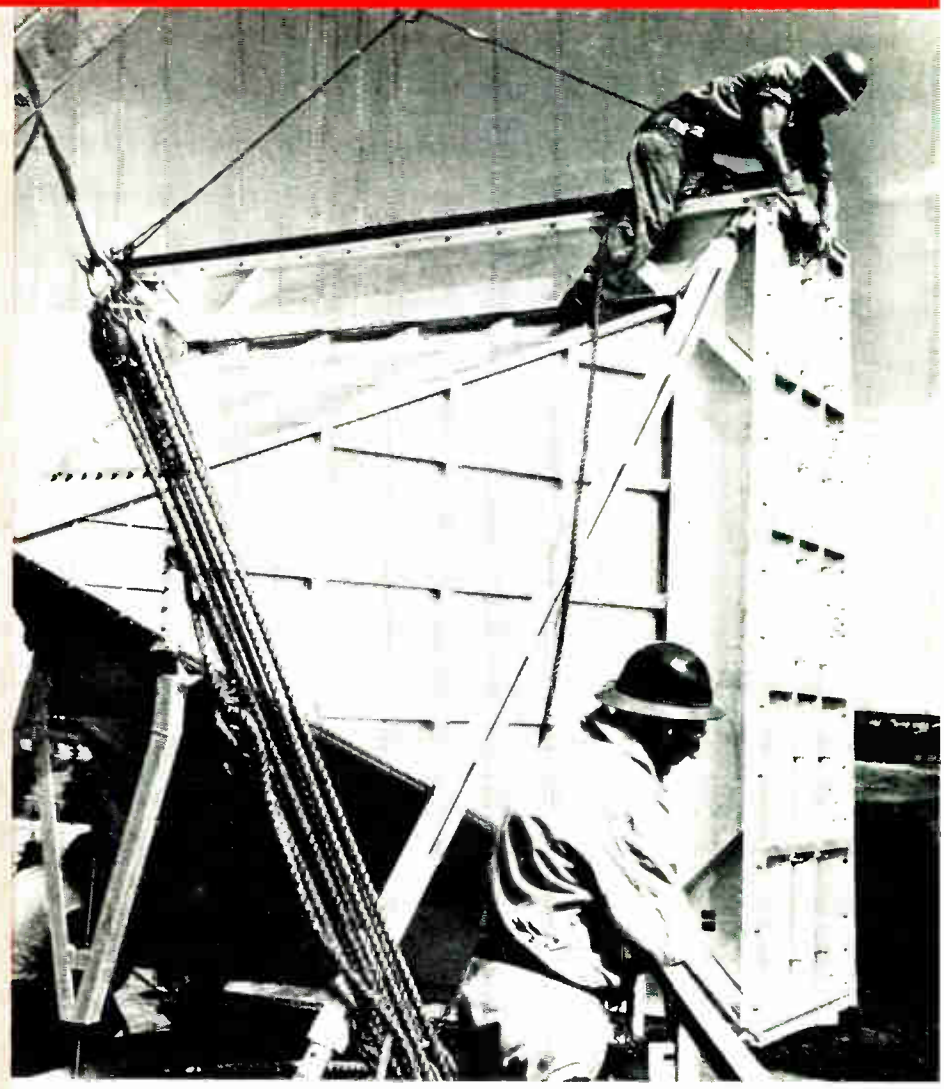
ELECTRONICS *and* COMMUNICATIONS

DESIGN—MANUFACTURE—ENGINEERING—DISTRIBUTION—APPLICATION

New Ideas For Modern Management



Close-up view of one of the microwave antenna in the Buffalo-Toronto link of the Bell Telephone Company's microwave transmission system. The antenna weighs nearly one and one-half tons and is ten feet square.

Nov.-Dec. 1955 ★ $5.00 a year
An AGE Publication, Toronto, Canada

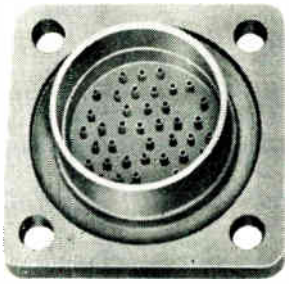
Circulation Of This Issue
Over 10,200 Copies

THE PROBLEM

THE FIRST OF ITS KIND IN CANADA

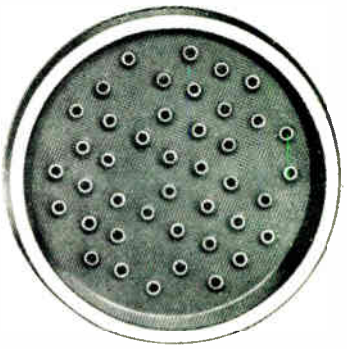
1. Terminations to be concentrated within a diameter of .820 inches.
2. POLARIZED orientation of terminals.
3. Terminations to withstand Voltages ranging from 15 to 550 volts A.C. and an insulation resistance of over 10,000 Megohms between pin to pin and pin to ground.
4. Terminals to be tubulations for No. 25 wire.
5. Header to be VACUUM TIGHT.

THE SOLUTION



Connector for vacuum tight enclosure.

Double size.



THE CONCLUSION

This HEADER challenged each of the various processes in the manufacture of HERMETIC SEALS, i.e: glass making, controlled atmosphere and temperature and tining equipment. Our engineers were presented this problem and within a few weeks this Header was delivered.

This HEADER is the first of its kind in Canada — the first of its kind anywhere in the world.

THE CUSTOMER *RCA VICTOR CO., LTD.*

Write us today telling us of your problems and you can be assured of an immediate reply and solution.

Quality **HERMETICS, LTD.** 45 Hollinger Road East York, Toronto, Ontario

SOME OF OUR OTHER PRODUCTS Crystal Holders Transistor Holders Condenser Seals Multi-Terminal Headers and Plugs Individual Terminals Special Applications

For further data on advertised products use page 99.

Due to the flexible and active state of the Canadian electronics industry, the publishers of Electronics and Communications have found it necessary to compile this addenda to the 1955 Directory issue in order to bring this reference issue fully up to date.

Remove This Section And Insert In The Sept. - Oct., 1955 Directory Issue Of Electronics and Communications.

Buyers' Guide Of Electronic And Communications Equipment

☆ Addenda To 1955 Directory ☆

AMMETERS
Measurement Engineering Ltd.
John Herring & Co. Ltd.
Aviation Electric Ltd.
Associated Electronic Components

AMPLIFIERS (Audio Frequency)
Measurement Engineering Ltd.
Aviation Electric Ltd.
Canadian Aviation Electronics Ltd.
Canadian General Electric Co. Ltd. (Electronics Equip. & Tube Dept.)
Radio Engineering Products Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Ampex Corp.

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AMPLIFIERS (Keying)
Canadian Aviation Electronics Ltd.

AMPLIFIERS (Magnetic)
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Magnetics Inc.
The Glendon Co. Ltd.
Aviation Electric Ltd.
Data Processing Association Ltd.

AMPLIFIERS (Musical)
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AMPLIFIERS (Power)
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Aviation Electric Ltd.
Canadian Aviation Electronics Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

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

AMPLIFIERS (Wideband)
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Canadian Aviation Electronics Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

ANALYZERS (Audio)
Canadian General Electric Co. Ltd. (Electronics Equipment & Tube Dept.)
Canadian Marconi Co.

ANALYZERS (Frequency)
Canadian General Electric Co. Ltd.
Canadian Marconi Co.

ANALYZERS (Magnetic)
Measurement Engineering Ltd.

ANALYZERS (Video)
Measurement Engineering Ltd.

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Measurement Engineering Ltd.
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Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
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Standard Telephones & Cables Co. (Canada) Ltd.
Sinclair Radio Labs. Inc.
Andrew Antenna Corp. Ltd.

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Aviation Electric Ltd.
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ANTENNA REFLECTORS
Aviation Electric Ltd.
Canadian Aviation Electronics Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Sinclair Radio Labs. Inc.
Andrew Antenna Corp. Ltd.

ANTENNA ROTATORS
Aviation Electric Ltd.
Andrew Antenna Corp. Ltd.

ANTENNA TOWERS
Aviation Electric Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Sinclair Radio Labs. Inc.

ANTENNAS AIRBORNE
Measurement Engineering Ltd.
Aviation Electric Limited
Canadian Aviation Electronics Limited
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Andrew Antenna Corporation Ltd.

ANTENNAS (Broadcast)
Canadian Aviation Electronics Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Sinclair Radio Labs. Inc.
Standard Telephones & Cables Mfg. Co. (Canada) Limited
Andrew Antenna Corp. Ltd.

ANTENNAS (Directional)
Measurement Engineering Ltd.
Canadian Aviation Electronics Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Sinclair Radio Labs. Inc.
Andrew Antenna Corp. Ltd.

ANTENNAS
Measurement Engineering Ltd.
Canadian Aviation Electronics Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Limited
Andrew Antenna Corp. Ltd.

ANTENNAS (Marine)
Measurement Engineering Ltd.
Aviation Electric Limited
Andrew Antenna Corporation Ltd.

ANTENNAS (Railroad)
Aviation Electric Limited
Andrew Antenna Corporation Ltd.

ANTENNAS (Television)
Canadian Aviation Electronics Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Sinclair Radio Labs. Inc.
Standard Telephones & Cables Mfg. Co. (Canada) Limited

ANTENNA (Tuning & Phasing Equipment)
Andrew Antenna Corporation Limited

ACCELEROMETERS
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John Herring & Company Limited

ATTENUATORS
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John Herring & Company Limited
Radio Engineering Products Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

BAFFLES (Speaker)
Measurement Engineering Ltd.
Associated Electronic Components

BAFFLES (Speaker) (Theater)
Ampex Corporation.

BATTERIES (Storage)
Canadian Aviation Electronics Ltd.

BEACONS
Measurement Engineering Ltd.
Aviation Electric Limited
Canadian Aviation Electronics Ltd.
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

BEARINGS (Jewel)
John Herring & Company Limited

BLOWERS
John Herring & Company Limited

BOOMS (Microphone)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company

BRIDGES (Capacitance)
Measurement Engineering Ltd.
Canadian Marconi Company
John Herring & Company Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

BRIDGES (Electrical)
Measurement Engineering Ltd.
Canadian Marconi Company
John Herring & Company Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

BRIDGES (Impedance)
Measurement Engineering Ltd.
Canadian Marconi Company
John Herring & Company Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

BRIDGES (Inductance)
Measurement Engineering Ltd.
Canadian Marconi Company
John Herring & Company Limited

BROADCAST EQUIPMENT
Measurement Engineering Ltd.
Canadian Aviation Electronics Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

CABINETS
Measurement Engineering Ltd.
Canadian Aviation Electronics Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

CABLE
The Glendon Co. Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canada Wire & Cable Mfg. Co. (Canada) Ltd.
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

CABLE CLAMPS
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

CABLE (Coaxial)
The Glendon Co. Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Andrew Antenna Corporation Limited

CABLE (Coaxial Rigid)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Andrew Antenna Corporation Limited

CABLE (Insulated)
The Glendon Co. Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

CABLE (Microphone)
The Glendon Co. Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

CABLE (Microphone-Retractile)
The Glendon Co. Ltd.

CABLE (Retractile-Insulated)
The Glendon Co. Ltd.

CABLE (Shielded)
The Glendon Co. Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

CABLE (Transmission Line)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Andrew Antenna Corporation Limited

CALIBRATORS
Measurement Engineering Ltd.
Canadian Marconi Company

CALIBRATORS (Sweep)
Measurement Engineering Ltd.

CALIBRATORS (UHF)
Canadian Marconi Company

CAMERAS (Oscilloscope)
Canadian Aviation Electronics Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

CAMERAS (Television)
Canadian Aviation Electronics Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

CAPACITORS
The Glendon Co. Ltd.

CAPACITORS (Ceramic)
John Herring & Company Limited

CAPACITORS (Ceramic By-Pass)
Associated Electronic Components

CAPACITORS (Ceramic Temperature Compensating)
Associated Electronic Components

CAPACITORS (Ceramic Trimmers)
Associated Electronic Components

CAPACITORS (Fixed)
The Glendon Co. Ltd.

CAPACITORS (Mica)
The Glendon Co. Ltd.
Associated Electronic Components

CAPACITORS (Molded)
The Glendon Co. Ltd.

CAPACITORS (Oil Filled)
The Glendon Co. Ltd.

CAPACITORS (Paper)
The Glendon Co. Ltd.

CAPACITORS (Paper Tubular)
The Glendon Co. Ltd.
Associated Electronic Components

CAPACITORS (Paper Canned)
Associated Electronic Components

CAPACITORS (Paper Metallized)
Associated Electronic Components

CAPACITORS (Oil-Filled Tubular)
Associated Electronic Components

CAPACITORS (Oil-Filled Canned)
Associated Electronic Components

CAPACITORS (High Voltage D.C.)
The Glendon Co. Ltd.
Associated Electronic Components

CAPACITORS (High Voltage A.C.)
Associated Electronic Components

CAPACITORS (High Voltage Pulse)
The Glendon Co. Ltd.
Associated Electronic Components

CAPACITORS (Carrier Coupling)
The Glendon Co. Ltd.
Associated Electronic Components

CAPACITORS (High Temperature)
The Glendon Co. Ltd.
Associated Electronic Components

CAPACITORS (Power Factor Correction)
Associated Electronic Components

CAPACITORS (Electrolytic)
The Glendon Co. Ltd.
Associated Electronic Components

CAPACITORS (Electrolytic Miniature)
Associated Electronic Components

CAPACITORS (Motor Starting)
Associated Electronic Components

CAPACITORS (Photoflash)
Associated Electronic Components

CAPACITORS (Energy Storage)
Associated Electronic Components

CAPACITORS (Plastic Film)
Associated Electronic Components

CAPACITORS (Tantalum)
The Glendon Co. Ltd.

CASES (Instrument)
Measurement Engineering Ltd.

CELLS (Photoelectric)
Associated Electronic Components
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

CELLS (Standard)
Measurement Engineering Ltd.
Canadian Marconi Company

CEMENTS
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

CHAMBERS (Shielded Screen)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Stark Electronic Co. Ltd.

CHECKERS (Tube)
Canadian Marconi Company

CHOKES (Audio)
Associated Electronic Components
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Radio Engineering Products Ltd.

CHOKES (Filter)
Associated Electronic Components
Radio Engineering Products Ltd.

CHOKES (Power)
Associated Electronic Components
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

CHOPPERS
John Herring & Company Limited

CIRCUITS (Printed)
Measurement Engineering Ltd.
The Glendon Co. Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

CLIPS (Test)
Canadian Marconi Company

COATINGS (Protective)
Measurement Engineering Ltd.

COMMUNICATIONS SYSTEMS (Aircraft)
Measurement Engineering Ltd.
Aviation Electric Limited
Canadian Aviation Electronics Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

COMMUNICATIONS SYSTEMS (Aircraft Traffic Control)
Measurement Engineering Ltd.
Aviation Electric Limited
Canadian Aviation Electronics Ltd.
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

COMMUNICATIONS SYSTEMS (Carrier Current)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Northern Radio Mfg. Co. Ltd.
Radio Engineering Products Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Radio Engineering Products Ltd.

COMMUNICATIONS SYSTEMS (Marine Radio-Telephone)
Measurement Engineering Ltd.
Aviation Electric Limited
Canadian Aviation Electronics Ltd.
Canadian Marconi Company
Northern Radio Mfg. Co. Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

COMMUNICATIONS SYSTEMS (Microwave)
Measurement Engineering Ltd.
Canadian Aviation Electronics Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

COMMUNICATIONS SYSTEMS (Railroad)
Measurement Engineering Ltd.
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Aviation Electronics Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

COMMUNICATIONS SYSTEMS (Vehicular)
Measurement Engineering Ltd.
Aviation Electric Limited
Canadian Aviation Electronics Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

COMPARATORS
Measurement Engineering Ltd.

COMPUTERS (Analog)
Data Processing Associates Ltd.

COMPUTERS (Digital)
Data Processing Associates Ltd.

CONNECTORS (Coaxial Cable)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

CONNECTORS (Waterproof)
Aviation Electric Limited

CONTROLS (Alarm)
Measurement Engineering Ltd.
Canadian Aviation Electronics Ltd.
Standard Telephones & Cables Mfg. Co (Canada) Ltd.
John Herring & Company Limited

CONTROLS (Counting)
Canadian Marconi Company
Data Processing Associates Ltd.
John Herring & Company Limited

CONTROLS (Electronic)
Measurement Engineering Ltd.
The Glendon Co. Ltd.
Data Processing Associates Ltd.
John Herring & Company Limited

CONTROLS (Frequency)
Canadian Marconi Company

CONTROLS (Humidity)
Canadian Marconi Company

CONTROLS (Level)
John Herring & Company Limited

CONTROLS (Materials Thickness)
Measurement Engineering Ltd.

CONTROLS (Photoelectric)
Measurement Engineering Ltd.
John Herring & Company Limited

CONTROLS (Radio)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

CONTROLS (Servo)
Aviation Electric Limited
Data Processing Associates Ltd.

CONTROLS (Smoke, and Combustion, Electronic)
John Herring & Company Limited

CONTROLS (Temperature, Electronic)
Measurement Engineering Ltd.
Associated Electronic Components
Canadian Marconi Company
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

CONVERTERS (AC-DC)
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

CONVERTERS (DC-AC)
Aviation Electric Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

CONVERTERS (Microwave)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

CORDS (Line)
Canadian Marconi Company

CORES (Magnetic)
Magnetics Inc.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

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

CORES (Powdered Iron)
The Glendon Co. Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

COUNTERS (Electronic)
Measurement Engineering Ltd.
Canadian Marconi Company
Data Processing Associates Ltd.
John Herring & Company Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

COUNTERS (Frequency)
Measurement Engineering Ltd.
Canadian Marconi Company

COUNTERS (Geiger)
Measurement Engineering Ltd.
Canadian Aviation Electronics Ltd.
Canadian Marconi Company

COUNTERS (Photoelectric)
Measurement Engineering Ltd.
Canadian Marconi Company
John Herring & Company Limited

CRYSTAL (Detectors)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

CRYSTAL (Holders)
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CRYSTALS (Precision Ground Quartz)
W. Garry Wright Electronics of Can. Ltd.

CRYSTALS (Quartz Freq. Control)
Rogers Majestic Electronics Limited
C. R. Snelgrove Co. Limited

CRYSTALS (Scintillation Counter)
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Canadian Marconi Company
Radio Engineering Products Ltd.

DECADE BOXES (Capacitance)
Measurement Engineering Ltd.
Associated Electronic Components
Canadian Marconi Company
John Herring & Company Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

DECADE BOXES (Resistance)
Measurement Engineering Ltd.
Canadian Marconi Company
John Herring & Company Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

DELAY LINES
Canadian Aviation Electronics Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
John Herring & Company Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

DETECTORS (Defect, Electronic)
Measurement Engineering Ltd.

DETECTORS (Fire, Electronic)
Measurement Engineering Ltd.
Canadian Aviation Electronics Ltd.

DETECTORS (Smoke, Electronic)
Measurement Engineering Ltd.
John Herring & Company Ltd.

DIALS (Precision)
Canadian Marconi Company

DIODES (Germanium)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

DIRECTION FINDERS
Aviation Electric Limited
Canadian Marconi Company

DRUMS (Memory, Magnetic, Recording)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Data Processing Associates Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

ENGRAVING & PROFILING
Measurement Engineering Ltd.

FILTERS (Band Elimination)
Measurement Engineering Ltd.
Radio Engineering Products Ltd.
Andrew Antenna Corporation Limited

FILTERS (Crystal)
Measurement Engineering Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

FILTERS (Equalizer)
Radio Engineering Products Ltd.

FILTERS (Electronic)
Measurement Engineering Ltd.
Aviation Electric Limited
Radio Engineering Products Ltd.
Sinclair Radio Labs. Inc.

FILTERS (Radio Interference)
The Glendon Co. Ltd.
Andrew Antenna Corporation Limited

FORMS (Coil)
The Glendon Co. Ltd.

GAUGES (Comparator)
Measurement Engineering Ltd.

GAUGES (Electronic)
Measurement Engineering Ltd.
Aviation Electric Limited
John Herring & Company Ltd.

GAUGES (Strain)
John Herring & Company Ltd.

GAUGES (Vacuum)
Measurement Engineering Ltd.
Aviation Electric Limited

GALVANOMETERS
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Associated Electronic Components
Canadian Marconi Company
John Herring & Company Ltd.

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Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

GENERATORS (Harmonic Frequency)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company

GENERATORS (Microwave)
Measurement Engineering Ltd.
Canadian Marconi Company

GENERATORS (Pulse)
Measurement Engineering Ltd.
Canadian Marconi Company

GENERATORS (Variable Frequency)
Measurement Engineering Ltd.
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

GENERATORS (Waveform)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company

GENERATORS (Picture Signal)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

GENERATORS (Square Wave)
Measurement Engineering Ltd.
Canadian Marconi Company

GENERATORS (Signal, Sweeping)
Measurement Engineering Ltd.
Canadian Marconi Company
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

GENERATORS (Signal, Television, Synchronizing)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company

GEOPHYSICAL (Equipment)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

HEADPHONES
Associated Electronic Components
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

HEADSETS
Associated Electronic Components
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

HEADS (Recording)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

HEATING (Electronic, Induction)
(Electronic Equipment & Tube Dept.)
Canadian General Electric Co. Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

HORNS (Speaker)
Associated Electronic Components
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

INDICATORS (Volume)
Measurement Engineering Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

INDICATORS (Leakage)
Measurement Engineering Ltd.
Associated Electronic Components

INDICATORS (Electronic)
Measurement Engineering Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Data Processing Associates Limited
John Herring & Company Ltd.

INDICATORS (Frequency)
Measurement Engineering Ltd.
Canadian Marconi Company

INDICATORS (Smoke, Fire & Electronic)
Measurement Engineering Ltd.
John Herring & Company Ltd.

INDICATORS (Strain)
John Herring & Company Ltd.

INDICATORS (Timing)
Measurement Engineering Ltd.
Canadian Marconi Company

INDICATORS (Vacuum)
Measurement Engineering Ltd.

INDUCTANCES (Electronic)
Measurement Engineering Ltd.

INDUCTANCES (Receiving or Transmitting)
Measurement Engineering Ltd.

INSTRUMENT (Precision)
Measurement Engineering Ltd.
Associated Electronic Components
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
John Herring & Company Ltd.
Triplett Instrument Company

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

INTERCOMMUNICATION SYSTEMS
Measurement Engineering Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

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

INSTRUMENTS (Panel)
Measurement Engineering Ltd.
Associated Electronic Components
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
John Herring & Co. Ltd.
Triplett Instrument Company

INSULATORS
Quality Hermetics Limited

LORAN (Systems)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

MAGNETS
The Glendon Co. Ltd.

MEGAPHONES (Electronic)
Measurement Engineering Ltd.

MEGOHMMETERS
Measurement Engineering Ltd.
Associated Electronic Components
Canadian Marconi Company
John Herring & Company Limited

METAL PARTS
Measurement Engineering Ltd.

METERS (Field Strength)
Measurement Engineering Ltd.
Canadian Marconi Company

METERS (Deviation)
Canadian Marconi Company

METERS (Frequency)
Measurement Engineering Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company

METERS (Phase Monitors)
Andrew Antenna Corporation Ltd.

MACHINES (Disc Recording)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company

MACHINES (Wire Stripping)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

MICROPHONES
The Glendon Co. Ltd.
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

MICROWAVE TRANSMISSION LINES
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

MODULATORS
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

NEEDLES (Cutting)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company

NEEDLES (Play-back)
The Glendon Co. Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company

NETWORKS (Pulse Forming)
The Glendon Co. Ltd.

PROBES (High Frequency)
Measurement Engineering Ltd.

PROBES (Microwave)
Measurement Engineering Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

OSCILLATORS
Measurement Engineering Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

OSCILLATORS (Controlled)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company

OSCILLATORS (Audio Frequency)
Measurement Engineering Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Radio Engineering Products Ltd.

OSCILLATORS (Cavity)
Measurement Engineering Ltd.
Canadian Marconi Company

OSCILLATORS (Radio Frequency)
Measurement Engineering Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

OSCILLOGRAPHS (Direct Wiring)
Measurement Engineering Ltd.
Data Processing Associates Limited

OSCILLOGRAPHS (Recording)
Measurement Engineering Ltd.
Data Processing Associates Limited

OSCILLOSCOPES (Cathode Ray)
Canadian Aviation Electronics Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Data Processing Associates Limited

OSCILLOSCOPES (Portable)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

PICKUPS
The Glendon Co. Ltd.

PICKUPS (Ceramics & Crystal)
The Glendon Co. Ltd.

PICK-UPS (Magnetic)
The Glendon Co. Ltd.
Associated Electronic Components
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

PICK-UPS (Transcription)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company

PLUGS (Telephone)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Radio Engineering Products Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company

PLUGS (Terminal)
Quality Hermetics Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company

POINTERS (Dial)
John Herring & Company Limited

POTENTIOMETERS (Induction)
Canadian Marconi Company

POTENTIOMETERS (Linear & Non Linear)
Measurement Engineering Ltd.
John Herring & Company Limited
Canadian Marconi Company

POTENTIOMETERS (Portable)
John Herring & Company Limited
Canadian Marconi Company

POWER SUPPLIES (Regulated)
The Glendon Co. Ltd.

PRE-AMPLIFIERS (Communication)
Measurement Engineering Ltd.
Radio Engineering Products Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

PRINTED CIRCUITS
The Glendon Co. Ltd.

PUBLIC ADDRESS SYSTEMS
Measurement Engineering Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

RACKS (Relay)
Measurement Engineering Ltd.
Associated Electronic Components
Radio Engineering Products Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

RADAR EQUIPMENT
Canadian Marconi Company
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

RECEIVERS (Communications)
Measurement Engineering Ltd.
Canadian Aviation Electronics Ltd.
Canadian Marconi Company
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telepnones & Cables Mfg. Co. (Canada) Ltd.

RECEIVERS (Loran)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

RECEIVERS (Portable & Mobile)
Measurement Engineering Ltd.
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company

RECEIVERS (Railroad)
Measurement Engineering Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Canadian Marconi Company
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

RECEIVING EQUIPMENT (General)
Measurement Engineering Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Aviation Electric Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Canadian Marconi Company

RECORDERS (Potentiometer)
Data Processing Associates Limited
John Herring & Company Limited

RECORDERS (Tape)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Data Processing Associates Limited
Ampex Corporation

RECORDERS (Telemetering)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Data Processing Associates Limited
Ampex Corporation

RECORDING (Heads)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Data Processing Associates Limited

RECORDING (Tape)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

RECTIFIERS (Germanium)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

RECTIFIERS (Selenium)
Measurement Engineering Ltd.
Associated Electronic Components
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

RECTIFIERS (Tube)
Aviation Electric Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

REGULATORS (Voltage)
The Glendon Co. Ltd.
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

RELAYS
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Associated Electronic Components
John Herring & Company Limited
Radio Engineering Products Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

RELAYS (Coaxial)
John Herring & Company Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Andrew Antenna Corporation Ltd.

RELAYS (Differential)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
John Herring & Company Limited

RELAYS (High Voltage)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Associated Electronic Components
John Herring & Company Limited

RELAYS (Impulse)
Associated Electronic Components
John Herring & Company Limited

RELAYS (Polarized)
Radio Engineering Products Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
John Herring & Company Limited

RELAYS (Rotary)
Associated Electronic Components
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

RELAYS (Sequence)
John Herring & Company Limited
Associated Electronic Components
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

RELAY (Telephone)
Radio Engineering Products Ltd.
John Herring & Company Limited
Associated Electronic Components
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

RELAYS (Time Delay)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
John Herring & Company Limited
Associated Electronic Components
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

RESISTORS (Fixed)
The Glendon Co. Ltd.
John Herring & Company Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

RESISTORS (Low Wattage)
The Glendon Co. Ltd.
John Herring & Co. Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

RESISTORS (High Frequency)
The Glendon Co. Ltd.
John Herring & Co. Limited

RESISTORS (High Stability)
The Glendon Co. Ltd.

RESISTORS (High Voltage)
John Herring & Co. Limited

RESISTORS (High Wattage)
The Glendon Co. Ltd.
John Herring & Co. Limited

RESISTORS (Variable Composition)
Precision Electronic Components Ltd.

RHEOSTATS
The Glendon Co. Ltd.
Associated Electronic Components

SEALS (Hermetic)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Quality Hermetics Limited

SERVOMECHANISMS
Aviation Electric Limited
Data Processing Associates Limited
Canadian Aviation Electronics Ltd.

SHOCK MOUNTS
Aviation Electric Limited

SHUNTS (Meter)
Measurement Engineering Ltd.
Associated Electronic Components

SOCKETS (Tube)
The Glendon Co. Ltd.

SOCKETS (Kinescope)
The Glendon Co. Ltd.

SOCKETS (Printed Circuits)
The Glendon Co. Ltd.

SPEAKERS
The Glendon Co. Ltd.

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

SWITCHES (Coaxial Cable)
Measurement Engineering Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Andrew Antenna Corporation Limited

SWITCHES (Electronic)
Measurement Engineering Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
John Herring & Co. Limited

SWITCHES (Limit)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

SWITCHES (Rotary)
John Herring & Co. Limited

SWITCHES (Instrument)
John Herring & Co. Limited

TAPE
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Data Processing Associates Limited

TELEMETERING SYSTEMS
Measurement Engineering Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Aviation Electric Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TELEPHONES (Handsets)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Aviation Electric Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TERMINAL BLOCKS
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TERMINAL BOARDS
Measurement Engineering Ltd.
The Glendon Co. Ltd.
Quality Hermetics Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telepnones & Cables Mfg. Co. (Canada) Ltd.

TESTERS (Tube)
John Herring & Co. Limited

TESTERS (Capacitor)
Canadian Marconi Company
John Herring & Co. Limited

TESTERS (Circuit)
John Herring & Co. Limited

TESTERS (Continuity)
John Herring & Co. Limited

TESTERS (Distortion)
Canadian Marconi Company
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

TESTERS (Insulation)
Associated Electronic Components
John Herring & Co. Limited

TESTERS (Meter)
Canadian Marconi Company
John Herring & Co. Limited

TESTERS (Transistor)
Measurement Engineering Ltd.

