromicroamperes and equilibrium voltages in the order of 10,000 volts. Battery performance is not affected by environmental conditions, and shelf and use life are not changed by short circuiting.

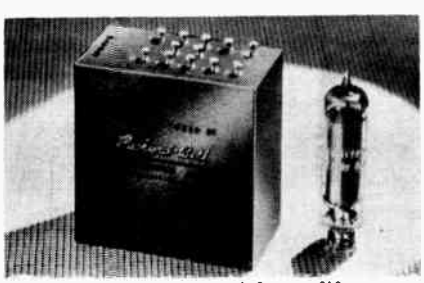
Patterson, Moos Division of Universal Winding Company, Inc., 90-28 Van Wyck Expressway, Jamaica 18, N.Y., U.S.A.

● *Transistorized Control Amplifier*

Item 1624

Packard-Bell Electronics Corp. displayed for the first time at the IRE Show in New York City, March 18th-21st, a diminutive transistorized control amplifier that has become the vital element in regulating power for an entire military aircraft fire control system.

Weighing but 11 ounces, the mighty midget is a part of an integrated power supply system designed and built by Packard-Bell Electronics for North American Aviation.



The custom component has a life expectancy of 10,000 hours or more, with ripple less than 50 mv from peak to peak, operating temperature of minus 65 degrees to plus 125 degrees centigrade, and is adaptable to voltages of plus or minus 50 to plus or minus 1000. Its regulation is plus or minus 1 per cent, with circuit gain of 60 to 80 db.

Packard-Bell Electronics Corporation, Los Angeles 64, California, U.S.A.

For further data on advertised products use page 55.

NEW PRODUCTS

● *Polystyrene Capacitors*

Item 1625

Deltaply "85" capacitors offer exceptional electrical properties in the temperature range -55° C to +85° C. They are recommended for applications in which a small uniform capacitance change with temperature, high Q, very high insulation resistance, very low dielectric absorption and high stability are critical factors. The temperature-capacitance co-efficient is —120 PPM/°C. and is very nearly linear. Insulation resistance in megohms x microfarads varies from 10 million at 25° C to 200,000 at 85°C.

Capacitance values from .001 to 10.0 mfd. may be obtained in hermetically sealed metal tubes or CP-70 cans. Six voltage ratings from 50 to 1000 volts are available.

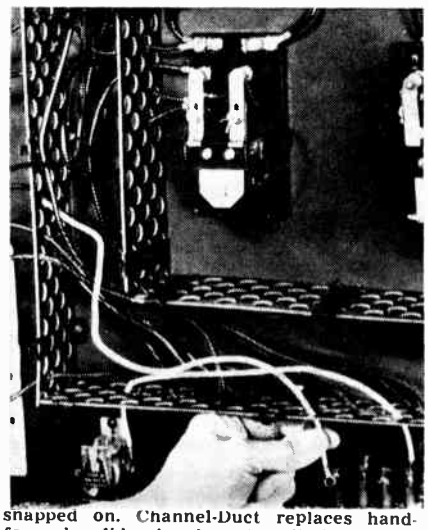
Manufactured by **Dearborn Electronics Laboratories, 1421 North Wells Street, Chicago 10, Illinois, U.S.A.**

● *Three Sided Wiring Duct*

Item 1626

Glastic Channel-Duct, a 3-sided wiring duct for simplifying panel wiring, is now available in a 2-inch high size as well as 3-inch size. The new size extends only two inches away from the panel.

Channel-Duct provides a means for lowering fabrication and assembly costs in the production of control panels. Wires are laid in the glass-reinforced polyester duct, then strung through holes to the nearest connection points before the cover strip is



snapped on. Channel-Duct replaces hand-formed solid wire layouts, eliminates expensive harnesses and simplifies maintenance. It is easy to shear, easy to mount and doesn't require mitred corners.

Some additional benefits of Glastic Channel-Duct include UL-recognized flame retardance to 105°C., dielectric strength of 5000 volts minimum, high impact strength, dimensional stability and superior arc resistance.

