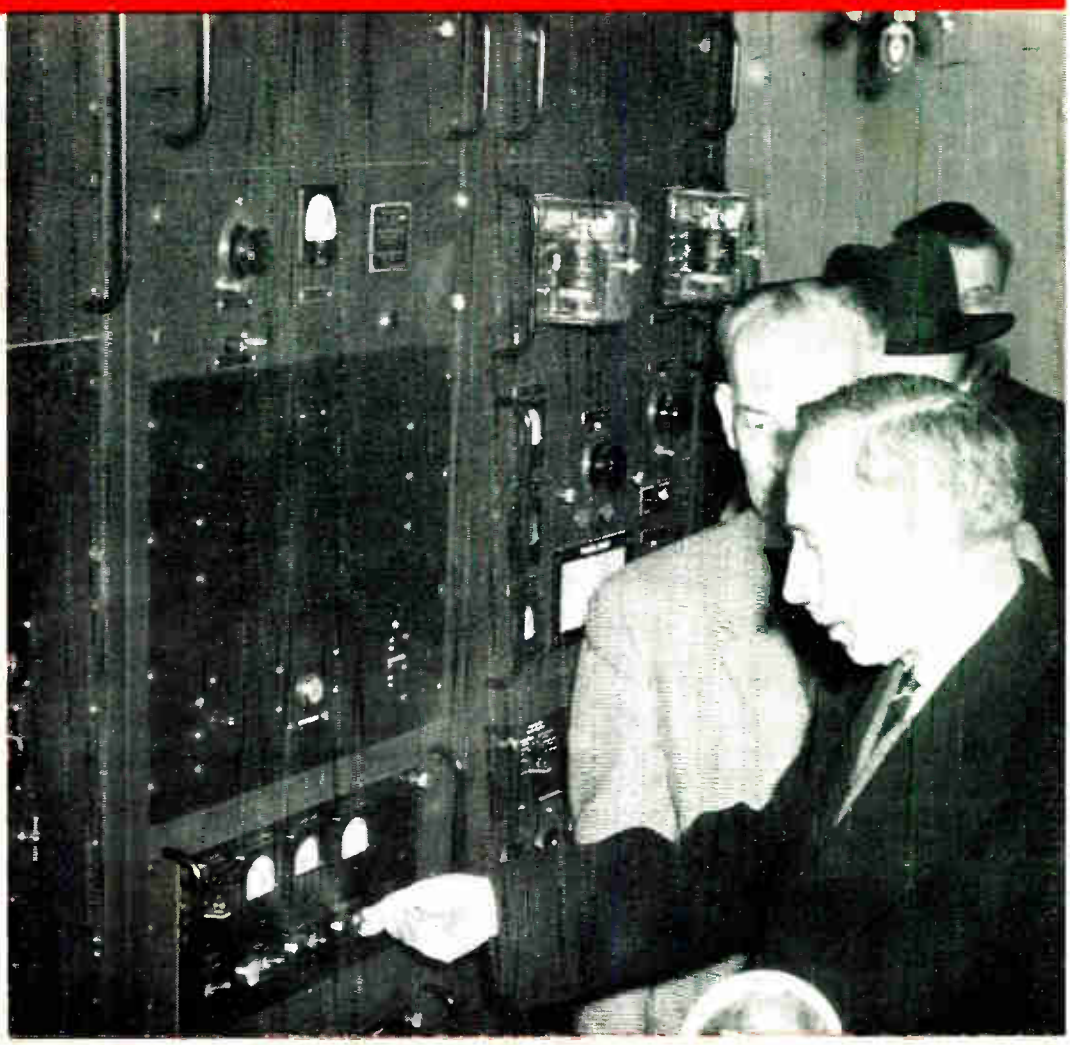
ELECTRONICS and COMMUNICATIONS

DESIGN—MANUFACTURE—ENGINEERING—DISTRIBUTION—APPLICATION

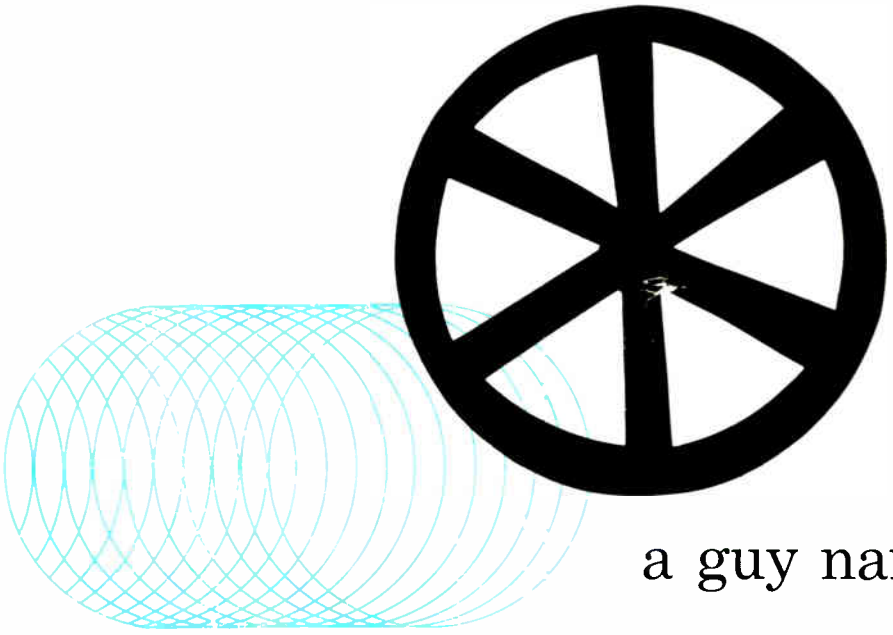
New Ideas for Modern Management



The Hon. George C. Marler, Minister of Transport is shown above turning the dial which officially opened the Dorval Airport installation of a very high frequency omnirange airway which inaugurated a new system of air navigation in Canada.

March, 1956 ★ $5.00 a year
An AGE Publication, Toronto, Canada

Circulation of This Issue
Over 10,200 Copies



a guy named Og

Once your name was Og. You tired of shouldering mastodon steaks...of dragging your mate by her hair. You invented the wheel.

Later, your name was Watt. Steam made your kettle-lid dance...and the Industrial Revolution was on.

Yesterday, you were a bicycle mechanic named Henry...today, your brainchild's descendants are counted in millions.

Your name is legion. You created every linkage... every device...every system.

You're an engineer.

You make things work better...faster...more accurately ...more economically.

Next week...next month...next year...some system will need a better, faster, more accurate or more economical means of recording...or indicating...or computing...or controlling a process.

You'll want precision potentiometers.

You'll discover that Helipot makes the most complete line... linear and non-linear versions...in the widest choice of sizes, mounting styles and resistances.

many models of HELIPOT* *precision potentiometers are stocked for immediate shipment ...our engineers will gladly adapt standard* HELIPOTS *to your requirements...or build entirely new* HELIPOTS *for you.*

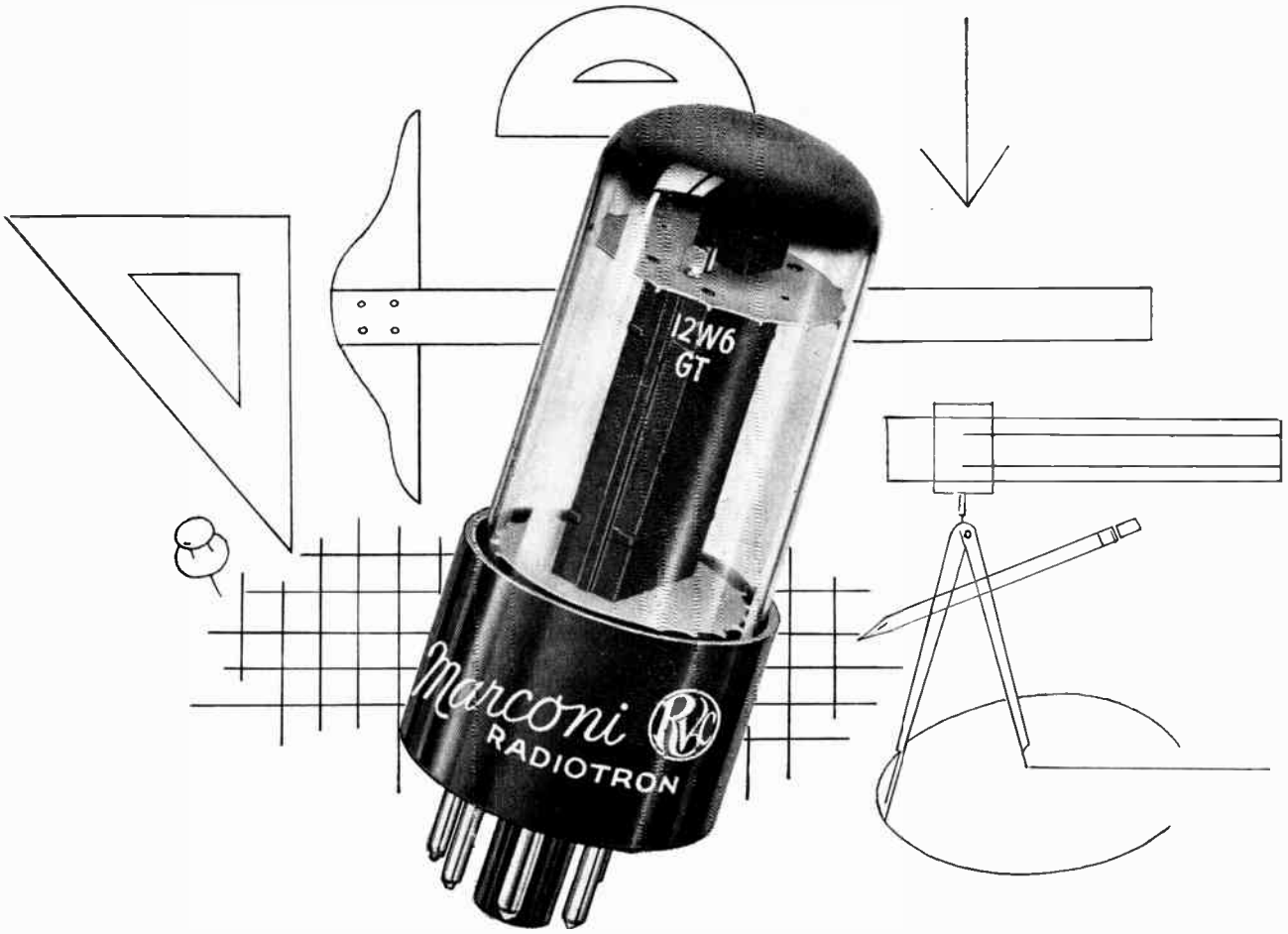
for information and specifications ...write for data file 307

You're an engineer. Your career is in the making. Helipot would like to hear from you.

Helipot® *first in precision potentiometers*

Canadian Factory: No. 2 Six Points Rd., Toronto 18, Ont.
Sales Representatives: R-O-R Associates, Ltd.
280 Lawrence Ave. West, Toronto 12, Ont.
a division of Beckman Instruments, Inc.

For further data on advertised products use page 65.



Tubes to meet Canadian needs!

Marconi RVC Radiotrons are designed to meet the needs of Canadians from coast to coast . . . bringing the benefits of highest quality and rigid standards of manufacture to radio stations, home receivers and all types of electronic installations. Your customers' satisfaction is guaranteed by the traditional quality of Marconi . . . Canada's largest electronic specialists.

CMC
CANADIAN MARCONI COMPANY
REGISTERED TRADE MARK

MARCONI RADIOTRONS

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 65.

with an eye to economy buy **AUTOMATIC ELECTRIC** substation protectors

TYPE 18
OUTDOOR SUBSTATION PROTECTOR

"DOLLAR-SAVER" DISCHARGE BLOCKS

Self-grounding, self-restoring, rarely need replacement. Save costly trips after storms.

RUSTPROOF COVER

Solid aluminum. Keeps trouble-causing dust, rain and other moisture out.

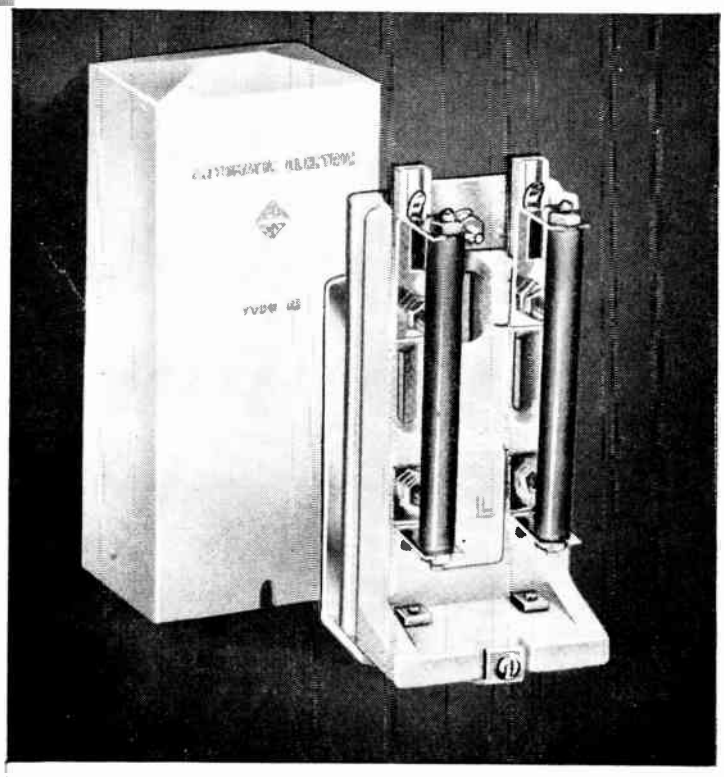
SPEEDY MOUNTING BRACKET

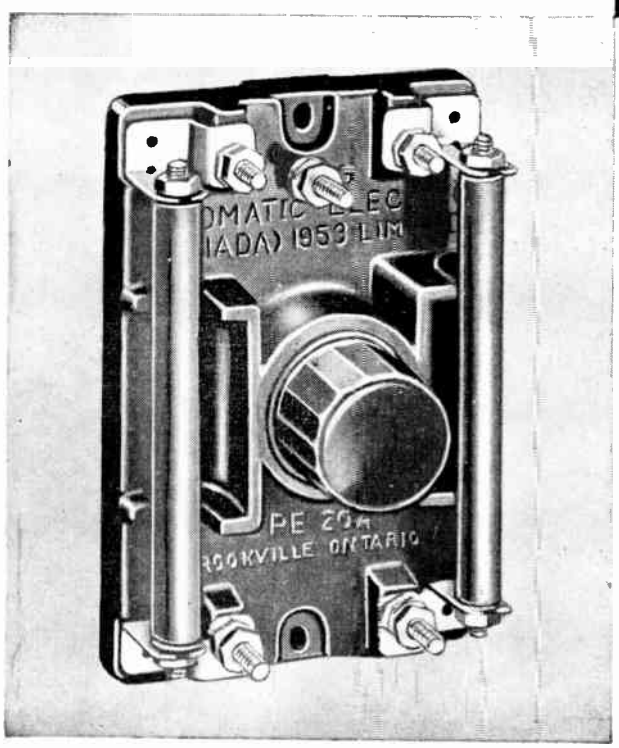
Just two screws fasten protector to wall. Terminals easy to reach.

LONG-LIFE BASE

Heavy porcelain. Stands hard service. Helps ensure long service life.

Cat. No.	Dimensions	Fuses	Shipping Wt.
SB-18	2¾" x 2¾" x 7½"	7 ampere	2¼ lbs.





TYPES 20 AND 20A
INDOOR AND OUTDOOR SUBSTATION PROTECTORS

Type 20A for indoor service illustrated. Equipped with "Dollar-Saver" discharge blocks, protected from dust and moisture by plastic cover. Heavy one-piece base with ample spacing between terminals and heavy walls between discharge blocks and fuses.

Type 20 for outdoor use furnished with heavy gauge metal base plate and cover, hot-dip galvanized for protection against rust and weather.

Cat. No.	Type	Dimensions	Fuses	Shipping Wt.
SB-91	20 (Outdoor)	5⅛" x 3⅛" x 8"	7 amp.	4¾ lbs.
SB-88	20A (Indoor)	3½" x 2¾" x 5¼"	7 amp.	1¾ lbs.

Ask for Catalogue 4068-B, covering the complete line of AUTOMATIC ELECTRIC Protective Equipment.

5553

AUTOMATIC ELECTRIC (CANADA) LIMITED

Distributor in Canada

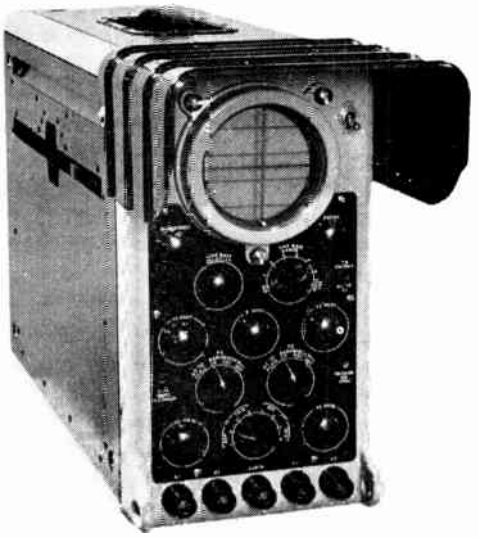
AUTOMATIC ELECTRIC SALES (CANADA) LIMITED

Head Office: 185 Bartley Drive, Toronto 16

MONTREAL • OTTAWA • BROCKVILLE • HAMILTON • WINNIPEG • REGINA • EDMONTON • VANCOUVER

For further data on advertised products use page 65.

INTRODUCING...



The NEW

COSSOR

OSCILLOSCOPES

For All Applications

MODEL 1058

Single beam 4" tube
Post deflection acceleration

Wide band D.C. Y amplifier
Symmetrical X amplifier

Free running or triggered time base

Sweep expansion times 5

Automatic trigger and sync. control

Continuously variable trigger pulse attenuator.

Y AMPLIFIER

D.C. to 6 mc/s.

Sensitivity 25V to 125V per cm.
Gain continuously variable.

X AMPLIFIER

10 c/s to 150 Kc/s.
Sensitivity .5V to 50V per cm.
Gain continuously variable.

Weight — 42 lbs.

MODEL 1052

Double beam 4" tube.
Frequency Range
25 c/s to 3.5 mc/s
Matched amplifiers.

Full screen deflection at all positions of T.B.

Sweep duration — 5 microsecs to 200 milliseconds.

Weight — 42 lbs — portable.

MODEL 1056

Single beam post deflection acceleration.

Y AMPLIFIER

5 c/s to 40 mc/s.
Rise time 10 millimicrosecs.
Sensitivity — .2V to 60V per cm.
Gain continuously variable.
Signal delay 16 millimicrosecs.

TIME BASE

Triggered only
10 millimicrosec. to 30 microsec per cm. Sweep amplitude two screen diameters.
Timing wave 100 mc/s to 100 Kc/s

Weight — 65 lbs. approx.

MODEL 1059

Double beam
Post deflection acceleration

Y AMPLIFIER

10 c/s to 10 mc/s.
Sensitivity .2V to 180V per cm.
Gain continuously variable.

Signal delay 150 millimicrosecs.

Y1 PREAMPLIFIER

Gain 20 times over 20 c/s to 5 Kc/s.

Y2 AMPLIFIER

Same as Y1.

X AMPLIFIER

10 c/s to 500 Kc/s.
Sensitivity 3V to 15V per cm.
Gain continuously variable.

TIME BASE

Triggered with sync.
Free running without sync.

.1 microsec to 50 millisec. per cm.

Expansion times 5.

Weight — 65 lbs. approx.

COSSOR (CANADA) LIMITED

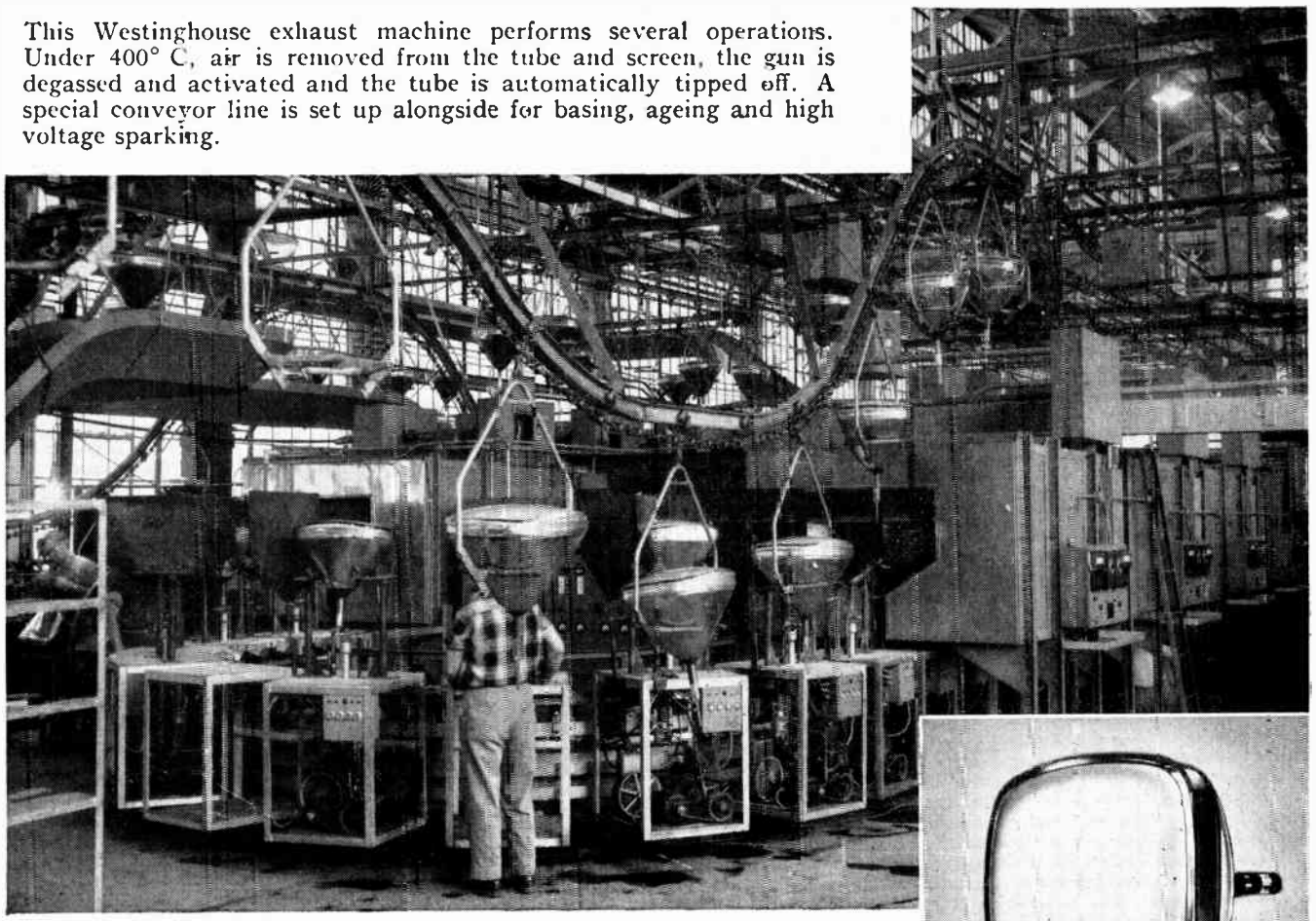
**301 Windsor St.,
HALIFAX, N.S.**

**8230 Mayrand Str.,
Decarie Blvd.,
MONTREAL, QUEBEC**

**648A Yonge Street
TORONTO, ONTARIO**

For further data on advertised products use page 65.

This Westinghouse exhaust machine performs several operations. Under 400° C, air is removed from the tube and screen, the gun is degassed and activated and the tube is automatically tipped off. A special conveyor line is set up alongside for basing, ageing and high voltage sparking.

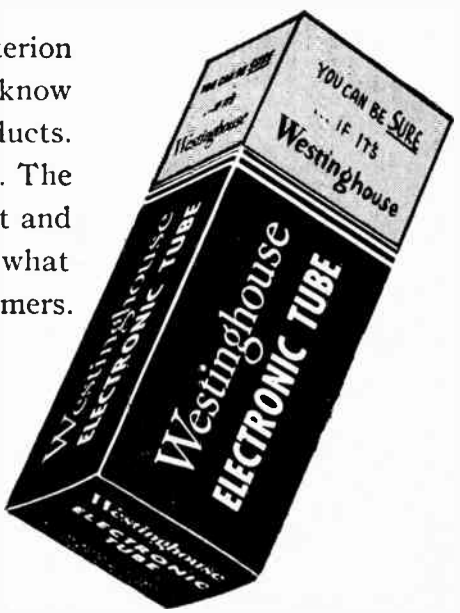


Quality Control means Quality Picture Tubes

. . . and satisfied customers.

Satisfied customers are your criterion of a job well done. To achieve this you know you must work with quality products. That is why we suggest Westinghouse tubes. The latest production methods and the newest and best equipment are used throughout. This quality control is what makes good tubes. Good tubes help make satisfied customers.

- *Purchase Westinghouse tubes from your local tube jobber.*



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

CANADIAN WESTINGHOUSE SUPPLY CO. LTD.

Halifax · Quebec City · Montreal · Ottawa · Toronto · Hamilton · North Bay
Fort William · Winnipeg · Regina · Saskatoon · Edmonton · Calgary · Vancouver

For further data on advertised products use page 65.

ELECTRONICS and COMMUNICATIONS

THE ONLY CANADIAN JOURNAL DEVOTED SPECIFICALLY TO THE APPLICATIONS OF COMMUNICATIONS AND ELECTRONICS

MARCH • 1956
Vol. 4 No. 2

EDITORIAL CONTENTS

FEATURES

DEPARTMENTS

PRINTED IN CANADA
60

PUBLISHED BY AGE PUBLICATIONS LIMITED

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

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

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

Subscription Rates: Canada and British Possessions - $5.00 per year
United States of America - $7.50 per year • Foreign - $10.00 per year

Authorized as second class mail. Post Office Department. Ottawa.

For further data on advertised products use page 65.

VOLUME 4, NUMBER 2 • MARCH, 1956

"Do-It-Yourself" Personnel Training

Most people will recall that during the early days of the last war one of the most significant shortages suffered by this country was a lack of skilled and semi-skilled technicians. As a result of this shortage, trained personnel were brought across from the United Kingdom to fill the gap in manufacturing plants wherever the paraphernalia of war was being manufactured.

It would be fatuous to blame Canadian industrial management for their shortsightedness in not having trained technician apprentices in the years preceding the war, for these were years during which this country and many others were just nicely recovering from the economic injuries sustained during the lean thirties, the years during which there was not enough work to gainfully employ fully skilled technicians apart from the training of apprentices. Today, however, the situation is vastly changed and Canada is enjoying the benefits of a lively economy with its accompanying high rate of employment and production in all spheres of activity.

★

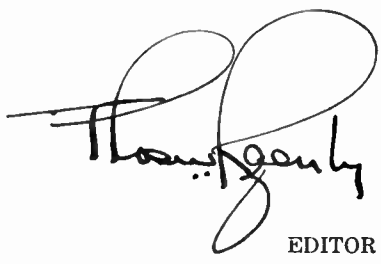
In the field of electronics, which this magazine has termed the "youngest and fastest growing industry in Canada," there has recently been sounded a warning which should be taken to heart by every manufacturer engaged in this field. It is the warning that Canada's electronic industry could be heading for a road block that will slow down its seven league strides. The trouble stems from a sharp shortage of skilled personnel to man the industry's highly specialized drafting boards. Already causing concern, this is a problem that could become acute as the electronics field continues to expand. That such a situation should obtain, in spite of the fact that our technical schools are graduating hundreds of electronic technicians annually, emphasizes the seriousness of the situation.

★

★

The question then arises — what steps should be taken to avoid a problem which may conceivably develop into a major deterrent to the electronic industry? One firm at least believes it has the answer with a "Do-It-Yourself" approach. Officials at Canadian Westinghouse reason that if skilled draftsmen are such a rare commodity, then they will simply have to produce their own. From this thinking has emerged a project which is believed to be unique to the electronics industry. The venture is a three and one half year training program in electronics drafting which has wisely been inaugurated to make sure that this company will have a future pool of drafting talent available.

Westinghouse officials are to be commended for their forward thinking in this matter and other companies would do well in considering similar methods of training skilled personnel if their future development programs are not to be hampered by the lack of capable help.



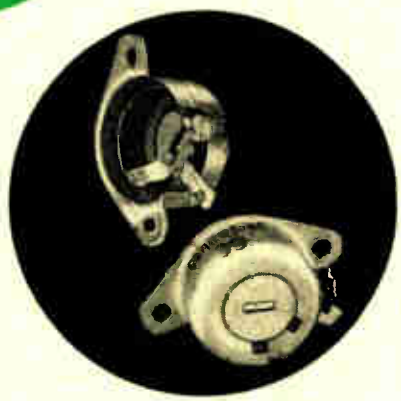
EDITOR

From "The House of Resistors"** come . . .

COST-REDUCING CONTROLS

So you must *get cost down* in designing that assembly? That's just the time to enlist Clarostat's cost-saving talents and facilities. The same superlative engineering and production skill that accounts for the finest quality in controls and resistors, is also available for designing and fabricating cost-reducing components. Three typical examples are presented herewith. These are *standard* items, promptly available in any quantities, at marked savings. And for any extraordinary requirements, *special* controls and resistors can be developed, tooled-up and produced.

The original "Humdinger" Series MH. Compact, rugged, wire-wound control. Virtually millions in use. Fibre base holds resistance winding. Movable arm and shaft. 1-watt. 2 to 1000 ohms.

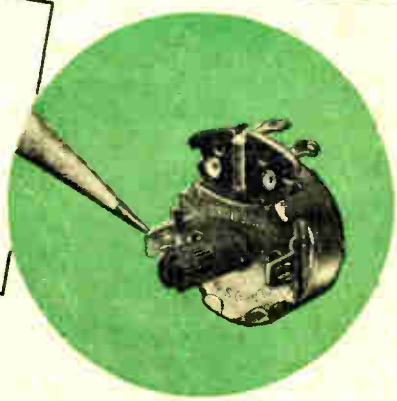


Latest "Humdinger" Series 39. Metal-case mounted with rivets or screws. Mounting surface serves as cover. Semi-fixed setting by screwdriver slipped into rotor slot — no shaft. 2-watt. 4 to 5000 ohms.

* *It's easy*

to solve control problems with CLAROSTAT!

Send us that control spec, regardless how "special". Our engineering collaboration, quotations and delivery schedules are yours for the asking.



Twist-Tab Mounted Series 47. Eliminates usual bushing, lockwasher, nut. Composition-element control. Metal or plastic shaft. Plastic shaft has rear slotted protrusion, therefore adjustable from front or rear.

STAND PAT WITH CLAROSTAT® Controls & Resistors

**Trade Mark

Ask your Distributor now or write to:

ELECTRONIC TUBE & COMPONENTS DIVISION

CANADIAN Marconi COMPANY

830 Bayview Avenue, Toronto, Ontario.

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

CL-5464

For further data on advertised products use page 65.

RETMA REPORT

A Monthly Bulletin Of Association Activities Prepared For Electronics And Communications

By

BASIL JACKSON

Electronics Industry Reports To Royal Commission

On March 1st, Carl A. Pollock, president of the Radio-Electronics-Television Manufacturers Association of Canada, and Stuart D. Brownlee, past general manager of the Association, presented the Electronics Industry report to the Royal Commission on Canada's Economic Prospects. The report to the Royal Commission was very optimistic about the future of the Electronics Industry in Canada. Due to the evolutionary and auto-generative nature of the art and science of electronics, the industry possesses untapped resources in the way of technological innovations which will provide a springboard for the development of new useful products and for the establishing of new industries in Canada. It was pointed out that today the industry is manufacturing products which only ten years ago were only in the laboratory stages of development, and it is claimed that ten years from now the same situation will evolve —— in fact new, currently unknown, industries will be created in Canada due to the application of the art and science of electronics.