TESTERS (Vacuum Tube)
Measurement Engineering Ltd.
John Herring & Co. Limited

THERMOCOUPLES
Measurement Engineering Ltd.
Associated Electronic Components
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TIMER (Cycle)
Measurement Engineering Ltd.
John Herring & Co. Limited
Aviation Electric Limited

TIMERS (Interval)
Measurement Engineering Ltd.
John Herring & Co. Limited
Aviation Electric Limited

TIMERS (Reset)
John Herring & Co. Limited
Canadian Marconi Company

TIMERS (Electronic)
Measurement Engineering Ltd.
Canadian Marconi Company
John Herring & Co. Limited

TIMERS (Impulse)
Measurement Engineering Ltd.
John Herring & Co. Limited

TIMERS (Sequence)
Measurement Engineering Ltd.
John Herring & Co. Limited

TRACERS (Oscilloscopes)
Data Processing Associates Limited

TRANSCEIVERS
Measurement Engineering Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Aviation Electric Limited

TRANSDUCERS
John Herring & Co. Limited
Aviation Electric Limited

TRANSFORMERS (Audio)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Associated Electronic Components
John Herring & Co. Limited
Radio Engineering Products Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TRANSFORMERS (Input-Output or Interstage)
Associated Electronic Components
John Herring & Co. Limited
Radio Engineering Products Ltd.

TRANSFORMERS (Modulator)
Associated Electronic Components

TRANSFORMERS (Very Low Frequency)
Associated Electronic Components

TRANSFORMERS (Power)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Associated Electronic Components

TRANSFORMERS (Isolation)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

TRANSFORMERS (Voltage Regulating)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

TRANSFORMERS (Miniature)
Associated Electronic Components
John Herring & Co. Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

TRANSFORMERS (Pulse)
Associated Electronic Components

TRANSFORMERS (Toroidal)
Measurement Engineering Ltd.
John Herring & Co. Limited
Radio Engineering Products Ltd.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TRANSFORMERS (Broad Band)
Canadian Aviation Electronics Ltd.

TRANSISTORS
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TRANSMITTERS (Broadcast)
Canadian Marconi Company
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TRANSMITTERS (Color Television)
Canadian Marconi Co.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TRANSMITTERS (Direction Finding)
Aviation Electric Limited
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TRANSMITTERS (Fixed Station)
Measurement Engineering Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TRANSMITTERS (Loran)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TRANSMITTERS (Marine)
Measurement Engineering Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Aviation Electric Limited
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TRANSMITTERS (Portable)
Measurement Engineering Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Aviation Electric Limited
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TRANSMITTERS (Radio Range)
Measurement Engineering Ltd.
Canadian Aviation Electronics Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TRANSMITTERS (UHF)
Measurement Engineering Ltd.
Canadian Aviation Electronics Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TRANSMITTERS (VHF)
Measurement Engineering Ltd.
Aviation Electric Limited
Canadian Aviation Electronics Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TUBES
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
R.C.A. Victor

TUBES (Battery Charger)
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TUBES (Cathode Ray)
Aviation Electric Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TUBES (Cathode Ray Multiple)
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

CATHODE RAY (Studio)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TUBES (Television Picture)
Aviation Electric Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TUBES (Geiger)
Measurement Engineering Ltd.
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TUBES (Hearing Aid)
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TUBES (Ignitron)
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TUBES (Ionization)
Aviation Electric Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TUBES (Klystron)
Aviation Electric Limited
Aviation Electric Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Eitel-McCullough Inc.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TUBES (Miniature)
Aviation Electric Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TUBES (Amplifier)
Aviation Electric Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Eitel-McCullough Inc.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TUBES (Receiving)
Aviation Electric Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TUBES (Rectifying)
Aviation Electric Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Eitel-McCullough Inc.
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TUBES (Subminiature)
Aviation Electric Limited
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TUBES (Camera Pickup)
Aviation Electric Limited
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

TUBES (Travelling Wave and Thyiatron)
Eitel-McCullough Inc.

TUBING (Aluminum)
John Herring & Co. Limited

TURNTABLES (Recording)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

VIBRATION MOUNTS
Aviation Electric Limited

VOLTMETERS (Crystal)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

VOLTMETERS (Electronic)
Measurement Engineering Ltd.
Associated Electronic Components
Canadian Marconi Company
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

WAVEGUIDES
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

WAVEGUIDE EQUIPMENT
Measurement Engineering Ltd.
Canadian Marconi Company
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

WIRE
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Canada Wire & Cable Mfg. Co. (Canada) Ltd.

WIRE (Aluminum)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

WIRE (Antenna)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

WIRE (Insulated)
The Glendon Co. Ltd.
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

WIRE (Copper)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)
Standard Telephones & Cables Mfg. Co. (Canada) Ltd.

WIRE (Stripped)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

WIRE (Enamelled)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

WIRE (Guy)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

WIRE (High Voltage)
Canadian General Electric Co. Ltd. (Electronic Equipment & Tube Dept.)

X-RAY (Condensers)
The Glendon Co. Ltd.

Addenda To 1955 Directory Issue Of

Canadian Electronic And Communication Equipment Suppliers

With Listing Of American And Foreign Principals

Aviation Electric Ltd., 200 Laurentian Blvd., Montreal, Quebec. Also: Aviation Electric Ltd., Vancouver, B.C. Representing:
Aviation Electric is the Canadian Representative of the following divisions of BENDIX AVIATION CORPORATION:
Bendix Radio
Eclipse-Pioneer
Pacific Division
Red Bank
Scintilla
Aviation Electric is also Canadian representative of ROBINSON AVIATION INC.

Associated Electronic Components, 37 Roselawn Ave., Toronto 12, Ont. Representing:
A/S Tobias Jensen Condenser Products Co. Ltd., Glostrup, Copenhagen, Denmark
Peerless Factories A/S, Copenhagen, Denmark
Danish Ventil Industry, Soborg, Copenhagen, Denmark
A/S Danavox, Copenhagen, Denmark
Tage Schouboe, Copenhagen, Denmark
Alois Zettler, Munich, Germany
Osvald Jensen, Copenhagen, Denmark
Jorgen Schou, Copenhagen, Denmark
I/S Jensen Electric, Copenhagen, Denmark

Ampex American, 70 Granville St., Toronto, Ont. Representing:
Ampex Corp., 934 Charter St., Redwood City, Cal.

Andrew Antenna Corp. Ltd., 606 Beech St., Whitby, Ont.

Atlas Radio Corp. Ltd., 50 Wingold Ave., Toronto 10, Ont. Representing:
Advance Electric and Relay Co., 2435 N. Naomi St., Burbank, Cal.
Amperite Co., 561 Broadway, New York 12, N.Y.
Atlas Sound Corp., 1451 39th St., Brooklyn, N.Y.
Audiogersh Corp., 23 Park Pl., New York 7, N.Y.
Automatic Mfg. Corp., (K-Trans, K-Caps), 65 Gouverneur St., Newark, N.J.
B & K Mfg. Co., 3731 N. Southport Ave., Chicago 13, Ill.
The George W. Borg Corp., (Micropot Microdial), 120 S. Main St., Janesville, Wis.
Continental Connector Corp., Northern Blvd. at 45th, Long Island City 1, N.Y.
Continental Electric Co. (Cetron), Geneva, Ill.
Harry Davies Molding Co. (Dakaware), 1428 N. Wells St., Chicago 10, Ill.
DeJur-Amsco Corp., Northern Blvd. at 45th, Long Island City 1, N.Y.
Drake Manufacturing Co., 1713 W. Hubbard St., Chicago 22, Ill.
Edin Co. Inc., 207 Main St., Worcester 8, Mass.
Elco Corp., "M" Street below Erie Ave., Philadelphia 24, Pa., U.S.A.
Electrical Industries Inc., 44 Summer St., Newark, N.J.
Electrolabs Reg'd., (Electrophone), 7385 St. Lawrence Blvd., Montreal 16, Que.
Electro Products Laboratories Inc., 4501 N. Ravenswood Ave., Chicago 40, Ill.
Flahan Co., 7517 Pelham Drive, Cleveland, Ohio.
Gertsch Products Inc., P.O. Box 13856, 11846-48 Mississippi Ave., W. Los Angeles 25, Cal.
Fred Goat Co. Inc., 314 Dean St., Brooklyn 17, N.Y.
Hewlett-Packard Co., 395 Page Mill Rd., Palo Alto, Cal.
I. E. Manufacturing, 325 N. Hoyne Ave., Chicago 12, Ill.
Industrial Hardware Mfg. Co. Inc., 109 Prince St., New York 12, N.Y.
International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Cal.
Javex, P.O. Box 646, Redlands, Cal.
Jerrold Electronics Corp., 26th and Dickinson St., Philadelphia 46, Pa.
Kay Lab. Inc., P.O. Box 1578, 1090 Morena Blvd., San Diego 10, Cal.
Erik A. Lindgren & Assoc., 4515 N. Ravenswood Ave., Chicago 40, Ill.
Linear Equipment Laboratories, Inc., 380 Oak St., Copiague, L.I., N.Y.
Lowell Manufacturing Corp., 3030 Laclede Station Rd., St. Louis 17, Mo.
Micamold Electronic Corp., 1087 Flushing Ave., Brooklyn 37, N.Y.
J. W. Miller Co., 5917 S. Main St., Los Angeles, Cal.
M. A. Miller Mfg. Co. (Carillon), 4th and Church Sts., Libertyville, Ill.
Najesco Inc., 1449 South 26th St., Philadelphia 46, Pa.
Northern Products Co. (Autone), 2210 N. Clark St., Chicago 14, Ill.
Nucleonic Co. of America, 136 DeGraw St., Brooklyn 31, N.Y.
Oak Manufacturing Co., 1260 Clybourn Ave., Chicago 10, Ill.
Orradio Industries Inc., T-120 Marvyn Rd., Opelika, Ala.
Oxford Electric Corp., 3911 S. Michigan Ave., Chicago 15, Ill.
Partridge Transformers Ltd., Roebuck Rd., Tolworth, Surrey, England
Penn Boiler & Burner Mfg. Corp., Lancaster, Pa.
The Pentron Corp., 777 S. Tripp Ave., Chicago 24, Ill.
Pilot Radio Corp., 37-06 - 36th St., Long Island City, N.Y.
Precision Apparatus Co. Inc., 92-27 Horace Harding Blvd., Elmhurst, L.I., N.Y.
Pyramid Instrument Corp. (Amprobe), 630 Merrick Rd., Lynbrook, N.Y.
Rek-O-Kut Co. Inc., 38-01 Queens Blvd., Long Island City 1, N.Y.
The Shavex Co., 3456 Glendale Blvd., Los Angeles 39, Cal.
Sierra Electronic Corp., 1050 Brittan Ave.,
Herman H. Smith Inc., 2326 Nostrand Ave., Brooklyn 10, N.Y.
Staver Manufacturing Co. Inc., (Minispring, Minishield), P.O. Box 431, 41-51 N. Saxon Ave., Bay Shore, L.I., N.Y.
Switchcraft Inc., 1328-30 N. Halsted St., Chicago 22, Ill.
Taybern Equipment Co. Inc., 5 University Place, New York 3, N.Y.
Taylor Tubes Inc., 2312 Wabansia Ave., Chicago 47, Ill.
Telex Laboratories Inc., Telex Park, St. Paul 1, Minn.
Tel-Instrument Co. Inc., 728 Garden St., Carlstadt, N.J.
Terado Co., 1068 Raymond Ave., St. Paul 14, Minn.
Triple-A Specialty Co., 2101-11 Walnut St., Chicago 12, Ill.
Vaco Products Co., 317 E. Ontario St., Chicago 11, Ill.
Thompson Products Inc., Electronics Div., 2196 Clarkwood Rd., Cleveland 3, Ohio.
Walsco Electronics Corp., 3602 Crenshaw Blvd., Los Angeles 16, Cal.
Ward Products Corp., 1148 Euclid Ave., Cleveland 15, Ohio.
Workshop Associates, Endicott St., Norwood, Mass.
Bohne Industries Ltd., 1153 Queen St. W., Toronto.

Canadian Aviation Electronics Ltd., P.O. Box 630, 6214 Cote de Liesse Rd., Montreal, Que.

Canadian General Electric Co. Ltd., Electronics Equip. & Tube Dept., 830 Lansdowne Ave., Toronto 4, Ont.

Canadian Marconi Co., 2442 Trenton Ave., Montreal 16, Que. Representing:
Gates Radio, Quincy, Ill.
Marconi Wireless, Chelmsford, Eng.
General Radio, Cambridge, Mass.
Atomic Instruments, Cambridge, Mass.
Tinsley Instruments, St. Jerome, Que.
Keithley Instruments, Cleveland, Ohio.

Data Processing Associates Ltd., 1313 Wellington St., Ottawa, Ont. Representing:
Electro Data Corp., Pasadena, Cal.
Mid-Century Instruments Corp., N.Y.
Dian Laboratories Inc., New York, N.Y.
Dynamics Research Associates, Ltd., Seattle, Wash.
Telecomputing Corp., N. Hollywood, Cal.
Tally Register Corp., Seattle, Wash.

Ahearn and Soper Ltd., Ottawa, Canada. Representing:
Eitel-McCullough Inc., San Bruno, Cal.

Glendon Co. Ltd., 44 Wellington St. E., Toronto 1, Ont. Representing:
Neosid (Canada) Ltd., 10 Vansco Rd., c/o Hollywood P.O., Etobicoke, Toronto 14, Ont.
Neosid Ltd., Stonehills House, Howardsgate, Welwyn Garden City, Herts., Eng.
The Constanta Co. of Canada Ltd., 280 Regina Ave., Verdun, Montreal, P.Q.
Electronic Controls Ltd., 22 Front St. W., Toronto 1, Ont.
The Telegraph Condenser Co. Ltd., Export Div., North Acton, London W. 3, England.
Electro Acoustic Industries Ltd., Stamford Works, Broad Lane, Tottenham, London N. 15, England.
Cosmocord Ltd., 700 Great Cambridge Rd., Enfield, Middlesex, England.
Hardwick, Hindle, Inc., 40 Hermon St., Newark 5, N.J., U.S.A.
Permonite Manufacturing Co., 4554 North Broadway, Chicago 40, Ill., U.S.A.
Bodnar Industries Inc., 19 Railroad Ave., New Rochelle, N.Y., U.S.A.
Mullard Overseas Ltd., Century House, Shaftesbury Ave., London, W.C. 2, Eng.
Reliance Electrical Wire Co. Ltd., Staffa Rd., Leyton, London E.10, England.

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Neosid (Canada) Ltd., 10 Vansco Rd., c/o Hollywood P.O., Etobicoke, Toronto 14, Ont.
The Constanta Co. of Canada Ltd., 280 Regina Ave., Verdun, Montreal, P.Q.

Herring & Co. Ltd., John, 3468 Dundas St. W., Toronto 9, Ont. Representing:
Automatic Electric Manufacturing Co., Mankato, Minn.
Shallcross Mfg. Co., Collingdale, Pa.
Ripley Co. Inc., Middletown, Conn.
Stevens-Arnold Inc., 22 Elkins St., S. Boston, Mass.
Geo. Rattray & Co. Inc., 116 Myrtle Ave., Richmond Hill, N.Y.
Landis & Gyr, Inc., 45 W. 45th St., New York, N.Y.
National Capacitor Co., 585 Washington St., Quincey 69, Mass.
Mucon Co. Inc., 9 St. Francis St., Newark 5, N.Y.
H-B Instrument Co., American & Bristol Sts., Philadelphia, Pa.
Barber-Colman Co., Rockford, Ill.
Fortiphone Ltd., 247 Regent St., London W.1., England.
Magnetics Inc., P.O. Box 230 E, Butler, Pa.

Measurement Engineering Ltd., Arnprior, Ontario. Representing:
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Bradley Laboratories Inc., 168 Columbus Ave., New Haven, Conn., U.S.A.
Browning Laboratories Inc., 750 Main St., Winchester, Mass., U.S.A.
Calidyne Co., 120 Cross St., Winchester, Mass., U.S.A.
Croydon Precisions Instrument Co., 116 Windmill Rd., Croydon, Surrey, Eng.
Electro-Measurement Corp., 4312 S.E. Stark St., Portland 15, Oregon, U.S.A.
Ekco Electronics Ltd., Ekco Works, Southend-on-Sea, Essex, England.
Decade Instrument Co., Box 153, Caldwell, N.J., U.S.A.
Frequency Standards Ltd., P.O. Box 504, Asbury Park, N.J., U.S.A.
Instrument Electronics, 90 Main St., Port Washington, N.Y., U.S.A.
Humidial Co., Colton, Cal., U.S.A.
Hastings Instrument Co., Hampton, Va.
Jan Hardware, 75 North, Brooklyn, N.Y.
Jackson Bros. Ltd., Kings Way, Waddon, England.
Kay Electric Co., 14 Maple Ave., Pine Brook, N.J., U.S.A.
Krohn-Hite Instrument Co., 580 Massachusetts Ave., Cambridge 39, Mass.
The Narda Corp., 160 Herricks Rd., Mineola, N.Y.
National Research Corp., 160 Charlemont St., Newton Highlands 61, Mass.
Niagara Electrical Instr. Co., 559 Ellicott St., Buffalo 3, N.Y.
Polarad Electronics Corp., 43-20 34th St., Long Island City, N.Y.
Potter Instrument Co., 115 Cutter Mill Rd., Great Neck, N.Y.
Reliance Ltd., Sutherland Rd., Higham Hill, Walthamstow, London, England.
Sanders Associates, Nashua, N.H.
Sensitive Research Instrument Co., 310 Main St., New Rochelle, N.Y.
Servo Corp. of America, 20-20 Jericho Turnpike, New Hyde Park, N.Y.
Servotrol Co., Framingham Centre, Mass.
Trad Electronics Corp., 1001 First Ave., Asbury Park, N.J.
Technology Instrument Corp., 531 Main St., Acton, Mass.
Vacuum Electronic Eng. Co., 86 Denton Ave., New Hyde Park, N.Y.
Roger White Electron Devices, 12 Island Rd., Ramsey, N.J.

Precision Electronic Components Ltd., 50 Wingold Ave., Toronto 10, Ont.

Quality Hermetics Ltd., 45 Hollinger Rd., Toronto 16, Ont.

Radio Engineering Products Ltd., 1080 University St., Montreal, Que.

Rogers Majestic Electronics Ltd., 11-19 Brentcliffe Rd., Leaside, Toronto 17, Ont.

Standard Telephones & Cables Mfg. Co. Canada Ltd., 9600 St. Lawrence Blvd., Montreal 12, Que. Representing:
Standard Telephones & Cables Ltd., Connaught House, 63 Aldwych, London W.C. 2, England.
International Telephone and Telegraph Corp., 67 Broad St., New York 4, N.Y.

Snelgrove Co. Ltd., C. R., P.O. Box 10, Station R., Toronto, Ont.

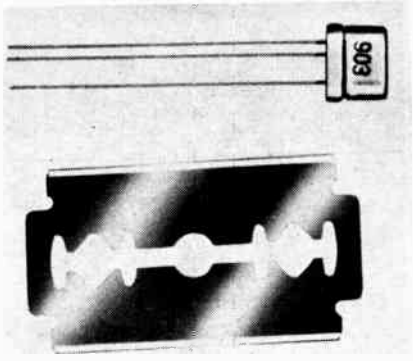
W. Garry Wright Electronics of Canada Ltd., 628 Kent St., Whitby, Ont.

Addenda To 1955 Directory

PRODUCT INFORMATION SECTION

Texas Instruments Marks Full Year As Lone Silicon Transistor Manufacturer, Ups Line From 5 to 7 Types

Marking a full year as the exclusive commercial producer of transistors made from silicon, Texas Instruments Incorporated has announced further expansion of its line from five to seven types of n-p-n grown junction silicon transistors. During the year, TI has voluntarily reduced prices twice — once by 25 per cent — to encourage



the application of silicon transistors.

Texas Instruments silicon transistors have found wide application in airborne military and complex commercial electronic equipment. Since commercial introduction in May of 1954, steadily increasing production has allowed TI to broaden its line *three* times.

Many manufacturers — including Texas Instruments, which is the largest producer of germanium radio frequency units — make transistors from germanium, which operates satisfactorily to 65°C. (149°F.). Silicon transistors will operate satisfactorily to 150°C. (302°F.).

The new Types 951, 952, 953 are medium power silicon transistors and are improvements on the superseded Type X-15. They can produce a power gain of 30 db, supply up to 1 watt of Class B power, and be operated up to 150°C.

The other four silicon transistor types (903, 904, 904A, 905) in the exclusive Texas Instruments line are classified as small signal units. Three current amplification ranges are available. The minimum alpha in each range is 0.90, 0.95, and 0.975. One type has a minimum alpha frequency cut-off of 8 mc.

Texas Instruments has been able to repeatedly add new models and make substantial price reductions as a result of improved manufacturing techniques. Current production capacity — aided by a recently completed plant expansion just for semi-conductors — enables silicon transistors to be delivered in unlimited quantity.

For detailed information on the three new type of silicon transistors, write for the new Series 950 bulletin. Series 900 bulletin on small signal types also available.

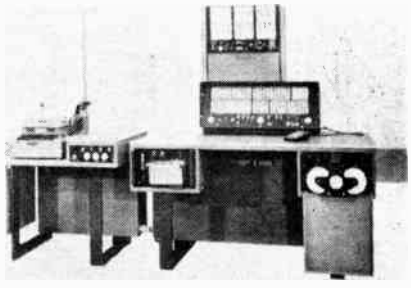
Texas Instruments represented in Canada by:
Computing Devices of Canada Limited, P.O. Box 508, Ottawa 4, Ont.

Datatron Electronic Data Processing Machine

Science, industry, and business are faced with enormous and expensive operations in the handling and processing of data. DATATRON electronic data processing machines are helping to bring about revolutionary improvements in such operations. On any type of data processing problem, DATATRON systems are fast, efficient, and offer practical dollar savings.

Available through lease or purchase at a fraction of the cost of the very large-scale data processing systems, DATATRON is within the reach of virtually all business, research, and engineering organization. Substantial company-wide savings are made possible by the DATATRON computer in such functions as statistical analysis, maintenance of office systems, storage of records, accounting operations, design, development and testing, and manufacturing control. Reduced operating costs may be far more significant than the initial low purchase price of DATATRON machines.

DATATRON machines are designed so that all components function at levels far below their engineered specifications, thus assuring maximum reliability of operation.



A two-week course in programming and coding is scheduled regularly at ElectroData's computing center in Pasadena, and training in maintenance is available to customer personnel.

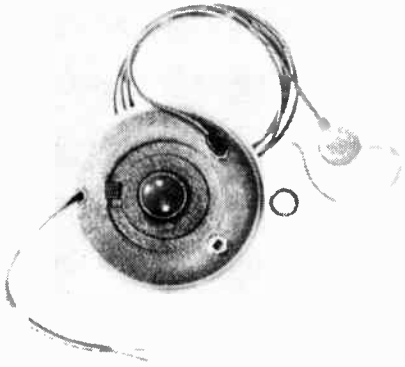
The DATATRON digital computer system is manufactured by ELECTRO-DATA Corporation, Pasadena, California, an affiliate of Consolidated Engineering Corporation. All phases of customer application and service, sales and maintenance in Canada are handled by:
Data Processing Associates Limited, 1313 Wellington Street, Ottawa, Ont.

Telex TV Listener

A new listening device that attaches to the audio system of television sets and permits children to hear their favorite programs without disturbing others is being marketed by Telex, Inc., St. Paul, Minn., manufacturers of headsets and electronic components.

Known as the "TV Listener", the device consists of a control unit, with volume controls and on-off switch, and is connected to the TV set's output circuit by a 15-foot cord, two jacks and a Telex Earset receiver which plugs into the jacks.

Earset volume may be adjusted by controls on the chairside. "Listener" control on the unit does not affect volume of TV speaker itself. Earset receiver is lightweight and slips over one ear, leaving the other ear free for conversation while producing full-tones personal hearing, the manufacturer states, and the 4-foot Earset cord allows for the usual shifting of position while helping to confine the children to one general area.



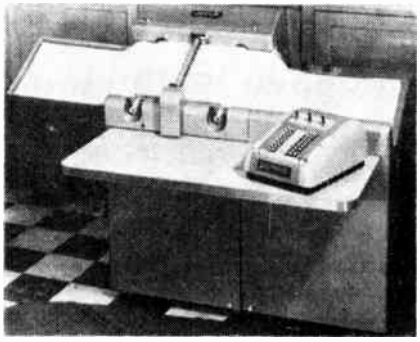
Another useful application for the Listener is in institutions where individual listening controls are desirable. The manufacturer reports the unit to be ideal for persons with hearing loss.

As the unit does not alter the basic operation of the TV set, it is simple and safe to use. The case is 3½" in diameter, 1" thick and extremely light in weight.

For additional information and prices, write:
Dept. KP, Telex, Inc., Telex Park, St. Paul 1, Minnesota. Mention this publication.

Tally Register Digital Point Plotter

Operating directly from electronic digital computers, punch card machines, keyboards and punched tapes, the TALLY REGISTER high speed digital point plotter provides a continuous feed two direction grid printing facility. Tpe 8113 — Model 3 Plotter features numeric abscissa printing. This provides for numeric printed identification of reference points along the lower edge of the plot. Characters may be printed at a



rate of ten per second and may be programmed to print at any abscissa point desired. Speed of 20 points per second with four symbols and sequenced programming can be accomplished. The TALLY REGISTER Plotter is manufactured by TALLY REGISTER Corporation, Seattle, Washington. Full technical information may be obtained from their Canadian representatives:
Data Processing Associates Limited, 1313 Wellington Street, Ottawa, Ont.

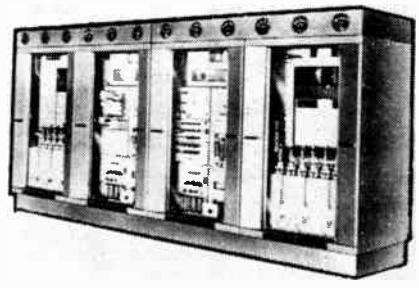
Tension Gauge

These are precision measuring instruments for determining the tension of any spring up to 500 grammes with micrometer accuracy, and are the most advanced gauges of their kind in the world. This design eliminates approximation and the user pre-sets the gauge to the required tension (in grammes) by means of the knurled pre-setting screw. The operating strip is then applied to the tip of the spring under test; deflection of the operating strip to either side, simultaneously with movement of the spring under test, indicates that the spring tension is equal to the gauge setting. The user

can concentrate attention simply on the movement of the spring under test without having to try to observe a gauge scale at the same time.
Distributed in Ontario by Prince and Roberts, 61 Charles St. W., Toronto.

10 Kw Television Transmitter

A new concept in T.V. Transmitters is presented in the Standard Electronics 10 k.w. Transmitter featuring lower initial cost — lower installation cost, all units self-contained — lower operation costs. Only 30 k.w. at 90



per cent power factor — black level and lowest prices with longest life amplifier tubes.

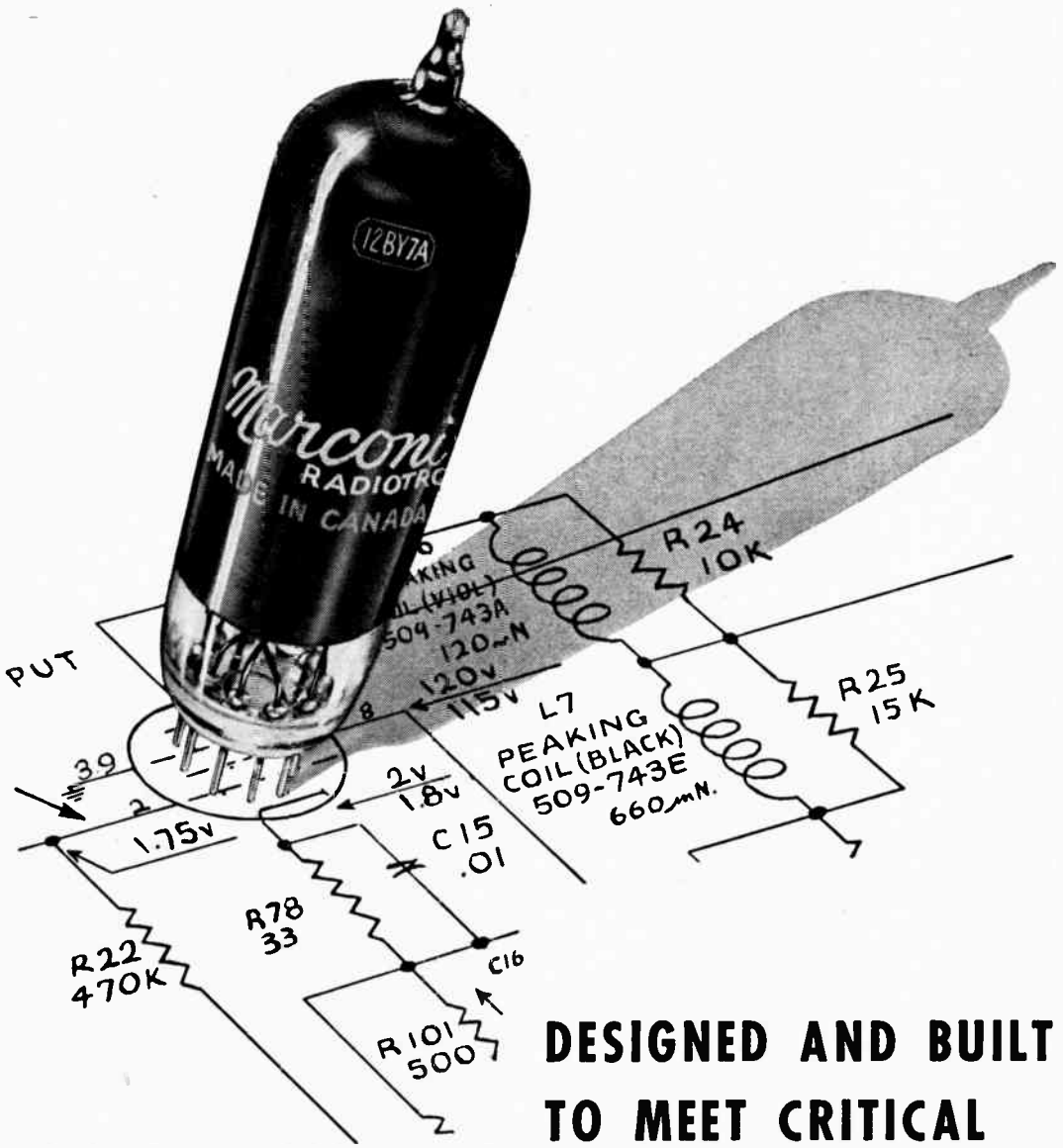
Address enquiries to:
Canadian Westinghouse Co. Ltd., Electronics Division, Hamilton, Ont.

Note...

The Editors of Electronics and Communications have endeavored to compile as complete a directory of the Canadian electronics and communications industries as possible including listings of Canadian manufacturers, sales representatives and the firms they represent.

Due to the extensive ramifications of these industries and the many categories of related components and types of equipment which could be numbered in the thousands it has been necessary to compile this addenda to the September - October 1955 Directory Issue of Electronics and Communications.

Readers are requested to remove pages three to ten of this issue and insert them in the September - October 1955 Directory Issue in order to bring the Directory Issue completely up-to-date.