Technical data and prices can be obtained by writing to: **The Glastic Corporation, 4321 Glenridge Road, Cleveland 21, Ohio.**

● *Literature re Moseley Instruments*

Item 1627

R-O-R Associates Limited, 290 Lawrence Avenue West, Toronto, announces that new literature is available on Moseley X-Y Recorders and Data Handling Instruments. This material includes pamphlets on three versatile models (Model 1, drum type; Model 2A, flat bed type: Model 3, desk type) featuring ranges from 5 millivolts to 500 volts; 200,000 ohms per volt input resistance, zero offset, speeds up to ½

For further data on advertised products use page 55.

NEW PRODUCTS

second full scale; 0.25 per cent accuracy.

Rugged and stable, all models provide facilities for curve drawing and curve following. Digital data may be plotted in point form from keyboard, tape or I.B.M. card sources.

Data sheets are also available on the following: Model F-1, Curve Follower; Model 2, Recorder Character Printer; Model 20 Series — Moseley DC Voltmeter; Model 4, which is rack mounted version of Model 2A (all models can be furnished rack mounted as required); Model 30A, Card Translator; Model 40 Keyboard; Model 50, Tape Translator; Model 60, Logarithmic Converter.

Demonstrator instruments are available for trial.

For further information apply to **R-O-R Associates Limited, 290 Lawrence Avenue West, Toronto 12, Ontario, Canada.**

● *Precision Phase Meter*

Item 1628

Type 405 Series is the most stable and convenient device for measuring a phase angle between two alternating voltages without either amplitude or frequency adjustment. In addition to its capability of presenting the phase angle directly in degrees on an 8" rectangular panel meter with mirror scale, it is also capable of plotting phase-frequency curves on a recorder or oscilloscope. Furthermore, this instrument has no ambiguity at zero degree, and it is perfectly stable for measuring a small fraction of one degree on all ranges including 0-12° range. This instrument consists of a coincident slicer and cathode-coupled limiter stages with plate-to-grid degeneration. Most of these circuits were developed by our engineering staff.

This instrument has a number of outstanding features: (1) Meter reading is independent of the ratio of the input signal amplitudes. (2) Equal accuracy for symmetrical waveforms of any shape. (3) No amplitudes adjustment in both signal voltages. (4) No ambiguity at zero degree. (5) Provision for identification of "LEAD" and "LAG". (6) Provision for self-calibration and self-adjustment.

The specifications are as follows: Type 405L has a frequency range from 1 c.p.s. to 20 kc., and Type 405H has a frequency range from 8 c.p.s. to 500 kc. There are eight phase ranges: 0-12, 0-36, 0-90, 0-180, 180-192, 180-216, 180-270 and 180-360 degrees. The relative accuracy is ±¼°, and the absolute accuracy is ±1° or 2 per cent at any range. The input voltage is 0.3 volt to 70 volts for Type 450L, and 2 volts to

40 volts for Type 405H. The front panel reading is completely independent of the ratio of signal amplitudes, ranging from 1 to 20 times for Type 405H, and 1 to 230 times for Type 405L. The input impedance is 3 megohms shunted with 20 uuf on both input channels for Type 405H; and 6.8 megohms shunted with 20 uuf for Type 405L.

For further information write: **Advance Electronic Labs., Inc., 249-259 Terhune Ave., Passiac, N.J.**

● *Photoelectric Controls*

Item 1629

Replacement of Photoelectric Controls or Light Sources in seconds is afforded by new plug-in mounted controls announced by Autotron, Inc.

Sockets are built into separate mounting bases. Controls and Light Sources plug into the bases and are secured by snap action clamps. The sockets swivel for precision alignment. A soft Neoprene gasket seals out dust. Replacement requires no special tools or skill.

Dark actuated and Light actuated photoelectric controls, photoelectric timing controls and a whole series of light sources are available with plug-in mountings, for 115 V. 50-60 C. and 230 V. 50-60 C.

All housings are cast aluminum with splash-proof gasket seals. Bases have adjustable brackets for mounting convenience.

Approximate over-all dimensions, (light source or control) including base but not including bracket and lens tube: height 10¾", width 4", depth 4".

Literature on request to **Autotron, Inc., Box 722-CJ, Danville, Ill., U.S.A.**

● *Variable Composition Resistor*

Item 1630

Precision Electronic Components (1956) Ltd. are now producing a new ½" dia. Variable Composition Resistor which will meet the MIL-R-94A specifications of style RV6.