Among other important recommendations, the two outstanding were those directed to the questions of research and technical education. In emphasizing that the basic factor responsible for the development of electronics is research, both fundamental and applied, the presentation recommended that both Government and industry assist each other in providing more research facilities within Canada. Special tax allowances for research work and the consideration of the Department of Defense Production issuing more development contracts which take cognizance of the fact that research work is very costly, were advocated. With regard to technical education, the RETMA Brief points out the great need for training more technical personnel of all types, and recommends that the Federal Department of Labor, the Department of Citizenship and Immigration, and representatives of Provincial Departments of Education, meet with representatives of the Electronics Industry to formulate an active program for expanding the present facilities for higher technical education, for the founding of new centers of technical learning, for the surveying and placement of technical personnel in the industry, and for the continual review of the situation. It was emphasized that this action is necessary not only for the future benefit of the Electronics Industry, but to ensure a constant supply of trained electronics specialists and service technicians for the many industries using electronic equipment.

The Radio-Electronics-Television Manufacturers Association of Canada, in its presentation to the Royal Commission, gave a summary of the work which it had accomplished and is still carrying on for the upgrading of the technical education of service technicians. The Brief went on to say that, although, under the British North America Act, education is the responsibility of the individual Provincial legislatures, a co-operative effort should be made to co-ordinate the technical education on a national level and the award of Canadian national certificates in engineering should be instituted, patterned after the system operating in Great Britain. It was inconceivable to the authors of the British North America Act in 1867 that the sciences would eventually cause revolutionary developments to take place so

(Continued over page)

that the length and breadth of Canada could be linked simultaneously by electronic means, and some measure of a national education system, at least in technology, should be achieved at the earliest opportunity.

A section of the Brief deals with automation, and it is stated that the application of automation to primary and secondary industries will lower the costs of production, resulting in lower end prices of the products manufactured, and will create a wider market for these goods, ultimately increasing the number of workers required. The gradual introduction of automation and its orderly development by responsible industrial and labor representatives will ensure that its effects will be beneficial to all Canadians.

The Electronics Industry Brief, as presented by Radio-Electronics-Television Manufacturers Association of Canada, is divided into three parts. Part I deals with the development of the Canadian Electronics Industry from early times. Part II deals with the Canadian Electronics Industry today, while Part III concerns the Canadian Electronics Industry and Canada's Economic Prospects.

Première Of Industry Film

On February 15th, at a joint meeting of the Radio-Electronics-Television Manufacturers Association of Canada Board of Directors, Parts and Accessory Division, and Receiver Division, in Montreal, the industry film prepared by RETMA received its premiere performance. The film is entitled "Electronics in Canada", is in color and gives an account of the contribution of the Electronics Industry to Canada's economy and welfare. The film took over a year to prepare and make, and pays tribute to the part played by the Electronics Industry in the National Defense program, shows the contribution to industry in general, and graphically illustrates the important parts and accessory segment of the industry which has been built up in Canada over the years.

It is the intention of RETMA of Canada to make this film available on loan to interested groups, organizations, Government departments and educational institutes such as schools and universities.

Applications for loan of the film should be addressed to Radio-Electronics-Television Manufacturers Association of Canada, 200 St. Clair Avenue West, Toronto 7, Ontario.

Membership Of RETMA Of Canada

The membership of Radio-Electronics-Television Manufacturers Association of Canada now stands at 116 full members and 2 associate members. There are 22 members in the Receiver Division, 22 members in the Electronics Division, and the Parts and Accessory Division have 72 members.

Two new applications for membership, both for the Electronics Division, were recently ratified by the Directorate. They are as follows:

Spilsbury and Tindall Limited, 44 Water Street, Vancouver, B.C., manufacturers of radio communication equipment.

PSC Applied Research Limited, 1500 O'Connor Drive, Toronto, Ont., manufacturers of airborne electronic navigation equipment, fire control equipment, servo mechanisms, etc.

(Continued on page 36)

For Greater Television Development and Service

The Simpson 303 is a versatile instrument — use it as an electronic DC voltmeter, an ohmmeter, an AC voltmeter, an AF voltmeter, an RF voltmeter (with accessory probe), an output-meter, or a FM indicator.

Painstaking research by Simpson engineers in the laboratory, working closely with TV set manufacturers produced the model 303. Compact for greater portability, the 303 is also accurate and functional. Its large 4¼" meter is easy to read and its wide voltage and resistance ranges, as well as low current consumption, justify its claim to versatility.

Simpson model 303

Vacuum tube Voltmeter

SPECIFICATIONS:

DC input Resistance 10 megohms
AC input approximately 200 mmf shunted by 275K.
Flat Frequency Response
- AC-25 cycle to 100 KC
- RF-20KC to 100 MC

5 DC Voltage Ranges 1.2V to 1200V
5 AC Voltage Ranges 1.2V to 1200V
5 Ohm Ranges — to 1000 megohms.
High Frequency and High Voltage Probe available as accessories.
Available in 60 cycle or universal 25-60 cycle.
Also available with roll top case, Model 303RT.

In U.S.A.
Simpson Electric Company
5200 W. Kinzie Street
Chicago 44, Ill.

Bach-Simpson LIMITED

1255 BRYDGES ST. LONDON, CANADA

For further data on advertised products use page 65.

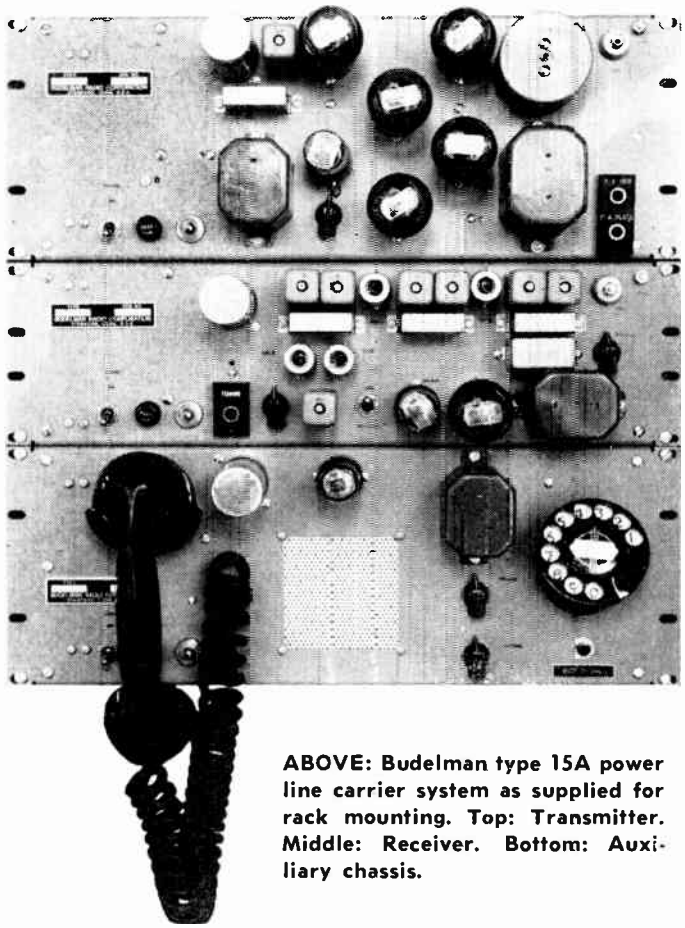
BUDELMAN POWER LINE CARRIER

A flexible carrier current telephone system at a very moderate price for use in:

- **push-to-talk single or two-frequency systems**
- **two-frequency duplex systems; loudspeaker calling, code calling and 60-cycle or 780-cycle dialling are available.**

UNITIZED EQUIPMENT built up of several standardized chassis to suit particular circuit requirements. Each basic function is incorporated in a separate chassis for ease of maintenance and to allow assembly as required.

Each chassis is self-powered from either 115 volt A.C. source or 130 volt D.C. source without modification, to permit emergency operation from a stationary battery. This feature allows standby D.C. operation without the expense of DC-AC convertors.



ABOVE: Budelman type 15A power line carrier system as supplied for rack mounting. Top: Transmitter. Middle: Receiver. Bottom: Auxiliary chassis.

HERE ARE BASIC CHASSIS:

CARRIER CURRENT TRANSMITTER TYPE 151A — This unit contains a 3-5 watt MOPA transmitter utilizing a highly stable electron — coupled oscillator operating on any specified frequency between 40 and 160 KC with provisions for crystal control of the operating frequency. The power amplifier utilizes two tubes in parallel for reliability. It is amplitude-modulated by a push-pull modulator and audio amplifier. Provisions are made in the audio input for a hybrid connection in the case of two-wire duplex audio extensions.

CARRIER CURRENT RECEIVER TYPE 152A — A self-powered, amplitude-modulated unit of the tuned R-F type employing two stages of R-F amplification and a complete freedom from spurious responses. An additional R-F stage is provided after the detector to amplify the carrier for AVC purposes. A squelch circuit quiets the output of the receiver except when a carrier is being received.

AUXILIARY CHASSIS TYPE 153A — Typical of various types of auxiliary chassis available to supplement the transmitter and receiver and to form, with them,a complete carrier terminal. The 153A unit is used in cases where the system calls for push-to-talk operation, outgoing dialing using 60-cycle or 780-cycle tones, and incoming loudspeaker calling. It is self-powered and contains a push-to-talk handset and hangup, tone oscillator, dial loudspeaker and control circuit.

AUXILIARY UNITS AVAILABLE

- **Type 182A switch panel.**
- **Type 183 dual tuning panel.**
- **Type 183B dual trap panel.**
- **Type 184B dual matching panel.**
- **6 milihenry adjustable loading coil.**

Engineers and consultants on mobile, fixed-to-mobile, point-to-point, and multi-channel radio communication systems; suppliers of telephone apparatus of all kinds; manufacturer and supplier of scientific instruments, industrial and broadcast television cameras, radios, high-fidelity reproducers and television receivers.

PYE CANADA LIMITED

60 Front St. W., Toronto

193 E. Hastings St. VANCOUVER
78 Bank Street OTTAWA
1191 University St. MONTREAL
3 Duke St. HALIFAX

For further data on advertised products use page 65.

business briefs & trends

★ The United States Department of Labor has announced that automatic production techniques are creating new jobs. Department of Labor officials in Washington have announced the following new labor categories: automation machine operator, automation assembler, automation machine tender, stager, printed circuit sprayer and printed circuit machine operator.

* * *

★ Electronic firms have been created at the rate of one per week over the past year in California. Financing for these firms has created a sufficient problem to justify the establishment of financing firms specializing in the backing of electronic manufacturing companies.

* * *

★ President Eisenhower's 1956 budget message indicates that expenditures for electronics and communications during 1957 will be higher than the preceding year. The amount of money set aside for the construction of guided missiles will be as much as one third more than the amount spent in 1956, and about half the cost of the 1957 guided missile program will be for electronic equipment.

* * *

★ James D. Secrest, executive vice-president of RETMA in the United States, anticipates that at least 250,000 color television sets will be sold this year.

* * *

★ Donald G. Mitchell, president of Sylvania Electric Products, Inc., foresees that by 1965 the distribution-service business in the electronics industry will reach a value of $5,178,000,000. Mr. Mitchell's breakdown of this 1965 figure sees $2,104,000,000 being spent for electronic components, $1,389,000,000 for the distributor's take and $1,685,000,000 being paid to the service and installation segment of the industry.

* * *

★ Television is now available to the people of 36 countries. Reliable figures show that 1,000,000 television sets are in use in Soviet Russia, 300,000 in West Germany, 210,000 in Cuba, 175,000 in Mexico, 150,000 in Brazil, and 225,000 in both Italy and Japan.

* * *

★ In the world of high speed calculators the Russians recently announced possession of a calculator capable of seven to eight thousand operations per second. International Business Machines' president G. H. Sheppard has countered this with the claim that his company has produced one capable of 60,000 operations per second.

* * *

★ The first permit to construct a critical experiment facility for the conduct of nuclear reactor core tests in private industry has been granted to The Babcock & Wilcox Company by the United States Atomic Energy Commission. The facility, designed for critical experiments and proof testing of reactor components, will be safeguarded by a special electronic control system tied in with the critical assembly doors of the installation.

* * *

★ The growing importance and specialization required in nucleonic instrumentation is evidenced by the recent formation of a permanent Nucleonics Group within Britain's Scientific Instrument Manufacturers' Association. Well over half of the 140 member firms of the Association are engaged to some extent in the field of atomic energy applications, by the provision of electronic, mechanical and optical instruments.

★ The United States electronic industry are looking to pleasure loving Americans to provide a one million dollar annual market for electronic equipment. The pleasure lovers involved are the owners of some five million pleasure boats which constitute a potential market for equipment such as small compact radar sets, communication, sonar and depth sounding apparatus.

* * *

★ According to recent figures there are now 94,500,000 telephones in use in the world. More than half of this number are serving the United States with one telephone to every three Americans.

* * *

★ Instrumentation for nucleonic applications is increasing rapidly. One firm reports that its sales of equipment for industrial, nuclear and medical applications topped the million dollar mark for 1955, a gain of 13 per cent in shipments for the previous year.

* * *

★ First insurance company in the Pacific Northwest to institute high-speed electronic data processing was General of America with headquarters in Seattle, Washington. The company has installed a complete system to take over paperwork loads in billing, rerating and accounting for thousands of agents and hundreds of thousands of policyholders.

* * *

★ The Canadian electronics industry is eyeing Germany's $600,000,000 bank roll with which it intends to buy armaments from nations abroad. The Canadian aircraft industry is reported to be making a strong bid to manufacture some of the 1,236 aircraft which the German airforce has been authorized to purchase. Radar and electronic equipment for such aircraft as may be manufactured in Canada for Germany's account constitutes a profitable potential business for the electronics and communications industries in this country.

* * *

★ Dr. W. H. Watson, director of the Computation Center, University of Toronto, has told the Royal Commission on Canada's Economic Prospects that the age of the electronic computing machine is dawning in Canada and that the Federal Government should recognize its potential impact on the nation's economy by backing scientific study into this field.

* * *

★ Otis Elevator Company's vice president, W. J. W. Reid, told a recent gathering of the Ontario Association of Professional Engineers that "the atom and the automatic factory coupled with a phenomenal growth in world population and industrialization have resulted in forces for production beyond the imagination". Quoting a U.S. weekly report to management (Business International) he predicted that within ten years' time the atom will have become the world's largest business employing more engineers, technicians, management, labor and capital than any other.

* * *

★ Canadian Customs and Excise officials have ruled that "transcription turntables which are designed, manufactured, catalogued and sold exclusively for use in broadcasting stations or for professional users, such as phonograph record manufacturers or commercial studios, are not subject to excise tax".

(Turn to page 35)

Automatic, maintenance-free, instantaneous voltage stabilization

Static-magnetic constant voltage transformers are a practical and efficient solution for controlling input voltage to voltage-sensitive electrical and electronic equipment.

Sola Constant Voltage Transformers are widely used both as built-in components and as accessory units. They differ from regulators which depend solely upon saturation of core materials for their regulating action, or electronic types employing tubes. Sola Constant Voltage Transformers have the following characteristics:

1. Regulation within ±1%, with primary voltage (transient or continuous) variations as great as 30%.
2. Response time less than 1½ cycles.
3. No moving or wearing mechanical parts, nor vacuum tubes; requires no manual adjustments.
4. Completely automatic, continuous regulation.
5. Self-protecting against short-circuits on output.
6. Current-limiting characteristics protects load equipment.
7. Can often be substituted in place of conventional non-regulating transformers.
8. Generally smaller than other types of regulators for similar duty.
9. Isolates the input and output circuits.

Forty-three Sola stock units are available in a wide variety of ratings, voltages and types. In addition, custom-designed units can be manufactured (in production quantities) to meet specific requirements.

The experience of the world's largest manufacturer of constant voltage transformers is available to you. We invite you to discuss your voltage stabilizing problems with a Sola Sales Engineer.

SOLA *Constant Voltage* **TRANSFORMERS**

WRITE FOR LITERATURE. Sola Constant Voltage Transformers are described in a 4-page folder. Write for a copy of 32C-CV-170 on your letterhead, please.

CONSTANT VOLTAGE TRANSFORMERS for Regulation of Electronic and Electrical Equipment • **LIGHTING TRANSFORMERS** for All Types of Fluorescent and Mercury Vapor Lamps. • **SOLA ELECTRIC CO.**, 4633 West 16th Street, Chicago 50, Illinois, Bishop 2-1414 • *NEW YORK 35: 103 E. 125th St., TRafalgar 6-6464 • PHILADELPHIA: Commercial Trust Bldg., Rittenhouse 6-4988 • BOSTON: 272 Centre Street, Newton 58, Mass., Bigelow 4-3354 • CLEVELAND 15: 1836 Euclid Ave., PRospect 1-6400 • KANSAS CITY 2, MO.: 406 W. 34th St., Jefferson 4382 • LOS ANGELES 23: 3138 E. Olympic Blvd., ANgelus 9-9431 • TORONTO 17, ONTARIO: 102 Laird Drive, Mayfair 4554 • Representatives in Other Principal Cities*

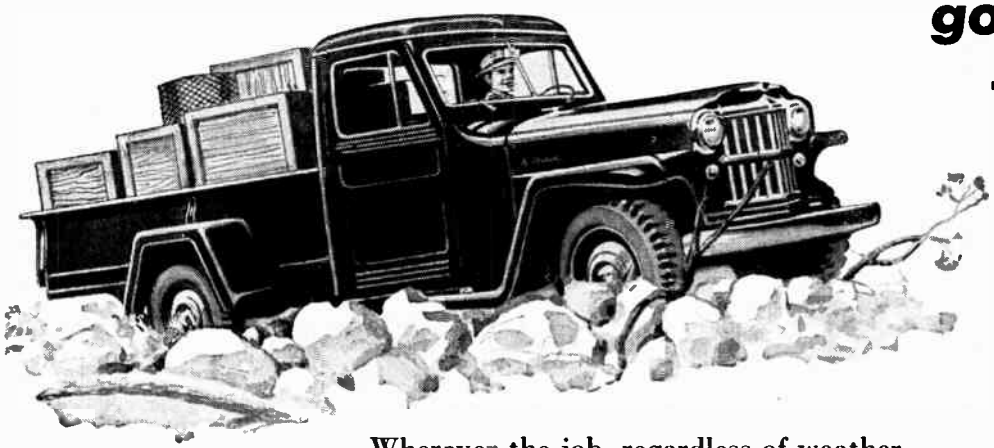
For further data on advertised products use page 65.

The nation's work horses!

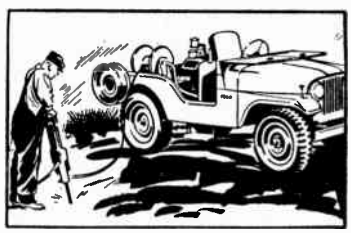
'Jeep'® 4 Wheel-drive VEHICLES

go anywhere —anytime

to the job, on the road or off.

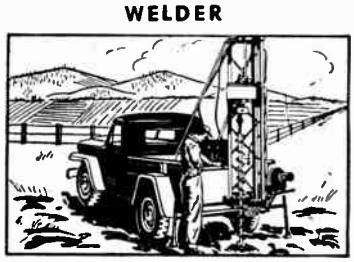


Wherever the job, regardless of weather or ground conditions, a sure-footed 'Jeep' vehicle will get there, with men, equipment or payload. Shifting instantly from 2-wheel drive to the added traction of all four wheels, they go through sand, mud, snow and navigate the steepest grades with ease.



COMPRESSOR

WELDER



DRILL

'JEEP'-A-TRENCH

The most versatile vehicles ever built!

CJ-5 'JEEP'

Every 'Jeep' vehicle has 3 power take-off points available. Each is a mobile power plant, delivers ready auxiliary power anywhere to operate compressors, generators, belt-driven equipment and winches. And there's over fifty pieces of special equipment to make 'Jeep' 4-wheel drive vehicles the handiest, most useful and profitable investment any business could make!

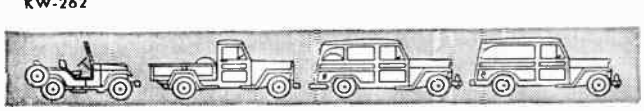
'JEEP' CARGO PERSONNEL CARRIER

'JEEP' SEDAN DELIVERY

For the toughest "impossible" jobs the world automatically thinks of 'Jeep'

KAISER-WILLYS OF CANADA LTD.

KW-262



WINDSOR • ONTARIO

Canada's most useful vehicles

For further data on advertised products use page 65.

This is the Plant that SPERRY built...

TO OVERHAUL *EVERY* TYPE OF INSTRUMENT

HERE, in the most modern plant of its kind in Canada, a staff of engineers with a combined experience of hundreds of years . . . using instruments, inspection facilities and control procedures of the most modern kind . . . are equipped to overhaul and repair more than 500 different types of meters, controls and devices.

Recording instruments need to be periodically overhauled. This can be done by Sperry on a regular schedule that allows for continuation of operations. Often it is less expensive to overhaul and repair intricate metering devices, etc., than to replace them.

Complete facilities exist at Sperry for the overhaul and rework of gyroscopic, electronic, electrical, magnetic, electro-mechanical, pressure sensitive, chronometric, optical and hydraulic instruments; also for custom work in manufacturing, modification or repair of tools and parts.

The Sperry plant is conveniently located to give fast service, and Sperry engineer representatives are qualified to give full information on any overhaul or repair problem.

For further assistance write, wire or phone:

OVERHAUL SALES DIVISION

SPERRY GYROSCOPE OTTAWA LIMITED

Phone 8-1600

3 Hamilton Ave., Ottawa, Ont. 1-1

For further data on advertised products use page 65.

NOW— *in full operation*

Standard *Coil*

SERVING CANADA—COAST TO COAST

NEW PLANT
NOW OFFERS YOU
TUNER KNOW-HOW — MOST ADVANCED ENGINEERING AND PRODUCTION TECHNIQUES.

WORLD'S LARGEST INDEPENDENT MANUFACTURER OF TV TUNERS

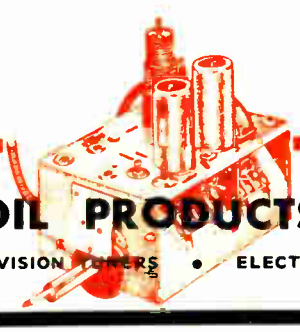
WHAT YOU WANT — WHEN YOU WANT IT

Whatever your needs, you can be certain with STANDARD. World-famous quality and dependability.

Exceptional tuner know-how backed by over 20 years' experience in the Electronic field. Up-to-the-minute engineering techniques . . .

The last word in production, speed, skill and efficiency. For peak performance — pick STANDARD. It's "The Standard" of quality the world over.

IN TV—IT'S STANDARD!



Standard

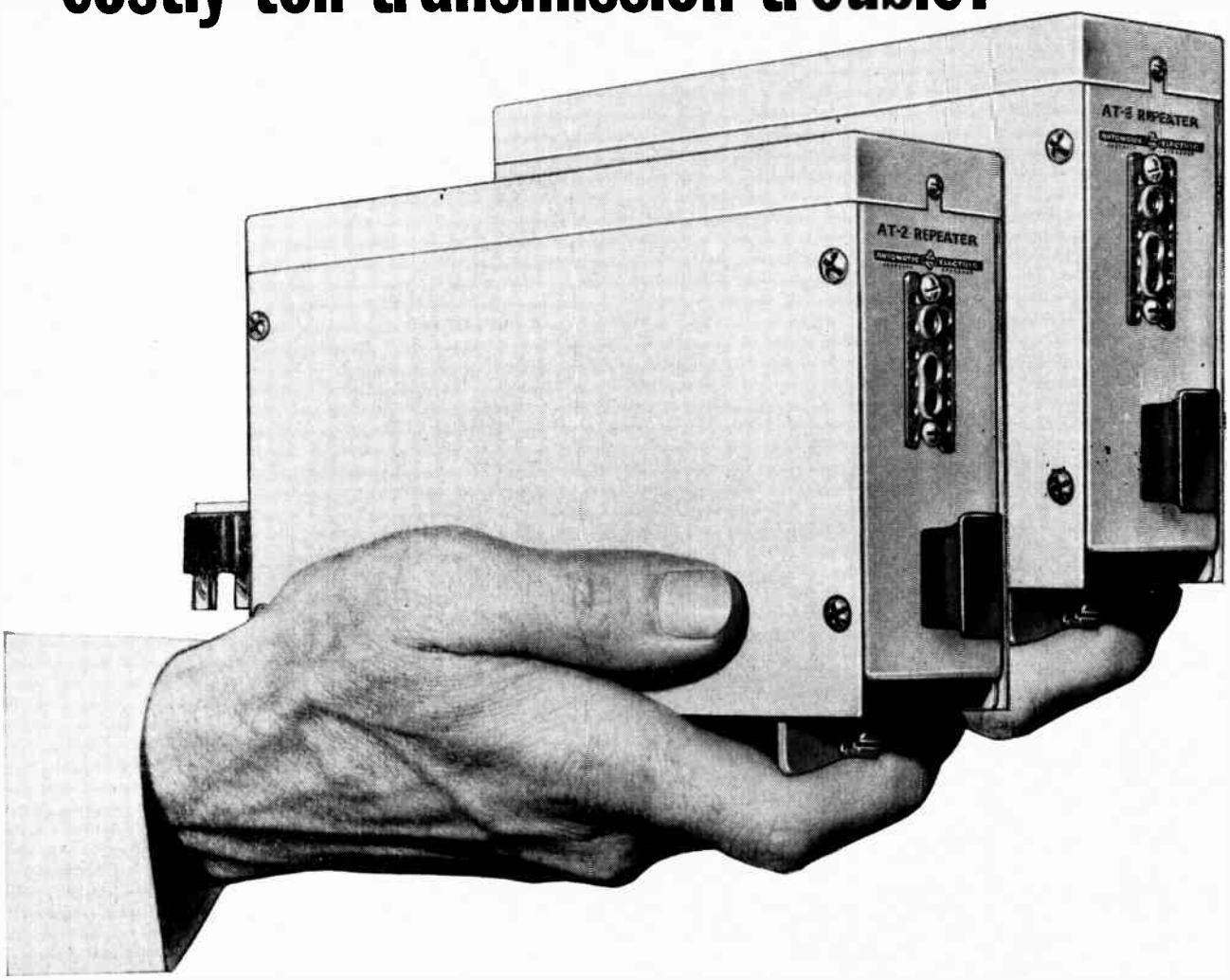
37 Drummond St.
Mimico, Ontario

COIL PRODUCTS (CANADA) LTD.

TELEVISION TUNERS • ELECTRONIC EQUIPMENT AND COMPONENTS

For further data on advertised products use page 65.

A small handful that can save a peck of costly toll transmission trouble!



Automatic Electric's Type AT-2 and AT-3 Voice Frequency Repeaters can improve transmission on many trunks or long lines where the cost of conventional repeaters or other methods are prohibitive. AT Repeaters end the need for costly cable loading, or the use of heavier gauge cable or wire to raise transmission level. And on new installations, smaller gauge cable or wire can be used with these repeaters—reducing outside plant costs.

AT-2 and AT-3 Repeaters provide for the first time all the benefits of the negative-impedance principle (economical voice frequency amplification on marginal trunks, special service circuits and foreign-exchange lines), plus all the space-saving, long life advantages of transistorized circuits. Initial cost of these repeaters is low, and the use of transistors instead of vacuum tubes practically eliminates maintenance.

The Type AT-2 is a "series-type" repeater. Type AT-3 is a "shunt-type". On non-loaded lines, the Type AT-2 is limited to 8 db gain, and the Type AT-3 is often used with it, to aid in bringing circuits up to toll quality requirements. The combination improves transmission quality, and provides a maximum gain of 10 db when used at the midpoint of a line, and 6-8 db when used as terminal repeaters. The Type AT-3 is added also on installations where excessive impedance discontinuity would cause a high "echo", or where the use of the AT-2 Repeater alone would cause the "hybrid coil"-equipped toll circuits and carrier channels to "sing". (The Type AT-3 Repeater is rarely used alone.)

Type AT-2 and AT-3 Repeaters are completely self-contained: power is supplied by the exchange battery. Because these repeaters use transistors, a repeater requires only 1 watt of power to operate—or about 1/10th as much as repeaters of older designs.

A complete repeater is only 5¼ inches high, 2 inches wide, 8½ inches deep. A bank of eight repeaters can be mounted side by side on a 19-inch relay rack, or a bank of ten repeaters on a 23-inch W. E. type relay rack.

5615

For complete Information
Write today for Circular 1844-A

AUTOMATIC ELECTRIC
(CANADA) LIMITED
Distributor in Canada
AUTOMATIC ELECTRIC SALES (CANADA) LIMITED
Head Office: 185 Bartley Drive, Toronto 16
MONTREAL • OTTAWA • BROCKVILLE • HAMILTON • WINNIPEG • REGINA • EDMONTON • VANCOUVER

For further data on advertised products use page 65.

PROGRESS

Points
An
Electronic*
Finger

The relay tower is a sign of our progress in communications just as the transmission tower opened the country with electric power over the past 50 years.

Central Bridge already successful in building steel ship bottoms, tanks, bridges and structural work of all kinds, leads again with fabrication and erection of these new electronic fingers in the sky; the television and micro-wave relay tower.

CENTRAL BRIDGE *Company, Limited Trenton, Ontario*

**Central Bridge Towers were recently made for:*
Bell Telephone Company of Canada
Dept. of National Defense
Canadian Broadcasting Corporation
Eastern Telephone and Telegraph
New Brunswick Telephone Company

For further data on advertised products use page 65.

announcing

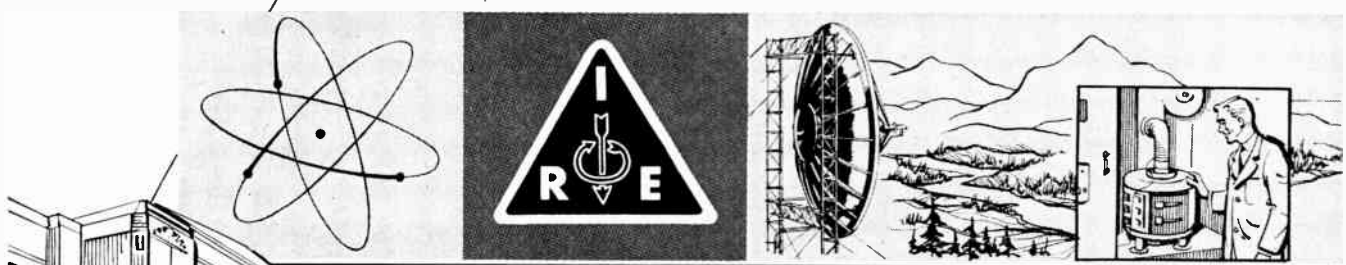
CANADA'S FIRST FULL SCALE

ELECTRONICS and NUCLEAR SCIENCE

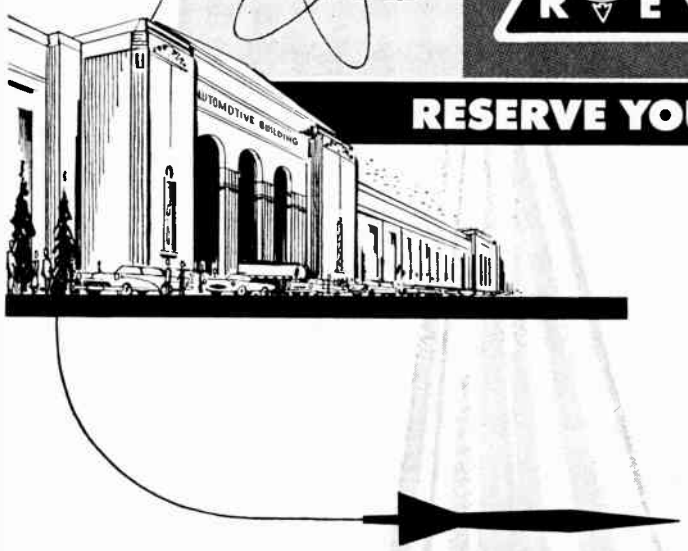
CONVENTION

and exposition

AUTOMOTIVE BUILDING, EXHIBITION PARK
TORONTO, CANADA
OCTOBER 1ST, 2ND and 3RD, 1956



RESERVE YOUR EXHIBIT SPACE NOW!



On the occasion of the 30th Anniversary of the Institute of Radio Engineers in Canada, this Convention and Exposition will be a milestone in the development of the Electronics Industry.