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ELECTRONICS and COMMUNICATIONS

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

NOV. - DEC. - 1955
VOL. 3 No. 6

EDITORIAL CONTENTS

FEATURES

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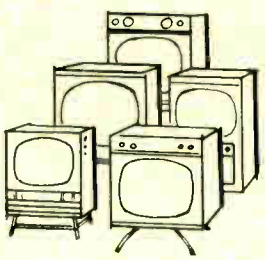
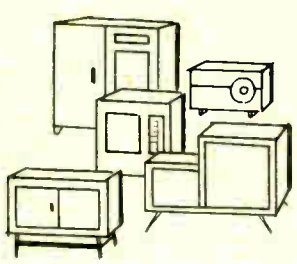


In Television, high voltages put extra strain on set components. Tubes must be able to take it! That's just one of the reasons why forward-looking manufacturers use Westinghouse as original equipment.



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business briefs & trends

★ Maj. Gen. Francis L. Ankenbrandt, Director of the Joint Communications Electronics Committee of the U.S. Joint Chiefs Of Staff, estimates that approximately 15 per cent of the entire defense department budget of 34 billion dollars for 1956 will be spent on electronic and communications equipment.

* * *

★ The first meeting of the special RETMA Policy Committee on the Royal Commission, recently formed under the chairmanship of R. M. Brophy, was held recently in Toronto. Carl A. Pollock, RETMA President and a member of the committee, said that the committee was established as a policy and steering group to direct a Task Group of market research and other industry specialists in compiling information to assist the recently-appointed Royal Commission on Canada's Economic Prospects.

* * *

★ Total value of orders for electronic and communications equipment placed by the Department of Defense Production in the period of September 1st, to September 30th, amounted to $1,413,592. This figure includes only those contracts in excess of $10,000 and does not include the value of contracts placed for classified equipment.

* * *

★ The Radio-Electronic Television Manufacturers Association of Canada reports that: "For the first time since sales of television receivers started in Canada, in 1949, the monthly sales have exceeded 100,000 units. During September 119,724 television sets were sold, a 45 per cent increase over September, 1954. Previous highest monthly sales was in November, 1954 when 93,649 units were sold. The September figures show a 68 per cent increase over the 71,108 television sets sold in August of this year."

* * *

★ Dr. W. R. G. Baker, General Electric Co., Vice-President told the Boston, Mass., Conference on Distribution that the rapid development and application of electronics to the field of industrial communications together with the use of closed circuit television and the use of electronic computers is already having a pronounced effect on marketing and distribution. Dr. Baker told the gathering that two-way radio and other developments will help management "achieve new precision in eliminating costly product development errors".

* * *

★ Robot thinkers — devices to replace human brains in industry — will not result in widespread unemployment as many have feared, a noted automation authority has declared. Addressing dinner meeting of the Los Angeles section of the Institute of Radio Engineers, Dr. Dean E. Wooldridge, president of the Ramo-Wooldridge Corporation, said: "Ultimately, a major portion of the processing data that now occupies the routine attention of thousands of people will be accomplished automatically. A large fraction of the repetitive activities of factory workers will be done by the use of new automation techniques." But the direct results of this spreading industrial revolution, Dr. Wooldridge predicted, will be a large increase in national productivity and a better life for all. "Hundreds of thousands of people will be employed by companies engaged in the various branches of automation," he said, "with annual sales reckoned in billions of dollars." The electronics expert said that automation will also result in the appearance of new products, whose design and production will be for the first time economical.

★ Admiral's 5,000,000th television receiver will come off the production line at the end of this month, according to Vincent Barreca, president of Canadian Admiral Corporation. Company plants in Canada and the U.S., Mr. Barreca estimates, have consumed over 10,000,000 miles of wire of all types in producing television sets. For the operation of these five million receivers, more than 100,000,000 picture and receiving tubes were required. Admiral TV sets placed side by side would reach from Halifax to Windsor — about 1,500 miles.

* * *

★ The first section of the transatlantic cable is reported to have been completed in the last week of September. The Scotland-Newfoundland section of cable is scheduled to be laid next summer with anticipated commencement of service some time toward the end of 1956.

* * *

★ It is expected that by the end of the summer of 1956 a VOR airway will be commissioned between Montreal and Windsor. Equipment is on hand and is being installed between Toronto and Windsor and consideration is being given to placing shortly a further large order for equipment for most of the Prairie stations and those in eastern Canada.

* * *

★ It has been realized for some time that, with the increasing speed of modern aircraft, coupled with the increased volume, more precise control of their movements must be exercised over greater distances. This involves knowing more accurately the position of the aircraft being controlled. To accomplish this, consideration is being given to ordering surveillance radar equipment for 15 of the major airports, including Toronto, which will enable traffic controllers to see aircraft as small as military jets at a distance of 90 miles and at elevations up to 60,000 feet.

* * *

★ A new type of hands-free telephone by which a telephone user can carry on a conversation from as far as 20 feet away from the instrument, or by which a large group can participate in a telephone conference without passing a bulky instrument from one to another, has been announced by the Stromberg-Carlson Company, a division of General Dynamics Corporation.

This new instrument, offering several advantages over other types of hands-free, or loud-speaking telephones, was introduced at the USITA convention last month.

* * *

★ Employment of "synthetic intelligences" in future automation systems and the responsibility of university training in meeting the challenge, was discussed recently by Dr. Simon Ramo, executive vice-president of The Ramo-Wooldridge Corporation, in a symposium at the Statler Hotel honoring Dr. Gordon Sproul's twenty-fifth anniversary as president of the University of California.

"Anyone brave enough to challenge the idea that in a few years the replacement of man's brains will be the top industry of the nation is in danger of having his brains amongst the first to be replaced," the scientist said. "Because of major changes now being made in electronics, this industry is riding high, if not at the top, in influencing university training in the future and it rapidly is becoming the greatest industry user of university graduates."

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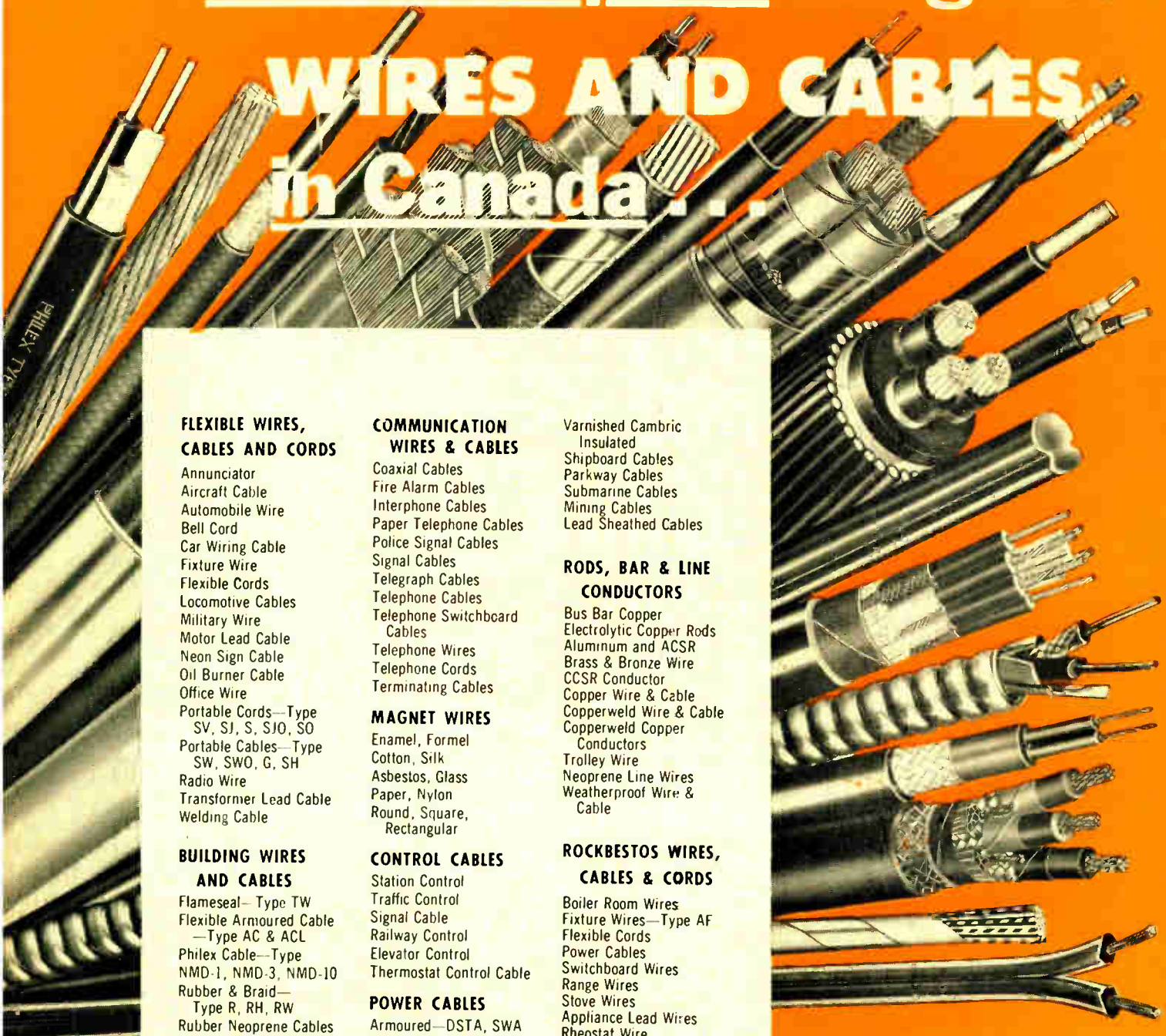

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ELECTRONICS & COMMUNICATIONS

Automation - No Threat To Jobs . . . !

Automation is no threat to jobs, but, on the contrary, our American economy "desperately needs automation to maintain our standard of living with the onrush of our population increase."

This conviction was expressed recently by Robert C. Tait, president of Stromberg-Carlson Company, a division of General Dynamics Corporation, in testifying before the Subcommittee on Economic Stabilization of the Joint Congressional Committee on the Economic Report. Mr. Tait's remarks, we believe, are equally applicable to the Canadian economy.

Citing the telephone industry, as an example, Mr. Tait pointed out that "the introduction of the dial telephone displaced large numbers of telephone operators". Yet, he continued, "despite the terrific pace with which telephone companies have been modernizing their plants and installing dial phones and automatic equipment, including now completely automatic toll ticketing systems, there are more people employed by the telephone companies today than ever before".

Actually, Mr. Tait declared, automation "may be a lifesaver at this particular time in our history when we are facing a more rapid relative increase in total population over the next decade than in the work force". That is, he explained, the big increase in population is taking place in the very young, and in the over-65 groups, rather than in the work force age.

To produce the goods that will be required by this rapidly growing population, one large industry has estimated that by 1964 it "will have to produce twice the volume of goods produced last year, with only 11 per cent more people on its payroll," Mr. Tait related. Adjusted for a probable decrease in working hours during this period, this means that ten years hence that company's employees must produce about twice as much for every hour of work as they did last year, he pointed out.

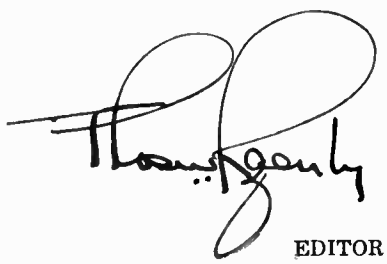
"Automation in every conceivable direction, from blueprint to the shipping dock, is the only answer to this situation," Mr. Tait declared.

He also called attention of the Congressional Committee to the fact that "automation is being directed largely toward manufacturing processes, and manufacturing provides only about 30 per cent of total employment". In view of these facts, he continued, "even if we applied all that we know about automatic controls, regardless of costs, only a small segment of the labor force would be affected.

"Rather than mass unemployment as a result of automation," Mr. Tait declared, "we face a labor shortage over the next ten to twenty years."

"What should be of greater concern than the impact of automation," Mr. Tait told the committee, is "the availability of human engineering talent."

"We are really getting into a serious situation in this respect, for we are graduating far fewer engineers than our industry needs now, let alone in the future," he declared. "Even if we persuaded twice as many qualified students to take up engineering in the future as are now entering these fields, it would take years before we could catch up with the shortage."



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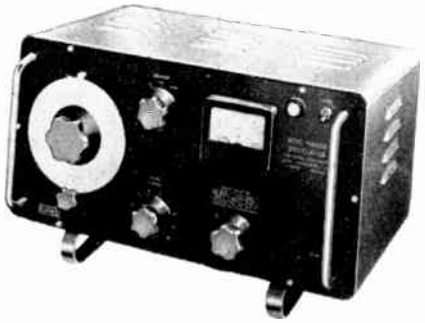

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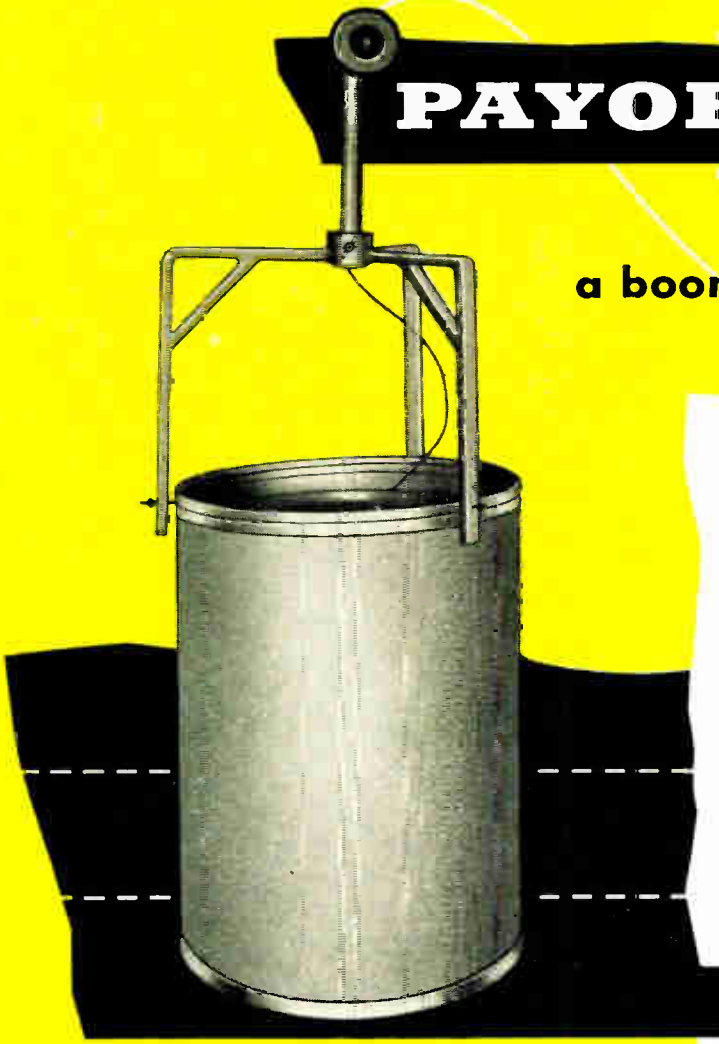

a boon to users of FEDERAL magnet wire

Fabricators simply open this amazing new container and thread the machine. The wire pays off like a fisherman's line from a spinning reel. There are no backlash, overrun or inertia problems and—most important—no stops.

Saves Time—Saves Work—Saves Money.

One Payoffpak container holds 600 lbs. of magnet wire—replaces 8 reels.

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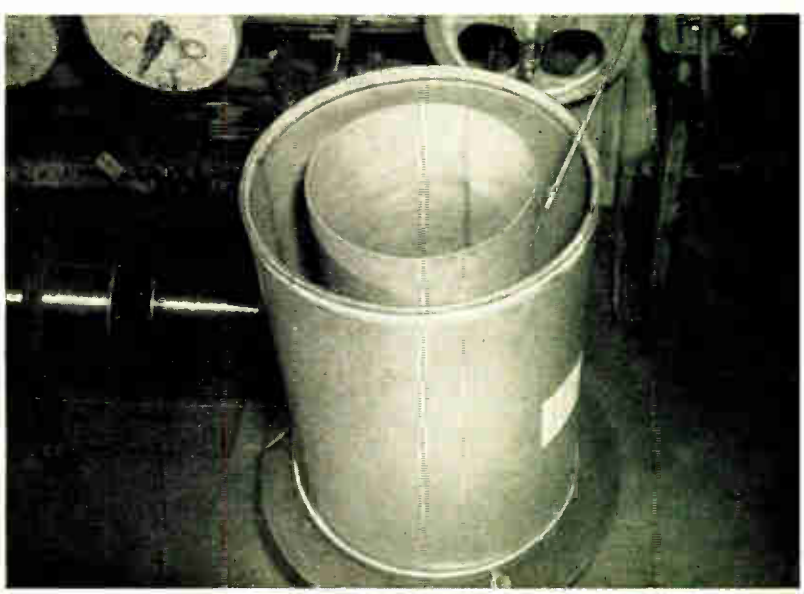
Interlocking tops and bottoms allow storage in a minimum amount of space.

Made of tough, reinforced fibre—standard-size container weighs only 22 lbs.

Speed up your production with Payoffpack—improve your product with Federal Magnet Wire!



FEDERAL Wire and Cable Company Limited
GUELPH, ONTARIO

5508

A LETTER FROM STATION CFAC,
CALGARY, ALBERTA

E. C. CONNOR
Technical Director
Broadcast Station CFAC
Calgary, Alberta

AN AMPEX FALLS —AND PROVES ITSELF!

An accidental fall really proved the ruggedness of one of our Ampex 600's. It had had to be located on a narrow shelf four feet above a cement floor in an industrial building. Despite precautions someone pulled on the microphone cable at precisely the wrong moment and the recorder landed on one corner on the floor. The Ampex continued to record, and to the surprise of all concerned, it was impossible to detect the spot on the tape where the machine had fallen off the shelf. The only damage to the recorder was a displaced hold-back tension spring.

At present we have in service two Ampex 401's, two 403's, two 350's and two 600's. Required servicing has been much less than anticipated, and all are within specifications. To say that we are enthusiastic about the performance of our Ampex recorders could be considered an understatement.

Sincerely,

BROADCAST STATION CFAC
Earle C. Connor
E. C. Connor
Technical Director

THE AMPEX 600 WAS DESIGNED BOTH FOR USE AND ABUSE

When the 600 was first developed, Ampex engineers performed a test similar to CFAC's accidental drop—not by accident, but quite intentionally. Also, the Ampex 600 was given running tests equivalent to an estimated 10 years of service. These are reasons why the price you pay for an Ampex buys both the finest performance available and the most hours of service per dollar.

AMPEX
AMERICAN CORPORATION

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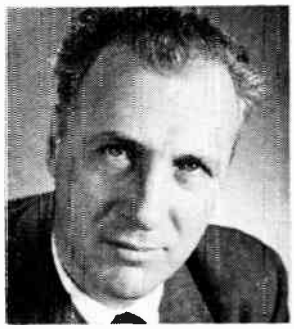

The Editor's Page.

The following correspondence has been received in answer to a commentary made last month in The Editor's Space with regard to an address delivered by His Eminence the Cardinal Archbishop of Montreal, which dealt in some respects with automation and labor. Since the commentary was based on press reports the following broader concept of the Cardinal's remarks are published below.

* * *

Editor,
Electronics and Communications,
Toronto, Ontario.

Dear Sir:

In the recent directory issue in a column titled "The Editor's Space" you dealt with a commentary by Cardinal Leger on the subject of automation. Knowing the Cardinal, I was quite sure the impression you gave of his address was not correct. I therefore forwarded this to His Eminence and enclosed is a reply from Reverend Alex Carter which I am sure you will agree, after reading, puts an entirely different light on the Cardinal's address.

The point I feel we are dealing with here, is the prevalence today of the press in quoting people out of context in an effort to slant the public opinion along the lines of the editor's thinking. No doubt your own acquaintance with the Cardinal's remarks were limited to those that you secured from one of the Montreal or Toronto daily papers. While freedom of the press is certainly a fundamental of a true democracy, there is also a corresponding responsibility to publish the facts in so far as that is possible.

Might I also take this occasion to compliment you and the staff of *Electronics and Communications* for pioneering a very good trade publication for the electronics industry. Your recent trade directory is a high point in your continued progress and improvement in this particular publication.

Sincerely,
P. J. Heenan.

* * *

Electronics and Communications,

Dear Sir:

The attention of His Eminence the Cardinal Archbishop of Montreal has been called to an article written in your publication, under the title of "The Editor's Space". It dealt largely with a commentary on certain observations made by His Eminence in a sermon delivered to the workers at St. Joseph's Oratory on Labor Day this year. The remarks in your article did not show understanding of the sermon which Cardinal Leger gave on that day. This is not too surprising when you consider that they were based upon a few excerpts taken completely out of context and, I may add, not too exact in every instance. To clear up any misunderstanding in this matter, I have undertaken on the instructions of His Eminence to summarize the remarks which he made on that occasion.

In his sermon of Labor Day His Eminence was discussing the present condition of the worker. He commented on the double revolution, technical and philosophical, which the world has witnessed during the last century. The Cardinal did not decry the technical revolution as such. Indeed he mentioned a happy consequence, namely, the increase of efficiency of human work. The unhappy consequence of which he spoke was in no way a lamenting of improved technical procedures. He merely described the dangers inherent in our present economy, due to the fact that the social change and social thinking did not develop in equal proportion to the technical. He gave as an instance the concept of the absolute and unlimited right of private property and showed the dangers of this concept when applied to a small number who, due to their large productive holdings, could influence and control the subsistence of a large number of workers. In pointing out the possible injustice which would result from the belief that a person has a right to use, abuse or destroy his own property regardless of the welfare of the workers, His Eminence was merely applying a fundamental of Christian social teaching.

The second point made by His Eminence was the philosophical revolution. He spoke of the time when men realized their own inherent weakness. They sought to safeguard themselves by the forming of guilds which guaranteed certain basic points of justice. This was in contrast to economic liberalism which would sacrifice man to the law of supply and demand and which at one point risked to dehumanize him with assembly line methods.

Now we come to the point which seems to have caused all the furore. His Eminence, continuing his line of thought as applied to both technical and philisophical development, pointed out that with increased automation: first, the power of production could be left in the hands of a few; second, if humanity adheres to Marxist ideology "the mass of people cut away from God will be nothing more than a pile of flesh debased by pleasure and degraded by surrounding weakness". We would like to point out that this latter part was applied to the results of Marxist thinking and not to the fact of the forthcoming automation. This is easily seen in the context by His Eminence's subsequent remarks. He refers to the 16-hour day as a nightmare of the past. He states it is not the mission of the Church to interfere in the affairs of the world with a view of changing the technical structure of society. He pleads with employers for human working conditions and home conditions for the workers favorable to the development of man's dignity and the fulfillment of his divine vocation. Finally he calls on both employers and workers to restore man's dignity, especially as increased leisure will play a large role in this human development and human culture. He comments that it would be a great pity to lose this chance to increase personal dignity and to allow themselves, as a result of the Marxist philosophy to be submerged in a collective mass.

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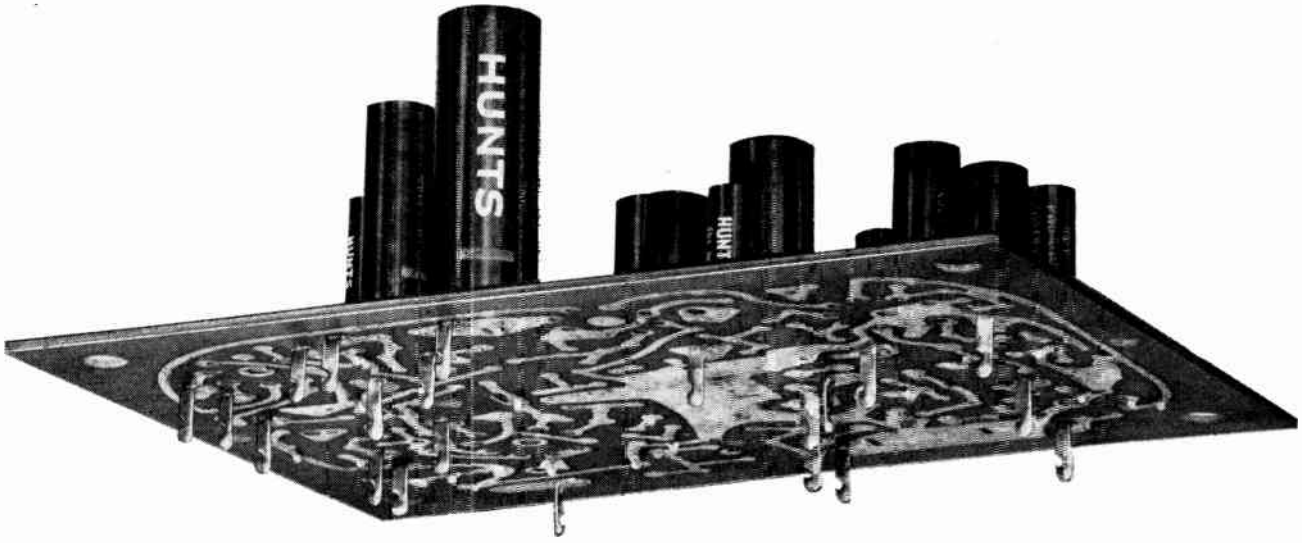
For further data on advertised products use page 99.

now... capacitors for printed circuits



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Hunt plug-in PW Series Capacitors are speeding production and cutting assembly costs for major Canadian TV and radio manufacturers. Their outstanding success and rapid acceptance is due to their reliable high quality, rugged, long-life construction. Hunt PW Series Capacitors are enclosed in a rigid, high-strength tube of molded bakelite and sealed with an epoxy resin of great adhesive power and noted ability to resist moisture.

The tinned copper leads, cut to the customer's specified length, are extended from the same end of the tube and held in place to close tolerance to assure ease of use in printed circuit boards. Hunt plug-in PW Series Capacitors meet and exceed Canadian demands for automation programs within the electronic industry.

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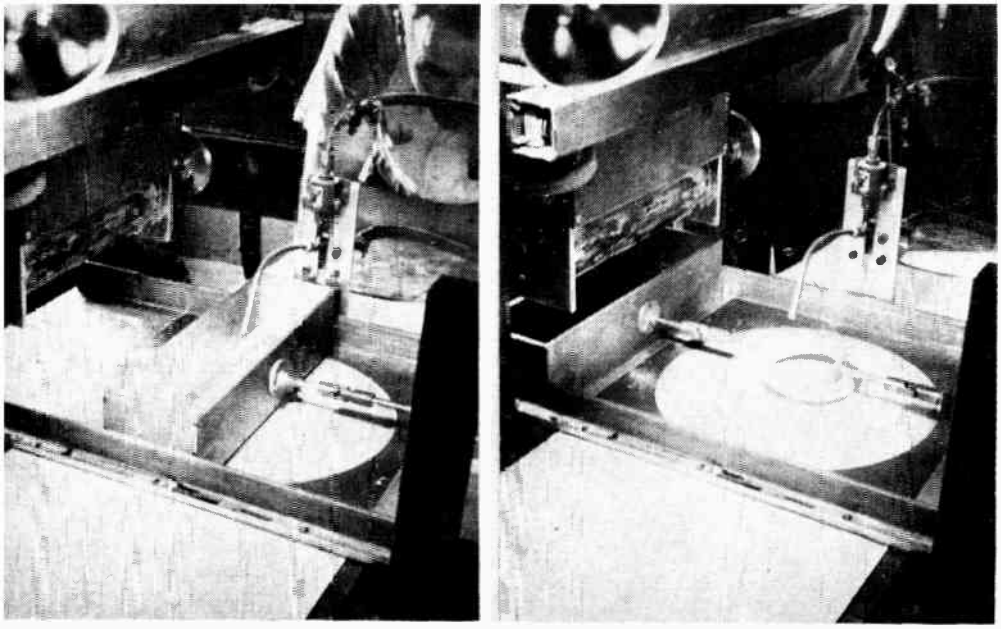

● Pouring the powder into the biscuit form. Note the tube which sucks out powder where the hole will be.

Microfusion Process For Long-Playing Records

By GARETH ROLLAND

A new and revolutionary method for processing long-playing records known as the "microfusion process" has recently been announced by officials of Cook Laboratories Inc. Basically a new idea it is anticipated that the development will have a startling and dramatic effect on the ears and pocketbooks of all hi-fi fans and it has been termed by those concerned with its development as the greatest advance in records since the LP ousted the 78 shellac.

The problem of noise confronts both manufacturer and customer at every turn. Vinyl seemed to be the answer to a major part of this problem. In most plants additives are used to make a quiet surfaced recording. However the "soft" and pliable record that results just won't stay quiet! As the grooves are pliable the stylus pushes them around or is in turn pushed by them. Obviously the correct tracking of all the high frequencies is impossible. The original lacquer master is as quiet as the grave but getting thousands of duplicates in the hands of the music lovers is not an easy matter. After all, the original lacquer master doesn't have to stand repeated playings whereas the commercial copy gets the full treatment, sometimes played every day. Dust and perspiration from eager hands also take a heavy toll.

In the "Microfusion" process, records are manufactured from the purest vinyl: No additives are used. Pure powdered vinyl is the best record material known. It behaves however like a pie crust. The more you work it the worse it gets. With vinyl, "the first time you mold it, is the last good time". The current method entails pre-heating the vinyl until it becomes a gelatinous mass of solid plastic. In this form it is fed to the press. With "Microfusion" the pure vinyl powder becomes the record in a single step. There is no working. The resultant record is a quiet and faithful replica of the original lacquer. And what's more it stays that way.

No Bogies Employed

Until "Microfusion", it would have been extremely difficult to mold pure unadulterated vinyl. Cost alone would have rendered the project prohibitive. "Microfusion" makes this possible and the ensuing record has harder grooves with much better and more complete tracking of the highs. This means brighter highs with less progressive distortion of actual high frequency content.

Ever buy your favorite soprano only to find that she had the "wavers"? You darkly suspected turntable trouble only to discover that you'd bought a record with the "wow" built in. This means a stretched "stamper" distorted by steam, pressure and continued use!