This unit is completely enclosed and the shaft is sealed; it can safely be rated at ⅓ watt at 70°C ambient temperature, and derated at 120°C.

The insulation resistance of this control remains high even under 95 per cent humidity; the unit does not corrode when subjected to a 200 hour salt-spray test, and its life expectancy is exceptionally high.

Precision Electronic Components (1956) Ltd., 50 Wingold Ave., Toronto 10, Ontario, Canada.

For further data on advertised products use page 55.

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
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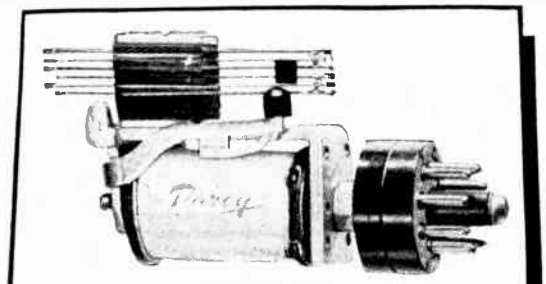

TYPE CG
WITH PLUG-IN BASE

TYPE CC

CLM-DARCY RELAYS

Assistant Manager

Salary $6,000 to $8,000
plus incentive bonus

A well established, medium size, prestige organization in the field of exposition production and management, requires an assistant manager (28-40).

Applicant must possess sales ability, be a good correspondent and adept at handling detail, have proven administrative experience, and be a creative thinker.

This position offers an excellent future in an unusual and interesting business.

Box 1000
ELECTRONICS & COMMUNICATIONS
31 Willcocks St. - Toronto 5, Ont.

Write today for your free copy of this Technical Paper

ask for data file **71E**

AC Performance and Phase Compensation of Copper-Mandrel Potentiometers

BY BENJAMIN F. LOGAN

*

Research Engineer
Dynamic Analysis & Control Laboratory
Massachusetts Institute of Technology

1178

Beckman® / **Helipot** *Corp. Newport Beach, Calif.*
a division of Beckman Instruments, Inc.
Canadian Factory: No. 3 Six Points Rd., Toronto 18, Ont.
Sales Representative: R-O-R Associates, Ltd.
1470 Don Mills Road, Don Mills, Ont.

For further data on advertised products use page 55.

INDEX TO ADVERTISERS

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Company Address ..... City ..... Prov. .....

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BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in Canada

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ELECTRONICS AND COMMUNICATIONS

31 - 35 Willcocks Street

Toronto 5, Ontario

INDEX — Continued

Your request for further information on New Product items or additional information concerning advertisements in Electronics and Communications will be promptly acknowledged.

For further data on advertised products use page 55.

An important announcement concerning HEATHKITS

HEATH Company
A SUBSIDIARY OF DAYSTROM INC.
305 TERRITORIAL ROAD • BENTON HARBOR, MICHIGAN • WALNUT 5-1175
MANUFACTURERS OF Heathkit PRECISION ELECTRONIC INSTRUMENTS

Dear Customer:

We are pleased to announce, at this time, the availability of Heathkits in Canada. We've been trying to arrange this convenience for you for some time.

As of May 1st 1957, you can buy Heathkits, over-the-counter or by direct-mail, from DAYSTROM LIMITED, 2 RAITHERM RD., TORONTO 10, ONT. CAN. In the future, all orders should be directed to DAYSTROM LIMITED for processing and shipment to your door.

The biggest advantage of this new distribution in your country will be the convenience of being able to purchase a kit - by mail or in person - without the usual paperwork and delay of customs. The new Canadian kit prices are listed in this advertisement, and are comparable to the previous U.S.A. price, plus delivery charges, customs and excise levies, etc. The only additional charge is for postage from Toronto, Ontario, if you order by mail.

For your convenience, DAYSTROM LIMITED will offer service facilities for Heath products, and hopes eventually to have a Hi-Fi demonstration room. Store hours will be 8:30 A.M. to 5:00 P.M., Monday through Friday.

The same friendly, reliable service you are accustomed to receiving from Heath is assured in dealing with DAYSTROM LIMITED, a sister company of ours. We feel sure you will find that this new arrangement saves you time and trouble - yet costs you no more than before. Another Heathkit "extra" for your convenience!