A comprehensive programme of exhibits and technical papers by leading experts will be presented in the superb accommodation of the Automotive Building at Exhibition Park in Toronto, Canada. The addition of exhibits and symposia on the industrial application of nuclear science will be an important feature of this scientific assembly.

The 1956 Canadian I.R.E. Convention will be a must for thousands of engineers, technicians and buyers from Canada, the United States and abroad.

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

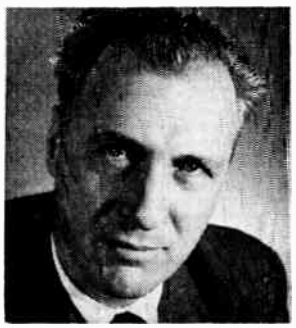
CANADIAN I.R.E. CONVENTION

Office: 745 Mount Pleasant Rd., Toronto 12, Canada
Telephone HUdson 8-7768

30th Anniversary in Canada

The Institute of Radio Engineers

For further data on advertised products use page 65.



The EDITOR'S PAGE

Electronic engineers are becoming so incensed at claims for the braininess of machines that one of them has drawn up specifications for one of the most amazing data processing systems ever developed. The specifications were outlined in a recent Minneapolis-Honeywell Regulator Company inter-office memorandum, and go something like this:

Our Engineering Department has completed the design analysis of an automatic "brain" that outperforms all contemporary electronic data processing machines and so-called robot "brain" computers. We know the performance characteristics of its components and we have a group of working models. Most important, however, it has been proved that the unit can be produced by unskilled labor! Yet we believe that our Production Department would have a difficult assignment in manufacturing it.

This compact unit (only about one-twentieth of a cubic foot in volume) operates on one-tenth of a volt of electricity. It can instantaneously digest extremely complex data and transmit signals or message responses. It can initiate a complete range of appropriate control actions. It has 10,000 times as much "memory capacity" as present-day electronic computers, and it can store this data for 60 to 90 years, sometimes longer.

The unit is fully sub-miniaturized. More than 15 billion tiny message relay centers handle hundreds of automatic operations. But to duplicate its functions in any computer-type unit—even without regard for cost —would require a five-story building to enclose the components. The full capacity of the Ottawa river would be required for cooling the unit to prevent it from burning itself out during operation.

What is this amazing man-made brain? Well, it's just that—the human brain!

Computer manufacturers may now close their mouths and take a deep breath of relief.

* * *

Speaking of electronic brains, we have received a release which states that one of these devices has recently been developed in the United States for fitting into a new type aircraft bombsight. Like all other electronic brains it is credited with remarkable capabilities, one of which is that it will permit bombers of the U.S. Strategic Air Command to bomb any target on earth with pin-point accuracy. Providing enough of them are ordered by the U.S. Air Force, manufacturers say that they may be able to knock the price of the instrument down to $300,000.00 each. Now if some well-meaning little scientist in some back attic room can produce an electronic brain that will work out a compromise between the policy making brains of the world's political power blocs we could all get back to eating strawberries and cream out of season and rest assured that our pant seats were not destined to be blown off at some future date by nasty little guided missiles all directed with electronic brains with built-in paranoidal tendencies.

According to reports, there is a possibility that the Canadian Broadcasting Corporation will forsake Channel 9 in favor of Channel 6 for telecasting programs from Toronto's CBLT. This possibility has aroused the ire of hundreds of people in the Toronto area who are on the extreme fringe area of the transmissions from Buffalo's Stations WBEN and WGR. Toronto residents in the fringe areas of the Buffalo stations are justifiably concerned over the likelihood that any increase in power of CBC's Toronto station will interfere with their reception of American telecasts. CBC officials have gone on record to state that reception from the American stations will not be interfered with as a result of the proposed change-over. This, however, remains to be seen.

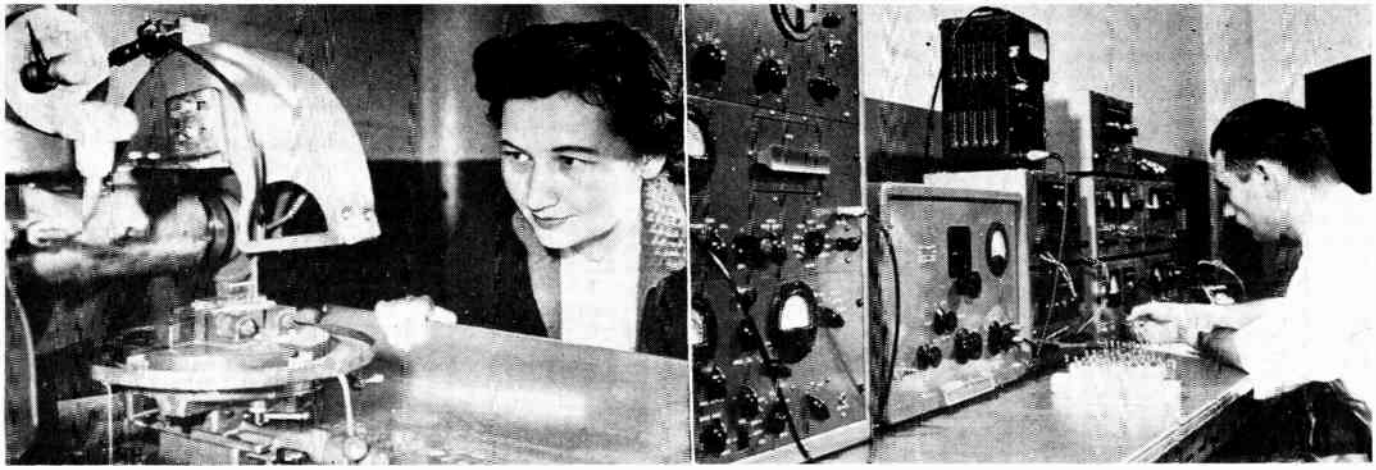
Apart from the likelihood of blanketing out the Buffalo stations and forcing a consistent diet of Canadian programs from the electronic gullets of television receivers in the Toronto area, there are other implications to the prospect that do not augur well for the Canadian television manufacturing industry.

What, for instance, will be the effect on the marketing possibilities of Canadian-produced color television sets if color TV fare available to Canadians is to be restricted solely to those United States-originated programs selected for re-telecasting through the facilities of the CBC?

It is only within the last few months that the CBC announced plans for carrying out the necessary changes to equipment to permit the Montreal, Ottawa and Toronto stations to carry color programs originating in the United States. On the basis of this development the Canadian television manufacturing industry was afforded ample reason to commence the manufacture of color television sets, but we are inclined to doubt that the industry's Toronto area market forecasts were based on the assumption that Canadians would spend money on color television sets if the only color telecasts they are going to be permitted to receive are the ones selected by the CBC. And this, indeed, will be the situation if, as many people believe, the proposed increase in power for Toronto's television station blankets out reception of the Buffalo stations through which a free selection of American color telecasts could otherwise be received.

* * *

The latest comments on the perils confronting labor as a possible result of automation have come from a recent series of lectures sponsored by the Woodsworth School for Workers in Toronto. Assuming that automation will have an adverse effect on labor there is no more appropriate time than now to do some constructive thinking on how these effects may best be alleviated, or better still, avoided. Constructive thinking on the issue would at least be better than the lugubrious prognostications which would appear to constitute the main train of thought on the part of labor officials who are concerned with the advent of automation and its possible effects on labor.



● *Left:* Mrs. Martha Meyer, RCA Victor lab assistant, watches diamond saw slice the tiny, loaf-like ingot of germanium into wafers .015" thick. Wafers are then cut into pellets, each forming the heart of one transistor. *Right:* J. E. Pinnell, physicist-engineer, tests finished transistors in this bank of equipment which lines one wall of the miniature plant.

● Research And Testing Is Slowly Piecing Together The Hidden Secrets Of The Tiny Electronic Workhorse Known As The Transistor. As Solutions Are Found To The Many Mass Production Problems It Is Anticipated That Manufacturing Facilities Will Turn Out . . . . .

Transistors By The Million

A MINIATURE factory in Montreal is quietly blending Canadian manufacturing equipment and industrial know-how to spawn the nucleus of a major new industry from a metal once considered useless.

Measuring only about 40 feet square, the factory is housed within the main plant of RCA Victor Company, Ltd. Its product, president F. R. Deakins has now revealed, is the latest wonder of the electronics age: the transistor.

Reporting entry of the company into production of the transistors, the tiny marvel which promises to revolutionize the design and slash the cost of electronic products of the future, Mr. Deakins said that present output of about 200 a week is earmarked entirely for research and testing. But he hinted that larger production for commercial use may not be far off.

"Commercial transistor production in Canada is just beginning, demand is increasing rapidly, and problems of mass production are gradually being overcome. Perhaps, within a few months, electronic devices equipped with Canadian-made transistors will be available in quantity for the first time", company officials state.

Most of the production equipment, including the special furnaces and ovens, the testing apparatus and the assembly machinery, was designed and built at Montreal demonstrating the technical skill and inventiveness of the Canadian people.

Ten years ago a laboratory curiosity, the transistor today is challenging the electron tube in many markets. Big space and power savings resulting from its miniature size, tiny power needs and long life are speeding the changeover, and RCA Victor officials say an almost unlimited range of potential uses is forming.

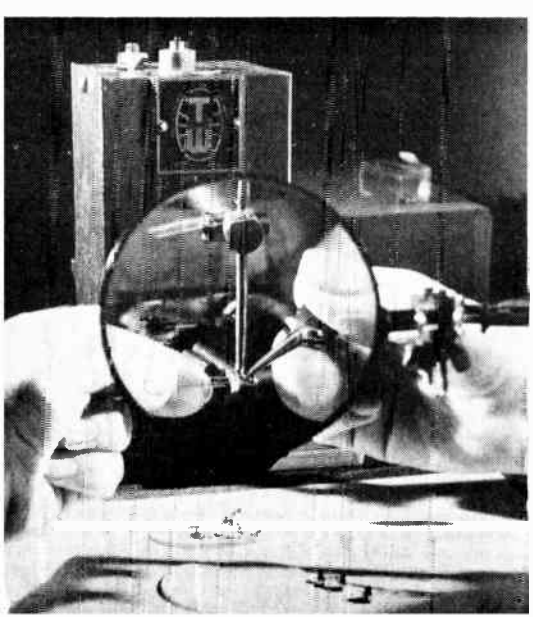
Transistor car radios, for instance, will run on about the same amount of power needed for the two dial lights, while one type of transistor-equipped electronic computer — an adder which can do 100,000 single digit sums per second — needs only one quarter of the power and occupies one-seventh the space required for present models.

Transistor - equipped hearing aids slip unobtrusively into a vest pocket, a purse, or in milady's hairdo. Midget radios are on the market. And the military, too, is using transistors, in guided missiles and other equipment.

How They Are Made

The type now being made looks like a little tin can on legs. A metal shell about the size of a kernel of corn houses its tiny, precision-made heart. Three wires sticking out from the bottom, like a tripod, are its connectors.

For skill and precision-workmanship, transistor manufacture probably has few parallels, certainly in Canada,



● *Left:* Platinum wire — not much thicker than a human hair — being spot welded to a connector lead of the transistor base. *Right:* Germanium is pulled slowly through special furnace, in an operation called "zone purification" which sweeps impurities back into one end of the ingot. The contaminated end is then sliced off. P. G. Webster, manager of the transistor plant, adjusts controls.

according to company officials. Handling the tiny parts requires the eyesight and finger dexterity of a watchmaker accustomed to working with the aid of a magnifying glass.

At the Montreal plant, technicians start their long, involved production process with a white powder which is recovered from waste gases in metal refining, costs $100 a pound, and is called germanium dioxide.

Using cellophane so as not to contaminate it with their hands, they pour this into a carbon bolt, then bake it for seven hours in a special furnace at temperatures as high as 1050 degrees Centigrade. As hydrogen gas removes the oxygen in the powder, an ingot of germanium metal, about six inches long and half an inch across, is formed.

Six more hours are needed to draw the ingot slowly through a transparent pipe, made of quartz which doesn't melt at high temperatures. Several coils girdling the pipe at intervals provide high frequency induction heating, and as hydrogen is pumped through steadily to guard against oxidation the impurities are swept gradually back into one end of the ingot.

This contaminated piece is then sliced off, and what's left is believed to be the purest substance in the world. Such high-grade germanium, however, conducts electricity poorly and, hence, is useless. So in a third furnace a "seed crystal" dopes the ingot with tiny amounts of impurities, planting them in definite patterns so the metal will conduct at the exact rate required.

Looking now like a tiny, stretched-out loaf of bread, the germanium is ready for slicing.

A high speed diamond saw carves it into wafers .015" thick, which are polished by a fine abrasive, and then gently scribed, in a lattice-like pattern by a diamond sharpened like a pencil point.

The wafer is then broken into pellets about one-eighth of an inch long, which get a fast, half-minute bath in hydrofluoric acid, nitric acid and iodine catalysts. This slims them down to a uniform .005", and eats away tiny stresses and strains which could impair the finished product.

Now the stage is set for the final, and most delicate, series of operations.

Production Problems

In a special oven, heat fuses a tiny nickel base tab and two bits of indium metal — one as big as a pinhead and the other a third as large — to each pellet of germanium.

Then the base tab is actually spot welded to the center of three connector leads sticking out of the transistor base. And a fine platinum wire — not much thicker than a human hair — is joined the same way to each of the other two.

Finally, the platinum wires are soldered to the little specks of indium grafter earlier onto either side of the germanium pellet, and the heart of the transistor is complete.

From there it moves to a humidity-controlled "Dry Box", where human hands encased in rubber gloves fit it into another machine. Directly underneath goes a tiny tin can, and as buttons are pressed the stem is driven into its permanent casing.

While this is a pilot operation, most of the equipment is the same size as would be used in a commercial factory.

Production problems, too, are just as awesome, says P. G. Webster, manager of the transistor pilot plant. If each step is not done letter-perfect, the finished product simply won't work.

Making production even more difficult is the fact that there are still many mysterious things about transistors. Occasionally, microscopic examination of a batch will not reveal a single flaw; yet for some reason, they all fail to work.

Research and testing is slowly piecing together these hidden secrets of the tiny workhorse. And as solutions are found to the mass-production problems they have created, transistors will start coming off the lines by the millions.

Television Tube Aluminizing System Processes 192 Twenty-One Inch Tubes Per Hour

A new high production system for aluminizing television picture tubes in which each cart evacuates and coats two tubes with a single vacuum pumping system was exhibited for the first time at this year's Radio Engineering Show in New York.

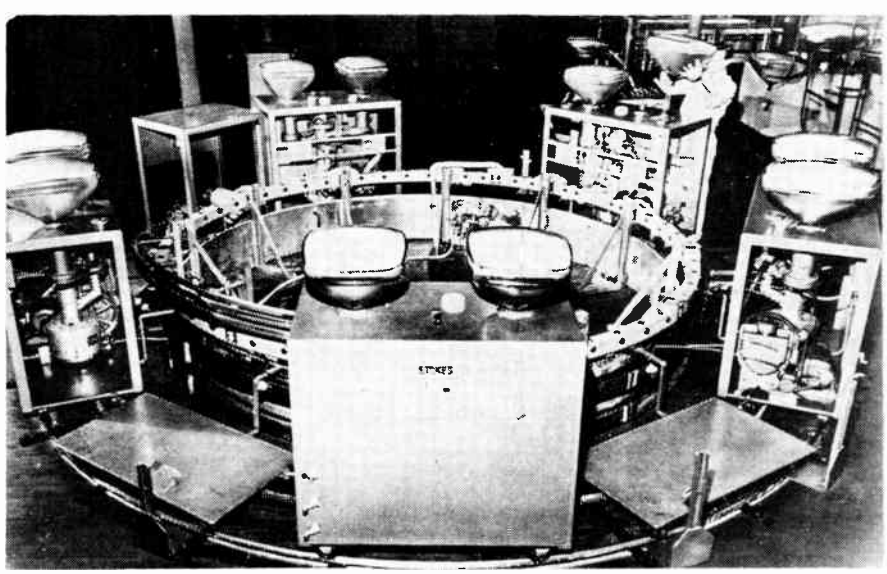
Earlier aluminizing equipment has handled only one tube per cart. The new dual-tube carts can process two 21-inch pictures tubes in a 6½ minute overall cycle — from loading to unloading — and the standard five-cart continuous system, operating around a circular track only 17 feet in diameter, will turn out 96 finished tubes per hour.

Five additional carts can be added to the standard dollies, to produce 21-inch tubes at a rate of 192 per hour. Tubes up to 27-inch can be accommodated.

The first of these new dolly systems has recently been installed at Thomas Electronics, Inc., Passaic, New Jersey.

One of the dual-tube carts was demonstrated in continuous operation at the Stokes exhibit, at the I.R.E. Show.

Another interesting display exhibit by the same company was a special adaptation of their Eureka tabletting press for making microscopic-sized parts of powdered metal — such as the tiny toroids which are used by the millions in electronic computers. The special Eureka press was operated at slow speed for the benefit of the viewers and a magnifying glass was used to enlarge the working area to show the operation clearly.



● The new Stokes dual-tube carts for aluminizing TV picture tubes evacuate and coat two tubes with a single vacuum pumping system. The standard five-cart continuous system, shown here, will turn out 96 finished 21-inch picture tubes per hour. Five additional carts can be added to the standard dollies, to produce 192 tubes per hour. The system operates around a circular track only 17 feet in diameter.

Automation Is Nothing More Than The Application Of Established Practices To Keep Pace With Increased Demands But Contrary To Public Belief There Is . . . .

Automation For Low Volume Too!

SPEAKING to the Toronto Chapter, A.S.T.E., C. P. Farr, manager of Special Machine Sales, Standard-Modern Tool Company Ltd., said that "reality and popular conception of automation are far apart."

Glamorized by the press, this new word in our language depicts for the man in the street a couple of hundred feet of machinery with everything clicking through untouched by human hands. While often inaccurate, current press reports of a mechanical Utopia are nevertheless serving to make people aware of new developments in Canadian industry.

To the engineer, however, the word "automation" immediately demands answers to many questions. Transfer of components from machine to machine, location of parts within the machine, method of interlocking machine sections, production rates — these are but a few of the engineer's technical queries.

Mr. Farr pointed out that automation could also be applied for low volume production and illustrated how this could be achieved. Such an application is typified in a two-position shuttle machine built for a leading Canadian automobile manufacturer by Mr. Farr's company. This machine controls and taps two aluminum adaptor plates which are used to accommodate either the Six or the V-8 engine to the transmission of a popular Canadian built automobile. Production rate on this machine is 45 units per hour.

With this machine a component is loaded into a fixture, and secured with a pneumatic wrench. Various holes are drilled at the load position; tools may be left out of certain spindles, depending on which adaptor is to be drilled. The fixture and component then traverse to the second work position, where appropriate holes are tapped from both sides. Upon completion of tapping, the fixture and component automatically return to loading position.

All operations are performed in series, a factor which limits this type of machine to low production. However, it does provide the minimum of equipment and capital investment to perform all the operations automatically.

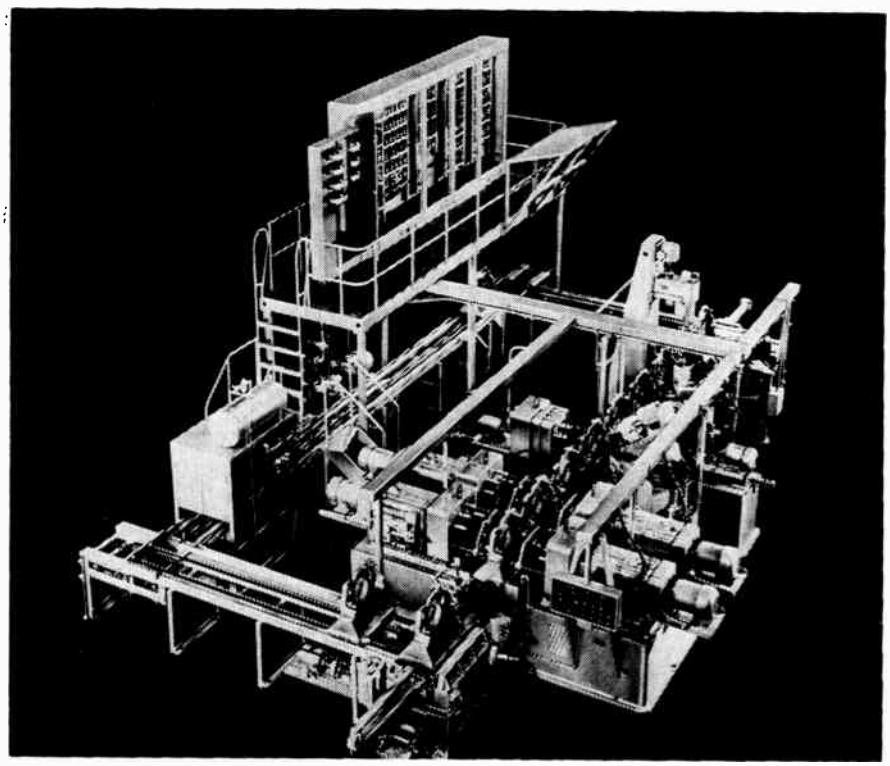
High production equipment is being built and installed in Canada too. Outstanding in this connection is the machine recently completed. It is a 12-station transfer machine capable of performing 5520 operations per hour on automotive torque convertor housings.

"Automation is nothing more than the application of established practices to keep pace with increased demands," according to Mr. Farr. It is simply making tools produce more effectively than last year with the result that more goods are put within reach of more people.

Contradictory facts and figures are now being thrown at the public on the effects of automation. On the one hand the worker sees automated machinery putting him out of a job, while on the other government and industrial leaders state that automation is increasing the need for employment in industry.

In Canada, for example, one major automotive manufacturer is now turning out engine blocks on an assembly line which performs more than 800 special operations employing only twenty-seven men. But at the same time its roster of employees has increased from something like 700 in 1929 to in excess of 5400 last spring.

These contradictions are explained, said Mr. Farr, by three factors — a growing population, new inventions now in demand which were unheard of twenty years ago, and automation itself which creates a demand for skilled workers to plan, build, and operate automated machinery.



● Typical of high production equipment is the above 12-station transfer machine capable of performing 5,520 operations per hour on automotive torque convertor housings.

For further data on advertised products use page 65.

- **To Save Space**
- **To Cut Costs**
- **To Speed Operations**

Manufacturers Use...

Fibre Receptacles

USE of vulcanized fibre nesting-stacking trays for fast, efficient handling of television set components helps improve assembly operations, decrease materials handling costs and obtain greater work space.

The company was looking for an intra-plant materials handling system that would further lower their unit costs. After experimenting unsuccessfully with several types of containers, the company decided to use specially designed Kennett materials handling receptacles. Here's a step-by-step description of how this handling problem was solved.

Wooden trucks on roller wheels were first provided for the job. These trucks had built-in pockets or compartments to fit the various sizes and shapes of television parts and sub-assemblies transported.

This method of transport was expensive, troublesome and time-consuming. The trucks were heavy and bulky. They cluttered up valuable work areas and aisle space. They were a costly overhead expense item because the trucks had to be discarded or the compartments ripped out and replaced every time television parts or sub-assemblies became obsolete.

Corrugated cartons with corrugated partitions were used next. These proved costly because they have a very short life span and needed frequent replacement.

Then vulcanized fibre containers were tried and found successful in this material handling application. These receptacles, made from tough cellulose plastic, are strong, light in weight, durable and resilient. They resist denting, cracking and chipping and will not splinter, rust or corrode. Smooth-surfaced and rugged, they provide complete protection, at all times, for the smallest, the most delicate electronic part.

Particularly important is the fact that these receptacles can be fitted with interior wooden partitions built in a company's own woodworking shop. These low-cost partitions can be easily removed and replaced without damage to the containers themselves. Therefore, the receptacles not only won't wear out, they cannot be outdated, regardless of changes in the types of television components they carry.

Space Savers

Another valuable feature of the receptacles — important in this application as well as in thousands of other materials handling operations throughout industry — is the unique nesting-stacking feature which permits storage of the maximum number of trays in the smallest possible space.

Here's how one company uses these vulcanized fibre materials handling receptacles: Television components are placed in individualized compartments of the trays and then stacked in pallet loads. The tapered shape of the receptacles, together with the protective metal bar which can be fitted across the top, permits the compact stacking of the maximum number of full trays without damaging contents.

Loaded trays are transported by fork truck to assembly stations where they are placed in tiers on the floor beside the assembler. With this convenient arrangement, the assembler can easily remove sub-assemblies and parts from the full trays at his left, perform the required assembly operation, and then place the completed components in empty trays on his right.

As the trays on the right are filled, they are moved by fork truck to the next assembly station where the process is repeated. This continues until the television components in the vulcanized fibre containers arrive at the final assembly area.

The exclusive "nesting" feature of the receptacles permits storage of the maximum number of these empty trays, sometimes as many as 80, in a small area. In addition to saving valuable floor space, nesting arrangement makes it possible to carry more trays per trip.

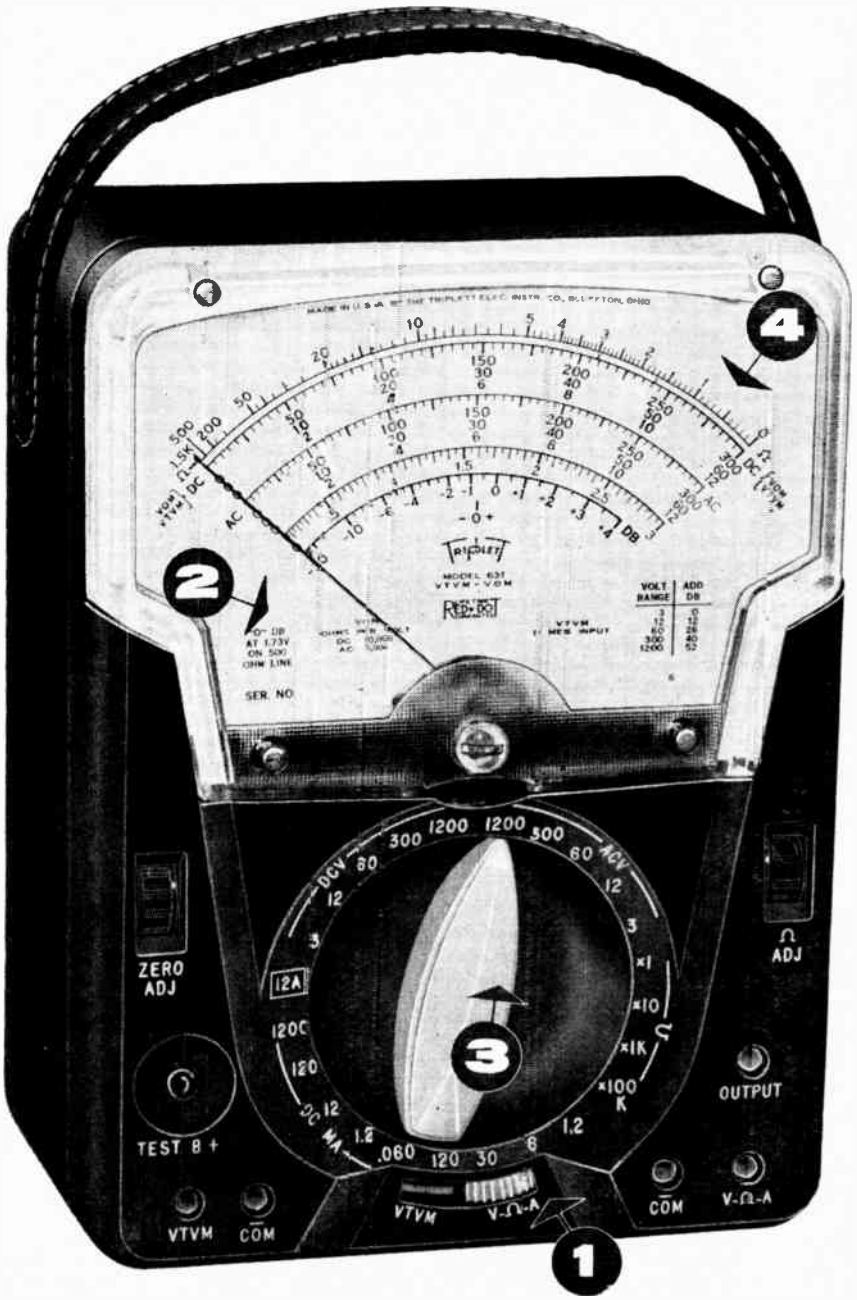
● With assembly operations completed, empty containers are stacked in pallet loads. Nesting feature of the Kennett receptacles permits storage of the maximum number, sometimes as many as 80, in a minimum of space.

● Employee removes television components from the full receptacles at the left, performs the required assembly operations and places completed work in trays at the right. Trays are then transported to other stations until they arrive at final assembly area. Interior compartments protect contents, can be easily removed and changed to fit different sizes and shapes of parts.

a VOM ...plus a VTVM when you need it.

DOUBLE USE...HALF THE PRICE

TRIPLETT MODEL 631—In one year accepted as the standard COMBINATION VOM-VTVM



Battery operated

1 Just flip the switch.

2 Standard sensitivities as used in servicing manuals.

3 34 ranges—with the famous Triplett single knob control.

4 Extra long scales —unobstructed visibility.

$83.30

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

Megohms: 0-1.5-150 (6,800-680,000 ohms center scale.) Galvanometer center mark "—0+" for discriminator alignment.

RF Probe permits measurements up to 250 MC. $9.10 net extra.

Featured by leading electronic parts distributors everywhere.

TRIPLETT

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

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

WILLIAM F. KELLY COMPANY
2781 Yonge Street, Toronto 12, Ontario

C. M. ROBINSON COMPANY
189 Market Street, Winnipeg
325 10th Avenue, Calgary
550 Beatty Street, Vancouver

Laboratory Tests Of Recently Developed Electronic Air Filter Claim 99 Per Cent Efficiency For Unit Which Will Reduce . . .

Industrial Plant Air Pollution

IT was back in 1940 that work began on a unit that would aid sufferers of hay fever, asthma and other dust allergens.

After 15 years of research and experimentation, that unit has become a reality.

The present model of the Dustronic (electrostatic) air cleaner is the product and end result of approximately 150 experimental models that preceded it in the workshop.

The need for such a unit to offer relief to dust and pollen victims was brought home strongly to Richard R. Cook, Chicago manufacturer and engineer.

Cook saw his own wife and children suffer headaches, tears, burning eyes, sleepless nights and other distressing symptoms of hay fever, asthma and dust allergy, and after all the remedies of the day were tried and proved to be not completely successful, Cook decided to tackle the problem on his own.

The problem, as Cook saw it, was to remove the source of irritation, so he set about to devise an air cleaner that would remove the pollen and dust from the air.

One of the biggest obstacles that faced Cook was to construct an air cleaner that would not give off ozone, a gas which can be harmful to humans in large doses, and still collect the fine particles.

Ozone is formed whenever high voltage is passed over a small wire. Many persons have smelled ozone at one time or another without realizing what it was. The odor of ozone is particularly noticeable during a violent thunderstorm with accompanying strong lightning charges.

The ozone problem proved to be extremely stubborn but constant experimentation resulted in the building of an air cleaner which does not produce detectable ozone.

In the early stages of experiment, Cook and his staff tested many types of filters to trap the airborne allergenic particles, and chemical substances to hold and destroy the particles.

Cabinet units were designed, tested and then rejected because of excessive weight, or impractical size.

The perfected unit is completely mobile, light in weight (approximately 35 pounds), and very compact in size, measuring 16 by 13 by 24 inches.

The unit is a circulating type room air cleaner consisting of a metal housing which contains a coated primary filter, an electrostatic precipitator of special design, a power supply and a fan for air circulation.

In addition to the primary filter at the base of the unit, there are light electrostatic collector plates covered with a patented adhesive that destroys the germs and virus. These collector plates are easily cleaned when it becomes necessary.

In actual operation, air is drawn into the base of the unit and all the coarser airborne allergenic particles are removed by a specially-treated mechanical aluminum filter which traps large dust, lint and pollens.