"Microfusion" doesn't employ either of these "bogies". Molding is gentle

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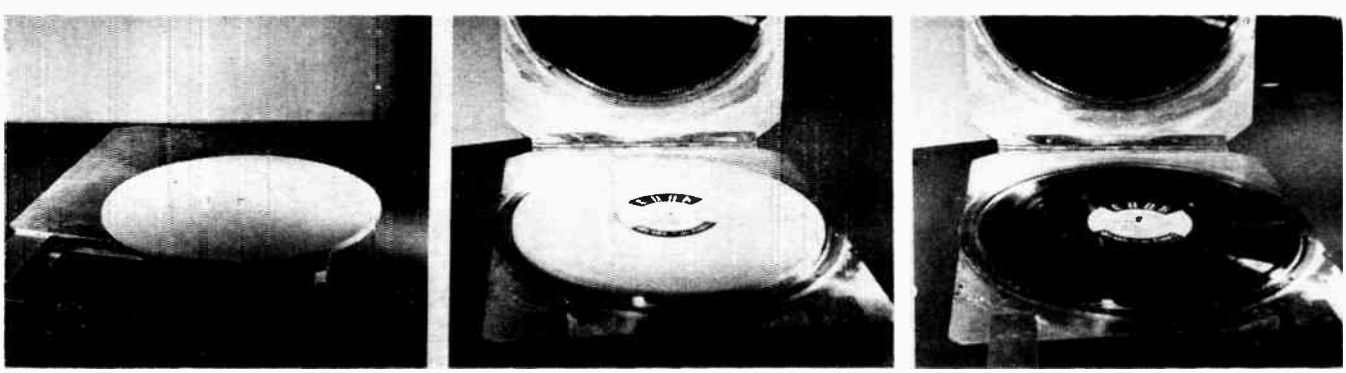
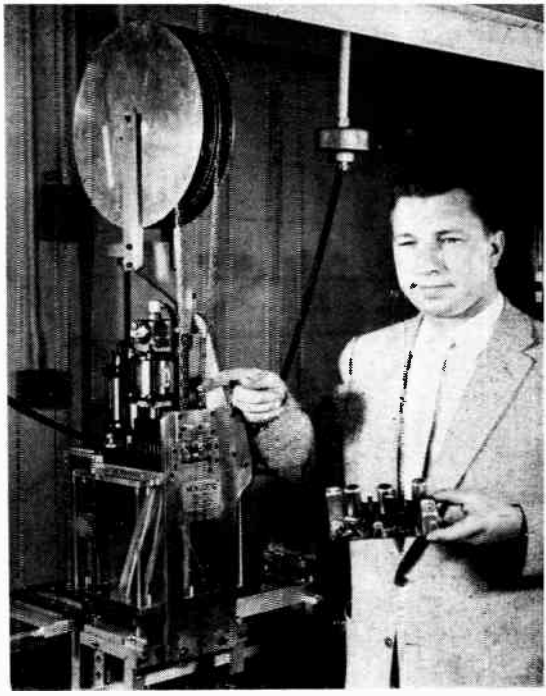


Left: Pure vinyl "Biscuit" formed by gentle heating of the powder. *Center:* Biscuit in press with label applied. *Right:* Completed record.

Automation From Printed Circuits To Mechanized Assembly

By PAUL MAXIMOFF
Malco Tool And Mfg. Co.



● Paul Maximoff, Malco Tool and Mfg. Co., pointing to self-retaining terminals used in assembly of printed TV circuit.

Introduction of printed circuitry, while a milestone in electronic progress, was not in itself the impetus for the great strides that industry has taken toward automation. However, it was the development which opened the door to new and faster techniques, highly improved production methods and the reduction of human error.

As always the case with progress such as this, it created the need for skilled operations and precision machinery.*

An entirely new form of electronic circuitry, the printed circuit board was readily adaptable to mass production assembly and soldering techniques. Developments in this respect were rapid. Soldering operations and devices quickly conformed and special printed hardware to facilitate terminal connections was introduced.

Among the first developments in printed circuitry hardware was the Malco miniature self-retaining tubular pin terminal. This terminal is designed so that two beads on the lower part of the pin terminal depress and snap out when inserted in the printed circuit board, thus locking them in. Not only does this eliminate roll-over operations, but it permits insertion of pigtails into the receiving holes of the terminals at either the top or bottom of the board. Flanging the bottom hole of the terminals allows additional wrap-around connections.

Companion to these was the development of a female contact which fits to the top of the tubular pin for quick connect and disconnect applications. Wire wrap terminals for use with wire wrapping machines have also been developed.

Obviously, manual insertion of these terminals would be both tedious and time consuming. However, by producing them in chain form and on reels and by using automatic insertion equipment the operation becomes fast, accurate and completely automatic.

This was accomplished in the development of the Malco Automatic Pin and Contact Inserting Machine, along with equally automatic crimping equipment and also staking equipment for the wire wrap type terminals.

Perhaps the most important of these is the inserting machine which inserts up to 40 or more terminals in three seconds, turning out 1200 complete printed circuit boards per hour.

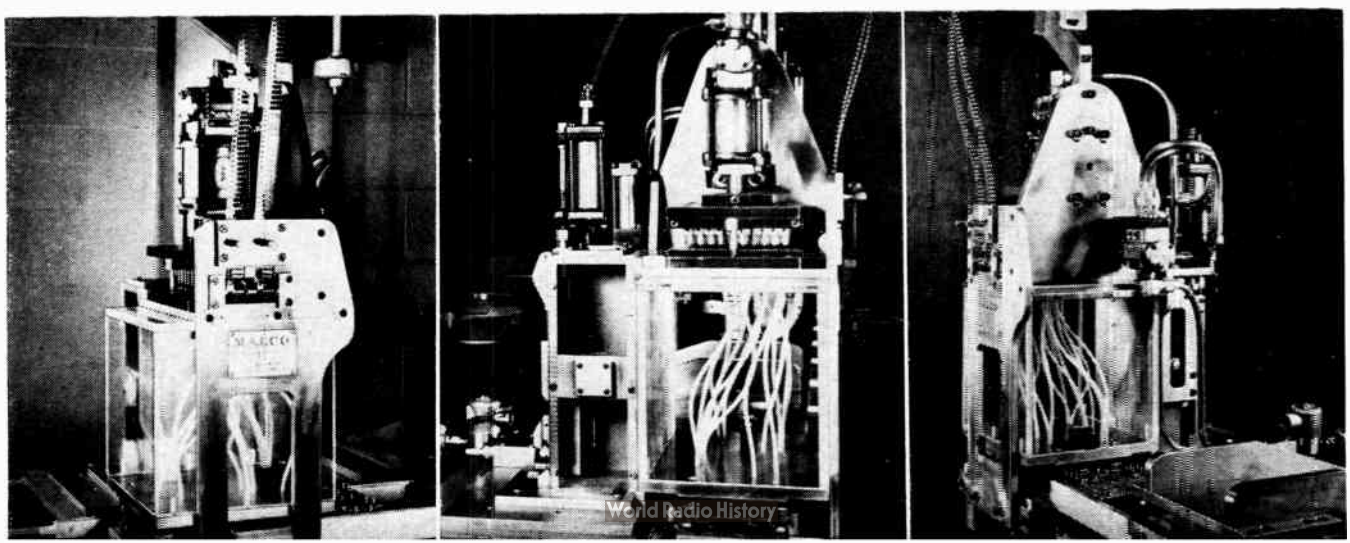
Tubular pin type terminals in continuous chain form are fed from two reels, threaded through rollers, and passed through a die where they are automatically formed and severed from the carrying strip when the punches descend. They are then deposited into individual plastic tubes, which in turn are directed into any symmetrical or non-symmetrical pattern the printed circuit board may call for. The tubes and individual jig bored bushing are enclosed in a plastic and aluminum box which can be quickly removed from the machine and replaced with new box when the circuit pattern is changed.

After the pins have fallen into their respective bushings, a vibrator is actuated, thus facilitating the nesting of the pins into the board. This portion of the cycle is reached when the printed circuit board is raised by a platen to register against the master pattern box by pilots under the first station head.

When the platen recedes to transfer position, the strip with pins attached is automatically advanced for the repeat cycle.

(Turn to page 68)

● *Left:* Front view of Malco automatic pin and contact inserting machine. Self-retaining terminals in chain form are fed from two reels (not shown) through cut off and feeding mechanism and dropped through tubes into printed circuit board. *Center:* Rear view of Malco automatic pin and contact inserting machine, showing cut off and feeding mechanism. *Right:* Malco automatic pin and contact inserting machine with second stage in foreground. In second stage, platen presses inserted terminals into board, engaging self-retaining snap-in feature.



Microwave Engineering Applications of the Ferromagnetic Faraday Effect - - -

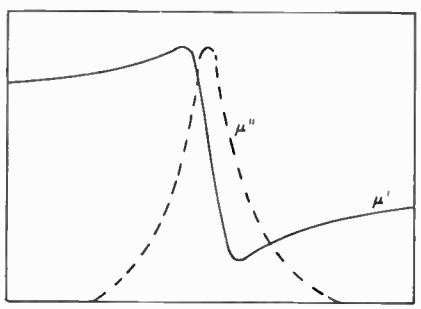
By W. W. H. CLARKE, B.Sc., Ph.D., A.Inst. P., A.M.I.E.E., P.Eng.

Defense Research, Telecommunications Establishment, Electronics Laboratory.

As a direct result of the development of ferrites for high frequencies, special ferromagnetic effects have become significant in microwave engineering. The physical basis of these effects is presented qualitatively, with particular reference to the rotation of plane of electromagnetic wave polarisation in the presence of a longitudinal magnetic bias, which is the Faraday effect. The rotation is non-reciprocal, and has formed the basis for design of novel microwave components with properties of uni-directional or variable propagation depending on a fixed or variable longitudinal magnetic field. Similar non-reciprocal properties may be excited by transverse fields in components where the geometry is unsymmetrical. Exploitation of the new microwave facility has been rapid, so that several commercial designs are now readily available, while further development work is proceeding in many places, employing the Faraday and related effects.

This article is intended to provide a fundamental qualitative picture of wave propagation in magnetised ferrites from an engineering aspect, to show how the Faraday effect can be employed in a variety of novel applications, and to explain the properties of typical components which have been developed by various workers.

THE Faraday effect is the change of polarisation of a plane electromagnetic wave as it passes through a magnetised ferromagnetic medium. This paper is concerned with the Faraday effect at microwave frequencies, with its explanation, and with its application through the medium of high resistivity



VARIATION OF $\mu = \mu' - j\mu''$ WITH FREQUENCY — $\mu' = 1$ AT RESONANCE

FIG 1

ferrites, which provide reasonably low attenuation of electromagnetic waves.

In simple terms, the bound electrons in a ferrite precess about the magnetisation vector at a frequency proportional to the magnetic field; hence the "precessional vector" lies along the magnetisation vector. A plane electromagnetic wave may be regarded as the sum of two contra-rotating circularly polarised components, whose propagation constants are differentially affected by the precession. This difference is a maximum when the precessional and Poynting's vectors are aligned. Owing to the differential phase delays of the circular components, their resultant is a plane wave with polarisation changing throughout its path in the medium.

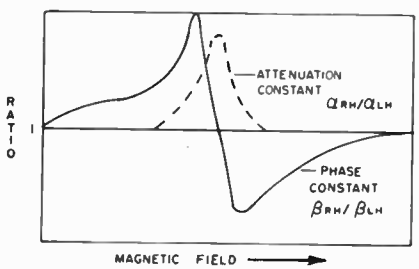
A number of recent engineering developments have been concerned with the Faraday effect at microwave frequencies [1-10]. This had been predicted but was not realised until ferromagnetic materials were developed [11-16] with sufficiently high resistivity to be transparent to microwaves. High resistivity reduces eddy current losses in the new ferromagnetic materials, which are known as ferrites, permitting microwaves to be passed through them with small attenuation. The Faraday rotation is then apparent and can be employed in microwave engineering applications [8-10, 17-22].

It is apparent that many applications of non-reciprocal transmission properties of ferrites [23-26], caused in particular by the Faraday effect, are being developed. Behind the Faraday effect and its development for microwave applications there are also a number of theoretical papers, concerning the Faraday effect itself [4, 27-30], ferromagnetic resonance [1, 31, 32, 33] which occurs when the precession frequency becomes equal to the microwave frequency, and general propagation in gyromagnetic media [34, 35]. In most practicle cases, gyratory transmission lines with longitudinal magnetisation behave in a manner which may be almost entirely explained by a simple non-reciprocal rotation of the plane of polarisation. The uses of the Faraday effect are more developed than the uses of non-reciprocal behavior introduced by magnetic fields perpendicular to the direction of propagation.

Ferrite devices for microwave isolation, duplexing, modulation and switching are becoming well known and this paper discusses some examples of these, and their behavior. Other possible applications of ferrites at microwaves are mentioned.

The Faraday Effect

All electrons possess a gyroscopic moment, J, and a magnetic moment, M,



BEHAVIOUR OF PROPAGATION CONSTANT FOR LEFT- AND RIGHT-HANDED CIRCULARLY POLARISED WAVES

FIG 2

which causes them to precess in a magnetic field. When in a normal orbital position, these gyromagnetic properties are almost cancelled by the nucleus and other electrons, leaving only the usual small para- or dia-magnetic behavior.

However, the outer electrons of certain atoms are, in a crystal lattice, held at some distance from the nuclei by interatomic forces and exhibit their full gyromagnetic property. This is known as ferromagnetism.

The precession frequency of an electron in a field H is given by:

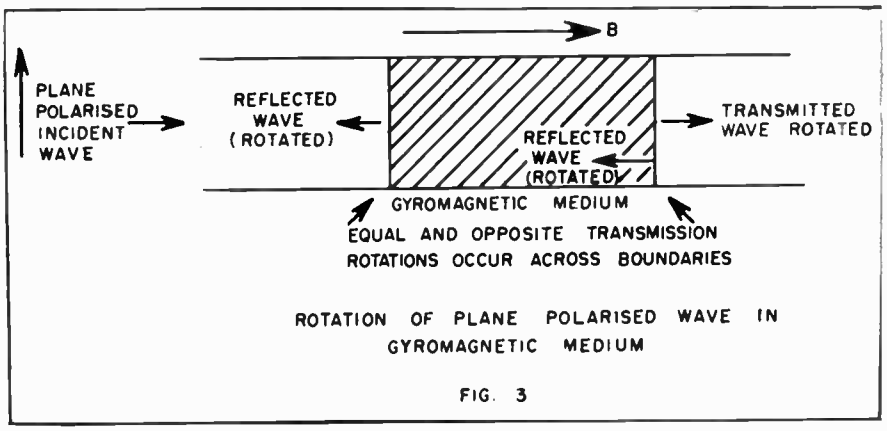


FIG. 3

$$f = \frac{M}{J} \cdot \frac{H}{2\pi} \quad \ldots . \quad (1)$$

For a field of 3000 gauss this gives a frequency of the order of 10,000 Mc/s. Hence an incident wave of that frequency will have a circular component rotating with the same frequency and sense as the precession, which is the phenomenon of ferromagnetic resonance.

Ferromagnetic resonance introduces a dividing line in that the Faraday effect has the opposite sense for frequencies above the resonance to that for frequencies below the resonance. This is implied by the behavior of the permeability near resonance shown in Fig. 1 for a circularly polarized wave. The complex permeability is μ where:

$$\mu = \mu^1 - j\mu^{11} \quad \ldots . \quad (2)$$

According to the classical interpretation, the precession rate of the electron spins is an effective addition to, or subtraction from, the frequency of the incident wave, depending on the (circular) sense of the polarisation insofar as the propagation constants are concerned.

Hence, (with constant permittivity) the velocities for the two polarisations are proportional to the values of $(\mu)^{-\frac{1}{2}}$

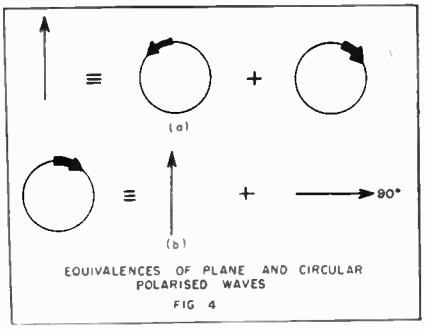


FIG 4

at frequencies $f + \Delta f$ and $f - \Delta f$ where f is the actual microwave frequency and Δf is the precession rate. This leads directly to the change of sense of the Faraday effect at resonance. Though not rigorous, these considerations lead to an appreciation of phenomena, which Polder and Hogan[8] have explained with rigorous mathematics for the case of an infinite plane wave in material with assumed damping characteristics typical of the shape of the ferromagnetic resonance curve. Figure 2 shows the difference between polarised waves at different frequencies with constant magnetisation. Predictable application of the Faraday effect is easier at magnetic fields below resonance, and from the engineering point of view requires lower driving currents for the fields.

In most engineering applications it is not desirable to operate too close to resonance owing to the differential attenuation of the two wave components, to the general high loss region near the maximum of μ^{11} and to the zero difference of velocities occurring in the resonance transition. Control of the Faraday effect in this region necessitates control of small changes in, or deviations of, a field which is large.

Simple Gyrator Operation

The foregoing description of fundamental processes implies that plane polarised waves with any orientation of polarisation are transmitted as well as circularly polarised waves. Hence in applications of ferrites circular guide is commonly used, and selection of particular planes of polarisation is accomplished by junctions of circular guide to rectangular guide of substantially the same impedance. Simple gyrator operation is now described in detail with respect to circular guides, and the ideas developed are then extended to include plane polarisation filters (rectangular guides) at input and output of a gyratory circular guide.

With reference to Figure 3 a plane polarised wave incident from the left in the transmission line will cross the boundary into the magnetised ferromagnetic material and will suffer a small instantaneous rotation, and there will be a reflected wave of rotated polarisation. These rotations are usually small and are due to the Kerr effect; equal and opposite (Kerr) effects occur on leaving the gyromagnetic medium. Hence the net rotation of the transmitted wave is only that due to the Faraday effect. All the rotations described can only occur when there is magnetisation along the direction of propagation, and they depend on the existence of different propagation constants for LH and RH circularly polarised components, whose equivalence to one plane polarised wave is indicated in Figure 4(a).

The difference in propagation constants is manifest as two differences — in phase constant and in attenuation constant; the former producing Faraday rotation, and the latter generally producing a transmitted wave comprising two unequal circular components (LH and RH), equivalent to one elliptically polarised wave. Figure 4(b) illustrates the equivalence of two plane polarised waves with polarisations at right angles and also 90° out of phase, to one circularly polarised wave. Thus the general case of an elliptically polarised wave transmitted resolves into two unequal circular components and thence into four plane polarised components which add vectorially in pairs. If A_L and A_R are the amplitudes of the LH and RH circular components respectively, they resolve into one plane component of amplitude $A_L + A_R$ polarised in the direction in which the circular components add and another of amplitude $A_L - A_R$ polarised (at 90°) in the direction in which the circular components subtract. These conditions are illustrated in Figure 5. Unequal circular components cannot add to form a plane polarised wave, but are representable by two unequal plane waves at right angles to one another. Therefore, when the emergent wave is elliptically polarised and is fed to rectangular waveguide, there is a further loss of power, by reflection, and by the excitation of evanescent modes in the rectangular waveguide.

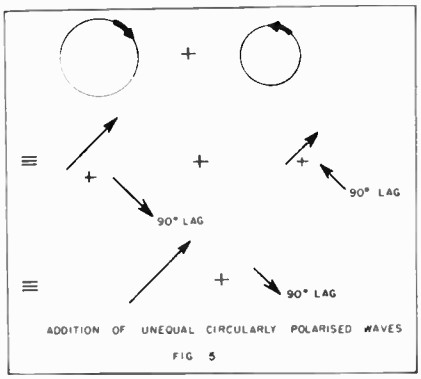


FIG 5

The useful gyrator is one in which the attenuations of LH and RH circularly polarised waves are both low. Then a rectangular waveguide, accepting only one component of plane polarized wave, may be used beyond the gyrator, with its "acceptance polarisation" at any orientation with respect to the input polarisation. Where the angle between the input and output polarisations is Θ as in Figure 6, M is the magnetisation (positive in the direction which rotates towards the output polarisation), l is the length of the gyrator, and K is a constant, then:

$$\phi_1 = KMl - \Theta \quad \ldots . \quad (3)$$

where ϕ_1 is the angle which determines the transmission. The energy transmitted is given by:

$$\frac{W_{out}}{W_{in}} = \cos^2\phi_1 \quad \ldots . \quad (4)$$

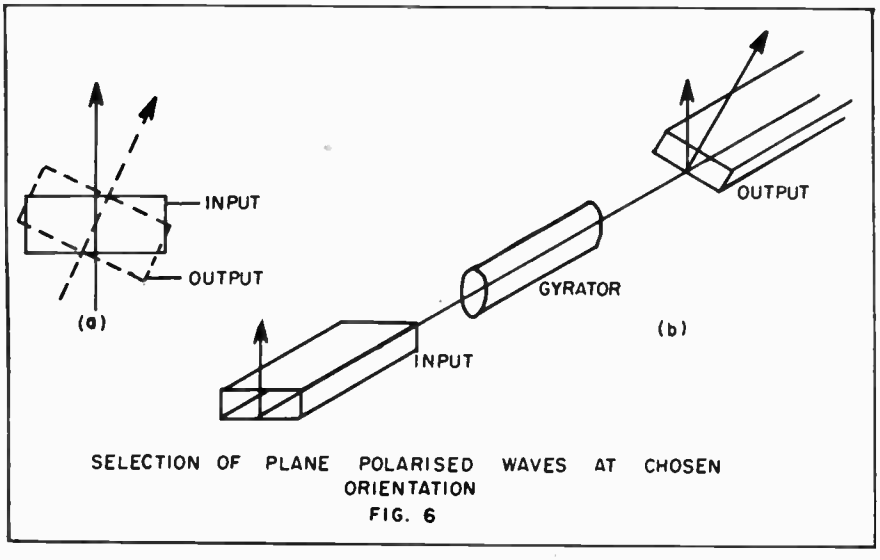
This neglects multiple reflections on the assumption that they are absorbed for polarisations at 90° to the input polarisation at the junction of input guide and gyrator, and at 90° to the output polarisation at the junction of the output guide and gyrator.

(Turn to page 32)

Without absorbers, the energies in the successive reflected waves will be

W_{in} $(1 - \cos^2 \phi_1)$ reflected from second boundary.

$W_{in}\sin^2\phi_1 \cos^2 \phi_2$ reflected wave transmitted across first boundary.



SELECTION OF PLANE POLARISED WAVES AT CHOSEN ORIENTATION

FIG. 6

where $\phi_2 = KM1 - \frac{\pi}{2} + \Theta$

$W_{in}\sin^2\phi_1 \sin^2 \phi_2$ doubly reflected wave

$W_{in}\sin^2\phi_1 \sin^2\phi_2 \cos^2\phi_1$ doubly reflected wave transmitted across second boundary

etc.

Their relative phases will determine how they add, and the impedance mismatch reflections at the boundaries of the gyrator will complicate the situation beyond the possibility of useful analysis. With an absorber to remove the component of the output wave polarised at 90° to the output plane of polarisation the situation is relatively simple and relation (3) is obeyed.

With two absorbers at 90° to the input and output polarisations the two directions of through transmission give energies transmitted:

$W_{L-R} = W_o \cos^2 (KM1 - \Theta)$ (5)

$W_{R-L} = W_o \cos^2 (KM1 + \Theta)$ (6)

From this it is seen that the operation is generally non-reciprocal, but the special case ($\Theta = n\pi/2$) gives reciprocal operation when $KML = \Theta$ as far as energy transmission is concerned. When "n" is an even integer the operation is entirely reciprocal for phase, which fact is utilised in a ring duplexer incorporating a ferrite component in this condition[18]. In many applications it is undesirable to dissipate energy in the gyrator. The choice of $\Theta = O$ in the direction of main energy flow is then imperative, and is achieved by adjustment of magnetic field and length of ferrite.

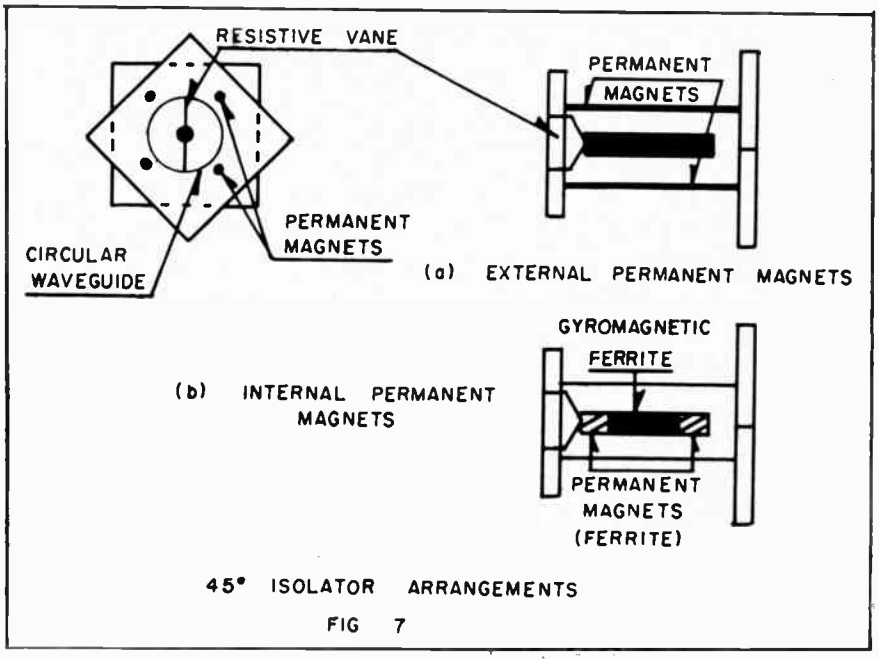
The applications fall into two classes, the first of which involves only the non-reciprocal behavior with Θ and M fixed in value, while the second involves the variation of M, the magnetisation.

Static Gyrators

4.1 The maximum difference between transmission in two directions, assuming absorption of wave components polarised at right angles to the accepted polarisations, is achieved in the case $\Theta = \frac{\pi}{4}$, when the magnetisation is adjusted to make $KM1 = \frac{\pi}{4}$ as well. It is possible to meet this condition almost exactly using permanent magnets outside the circular waveguide section, and it is not necessary to provide taper transitions from rectangular to circular sections, when a standing wave ratio of about 1.2 may be tolerated. Figure 7 shows the salient features of such an arrangement. This type of gyrator has become a production item already and is used in many laboratories to isolate klystrons and other microwave generators from load changes. A typical example of one manufacturer's product has a forward attenuation of 0.3 db, reverse attenuation of 36 db, input v.s.w.r. = 1.10 output v.s.w.r. = 1.22 and the product carries a specified maximum forward attenuation of 0.5 db and minimum reverse attenuation of 25 db. The power handling capacity is approximately 5 watts with less than 1 watt dissipation permitted. Higher power units are also becoming available commercially.

4.2 The case $\Theta = \frac{\pi}{2}$ and $\phi = O$ is reciprocal with regard to power, but there is a difference of π between the phase shifts for the two directions of transmission. Since $KM1 = \frac{\pi}{2}$, there are no multiple reflections (except due to impedance mismatch), and the conditions are very simple. Such a component provides a low loss wave guide device, non-reciprocal in phase, which, when used in a circulator as indicated in the schematic Figure 8, adds the wave passed by the gyrator arm to that passed by the other arm so that input 1 feeds output 2, input 2 feeds output 3, input 3 feeds output 4 and input 4 feeds output 1. With power fed to any one of the four feeds, there is an output at one of the two feeds in the other magic tee, and there is cancellation at the other two points provided the path lengths in the two arms of the circulator are arranged correctly with a phase difference $m\frac{\pi}{2}$ (m assumes different integer values for the two directions through the circulator). A unit of this type may be used as a duplexer; with transmitter feeding 1, and the antenna fed from 2, the receiver is connected to 3. In this application the receiver isolation is limited by the input v.s.w.r. which may be achieved for the antenna. It is of course possible to back up the isolation by waveguide switches of the ferrite or conventional type, open during the transmitter pulse. The practical limit of a gyratory circulator is in the neighborhood of 40 db isolation of a narrow frequency band (say 20 mc/s at 10,000 mc/s), and considerably less isolation for larger bandwidths. By special adjustment of tuning studs in a practical circulator at one frequency, it is possible to achieve about 55 db isolation in the laboratory.

(Turn to page 34)



45° ISOLATOR ARRANGEMENTS

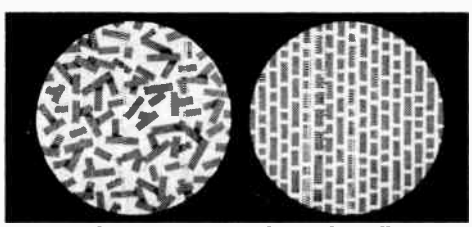
FIG 7

Now...record the whole performance...

without a break!

Got a favorite concert or opera program you'd like to preserve on tape? Symphony or dramatic production? Now, *record it all* using new "Scotch" Brand Extra Play Magnetic Tape. With 50% more tape wound on each reel, Extra Play Tape gives you as much recording time as 1½ reels of standard tape, plus strength to spare. This means annoying interruptions for reel change are sharply reduced to offer more perfect recording results.

You'll notice a crisper tone and higher fidelity, too—the result of "Scotch" Brand's exclusive oxide dispersion process. By packing minute, fine-grain oxide particles into a neater, thinner pattern, "Scotch" Brand has been able to produce a super-sensitive, high-potency magnetic recording surface. Hear the difference yourself. Try new "Scotch" Brand Extra Play Tape on your own machine.



Electron Photo Microscope Shows the Difference!

At left, artist's conception of magnified view of old-fashioned oxide coating still used by most ordinary long play tapes. At right, "Scotch" Brand's new dispersion method lays fine-grain particles in an orderly pattern to give a super-sensitive recording surface that contains as much oxide as conventional tapes, yet is 50% thinner.

NEW! REG. TRADE MARK **SCOTCH** BRAND

Extra Play Magnetic Tape 190

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

3M

For further data on advertised products use page 99.

MICROWAVE ENGINEERING

(Continued from page 32)

This is extremely critical and not significant for engineering applications. Figure 9 is a photograph of a circulator employing a coil energised gyrator.

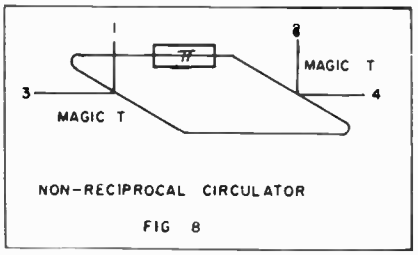
4.3 There are other possible, more complicated devices which come in the category of static gyrators, but mostly they have significance in connection with dynamic gyrators or other devices, and they represent generalisations of the basic components already described. For example it is possible in an isolating gyrator

$$(\Theta = \frac{\pi}{4}, \mathrm{KM1} = \frac{\pi}{4})$$

to feed reflected energy into a side arm. Then, if a gyratory switch is employed beyond the isolator, reflections from the switch appear in the side arm. The behavior is similar to that of the circulator of Figure 9, but the design is more compact.