Thank you.

Robert Erickson, Pres
Heath Company

DAYSTROM LIMITED — *A Subsidiary of Daystrom, Inc. Distributor of Heathkits in Canada* — **2 RAITHERM ROAD TORONTO 10, ONT.**

For further data on advertised products use page 55.

world's finest electronic equipment in kit form...

HEATHKIT®

High Quality
Advanced Design
Reliable Performance
Real Economy

Heathkit DX-20 CW TRANSMITTER KIT

MODEL DX-20
$47.95
Shpg. Wt. 18 Lbs.

Outstanding dollar-per-watt value! 50 watts plate power input, bandswitching for 80, 40, 20, 15, 11, and 10 meters. Crystal or external VFO excitation. Pi network output—"potted" transformers—TVI suppressed—pre-wound coils. Uses 6CL6 oscillator, 6DQ6A 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
$254.95
Shpg. Wt. 107 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—build 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.

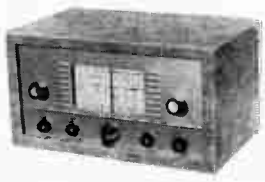
Heathkit VFO KIT

MODEL VF-1
$25.95
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—headphone jacks—AGC—BFO. Cabinet available separately as shown.



MODEL AR-3
$42.95
(less cabinet)
Shpg. Wt. 12 Lbs.

Heathkit GRID DIP METER KIT

MODEL GD-1B
$23.95
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 precalibrated. Easy to build, and extremely valuable for literally hundreds of jobs.

Heathkit "Q" MULTIPLIER KIT

MODEL QF-1
$12.95 *Shpg. Wt. 3 Lbs.*

Adds selectivity and flexibility to your receiver, and rejects undesired signal or hetrodyne. Tunes any signal within IF 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 IF. Will not 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.

MODEL DX-35
$74.95
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 "AUTOMATIC" CONELRAD ALARM KIT

MODEL CA-1 **$17.95**
Shpg. Wt. 4 Lbs.

The CA-1 Conelrad Alarm can be used with any radio receiver that has AVC. Automatically cuts AC power to your transmitter and lights a red indicator when monitored station goes off the air. Features heavy-duty 6-ampere relay, a thyratron tube to activate relay, and built-in power supply. Sensitivity control adjusts to various AVC levels. Complete instructions provided with kit.

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.

$16.95 MODEL AM-1 *Shpg. Wt. 2 Lbs.*

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Distributor of Heathkits in Canada

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TORONTO 10, ONT.

For further data on advertised products use page 55.

NEW *Heathkit* PROFESSIONAL RADIATION COUNTER KIT

MODEL RC-1

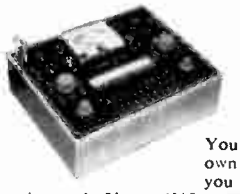
$108.95 Shpg. Wt. 8 Lbs.

- *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 microampere 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

$39.95 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

Indicatescondition of CRT on large "good-bad" scale. Spring-loaded switches protect operator. Checks all electromagnetic deflection 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

$26.95 Shpg. Wt. 10 Lbs.

Heathkit VISUAL-AURAL SIGNAL TRACER KIT

MODEL T-3 **$27.95** 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.

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-4A

$59.95 Shpg. Wt. 16 Lbs.

Heathkit SIGNAL GENERATOR KIT

MODEL SG-8

$25.95 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

$22.95 Shpg. Wt. 7 Lbs.

Heathkit LINEARITY PATTERN GENERATOR KIT

MODEL LP-2

$26.95 Shpg. Wt. 7 Lbs.

Supplies information for white dots, crosshatch 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 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.

Heathkit LABORATORY GENERATOR KIT

MODEL LG-1

$57.95 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.

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For further data on advertised products use page 55.

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.

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. IM distortion only 1% at 20 watts. Output impedance is 4, 8, or 16 ohms. Hum and noise are 99 db below rated output.