A two-speed fan draws the air through the patented collector plates

● **The above illustration shows the Dustronic portable unit which weighs 35 lbs. and requires no installation other than plugging into any electrical outlet.**

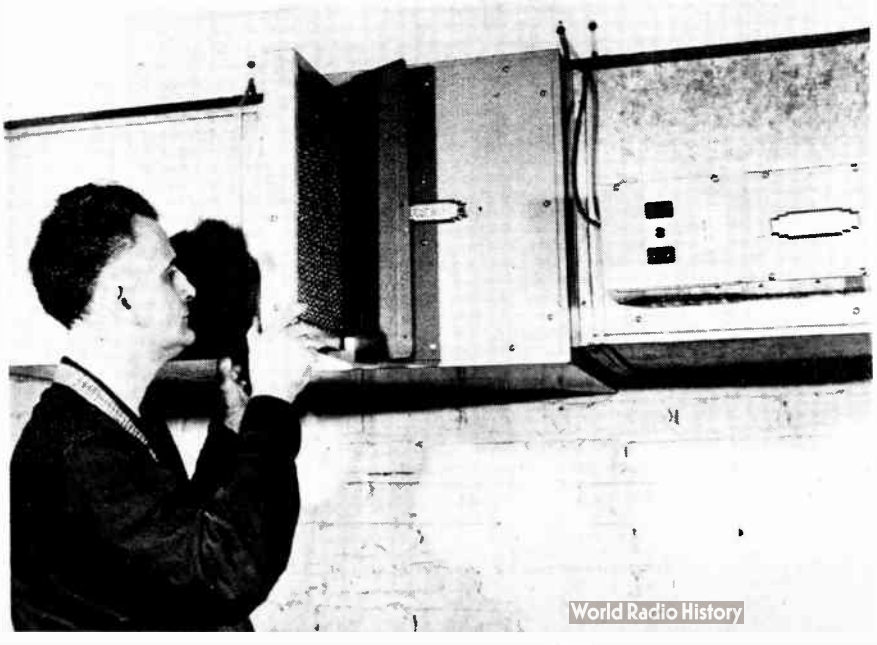
at high speed for rapid clearing of dust-laden air or at a lower speed for slower circulation and quiet operation for bedroom or office use.

All of the fine particles that manage to evade the mechanical filter, and a test by a leading research laboratory reveals that very little gets by this first filter, pass through multiple electrostatic collector plates. Each particle becomes charged and travels toward the plate with the opposite charge. The collector plates are so designed as to create a turbulent flow of air which insures catching all undesirable particles.

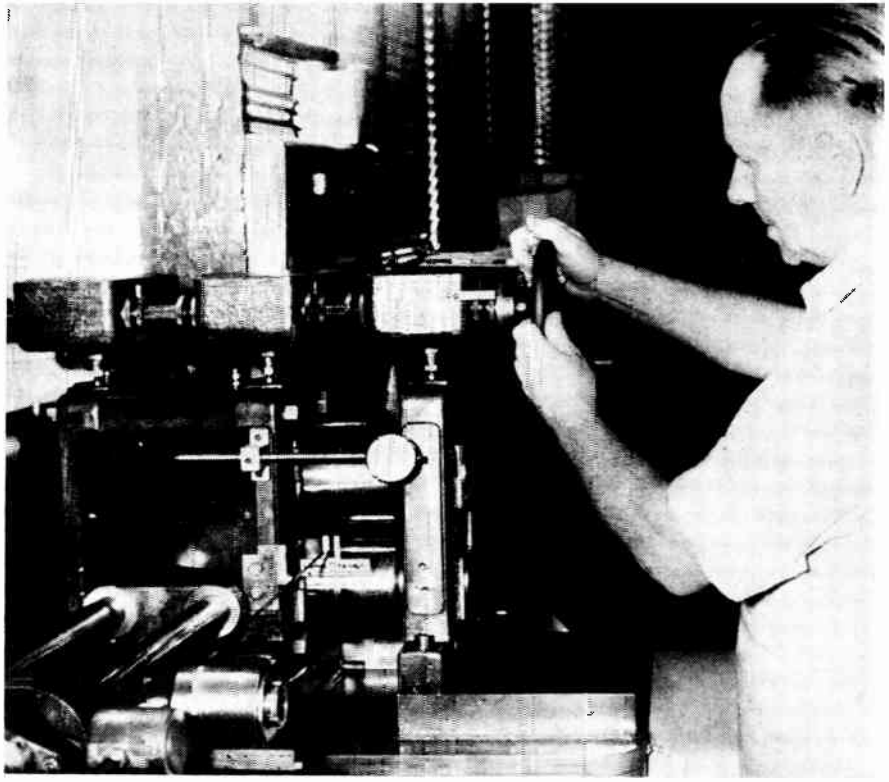
The patented adhesive on the collector plates completes the job of holding and destroying the germs and virus. This solution is flameproof and noncorrosive, will not dry out and is not harmful to the skin.

The tests undertaken by a Chicago research laboratory reveal that the unit is at least 99 per cent effective in removing ragweed pollen from the air.

In addition to giving relief to hay fever and asthma victims, the unit is an effective room sterilizer, and will help prevent colds and infections.



● **Workman is shown installing mechanical filter of Dustronic air cleaner into duct work of warm air furnace. The Dustronic traps dust and other elements from the air before it is warmed and blown into living or working quarters.**



● Above photo shows special rolling mill designed to roll recording band for facsimile recorders.

Self Operating Stylus Mechanism Made Possible By New Rolling Mill Designed To Roll Recording Band From Type 302 Stainless Steel Strip For . . . .

Continuous Band Facsimile Recorders

A MAJOR metallurgical obstacle in the development of a continuous band facsimile recorder has been licked by the development of a small rolling mill custom-built by Stanat Manufacturing Co. Facsimile equipment is used in a host of applications, the best known of which is probably WBAN (pronounced wayban) — the nationwide weather reporting system formed by the U.S. Weather Bureau, Air Force, and Navy.

To overcome the objection to former equipment which required too much operator attention and manual handling, Times Facsimile engaged in an intensive research program to develop a continuous recorder. For the recorder to work automatically and continuously, the stylus mechanism — the actual "printing" device — had to be made self-operating. In other words, it had to track continuously during the recording cycle. First, several styli on a moving band driven by sprockets were tried. Experiments with different drive arrangements and bonding techniques for attaching styli to the band created new problems — invariably the band would fracture either at points of welding or where the sprockets meshed with it.

Engineers struck upon custom rolling type 302 stainless steel strip to produce a satisfactory band and after consultation with engineers from the Stanat Manufacturing Company, designers and builders of small rolling mills and other metal processing equipment, a special mill, designed specifically for rolling the bands was built by the Stanat Company.

The machine has two 5 in. diameter x 4 in. face width rolls which are adjustable by means of a single handwheel worm drive screwdown. Cold rolling is performed to improve the band's fatigue stress characteristics. Lugs for holding the styli are spot welded to the band, and the styli (tungsten wire) with their holders are attached.

Production of the band starts with a narrow strip of flat stock which is inserted between the work roll, looped around an idler takeup roll and butt-welded at the ends to form a circle. The strip is continuously cold rolled in this manner to a predetermined thickness and length. A tension device operating on guide rods mounted on the machine base, exerts pressure on the take-up roll, maintaining the exact degree of tension desired in the strip as it is reduced and elongated. The peripheral length of the band is thus increased to a point where it can be used to connect the corresponding ends of cylindrical drums of the Facsimile equipment for which it is intended. A gauge permits the operator to halt the operation precisely when the desired band circumference is attained.

Another unique feature of the Stanat mill is its removable outboard housing which enables the operator to extract finished work. Engineers obtained this feature from their rotary gang slitters which allows the operator to gain access to cutter arbors in a similar manner.

The mill is an extremely compact, package unit with housings, motor and drive mounted on a single bedplate.

Durability tests performed on the new, continuous band recorder have proved highly successful — indicating a minimum life on a statistical basis of at least two years. The new "Weather-Fax" performs without an operator and produces a clear reproduction of the original.

Facsimile is the only communication method that permanently reproduces original copy — both printed and pictorial matter — simultaneously on any number of facsimile recorders included in a specific circuit. The technique is not new; it has been used since the middle 1920's. WBAN, for example, is a network comprising over 400 widely dispersed receiving stations which include approximately 150 USAF bases, 80 Naval Air Stations, 25 major commercial airline terminals and over 30 government weather stations. Weather information, tabulated in Washington, is regularly transmitted to and recorded by all of these facsimile recorders simultaneously and appears as a weather map with complete data imprinted.

Correct Determination Of Aircraft Speed To Assure Safe Take-Off Is The Subject Of Current Development Projects And It Is Believed That Electronics Will Provide The Means Of Producing An Acceptable . . . .

Monitor For Aircraft Take-Off

By LESLIE L. HILL, Ph.D.

Consulting Editor, Electronics And Communications

UNTIL recently the aircraft industry may justifiably have been regarded as one of the strongest links in the backbone of mechanical engineering, and it can be said that the advocates of the use of electronic devices in this industry had to fight their way through a barrier of habit and prejudice. It is only recently that aircraft manufacturers have been obliged by force of progress in the electronics industry to accept the developments of the science as a means of furthering design and research in the aircraft industry.

This article deals with one of the most important problems in aircraft research — acceleration.

Acceleration is the time rate of the change of velocity. Since velocity is a directed quantity, acceleration a is a vector equal to

$$\lim_{\Delta t \to 0} \frac{\Delta v}{\Delta t} = \frac{dv}{dt}$$

where Δv is the increment in the velocity v which the moving object acquires in t units of time.

If an aircraft moving in a straight line at a speed of two miles per minute increases its speed until it is flying at a rate of five miles per minute at the end of the next minute, its average acceleration during that minute is three miles per minute. If the increase in speed during this one minute interval of time is uniform, the average acceleration is equal to the actual acceleration. If the increase in speed in this example is not uniform, the instantaneous acceleration at the time t_1 is determined by evaluating the limit of the quotient $\frac{\Delta v}{\Delta t}$ as the time interval $\Delta t = t - t_1$ is made to approach zero by making t approach t_1.

Acceleration elements to be installed between an airspeed element and the airspeed indicator have been in use since 1947. There are a great many models of mechanical accelerometers (strain-gauges) and electronic devices (pick-up tubes), which are already being manufactured or under consideration by manufacturers.

The importance of a pilot being able to read at any moment the acceleration of an aircraft during take-off cannot be over-estimated. Accidents have been traced to pilot errors in estimating that acceleration has been sufficient for take-off where no optical or acoustical means of measuring acceleration have been available in the aircraft.

There are a number of ideas on this subject, emphasizing the necessity for a pilot to have either an instrument to show him optically that acceleration is sufficient for take-off or an acoustical device which would switch on an alarm to show that acceleration was not sufficient for take-off. From a standpoint of weight considerations in the aircraft, it would seem obvious that the best way of solving the problem would be by electronics. One development has consisted of a relatively simple set-up using a tube containing mercury and resting in a fore and aft horizontal position, but tests have been abandoned because of impracticability from an engineering point of view. Further tests were made in an attempt to solve the problem from a fully mechanical point of view by setting up a strain-gauge accelerometer between the airspeed element and the indicator. First prototypes included the Statham accelerometer, giving an output of approximately 70 micro-amps. If transistors are inserted, the output will go up to approximately 450 micro-amps.

The calibration factor of the accelerometer is 6790 and is expressed as the open circuit output voltage in microvolts due to a unit input of acceleration with one volt applied to the input terminals. The voltage produced is proportional to the acceleration ± 0.5 G, fed into the main unit.

There are a number of moving coil type indicators which have enough sensitivity to read the instrument output directly. This indicator could easily be incorporated in the existing speedometer of an aircraft instrument panel.

A positive warning could be provided by using a sensitive relay to energize a red light or alarm whenever the instrument output falls below some present value. With a pressure transducer, one could use two instruments, one with a nominal range of 0-25 p.s.i. and one having a nominal range of 0-8 p.s.i. The latter could have an error as high as 0.08 p.s.i. which might still be satisfactory in the range 0-1 p.s.i.

A ballast regulating tube could be used converting the 22/32 volts of the aircraft system to the maximum permissible voltage across the apparatus of 10 volts. The theoretical background of the principle seems quite clear:

F = thrust generated by power plants

$f(v)$ = retarding force of friction, a function of velocity

M = aircraft mass

$M = \frac{dv}{dt}$ = time integral of which plus the constant of integration (wind component) determines whether or not the aircraft will take off, because power plant characteristics and the drag or frictional characteristics are velocity variables, such as $\frac{dv}{dt}$

$$F - f(v) = M \frac{dv}{dt}$$

a = constant coefficient determining magnitude of acceleration component

$F(v)$ = function of airspeed

K = constant equal to the function of airspeed, when the acceleration is zero and the airspeed is the minimum acceptable take-off velocity.

$$a \frac{dv}{dt} + F(v) = K$$

N = speed in r.p.m.

a = in standard G's.

r = radius of rotation of center of gravity of active mass in inches

$$a = \frac{4\pi^2 N^2 r}{(32.174 \times 43200)} = 2.840 \times 10^{-5} \times Nr$$

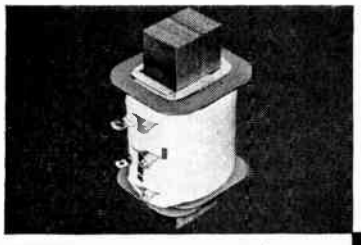
open circuit voltages can easily be measured by a potentiometer, while holding input voltage constant.

Aircraft manufacturers have been engaged in a thorough investigation of the foregoing problem since 1953. Tests seem to have had relatively good results with the Statham accelerometer. Nevertheless it is important to mention other possibilities to solve various difficulties.

A vacuum tube accelation pick-up was invented and thoroughly tested but this means of solving the problem is not to be recommended especially in view of recent progress of transistors.

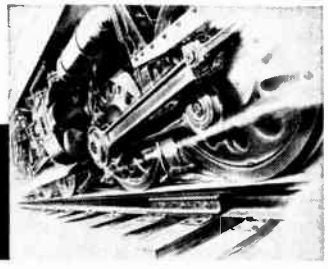
Another valuable contribution was made in constructing a pick-up stylus coupled to a moveable plate of a transducer tube by measuring the roughness on a wide range of surface shapes. The high electrical output of the tube reduces any complexity of amplifying and indicating circuits. Such a device would be highly useful whilst the aircraft was still on the ground and could give a direct indication of acceleration. Several aircraft companies in the United States make use of such an accelerometer and a program for incorporating this pick-up stylus tube as standard equipment in aircraft is under serious consideration, even to the extent of applying it for airborne use.

Some accelerometers use piezo-electric bariumtitanate elements. The range is from 0.022g to 600 g, and the corresponding voltage output range of 1 m.v. to 27 v. readily measured.



DIELECTRIC STRENGTH. National Vulcanized Fibre gives electrical parts high dielectric strength—plus toughness and excellent forming properties. Has ideal application as insulation.

NATIONAL VULCANIZED FIBRE



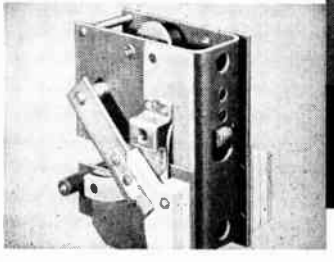
DURABLE—TOUGH—RUGGED. National Vulcanized Fibre rail joint insulation withstands years of continuous exposure and heavy pounding of today's high-speed railroading. Will not corrode or deteriorate.

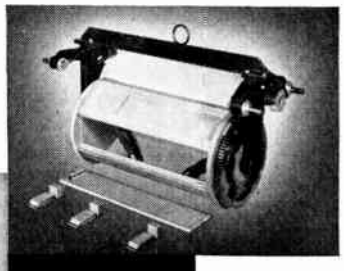
ARC RESISTANCE. In circuit breakers, National Vulcanized Fibre safely curbs electrical arcing without carbonizing or tracking. Easy to bend, punch and form. Light in weight. Heat-and-shock resistant.

FOR MEN WITH IMAGINATION . . .

two materials of unlimited application

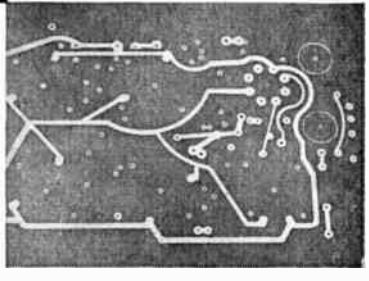
MACHINABILITY—MECHANICAL STRENGTH. New paper-base Phenolite not only has excellent arc resistance, but superior machining qualities as well. Great compressive and tensile strength.





PHENOLITE Laminated PLASTIC

CHEMICAL RESISTANCE. Chemical-resisting grades of Phenolite are unaffected by most corrosive fluids and atmospheres. Retain high strength, resiliency and dimensional stability



COMPACT DESIGN—ECONOMY—HIGH TEMPERATURE RESISTANCE. Printed circuits made of copper-clad Phenolite permit compact design, simplify production, reduce assembly time.

Here are six ideas to spur your imagination. They only *suggest* the many things that can be done with National Vulcanized Fibre or Phenolite Laminated Plastic.

The full list of current uses for these materials would more than fill this page and many more pages! Yet more are coming up almost every day. For NVF is not only the world's largest producer of vulcanized fibre. We also make a fulltime job of thinking up new improvements to our products—and new ways of using them to improve *yours*. Result: designers call our materials the most versatile ever.

Looking for an easy, economical way to improve production—or products? Team up with NVF. We're prepared to assist you all the way from initial design to the delivery of precision fabricated parts. Our new 16-page Catalog will give you full information about our products and services. Write for it on your business letterhead to Dept. O-3.

NATIONAL

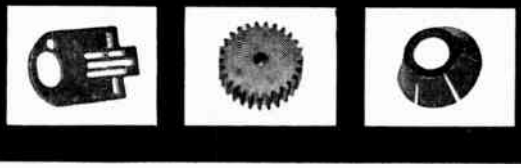
FIBRE COMPANY OF CANADA, LTD.

ATLANTIC & HANNA AVENUES, TORONTO

1411 CRESCENT STREET, MONTREAL

Also Manufacturers of Peerless Insulation, Materials Handling Receptacles, Vul-Cot Wastebaskets and Textile Bobbins.

Typical parts fabricated by NVF



For further data on advertised products use page 65.

Advanced Design And Engineering Of New Logging And Scanning System Affords A New Economic Significance To . . . .

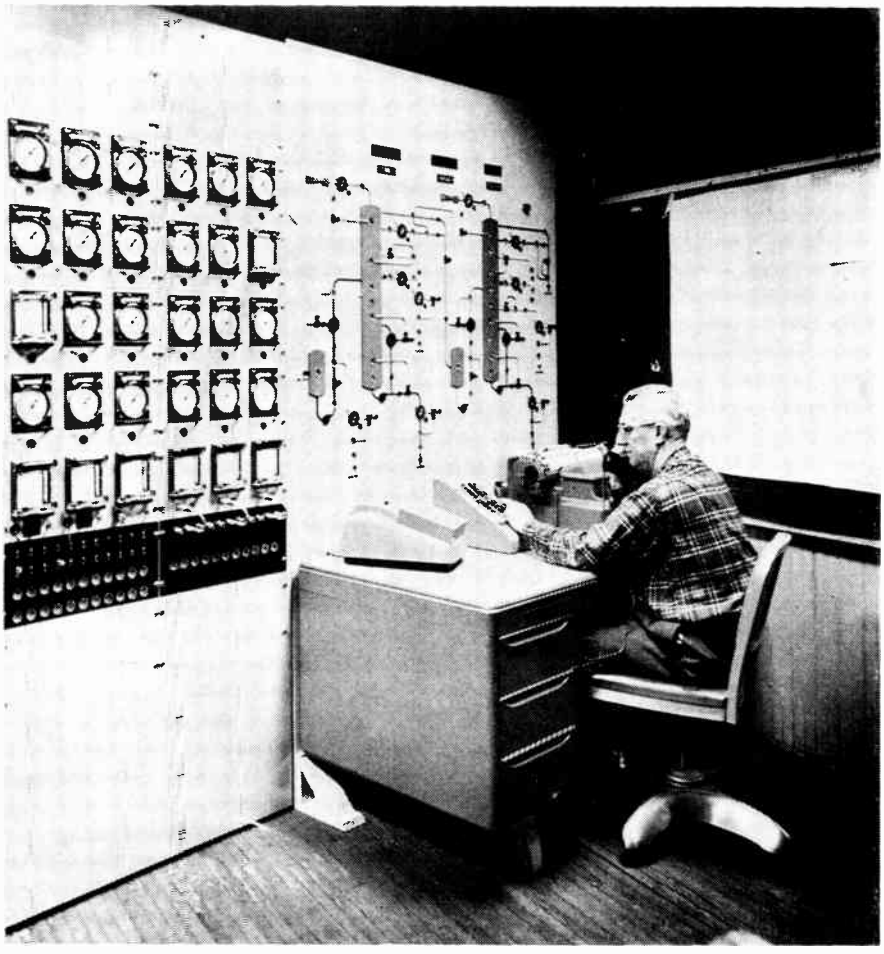
Automatic Control Of Process Industries

A NEW automatic system of scanning and logging which overcomes the drudgery of manual logging and eliminates the delay in observing important process changes and conditions has recently been developed to aid processing industries to keep a closer watch on the manufacture of their products and thereby assure better quality products for their customers. The new automatic scanning and logging system enables the operator to instantly visualize, evaluate and act upon every processing irregularity as it occurs. It summarizes all of the processing data on a section of graphic panel, a panel of miniature indicating or recording receivers, and a logging typewriter or auxiliary column printer.

The graphic panel section has a complete schematic process layout. Numbered lights are located on the panel to indicate the recorded and controlled process variables. The compact instrument panel accommodates the indicating and recording receivers with numbered lights to correlate the instruments with the graphic. The adjacent panel contains racks of relays which electronically convert the process data to electrical impulses to the digitizing and logging equipment. On the control desk a typewriter automatically logs point valves as often as required for close supervision. The operator can check any desired station with a small push button on-demand readout selector. The time of readout, point valve, and station number appear in large illustrated digits on the graphic panel and are typed by the auxiliary column pointer.

Continuous Point Scanning

Point scanning is continuous at the rate of one point per second and a signal light glows to indicate the point being scanned. A white light signifies normal conditions, while red indicates above and amber below normal. Any off-normal condition produces both an audible and visual alarm the instant such condition occurs. In addition, time, point value and station appear in lighted blocks at the top of the graphic panel and the same information is printed by an auxiliary column printer. The red or amber off-normal signal lights appear both on the graphic panel and the process control panel. When the off-normal condition occurs during scheduled logging, the time, point value and station number type out on the automatic typewriter as well as on the column printer. The audible off-normal alarm can be acknowledged by the operator. However, the off-normal signal lights and visual alarm remain on until the process condition is remedied. The auxiliary printer can be set to print the return to normal conditions following process upset or it can continue to print the off-normal values each time the off-normal point is scanned. In addition, the operator at the control desk, can readout any process point on demand by pressing station selector buttons. Complete logging of all points can be called for by the operator at any time.



● The new Taylor Trans-Scan-Log Control System combines pneumatic and electric transmission covering such variables as temperature, pressure, flow, level, load, density, pH, conductivity, viscosity, stress, speed and many others.

BUSINESS BRIEFS

(Continued from page 15)

★ RETMA of Canada reports that Canada is now the third nation in the number of television receivers in use with two million sets, and is second in the number of operating television stations with thirty-three.

* * *

★ Under the aegis of the Armour Research Foundation, Illinois Institute of Technology, a project known as the European Technical Observation Group will seek up-to-date information on European research and development. The information will be funnelled, as required, to 16 non-competing companies. It is anticipated that the plan will be of value to smaller companies dependent upon non-organized means of obtaining European information on new ideas and techniques.

* * *

★ Department of Defense Production contracts awarded to the Canadian electronics industry in the period December 1 to December 31, 1955, totalled $426,905. Of this total it is estimated that $330,874 was awarded to smaller Canadian manufacturing firms, paralleling an American trend toward awarding more electronic contracts to small business firms.

* * *

★ Increasing production requirements for the supply of all types of tubes have stimulated the volume of business in the tube machine manufacturing industry. Some estimates of the anticipated volume of business in this sphere reach as high as $20,000,000 for 1956.

* * *

★ A six-fold extension in plant facilities has marked the growth of one Canadian manufacturer of resistors, who reports that product quality has created an American demand for the majority production of their product. American requirements for the product are for guided missile work.

* * *

★ A record 10,874,234 TV picture tubes and 479,802,010 receiving tubes were sold by American manufacturers during 1955. Retail sales of television sets for the same year amounted to 7,421,084. The sale of radio sets, excluding automobile radios, totalled 6,921,384.

* * *

★ The magnetic recording industry in the United States has enjoyed a profitable year with an estimated production of 360,000 units with sales reported to have been more than 20 per cent over the previous year.

* * *

★ The expected sharp upswing in the production of color television sets in 1956 will provide a major new market for the capacitor industry. This by virtue of the fact that the average black-and-white TV set requires 60 capacitors, while color receivers use approximately 320 capacitors per set.

* * *

★ The value of electronic equipment used at the United States White Sands Proving Grounds amounts to $45,500,000. The Ordnance Corps' share of this equipment amounts to $21,500,000 and the remaining $24,000,000 belongs to the Signal Corps.

* * *

★ Management of the electronics industry in Los Angeles, which includes 440 electronic companies operating 502 plants, expect to outshine New York and Chicago as the most active centers of electronic manufacturing within the next five years. The total volume of sales of electronic equipment manufactured by electronic firms in the Los Angeles area amounted to $842,000,000 last year. This year sales are expected to reach $1,000,000,000. By the end of 1960 business leaders expect that the Los Angeles electronic industry will garner one-third of the nation's total electronic bill of $15,000,000,000.

For further data on advertised products use page 65.

RETMA REPORT

(Continued from page 12)

Survey Of Technical Personnel

Results of a recent survey made within the member-companies of RETMA indicated that approximately 25,000 production workers are employed in the present Canadian Electronics Industry with an annual payroll of over $75,000,000. It is emphasized, however, that this survey is not complete and did not include, for instance, production workers employed in telephone, telegraph and other associated services. The 25,000 production workers would probably increase to at least 50,000 persons if the survey were expanded to include all phases of electronics and to cover distributors, dealers and service technicians.

These surveys have served to emphasize the extreme shortage of technically trained personnel in the Electronics Industry, and have provided the industry with concrete information about the present and future aspects of this problem.

Retma Technical Training Films

The Service Committee of RETMA has available three training films (16 m.m.) of interest to service-technicians in the television field. They are entitled "Localizing Troubles", "Deflection Output Circuits", and "Practical Television Alignment". They are rented by RETMA to organized groups of service-technicians and others who would benefit by viewing the films. The Service Committee also has available a number of service bulletins giving technical information on such subjects as "Television Interference", "Vertical Roll", "Test Pattern Interpretation", and "Elimination Of Television Receiver Interference". These are for free distribution to interested groups and to individual service technicians.

For further data on advertised products use page 65.

For further data on advertised products use page 65.

S. V. LAZECKI

The Following Paper Was Presented By Mr. S. V. Lazecki At The Halifax Meeting Of The Communications Section Of The Canadian Electrical Association. Mr. Lazecki Is Senior Systems Engineer Of Computing Devices Of Canada Limited.

Data Processing And Methods

Observation of trends in industry over the past ten years reveals that data processing methods and automation are being eagerly adopted. Product analysis, process control and manufacturing methods which lead to higher industrial efficiency and lowered cost of production are the result of such measures.

Automation is viewed by some with hopes for improvement of our general standard of living, by others with fear of the social and economic problems involved. However, all can appreciate that these measures provide another tool in expanding our knowledge into fields which have been closed to us, not because of a lack of understanding of the principles and equations involved but because of the discouraging mass of routine calculations necessary to proceed to the solution of each step. The best mechanical calculators have been inadequate in the face of such problems.

The concept of automation is a very old one but only in the past 20 years has there been sufficient incentive, combined with new techniques and components, to provide the means and application for high-speed calculating control systems. Such systems can supplement human endeavor to the point where almost all production methods can be brought under the push-button control of a single, integrated group of operators.

The electric power industry has unique characteristics which, combined with necessity and incentive, have led them into extensive application and use of data processing methods, combined with automation. This has been necessary in order to solve the complex problems associated with economical use of widely scattered installations linked into complicated distribution systems.

A recently-published American forecast indicates a power demand in 1970 four times that presently produced. The figure reaches one trillion kwh. The relative progress in Canada could be even greater. Thus, distribution and control problems of even greater complexity can be expected in Canada.

In general, the value of data processing equipment is its ability to read input data, analyze and perform complex calculations at high speed. The results provide signals which operate automatic controls, both local and remote, to ensure almost instantaneous response in correcting factors which could cause inefficient operation.

Such equipment is divided into two classes. The first class, based on analogue methods of calculation, contains network analyzers, analogue differential analyzers, and special-purpose electronic and electromechanical analogue computers. The second class, based on the digital or numerical principle, includes the very fast electronic and the relatively sluggish electromechanical calculators with very large memories in which to store numerical data resulting from the very numerous elemental processes through which the calculation progresses.

The latter type provides the greatest accuracy but, by the nature of the process, requires time in which to arrive at the final result and careful and complex programming of the calculating, storage and read-out functions. Electromechanical types require considerable time to carry out a complex calculation. Electronic computers, however, can be built to match the response time of most read-out or control devices.

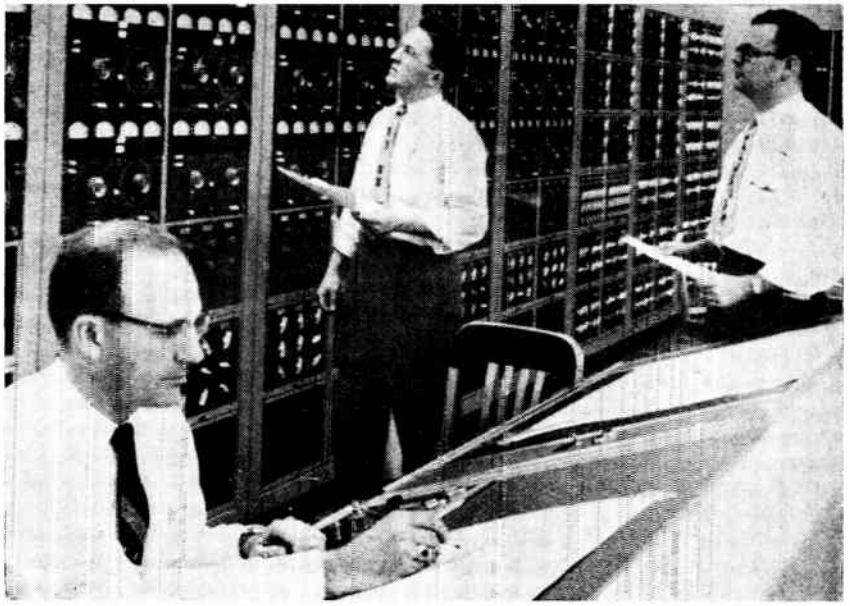
On the other hand, the analogue de-

vices are inherently less accurate but provide almost instantaneous solution. Both types find application in the electric power industry and may be used jointly for the solution of certain complex problems. Choice of the method usually depends on the type of problem. Likewise the extent of the calculation or automation is controlled by the economy of machine functions vs. human operator functions. Final analysis, decision and responsibility must always be the function of the human operator.

In the electric power industry four major activities can be helped by automation and data processing.

a. Analysis of the behavior of the large power-generating and distributing systems under various conditions both technical and economic.
b. Forecasting future expansions and services of the systems.
c. Operational control of the system.
d. Accounting and billing.

In the analysis of the distribution systems, network analyzers occupy the most prominent place. These, in some cases, have been used for over 30 years and a large quantity are in operation. The leaders in construction and improvements of these machines are Westinghouse Electric Corporation and General Electric Company. The net-



● Westinghouse Network Analyzer.

of the operating frequency permits considerable reduction of the size of the reactive components of the analyzer. The typical studies carried out with the network analyzers can be listed as follows:

a. Voltage regulation studies.
b. Load control and stability studies to determine transmission limits.
c. Short circuit studies.

lyzers had a multitude of meters, later ones use the remote selection of the point of metering and the centralized assembly of meters. For the convenience of the operator, the meters are equipped with automatic scale and sign change. A very large network can be analyzed by this method with 25 generators and 70 busses.

The accuracy of the network analyzer is not very high but offers great

The Electric Power Industry

work analyzer represents the replica of the power system in miniature. All components of the system have their low power equivalents in the form of generators, resistors, reactors and transformers suitably connected to behave as in the real system. The electromotive forces are considerably scaled down so that currents and powers are read with large conversion factors.