Dynamic Gyrator Applications

5.1 In this context the word "dynamic" implies variation of the magnetisation of a ferrite unit, and more specifically, with regard to the Faraday effect, variation of the magnetisation in the direction of propagation. It is evident that the incident microwaves may be entirely transmitted through, or partly reflected by and partly absorbed in a ferrite component, in the general case of an angle Θ between the input and output planes of polarisation. The magnetisation can have two values which define these two conditions. Practical applications of this



NON-RECIPROCAL CIRCULATOR

FIG 8

switching condition generally employ $\Theta = 0°$ or $\Theta = 90°$, and are complicated by the effects of hysteresis which make it difficult to achieve the two values of magnetisation repetitively with the required accuracy. Rapid change from open to closed or closed to open depends on the build-up time of the field and is limited by the design of the energising coil and the associated short circuited turn effect[22].

The hysteresis effect is illustrated in Figure 10 which shows the transmitted power as a function of coil current for the case $\Theta = \pi/2$. The current should be made to vary between the value giving maximum attenuation and a less critical value giving minimum attenuation, in order to provide the greatest switching depth. Hysteresis loops of attenuation against magnetising field as in Figure 11 may be followed. Figure 11(a) indicates the optimum, and Figures 11 (b) and (c) indicate cycles on either side of the optimum. These cycles may be used for switching or modulation provided the magnetising field can be driven in the required manner. The cycles indicated in Figure 11 (b) may be the basis for doubling the frequency of the field applied to the ferrite.

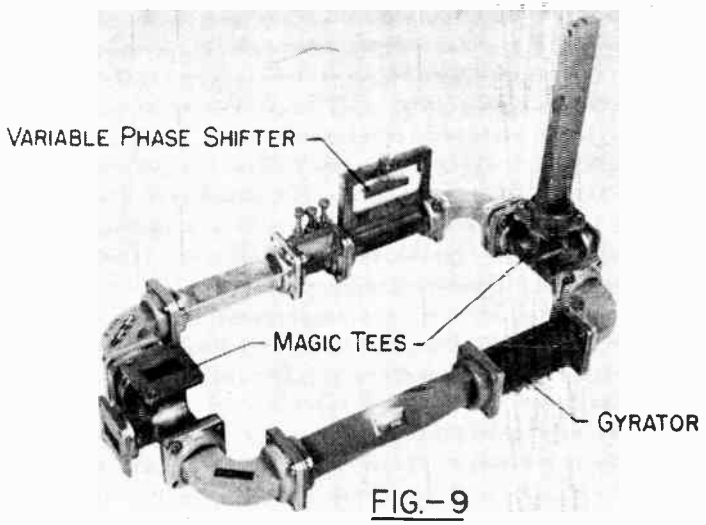


FIG.-9

FOUR PORT WAVE-GUIDE CIRCULATOR

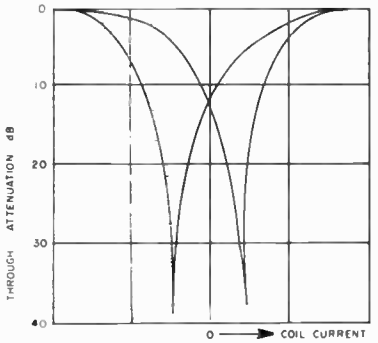
5.2 The foregoing has indicated the critical nature of the maximum attenuation position which is one limitation in applications to switching. The other limitation is switching speed which reduces to a problem in inductance and current pulse driving circuit design. Figure 12 is a photograph of a gyrator designed for switching square waves at a pulse repetition frequency of 100 kc/s. With a power of 20 watts dissipated in the driving circuit, the transmitted waveform of Figure 13 has been obtained by the author, using this gyrator.

The reliable performance of these components is properly defined without any daily adjustments of bias or other circuit controls, and it is possible to obtain a reliable 1.0 db to 20 db switching function with rise times 0.7 μs and fall times 0.8 μs for the above power dissipation (20 watts). There are hysteresis heating of the ferrite and microwave power dissipation, and there is a secondary effect of resistive heating in the coil windings. These are limiting design factors. About 5 watts of microwave power can be handled at 100 Kc/s switching rate by the gyrator in Figure 12. Driving circuit dissipation may be increased to reduce the switching time, without affecting the dissipation in the gyrator except in the coil windings, but increase of switching frequency produces more hysteresis heating.

Incorrect adjustment of the standing current bias in the gyrator coil results in a decrease in depth of the square wave or in a waveform with two spikes of maximum attenuation at the bottom of the square wave; these correspond with cyclic operation, in accordance with Figures 11 (b) and 11 (c) respectively. The transmission part of the square wave is not at all critical with respect to bias.

5.3 For purposes of modulation, the gyrator is in most respects excellent, though it is not capable of producing a pure modulation. It is inevitable that the waveform imposed on the microwave signal shall be distorted by the gyrator in the manner indicated by the graph of attenuation against magnetising field, Figure 10. The theoretical distortion is simply that of part of a cosine curve, and in practice hysteresis adds to this. The fast rise and fall times obtainable with square wave switching functions indicate that gyrators may also modulate at relatively high frequencies. Sine waves may be impressed at frequencies up to 1 Mc/s for large modulation percentages and at higher frequencies with decreasing amplitude (or increasing heat dissipation) owing to increasing hysterisis losses and increasing power drive requirements for the same amplitude.

5.4 Modulation requires an approach to linearity in the control characteristic , which is not adequately provided for large percentage modulations, as may be seen from Figure 10. Switching requires two stable states of maximum and minimum attenuation and it may be seen that the maximum attenuation is critical. Thus the two dynamic functions are subject to limitations, but within their limitations they represent a significant addition to microwave techniques.



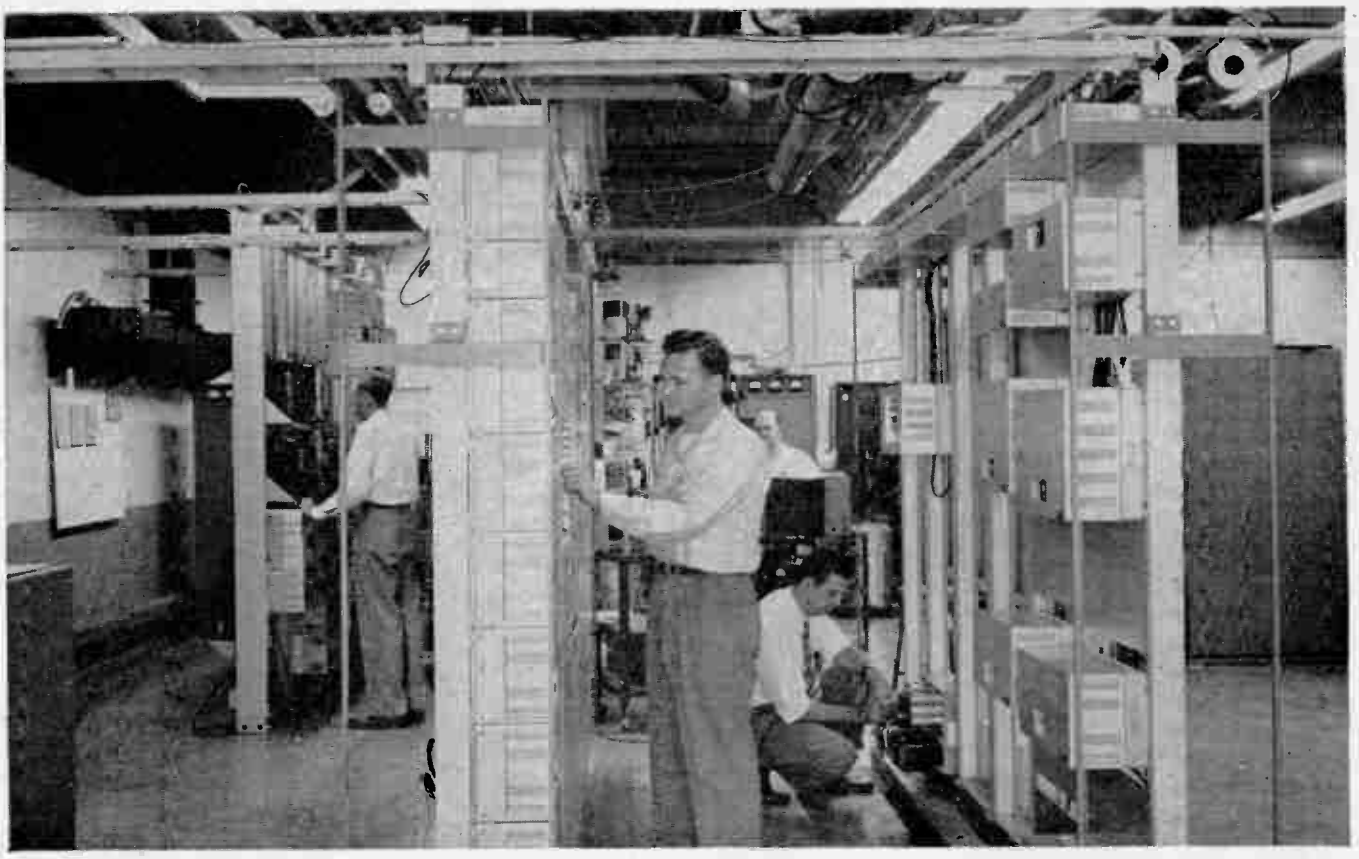
HYSTERESIS EFFECT IN GYRATOR ATTENUATION

FIG 10

Materials

The type of ferrite material involved in applications at microwave frequencies is the product of a highly specialised and highly developed technology[13, 14, 15, 16]. Ferromagnetic materials of spinel structure. in which the cubic lattice is

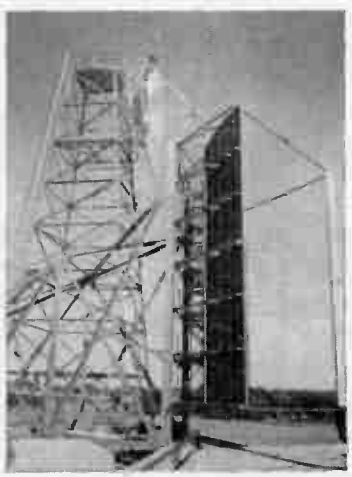
(Turn to page 72)



This Laboratory is Making History in Trans Horizon Communication

In this ultra-modern Trans Horizon laboratory are the scatter propagation communication field's most extensive and complete facilities for research and development. Cuts at right show Cedar Rapids-Lamar, Missouri terminals of Collins 350-mile test circuit for long haul UHF studies. Collins' progress in pioneering techniques used in UHF and VHF scatter propagation is supported by development of a whole new line of equipment and components. Many of these developments have already achieved singular contributions to the radio field, but all are a part of an integrated Trans Horizon program begun at Collins over ten years ago.

Lamar, Mo. terminal (above) and Cedar Rapids terminal (below) of Collins Trans Horizon Test Circuit



Collins CREATIVE LEADERSHIP IN ELECTRONICS

COLLINS

COLLINS RADIO COMPANY OF CANADA, LTD.
77 METCALFE ST., OTTAWA, ONTARIO

For further data on advertised products use page 99.

Radio Aids To Air Navigation In Canada

In opening the new $600,000 terminal building at Saskatoon Airport last September 29th, Transport Minister George C. Marler said that it was one of the largest terminal buildings to be constructed under the Department of Transport's present program of improving ground facilities at Canadian airports and that it was one of the large number now in the planning or construction phase throughout the country.

In the matter of equipping Canadian airports with the communication apparatus and aids to navigation the following statement prepared for *Electronics and Communications* by the Deputy Minister's office, Department of Transport, outlines the Department's plans for maintaining high efficiency at Canadian airports through the use of modern equipment.

It is the practice of the Canadian Government to install the latest developments in aids to air navigation on the Canadian airways. In some instances Canada has been behind similar installations in the United States, but this has worked to our advantage, since we are able to profit by the experience obtained by the American authorities, who are very generous in keeping their Canadian counterparts advised.

Low frequency four course radio ranges have now been operating in Canada for some fifteen years. An active program to replace these ranges with VHF Omni Ranges was started in 1954 and will be continued until all Canadian airways are equipped with these new facilities.

It is expected that by the end of the summer of 1955 a VOR airway will be commissioned between Montreal and Windsor. Equipment is on hand and is being installed for the airway between Toronto and Winnipeg. Consideration is being given to placing shortly a further large order for equipment for most of the Prairie stations and those in eastern Canada.

All the principal Canadian airports are equipped with instrument landing facilities. Several of them, as is the case at Toronto, have two runways so equipped. These aids have very materially increased the regularity and safety of scheduled flights by the Canadian airlines.

A complete modern G.C.A. installation is being installed at Gander airport this fall and, barring unforeseen difficulties, should be in commission some time next spring.

It has been realized for some time that, with the increasing speed of modern aircraft, coupled with the increased volume, more precise control of their movements must be exercised over greater distances. This involves knowing more accurately the position of the aircraft being controlled. To accomplish this consideration is being given to ordering surveillance radar equipment for fifteen of the major airports, including Toronto, which will enable traffic controllers to see aircraft as small as military jets at a distance of ninety miles and at elevations of up to 60,000 ft.

Long distance aids to navigation, mainly over the oceans, are provided by Loran stations on the East and West coasts.

The above paragraphs outline various aids by which aircraft may fly from point to point or land safely at airports.

Communications between aircraft and the ground also may be classified as an aid to navigation. Canada has also been keeping up-to-date in this respect, as the use of high frequencies for this purpose is gradually being replaced by VHF type of communication.

Since Malton Airport, serving Toronto, is one of the busiest in Canada, it is fully equipped with up-to-date aids and communication facilities. Remote transmitting and receiving stations permit transmissions to take place without interference to reception. The traffic control center is connected with all airports in its control area, and adjacent centers in Canada and the U.S., by voice. Weather maps, prepared in Montreal, are received in the Met. office by facsimile for use in forecasting weather conditions. An efficient public address system is in use. When a decision is made to use any newly developed aid, Malton Airport is one of the first to receive an installation.

● Nerve center of Department of Transport's Saskatoon Airport is the radio control room, located in ample size headquarters in the new terminal building. Shown left to right, are Sid Young, O.I.C. of the station, formerly of Victoria, B.C.; Elmer Walsh of Winnipeg and Charles Fisher recently of Yellowknife; and Walter Thiet, who hails from Millet, Alberta.

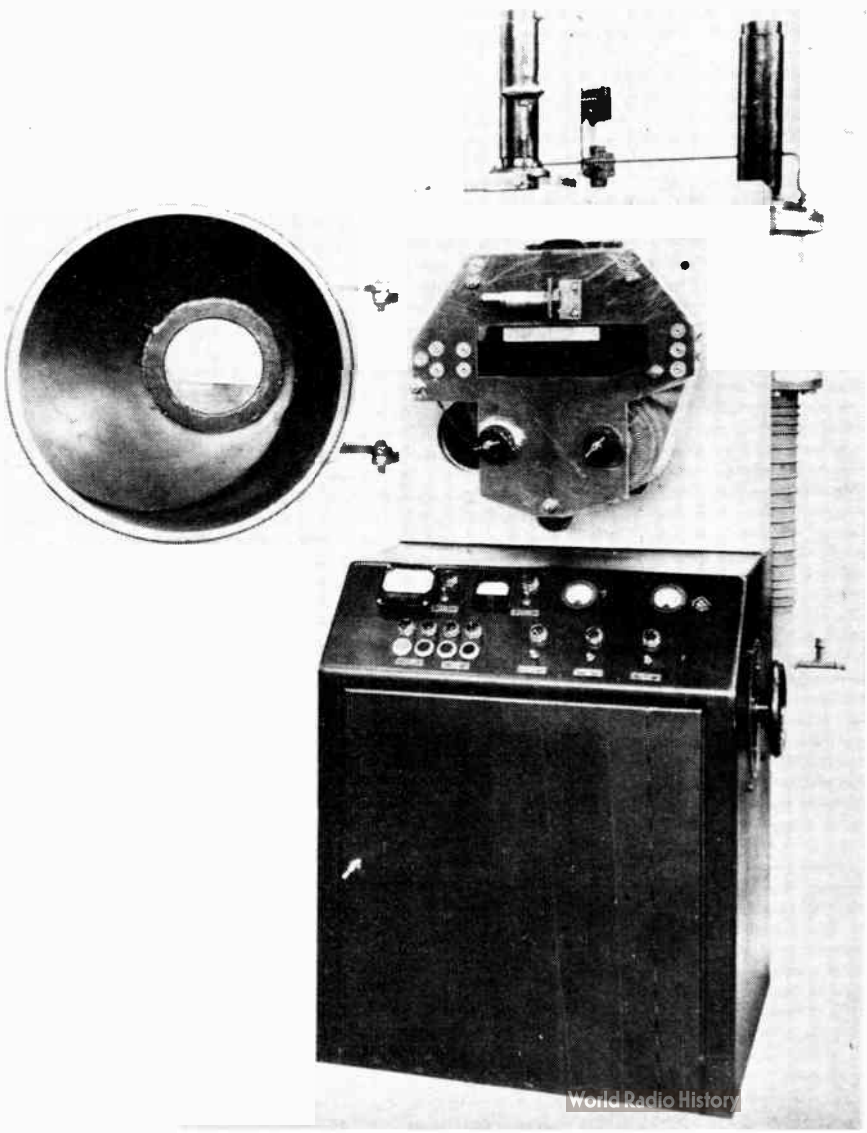
For further data on advertised products use page 99.

Single-Chamber Continuous Roll Vacuum Metallizer

A faster technique for metallizing offers the electronics industry faster production in metallizing condenser papers for the manufacture of capacitors — metallizing printed circuit boards and illuminizing television picture tubes.

FASTER metallic coating of plastic film and sheeting, such as Mylar, acetate, cellopane, and butyrate, as well as of condenser paper, textile fabrics, and even thin sheet steel is possible with a new type of vacuum equipment for continuous roll metallizing.

The new metallizing equipment represents a completely new approach to the problem of continuous deposition of metal on a moving web of material. Previously, continuous roll metallizing of plastics, paper, or textiles has been done in a dual-chamber set-up, with the base material being out-gassed in one vacuum chamber and then transferred to a second chamber to receive the thin coating of metal deposited by evaporation.



The new Stokes units have only a single vacuum chamber and thus need only a single vacuum pumping system. This makes them more compact, taking up much less floor space, and saves considerably on capital investment. And the new continuous metallizers coat the base material faster than previously available equipment.

The new continuous roll metallizing units can coat material in widths of 6, 24, 36, 48, 54 or 60 inches, at speeds up to 500 feet per minute. Rolls up to 24 inches in diameter can be accommodated in the units, and material ranging in thickness from .0005 in. up to .0020 in. can be successfully coated on a continuous basis. (A 24-inch diameter roll of thin gauge plastic film, for example, might contains as much as 40,000 feet of material, depending on the size of the core of the roll.)

The Stokes metallizing units are designed to deposit a brilliant, uniform coating of metal over the entire width of the material with no dark or "burned" areas. They incorporate an ingenious device for continuously supplying the pure metal to be deposited. An observation-port set into the cover of the unit, plus a fluorescent light source placed behind the coated film, allows the operator to check the uniformity and quality of the coating continuously, during the deposition process, and to adjust the speed of travel of the material through the evaporation chamber so as to obtain the desired thickness of metal deposit. Air-actuated poppet valves, push-button controlled from the front panel, simplify the operation of the units.

Recent Development

Vacuum metallizing, a fairly recent arrival on the industrial scene, is now a well-established procedure for low-cost finishing of molded plastics, metal die-castings and stampings, and paper. Its widespread application for decorative purposes led to the development of continuous roll metallizing.

Metallized plastic film is already in fairly wide use for the interior trim of automobiles—door panels, scuff plates, dashboards, and upholstery welting. The number of these applications is expected to increase steadily in the next few years.

Vacuum metallized Mylar, for example, can be bonded to rigid vinyl or steel sheet, and then embossed or stamped to provide a durable, brilliant decorative effect. Such material is usually bonded to the base sheet metallized side *down* (in), and the tough Mylar film thus acts as a rugged, scuff-proof protection for the shiny coating.

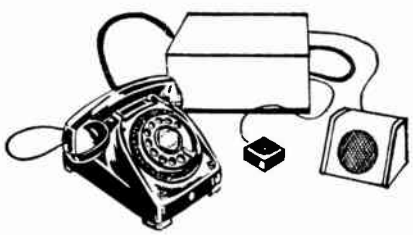
(Turn to page 71)

● The new Stokes single-chamber continuous roll metallizers can coat plastic film and other base materials in widths from six inches (model shown here) up to 60 inches at speeds up to 500 feet per minute. Other uses for the process include continuous roll metallizing of condenser paper for the production of capacitors, production of printed circuit boards and the illuminizing of television picture tubes.

NEW TELEPHONE CONVENIENCE

the loud speaking telephone

EASY TO INSTALL "PACKAGE"



All components including the type 88 Loud-Speaking Telephone (with built-in microphone, "ON" and "OFF" buttons, volume control knob and signal light) and desk top speaker, control unit with plug in amplifier, terminal block and necessary connecting cords are supplied as a complete "package".

Installation is simply a matter of mounting the amplifier unit, connecting to 115 volts, 60 cycles power supply, connecting the telephone line to the terminal block, and connecting the cords.

The Automatic Electric Type 88 Loud Speaking Telephone opens a new era in telephone convenience! The built-in microphone (5) picks up the normal voice, while the other party is heard, clearly and naturally, through the separate speaker (6). Others may join in the conversation by gathering around the desk! For privacy, raise the handset and talk in the usual way; to use the loud speaker again merely replace the handset.

A regular telephone, a loud-speaking telephone and a conference telephone are combined in one instrument. Busy executives, bankers, editors, accountants and other business and professional people enthusiastically welcome this "hand-free" convenience. Available with or without dial for use on any telephone line.

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For further data on advertised products use page 99.

Television And Dentistry

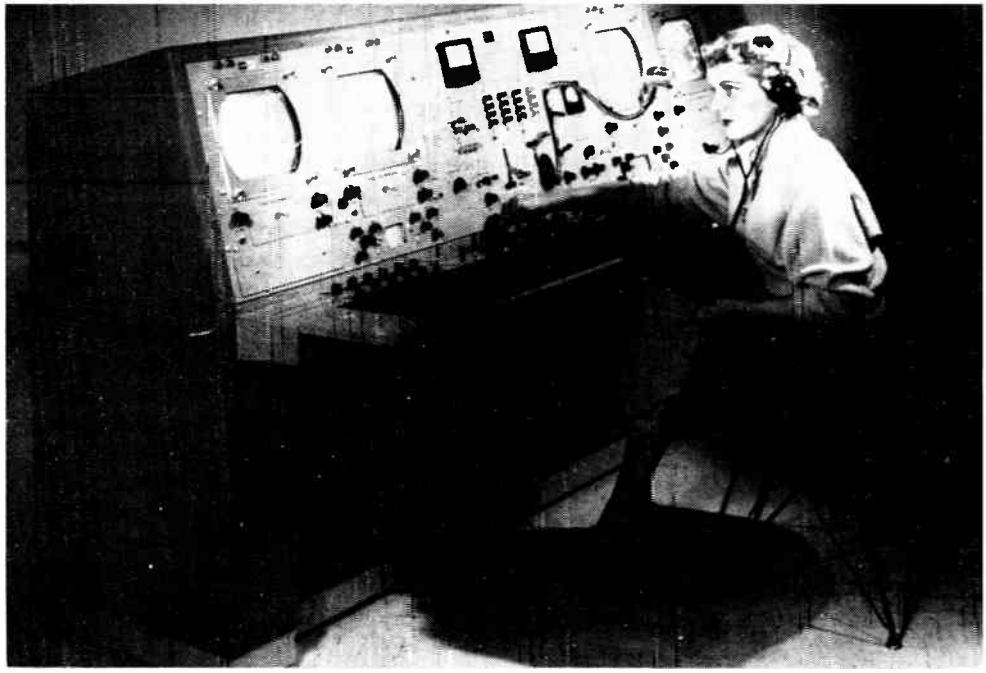
MAKING a noteworthy advance in the field of audio-visual instruction, a built-in industrial television system has been incorporated in the new dental school of the University of Texas at Houston.

By means of this installation, fewer instructors are required for a substantially larger number of students than formerly.

There will be 50 unit labs, each accommodating four students. Each lab will have its own 17-inch television monitor on which the students can follow the instructor at close range.

When a student wishes to interrogate, he uses a microphone, instead of raising his hand as has been traditional classroom practice. A cue lamp indicates to the instructor that a query has been made. All students in the different labs hear the question and answer clearly.

The instructor, also, can make use of any teaching aids which regardless of size are reproduced distinctly on the screen.



● This master console designed by Kay Lab is part of the audio-visual television system installed recently in the University of Texas Dental Branch, Houston.

Assisting the instructor is an operator in an adjacent room, who completely controls the camera for positioning, image size, lens and focus. Instructors may originate lecture material from a desk, or from any one of the special purpose laboratories located in the building.

The specially designed television system is equipped with slide and motion picture projectors, by means of which the control room operator can fade in any desired instruction material. Special x-ray viewing equipment is included.

Program information originating in the University's nearby Cancer Research Lab or at local TV broadcast studios can also be displayed. In addition, conference rooms and lecture halls are equipped with television outlets for remote viewing of operations taking place in laboratories elsewhere in the dental school building.

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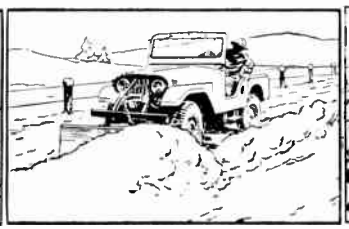

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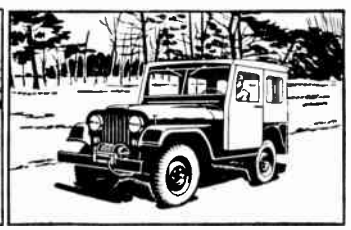

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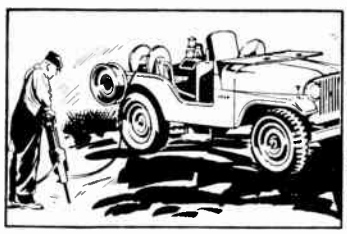

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WELDER. Service on the spot in any weather.

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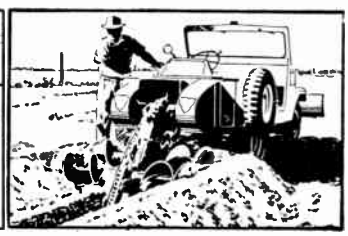

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For the toughest "impossible" jobs the world automatically thinks of 'Jeep'

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WINDSOR • ONTARIO

Canada's most useful vehicles

  For further data on advertised products use page 99.

Televised Flight Information

THE first airline use of closed circuit television is underway at the Portland Airport, Portland, Oregon, where United Air Lines is testing TV as a fast, efficient way to disseminate flight information.

The experimental telecasts originate in United's dispatch office — central source of flight information — where arrival and departure times are posted on a large plexiglass panel. A TV camera, focused on the panel, transmits pictures via coaxial cable to four receivers in the terminal building. One receiver is in United's telephone sales office, another in the ramp chief's office, and two are in the lobby for public viewing.

Flight information ordinarily is reported to various departments by telephone and telemeter. As compared with this method, closed circuit TV thus far has been found to have these advantages:

(1) Faster reporting of arrival and departure times to the public; (2) simultaneous reporting to all departments; (3) elimination of exposure to error through transcribing or transmitting flight information; (4) elimination of duplicate effort, since agents no longer have to post changes on Flight Information boards in the lobby and telephone sales office.

The Portland installation is the result of tests begun 18 months ago by United and Kay-Lab Corporation of San Diego, makers of industrial electronic equipment. Portland was chosen for a full-scale test because all of United's offices there, except a downtown ticket office, are under one roof.

United and Kay-Lab are exploring inter-city use of closed circuit TV and transmission to receivers at remote locations. If the Portland tests prove satisfactory on all counts, similar installations may be made at major stations on the airline's 13,250-mile system.

● H. C. Warrington (left), superintendent of research and development for United Air Lines, adjusts TV camera suspended from ceiling of flight dispatch office in Portland, Ore., where company is making first airline use of closed circuit television. Camera is focused on Flight Information panel at which Tom Petty, lead load planner, is posting schedule changes. The changes are seen on four TV receivers at strategic locations in the terminal building.

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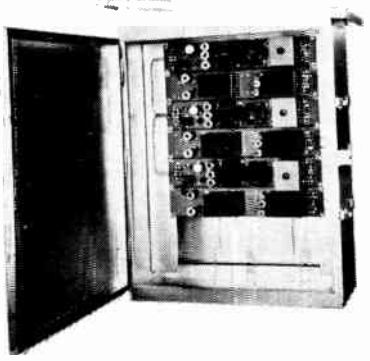
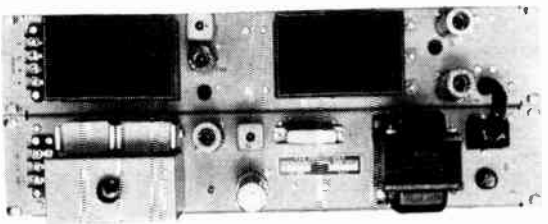
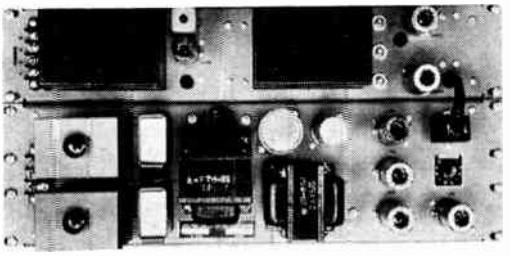


Typical subscriber carrier terminal showing 3 channels of bridged ringing carrier in outdoor pole-mounting cabinet.



Type 16A — Central Office carrier, Selective (Divided) ringing.



Type 16A Subscriber Carrier Terminal. Selected (Divided) ringing.

Type 16A Carrier E & M Auxiliary signalling chassis.

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 commercial television cameras, radios, high-fidelity reproducers and television receivers.

For further data on advertised products use page 99.

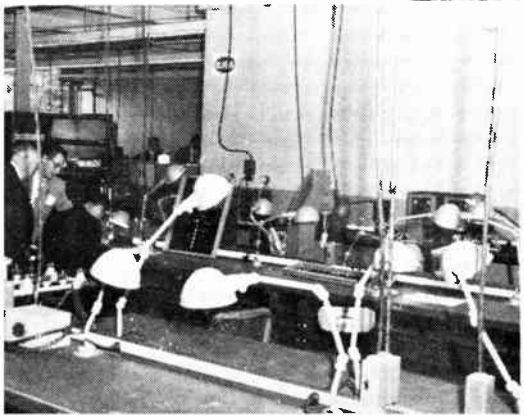
NEWS ☆ ☆ ☆

Varian Associates Establish First Canadian Klystron Manufacturing Plant

Canada's first klystron manufacturing and research plant went into operation October 21, with the dedication of the new Varian Associates of Canada Ltd. facility in Georgetown, Ontario. The opening ceremonies were attended by representatives of government and industry, with the dedication address given by Dr. Russell H. Varian.