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. **$79.95** 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. 38 lbs. Express only. **$106.90**

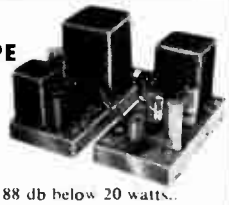
Heathkit 7-WATT

Using a tapped-screen output transformer of new design, frequency response of this unit is ±1½ 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.*

$22.95 MODEL A-7D

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. **$25.95**

Heathkit 20-WATT DUAL-CHASSIS WILLIAMSON TYPE

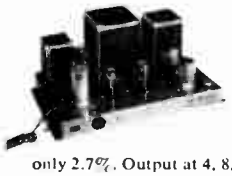


Features the famous Acrosound TO-300 "ultra linear" output transformer. Uses 5881 tubes and has a frequency response within ±1 db from 6 cps to 150 kc at 1 watt. Harmonic distortion only 1% at 21 watts. IM distortion at 20 watts only 1.3%. Output impedance is 4, 8, or 16 ohms. Hum and noise is 88 db below 20 watts.

KIT COMBINATIONS

W-3M: Consists of main amplifier and power supply for seporate chassis construction. Includes all tubes and components necessary for assembly. Shpg. Wt. 29 lbs. **$67.95** 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. **$94.90** Express only.



Heathkit 20-WATT SINGLE-CHASSIS WILLIAMSON TYPE

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. IM distortion only 2.7%. Output at 4, 8, 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. **$53.95** 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. **$80.90** 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-9C **$47.95** *Shpg. Wt. 23 Lbs.*

Heathkit HIGH FIDELITY PREAMPLIFIER KIT

MODEL WA-P2 **$26.95** *(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 **$25.95** *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-3A **$32.95** *(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, cascode front end, temperature-compensated oscillator, built-in power supply, and other outstanding design features. Pre-aligned IF and ratio transformers. Sensitivity is better than 10 microvolts for 20 db of quieting. Covers 88 to 108 mc.

AM BROAD BANDWIDTH

MODEL BC-1A **$32.95** *(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 IF 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 **$54.95** *Shpg. Wt. 30 Lbs.*

Employs two Jensen speakers to cover from 50 to 12,000 cps. Response is within ±5db. 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 **$135.95** *Shpg. Wt. 90 Lbs.*

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For further data on advertised products use page 55.

Heathkit HARMONIC DISTORTION METER KIT

MODEL HD-1

$59.95

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

$44.95

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

$28.95

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.

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

$19.95

Shpg. Wt. 3 Lbs.

Heathkit VARIABLE VOLTAGE REGULATED POWER SUPPLY KIT

MODEL PS-3

$47.95

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+ circuits are isolated from ground. Ideal lab power supply.

AUDIO GENERATOR

MODEL AG-9A

$40.95

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 ±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 4½" meter. Meter calibrated for output voltage or db. Output ranges are—.003, .01, .03, .1, .3, 1, 3, and 10 volts.

Heathkit "Q" METER KIT

The Model QM-1 measures the Q of inductances and RF resistance and distributed capacity of coils. Employs a 4½" 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

$53.95

Shpg. Wt. 14 Lbs.

Heathkit IMPEDANCE BRIDGE KIT

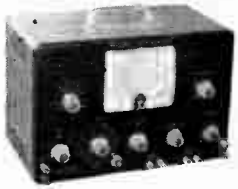
MODEL IB-2A

$69.95

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 1% resistors and 1% 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.

AUDIO ANALYZER KIT



MODEL AA-1

$59.95

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 CRYSTAL RECEIVER KIT

MODEL CR-1

$10.95

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, 5½" 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. **$6.95**

MODEL BR-2

$26.95

(less cabinet)

Shpg. Wt. 10 Lbs.

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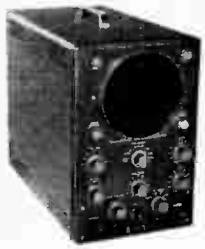
For further data on advertised products use page 55.

HEATHKIT ETCHED CIRCUIT
OSCILLOSCOPE KITS

You may choose from two different oscilloscope models when you purchase a Heathkit scope. Both 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-11

$82.95

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 5UP1 CRT.

FULL SIZE 5"

The Model OM-2 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-2

$49.95

Shpg. Wt. 21 Lbs.

Heathkit VOLTAGE CALIBRATOR KIT

MODEL VC-3

$14.95

Shpg. Wt. 4 Lbs.