Network Analyzers

The network analyzers are used for study of the d.c. and a.c. systems. Some analyzers operate with the frequency 60 c/s., but there are others using the frequency of 10,000 c/s. The increase

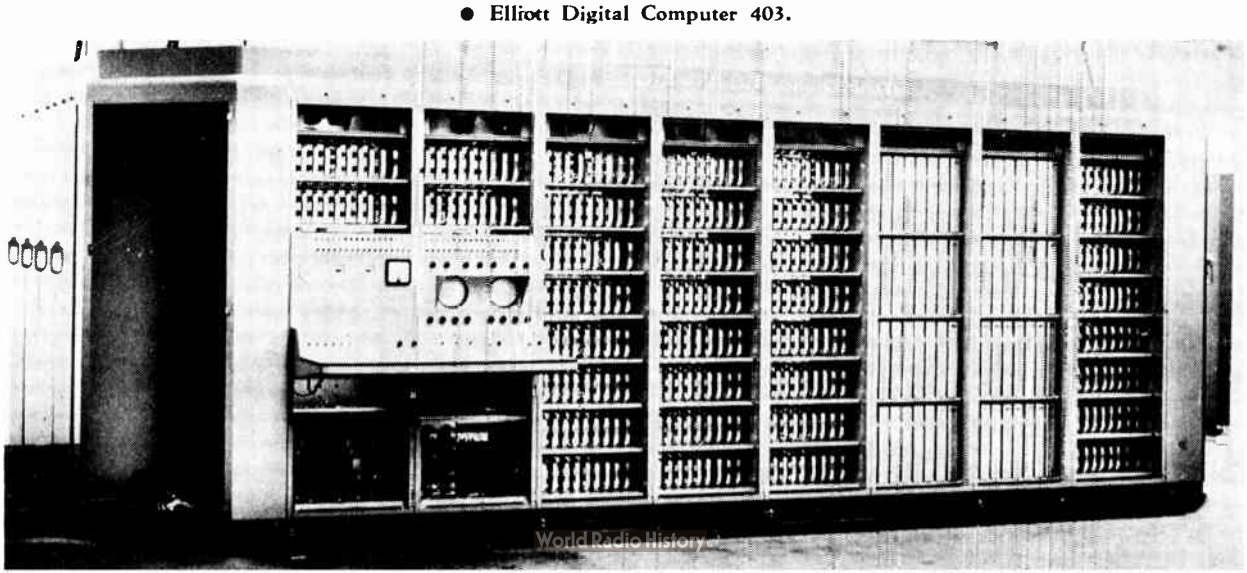
d. Transient studies by expressing the transient condition as a succession of the steady states.

The network analyzer can tackle problems other than the electrical distribution and generation provided that the system elements can be represented by electrical components. The normal procedure when using them is to set network connections manually, select system components and establish generator electromotive forces in their correct amplitudes and phase angles. The results can be read on various busses by means of the voltage, current, power and var meters. Early network ana-

flexibility in the application. The success can be judged by over 40 network analyzers used by the electric power companies in the United States. Several network analyzers are operated by the universities and computation centers, who offer their services on a rental basis. Every year brings new applications to their use in more and more difficult problems, from the ingenuity of the engineers operating them. For some problems, approximate solutions are provided and the more precise requirements are obtained by the digital computer. The knowl-

(Turn to page 50)

● Elliott Digital Computer 403.



NEWS ☆ ☆ ☆

L. W. Roberts Heads New Section Of Bomac Labs

Louis W. Roberts, one of the country's leading specialists in the development of microwave tubes and components, has joined the staff of Bomac Laboratories, Inc., Beverly, Mass. He will be in charge of a newly formed theoretical section, which will function as a consulting group to other sections of the engineering department.


L. W. ROBERTS

Mr. Roberts has a background of experience in research and consulting work for various organizations. He holds several patents in the microwave tube field and is the author of numerous articles and reports.

Canada's First Data Processing Center Opened

Computing Devices of Canada Limited have announced that their Data Processing Center at Ottawa is now available to serve government and industry in any part of Canada.

The new service will make available to business executives problem formulation and analysis, programming, computation, data reduction, application of data processing equipment to business procedures and practical instruction in computer operation and programming.

Electronic computers at the Data Processing Center can be utilized in the following specific services: solving complicated engineering and research problems at high speed; automatic control of train and plane reservations; automatic billing; complete payroll calculation; automatic handling of life insurance premiums and policy records; statistical calculations; logistics; production control; and traffic control.

Charles L. Thompson Ltd. To Represent University Loudspeakers

Lawrence J. Epstein, general sales manager of University Loudspeakers, Inc., of White Plains, N.Y., has announced the appointment of Charles L. Thompson Ltd., of 3093 Woodbine Drive, North Vancouver, B.C., as representatives for Western Canada.

Russell H. Smith Sales Manager For Hysol (Canada) Ltd.

Russell H. Smith of Toronto has recently been appointed sales manager of Hysol (Canada) Limited, Canadian affiliate of Houghton Laboratories, Inc., of Olean, N.Y.

Mr. Smith received his B.Sc. degree in electrical engineering from the University of Manitoba in 1947, and studied business administration at the University of Toronto. He has been engaged in electrical manufacturing as a control and technical sales engineer, and in sales management and promotion.

Pye Advances Into Optical Field

Pye Canada Ltd's. parent company, Pye Limited of Cambridge England, recently acquired a substantial interest in W. Watson & Sons of Barnet and London, England, since 1837, world famous optical and scientific instruments company, particularly noted for their complete range of microscopes.

Watson's experience in the photograph lens field will add greatly to the already vast range of Pye Television equipment. Leading in this capacity is the highly regarded Watson Vari-Focal or 'Zoom' Lens which is at present being used with great success by the CBC and many private TV stations throughout Canada and the world.

No alteration is contemplated in the present management or policy of the company, nor in its marketing arrangements.

Stark Electronic Instruments Ltd. Appointed Reps For Shielding Inc.

Shielding Incorporated of Riverside, New Jersey, announce the appointment of Stark Electronic Instruments Ltd. of Ajax, Ontario, as their licensed manufacturing representative for Canada.


J. W. MacDONALD

Shielding Inc. are pioneers in the design and manufacture of all types of shielded enclosures, including those custom-built to military specifications for the armed services, as well as Microwave absorption rooms and photographic dark rooms.

Mr. John W. MacDonald is sales manager of Shielding Incorporated.

G. Garnett Simms To Manage Canadian Sales Office Of Acheson Colloids Co.

A new Canadian sales office was recently opened by Acheson Colloids Company, of Port Huron, Michigan, manufacturers of "dag" Colloidal Dispersions.


G. GARNETT SIMMS

The new office, located at Suite 564, 199 Bay Street, Toronto 2, Ontario, will be managed by G. Garnett Simms. The Canadian market for Acheson Colloids' 'dag' products was previously served by The Lubrite Company of Canada, Ltd.

Mr. Simms has had twelve years of engineering and sales experience with well-known companies. He is a member of the Association of Professional Engineers of the Province of Ontario and the Canadian Institute of Mining and Metallurgy.

CGE To Build Television Amplifier For CBC

Canadian General Electric Company has announced the signing of a contract with the Canadian Broadcasting Corporation for a 35 KW television amplifier to be located atop Mount Royal in the heart of Montreal.

The amplifier and associated equipment is being supplied to allow the station, CBFT-Montreal, to increase its power to the maximum permissible of 100,000 watts on Channel 2.

CBFT is the 58th broadcasting station to be equipped by Canadian General Electric, and is the third Canadian TV station to employ a G-E 35 KW amplifier.

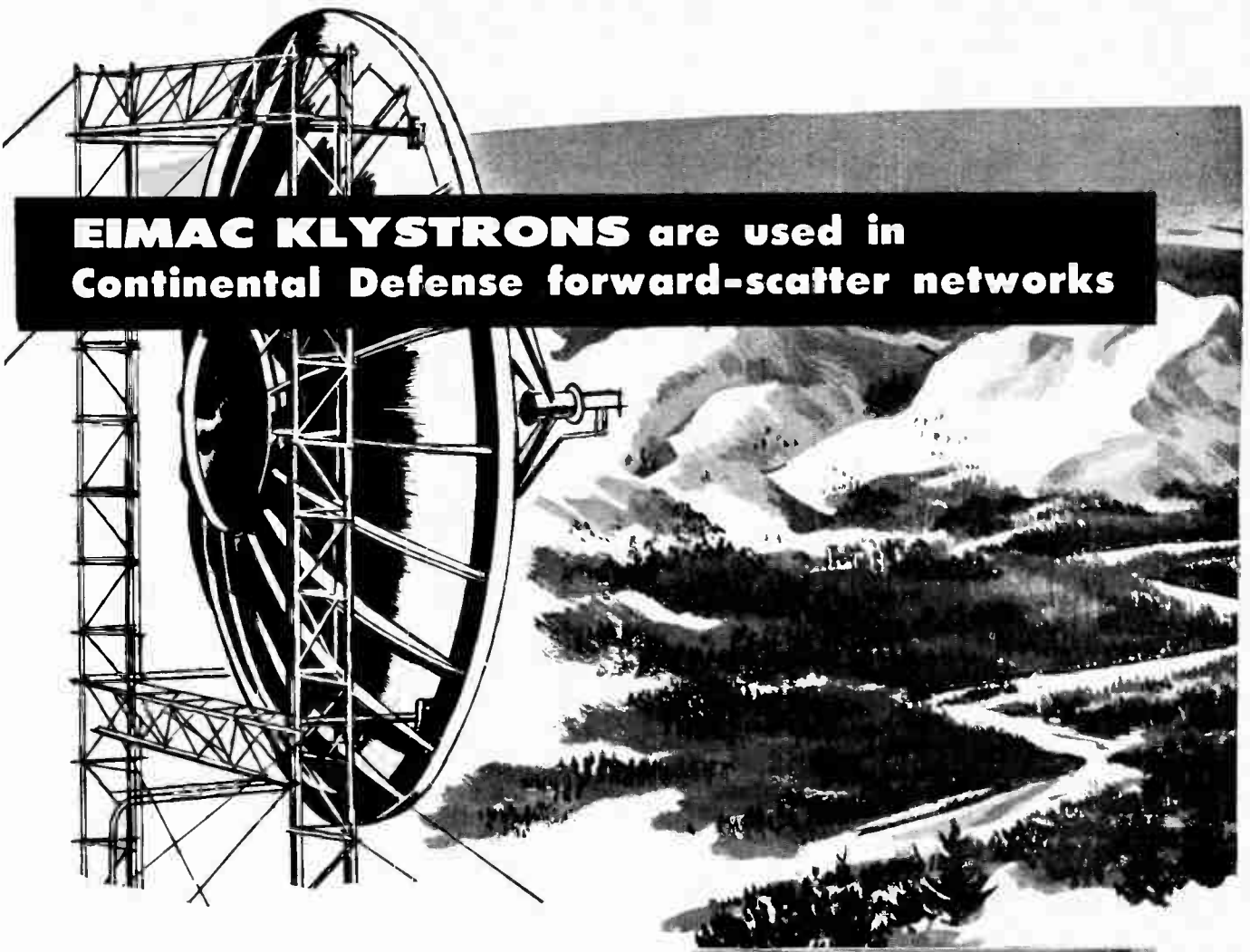
The CBFT installation will be unique in that special steps are being taken to modify the antenna without removing it from the top of the supporting tower.

February Meeting Of Toronto Section, IRE

On Monday, February 27th, the Toronto Section, Institute of Radio Engineers, held their regular monthly meeting. The speaker on this occasion was J. S. Ford, Chief Engineer, Canadian National Telegraphs.

Mr. Ford's topic was "Record Communications", dealing with the principles and applications of teleprinter and facsimile communication systems.

(Turn to page 42)



EIMAC KLYSTRONS are used in Continental Defense forward-scatter networks

Collins Radio Company's pioneering of circuits and equipment has contributed greatly to the success of the revolutionary new art of forward-scatter communications. From the beginning of this program, Eimac tubes have provided the high power necessary to make scatter propagation practical. In Collins newest high power microwave transmitters for beyond-the-horizon communications in Continental Defense networks, only Eimac klystrons are used as final amplifier tubes.

Third in a series of advertisements emphasizing the extensive application of Eimac amplifier klystrons and circuit components, negative grid tubes and rectifiers by leading manufacturers of forward-scatter UHF/microwave transmitters.

Collins two and ten kilowatt forward-scatter transmitters utilize Eimac amplifier klystrons, negative grid tubes and rectifiers.

Eimac
THE POWER FOR FORWARD-SCATTER

EITEL-McCULLOUGH, INC.
SAN BRUNO CALIFORNIA
The World's Largest Manufacturer of Transmitting Tubes

REPRESENTED IN CANADA BY

THE AHEARN AND SOPER COMPANY LIMITED
P.O. Box 715 Ottawa, Ontario

For further data on advertised products use page 65.

NEWS

(Continued from page 40)

North-West Telephone Co., Uses Forward Scatter

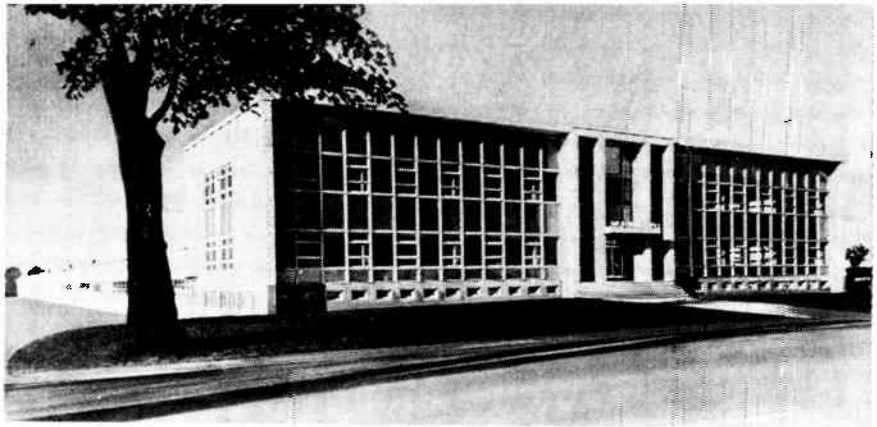
TWO new developments will feature the growth of the chain of radio telephone circuits northward on B.C.'s coast, according to an announcement by P. R. Tupper, vice-president and general manager of the North-West Telephone Company.

A VHF radio relay chain now extends to the northern tip of Vancouver Island with a spur link to Ocean Falls, but company officials hope to extend the chain to Kitimat, Prince Rupert and the Queen Charlotte Islands this year.

In order to do this, "island hopping" and "forward scatter" will have to be used.

To carry a VHF signal a long distance it is necessary to have a series of intermediate stations relaying the waves one to the other in chain-like fashion. The VHF chain between Vancouver and San Josef at the northern tip of Vancouver Island is of this nature, requiring six relay stations between the two terminals.

To extend the chain from San Josef to Prince Rupert and Kitimat will require the erection of relay stations on a number of coastal islands. Hence the term, "island hopping".



● The new Canadian Marconi Company building at 6035 Cote de Liesse Road, Ville St. Laurent, is located 1.8 miles west of the Decarie Circle, the new building is 990 feet long by 161 wide, and it has a total floor area of 176,400 square feet. Provision has been made for air-conditioned office space on two floors with a total floor area of 16,000 square feet. The rest of the building will be used for warehousing and light manufacturing purposes.

The link from San Joseph to Sandspit, on the Queen Charlottes will be the longest single VHF hop ever attempted by the North-west Telephone Company. To span the 240 miles between San Josef and Gray Bay (near Sandspit) a new technique of radiotelephone propagation known as forward scatter, will be used. Widely spaced antennas at Gray Bay will pick up the waves and special equipment will strengthen the signal.

This link, using "forward scatter", will go into operation soon. However, the number of circuits that can be economically obtained through the use of "forward scatter" is limited, and for this reason the more conventional relay station method will be used where a large number of circuits are expected to be required.

Office Automation Exhibit For April 17, 18, 19

Practical office automation — the new approach to office mechanization — will be the subject of a three day meeting and equipment exhibition in Toronto at the Royal York Hotel on April 17, 18 and 19. The meeting is sponsored by the Toronto Chapters of the National Office Management Association and the Systems and Procedures Association.

(Please turn to page 44)

For further data on advertised products use page 65.

For further data on advertised products use page 65.

NEWS

(Continued from page 42)

E. G. Gramman To Co-ordinate Reps In Canada And U.S.

E. G. Gramman has joined the sales department of Kay Lab, San Diego electronics firm. Gramman will bring to Kay Lab a broad background of experience in television broadcasting and industrial sales and application engineering.

E. G. GRAMMAN

R. T. Silberman, Kay Lab sales manager, said the addition of Mr. Gramman as a supervisory field engineer is part of the company's program for expanding the field and application engineering services available at the main plant.

Gramman will work with R. G. Cunningham, sales engineer, in co-ordinating the activities of the firm's field engineering representatives covering the United States and Canada.

Leonard Electric Appointed To Represent Airpax Products

Leonard Electric Ltd. of 346 Bering Avenue, Toronto 18, Canada, has recently been appointed to represent Airpax Products Company throughout Eastern Canada.

The parent company manufactures a wide variety of signal choppers and power vibrators. The company also designs and manufactures power, audio and pulse transformers to customer specifications and recently announced its entry into the field of magnetic amplifier design and production.

Mercury Recordings To Be Distributed Through Pye

Pye Canada Ltd.'s parent company, Pye Limited of Cambridge, England, announced recently that Nixa Recording Company, one of the Pye Group, has entered into an agreement with Mercury Records Incorporated of Chicago. This agreement means that Mercury and EmArch labels will now be available to Nixa, the previous agreement between Oriole of London, England, and Mercury having been terminated by mutual consent.

James R. Day Guest Speaker Before Bay of Quinte Section, IRE

James R. Day of Radio Engineering Laboratories Inc., was the guest speaker at the March 13 meeting of the Bay of Quinte Section of the Institute of Radio Engineers. Mr. Day's subject dealt with "scatter propagation".

Mr. Day designed the whole of the radio communication equipment used in the first applications of the scatter phenomenon, which were made in the Canadian north.

Mr. Day graduated from the Massachusetts Institute of Technology in 1931 with a B.Sc. degree in mathematics and has been engaged in development work in radio communications with several organizations since that time. In particular he was closely associated with the late E. H. Armstrong. He has been with Radio Engineering Laboratories Inc. since 1945 and is now the vice-president in charge of research and engineering.

N.R.C. Scientists Receive Appointments

Two members on the staff of the microwave section, Division of Radio and Electrical Engineering, have recently received appointments. A. E. Covington has been elected president of the Ottawa Center, Royal Astronomical Society of Canada. Paul A. Redhead has been appointed chairman of Technical Committee 7 (Electron Tube Committee) of the Institute of Radio Engineers.

Precise Development Corp., Appoints Len Finkler Eastern Canadian Rep.

Melville Byron, vice-president of Precise Development Corporation, of Oceanside, New York, has announced the appointment of Len Finkler as their Eastern Canada representative.

Mr. Finkler recently formed his own "rep" organization, having previously been associated with a radio parts distributor.

Microwave System Announces New Agency Appointment

George A. Collins, P.Eng., general manager of Microwave Systems, has announced the appointment of his company as Canadian representatives for Radio Frequency Laboratories, Inc., of Boonton, N.J.

Radio Frequency Laboratories, Inc., are manufacturers of a wide range of electronic equipment, which will be application-engineered and serviced in Canada by Microwave Systems.

(Turn to page 48)

For further data on advertised products use page 65.

For further data on advertised products use page 65.

NEW PRODUCTS

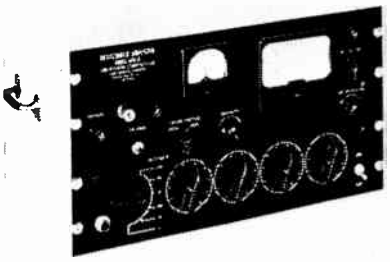
New Product specifications published in Electronics and Communications have been briefed for your convenience. If you require further information on any of the items published you may readily obtain such by using our Readers' Service, Page 65. Just mark the products you are interested in on the coupon on Page 65 and the information will be in your hands within a few days.

● *Analyzer Model KED-15*

Item 1009

A "perfected" Resistance Analyzer, capable of accurately measuring the voltage coefficient of resistors over a variety of ranges from 1000 ohms to 1,111 megohms to within 0.1 per cent, has been developed.

Identified as Model KED-15, this precision laboratory test instrument is considered the "final" of a series of development models which have been marketed during the past several years with increasing success.



The Model KED-15 was designed to check such characteristics as d.c. resistance, temperature co-efficient, and voltage co-efficient of resistors according to JAN specifications.

The voltage coefficient of any resistor up to a capacity of two watts can be determined down to as low as 0.0002%/volt. The voltage across the measured resistance is continuously variable in three ranges from 0 to 500 volts by a self-contained regulated power supply. Resistors can be readily measured with good sensitivity with voltages as low as 0.5 volts.

The Model KED-15 is designed for 115 v., 60 cycle operation; comes equipped with a natural finished oak cabinet, weighs 60 pounds, and measures 19½" x 11" x 12" deep.

● *Multi-Amp Tester* *Item 1010*

An instrument that makes possible a systematic motor maintenance program may turn out to be a money-saver for Canadian Industry.

The instrument called "Multi-Amp" is designed to check the efficiency and safety of protective devices such as — circuit breakers, overload relays, etc., by simulating the actual overload or locked rotor conditions.

Testing any current actuating device simply entails connecting the device to the proper output terminals of the PORTABLE Multi-Amp, and adjusting to the proper value while observing a current indicating instrument and timer. These results are then checked against the manufacturer's published time-current curves.

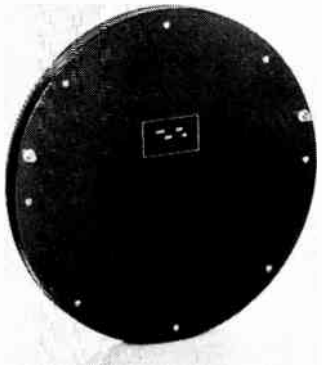
The Multi-Amp Tester lets you know if the protective devices are really protecting and eliminates costly "down-time" caused by electrical motor failure.

To keep abreast with the ever-growing electrical industry, Multi-Amp Corporation have initiated this protective unit — the only one of its kind in Canada or the States.

● *4100 Microsec Delay Line*

Item 1011

A solid fused quartz delay line which produces delay of 4100 microseconds has been developed. This delay is equivalent to more than 300 miles of radar range.



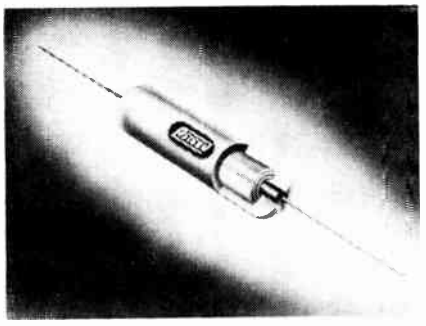
The carrier frequency is 8 m.c. with a bandwidth of 2 m.c. Attenuation is 56 d.b. when determinated by a tune 100-ohm load. The spurious requirements for shock, vibration, pressure, temperature, humidity and hermetic seal can be met. Units of longer delay and higher carrier frequency are possible.

For further data on advertised products use page 65.

• *Unique Molding Plastic Capacitor Sealing Method*

Item 1012

A leading manufacturer of capacitors and r.f. filters, recently announced that U.S. Patent 2,713,700 has been granted on their exclusive process of manufacturing molded plastic capacitors.

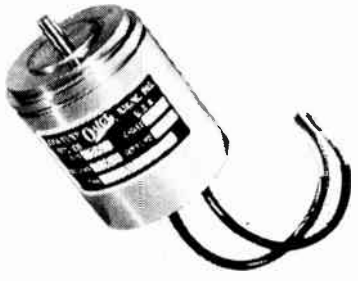


Already being used to produce Astron's two famous molded plastic capacitors, Blue Point (R) paper tabulars and Comet® Metallized Paper Tubulars, this revolutionary process gives the capacitor buyer complete protection against moisture and humidity damage even under the severest climatic conditions.

• *New Smaller 12 Power Synchro Transmitter*

Item 1013

A new smaller, more powerful 26V 400 cycle synchro transmitter with unprecedented power for its size has just been announced. Although only 2.125" long and housed in a size 18 frame, Type 3H-3309 runs up to 12 size 15 Type 2C-4005 synchro



control transformers. Output voltage on each of the 12 control transformers of the load is 19.8 volts. Full load input current of a 12 unit system is 1.42 amperes. While Type 3H-3309 transmitter is designed for use with a maximum of 12 control transformers, it may be used with less than 12, resulting in reduced current input to the transmitter and increased output voltage on each control transformer used. For example, using 1 control transformer results in .860 amperes input current and 21.8 output voltage; a 5 control transformer system results in 1.06 input current and 21.2 output voltage on each control transformer. No load input current in .8 amperes, no load wattage 2.4 watts, output voltage 11.8V, phase shift rotor to stator 3.8°, angular accuracy 15 minutes, null voltage 50mv and rotor moment of inertia 24 gmcm². Operating temperaure range is from —55°C to +95°C. Friction @ 25°C is 15 gram-cm and @ —55°C is 45 gram-cm. Weight is 8.5 oz.

(Turn to page 51)

For further data on advertised products use page 65.

● Shown above are officers of Standard Coil Products (Canada) Limited, discussing the technicalities of a television tuner. From left to right they are: E. J. Swanson, general manager; Bill Phillips, chief engineer; Frank Hedemark, production manager; and C. W. (Chuck) Peterson, sales manager.

Standard Coil Products To Introduce New Tuner

Standard Coil Products (Canada) Limited, a subsidiary of the Standard Coil Products Co. Inc. of Melrose Park, Illinois, who established office and manufacturing facilities at 37 Drummond Street, Mimico, last July, now report that approximately fifty per cent of all television tuners used in Canadian manufactured television receivers are produced by their company.

The parent firm, which in 1934 was a "Loft operation", is now a multi-million dollar concern manufacturing television tuners and radio coils in addition to a wide range of electronic components for government and industry.

The Canadian plant, which covers some 20.000 square feet of floor space, is presently concerned exclusively with the manufacture of the "Standard Tuner", the first of which was produced in Canada on August 15th, 1955, less than one month after the announcement of the Canadian operation.

The Canadian plant, which employs about 400, will soon start production of a new tuner incorporating a completely new concept in tuner technique. The new unit, which is known as the "Neutrode Tuner", will offer considerably improved performance at lower cost to the user.

The manufacturing plant of Standard Coil Products (Canada) Limited has been designed to facilitate future expansion, a project which company officials contemplate for the near future.

Titania Electric Corp. Of Canada Represented By Lake Engineering Co.

The Titania Electric Corporation of Canada, Ltd., Gananoque, Ontario, has announced the appointment of Lake Engineering Co., Ltd., Scarborough, Ontario, to represent their products throughout Canada.

Manufacturers of high-temperature, high-reliability components and electronic instruments, Titania Electric is well-known for GLENNITE(R) ceramic elements produced by the revolutionary thin sheet process, allowing sub-miniaturization of components for airborne equipment, portable communications gear, and complex electronic systems.

For further data on advertised products use page 65.

P. A. YORK

● A. V. Armstrong, president of the Amalgamated Electric Corporation Limited, has announced the appointment of P. A. York as manager of advertising and publicity.

Frank Entwistle Receives Cossor (Canada) Appointment

Cossor (Canada) Limited announce the appointment of Frank Entwistle as Chief of Contracts Administration.

F. ENTWISTLE

Mr. Entwistle brings to Cossor (Canada) an extensive scientific and administrative background with world-wide experience of aviation requirements.

Prior to the War, he held successive appointments as Chief of the Scientific Instruments Branch and then assistant director of the British Meteorological Service.

Mr. Entwistle served as a Group Captain in the Royal Air Force during the war, where he was responsible for all R.A.F. meteorological facilities overseas and was also associated with the establishment of control facilities at North Atlantic Bases operated jointly by the R.A.F. and the U.S.A.F.

Since the war and prior to joining Cossor (Canada), Mr. Entwistle was Chief of the Flight Branch of the International Civil Aviation Organization in Montreal, in which capacity he was responsible for the technical supervision and coordination of several aspects of work in that organization in the field of international air navigation, including operational requirements, the airworthiness of air craft, aircraft accident investigation and the training and licensing of personnel.

(Turn to page 58)

For further data on advertised products use page 65.

DATA PROCESSING METHODS

(Continued from page 39)

edge gained from the study of the system on the network analyzer is invaluable to engineers when dealing with sudden emergencies of the power demand, up to the stability limits of the system.

The general experience has been that demand for network analyzer service becomes increasingly heavy as experience builds up in methods of application. Analyzers can be designed in such a way that they may be expanded together with the expansion of the distribution system and the applications of the analyzer. The next tool used successfully by the electric power companies in somewhat restricted applications is the Analogue Differential Analyzer used to solve the differential equations.

In view of the special problems encountered in the electric power industry, certain special purpose analogue computers have been developed and built. The Transmission Loss Penalty Factor Computer, developed by the General Electric Co., is a typical case. This computer, used in conjunction with the network analyzer, permits selection of optimum loading schedules. The short range loading of a hydro-thermal electric system can be successfully analyzed by the analogue computer for various network conditions.

A very interesting type of computer has been built by the Leeds and Northrup Co. for the integrated Southern Company System where the computer calculates the incremental cost of power delivered and the input data to the computer is directly fed from the remote points by a telemetering system. The computer operates 24 hours a day and permits quick readjustment of the loads and control of the system under rapidly changing load conditions. The human element makes decisions by the operation of simple controls and is continuously informed of economical status of the system. This computer represents a significant step in data handling, because the real data is automatically fed to the calculating machine and the human operator supervises the system and makes final high level decisions. In other words, the computer operates in real time.

The machines described above were of the analogue type. Equally powerful tools are represented by the digital machines which are of two types: very fast electronic and rather slow electromechanical. They require extensive preparation of the program instructing them in the arithmetical and logical operations to be performed, and in what sequence. Once the program is prepared, the machines can readily and quickly calculate the results for various sets of parameters with a high degree of accuracy. They can be programmed to solve problems of circuit analysis, cost analysis, and load and cost forecasts. The computer time cost is usually much higher than in the case of the analogue computers and for this reason it is sometimes more economical to obtain the approximate solution on the network analyzer or any other analogue machine, and use the digital machine for the final accurate solution.

The recent advances in storage capacity and in operational speed of the digital computers make them successful competitors of the network analyzers. The input data to the digital computer must be prepared in a digital form on punched cards, punched paper tape or recorded on magnetic tape. The output data can be obtained in similar forms or printed on paper in the form of tables. Let me quote a few examples of the applications of the digital computers to the problems of the electric power companies.

The records of load duration (hourly or otherwise) can be made automatically on punched cards. This record can then be processed by the machine to prepare statistical data or to predict future loads, taking into account the customer predictions and seasonal factors. This method was adopted by the Southern Services Inc. using I.B.M. computing equipment.

Some companies, having already available a digital computer as used in their accounting departments, have developed a method of network analysis on the digital machine for a system having a small number of loops.

The transient studies of a network of synchronous and induction machines was successfully carried out on digital machines by engineers of the Westinghouse Corporation.

The Tennessee Valley Authority used the digital computer to study the best design of a new system of transmission lines. Line constants were determined. In the first stage of the analysis, the problem was investigated on the network analyzers and in the second the digital machine calculated tensor matrices.

Generation scheduling for the thermal plants of the Southwestern Public Service Company was calculated by means of the digital computer of the General Electric Company.

In view of the high initial and running cost of the digital machines, the electric companies are using the services of the computation centers on a rental basis. To my knowledge, there are two computing centers in Canada, one in Toronto and one in Ottawa.

In the operation of power systems, the combination of computation, automation and remote data transmission can provide the integrated control system permitting automatic or semi-automatic plant operation. In all automatic systems, the reliability of the control is of primary importance and if there is a problem of the replacement of the human operator by the automatic device, the latter should be at least as reliable as a human operator.

With the appearance of transistors, automation has obtained a component possessing useful life much longer than the electron tube. All symptoms indicate that the transistor will invade the automation and telemetering field and do much to assure the reliability of remotely controlled plants. Some are already in existence.