Organized last October, the new firm will be engaged in the manufacture of Varian klystron tubes for both Canadian and U.S. customers and will also be available for the development of advanced tube types and related microwave devices. The Varian klystron tube manufacturing and development facility is the first of its kind to be established in Canada and marks an important step in the growth of Canada's vigorous electronic industry.

At a recent directors' meeting, Mr. C. W. Carnahan, Manager of the new plant, was appointed Vice-President and General Manager of the firm. Mr. Carnahan was previously engaged in engineering management work in the Varian headquarters in California and before that served five years as manager of electronics research at Sandia Corporation, Albuquerque, New Mexico. Mr. B. H. Breckenridge, Assistant Treasurer, was appointed Business Manager and Assistant Secretary.



• The two views of the Varian plant shown at left are: *Top*, Test area. *Center, foreground*, is a special microwave test set-up (X-band). *Center, background*, with rack-mounted power supplies, metering, etc., is a production klystron test position. *Right, foreground*, is a klystron life-test rack. Environmental test equipment for shock and vibration is not shown in the photo. It's worth noting that Varian klystrons are given approximately 15 different electrical tests before judging them acceptable. Prior to shipment, about half of these tests are repeated to ensure proper field performance. *Bottom:* Assembly benches. In this area the many small parts are carefully assembled by skilled operators.

Mr. P. I. Corbell is Sales Manager and other key technical positions are filled by personnel on loan from the parent company until Canadian replacements are trained in the highly specialized field of klystron development and manufacture.

It is planned that management and operating functions of Varian Associates of Canada Ltd. will be assumed by an all-Canadian staff after the completion of the necessary training program.

Located on a ten-acre site at 45 River Drive in Georgetown, the new 10,000-square foot plant has provision for expansion to several times this area.

The new company is a subsidiary of Varian Associates of Palo Alto, California. Only seven years old, the parent company is now one of the world's largest in its field. It was founded by Russell and Sigurd Varian who pioneered the klystron in 1938 at Stanford University.

Len Finkler Opens Manufacturers' Agency At Port Credit

Mr. Len Finkler for some years past associated with the Canadian Electrical Supply Company and Electro Sonic Supply has announced the opening of his own manufacturers agency at 1505 Park Royale Blvd., Port Credit, Ontario.

Among the principals represented by Mr. Finkler are the Precise Development Corp., of Oceanside, N.Y., the K. Miller Tool and Manufacturing Company of Springfield, Mass., The Gernsback Publishing Company, and Pyramid Electric.

Mr. Finkler is associated in the new enterprise with W. Cohen of 4890 Plamondon Blvd., Montreal, who covers the Quebec area for the Len Finkler agency.

Prior to establishing his own business Mr. Finkler was engaged in the electrical and electronic sales business for 10 years with the Canadian Electrical Supply Company and Electro Sonic Supply the last five years of which he was employed in the capacity of sales manager.

Phillips Electric Sponsor England Trip For Canadian Engineers

Phillips Electric Company, Canadian subsidiary of British Insulated Callender Cables, have announced plans to send several Canadian graduate engineers to England for employment in the shops and laboratories of B.I.C.C. for the period of one year.

According to T. A. Lindsay, President of Phillips, the idea is to afford Canadian engineers an opportunity to gain first-hand experience in the shops and laboratories of one of the world's largest and most diversified manufacturers. Those eligible to qualify for the scheme will be under no obligation to work for either firm following the year's work. In making the announcement Lindsay said the employees of other firms in Canada who can secure leave of absence are also eligible for the trip.

Successful applicants for the scheme will be paid $3,900 for the year in addition to travelling expenses to England and return. Unmarried applicants who qualify for the scheme will be paid one-half this amount in sterling while in England, and the remaining paid in dollars on their return to this country. Married engineers will be paid their entire salary while in England but will have to defray travelling expenses for their families.

C.G.E. Awarded Contract For Charlottetown TV Installation

Canadian General Electric Co. Ltd. has announced the signing of a contract with Island Broadcasting Company, headed by Mrs. Keith S. Rogers and Mr. R. F. Large, Manager, for a complete television transmitter and studio installation at Charlottetown, Prince Edward Island.

Planning a Spring 1956 "On Air", CFCY-TV has been allocated Channel 13. The combined transmitter-studio operation is situated eight miles outside Charlottetown.

CFCY-TV, Charlottetown, is Canadian General Electric's 57th broadcasting station, and the equipment supplied includes C.G.E.'s Ultra-Power television antenna. Used on Channels 7 through 13, the Ultra-Power antenna represents a new development in simplified design and flexibility, allowing block building to the maximum allocated power of 325 Kw E.R.P.

British Radio Shows In 1956

The 23rd annual (British) National Radio Show will be held at Earls Court, London, from Wednesday, August 22, to Saturday, September 1, 1956, with a preview for overseas visitors and other special guests on Tuesday, August 21.

The exhibition, as previously, will be primarily concerned with broadcasting and all the equipment for it. It will include demonstrations of the latest television techniques, from every stage from camera to screen. There will also be exhibits of components and valves, electronic equipment for industry, service equipment and training methods.

Organizers are the Radio Industry Council, 59 Russell Square, London, WC. 1.

The 13th annual Radio Component Show will be held at Grosvenor House, Park Lane, London, W.1, from Tuesday, April 10, to Thursday, April 12. An innovation will be a preview on the afternoon of Monday, April 9, for overseas visitors, the press and other specially invited guests.

Exhibits by about 150 manufacturers—a record number—will cover the whole range of components for the radio, television, electronic and gramophone industries and test equipment.

Organizers are the Radio and Electronic Component Manufacturers Federation, 21 Tothill Street, London, SW. 1, to whom application should be made by intending visitors

Musimart Appointed Canadian Agents

Musimart of Canada Limited, Montreal, have announced their recent appointment as the Canadian agents for Dynamu Magnetronics Corporation, a division of the Maico Company of Minneapolis.

As agents for Dynamu Magnetronics Corporation, Musimart will handle Dynamu Heads, which have been heralded as one of the most revolutionary developments in the field of tape recording and reproduction technology.

J. M. Bridgman, Managing Director, PSC Applied Research Limited

Announcement of the appointment of J. M. (Monty) Bridgman to Managing Director of PSC Applied Research Limited has been made by officials of the company. Mr. Brigman joined PSC in 1947 to set up a Technical Division. Under his direction these grew into two self-sustaining companies, PSC Applied Research Limited (ARL) and Aeromagnetic Surveys Limited. He became Managing Director of ARL in 1951.

Mr. Bridgman previously was in charge of electronic development for the RCAF in Ottawa. He served with the RCAF and RAF as a radar expert from 1941 to 1947; in 1945 he was in charge of airborne radar for the Middle East Command of the RAF with the rank of Squadron Leader. After the war, at RCAF HQ in Ottawa, he promoted the use of Shoran for aerial survey.

Eitel-McCullough, Inc. To Add 17,000 Square Feet For Super Klystron Production

A new 17,000 square foot building, which will include facilities for the production of super-klystron amplifier tubes up to 20 feet long, will be added to the main San Bruno, California, plant of Eitel-McCullough Inc., manufacturer of Eimac electron-power tubes. Present plans call for completion of the building in early spring.

The need for additional klystron facilities arises from the demand for Eimac high power klystrons in an increasing number of electronic applications, including forward-scatter.

One section of the building will include a two-ton crane to handle the giant klystrons.

The new extension will bring the total square feet at the main Eimac plant in San Bruno to approximately 170,000 sq. ft. Eimac has office and research facilities at two other San Bruno locations and a major plant in Salt Lake City, Utah.

C.D.C. Appointed Agents

Computing Devices Of Canada Limited have recently announced their appointment as the Canadian representatives for Byron Jackson Co., P.O. Box 2017, Terminal Annex, Los Angeles, California; the Donner Scientific Company of 2801 Seventh Street, Berkley 10, California and Lavoie Laboratories Inc., Morganville, N.Y.

Canadian Admiral's Vincent Barreca Elected To Newly Created Post

Vincent Barreca, President of Canadian Admiral Corporation, has been elected to the newly-created post of vice-president-operations of the parent company, Admiral Corporation, with headquarters in Chicago. John B. Huarisa, Executive Vice-President, also announced Barreca's election to the Board of Directors, and said he will retain his Canadian affiliation.

Barreca, 38, is a native of Chicago. He joined Admiral in 1934 when the company was founded, and worked in all phases of production and purchasing. In 1946 he was assigned to Canada to establish Canadian Admiral Corporation, the first firm to manufacture TV receivers in the Dominion.

The Canadian subsidiary manufactures television and radio receivers in a new 130,000 sq. ft. plant in Port Credit, Ontario, a suburb of Toronto. According to industry statistics, the company's receivers are in over one-fourth of Canada's TV homes.

Dominion Sound Equipments Appoints R. T. Manuel To Newfoundland Post

The appointment of R. T. Manuel as sales and service representative in St. John's, Newfoundland, has been announced by J. McEwan, Halifax district manager for Dominion Sound Equipments Limited.

For the time being Mr. Manuel will make his headquarters in the Northern Electric office at 32 Adelaide Street, St. John's, Newfoundland.

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For further data on advertised products use page 99.

NEWS

(Continued from page 45)

Electronic Engineers Co-Operate For Public Good

The most far-reaching example of co-operation by many top-ranking professional engineers for the benefit of industry and the public was held in Ottawa recently. The results of this giant co-operative effort, which affects the technical and economic utilization of the radio air-waves, were examined in detail at the 11th annual meeting of the Canadian Radio Technical Planning Board.

Without parallel in the history of engineering development in this country, many electronic specialists met at this Board meeting, on an entirely voluntary basis, to consider recommendations made by engineers meeting during the past year, at their own expense, to make certain that the radio air-waves, which are in the public domain, will provide for the rapidly increasing number of radio and allied services. The results of these deliberations will undoubtedly reflect in clearer television reception and better radio listening in the homes of Canadians.

The Canadian Radio Technical Planning Board was formed to make recommendations to the Government and to industry for the conservation and efficient use of the radio spectrum, or the channels of communication, by proper forward planning and improved design of equipment which will, in turn, provide more channels of communication for the public service.

(Turn to page 48)

ELEVENTH ANNUAL MEETING OF CANADIAN RADIO TECHNICAL PLANNNG BOARD

● *Seated* (clockwise around table): E. L. Palin, Canadian Education Association; A. P. H. Barclay, chairman, Microwave Committee, CRTPB; C. M. Brant, Telecommunications Division, Department of Transport; F. G. Nixon, controller of telecommunications, Department of Transport; Stuart D. Brownlee, secretary-treasurer, CRTPB; Ralph A. Hackbusch, president, CRTPB; C. W. Boadway, vice-president, CRTPB; W. Ornstein, chairman, Fixed, Mobile, Land and Maritime Sub-Committee, CRTPB; J. E. Hayes, Canadian Broadcasting Corporation; W. B. Smith, Telecommunications Division, Department of Transport; G. B. Tebo, Hydro Electric Power Commission of Ontario. *Standing* (from left): C. J. Acton, Telecommunications Division, Department of Transport; F. A. Smith, Canadian Overseas Telecommunications Corporation; S. Bonneville, Telephone Association of Canada; L. G. Buck, Telephone Association of Canada; R. M. Brophy, Radio-Electronics-Television Manufacturers Association of Canada; W. H. Holroyd, Canadian Electrical Association; J. C. R. Punchard, Radio-Electronics-Television Manufacturers Association of Canada; A. Dion, Canadian Motor Coach Association; R. C. Poulter, Director of Public Relations, CRTPB; C. J. Pattenson, Institute of Radio Engineers; A. Reid, Association of Radio Relay League (Canadian Section); F. H. R. Pounsett, chairman, Broadcast Committee, CRTPB. At the 11th Annual Meeting, Ralph A. Hackbusch, RETMA of Canada Director of Engineering, was elected president, C. W. Boadway was elected vice-president, and Stuart D. Brownlee, general manager of RETMA of Canada, was elected secretary-treasurer.

For further data on advertised products use page 99.

NEWS

(Continued from page 46)

Collins Radio Company Takes Over Communications Accessories Co.

Collins Radio Company, Cedar Rapids, Iowa, a major developer and manufacturer of communication and navigation equipment, has acquired one hundred per cent ownership of Communication Accessories Company, an electronics component manufacturer, through an exchange of stock.

Communication Accessories Company currently employs 400 in its Hickman Mills, Missouri, operations. It specializes in the design, development and manufacture of toroids, audio band-pass filters, pulse transformers and magnetic amplifiers. Its products are used extensively in communication equipment and in guided missiles.

Collins' officials state that the new subsidiary will continue to operate as an independent unit in the components field with distribution through its established representatives. Edward J. King, Jr., founder and president of Communication Accessories Company, and other key personnel will continue with the organization.

Varian Associates Enter High-Energy Radiation Business

Varian Associates has entered the high-energy radiation business, according to an announcement this week by Dr. Russell H. Varian, President of the Palo Alto electronics firm. The company is planning construction of its own linear electron accelerator, under license recently obtained from Stanford University, where such accelerators were pioneered, and has undertaken development of special accelerator parts for the University of Chicago. Other contracts in this field are now being negotiated, Dr. Varian said.

Sensitive Research Instrument Moves To New Premises

Marvin I. Steinberg has announced the relocation of Sensitive Research Instrument Corporation in their new production and engineering laboratories at 510 Main Street, New Rochelle, N.Y.

Sensitive Research Instrument Corporation is represented in Canada by Measurement Engineering Limited of Arnprior, Ontario.

The new building is completely vibration proof, dust free and air conditioned and provides the company with about three times the production and engineering facilities previously available.

W. H. Heflin Elected To Top Post By Lenkurt Electric

William H. Heflin has been elected Vice-President and General Manager of Lenkurt Electric Co. of Canada Ltd. at Vancouver, British Columbia.

The company, an affiliate of Lenkurt Electric Co. in San Carlos, California, produces carrier telephone and telegraph systems and other electronic equipment for use throughout Canada.

W. H. HEFLIN

Election of Heflin to head operations will speed the Canadian firm's expansion program, according to L. G. Erickson, President.

Heflin has been with Lenkurt in San Carlos the past seven years, during which he has held various positions in sales, engineering and production. He had been manager of the Procurement Division since 1953, and before that was factory manager of the Special Equipment Division.

Division managers for Lenkurt of Canada are J. S. Agnew, accounting; C. W. Hunter, sales engineering; C. E. Whaley, applications engineering; M. O. Swailes, production, and H. R. Herron, quality control.

J. H. Cornell Elected PSC Director

J. H. (Bert) Cornell, Commercial Manager of The Photographic Survey Corporation, of Toronto, has been elected to the air survey organization's board of directors, D. N. Kendall, PSC President, announces.

Mr. Cornell joined PSC's aircraft operating company, Kenting Aviation, as a navigator in 1946. In that year he flew on PSC's first South American operation, an oil concession survey in Venezuela. In 1950 he transferred to PSC's Sales Division as Western Representative, with headquarters in Calgary. He returned to Toronto in 1951 to become PSC's Sales Manager, a post later designated as Commercial Manager when Mr. Cornell took over supervision of all the company's client relations.

Marsland Engineering To Manufacture TV Tuners For Canadian Market

Marsland Engineering Limited of Kitchener, Ontario, and Sarkes Tarzian Inc. of Bloomington, Indiana, have announced an exclusive licensing agreement between the two corporations for the manufacture of Sarkes Tarzian television tuners in Canada. The agreement became effective last October last.

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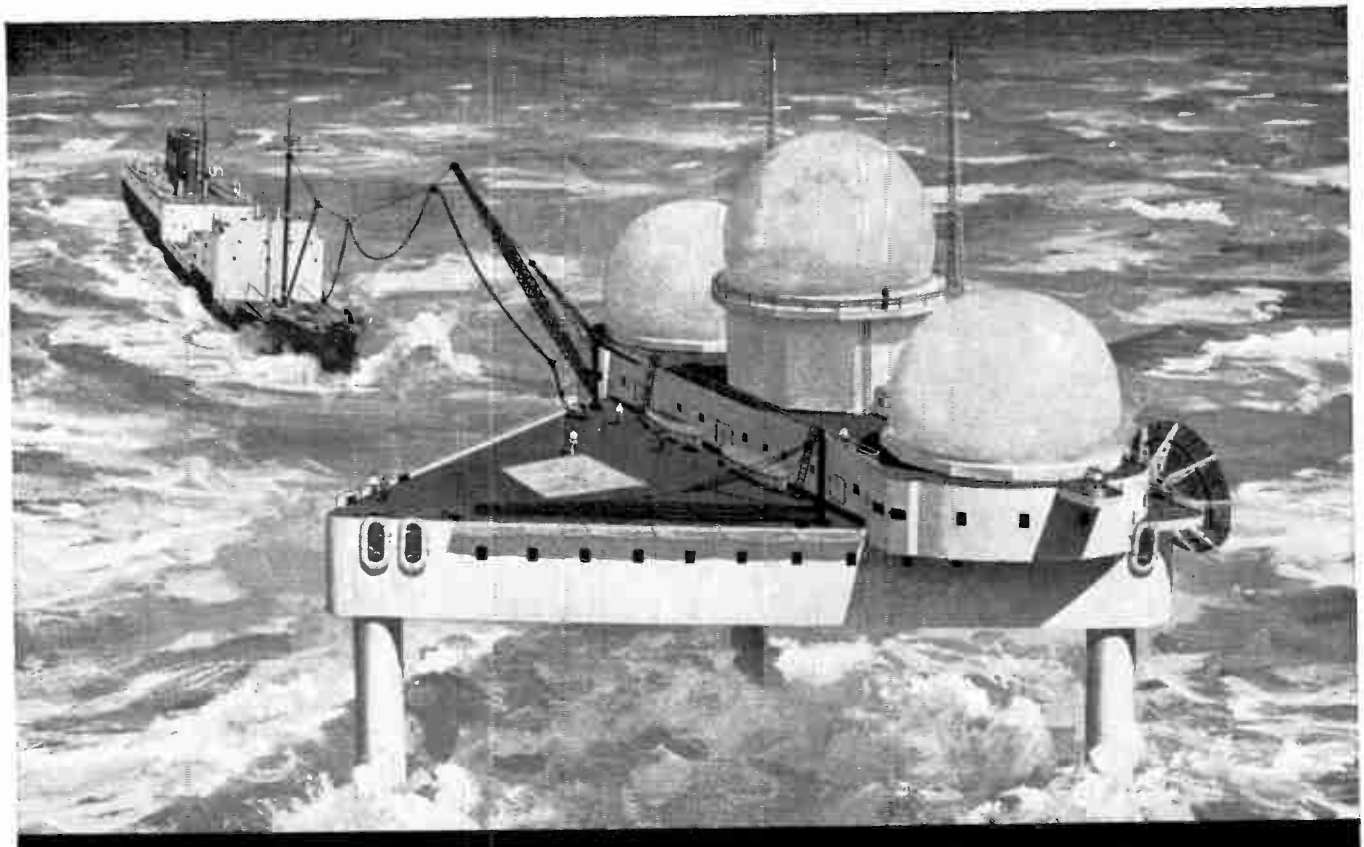
For further data on advertised products use page 99.



EIMAC KLYSTRONS are used in Texas Towers forward-scatter communications system

High power UHF/microwave forward-scatter transmitters by National Company are an example of reliable National equipment designed to meet the most exacting requirements. From the first National Company forward-scatter development link to the advanced Texas Tower communication net, Eimac klystrons have been used exclusively as high power final amplifier tubes. Eimac amplifier klystrons provide the power necessary to make long distance communication through forward-scatter techniques practical at microwave frequencies.

- ***Second in a series of advertisements emphasizing the extensive application of Eimac amplifier klystrons and circuit components by the leading manufacturers of forward-scatter UHF/microwave transmitters.***

National Company two, ten and fifty kilowatt transmitters employing Eimac klystrons and circuit components are among the pacesetters in the revolutionary art of forward-scatter propagation.

Eimac
THE POWER FOR FORWARD-SCATTER

EITEL-McCULLOUGH, INC.
SAN BRUNO • CALIFORNIA
The World's Largest Manufacturer of Transmitting Tubes
Canadian Factory Representative:
AHEARN & SOPER, LTD., P.O. Box 715, Ottawa, Ontario - Phone: 3-4068

For further data on advertised products use page 99,

NEWS

(Continued from page 48)

New President And Directors Named By Canadian Westinghouse

The Board of Directors of Canadian Westinghouse Company Limited announce the election of George L. Wilcox, former Executive Vice-President of the Westinghouse Electric International Company, New York, as President and Director of Canadian Westinghouse.

G. L. WILCOX

The Board also announce the election of two new directors, W. E. Phillips of Toronto, President of Duplate Canada Ltd., and L. E. Osborne, Vice-Chairman of Westinghouse Electric Corporation. The intention of the company is to elect, in addition to Mr. Phillips, other Canadian directors to its Board so that not only the independent shareholders but also the Canadian economy will be substantially represented.

Mr. Wilcox brings to his new position a thorough background in industrial management, combined with a broad knowledge in all phases of the electrical industry.

Mr. Phillips, in addition to serving Duplate Canada Ltd. as President, is Chairman of the Board of Canadian Pittsburgh Industries Ltd. He is a director of The Royal Bank of Canada, Massey-Harris-Ferguson Ltd., the Brazilian Traction, Light & Power Co. Ltd., the St. Lawrence Corporation Ltd. and several other Canadian companies. He is Chairman of the Board of Governors of the University of Toronto. His home is in Toronto.

Mr. Osborne, Vice-Chairman of the Board of Westinghouse Electric Corporation, has been with that company for 44 years.

Entron Incorporated Appoint Eastern Canadian Representative

Entron Incorporated, Bladensburg, Maryland, announces the recent appointment of Maurice Olfman, Montreal, as Entron factory representative for Eastern Canada.

JFD Opens New Canadian Plant

The JFD Manufacturing Co., Inc., Brooklyn, N.Y., recently announced the opening of a Canadian manufacturing and sales division. Called JFD Canada, Ltd., it is located at 51 McCormack Street, Toronto 14, Ontario; contains the latest, most modern stamping and assembling machinery.

In a statement, Mr. Julius Finkel, JFD President and founder, said, "Today's rapidly-expanding television markets demand that the antenna manufacturer provide the fastest possible service at the lowest possible prices." Mr. Finkel went on to say that this expansion move will give Canadian distributors and dealers on-the-spot service, faster delivery, savings in shipping and duty charges, and in product costs.

Perkin Appoints Electromechanical Products As Representative

The Electromechanical Products Company, Warden Avenue, Agincourt, Ontario, Canada, was recently appointed the exclusive manufacturer's representative in Canada for the Perkin line of DC power supplies, according to an announcement made by Philip Diamond, President of Perkin Engineering Corporation, 345 Kansas St., El Segundo, California.

(Turn to page 52)

For further data on advertised products use page 99.

time on our hands

Here's a handful of microtime . . . doled out in hundredths of a millimicrosecond. It's our new HELIDEL* delay line.

It's precise . . . wide-band . . . continuously variable. This is not an adwriter's pipedream . . . it's an engineer's, come true.

Which means that definitions are in order.

Precise = delay increments of only 2×10^{-11} sec; resolution 0.01% and better; linearity "better than ± 1%" . . . actually, so fine it can't be measured.

Wide-band = transmission of pulse signals up to 20 mc with negligible phase-distortion, overshoot, or distortion of waveshape.

Continuously variable = a distributed-constant, electromagnetic type . . . dreamed up in 1946 . . . developed in helical form since 1951, by Helipot and DuMont.

The HELIDEL is already used successfully in color-TV broadcasting and oscilloscopes . . . and as a trimmer in transmission systems.

What can you dream up?

Helipot *first in precision potentiometers*

Factory: No. 3 Six Points Road, Toronto 18, Ont.
Representative: R-O-R Associates, Ltd.
290 Lawrence Avenue West, Toronto 12, Ont.

To help you dream, there's a 10-page technical paper on the HELIDEL, *presented at the 1954* WESCON . . . *and a new data sheet, with complete specs. For your copies, write for Data File 1207.*

444 *TRADEMARK

  For further data on advertised products use page 99.

NEWS

(Continued from page 50)

W. S. Kendall Announces Collins Radio Appointments

W. L. "Murray" Binions has been promoted to the position of Assistant Director of Sales. His broad experience and wide acquaintanceship in the Canadian radio and electronics industry over the past ten years will be most effectively utilized in this new capacity.

W. L. BINIONS

J. H. McLeod, who came to Collins from the Department of Transport, will have the responsibility for setting up the Collins Field Service Organization in Canada. McLeod has just returned from Collins, Dallas, where he had several months' indoctrination on the latest equipments, including SSB transmitters, weather radar, the Collins Integrated Flight System, the Military ARC-27 UHF transceivers, etc.

Phillip Wharton will head up the Amateur and Industrial Component Sales. Mr. Wharton has a wide background of experience in electronics and has travelled extensively in this field. Wherever he has been he has set up and operated with enthusiasm. His most recent experience has been in that ham's paradise, Ethiopia, where his call letters were ET3S. His responsibility in Ethiopia was as a radio instructor for the United Nations' Technical Assistance Mission to Ethiopia. It is interesting to note that Phil Wharton was instrumental in persuading the Ethiopian Government to restore amateur radio again after the war.

CAE Opens Maintenance Laboratory At Dorval Airport

Canadian Aviation Electronics have established a repair and maintenance laboratory at the Timmins Business Aviation Hangar at Dorval Airport in Montreal.

This facility permits immediate and complete adjustment, repair or overhaul of any type of airborne electronic equipment. Should a visiting aircraft develop trouble in its communication, radio navigation or any other electronic equipment on board, it can be attended to without delay.

If new equipment is needed, it can be installed and the necessary cable harness and mounting brackets produced with the absolute minimum of delay.

CAE's Montreal plant is located six minutes drive from the Timmins Aviation Hangar, and the complete facilities of this plant are always available in support.

Douglas N. Kendall Vice-President Hunting Associates Limited

As Vice-President of Hunting Associates Limited, of Toronto, Mr. Douglas N. Kendall is executive head of all Hunting Group companies in Canada. He is President of The Photographic Survey Corporation, PSC Applied Research Limited, Field Aviation Company Limited and Kenting Aviation Limited and Vice-President of Aeromagnetic Surveys Limited.

In 1946 Mr. Kendall came to Canada to set up PSC, which has since grown to be the largest civilian aerial survey organization in the British Commonwealth, and in conjunction with other Hunting companies, the largest in the world. PSC Applied Research and Aeromagnetic Surveys, from being technical divisions of PSC, have grown to be separate companies with growing interests in the instrumentation and geophisics fields, respectively.

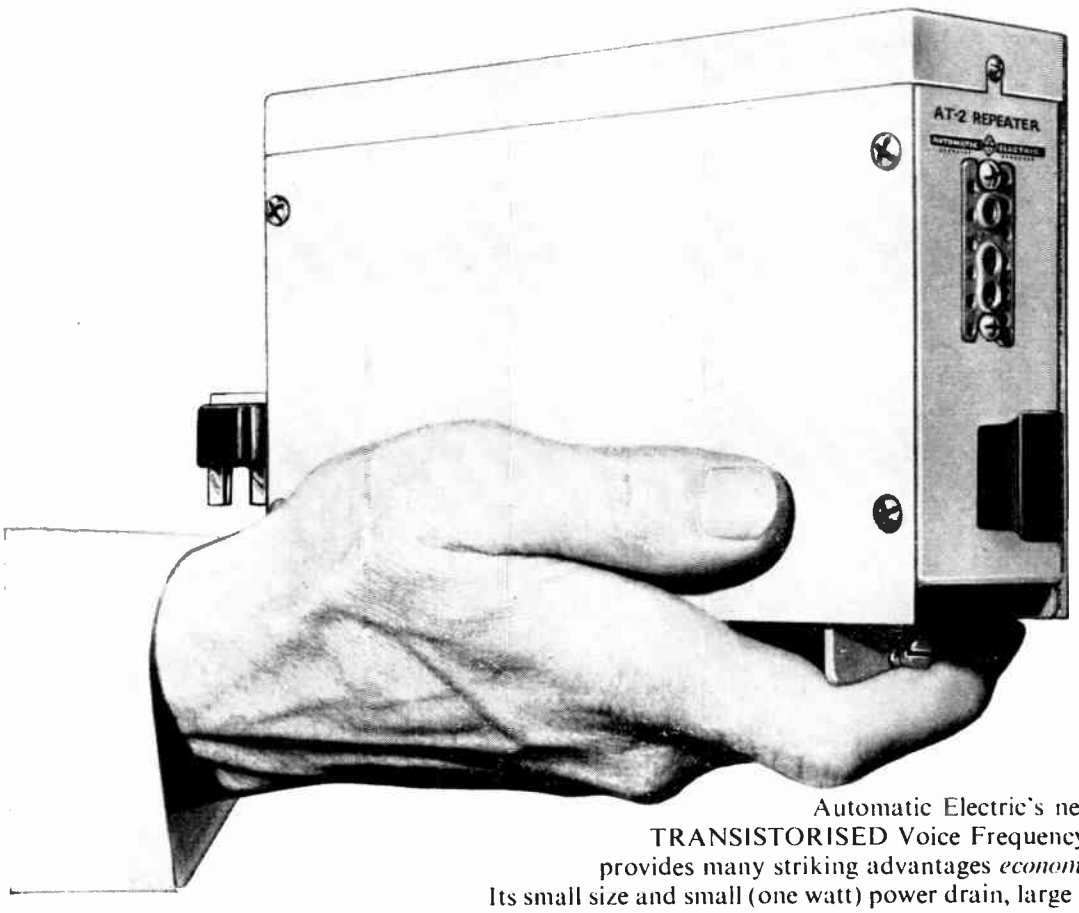
Community Television For Quebec Centers

New community television systems under construction in Magog, Quebec; Victoriaville, Quebec, and Shawinigan Falls, Quebec, are installing equipment manufactured by Entron Incorporated of Bladensburg, Maryland.

(Turn to page 64)

For further data on advertised products use page 99.

—here is the **easy, economical** way to gain toll quality transmission!



Automatic Electric's new type AT-2
TRANSISTORISED Voice Frequency Repeater
provides many striking advantages *economically*.
Its small size and small (one watt) power drain, large (up to 10 db)
gain and ease of installation, provides the answer to your transmission problems.