Use as a source of calibrating voltage for oscilloscopes or peak-to-peak VTVM's. Produces near-perfect square wave signals of known amplitude. Precision 1% attenuator resistors and multivibrator circuit for sharp square waves. Output frequency 1,000 CPS. Switch-selected outputs are .03, 0.1, 0.3, 1.0, 3.0, 10, 30 and 100 volts peak-to-peak

Heathkit AUDIO VTVM KIT

MODEL AV-3

$39.95

Shpg. Wt. 5 Lbs.

Designed especially for audio measurements and low-level AC measurements in power supply filters, etc. An entirely new VTVM circuit that is essentially flat from 10 CPS to 200 KC. Input impedance is approximately 1 megohm at 1,000 CPS. AC (RMS) voltage ranges are 0—.01, .03, .1, .3, 1, 3, 10, 30, 100 and 300 V. Db ranges cover —52 db to +52 db .1% precision resistors employed for maximum accuracy. Easy to build, and essential in audio work.

Heathkit ETCHED CIRCUIT VACUUM TUBE VOLTMETER KIT

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.

MODEL V-7A

$32.95

Shpg. Wt. 7 Lbs.

Heathkit 20,000 OHMS/VOLT VOM KIT

MODEL MM-1

$39.95

Shpg. Wt. 6 Lbs.

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This unique measuring instrument indicates capacitor values in mmf, or mfd. directly on a large 4½" 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.

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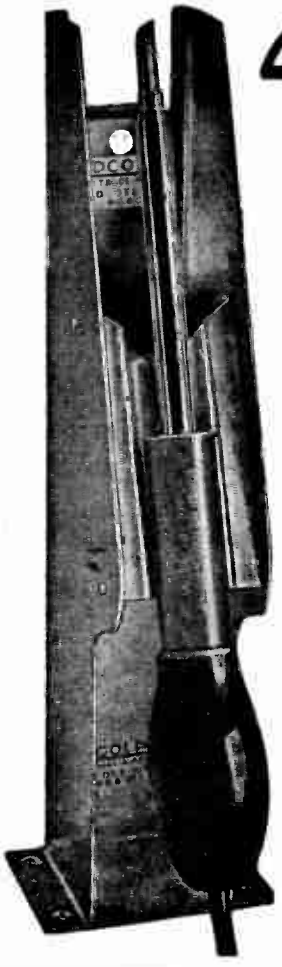

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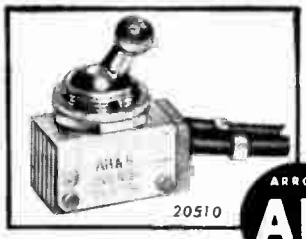

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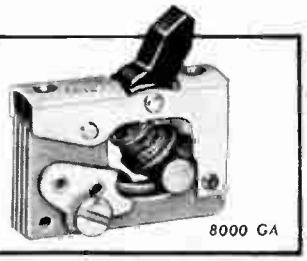

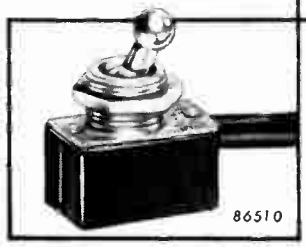

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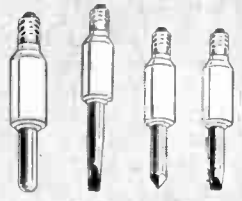

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RETMA Report

Against the background of this dynamic and growing industry your Directors have, frankly, had a difficult year. With the Receiver Division still accounting for over half the industry volume, the drop in the T.V. business has depleted our membership and income. This, coupled with the growth of the Electronics Division, has required a complete review of our fee structure and budget. It is greatly to the credit of your past Boards of Directors that the finances of your Association are in such healthy condition so as to not make the present situation an embarrassment. The new fee structure and budget that each Division has endorsed will make it possible for your Association to remain in a strong position and continue its growth.

You have heard the reports of the three Division Chairmen and I need not enlarge on them. It is here, of course, that the real work of the Association is done and the benefit realized. I congratulate the respective Chairmen, Messrs. Stopps, Punchard and Kingan, on their year's work, and thank them for the support they have given me.