The Tennessee Valley Authority has installed several remotely controlled power plants in their power distribution system and the Calgary Power Co. Ltd. operates several automatic hydro plants with very satisfactory results and with operating costs significantly reduced. Minneapolis-Honeywell has developed and installed a very interesting and successful automatic system for the load-frequency control of the Denison Dam in Texas, where very rapid load swings require equally rapid response of the control system.

Summary:

Computing machines provide very powerful tools in solving distribution and economical-generation problems which would otherwise be too difficult to solve in a timely or economical manner. These solutions provide the guidance for the technical personnel and the management to assess and plan the activity of the systems under their control. The electric power companies presently have much to gain by extensive use of computing equipment. The future requirements would appear to demand the use of such aids.

For further data on advertised products use page 65.

NEW PRODUCTS

(Continued from page 47)

● *New Bonding Process For Printed Circuit Laminates*

Item 1014

One of the most significant advances in copper clad laminates for printed circuits is a new bonding process recently developed. The result is faster production, fewer rejects and better printed circuits. The process is being adopted for various grades of Phenolite laminated plastics to form a new line of copper clads designated as the HP series.

Compared to grades made by other processes, the new copper clads possess double bond strength (12 to 15 lb.) and a much higher dip solder temperature resistance (30 seconds at 500°F.). Production-wise, the new HP series speeds up the operation, provides cleaner soldered joints, and minimizes bridging in the printed circuit. The new materials also exhibit high retention of bond strength after repeated heating and cooling — a condition which occurs in electronic circuits when a device is turned on and off.

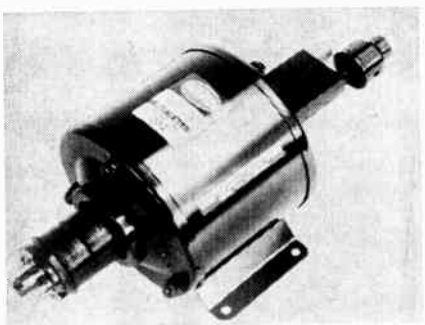
For further information on New Products, use postcard coupon on page 65.

● *Microwave Oscillator Tubes*

Item 1015

A new series of microwave oscillators offering wide-range electronic tuning and other unique advantages is announced. Known as backward-wave oscillators, these tubes sustain oscillation by energy interchange between an electron beam and a guided electromagnetic wave.

Conventional applications include local oscillators, sweep-frequency signal generators, high-speed AFC circuits, and laboratory microwave signal sources.



The new tubes outperform other microwave oscillators not only in bandwidth capability (with a single type covering a 2,000 m.c. range) but also in low pulling figure, freedom from hysteresis and long-line effects, and freedom from spurious modulation when modulated at high frequencies. In many cases the use of backward-wave oscillators will permit considerable simplification in equipment design.

These features will find application in high-quality telecommunications such as mobile television relays, where the low pulling figure is of special value. Backward-wave oscillators also make ideal modulators for terminal stations of microwave radio links. The new tubes will be employed as fundamental elements in entirely new equipments when their astonishing properties become generally known.

Tubes covering L-band through X-band are currently available. X-band through K-band types are in the final stages of development and will be available soon.

(Turn to page 62)

For further data on advertised products use page 65.

☆ Book Review ☆

Abstracts of the Literature on Semiconducting and Luminescent Materials and Their Applications, 1954 issue, compiled by the Battelle Memorial Institute.

This compilation of literature abstracts has been prepared by the Solid State Devices Division and the Physical Chemistry Division of Battelle Memorial Institute. The Digest was originated to augment the research activities of these divisions. Because of the large number of publications dealing with the broad subject of semiconducting and luminescent materials, this compilation has been found to provide a ready reference to pertinent literature in the field.

The principal source of reference has been the various abstract journals; however, where possible, oral papers and other articles have been abstracted. An attempt has been made to present the most important experimental results or conclusions and, thus, to minimize the necessity for the reader to obtain the original article. By including this information and by supplying subject and author indices, the compilation serves as a fairly complete desk reference in this area of technology.

Abstracts of the Literature on Semiconducting and Luminescent Materials is published by John Wiley and Sons Inc., 440 Fourth Avenue, New York 16, N.Y., contains 200 pages, soft cover bound in loose leaf format, price $5.00.

Network Analysis by M. E. Van Valkenburg presents a unified treatment of time-domain and frequency-domain concepts through the use of the pole-zero method of analysis. This method is also used extensively for interpreting network functions in relation to both transient and sinusoidal steady-state behavior.

Here are presented methods essential for advanced work in network theory, communication systems, servo-mechanisms, computers and other important areas.

The author begins his book with the development of circuit concepts, network conventions, and the writing of equilibrium equations. He then goes into the classical solution of differential equations for networks, which serves as a foundation for his later discussion of Laplace transformation. In subsequent chapters, he develops the concepts of impedance and transfer functions, and of complex frequency.

Dr. Van Valkenburg covers many important topics generally treated separately, such as duality, driving-point and transfer functions, Fourier series and the Fourier integral, frequency spectra, convolution, Foster and Cauer network realizations, and stagger-tuned amplified networks.

Network Analysis is published by Prentice-Hall Inc., 70 Fifth Avenue, New York 11, N.Y., contains 440 pages, over 500 line drawings, and numerous worked out examples. Hard cover bound, price $9.75.

Electronic Transformers and Circuits, second edition, by Reuben Lee. Since it was first published in 1947, Electronic Transformers and Circuits has won a special place in the engineer's library. Clear and practical, it offers the most useful data on the design of transformers for electronic apparatus and on the effects of transformer characteristics on electronic circuits. The relations and attributes common to all electronic transformers and reactors are covered, rather than just those of special application.

The treatment is quantitative, but physical aspects are emphasized and mathematical intricacies are simplified wherever possible. The aim has been to provide a book of maximum usefulness with a minimum of unnecessary material. Only those aspects of conventional transformer design which directly contribute to an understanding of transformer operation are included.

The second edition of the book has been expanded to cover new developments and to provide a fuller discussion of certain topics. There are new sections on magnetic amplifiers, pulse circuits, reactor surges, toroid cores, r.f. power supplies, wide-band transformers, and charging chokes.

Electronic Transformers and Circuits is published by John Wiley and Sons Inc., 440 Fourth Avenue, New York 16, N.Y., contains 360 pages, hard cover bound, price $7.50.

Spheroidal Wave Functions by J. A. Stratton, P. M. Morse, L. J. Chu, J. D. C. Little and F. J. Corbato. The tables included in this book are the result of a number of years of effort on the part of the authors. This volume makes it possible for the electrical engineer and physicist to handle wave problems in spheroidal co-ordinates with approximately the same degree of facility as has been possible previously for rectangular, circular, cylindrical, and spherical co-ordinates. The availability of these tables makes certain calculations in applied physics, acoustics, and radar much more practicable.

The book deals with those spheroidal wave functions appropriate for prolate or oblate spheroidal boundaries. It defines certain standard forms of their solution which are useful in practical problems, and it displays a collection of formulas giving the important mathematical properties of these functions. Included also is a set of tables from which values of the solutions can be obtained for the more interesting ranges of the variables. These tables contain the series co-efficients, together with some of the separation constants.

All the numbers contained in the tables were determined by the high speed electronic digital computer Whirlwind I at The Massachusetts Institute of Technology. They were computed, tabulated, and printed automatically, thus permitting a degree of reliability never before achieved in an undertaking of this nature with functions of this complexity.

Spheroidal Wave Functions is published by The Technology Press, Massachusetts Institute of Technology, and John Wiley & Sons, Inc., 440 Fourth Avenue, New York 16, N.Y., contains 613 pages, hard cover bound, price $12.50.

Electric Network Synthesis: Image Parameter Method, by Myril B. Reed. This book approaches the synthesis, or design, problem by first presenting the basic theory of the two-terminal and four-terminal, purely reactive network. Then, after fully explaining the reactive network pattern, it presents practical methods for correcting the design for dissipation, one of the greatest problems in network synthesis.

Filter design is described by means of an analysis of the lattice, or bridge type, section. The technique used is that of obtaining design parameters on the basis of the symmetric lattice, and using these parameters to create the desired network form. Use of ladder networks in building a filter network is also discussed.

Insertion loss and phase is then explained in terms of theory and useful charts. A full and intricate design for meeting insertion loss requirements makes this book of unquestioned utility for the engineer in actual design work.

Finally, a method for equalizing the pass band on a transfer-loss basis is presented. ELECTRIC NETWORK SYNTHESIS thus completely covers the process of designing networks to fit the very precise requirements for filter design.

Electric Network Synthesis is published by Prentice-Hall, Inc., 70 Fifth Avenue, New York 11, N.Y., contains 252 pages, hard cover bound, price $8.00.

For further data on advertised products use page 65.

Heathkit PRINTED CIRCUIT 5" COLOR TV Oscilloscope Kit

MODEL 0-10
$69.50
Shpg. Wt. 27 lbs.

The technical specifications for this fine instrument speak for themselves. Vertical channel sensitivity is 0.025 volts RMS/inch at 1 Kc. Vertical frequency response is essentially flat to 5 Mc, and down only 1.5 db at 3.58 Mc. Ideal for Color TV work!

Extended sweep generator range is from 20 cps to 500 Kc in five steps, far beyond the range normally encountered at this price level.

Other features are: plastic-molded capacitors for coupling and by-pass—preformed and cabled wiring harness—Z axis input for intensity modulation—peak-to-peak voltage calibrating source built-in—retrace blanking amplifier—regulated power supply—high insulation printed circuit boards—step attenuated and frequency compensated vertical input circuit—push-pull horizontal and vertical amplifiers—excellent sync. characteristics—sharp, hairline focusing—uses 5UP1 CRT—extremely attractive physical appearance.

An essential instrument for professional Laboratory, or for servicing monochrome or color TV.

Heathkit PRINTED CIRCUIT 3" OSCILLOSCOPE KIT

This light, portable 3" oscilloscope is just the ticket for the ham, for service calls, or as an "extra" scope in the shop, or lab. Measures only 9½" H x 6½" W x 11¾" D, and weighs only 11 lbs.

Employs printed circuit board for improved circuit performance. Vertical amplifiers flat within +3 db from 2 cps to 200 Kc. Vertical sensitivity 0.25 volts RMS/inch peak-to-peak, and sweep generator operates from 20 cps to 100,000 cps. R.F. connection to deflection plates.

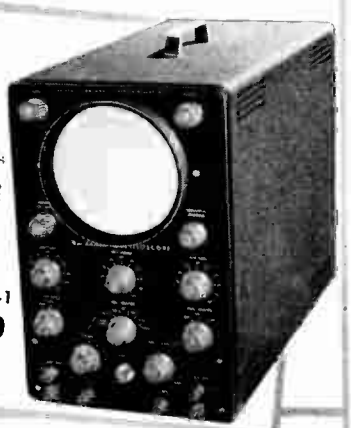
MODEL OL-1
$29.50
Shpg. Wt. 14 lbs.

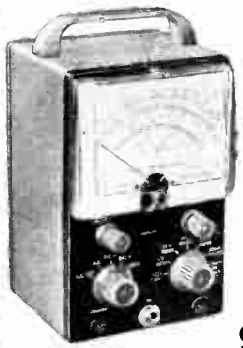
Heathkit PRINTED CIRCUIT 5" OSCILLOSCOPE KIT

This full-size 5" Oscilloscope incorporates many outstanding features.

Vertical channel flat within +3 db, 2 cps to 200 Kc, with 0.09 volts RMS/inch peak-to-peak sensitivity at 1 Kc. Sweep operation from 20 cps to 100,000 cps. Built-in peak-to-peak voltage calibration—3 step frequency compensated input attenuator—phasing control—push-pull deflection amplifiers. Printed circuits for reliable performance and reduced construction time.

MODEL OM-1
$49.50
Shpg. Wt. 26 lbs.





Heathkit PRINTED CIRCUIT VACUUM TUBE VOLTMETER KIT

MODEL V-7
$24.50
Shpg. Wt. 7 lbs.

This VTVM has set a new standard for accuracy and reliability in kit-form electronic instruments. Features modern, time-saving printed circuits, and functional arrangement of controls and scales. Includes new peak-to-peak scale for FM and TV work.

Measures AC (RMS) and DC voltage at 0-1.5, 5, 15, 50, 150, 500, and 1500; peak-to-peak AC voltage at 0-4, 14, 40, 140, 400, 1400, and 4000; center-scale resistance readings of 10, 100, 1000, 10,000, 100 K, 1 meg., and 10 meg. DB scale provided also. Zero-center operation within range of front panel controls. Polarity reversal switch—200 μa 4½ meter—transformer power supply—11 megohm input impedance — 1% precision resistors — high quality components used throughout.

Heathkit 20,000 ohms/volt MULTIMETER KIT

MODEL MM-1
$29.50
Shpg. Wt. 6 lbs.

Features comprehensive range coverage. 20,000 Ω/V D.C. and 5000 Ω/V A.C. Ranges: 0-1.5, 5, 50, 150, 500, 1500, and 5000 V. direct current from 0 to 150 μa., 15 a. in 5 steps. Center-scale resistance of 15, 1500 and 150,000 ohms, and db from —10 to +65.

Uses 1% precision resistors—50 μa. meter—molded bakelite case.

Heathkit DIRECT-READING CAPACITY METER KIT

Extremely valuable where speed and convenience are essential. Quality control work, production line checking, etc. Reads capacity directly on meter scale, from 0-100 mmfd, 1000 mmfd, .01 mfd, and .1 mfd. Residual capacity less than 1 mmfd. Not susceptible to hand capacity.

MODEL CM-1
$29.50
Shpg. Wt. 7 lbs.

Heathkit A. C. VACUUM TUBE VOLTMETER KIT

MODEL AV-2
$29.50
Shpg. Wt. 5 lbs.

Measures AC voltage only, from 10 cps to 50 Kc. Covers the range from 1 millivolt to 300 volts in 10 steps at high impedance input. Incorporates full 10 ranges of db scale from —52 db to +52 db. Essential in the audio laboratory or for audio enthusiasts and experimenters. Provides sensitivity essential for low level audio measurements.

Heathkit ELECTRONIC SWITCH KIT

This device will electronically switch between 2 input signals to produce both signals alternately at the output. Used in conjunction with an oscilloscope, it will permit the observation of 2 signals simultaneously. Provides switching rates from 10 cps to 200 cps.

MODEL S-2
$23.50
Shpg. Wt. 11 lbs.

Heathkit VOLTAGE CALIBRATOR KIT

Once calibrated, this instrument provides a known peak-to-peak voltage standard for comparison with unknown voltage values on an oscilloscope. Panel calibrated directly—no involved calculations required. Operates within a voltage range of .01 to 100 volts peak-to-peak.

MODEL VC-2
$11.50
Shpg. Wt. 4 lbs

HEATH Company

A SUBSIDIARY OF DAYSTROM INC.

BENTON HARBOR 3, MICHIGAN

For further data on advertised products use page 65.

SELECT YOUR NEXT HEATHKIT FROM

Heathkit TUBE CHECKER KIT

MODEL TC-2
$29.50
Shpg. Wt. 12 lbs.

Because of its low price this fine tube tester is available, not only to the service shop and laboratory, but to part-time servicemen, experimenters, and radio amateurs, as well. Will test all tubes commonly encountered in radio and TV service work. Simple "GOOD—BAD" scale on the 4½" meter. Tests for open, short, and quality on the basis of total emission. Includes illuminated roll chart. Fourteen different filament voltage values available. Separate lever switch for each tube element.

Model TC-2P is the same electrically as TC-2, except that it is housed in a beautiful two-toned portable carrying case. Only $34.50. Shpg. Wt. 15 lbs.

Portable carrying case available separately for Model TC-2, or older model TC-1. Cab. No. 91-8, $7.50. Shpg. Wt. 7 lbs.

CRT Test Adapter, Model 355 for use with the TC-2, $4.50. Shpg. Wt. 1 lb.

Heathkit TV ALIGNMENT GENERATOR KIT

Here is the complete R.F. signal source for FM and TV alignment, (both monochrome and color). Provides output on fundamentals from 3.6 Mc to 220 Mc in four bands, with harmonic output usable up through the UHF channels. Electronic sweep circuit eliminates mechanical gadgets and accompanying noise, hum, and vibration. Continuously variable sweep up to 0—42 Mc, depending on base frequency.

Variable marker (19—60 Mc on fundamentals) and crystal marker (4.5 Mc and multiples thereof) generators built-in. Crystal included with kit. Provision for external marker if desired.

Packed with outstanding features. 50 ohm output impedance — exceptionally good linearity—effective AGC action—plenty of R.F. output. An essential instrument for the up-to-date service shop.

$49.50
MODEL TS-4
Shpg. Wt. 16 lbs.

Heathkit SIGNAL GENERATOR KIT

MODEL SG-8
$19.50
Shpg. Wt. 8 lbs.

This is one of our most popular kits, and is "serviceman engineered" to fulfill the signal source requirements of the radio serviceman and experimenter.

Covers 160 Kc to 110 Mc on fundamentals (5 bands), with output in excess of 100,000 microvolts. Calibrated harmonics extend usefulness up to 220 Mc. Choice of unmodulated R.F. output, 400 cps modulated R.F. output, or 400 cps audio output. Step-type and continuously variable output attenuation controls.

Coils are prewound, and construction manual is complete. Calibration unnecessary for service applications.

Model RS-1

Heathkit RESISTANCE SUBSTITUTION BOX KIT

Provides switch selection of 36 RTMA 1 watt standard 10% resistors, ranging from 15 ohms to 10 megohms. Numerous applications in radio and TV work.

$5.50
Shpg. Wt. 2 lbs.

Heathkit CONDENSER SUBSTITUTION BOX KIT

Model CS-1

Very popular companion to Heathkit RS-1. Individual selection of 18 RTMA standard condenser values from .0001 mfd to .22 mfd. Aluminum panel, bakelite case, and includes 18" flexible leads with alligator clips.

$5.50
Shpg. Wt. 2 lbs.

Model DR-1

Heathkit DECADE RESISTANCE KIT

Twenty 1% precision resistors provide resistance from 1–99,999 ohms in 1 ohm steps. Indispensable around service shop, laboratory, ham shack, or home workshop.

$19.50
Shpg. Wt. 4 lbs.

Heathkit DECADE CONDENSER KIT

Model DC-1

Provides capacity values from 100 mmf to 0.111 mfd in steps of 100 mmfs. +1% precision silver-mica condensers used. High quality ceramic wafer switches for reduced leakage.

Shpg. Wt. 3 lbs.
$16.50

Heathkit CONDENSER CHECKER KIT

Model C-3
$19.50
Shpg. Wt. 7 lbs.

Measures capacity in four ranges from .00001 to 1000 mfds. Power factor control is provided for indication of electrolytic condenser efficiency. Tests capacitors under actual load conditions. Checks resistance from 100 ohms to 5 megohms. Direct reading scales for all tests. No calculation necessary.

Heathkit LABORATORY GENERATOR KIT

Model LG-1

Here is a signal generator for use where high accuracy and metered performance are essential. Covers 150 Kc to 30 Mc on fundamentals in 5 bands. 400 cps modulation variable from 0 to 50%. R.F. output at 50 Ω from 100,000 to 1 μv. Meter reads R.F. output in μv. or modulation percentage. Fixed-step and variable output.

$39.50
Shpg. Wt. 16 lbs.

Model T-3

Heathkit VISUAL-AURAL SIGNAL TRACER KIT

$23.50
Shpg. Wt. 9 lbs.

This signal tracer features a high-gain R.F. channel and probe to permit signal tracing from the receiver antenna input through the R.F. and I.F. stages. Separate low gain channel for audio circuits. Both visual and aural indication by means of speaker and electron beam "eye" tube.

Also noise locater circuit, wattmeter, and terminals for "patching" output transformer or speaker into external circuit.

Model M-1

Heathkit HANDITESTER KIT

$14.50
Shpg. Wt. 3 lbs.

The M-1 is literally pocket size to fit in your coat pocket, tool-box, glove compartment, or desk drawer. Measures A.C. or D.C. v. in 5 steps from a full scale minimum of 0—10 v. to a maximum of 0—5000 v. Measures direct current at 0—10 Ma and 0—100 Ma, and provides ohmmeter ranges of 0—3000 and 0—300,000 ohms. Sensitivity of 1,000 ohms/v. 1% precision divider resistors employed.

HEATH Company

A SUBSIDIARY OF DAYSTROM INC.
BENTON HARBOR 3, MICHIGAN

For further data on advertised products use page 65.

For further data on advertised products use page 65.

New Heathkit DX-100 PHONE AND CW TRANSMITTER KIT

This one compact package contains complete transmitter, with built-in VFO, modulator, and power supplies. Provides phone or CW operation—VFO or crystal excitation—and band-switching from 160 meters through 10 meters. R.F. power output 100—125 watts phone, 120—140 CW. Parallel 6146's modulated by push-pull 1625's. Pi network interstage and output coupling for reduced harmonic output. Will match non-reactive antennas between 50 ohms and 600 ohms. TVI suppressed with extensive shielding and filtering. Rugged metal cabinet has inter-locking seams.

The high-quality transmitter is packed with desirable features not expected at this price level. Copper plated chassis—potted transformers—wide spaced tuning capacitors—ceramic insulation—illuminated VFO dial and meter face—remote control socket—preformed wiring harness—concentric control shafts—high quality, well rated components used throughout. Overall dimensions 20⅞" wide x 13¾" high x 16" deep.

Supplied complete with all components, tubes, cabinet and detailed construction Manual. (Less crystals.) Don't be deceived by the low price! This is a top-quality transmitter designed to give you years of reliable service and dependable performance.

MODEL DX-100

$189.50

Shpg. Wt. 120 lbs.

Shipped motor freight unless otherwise requested. $50.00 deposit required for C.O.D. orders.

Heathkit AMATEUR TRANSMITTER KIT

MODEL AT-1

$29.50

Shpg. Wt. 15 lbs.

Enjoy the trouble-free operation of commercially designed equipment while still benefiting from the economies and personal satisfaction of "building it yourself."

This CW Transmitter is complete with its own power supply, and covers 80, 40, 20, 15, 11 and 10 meters. Single knob bandswitching eliminates coil changing. Panel meter indicates grid or plate current for the final. Crystal operation, or can be excited by external VFO. Crystal not included in kit. Incorporates features one would not expect in this price range, such as key-click filter, line filter, copper plated chassis, prewound coils, 52 ohm coaxial output, and high quality components throughout. Instruction Book simplifies assembly. Uses 6AG7 oscillator, 6L6 final and 5U4G rectifier. Up to 35 watts plate power input.

Heathkit GRID DIP METER KIT

Model GD-1B

$19.50

Shpg. Wt. 4 lbs.

This is an extremely valuable tool for Hams, Engineers or Servicemen. Covering from 2 Mc to 250 Mc, it uses 500 μa meter for indication. Kit includes prewound coils and rack. Will accomplish literally hundreds of jobs on all types of equipment.

Heathkit ANTENNA IMPEDANCE METER KIT

Use in conjunction with a signal source for measuring antenna impedance, line matching purposes, etc. Will double, also, as a phone monitor or relative field strength indicator.

100 μa meter employed. Covers the range from 0 to 600 ohms. An instrument of many uses for the amateur.

Model AM-1

$14.50

Shpg. Wt. 2 lbs.

Heathkit VFO KIT

MODEL VF-1

$19.50

Shpg. Wt. 7 lbs.

Weigh the cost of this kit against the cost of crystals—and consider the convenience and flexibility of VFO operation. This is one of the most outstanding kits we have ever offered for the radio amateur.

Covers 160—80—40—20—15—11 and 10 meters with three basic oscillator frequencies. Illuminated and precalibrated dial scale clearly indicates frequency on all bands and provides more than two feet of dial calibration. Reflects quality design in the use of ceramic coil forms and tuning capacitor insulation, and copper plated chassis. Simply plugs into crystal socket of any modern transmitter to provide coverage of the bands from 160 meters through 10 meters. Uses 6AU6 Clapp oscillator, and OA2 voltage regulator for stability. May be powered from plug on Heathkit Model AT-1 Transmitter, or supplied with power from most transmitters.

Heathkit ANTENNA COUPLER KIT

Model AC-1

$14.50

Shpg. Wt. 4 lbs.

Poor matching allows valuable communications energy to be lost. The Model AC-1 will match your low power transmitter to an end-fed long wire antenna. Also attenuates signals above 36 Mc, reducing TVI. 52 ohm coaxial input—power up to 75 watts—10 through 80 meters.

Heathkit COMMUNICATIONS RECEIVER KIT

Covers 550 Kc to 35 Mc in 4 bands. Features electrical bandspread—separate R.F. and A.F. gain controls—noise limiter—AGC—BFO—phone jack—5½" PM speaker.

CABINET: Fabric covered plywood cabinet. Part No. 91-10. Shpg. Wt. 5 lbs. $4.50

Model AR-2

$25.50

Shpg. Wt. 12 lbs. (Less Cabinet)

HEATH Company

A SUBSIDIARY OF DAYSTROM INC.

BENTON HARBOR 3, MICHIGAN

Heathkit DUAL-CHASSIS WILLIAMSON TYPE HIGH FIDELITY AMPLIFIER KIT

Main amplifier and power supply each have their separate chassis for flexibility of installation. Features the Acrosound "ultra-linear" output transformer. Frequency response within ±1 db from 10 cps to 100,000 cps. Power output is over 20 watts.

KIT COMBINATIONS

W-3M: Consists of main amplifier and power supply for separate construction. Includes all tubes, components and complete assembly instructions. Shpg. Wt. 29 lbs., Exp. Only $49.75

W-3: Consists of W-3M Kit listed above *plus* Heathkit Model WA-P2 Preamplifier. Shpg. Wt. 37 lbs., Exp. Only . . . $69.50

Heathkit ADVANCED DESIGN *High Fidelity* AMPLIFIER KIT

This advanced-design 25 watt Hi-Fi Amplifier features a new-design Peerless output transformer, improved circuitry, and uses KT-66 output tubes. This results in higher power output; improved bass and high frequency response; and reduced IM and harmonic distortion. Incorporates all the "extra" features that make for real listening enjoyment. Power handling capabilities increased to follow instantaneous power peak of full orchestra. Also new type balancing circuit, and "tweeter saver" to suppress HF oscillation. New physical design results in attractive appearance, suitable for use either in or out of a cabinet.

KIT COMBINATIONS

W-5M: Consists of main amplifier and power supply for single chassis construction. Includes all tubes, components, and complete assembly instructions. Shpg. Wt. 31 lbs., Exp. Only $59.75

W-5: Consists of W-5M Kit listed above *plus* Heathkit Model WA-P2 Preamplifier. Shpg. Wt. 38 lbs., Exp. Only $79.50

Heathkit SINGLE-CHASSIS WILLIAMSON TYPE HIGH FIDELITY AMPLIFIER KIT

This is the lowest priced Williamson-type Amplifier ever offered in kit form. Main amplifier and power supply on a single chassis. Features Chicago output transformer. Flat within ±1 db from 10 cps to 100,000 cps. Maximum power output over 20 watts.

KIT COMBINATIONS

W-4M: Consists of main amplifier and power supply for single chassis construction. Includes all tubes, components, and complete assembly instructions. Shpg. Wt. 28 lbs., Exp. Only $39.75

W-4: Consists of W-4M Kit listed above *plus* Heathkit Model WA-P2 Preamplifier. Shpg. Wt. 35 lbs., Exp. Only $59.50

Heathkit 6-WATT AMPLIFIER KIT

Model A-7B

$15.50

Shpg. Wt. 10 lbs.

Model A-7B; although not classified as a true high fidelity amplifier, this Heathkit Amplifier provides full 6 watts power output, more than adequate for normal home installation, and frequency characteristics are ± 1½ db from 20 to 20,000 cps. Push-pull output—detailed construction manual—top-quality parts. Output transformer tapped at 4, 8, and 15 ohms. Bass and treble tone controls provided. Two input channels.

MODEL A-7C: Same as Model A-7B exeept with preamplifier stage. Shpg Wt. 10 lbs., $17.50

Heathkit 20-WATT HIGH FIDELITY AMPLIFIER KIT

Model A-9B

$35.50

Shpg. Wt. 23 lbs.

Here is your least expensive route to real high fidelity performance. Full 20 watt output—separate bass and treble tone controls—frequency response ±1 db 20—20,000 cps—four switch-selected, compensated inputs—low hum and noise level—output transformer tapped at 4, 8, 16, and 500 ohms. Single chassis construction combines preamplifier, main amplifier, and power supply in one unit.

Heathkit HIGH FIDELITY PREAMPLIFIER KIT

Model WA-P2

$19.75

Shpg. Wt. 7 lbs.

Beautiful modern appearance blends with any interior color scheme.

Completely fulfills all the requirements for remote control, compensation, and preamplification for the Heathkit Williamson-type Amplifiers or any conventional Hi-Fi Amplifier. Five separate input channels, each with separate audio level control. Full record equalization accomplished with 4-position turnover and roll-off controls.

Separate bass and treble controls. Overall frequency response within 1 db from 25 cps to 30,000 cps. Hum and noise level extremely low. This brilliant performer will do justice to the finest available program sources.

HEATH COMPANY • Benton Harbor 3, Mich.

MAIL YOUR ORDER TODAY TO THE
HEATH COMPANY
A SUBSIDIARY OF DAYSTROM, INC.
BENTON HARBOR 3, MICHIGAN

ORDER BLANK

From _____

_____

_____

(PLEASE PRINT)

SHIP VIA

- ☐ Parcel Post
- ☐ Express
- ☐ Freight
- ☐ Best Way

QUANTITY	ITEM	MODEL NO.	PRICE

Enclosed find ( ) check ( ) money order for
Please ship C.O.D. ( ) postage enclosed for pounds.

On Express orders do not include transportation charges—they will be collected by the express agency at time of delivery.
NOTE: ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

ON PARCEL POST ORDERS include postage for weight shown.

ORDERS FROM CANADA and APO's must include full remittance.

Electronic Firms From Canada, Britain and United States Reserve 85% of Space For Canada's IRE Show.

The response from Canada, the United States, the United Kingdom and Europe has been so unexpectedly quick that 85 per cent of the total available space for the Canadian I.R.E. Show to be held October 1, 2 and 3 was sold within the first few weeks of the initial announcement. It is the opinion of C. A. Norris, general convention chairman, that this unprecedented rush was undoubtedly due to its being the most ambitious convention-exposition of its kind ever to be held in Canada and also to the fact that leading specialists of radio and electronics, plus atomic development, will be present. Space for 166 displays has already been sold.

It is in keeping with Canada's consistent role for peace that the theme of the atomic exhibits will be "humanity's boon — not doom". As to the electronic devices, basis for so much progress in the past two or three decades, these are now a vital part of the vanguard of automation. The radio and communications aspect of the exposition will remind many specialists of Canada's prominent part in radio and radar developments during the war, which resulted in a fruitful supply of up-and-coming experts to forge ahead in post-war industry.

The convention's technical program is under Dr. George Sinclair of the University of Toronto's Department of Electrical Engineering, and the technical papers read at the convention will undoubtedly be of a high caliber, embracing many research findings of Canadians and others.

The support of the Federal Government has been evidenced by the participation of four of its research and technical bodies and also in the ready co-operation of its trade commissioners abroad in promoting this convention-exposition. A letter from the Hon. C. D. Howe has complimented the I.R.E. on its enterprise in presenting this scientific assembly.

Manufacturers who have already reserved exhibit space for the show are listed below.