Saves space—Using transistors as small as a pencil eraser, instead of bulky tubes, Type AT-2 measures only 5¼" high, 2" wide, and 7½" long.

Saves maintenance—Transistors last many times longer than vacuum tubes, and are almost free from aging and dissipation. You can forget tube failures, forget frequent checks of output levels.

Saves power—Type AT-2 is fully self-contained; it needs no power supply other than your exchange battery. Draws only about 1/10th the power required for comparable vacuum tube units. (Special fins on transistors eliminate need for cooling fans, regardless of number of repeaters in installation.)

Offers simple installation—No electronic training necessary to install the Type AT-2 Voice Frequency Repeater. It can be removed at any time without interrupting conversations. A specially-designed Installer's Set is available for quick matching of network to line.

Has many applications—Maximum gain is about 10 db on non-loaded cable or open wire, and from 6 to 8 db on loaded cable or wire. You can use Type AT-2 to raise transmission to toll grade, or to permit use of smaller-gauge cable on inter-office trunks, long subscriber lines, foreign exchange lines, P-B-X tie trunks, tandem and tributary trunks, centralized intercept and information trunks, loaded and non-loaded cable, and other applications.

5559

Write today for Circular 1844.
It gives full details.

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 99.

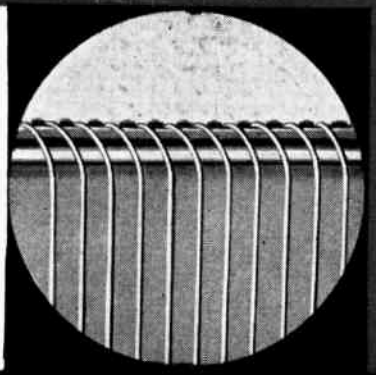
For further data on advertised products use page 99.

at work

Fashioning grids from wire that is not much thicker than a spider's silken thread is one of the many precision operations necessary to produce the components for ROGERS electronic tubes.

Designed and built by ROGERS engineers, these strong yet wonderfully sensitive grid winding machines draw out a pair of parallel wires called side rods, cut notches in them, feed winding wire around the rods and into the notches and then peen it fast in a solid mechanical bond. For a tube the size of a 6CB6 the side rods are less than 1/32" in diameter and are spaced about 5/32" apart.

High standards of engineering, rigid inspection and the thorough testing of every completed tube ensure the high quality and long-life performance of ROGERS electronic tubes.



A section of the finished grid as the inspector sees it under a microscope.

This enlargement shows the way in which the grid wire is notched into the side rods.

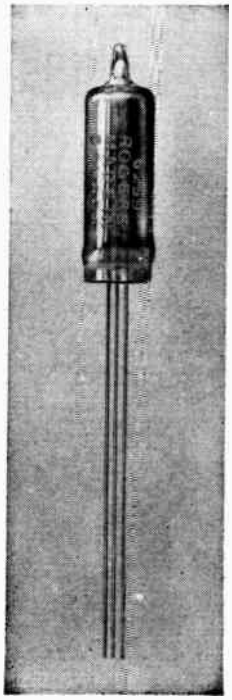
GERMANIUM DIODES · SPECIAL PURPOSE TUBES

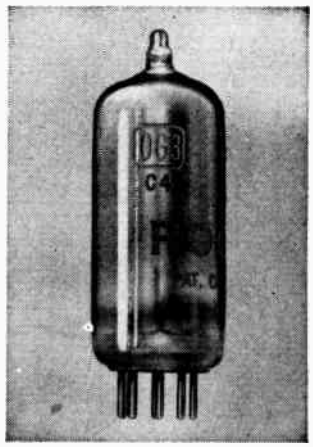
Voltage Reference Tubes

Miniature and Sub-Miniature

Types 6259 — OG3/5651

- Canadian design and manufacture
- Exceptionally high stability





▲OG3/5651—Voltage reference tube of the cold cathode discharge type; T5-1/2 bulb; miniature button 7-pin base, having exceptionally high stability over a wide current range.

◀6259—Voltage reference tube of the cold cathode discharge type; T-3 bulb; body length 1⅜" max; button base, 0.016" tinned flexible leads.

RATINGS	6259	OG3/5651
DC operating current	Max. 8.0 mA	Max. 10 mA
DC operating current	Min. 1.0 mA	Min. 1 mA
OPERATING CHARACTERISTICS		
Preferred DC operating current	4.5 mA	6 mA
A.C. resistance	max. 400 ohms	max. 400 ohms
A.C. resistance at 6 mA		300 ohms
DC starting voltage	max. 125 volts	max. 125 volts
DC operating voltage at 4.5 mA; variation from tube to tube	83-87 volts	
DC operating voltage at 6 mA; variation from tube to tube		83-87 volts
Temperature coefficient of operating voltage	-3 mV/°C.	-2.7 mV/°C.
Leakage Eb = 50V Rp = 3000 ohms	max. 5 uA	
Voltage jump	max. 0.1 volts	
Max. percentage variation of operating voltage during life	0.5 per cent	0.5 per cent
Max. percentage variation of operating voltage after first 300 hours of life	0.2 per cent	0.2 per cent
Max. short term variation of operating voltage over a 100 hour period after first 300 hours of life	0.1 per cent	0.1 per cent

Notes:

1. Equilibrium conditions are normally reached after 3 minutes operation.
2. The tubes may be operated in any position.

ROGERS

ELECTRONIC TUBE & COMPONENT DIVISION

11-19 Brentcliffe Road, Leaside, Toronto 17, Ontario

MONTREAL • TORONTO • WINNIPEG • VANCOUVER

NEW PRODUCTS

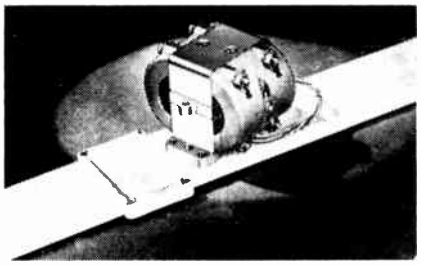
New Product specifications published in Electronics and Communications have been briefed for your convenience. If you require further information on any of the items published you may readily obtain such by using our Readers' Service, Page 99. Just mark the products you are interested in on the coupon on Page 99 and the information will be in your hands within a few days.

● *18-Ounce Torque Motor*

Item 937

A new and powerful torque motor designed to drive hydraulic servovalves or other mechanisms which demand fast response and high output force proportional to input current has recently been announced.

The torque motor is conservatively rated at nine pounds of force for 40 ma differential current. It may be driven from two miniature output tubes in push pull, or from magnetic amplifiers. When magnetic amplifiers drive the motor, low impedance, high current coils are available which dissipate the same power.



The stroke of the motor (± .015 inch) is proportional to input differential current. The displacement sensitivity is $^3/_4$ inch per ampere, or 20 ma for full stroke.

This rugged little 18-ounce motor is assembled with steel dowels and will withstand severe vibration without damage. The armature is of balanced construction so that large lateral accelerations have virtually no effect on armature position.

The torque motor is designed to operate from —65° to 400°F.

● *New Delay Line For Color TV*

Item 938

An inexpensive, distributed-constant delay line designed for use as a compensating delay in the luminance channel of color television receivers, has been announced.

The new Shallcross Type T 30036 Delay Line has an unusually high impedance of 4300 ohms and uniform response to 4 megacycles. Phase characteristics also are linear within 5 per cent to 4 mc. Total delay of the T 30036 is 0.8 microseconds. Rise time is only 0.1 microseconds.

The unit is enclosed in an aluminum can only $1^3/_8$" square by $3^1/_8$" high, exclusive of terminals. Modifications of the basic electrical and physical characteristics of the T 30036 can be made for quantity users.

Full details on this, and other Shallcross Delay Lines are available on request.

● *Self-Locking Micro Nuts*

Item 939

A line of remarkably tiny Flexloc micro nuts — miniature self-locking fasteners for precision instrument and electronic fastening applications have been introduced to the market.

The new Flexlocs meet the increasing demands of miniaturization for smaller and smaller precision fasteners, range in size from 0-80 up to 4-48.

The 0-80 micro nut, smallest in the line, measures less than one-eighth inch across its largest dimension.

It would take 261 of these miniature fasteners to fill a standard thimble.

Though much smaller than a standard Flexloc of the same nominal diameter, each micro nut provides all the mechanical advantages of its larger counterpart.

The Flexloc is a one-piece, all-metal fastener that functions as a stop nut as well as a locknut.

Its slotted, locking collar, whose segments are turned in slightly during manufacture, is expanded as the nut is tightened down on a threaded member. Spring-like pressure of the resilient, collar segments holds the Flexloc securely in place — whether seated or not — even under severe vibration. The Flexloc locks anywhere on a threaded member as soon as its locking threads are fully engaged.

Flexloc design permits repeated re-use. Because of all-metal, one-piece construction, heat, moisture, dryness of oil does not impair effectiveness.

Uniform locking torque permits more accurate preloading of bolts, studs and screws.

At present, SPS is making Flexloc micro nuts in brass, either plain or cadmium-plated, or aluminum. Size range includes 0-80, 1-64, 1-72, 2-56, 2-64, 3-48, 3-56, 4-40 and 4-48.

● *Sensitive Relay Catalog*

Item 940

A comprehensive catalog on high speed and sensitive relays is available.

The 12-page catalog describes relays especially designed for precision aircraft electronic equipment conforming to highest standards of inspection with excellent military ratings in quality control.

Operational charts and instructions for their use are included. The charts provide a means of predicting the behavior of special values of coil resistance and other operating characteristics. Dimensional and wiring diagrams are also shown in the relay catalog.

● *Snap-Around Volt-Ammeters Now Available*

Item 941

With the addition of three high voltage Amprobe Junior models there is now an Amprobe model available for every job and every budget. This complete line assures the correct model being available for all types of electrical servicing and installations.

The Amprobe Junior line of economy models are designed to fill a specific job at low cost. This tool now makes it possible for every man who formerly carried an ordinary voltage tester to work with greater accuracy and with the added convenience of a real snap-around ammeter. Amprobe Juniors are available in 0-125 250 volt models in current ranges of either 0-10, 0-25, 0-50 and 0-100 amperes ac and in 0-150/600 volt models in current ranges of either 0-25, 0-50 or 0-100 amperes ac.

The model 300 is the ideal Amprobe for general all around work. It covers 6 ammeter ranges up to 300 amperes ac and 3 volt meter ranges up to 600 volts. The tapered probe jaws are perfect for hard-to-get-at wires in crowded switch boxes.

The model 600, and 1200 are the same multi-range type of unit as the Amprobe 300 but designed to handle extra heavy loads up to 600 and 1200 amperes ac.

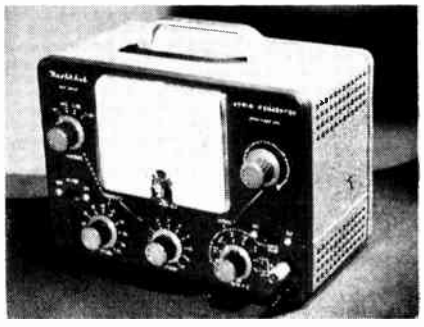
● *High-Fidelity FM Tuner Kit*

Item 942

The new Heathkit Model FM-3 features tremendous circuit improvements and brand new physical design. Sensitivity is better than 10 uv for 20 db of quieting, and it employs a completely modern tube line-up for high-gain and stable operation. Incorporates its own power supply, and has provision for low-level or high-level output at low impedance.

The attractive Model FM-3 matches the WA-P2 Preamplifier in color, styling, and physical size.

Incorporates automatic gain control, a highly stabilized oscillator, and illuminated tuning dial. Educational treatment of construction manual simplifies assembly for the

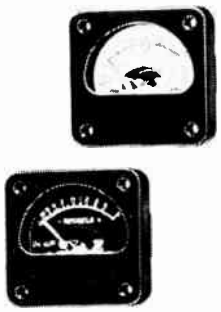


newcomer to electronics. IF and ratio transformers are prealigned, and the front-end tuning unit is pre-assembled and aligned. Uses 6BQ7A as a cascode type RF stage, 6U8 oscillator-mixer, two 6GB6's as IF amplifiers, a 6AL5 ratio detector, a 6C4 audio amplifier, and 6X4 rectifier.

• *VU And DB Panel Instruments*

Item 943

These new, completely self-contained $1\frac{1}{2}$" precision panel instruments are ruggedized and conform to MIL-M-10304 and MIL-M 3823 specifications. They are accepted and used by the armed services, and in commercial applications where audio level monitoring is necessary.



Both the VU meter and DB meter are available in either square or round housings. They are designed to meet the size and weight reduction requirements in anrcraft and electronic equipment which are subject to shock vibration or temperature extremes.

Positive watertight sealing is accomplished by an internal locknut between the meter mounting flange and case barrel. Terminal studs are sealed in a similar manner.

Various ranges, front or rear panel mounting, internal or external zero adjuster and rear illumination are available in this series.

• *Germanium And Silicon Lenses*

Item 944

Germanium and silicon lenses may now be obtained for use in infrared optics. Because of the high refractive indices, single elements have appreciably less aberration than glass lenses of equal power. Germanium is transparent beyond 1.8 microns with a 50 per cent reflection loss when uncoated. Silicon is transparent beyond 1.1 microns with a 45 per cent reflection loss when uncoated. Silicon has a strong absorption band at 9 microns. These lenses may be anti-reflection coated to provide transmittance of over 90 per cent for the spectral region of interest.

The sharp cut-off filter properties of these materials together with their excellent lens properties makes them of considerable importance to the infrared designer.

The manufacturers will design and fabricate lenses and optical elements to customers' performance specifications.

• *Vulcanized Fiber Containers For Electronic Components Described In Bulletin*

Item 945

Lightweight vulcanized fiber materials handling containers that can be used to speed the intra- and inter-plant transport of delicate radio and electronic components are described and illustrated in a recently released catalog.

This 24-page, multi-color brochure covers the company's line of Kennett tote boxes, trays and other materials handling receptacles, which can be supplied with removable compartments sized to fit all types of electrical parts and assemblies.

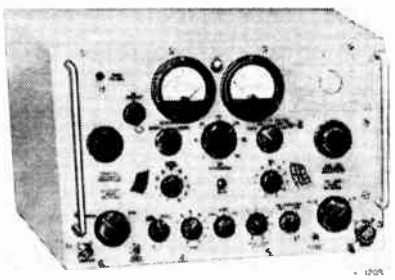
These fiber containers, providing complete protection for the most delicate components, offer advantages of strength, lightweight and durability. Nesting-stacking types permit multiple stacking of full containers and compact nesting of empties.

• *Radio Field Strength Meter*

Item 946

This extremely rugged equipment is designed to make field strength measurements in the range of 19 to 125 megacycles and will accurately measure field intensities ranging from 2 microvolts to 2.5 million microvolts per meter. Model 728 can be used to measure the field intensities of both AM and FM transmitting stations.

Provisions for linear or logarithmic output indications for recording meter use are included. Readings in decibels above 1 microvolt per meter are made by the simple addition of three values. Measurement of noise intensities can be made by means of accessory probes.



Model 728 consists of three separate units-receiver, power supply and antenna, each supplied in a separate case. The power supply operates from either wet or dry cells. A self-contained charger is provided for re-charging the wet cells. The antenna case contains an adjustable tripod, an adjustable dipole and other accessories. An antenna "K" constant chart (Bureau of Standards Data) is furnished with each unit.

The equipment is designed to meet the stringent requirements of military specifications for field use.

(Turn to page 58)

For further data on advertised products use page 99.

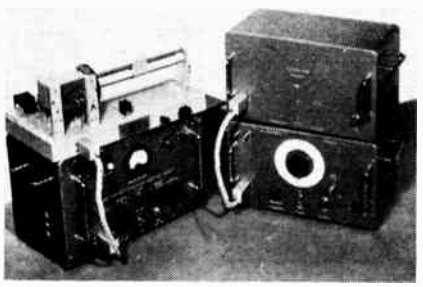
NEW PRODUCTS

(Continued from page 57)

• *Automatic Hysteresis Loop Recorder*

Item 947

An entirely new automatic hystereris loop recorder is now being distributed through the Commercial Products Division of Canadian Marconi Company. Designed to facilitate the testing of magnetic materials usually done by ballistic methods. It records the hysteresis loop on a chart 30 x 20 cms. in a few minutes, the time being controlled according to the material under test. The sensitivity of the record is controlled by the dial setting of the integrator amplifier. This covers a range of from 6 x 10^1 to 8 x 10^5 line turns per cm. on the recording chart. In practice this means that with a specimen of 1 sq. cm. section with a winding of 100 turns, 1 mm. corresponds to 60 lines (gauss).



The magnetizing current is automatically controlled and can be set to any maximum value up to 400 mA. This gives ample magnetization for saturation on normal ring samples without an undue number of turns. The control of the exciting current is such that it automatically reverses at each end of the loop, so that magnetization can be followed over any desired number of cycles. In addition minor loops at any point on the cycle can be plotted, by pressing a button which reverses the current.

Such alloys as H.C.R. can be plotted without any particular difficulty as well as silicon iron. One feature is the ease with which this flux measurement can be calibrated. This is done by simply applying a known e.m.f. for a definite length of time and noting the reading. No mutual inductance is involved. The reading is simply the integral of the fundamental equation

$$e = \frac{d\phi}{dt} \times 10^{-8}$$

where N = number of turns
and ϕ = flux in lines per sq. cm.

• *New 4-Channel Open-Wire Carrier System*

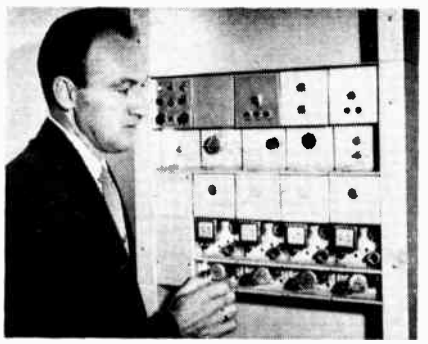
Item 948

Development of a new miniaturized 4-channel carrier telephone system for open-wire lines has been announced and is now being placed in regular production at the company's plant in Vancouver, B.C.

A prototype was given extensive tests under field operating conditions in the southwest part of the United States this summer.

The new system uses single-sideband suppressed carrier operating in the frequency range of 40 to 76 kc and co-ordinates with Western Electric OB carrier. The 45CB is designed to permit operation on the same open-wire pair with 3-channel Lenkurt 33A systems or other carrier systems using frequencies below about 35kc.

Three of the common equipment units in the 45CB have been transistorized. In addition to transistors, the new system has the latest proven electrical and mechanical design techniques such as unitized plug-in construction. All four channels are companded.



Type 45CB is the fourth system to be developed for the Lenkurt 45-class carrier family. Other 45-class systems include a 12-channel open-wire, 24-channel cable, and 240 channel radio carrier. These are designed so that channel groups can be transferred between different systems at carrier frequencies.

• *Booklet On Magnetic Tape Manufacture*

Item 949

Owners and operators of tape recorders, students, and others interested in magnetic recording will find a great deal of useful and interesting information about the manufacture and quality control of magnetic recording tape in a new illustrated folder recently published.

This new folder, "How Magnetic Tape is Made", completely describes and illustrates in six photos every step in the manufacture of magnetic recording tape, from start to finish. The publishers of the booklet, are the manufacturers of a line of well known tapes, and they are offering copies of the booklet free on request.

(Turn to page 60)

For further data on advertised products use page 99.

EDITOR'S PAGE

(Continued from page 25)

This was the tenor of His Eminence's remarks. The few lines which seem to have aroused some criticism was therefore isolated from the context of this message. They were not even correctly translated. For instance, His Eminence has been quoted as saying "the diffusion of a belief tending to substitute man for God by exalting his (man's) bounty and glorifying his egotism". This is not what His Eminence said at all. He was merely comparing the Christian concept of man weakened by original sin and the doctrine which strives now to substitute man for God by exalting man's natural *goodness* and *making* light of his tendency toward pride and egotism. Quite a difference!

May I point out that these words are vastly different from the ones which led you to apply His Eminence's statement to the starving millions in the world. I assure you that the concern of His Eminence for all of humanity is too well known to need any defense.

I think that anyone who reads the sermon of His Eminence in its entire context would not interpret it as a condemnation of technical progress. Far from begrudging the worker greater hours of leisure, he is only concerned to see this leisure used for human and cultural purposes. We might mention in passing that on this point Robert M. Hutchins in a recent visit to our city spoke on much the same terms. It would be a pity then if the important and timely message which the Cardinal delivered to the workers should be misunderstood and misinterpreted by criticisms based on a few lines taken out of context, and some of them not even true to the original.

Yours sincerely,
(Rev.) Alex Carter.

* * *

A firm of television manufacturers have recently released figures to show that they have consumed over 10,000,000 miles of wire of all types in the production of their television receivers. At first glance this would appear to be something of a record but compared to the lineal measure of red tape imposed upon the public by the Ontario Liquor Commission in the matter of filling out forms as a prerequisite to the purchase of a few ounces, it's hardly enough to tie one's sock up with.

* * *

Speaking of developments in the field of electronics perhaps one of the more startling to be made known is the music synthesizer, a device which can generate any tone produced by any musical instrument or by the human voice. According to claims that have been made for the contrivance it can reproduce audible tones that are beyond the range of the human voice or conventional musical instruments. Long playing records consisting of a medley of Stephen Foster tunes as played by a hillbilly band, a selection written by Bach for clavicord, Arndt's Nola for piano and Irving Berlin's Blue Skies has already been produced with the music synthesizer. The startling aspect of the records is the fact that neither an orchestra, a hillbilly band nor a clavicord were required to produce the selections. This cleverly accumulated mass of electronic hardware did it all by its own little roll of punched tape.

Alfred Wallenstein, conductor and music director of the Los Angeles Philharmonic Orchestra anticipates that the music synthesizer will find many uses in the future ranging in nature from that of a clinical tool for musical therapy to its possible use in psychological warfare. If we interpret the description of this machine correctly it would appear capable of unerringly duplicating anyone's voice and speech characteristics which, in our opinion, would make it a dangerous box of tricks to be in the possession of unscrupulous hands.

For further data on advertised products use page 99.

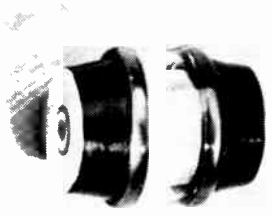
NEW PRODUCTS

(Continued from page 58)

• *Miniature Vacuum Fixed Capacitors*

Item 950

The smallest vacuum capacitors on the market, measure only $1\frac{5}{8}$ inches in length by $1\frac{5}{8}$ inches in diameter. They are available in capacities of 25, 40, 80, 120 and 150 mmfd at voltages of $7\frac{1}{2}$, 10, and 15 kv peak. Their all-copper construction makes possible current ratings of 30 amperes rms which can be doubled with the use of forced



air cooling. Their small size, low inductance, and negligible dissipation factor make them extremely useful for operation at the higher frequencies. Like all vacuum capacitors they are not damaged by internal arcing due to moderate over-voltages. For ease of mounting 8-32 tapped holes are provided on both ends.

Hi-Fi Replacement Stylii

Item 951

A fundamental change in the design of G-E high fidelity replacement stylii has been announced.

The new design stylii will be marketed under the name "Clip-In Tip" and will permit changing individual stylii tips by a simple "slide-in" method. In the new stylii models, the positioning knob, shaft and stylus holder have been made a permanent part of the variable reluctance cartridge. Only the diamond or sapphire tip and its baton need be replaced.

The present G-E stylus, requiring replacement of the entire assembly, has been completely abandoned. All future production will have the "Clip-In" feature. The change in design does not affect the performance characteristics of the stylus or cartridge.

The new stylii will permit users of the G-E single stylus cartridge to adapt their equipment to the three popular record speeds without changing the cartridge. With the dual cartridge, the user is now offered complete freedom in selecting and maintaining the combination of stylii best suited to his record collection.

It is further noted that the new stylii design offers a solution to the problem of dual stylii service which, with current models, involves the loss of both tips for the time it takes to service one. Using the "Clip-In Tip" models, the old stylii tips can quickly be removed while the companion is left in use.

Six "Clip-In Tip" stylii are available.

• *Microwave Frequency Standard For Accurate Measurements In 2400 To 40,000 mc Range*

Item 952

A new Microwave Frequency Standard for the accurate (.001 per cent) measurement of frequency from 2400 to 40,000 mc has been announced. It consists of a temperature stabilized crystal oscillator followed by a multiplier-amplifier chain, with outputs at 100,500, and 1500 mc.

The Standard is supplied complete with sweep circuits for use with reflex klystron local oscillators to obtain beats with harmonics of the Standard output.

Complete waveguide set-ups are supplied for the frequency ranges specified by the customer. These set-ups include a harmonic mixer for multiplying the Standard signal and mixing with the kylstron output, frequency meter, directional coupler, two variable pads, termination, detector, and coaxial adapter when required. The harmonic mixer is the only mixer specifically designed for multiplying a standard crystal controlled signal for frequency measurement. The waveguide components are all available individually if the customer wishes to make use of equipment now in his possession.

Besides the basic package and the waveguide components, the customer will require a video amplifier, a shortwave receiver, and an oscilloscope.

The purpose of the improved design is to incorporate advances in the present state of the art not available in present equipment.

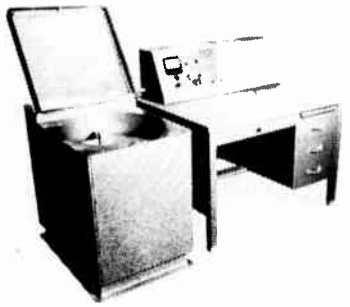
• *Precise Rotary Accelerator*

Item 953

A new, compact acceleration testing machine that tests and calibrates small assemblies while at the same time subjecting them to multiples of the acceleration of gravity has recently been developed. The accelerator, Model CK9X, is capable of subjecting objects as large as a 5" cube weighing a maximum of three pounds to accelerations up to 250 G's. The rotating table is tapped with groups of holes to permit mounting, testing and calibrating four objects simultaneously. The electronic controller furnishes a speed range up to 1000 rpm with very precise speed control. Eight instrument slip rings

For further data on advertised products use page 99.

are provided for electrical connection between rotating test objects, stationary instruments and power sources. All rings have shielded leads and are rated at 5 amps at 220 v and 10 amps at 110 v. The column assembly, motor mount, motor, rotating table, tachometer generator and rpm pickup are in a compact group, installed in a fabricated steel test stand with an integral ¼" thick steel plate safety guard enclosing the rotating table. The lid over the rotating table has a transparent window



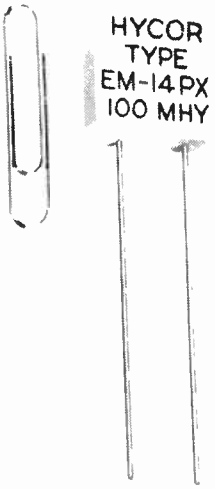
of ½" thick plexiglas which permits observation of the table top while providing protection for the operator. All controls are centralized in a console which may be placed on a table or desk remote from the machine. A tachometer generator and meter provide continuous speed measurement accurate to 2 per cent. In addition, a Strobocon frequency meter may be used to provide rpm readings accurate to ± .1 per cent. Dynamic braking is provided to bring the rotating table to a rapid stop. Single and four line pressure and vacuum systems are available if desired.

● *Toroid Coil*

Item 954

A new addition to the "Postage Stamp" Toroid Coil Series is announced by Hycor Company, Inc. This new configuration was designed specifically for use in printed circuitry. The tinned No. 20 AWG wire leads are spaced in accordance with the standards recently proposed by the RETMA Automation Committee.

The unit consists of a sub-miniature molybdenum permalloy toroid core with a winding having a residual hole as small as



1/16" diameter. Windings are impregnated with a special compound and the finished coil is encased in a tough epoxy plastic. Overall dimensions are: 13/16" x 13/16" x 3/8" thick.

It is available in any inductance up to 1 hy. The useful frequency range covers 1500 cps to 150 kc, dependent upon the inductance value. The unit is capable of withstanding temperatures from —55°C. to +125°C., plus extreme environmental conditions. Bulletin STP, showing complete technical data, is available upon request.

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For further data on advertised products use page 99.

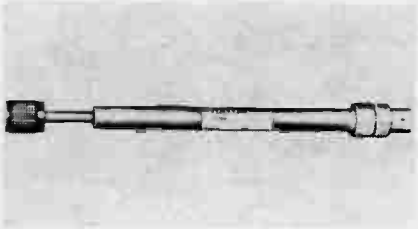
NEW PRODUCTS

(Continued from page 61)

● *First Sliding Coaxial Termination* *Item 955*

Two important developments in microwave test equipment, the first coaxial terminations with a low VSWR and the first sliding coaxial termination ever available, have been announced by The Narda Corporation, Mineola, Long Island, New York.

The basic Narda coaxial termination consists of a molded "Narda-Iron" terminating element mounted in a coaxial line and having a VSWR less than 1.05 over the entire frequency range of the S to X band, 2400 to 12,400 megacycles.



"Narda-Iron" is a new termination material developed by Narda engineers. It consists of powdered iron dispersed in plastic, and is cast to shape.

The Narda fixed coaxial terminations are useful for terminating directional couplers and other devices in actual operation or for test purposes. The low VSWR for the terminating element increases the effective directivity of directional couplers and facilitates more accurate VSWR measurement of all types of coaxial components.

The Narda sliding coaxial terminations provide the most accurate and convenient method for evaluating the residual VSWR of coaxial slotted lines and standardizing all types of impedance measuring equipment for coaxial line components. These terminations are particularly valuable for determining the VSWR of RF cables, connectors and adapters.

Both fixed and sliding terminations are available with type N or C connectors, either male or female. Power ratings are 5 watts average, 5 kw peak.

● *25 Per Cent Weight Savings With New Magnesium Mounting Bases* *Item 956*

Magnesium mounting bases weighing 25 per cent less than comparable aluminum bases with no sacrifice in strength and shock performance have been developed.

The bases are available in all Jan-C-172A and Mil-C-172B standard sizes and are also supplied in special sizes to meet unusual loading and dimensional requirements. The 25 per cent savings in weight per base times the number of such bases aboard an aircraft can mean as much as five to seven pounds saved.

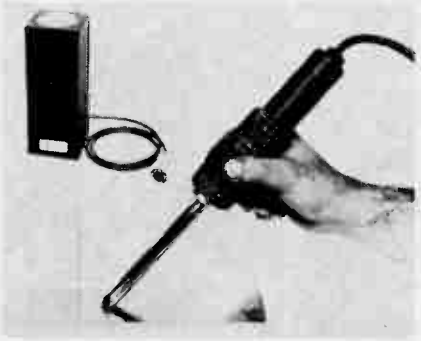
Although the virtue of lightweight magnesium has long been recognized, its application to mounting bases has been difficult because of the special problems of welding, and in the control of galvanic action between the magnesium and stainless hardware. The galvanic effect is defeated by "padding" the hardware with nylon and thereby isolating it from the magnesium.