Engineering Services Vital

I have on purpose left the field of Engineering to the last. There is one aspect of it which frankly confuses me. The work done by Ralph Hackbusch far exceeds that which might be expected of any Association member, yet it is in engineering committees, particularly Receiver, that the least general support is given. This is perhaps an indirect compliment to Mr. Hackbusch, but for the long term it is not very practical to rely so much on one man, no matter how willing he be.

I believe if we each took a moment to assess the value of the Association engineering services we would realize how vital they are, how much they deserve our support and how much we owe Ralph Hackbusch.

During Mr. Pollock's term of office he started the work of building a set of RETMA objectives. This work was not completed when he retired but he agreed to act on a special committee to complete the report. This has now been done and I believe on reading his report that he has provided this Association with objectives upon which we can base our operations. When it is duly presented through the Board I know you will agree with me and support it. I thank Mr. Pollock most sincerely for continuing this work.

Challenging Year Ahead

And now we come to the end of the year and look forward to a new one. To the incoming President, Board of Directors and Chairmen I suggest they have a most challenging year ahead of them. With a continuing strong economy, a healthy industry, and a new Government, with undoubtedly some new policies, there is a tremendous area in which to work. I know they will have your support, and I can assure them of mine.

While an Association is made up of interested members, many of whom do so much work in our overall interest, there is the permanent staff without which no association, and particularly this one, could not exist. In Fred Radcliffe, our General Manager, who has just completed his first full year with us, we have gained a man of both experience and judgment, to the very great benefit of the Association. On behalf of you and myself I thank him for his contribution, and assure him that he has the respect of us all. Through him, and again on your behalf I thank his entire staff who have so loyally supported him and worked so sincerely in our interests.

This, Gentlemen, closes my report of a year that, to me, has been intensely interesting. I have been active in RETMA work for some seven years and each has proved more rewarding than the last.

The privilege of working with you and for you is one I value, and I am looking forward to more years of maintaining my association with you albeit in not so active a capacity.

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TECHNICAL PERSONNEL AVAILABLE

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.

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ELECTRONIC ENGINEER — P.Eng., experienced in development of transmitters, pulse circuitry, installations, several years in supervisory and administrative positions in charge of technical, product design and production units. Estimates, schedules, budgets, hiring and customer liaison all in stride. Good character references. Seeking commensurate supervisory position in Ottawa district. Reply to Box 509, Electronics and Communications.

PROFESSIONAL ENGINEER—8 years experience in electronic components and chemical industries. Has excellent background in design, development, quality control, production trouble shooting, sales engineering, specifications writing. Desires position, preferably of supervisory nature with progressive organization. Reply to Box 510, Electronics and Communications.

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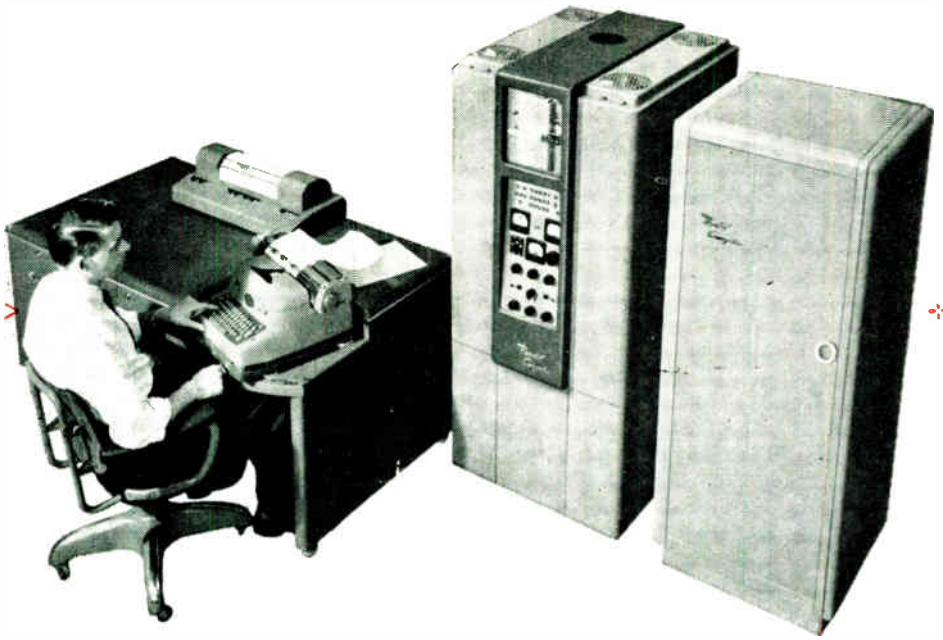