Adams Engineering Limited
Aerovox Canada Limited
Aircraft-Marine Products of Canada Limited
Alford Manufacturing Company Incorporated
Ampex American Corporation (Canadian Division)
Amphenol Canada Limited
Andrew Antenna Corporation Limited
Antiference (Canada) Limited
Atlas Radio Corporation Limited
Automatic Radio of Canada, Limited
Aviation Electric Limited

Bach-Simpson Limited
Bayly Engineering Limited
Bomac Laboratories Incorporated

Canadian Electric Resistors Limited
Canadian General Electric Company Limited
Canadian Marconi Company Limited
Canadian Westinghouse Company Limited
Cannon Electric (Canada) Limited
Centralab Canada, Limited
Collins Radio Company of Canada Limited
Computing Devices of Canada Limited
Conrad, Incorporated
Copper Wire Products Limited

Dawe Instruments Limited
Defence Research Board
Diamond State Fibre Company of Canada Limited
Dominion Electrohome Industries Limited

Edwards High Vacuum (Canada) Limited
Eitel-McCullough Incorporated
Electrodesign
Electro Impulse Laboratory, Incorporated
Electromechanical Products
Erie Resistor of Canada Limited
Essex Electronics of Canada Limited

T. S. Farley Limited

The Glendon Company Limited

Hackbusch Electronics Limited
John Herring and Company Limited
The Holden Company Limited

Industrial Electronics of Canada Limited
International Resistance Company Limited

G. F. Kelk and Company
Kester Solder Company of Canada, Limited

E. G. Lomas Company
J. R. Longstaffe Company Limited

Marsland Engineering Limited
McCurdy Radio Industries Limited
Mycalex Corporation of America

National Carbon Company, Division of Union Carbide Canada Limited
National Fibre Company of Canada Limited
National Research Council
R. H. Nichols Limited
Norden-Ketay Corporation
Northern Electric Company Limited

The Plessey Company of Canada Limited
Charles W. Pointon Limited
PSC Applied Research Limited

Radelin-Kirk Limited
Radio Condenser Company Limited
Radio Engineering Products Limited
RCA Victor Company Limited
Rogers Majestic Electronics Limited
R-O-R Associates Limited

Sigma Instruments Incorporated
A. C. Simmonds and Sons, Limited
Sinclair Radio Laboratories Limited
Sperry Gyroscope Company of Canada Limited
The Sphere Company, Incorporated
Stark Electronic Instruments Limited

Tenatronics Limited
Tensolite Insulated Wire Company Incorporated
TMC (Canada) Limited

United-Carr Fastener Company of Canada Limited

Varian Associates of Canada Limited

Y. W. Small Parts, Limited

For further data on advertised products use page 65.

Dr. James Hall Group Leader For Eimac Receiving Tube Group

Dr. James L. Hall has been named group leader of the ceramic receiving tube group for Eitel-McCullough, Inc., San Bruno, California, manufacturer of Eimac electron-power tubes, according to an announcement by Harold E. Sorg, vice-president and director of research of the firm.

DR. J. L. HALL

Dr. Hall has assumed the duties of Paul Williams who has moved to the position of special assistant to the director of research.

As group leader of the receiving tube group, Dr. Hall will direct all research, development, and production refinement of Eimac's new family of ceramic receiving tubes. Dr. Hall, a graduate of the University of Denver and the Massachusetts Institute of Technology, came to Eimac as an electronic research engineer in July, 1953 from the Stanford Research Laboratory. He was made Assistant Department Head of the receiving tube group at Eimac in December, 1954, and held that position until assuming his present duties.

Dominion Electrohome Plans Plant Expansion

Dominion Electrohome Industries Limited plans a $600,000 expansion of its manufacturing facilities at Kitchener, Ontario.

C. A. Pollock, company president and general manager, announces that work will begin shortly on the new two-storey building, which will house engineering and administrative offices as well as additional production facilities for Electrohome radios, electronic equipment and television receivers.

The new structure will provide the firm with an additional 102,000 square feet of floor space. Electrohome's present facilities, all in the Kitchener area, consist of about half a million square feet in three plants plus warehouse space.

Electronic Enterprises Limited To Handle Racon Hi-Fi Speakers

RACON the oldest manufacturer of speakers in the U.S.A. announces that Electronic Enterprises Ltd. has been appointed as Canadian distributor for RACON High-Fidelity speakers and tweeters. Electronic Enterprises Ltd., of 930 St. George Street, Montreal, will stock and service the complete line of equipment.

(Turn to page 60)

For further data on advertised products use page 65.

NEWS (Continued from page 59)

R. D. B. Sheppard Field Engineer For Ahearn and Soper Co.

The appointment of R. D. B. (Ben) Sheppard, P.Eng., as Field Engineer specializing in power tubes and communications is announced by Warren Y. Soper, president of the Ahearn and Soper Company Limited, Ottawa, Canada. Mr. Sheppard will be attached to the Electronics and Communications Division directed by John R. Foster.

R. D. B. SHEPPARD

Mr. Sheppard has served with the engineering department of the Canadian National Telegraphs (radio group) on field engineering in connection with point to point radio circuits throughout Canada. During the past two years he was Assistant General Radio Engineer specializing in field work and supervision of microwave installations including Canadian National Telegraphs' portion of the television transmission circuits from Toronto to Windsor and from Montreal to Quebec.

Fred W. Radcliffe Appointed New General Manager Of RETMA

Carl A. Pollock, president of the Radio-Electronics-Television Manufacturers Association of Canada, announces that Fred W. Radcliffe has been appointed general manager and secretary, effective April 16th.

In accepting the appointment, Mr. Radcliffe relinquishes his position of commercial vice-president of RCA Victor Company Limited; he has been in the commercial and administrative departments of RCA Victor for the past 36 years.

Fred W. Radcliffe is very well-known in the electronics industry and has been actively engaged in the work of RETMA of Canada for a long time. He has served as a director for 20 years and is currently the chairman of the sales and merchandising committtee of the receiver division.

For further data on advertised products use page 65.

Brian McConnell Now President Of Canadian Radio Patents

Effective February 1st, 1956, Brian McConnell became president of Canadian Radio Patents Limited, a patent licensing agency in the fields of electronics. Concurrently Mr. McConnell was elected to the board of directors of the company.

After graduating from the University of Manitoba with a B.Sc. degree in electrical engineering, Mr. McConnell spent two years with a firm of patent attorneys and, in 1937, joined the Canadian Westinghouse Company in Hamilton, where he was responsible for the patent administration of the company. He became a Registered Patent Attorney in 1940, and is a member of the Patent Institute of Canada.

AA Engineering Becomes Canadian Subsidiary of Armament Co.

Aircraft Armaments Inc., of Baltimore, is extending its operations into Canada through the formation of a Canadian subsidiary to be known as AA Engineering. The new company is owned jointly by Aircraft Armaments and its Toronto affiliate, Bawden Industries Ltd., and will specialize in armament and electronics engineering.

AA Engineering have opened offices in Ottawa where laboratory and engineering operations are carried on. It is expected that Canadian personnel will be engaged later to augment the present engineering staff brought from the Baltimore plant.

Joseph S. Brennan, chief of the Aircraft Armaments contracts division, is general manager of the Canadian company.

Industrial Electronics of Canada Build New Manufacturing Plant

Industrial Electronics of Canada Limited, 83 Torbarrie Road, is building a modern plant on a four-acre site located on the south side of Rexdale Boulevard at Kipling Avenue.

The new building is of brick, block and steel construction and will have a floor area of 20,000 square feet. The company has occupied its present location since January, 1954, and expects to move to the new premises by early summer.

Industrial Electronics of Canada Limited is a subsidiary of Servomechanisms Incorporated, Westbury, L.I., and manufactures products for the aviation industry, particularly fire control computers and accessories. The Industrial Division specializes in the manufacture of industrial type rectifiers, power supplies, street and highway lighting controls and electronic controls for industrial application.

D.O.T. Buys Airport Surveillance Radars

Decca Radar (Canada) Limited of Toronto has received an order from the Department of Transport for four Decca MR-75 medium range Airport Surveillance Radars. These sets, the first of their kind in Canada, are to be installed at Toronto, Montreal, Winnipeg and Vancouver Airports, where they will be used by the Department of Transport as an aid in the control of air traffic. The introduction of radar at these airports will permit the continuous control of large aircraft from a pick-up point of 75 miles at 25,000 feet to touch-down.

Hon. George C. Marler Opens Dorval Omnirange System

The recent opening of the omnirange air navigation system at Dorval Airport in Montreal by the Hon. George C. Marler, Minister of Transport, marked the inauguration of a new system of air navigation in Canada.

Units for the new navigation system were manufactured by Canadian Aviation Electronics Limited of Montreal and were the first omniranges to be manufactured in Canada on a production run basis. Production of the equipment provided by this company involved systems engineering and tooling all carried out in the main plant of C.A.E. in Montreal.

● When the Hon. George C. Marler, Minister of Transport, spun a dial at Dorval Airport, putting into operation the first "VOR" airway in the country, he inaugurated a new system of air navigation in Canada. Among the guests at the opening ceremony were Mr. K. R. Patrick, O.B.E., president, Canadian Aviation Electronics Ltd. and Air Vice Marshal J. L. E. de Niverville, Director of Air Services.

For further data on advertised products use page 65.

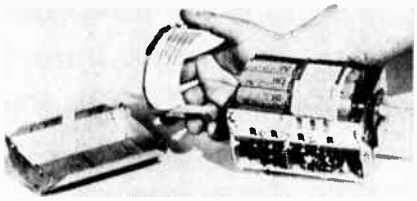
NEW PRODUCTS

(Continued from page 51)

● *Tuner Cleaner*

Item 1016

An easy-to-install TV tuner contact cleaner has just been introduced, called the "G.C. Kleen-O-Matic". The device is said to provide better picture performance by keeping tuner contacts free from oxidation and noise.



The "G.C. Kleen-O-Matic" is designed to clip on all Standard Coil tuners quickly where, with a few turns of the selector knob, it wipes contacts clean. A special linen webbing inside the brass housing constantly polishes the contacts. In addition, the device acts as a radiation shield on older versions of that tuner where covers were not furnished.

● *Ultrasonic Mixer-Cleaner*

Item 1017

Development of an ultrasonic mixer-cleaner designed to perform difficult cleaning or mixing jobs on a production or laboratory basis has been announced.

Consisting of a one-gallon capacity transducer driven by an ultrasonic generator, the mixer-cleaner, Model 1115, is extremely versatile and particularly useful for such diverse applications as blind-hole cleaning, degreasing, mixing of previously immiscible liquids, and removal of radio-active particles.

The transducer, in resonance with the generator at one megacycle, activates cleaning medium ultrasonically and provides positive but gentle cleaning for small fragile parts such as vacuum tube grids, meters and meter movements, printed and soldered circuits, automotive and motor parts, tools, etc. As a mixer, unit performs such difficult operations as agglomeration, deglomeration, emulsification, polymerization, chemical action, and bacterial and dye treatment.

All component parts are factory-tuned for maximum resonance. Unit operates with input of 110 v., 60 cycles, 2½ amps. Power is continuously variable to more than 100 watts. Entire weight: 60 pounds. Although the one gallon transducer assembly (which measures 6½" in diameter by 7½" deep) provides sufficient capacity for most operations, other capacities and frequencies are available.

● *Laboratory Instrument Catalog*

Item 1018

A twenty-page catalog illustrating and describing numerous new laboratory instruments is now available from the publisher. Included are such instruments as Liquid Phosphor Counters, Scalers, Linear Amplifiers, Ratemeters, Ultra-Stable Power Supplies, Scintillation Detectors, and Crystals.

● *Willys Adds "CJ-6" Model To "Jeep" Line*

Item 1019

Willys has added another utility vehicle to its growing family of 4-wheel drive products — a 101-inch wheelbase "Jeep" with a rated half-ton load capacity.

The makers point out that the CJ-6, as it is designated, simply will augment the current line of Universal "Jeep" vehicles, and is not a replacement for any model. They said it was designed specifically to supply a market for "Jeeps" in certain areas of industry and agriculture, and specialized fields where an increased payload is desired.

The vehicle fills the gap between the standard quarter-ton Willys "Jeep" with 81-inch wheelbase, and the 118-inch wheelbase one-ton "Jeep" truck.

Overall length of the CJ-6 is 155-56 inches, 20 inches longer than the standard "Jeep". It is powered though, by the same 4-cylinder 75-horsepower F-head Hurricane engine, and retains all of the versatility and rugged performance of the other four-wheel drive 'Jeep" vehicles in the Willys line, it was pointed out.

● *Arga Expanded Scale Voltmeters*

Item 1020

Many engineering applications require accurate readings of high a.c. or d.c. voltages. For example, measurement of voltage regulation in a 115 volt system might require determination of voltage changes of the order of ½ volt. A conventional meter would give a pointer movement only 1 230 (or less) of full scale.

Arga instruments suppress up to 95 per cent of the total voltage and display the remaining variable voltage over the entire meter scale. These meters are based on a thermal bridge which is in balance only at the base voltage point. A non-linear (tungsten in vacuum) element in a bridge with three wire-wound resistors provides the drive to a conventional movement, the bridge elements being encapsulated and attached firmly to the meter movement. This provides a compact standard diameter package for panel mounting.

Accuracies of ½ per cent over 50 to 2000 cycles are achieved with true r.m.s. indication. Wider band operation and accuracies to 0.1 per cent can be obtained as specials. Sensitivities as high as 0.3 inches per volt are obtainable.

● *Electronic Filters Frequency 0.02 to 20,000 cps*

Item 1021

Two new Variable Electronic Band-Pass Filters have been announced. The gain of the Model 330-A and 330-M is unity in the pass band and drops outside the pass band at a rate of 24 db/octave. The use of peaking reduces the attenuation at the corner frequencies by 8 db and permits a band width as narrow as one octave without attenuation in the center of the pass band.

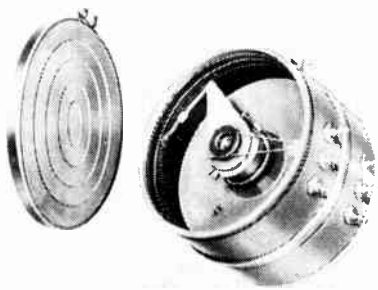
Both the high and low cut-off frequencies are independently adjustable from 0.02 to 2,000 cps in the 330-A and from 0.2 to 20,000 cps in the 330-M. This provides maximum flexibility of adjustment of both the band center frequency and the band width. By using two electronically regulated supplies the internal hum and noise is reduced to less than 100 microvolts. Calibration accuracy is ±5 per cent. The unit measures 17 x 8 x 12 inches overall.

For further data on advertised products use page 65.

• *New 3" Precision Ganging Potentiometers*

Item 1022

A new series of fully enclosed ganging potentiometers — economically priced for electronic applications that do not require the extended refinement of more expensive high precision types has been announced.



These 3" independent phasing potentiometers have a power rating of 8 watts. They feature precise 3606 external phasing, adjustable or fixed taps and linear or non-linear resistance elements. Contacts are made from precious metals.

• *"Isotron" Static Eliminator, Type No. 405*

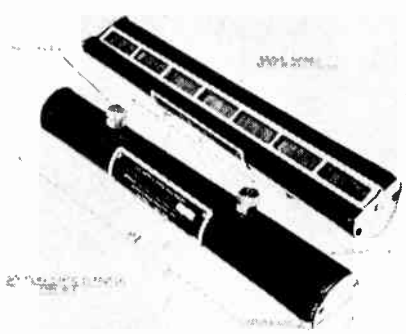
Item 1023

The Isotron Static Eliminator is designed for the removal of static electricity charges from sheet materials. It is suitable for use on automatic processes in which insulating sheets are guillotined, folded, printed or stacked, and where "static" interferes with high speed mechanical handling. Such applications include automatic wrappers using plastic film, envelope and paper bag making machines, and high speed printing machines.

The Isotron Static Eliminator may also be used in cases where static may give rise to fire hazard, e.g. in rubber and plastic spreading processes.

It is easy to install, requires no power or maintenance, and lasts indefinitely.

The Eliminator is in the form of a semi-circular section bar of suitable length to be suspended across the sheet and as close as possible to it.



The Eliminator should be mounted at right angles to the line of travel of the sheet and as close as possible to its surface, generally within 0.5" (12 mm.). The standard Eliminator is supplied nominally with an active length of 1 ft. For sheet materials of greater width than 1 ft. a number of standard lengths are placed end to end to cover the width of the sheet. For sheet material narrower than 1 ft. the Eliminator may be suspended lengthwise parallel to the line of travel of the sheet, or smaller lengths of active material corresponding with the width of the sheet may be mounted in the 1 ft. standard length shield. Two screw studs are provided 6 inches apart (150 mm.) on the standard unit for securing in position on the machine.

(Turn to page 64)

For further data on advertised products use page 65.

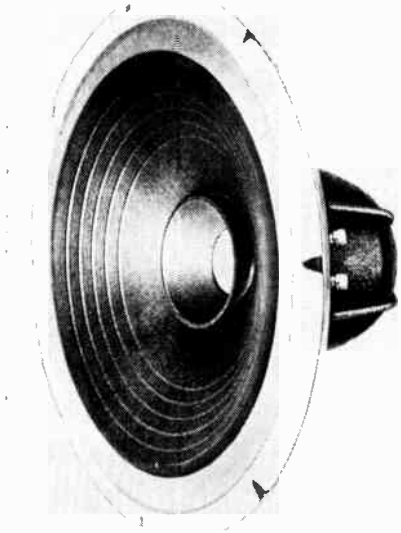
NEW PRODUCTS

(Continued from page 63)

● *Racon Hi-Fi Speakers*

Item 1024

The RACON line of High-Fidelity speakers consists of three 15" high quality speakers. Model 15HFX is a triaxial unit with wide frequency response 20-20,000 c.p.s. and a power handling capacity of 25 watts. This features a specially designed direct radiation type tweeter and a horn shaped cone for mid-range frequencies. Model 15HDX is a dual cone type speaker with frequency response 20-14,000 c.p.s. and a crossover at 5000 c.p.s. It utilizes a horn-shaped cone for higher frequencies. Model 15HW is a 15" bass woofer with a response of 20-4000 c.p.s., and is highly recommended for use in a 2 or 3-way system. All models feature a new principle in cone suspension for cleaner bass response. These speakers compare with models selling at higher prices.



The existing line will shortly be extended to a complete range of 12" dual and triaxial high-fidelity speakers which will be low in price and high in quality. Also to be announced shortly is a mid-range horn and driver unit.

● *Multiflex Galvanometer*

Item 1025

This Multiflex Galvanometer is a very compact self-contained light-spot instrument with 200 mm. scale, available in six models ranging in sensitivity from 2 x 10^{-8} A/mm. to 6 x 10^{-10} A/mm. with sensitivity selector 1 : 10 : 100. By increasing the strength of the magnet special models with double the sensitivity of the standard models are obtained. A selection of interchangeable scales may be supplied such as logarithmic scales, scales with suppressed zero (extending the scale up to 2 m.), etc. A two-pin plug-in shunt for continuous sensitivity control is one optional accessory, a four-pin plug-in shunt for connection of a thermo-convertor or an instrument rectifier is another.

The extreme versatility of the Multiflex Galvanometers is considerably enhanced by the ease with which they can be converted into an inexpensive oscillograph.

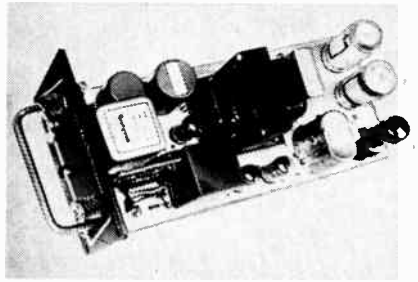
A Photographic recording attachment with a photo-sensitive chart, driven by a synchronous motor or a mechanical clock, is installed in the place of the scale, yet permits simultaneous observation on a red auxiliary scale.

Alternatively, a Photo-electric Tracing Recorder, the motor-driven pen of which is controlled by the amplified photo-electric current generated in a photo-electric cell by the light ray of the Multiflex Galvanometer will supply an ink-written record of the event.

● *Proportional Amplifier*

Item 1026

A new selective range d.c. proportional amplifier, designed for use as a preamplifier in recording measurement systems or as an amplifier in highly sensitive control systems, has recently been announced.



A unique feature of the new instrument (known as Model 2HLA-4) is its use of the Dolecam second-harmonic magnetic converter as the input modulator. This converter avoids the inherent limitations of the usual vibrator-type converter and makes possible linear output, high sensitivity and low noise level.

Other features of the instrument include extended frequency response, interchangeable plug-in range units and optional isolated input.

The optional isolated input is particularly useful in temperature measurements using thermocouples or thermistors. The plug-in range unit provides the desired combination of gain and bandwidth which is optimum for any given application. This range plug-in unit can be conveniently interchanged for a different combination of gain and bandwidth by merely replacing one plug-in unit by another.

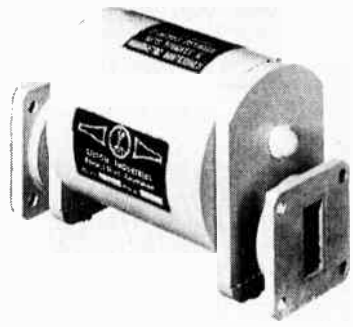
Full-scale voltage ranges as low as 100 microvolts may be selected, and a gain as high as 10^5 may be provided. The noise level is less than 5 microvolts and long term drift is less than 10 microvolts. Linear response within plus or minus 1 per cent may be extended from d.c. to as high as 80 c.p.s. Over-range inputs up to 1,500 times full-scale input have no adverse effects.

The Model 2HLA-4 is a portable instrument, weighing 20 pounds and measuring 6⅞" wide by 6½" high by 14" deep. It can be bench or rack mounted.

● *Microwave Load Isolator*

Item 1027

The new Litton Model X20-L Microwave Load Isolator, designed especially for laboratory use, provides significantly higher isolation over a wider band of frequencies than previously available units. A minimum isolation of 18 db and an average isolation



of 25 db is obtained over a band extending from 8600 Mc to 9600 Mc. The maximum input VSWR with the output shorted is 1.5 to 1. This isolator is an undirectional device which attenuates load reflections without appreciably reducing available power from the magnetron or klystron by utilizing the resonance absorption characteristics of ferrites. For higher power application, power as high as 20 watts can be applied to the Litton X20-L Isolator with the output shorted.

(Turn to page 67)

For further data on advertised products use page 65.

INDEX TO ADVERTISERS

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

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

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

Name Position

Company

Street City Prov.

3-56

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

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

Name Position

Company

Street City Prov.

3-56

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

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

Name Position

Company

Street City Prov.

3-56

Please turn page

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in Canada

5c POSTAGE WILL BE PAID BY

ELECTRONICS AND COMMUNICATIONS

31 - 35 Willcocks Street

Toronto 5, Ontario

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in Canada

5c POSTAGE WILL BE PAID BY

ELECTRONICS AND COMMUNICATIONS

31 - 35 Willcocks Street

Toronto 5, Ontario

BUSINESS REPLY CARD
No Postage Stamp Necessary if Mailed in Canada

5c POSTAGE WILL BE PAID BY

ELECTRONICS AND COMMUNICATIONS

31 - 35 Willcocks Street

Toronto 5, Ontario

INDEX — Continued

NEW PRODUCTS

(Continued from page 64)

● *New UHF Thermo-Couples*

Item 1028

A number of new UHF type vacuo junctions (thermo-couples) ranging from 5 MA upwards, have been added to this manufacturer's line of standard types.

The new thermo-couples are extremely small in size featuring both minimum capacitance and inductance.

The thermo-couples are electrically insulated from the heaters and tested to 100 volts, D.C. Resistance tolerances for heater or thermo-couple are plus or minus 10 per cent. The nominal output is 7 millivolts.

Current ratings can be exceeded by a 50 per cent overload for long periods of time without risk or damage to the thermo-couple; heaters will withstand transient overloads of 100 per cent.

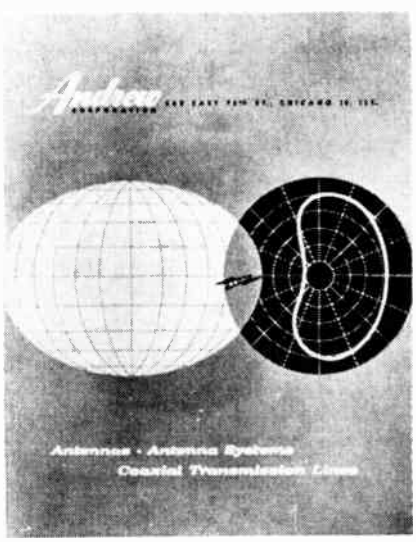
Over-all temperature co-efficient does not exceed 0.2 per cent. Dimensions do not exceed $\frac{5}{8}$" approx. Close electrical consistency is maintained.

Special ranges and outputs can be made to user's requirements.

● *New Andrew Catalog*

Item 1029

Designers and manufacturers of antennas, antenna systems and transmission lines have produced one of the most comprehensive catalogs, devoted to this segment of broadcasting and communications, that has come to our attention.



This 100 page catalog contains the product description and engineering data of over 500 of their products. Twenty pages are devoted to system engineering data and related information that engineers specializing in this field of electronics will find informative.

● *Special Copper For Printed Circuit Work*

Item 1030

Hard tempered rolled copper specially designed for use in the rapidly growing field of printed circuitry is now being made in both .0015 and .0027 gauges.

Immediately available to laminators who supply radio or television manufacturers, Revere Rolled Printed Circuit Copper, weighs 1 oz. or 2 oz. per square foot, depending upon the gauge, and is supplied in widths up to 38" in standard 350-lb. coils.

This new copper, which is for bonding to insulating board, is of uniform gauge and density throughout because of the rolling process used in its fabrication.

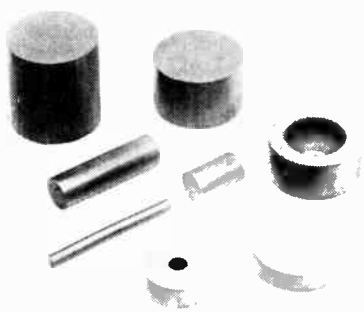
Users, who also include the manufacturers of electronic computers, are being told that this is electrolytic copper with top electrical conductivity. Its surface appearance is shiny and its etching and soldering characteristics are claimed to be excellent.

● *New Magnetic, Plastic Core*

Item 1031

A new magnetic, plastic core has been developed with unusually high temperature stability, high impact strength and excellent machinability.

It is seen as the solution to many applications where the use and design of cores have been restricted by the temperature limitations of standard materials.



The core is designed for high frequency applications for use as cores, filters and attenuators. Known as Ferrotron, the new material is expected to serve many specialized purposes in the electrical, electronic, radio, television, design, military and aviation fields.

Extensive tests have shown the core to be heat resistant up to 200°C (392°F). This material maintains high impact strength at temperatures as low as minus 100°C. In tests especially devised by Polymer, the core has demonstrated impact strength as great as 40 times that of commercially available high frequency core materials.

Constant magnetic permeability with frequency through 15 megacycles is another characteristic of the Ferrotron core, identified as Type 119.

Further tests have indicated that the core has extremely low magnetic loss tangent . . . so low, in fact, that it is below the measuring accuracy of testing equipment. Individual tests on wire-wound cores are required to determine the effective "Q" in a specific application.

The values were obtained on toroidal specimens measuring 0.250" I.D. x 1.000" O.D. x 0.375" length. Measurements were made on a model 260A Boonton "Q" meter, using a radio-frequency permeameter designed by P. H. Haas of the National Bureau of Standards.

All magnetic values of the core, from batch to batch, are uniform and well within the accuracy of the testing machine.

(Turn to page 68)

For further data on advertised products use page 65.

NEW PRODUCTS

(Continued from page 67)

• *Accessory Pulse Instruments*

Item 1032

These instruments measure delay line lengths, rise times, and minute repeated time intervals from a few millimicroseconds to tens of microseconds. These two new instruments, namely the B4-100 Marker Generator and the B4-200 Oscillator when used with our B-2A Pulse Generator and the required Power Supply, provides accurate scope markers and pulse delays by means of which time intervals can be measured to ± 1/500 microseconds.

The B4-100 Marker Generator provides .1 u.s. and 1 u.s. marker signals of either positive or negative polarity. Marker accuracy is .01 per cent. These signals are designed for use as intensity markers on a scope.

The B4-200 Oscillator consists of a free running blocking oscillator which is phase locked to the 1 u.s. marker pulses. The repetition rate can be varied from 1 k.c. to 10 k.c.

These units, in conjunction with a Rutherford B-2A Pulse Generator and a good synchroscope, provide a system to measure delay line lengths to ± 2 millimicroseconds. Literature is available.

• *New Catalog Describes 1373 Items*

Item 1033

The publication of a catalog of electronic wire which contains complete descriptions, specifications and illustrations of the publishers IN-STOCK line of 1373 items, claimed to be the largest and most complete in the electronics industry is now available on request.

The catalog lists 487 new items, full Government and MIL spec data, and special engineering cross-reference charts for extra-easy determination of individual wire needs.

Handsomely printed in 3 colors, the catalog is divided into 4 sections for easy, speedier use.

For further data on advertised products use page 65.

• *Field Engineers Data Sheets*

Item 1034

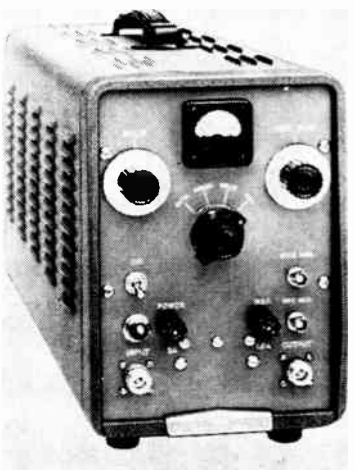
A San Bruno, California manufacturer of electron-power tubes, has published a data sheet on the new Eimac 4X250F radial-beam power tetrode. The 4X250F is the 26.5 volt version of the recently announced Eimac 4X250B. It is unilaterally interchangeable with the 4X150D in most applications. Intended for use with 26 volt electrical systems as required in airborne and some vehiclular operations, the 4X250F offers the advantages of easier cooling and longer life.

Also available is the new Eimac Field Engineers sheet, containing listings and a map showing the locations of Eimac Field Representatives throughout the United States and in Canada.

• *New Amplifiers Operate To 12.4 KMC*

Item 1035

From 4 to 12.4 KMC, new Model 492A and 494A Travelling-Wave Tube Amplifiers give broad band amplification, choice of amplitude, pulse, phase or frequency modulation, constant 25 to 30 db gain, and constant output. Instruments are compact, simple to operate, bringing convenience of low frequency measurements to the microwave region. Model 492A covers 4 to 8 KMC with 30 db gain, 10 mw output and 15 millimicrosecond rise time. Model 494A covers 7 to 12.4 KMC with 25 db gain, 5 mw output, 15 millimicrosecond rise time. Both amplifiers can be used for wide dynamic range



antenna tests and SWR measurements, generation of stable power level, elimination of klystron starting delay and jitter, calibration of attenuators over a wide range, calibration of CW Doppler radar systems, FM'ing high stability SHF sources, amplifying wide bandwidth signals containing complicated modulation and many routine laboratory measurements.

• *Data On Line Impedance Stabilization Networks*

Item 1036

A two-page catalog sheet describing Filtron's Series FSR-700 line impedance networks for 50-100-200-500 ampere circuits is available from the company. The new units are useful in connection with the measurement of radio-frequency interference in accordance with Air Force Specification MIL-I-6181B and Navy Specification MIL-I-16910A.

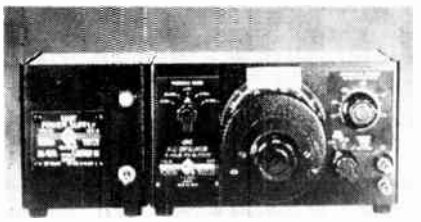
Data supplied includes: Maximum voltage ratings available, complete ratings for all units in the line, termination and connector types, dimensions and part numbers. Each rating is furnished in two designations, one for each of the above specifications, and are not interchangeable due to specified electrical characteristics.

The networks are illustrated by means of line drawings and photograph.

• *New R-C Oscillator*

Item 1037

Two new features are made available on the General Radio Type 1210-B Unit R-C Oscillator. Square-wave output is provided over the entire frequency range from 20 cycles to 500 kilocycles in addition to two sine-wave outputs. The square-wave output it 0 to 30 volts peak to-peak with about ¼-microsecond rise time. Output impedance is 2500 ohms. A sine-wave output of 0 to 7 volts is available from a 50-ohm output impedance with no-load distortion less than 1 per cent from 200 cycles to 200 kilocycles. A maximum of 45 volts is available from a 12,500-ohm output.



Automatic recording of frequency characteristics is made possible by means of the second new feature. The gear-drive precision dial is arranged so that it is easily driven automatically by a Type 908-P Synchronous Dial Drive. This motor drive can sweep any portion of each of the five decade frequency ranges. Several simple methods of synchronizing the sweeping with pen recorders can be used to give permanent records of frequency response. With a cathode-ray oscillograph the frequency characteristics of a network can be displayed when a Type 1210-P Detector and Discriminator is used with the oscillator to provide a horizontal-deflection voltage proportional to frequency.