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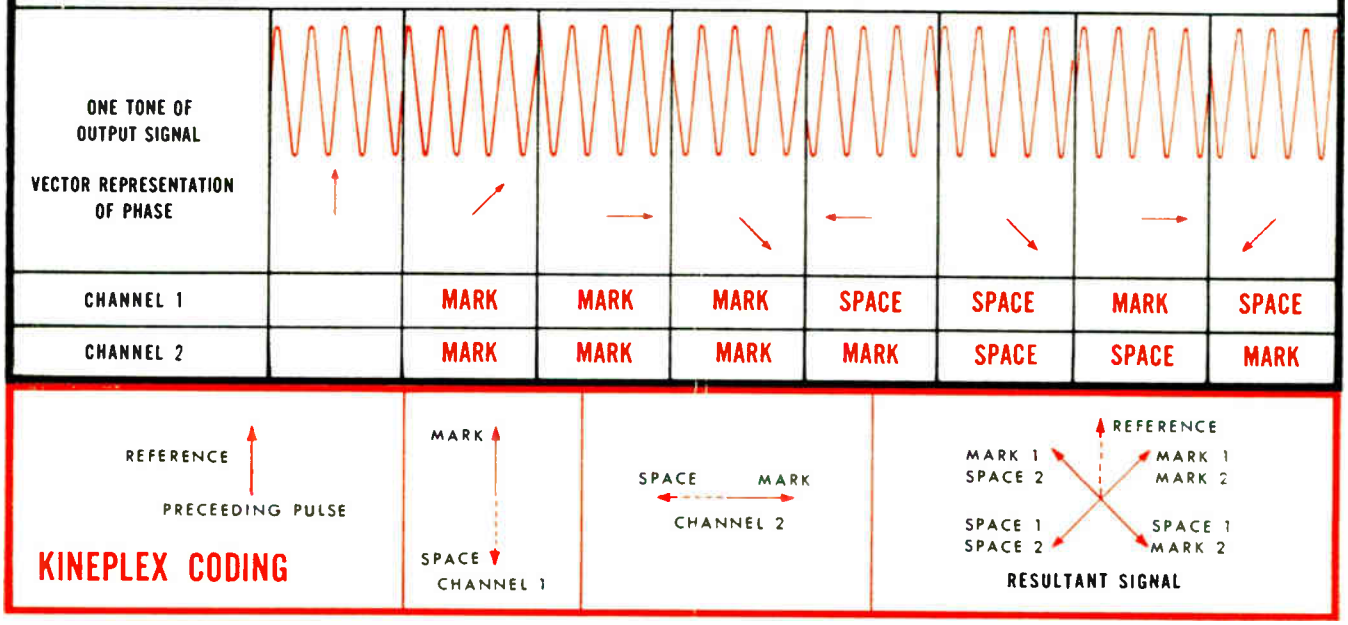

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Forty independent channels are transmitted by means of 20 different tones multiplexed in a voice band, each tone carrying two independent channels. The two channels are encoded onto each tone by phase shift keying the tone at the transition time between each successive pulse. The above diagram illustrates the encoding technique and demonstrates how the information is carried in the relative phase of two adjacent pulses.

Channel 1 is carried as a phase reversal between adjacent pulses, 0° for a MARK and 180° for a SPACE. Channel 2 is carried in a 90° relation to channel 1 information, +90° for a MARK and −90° for a SPACE. The resultant signal has one of the four possible values of phase as shown. The output signal for two channels is a tone of constant center frequency with phase shift occurring between pulses.

The receiving equipment includes detection circuitry at each tone frequency which measures the relative phase of successive pulses and regenerates the MARK-SPACE data as it appeared for each channel at the transmit equipment input. Each received pulse, following the measurement of its relative phase to the preceding pulse, is stored for one pulse interval so as to serve as the reference for the succeeding pulse. It should be noted that each pulse affects only two successive measurements, consequently requiring phase continuity of the transmission medium over only this period of time.

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