The frequency calibration accuracy of the Type 1210-B Unit R-C Oscillator is ± 3 per cent. The output control is logarithmic and is calibrated from 0 to — 50 decibels.

• *Vibration Mount For Electronic Equipment*

Item 1038

A new all-metal vibration mount for airborne electronic equipment has successfully met all requirements of MIL-C-172-B, its manufacturer reports.

Known as the Finnflex all-metal mount, its basic design consists of two load carrying convex Bellville-type springs in conjunction with a circular coil spring for dampening and wire mesh pads for snubbing. Its resonant frequency is below 10 c.p.s. with a magnification factor of less than 1½ at resonance with no double resonant peaks.

In order to meet the requirements of MIL-C-172-B, the mount was subjected to repeated 15G shock loading, tested for transmissibility within MIL limits, then subjected to repeated 30G shock loading and again tested for transmissibility.

The manufacturer who makes the mount in all standard military sizes and with either short or long studs, found it necessary to make over 400 experimental designs in order to perfect the current design of the Finnflex mount.

(Turn to page 70)

For further data on advertised products use page 65.

NEW PRODUCTS

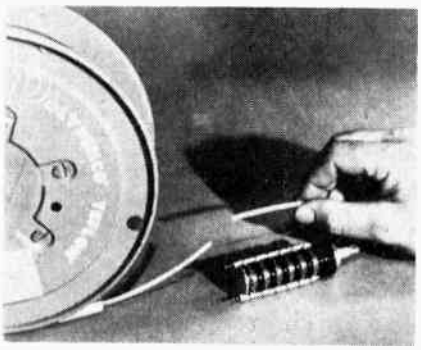
(Continued from page 69)

• *Thin Wall Teflon Tubing Insulation*

Item 1039

This tubing serves as an insulating sleeve around two stainless steel studs. These studs hold together multi-deck switches, and run fairly close to some of the switch terminals.

Insulating the studs with this Teflon tubing, prevents accidental grounding of the terminals when soldering connections to the switch.



Teflon was the only material tried that had adequate resistance to the heat from soldering irons. Unlike many forms of electrical insulation, Polypenco Teflon tubing does not melt, burn or decompose while soldering a joint next to it.

The tubing has a wall thickness of only .014" and a nominal inside diameter of .075". This thin wall permits a clean cutoff and simplifies assembly of the switch.

The Teflon spaghetti tubing is reported to maintain a high dielectric strength at elevated temperatures, dropping only slightly at 400°F. Its dielectric strength ranges from 900 to 1000 volts per mil upwards, based on a normal safety factor.

Tests have shown the material to be form stable at temperatures up to 525°F. (275°C). Teflon tubing meets Class H, AIEE standards for maximum hot spot insulating temperatures.

Polypenco Teflon tubing, a solid extruded type of insulating material, is not subject to the disadvantages of a woven or impregnated type of sleeving. It maintains full electrical insulating characteristics even when flexed or bent during assembly and installation.

In addition to high thermal stability, the tubing also has high surface resistivity, dropping to only 1013 ohms at 100 per cent relative humidity. This combination makes it possible to miniaturize an electrical assembly without fear of dielectric failure.

• *Miniature Transformer*

Item 1040

A new "Miniformer" miniature transformer, substantially reduced in size and weight but of superior efficiency, has recently been introduced. Designed primarily to meet the smaller space requirements of hearing aid components, the new "Miniformer" has additional applications where space and weight factors are of prime importance such as: computors, pocket radios, F-M transceivers, telephone recorders, air borne equipment, etc. This smaller, lighter unit measures only ¼" x $\frac{5}{16}$" x ⅜" and weighs but .004 lbs. (242 per lb.). The Gramer-Halldorson 100W72 interstage transformer, has a match impedance of: primary, 20,000 ohms; secondary, 1,000 ohms; d.c. resistance: primary, 1030 ohms; secondary, 167 ohms. Power rating for primary inputs from 1 volt to 7 volts: 2.5 milliwatts. Other impedance matches are also available. Leads are color-coded, high temperature plastic insulated.

• *Vacuum Tube Voltmeter*

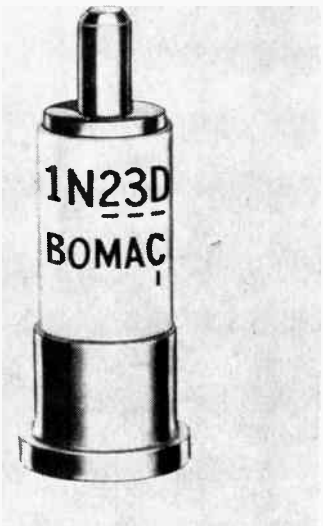
Item 1041

A new Vacuum Tube Voltmeter suitable for the measurement of low and high voltages at audio, video, ultrasonic and low radio frequencies. The circuit is essentially a high gain, three stage video amplifier, with heavy negative feedback, operating a diode voltmeter. A cathode follower is used before the amplifier up to the 10 volt range, so that the multiplier may operate at the low impedance level of the cathode circuit. Above 10 volts a frequency compensated divider direct on the input is employed. The large amount of negative feedback on the amplifier together with the stabilized H.T. supply makes the instrument virtually independent of supply voltage variations and ageing tubes, and eliminates the zero setting. The diode rectifier operates at a high level so that the scale shape is practically linear. The calibration is in R.M.S. values for a sine wave input, the indications being proportional to the average half-wave value. There are nine voltage ranges, from 0.03 volt F.S.D. to 300 volts F.S.D. In addition, an auxiliary decibel scale is provided which gives a range from -42 to 52 db. with reference to 1 mW. into 600 ohms. The circuit is arranged to limit on large inputs, so that the meter will not be damaged by occasional overloads of several hundred times normal. Up to 750 volts D.C. may be superimposed on the input signals up to 10 volts, and up to 500 volts D.C. on higher ranges. Up to 100 Kc/s., the input impedance is approximately equivalent to a resistance of 1 Megohm in parallel with a capacitance of 30 micromicrofarads on ranges up to 10 volts, and about 18 micromicrofarads on the 30 volts and higher ranges.

• *New High Sensitivity Silicon Diode*

Item 1042

A new silicon diode — the 1N23D — that can lower the overall system noise down to 7.5 db in a system with well-designed plumbing. It is designed for X-band mixer use in superheterodyne receivers where



low overall noise and minimum conversions loss are required. These characteristics enable the systems engineer to design for both maximum receiver sensitivity and maximum output signal to noise ratio. With proper mounting and circuitry these diodes may also serve as low level detectors and measuring devices in the X-band region. Both normal and reversed polarity are available.

For further information on New Products, use coupon on page 65.

For further data on advertised products use page 65.

Electronic Computers on your staff

Now, any business, large or small, can put electronic computers to work to cut costs and increase efficiency. C.D.C. is proud to announce Canada's first Data Processing Centre established by private enterprise. Located at the Company's Head Office in Ottawa, this centre is available to serve government and industry in any part of Canada.

USE OUR SERVICE . . .

. . . If you are planning to obtain your own computing facilities, you can have C.D.C. test your procedures and solve specimen problems using this centre.

. . . If you have your own computing facilities, you can transfer your peak loads or overloads to C.D.C.

. . . If you cannot justify having your own computing facilities, you can make use of those at this centre.

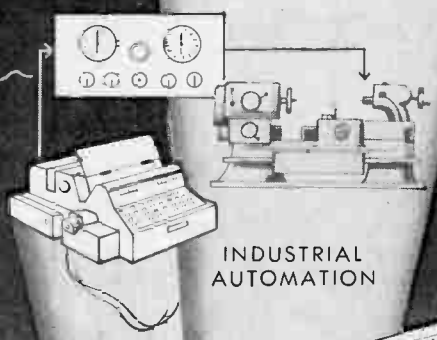
. . . If you are confronted with an unusually difficult research problem, you may find you have neither the necessary staff nor sufficient facilities — in such a situation, the C.D.C. Computing Centre will be found invaluable.

. . . If you have continually recurring computing or data processing problems, you can arrange to lease communication facilities linking your office directly with the C.D.C. Centre.

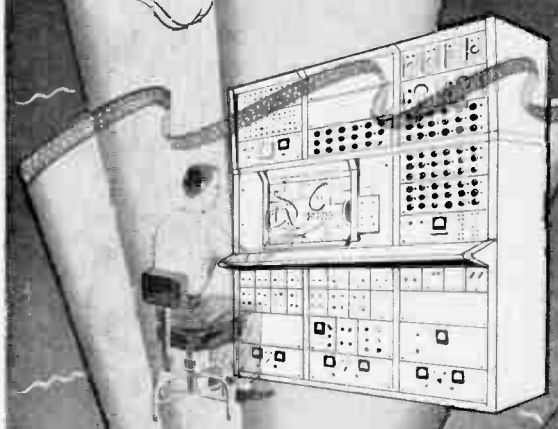
Highly qualified and experienced applied mathematicians and engineers, backed by the latest computer facilities, both digital and analog, are at your service for problem formulation and analysis, programming, computation, data reduction, application of data processing equipment to business procedures, practical instruction in computer operation and programming.

5604

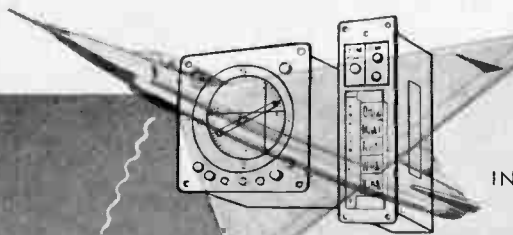
SIMULATION



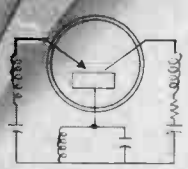
INDUSTRIAL AUTOMATION



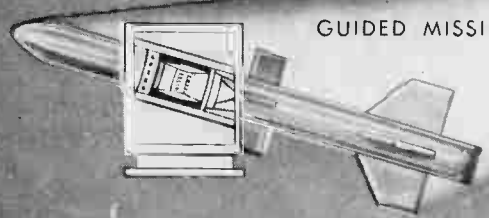
COMPUTERS



AIRCRAFT INSTRUMENTATION



SEMICONDUCTOR APPLICATIONS



GUIDED MISSILE ANALYSIS

RESEARCH · ENGINEERING · DEVELOPMENT · CONSULTING · MANUFACTURE

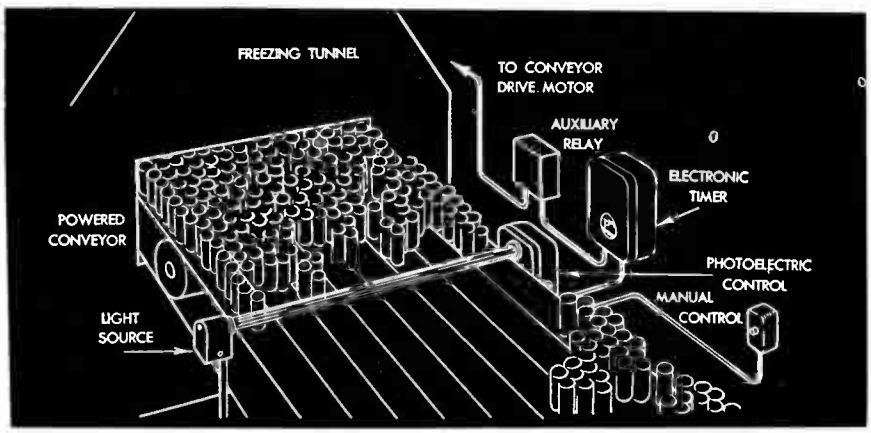
CDC

COMPUTING DEVICES OF CANADA LIMITED

P.O. BOX 508 • OTTAWA • CANADA

Conveyor Control In Quick Freezing

A WIDE metal conveyor belt moves small citrus concentrate cans through a freezing tunnel for quick freezing. As the cans pass through the tunnel, a freezing draft is forced downward in large volumes to "quick freeze" the citrus concentrate within the cans. The conveyor is normally packed solidly with cans, and should large spaces appear between the cans, the down-draft of air is forced through the conveyor itself and passes by the cans too quickly. This results in poor



or insufficient freezing of the citrus concentrate. A reliable, accurate control was required to stop the conveyor if a sizable gap appeared, and to signal the operator to refill the open gap with more cans.

This was accomplished by a combination of photoelectric controls and electronic timers. The photoelectric control beam shines horizontally across the conveyor. The timer is wired for delayed action operation and is started by the photoelectric control.

A push button is used to start the conveyor and bypass the timer relay until the conveyor moves the cans into the photoelectric control beam. The operator releases the push button and the conveyor continues to move the cans as long as the control beam is interrupted. If a gap appears, the photoelectric control beam is established across the conveyor. The photoelectric relay drops out and starts the timing cycle of the electronic timer. If the gap length exceeds the pre-set delay interval on the electronic timer, the timer relay drops out, shuts off the conveyor and rings an alarm. The conveyor starts, the alarm stops and the timer resets — all automatically — when the gap is filled with cans and the light beam is again broken.

If the gap length is shorter than the timed interval, cans coming along the conveyor break the beam and the photoelectric relay closes before the timing interval ends. This resets the timer, and allows uninterrupted conveyor movement.

Wire Stripper And Terminal Attacher

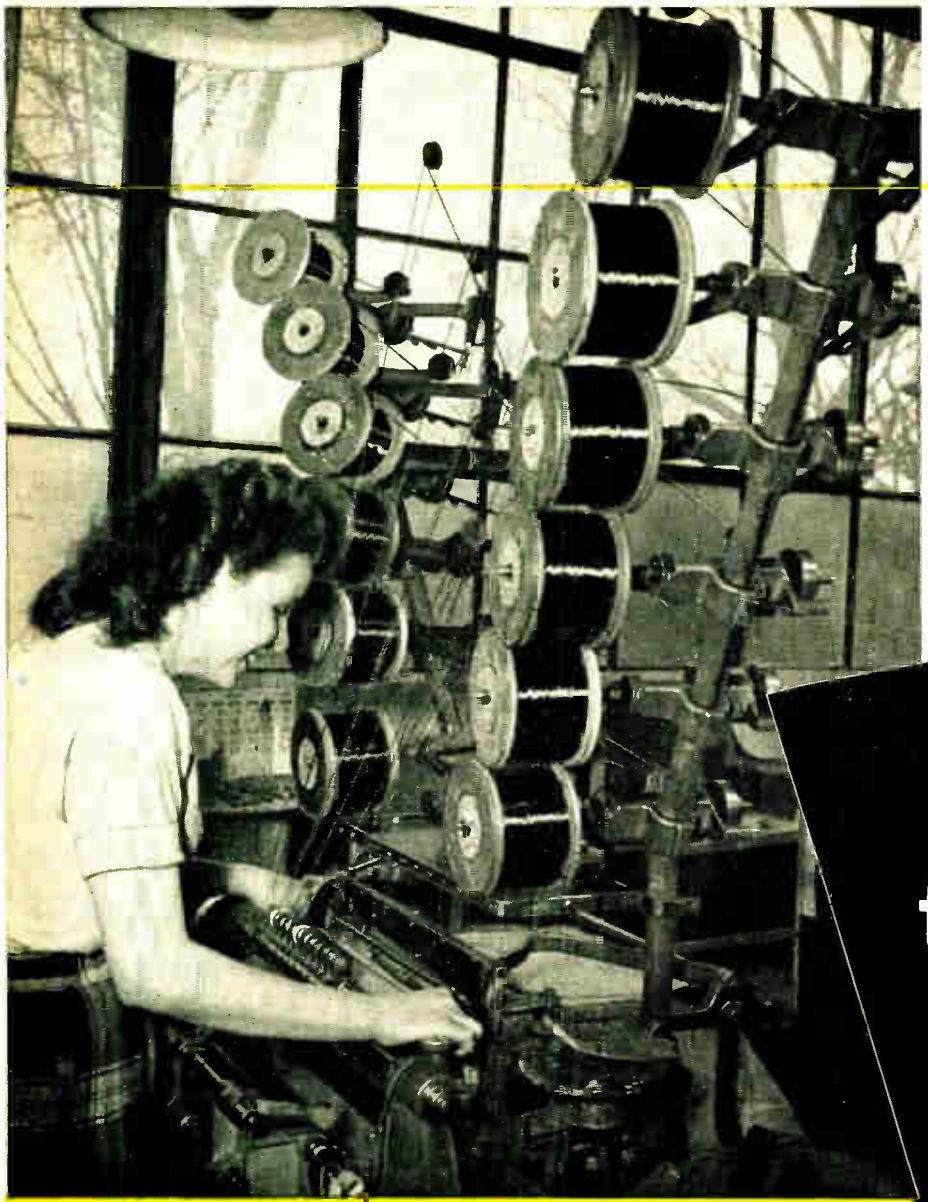
THE electronics and communications industries which are users of large quantities of insulated wire leads with terminals attached will be interested in a new automatic machine designed for measuring, cutting and stripping one or both ends of insulated wire. This new equipment also combines automatic terminal attaching to one end of the wire lead and manufacturers claim that practically any kind of terminal in strip form can be used.

If desired, an additional attachment may be had for marking finished wire leads with identification codes consisting of numbers and letters. This machine will then mark the wire, measure, cut, strip and attach a terminal to one end — all in one automatic operation — and at a rate of up to 3000 finished pieces per hour.

The TA-20-S which the machine is called, will handle solid or stranded wire from 3 inches up to 250 inches in length. The machine is equipped with automatic prefeeder, insuring even lengths of the wire leads. A wire reel holder is mounted on the all-steel stand, which is part of the machine.

Prefabricated terminals in strip form are fed to the die unit which is actuated by a switch being tripped by the feeding clamp assembly. The die unit is easily exchangeable so that the machine can handle different types of terminals.

The equipment is simple to set up and adjust and unskilled labor can be trained to operate the machine in a short time.



COIL WINDING
for Defence equipment
at Hammond Manufacturing.

and again the choice is FEDERAL Magnet wire

Hammond's selection of Federal Enamelled Magnet Wire for coil windings in important Defence equipment was made for four main reasons:

- It has more than adequate strength to withstand the required winding tensions.
- The enamel has exceptionally good aging characteristics.
- The insulation has a very high voltage breakdown factor.
- The close diameter tolerances ensure uniform coil dimensions.

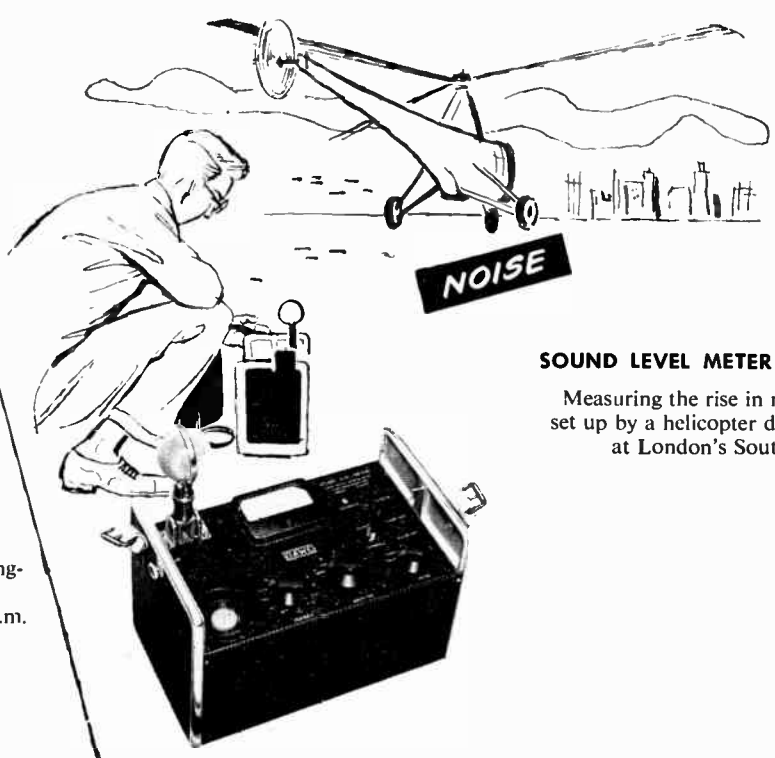
Federal Magnet Wires are available in a wide range of types, sizes and shapes—with a variety of insulations and protective coverings. They are supplied on standard sized reels or on reels to meet your special requirements. Federal Magnet Wire is also available in the new Payoffpak Container—holds 600 lbs. of continuous magnet wire—equivalent of 8 reels.

Federal are specialists in the field of Magnet Wires—for winding and rewinding of all types of electrical equipment. Rigorous control at every stage of manufacture is your assurance of consistently high quality. Federal engineering and production specialists are always ready to help you with any magnet wire problem.

5504

FEDERAL Wire and Cable Company Limited

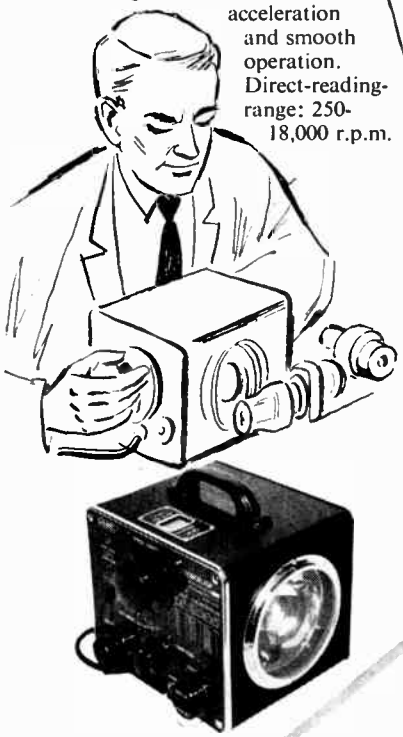
Head Office and Factory: GUELPH, ONTARIO
Sales Offices and Warehouse Stocks: St. John's, Nfld., Truro, Montreal, Winnipeg, Regina, Saskatoon, Calgary, Edmonton, Vancouver.



SPEED

STROBOFLASH TYPE 1200

Measures high-speed operations, observes fast-moving objects in apparent slow-motion, checks small rotating assemblies for acceleration and smooth operation. Direct-reading-range: 250-18,000 r.p.m.



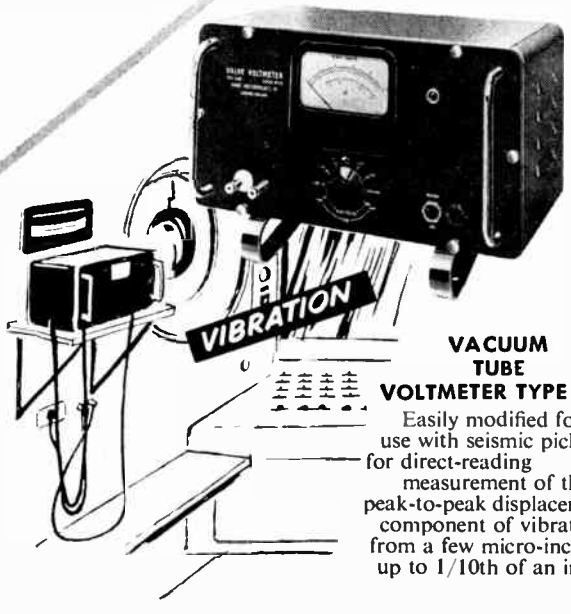
SOUND LEVEL METER TYPE 1400D

Measuring the rise in noise-intensity set up by a helicopter descending at London's South Bank.

got a problem in measurement?

use Dawe Electronic Instruments for fast, accurate answers!

With today's fast-paced production and high engineering standards, there are many difficult, and often, entirely new problems in measurement. In certain fields such as the aircraft industry, these problems crop up every day. Dawe electronic measuring instruments can provide the answers—quickly and accurately. Although these precision-made British-built instruments are simple to operate, they eliminate guesswork from all measurements used in checking, testing and experimentation.



VACUUM TUBE VOLTMETER TYPE 613

Easily modified for use with seismic pick-up for direct-reading measurement of the peak-to-peak displacement component of vibration from a few micro-inches up to 1/10th of an inch.

If your business requires fast, accurate measurement of noise, vibration, thickness, balance, or speed—call Dawe Instruments for technical information and advice without obligation. Ask for their free booklet "Dawe Instruments in Industry".

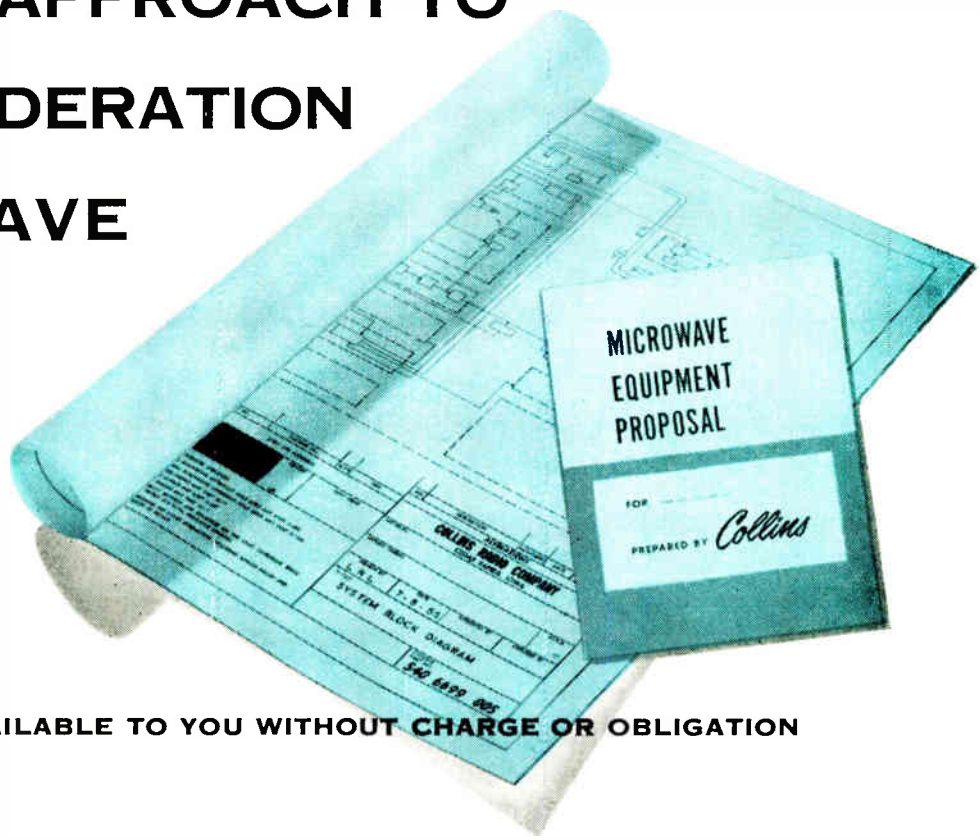
DAWE INSTRUMENTS LIMITED

Canadian Division — 1654 Bank Street, Ottawa, Ontario

5505

For further data on advertised products use page 65.

A SENSIBLE APPROACH TO YOUR CONSIDERATION OF MICROWAVE



THIS SERVICE IS AVAILABLE TO YOU WITHOUT CHARGE OR OBLIGATION

More and more companies are turning to microwave for reliable and economical multi-purpose communication and control of widespread facilities. Would a microwave installation increase the efficiency of your operations? You can get the answer to this question by calling for the services of Collins Application Engineering Department. Our engineers will carefully evaluate your need for microwave without charge or obligation. If they find that the nature of your operations is such that microwave is not economically feasible, they'll tell you so. If, as in most cases, you can profit from a microwave installation, they will prepare a recommendation tailored to your requirement . . . again without charge or obligation.

A word about Collins and microwave

Wherever the need for dependability in communication is critical, Collins Equipment is the world standard of excellence. You can have this same assurance of dependable operation in your microwave facilities by turning to Collins for the planning and engineering of your installation.

Take this sensible approach to the consideration of microwave. Let Collins first evaluate your need, then draw up a proposal for you to study.

COLLINS RADIO COMPANY OF CANADA, LTD.

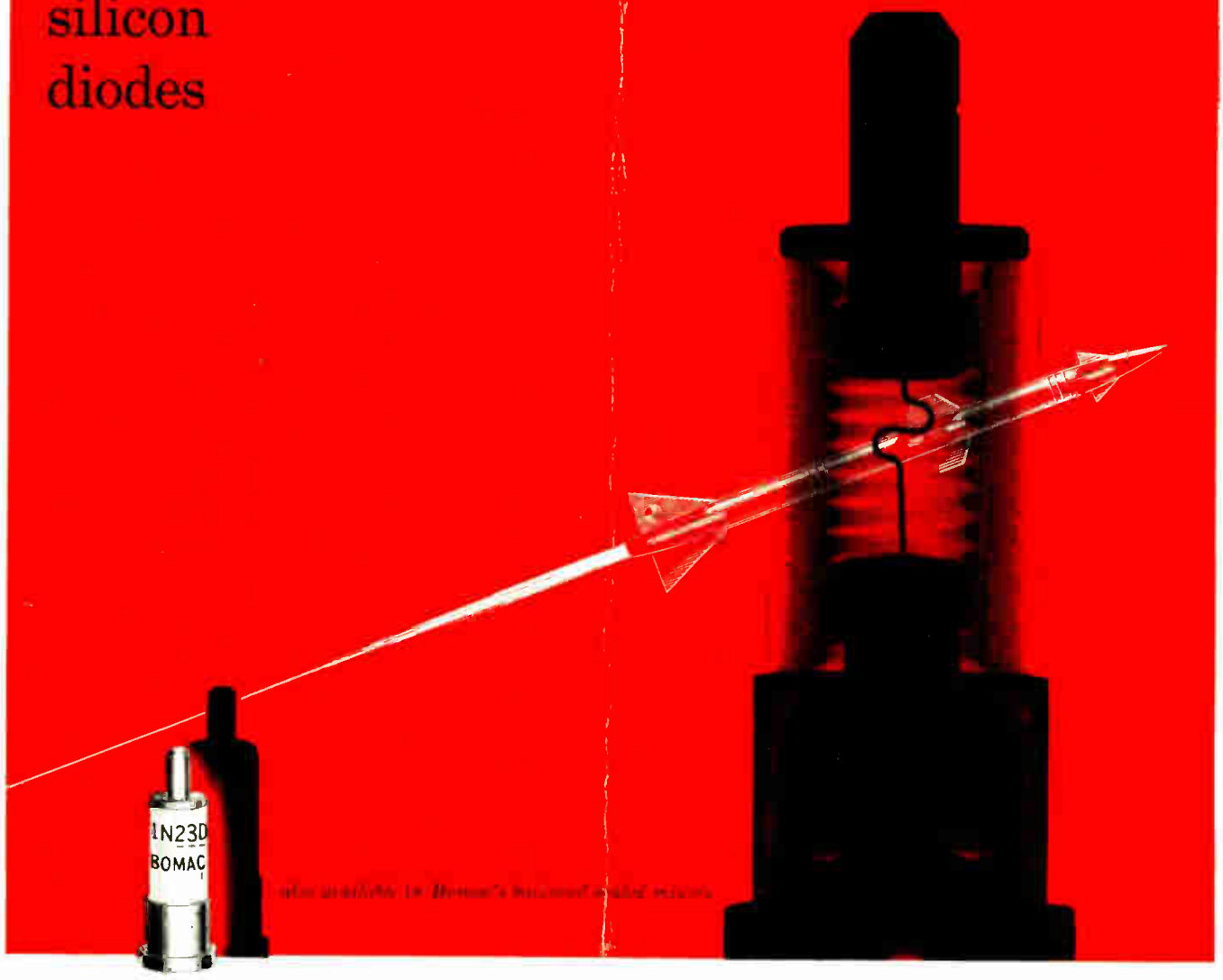
11 Bermondsey Road, Toronto 16, Ontario

COLLINS

For further data on advertised products use page 65.

7.5 db OVERALL SYSTEM NOISE...

with
well-designed
plumbing,
using
BOMAC'S 1N23D
silicon
diodes



Bomac Laboratories, Inc.

BEVERLY, MASSACHUSETTS

For complete specifications, write (on your company letterhead) to Dept. E-3

Offices in major cities: — Chicago • Kansas City • Los Angeles • Dallas • Dayton • Washington • Seattle • San Francisco • Toronto
Export: — Maurice. I. Parisier, 1860 Broadway, N.Y.C.

R. O. R. ASSOCIATES LTD., 290 Lawrence Ave. West, Toronto 12, Canada Tel. RUssell 1-9391