These magnesium mounting bases can be equipped with the Finnflex all-metal vibration mounts which meet all requirements of Mil-C-172B.

● *Ultrasonic Solder Gun* *Item 957*

A new soldering iron operated ultrasonically and having an internal source of heat for melting solders has been announced.

Designed for fluxless soldering and tinning of aluminum, germanium, silicon, and other hard-to-solder metals, the Alcar Solder Gun W Heated Tip (Model 1152) corrects a basic fault of conventional ultrasonic



soldering irons which require external sources of heat. A special heating coil within the transducer delivers heat to the working tip via a second power line contained in the one cord set. This eliminates the need for cumbersome heating devices to flow the solder.

Unit is resonant at 20 kilocycles and may be operated from either of Alcar's 30 or 100 watt generators.

● *Lightweight, Miniature Continental Connector For Airborne Electronics* *Item 958*

Two page illustrated color bulletin describing features of the new, 37 contact Continental Connector suitable for airborne electronics. Bulletin includes electrical and mechanical ratings, mounting and clearance dimensions and diagrams.

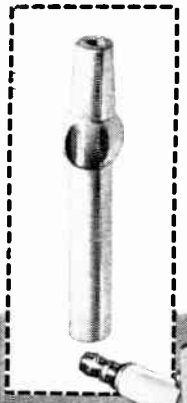
(Turn to page 65)

For further data on advertised products use page 99.

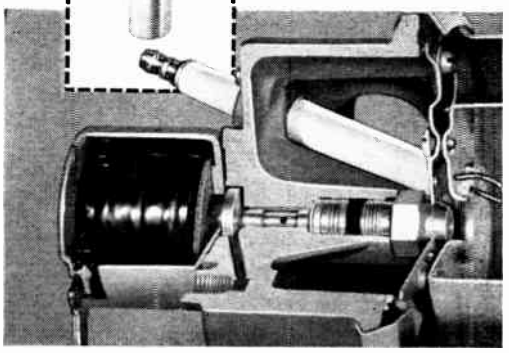
To withstand high heat, shock, and continuous off-on cycling . . .

Centralab ceramic insulator

used as igniter in new, instant car heater



Close-up of Centralab Electrical Porcelain spark-plug body.



Cutaway view of the heat exchanger and burner assembly. Centralab Electrical Porcelain spark plug is in upper left-hand corner. Fuel is ejected through metal nozzle just below spark plug.

A newly designed, gasoline-burning, instant heater for passenger automobiles uses the principle of reliable aircraft heaters.

The new heater is an injection-type system which is complete in itself. Ignition is accomplished by a spark plug of Centralab Electrical Porcelain, energized by a separate ignition system.

The spark is cycled off and on with the fuel — usually several times per minute, as the off-on cycling modulates heater output. Ignition is instantaneous.

This calls for complete reliability and perfect timing — accomplished with Centralab Electrical Porcelain made for specific heat-range and heat-shock requirements. Like all Centralab ceramics, it has high heat resistance, high dielectric strength, and dimensional stability.

Get the whole story on *all* the Centralab ceramics — including Steatite, Cordierite, Zirconite, and Titanate. Write for Centralab Ceramic Buyer's Guide, Bulletin 42-221. Or refer to it in Sweet's Product Design File.

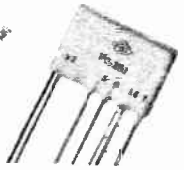
More proof that if it's a job for electronic components, it's a job for Centralab

Centralab's advanced engineering continues to create the prototypes of the components industry

CONTROLS

CERAMIC CAPACITORS

SWITCHES



PACKAGED ELECTRONIC CIRCUITS

CERAMICS

SPECIAL this month only!

Centralab Sweepstakes

28 Big Prizes!

Nothing to buy!
Nothing to answer!

1st PRIZE — $100.00 Gift Certificate for a Hart Schaffner & Marx Suit.

2nd PRIZE — Four (4) Arrow Shirts.

3rd PRIZE — Two (2) Arrow Shirts.

Twenty-five (25) 4th PRIZES — One (1) Arrow Tie each.

To be eligible for the grand drawing, simply send us your name and address on your letterhead. Or ask your Centralab rep for an entry blank. Entries must be postmarked no later than midnight, December 31, 1955. Contest not open in states where prohibited.

X-5513

Centralab Canada Ltd.

A DIVISION OF GLOBE-UNION INC.

964C E. Keefe Avenue • Milwaukee 1, Wisconsin
In Canada: 804 Mt. Pleasant Road, Toronto, Ontario

SINCE 1922, INDUSTRY'S GREATEST SOURCE OF STANDARD AND SPECIAL ELECTRONIC COMPONENTS

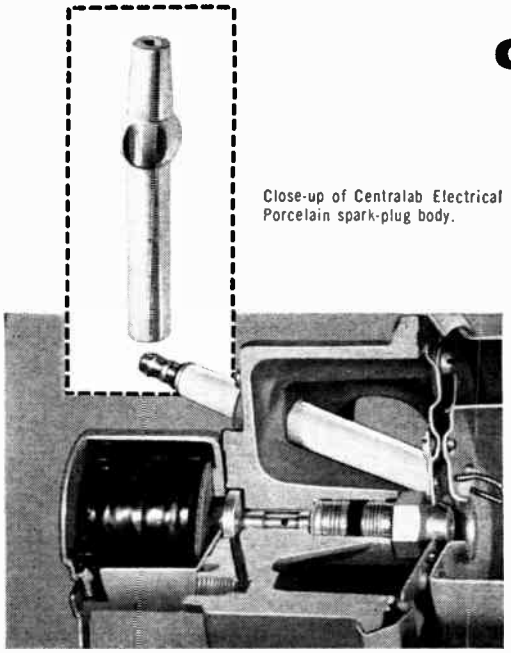
For further data on advertised products use page 99.

For further data on advertised products use page 99.

To withstand high heat, shock, and continuous off-on cycling . . .

Centralab ceramic insulator

used as igniter in new, instant car heater



Close-up of Centralab Electrical Porcelain spark-plug body.

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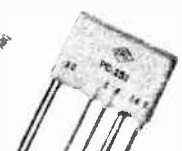

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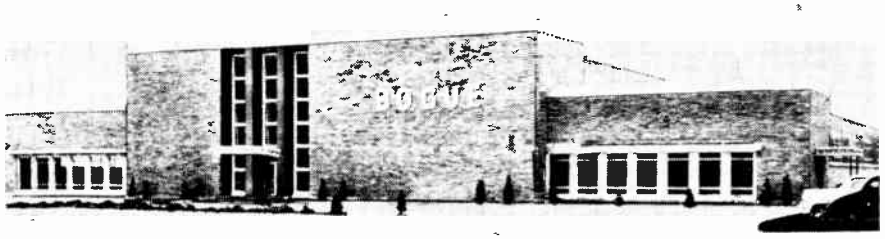


● Top: Exterior view of Bogue Electric of Canada's new headquarters in Gloucester, near Ottawa, Ontario. The new plant has 80,000 square feet of manufacturing space under roof. It is located on a 28-acre site. Bottom: Interior of the new plant. The plant will be equipped with the most modern production and testing facilities, and will employ approximately 350 persons when in full production.

Bogue Electric Of Canada Limited Open New Plant

Bogue Electric of Canada, Ltd., have formally opened their production and administrative headquarters in a modern plant recently completed at Gloucester, near Ottawa, Ontario, it has been announced by Edward P. Schinman, president.

An address by The Honorable C. D. Howe, Minister of Trade and Commerce and an Open House highlighted the inauguration ceremonies at which some 500 guests including important industrial and military leaders from the United States and Canada were present.

The new plant will give the Canadian firm important new facilities for the production of motors and generators, power supplies, control systems and electronic components for a wide range of industrial and military applications.

Mr. Schinman stated that the new plant will help to supply Canada's growing needs for these industrial power supplies and control systems as well as supply her Air Force and Navy with vital control and communications apparatus.

"With the Royal Canadian Air Force now engaged in the greatest peacetime build-up in its history, Bogue equipment specially designed to serve its needs — from tiny components for guided rockets and missiles to unique aircraft testing, servicing and starting equipment — will make important contributions to Canadian air power," Mr. Schinman said.

Other products to be manufactured at the new plant will include water conditioning equipment, magnetic amplifiers, rectifiers, servo-systems, sonic tank gauging equipment and bearing temperature monitors.

Designed for a maximum of efficiency and ease of materials handling, the ultra-modern industrial structure covers approximately 80,000 square feet under one roof. When the plant is in full production it will employ approximately 350 persons under the supervision of Mr. Thomas Trumbour, factory manager.

CAE To Handle Raytheon Communications Equipment

A variety of communications systems will now be distributed in Canada by Canadian Aviation Electronics of Montreal, according to an agreement with the Raytheon Manufacturing Company of Waltham, Mass. Among the Raytheon equipment to be handled by CAE will be the Raytheon color telecast equipment, which provides simultaneous video and high fidelity voice signals facilities. This equipment is provided in two variations for long range (I Watt) and medium range (.I Watt).

(Turn to page 76)

For further data on advertised products use page 99.

NEW PRODUCTS

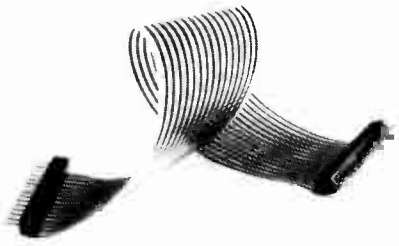
(Continued from page 62)

• *Flexible Printed Circuit Cables*

Item 959

Flexible printed circuit cables — made by an exclusive process of laminating the versatile plastic Kel-F with copper in thin sheets — are now being introduced. This unique development introduces an entirely new concept in the fabrication of multi-conductor cables or wiring harnesses.

The new cables have excellent electrical and mechanical properties for operation over a wide range of environmental conditions. Complete encapsulation of the conductors in Kel-F ensures maximum protection against moisture. Glass cloth can also be included in the laminations for increased strength and high temperature stability.



These new cables are lighter and thinner than many conventional cables. They are adaptable to many types of connectors or terminations and are easily secured by clamps, rivets or cement. The manufacturing technique eliminates wiring errors.

Additional conducting and insulating layers can be added to the basic cable to provide a greater number of separate conductors. As many as three conducting layers are possible, depending on the flexibility required. Each layer is made slightly shorter than the layer below to expose all the conductor ends for solder connection. Stacked circuits have been built up to five layers and may go higher depending on the application.

• *New AC Voltage Regulator*

Item 960

A new ac regulator designed and manufactured in Canada is now available for early delivery.

The Stedivolt will supply up to 7 kw on a 115 v line to a regulation of ½ per cent, for input variations between 103 v and 125 v — even wider range and faster response is obtained with loads 3.5 kw and under.

Supplied complete with heavy steel box as illustrated, the Stedivolt can be mounted easily in any location. A readily accessible present control permits setting output voltage to any desired level within control limits. (Voltmeter can be supplied as optional extra.)

Stedivolt advantages include:

Zero waveform distortion — Independent of power factor — Quiet operation — Simplicity and reliability — all components are standard proven industrial types — Fuse protection included — Accurate high speed regulation.

The Stedivolt should be used wherever line regulation is critical — in laboratories, standards rooms, instrument department, electric furnaces, heat treating, critical lighting installations — for all applications where accurate fully-automatic regulation is required.

• *Blast-Proof Water-Proof Loudspeaker*

Item 961

The availability of a new blast-proof and water-proof four-inch loud-speaker for radio and intercom service has been announced.

The P4-SB is designed to meet the requirements for a small, highly efficient loud-speaker which must operate reliably after exposure to heavy gun blasts, extreme shock and vibration, immersion in water and extremely high humidity. Reliability is a must in armed services field equipment and inclusion of these speakers in such equipment currently supplied is indicative of their performance under the above conditions.

This loudspeaker is available in two models — P4-SB-1 for mounting on front of panel and Model P4-SB-2 for mounting on rear of panel.

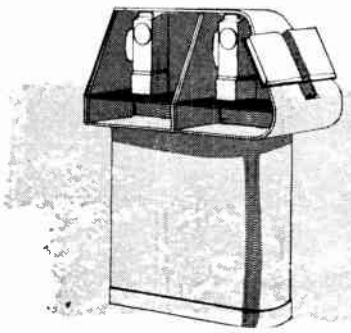
(Turn to page 69)

For further data on advertised products use page 99.

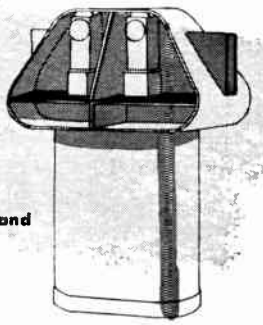
For further data on advertised products use page 99.

When it comes to TELEPHONE STANDS

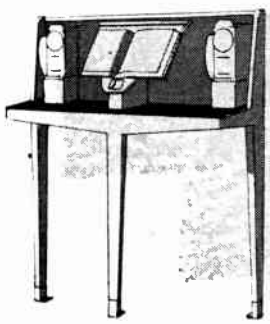
whether you want them ...



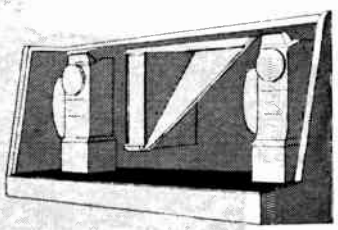
... wall mounted



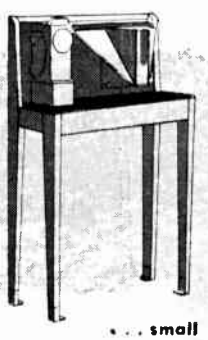
... or island



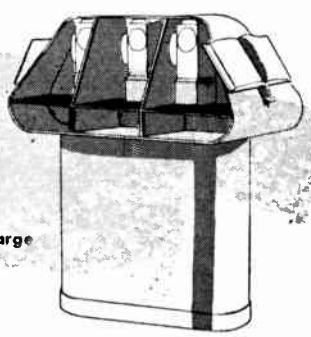
with legs ...



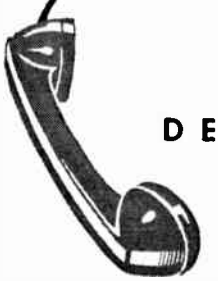
... or without legs



... small



... or large



DESIGN CRAFT *have the award-winning answer!*

It's easy to understand why Design Craft won the citation of merit from the Association of Canadian Industrial Designers for *distinctive appearance* and *planned efficiency*. The wide variety of modern designs . . . the wide choice of durable finishes that blend with any interior, make Design Craft *first* choice when it comes to Pay Telephone Stands. Details of the complete range are available from Automatic Electric.

Distributor in Canada

AUTOMATIC ELECTRIC

SALES (CANADA) LIMITED

Head Office: 185 Bartley Drive, Toronto 16

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

5562

For further data on advertised products use page 99.

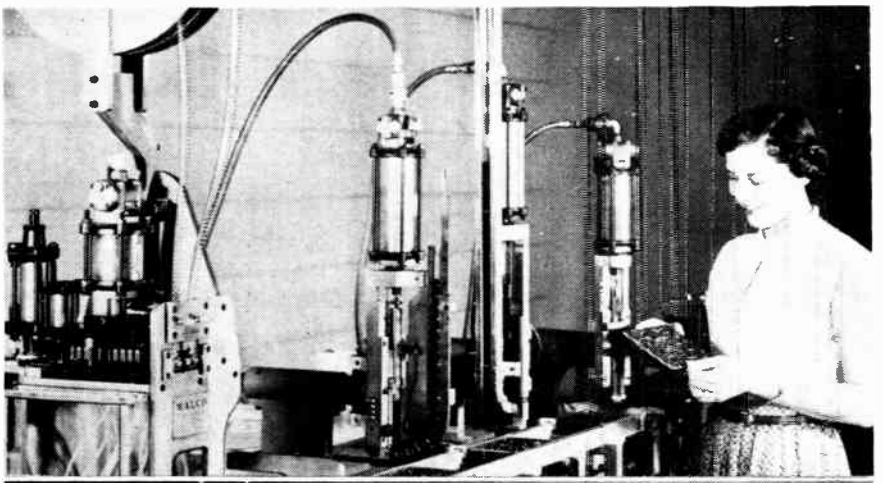
AUTOMATION

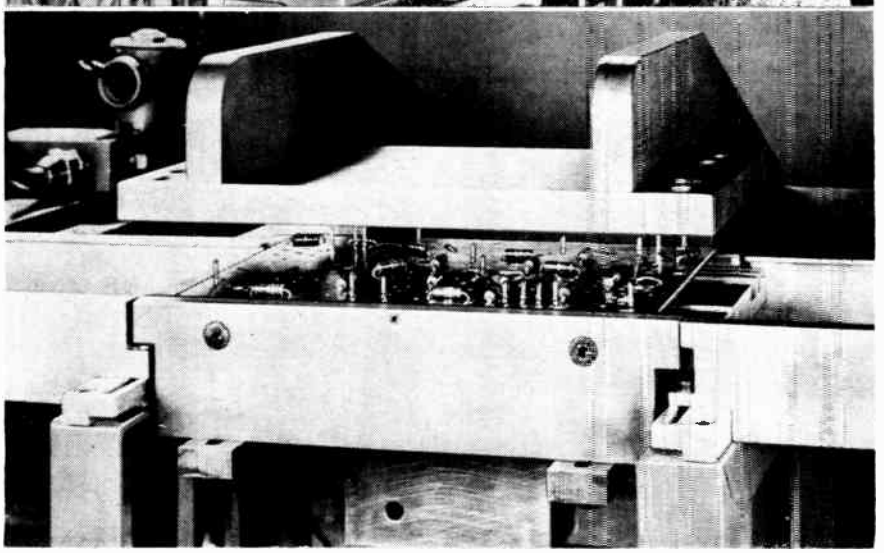
(Continued from page 29)

This feed portion of the machine is pneumatically operated and designed for quick replacement in the event of malfunction. It's construction is based on a gear and rack principle. The rack carries two feed pawls which are cammed individually to feed any desired number of pins by registering and locking the cam bar in line with the graduations on the plastic face plate. The chain scrap is also cut up in this section of the machine for efficient handling.

Transfer and handling of boards through the Malco machine can be accomplished either by rails or pallets normally used in automatic component assembly machines or they can be engineered to meet individual applications.

One leading radio-television manufacturer, using the Malco inserting machine in conjunction with other automatic assembly equipment, has eliminated over 400 hand soldered connections. Over 70 per cent of the components are automatically inserted. Adoption of methods similar to these will be industry-wide within the next few years.





● **Top: Examining printed circuit board taken from mechanized production line. In foreground is pin and contact inserting machine that inserts up to 40 or more self-retaining pin terminals and contacts within 3 seconds. Bottom: Close-up view of second stage of Malco automatic pin and contact inserting machine. Platen presses inserted terminals into printed circuit board, engaging self-retaining snap-in feature.**

The transfer mechanism then carries the board to the second stage of the operation where the platen ascends against a specially constructed plate with bushing inserts. This snaps the terminals into the board to retain them during subsequent operations prior to soldering.

The construction of the bushings in this station are of a funnel shape and highly polished, thus facilitating positioning and straightening of the pins during the snap-in process.

**Note: Equally important are the "human" or economic factors it has created. While an article of this nature is not concerned with these, they must be briefly mentioned. First, skilled operations and machinery has opened new fields for trained technicians. Second, since the manufacturer can produce "more" for "less" and is passing it on to the consumer as such, employment is increasing — not decreasing — as production strives to meet greater consumer demand.*

For further data on advertised products use page 99.

NEW PRODUCTS

(Continued from page 65)

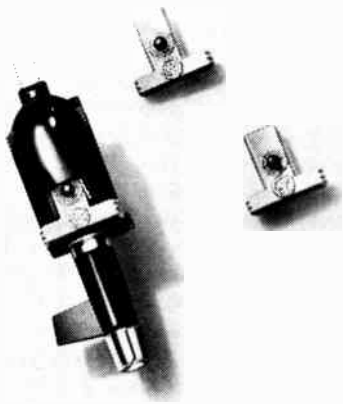
● *"Fluxvalve"*

Item 962

The "Fluxvalve", a radically new wide-range magnetic pickup with easily replaceable stylii has been introduced according to a recent announcement.

The unique design of the Fluxvalve meets the demands of all presently envisioned recording developments, including those utilizing less than 1 mil stylii.

With this revolutionary new pickup tracking distortion, record and stylus wear are reduced to new low levels.



The Fluxvalve is a turnover design featuring easily replaceable styli. A new kind of stylus, it has extremely high compliance for low tracking force (2-5 grams). The vibratory mass has been reduced to an amount so low that pickup response is flat at 30 kc on ordinary vinyl. A vital factor for smooth high frequency and transient response.

Electrical characteristics of the Fluxvalve include: frequency response absolutely flat to well beyond 20 kc; negligible intermodulation distortion; output of 25 millivolts at a normal recording level; and medium impedance, requiring a termination of 47,000 ohms.

The entire magnetic circuit, including the magnetic gap, is completely encapsulated in a tough plastic; dirt cannot enter the magnetic gap and the inside of the entire pickup is preserved indefinitely. The pickup is supplied with a mounting clip which adapts it to all standard arms, and also acts as the bearing for the turnover action.

● *Subminiatures Featured In New Neomatic Relay Brochure*

Item 963

A new brochure illustrating rugged subminiature relays designed for a wide variety of high-precision applications has been issued by the manufacturer.

Built to watch precision for today's electronic "tight spots", these relays feature high performance and shock qualities unique in subminiatures.

The brochure includes the world's smallest precision relay, the first built in a standard transistor case for transistorized circuitry.

Also featured are the Neomatic VK and VR series, light-weight, compact units with excellent vibration resistance due to counterbalanced armature design.

The brochure lists a variety of enclosures available in the VR and VK series and a complete rundown on specifications.

(Turn to page 70)

For further data on advertised products use page 99.

NEW PRODUCTS

(Continued from page 69)

• *"Extra Eyes" For Industry*

Item 964

The world's smallest self-contained television camera for circuit applications in industry is now available in Canada.

Weighing only 8½ lbs. and measuring a mere 4½" x 6½" x 10" the Dage 60 series camera is suitable for many industrial applications including plant security, plant inspection and supervision and remote observation of dangerous operations and material flow. Because it is compact, light weight, portable and sturdy the Dage unit can be easily installed out of sight, making hard-to-reach locations instantly visible.

A full range of accessories including a remote control panel is available. Any one of four lenses can be remotely selected and focussed for a choice of wide angle, normal and telephoto close-ups of the operation under study. The low cost unit provides extreme simplicity of operation, installation and maintenance.

• *100 KC GT Crystal Unit*

Item 965

The model GA-100 is one of a line of high stability crystal units. The GA-100 Crystal Unit contains a 100KC GT High Precision Quartz element in an evacuated glass bulb fitted with a standard octal base. The over-all dimensions are 4⅛" x 2". The unit exhibits a frequency shift of less than one-half cycle over a temperature range of 25°C. to 70°C. Aging characteristics average less than one part in 10^8 per week. Qs in the order of one million are readily attainable.

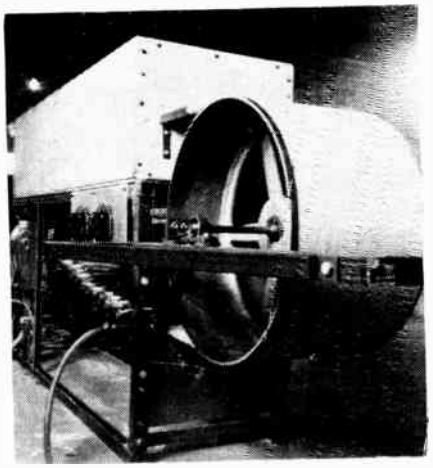
(Turn to page 74)

MICROFUSION

(Continued from page 28)

with electric heat and low pressure. Stampers stay put. Your future "wow" trouble will unfortunately or fortunately (as you wish) mean a new turntable because wow in records will be a thing of the past.

A powerful microscope is sometimes needed to show up the minute inaccuracies in the hair-breadth grooves of the molding. However these inaccuracies can cause extremely annoying disturbances on the finished record. Clicks, pops, and hisses reach monumental proportion in quiet passages often completely destroying the entire musical mood. The virgin powder fusion technique of "Microfusion" however creates a micro-accuracy in molding. A disc slightly larger than the finished record is formed from the vinyl powder. As this is carried to the press it is briefly and slightly heated to form a spongy cake. This is the sintering process and it produces a light porous "biscuit" about three times as thick as the finished record. The powder adheres together just enough to allow the biscuit to be handled. When the master is put in a special low pressure press, each minute particle of the biscuit is free to drift its way into the groove profile independently.



● End view of the special vinyl mixing and slow heating machine which forms the "biscuit".

It is an exact process and the record is formed without the slam bang brute force employed in ordinary methods. The result: a surface silence hitherto unapproachable. The average L.P. record has almost half a mile of groove, fifteen thousandths of an inch deep and twice as wide. This is a fine low line into which are etched corners and curves capable of pushing the stylus back and forth up to 15,000 times per second. The material in which the groove is molded must stand a needle pressure of ten tons per square inch. Microfusion provides that groove and gives less surface noise than the original tapes. As a bonus, it costs less to make records by

● View of the special vinyl mixing and slow heating machine showing the hopper and control gauges.

"Microfusion". And this is really good news to all music lovers — and record manufacturers.

METALLIZER

(Continued from page 38)

Colored transparent plastic film also can be metallized, permitting a beautiful metallic effect in every color of the spectrum to be produced. Printed patterns can also be applied by lithography to the metallized coating, to give very striking effects.

Other uses for continuous roll metallizing includes a variety of processes necessary to the electronics industry. They include the metallizing of condenser paper used in the production of capacitors, the metallizing of printed circuit boards and the illuminizing of television picture tubes.

Under active consideration at the moment, Mr. Seiter also told the S.A.E. meeting, is the continuous metallizing of thin sheet steel with a corrosion-resistant coating of aluminum. This combination could possibly in the near future replace galvanized steel for roofing and siding, flashing, gutters and downspouts, weather-stripping, and even window frames. Recent tests conducted in England have shown that aluminum-coated steel has markedly better rust-resistance than galvanized steel. At least one American company has been conducting tests on this type of material, using a modified Stokes vacuum metallizing unit to evaporate aluminum onto the steel sheet.

For further data on advertised products use page 99.

Microwave Engineering

(Continued from page 34)

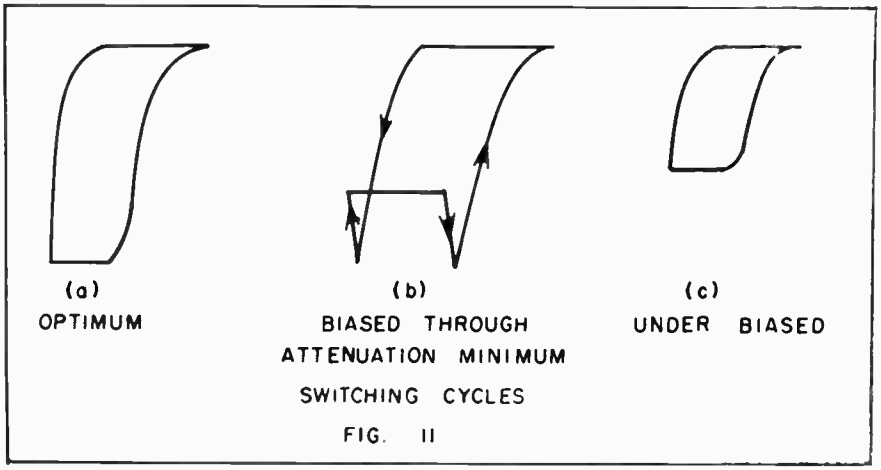


FIG. 11

formulated of the oxide of a bivalent metal ion and Fe_2O_3, exhibit high permeability and low hysteresis, and have a dielectric loss which is quite low at high frequencies[12, 15]. Sintered blocks of these materials are now produced by repeatable processes giving a consistent end product. Microwave applications involving anisotropic propagation have been found to require the admixture of the oxides of two bivalent metals with Fe_2O_3. Albers Schoenberg[16] describes the properties of ferrites, composed of MgO, MnO, and Fe_2O_3, which vary with the properties of the ingredients. The optimum proportions for microwave applications appear to be in the region 60-65% MgO, 5-10% MnO, 30% Fe_2O_3. A ferrite of this type (MF-1331) has the following properties:

Initial permeability at 1 Mc/s 50
Dielectric constant 13
Loss Angle at 10^{10} c/s (tanδ) 0.003
Resistivity Ohm-cm ..... 10^9

It is presumable that other spinels will be found in due course to have desirable microwave properties, but at the present time one formulation is pre-eminent.

Applications of Related Ferromagnetic Effects

In the microwave region ferrites exhibit doubly refractive properties similar to the phenomena associated with the Faraday effect. Transverse magnetisation produces different velocities for plane waves polarised parallel to the magnetisation and for plane waves polarised perpendicular to the magnetisation. This has been shown by Polder. In each case the velocity varies with magnetisation which produces a variable permeability and hence an associated variable impedance. Such a variable impedance could be used as a modulator providing variable reflection coefficient[10].

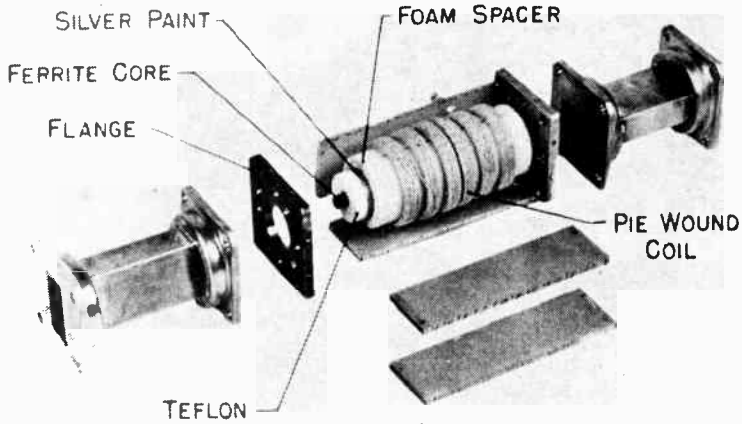


FIG.-12
MICROWAVE FARADAY SWITCH
FOR HIGH FREQUENCY MODULATION

An interesting application of double refraction has been described by Cacheris[30]. He has used a rotatory transverse magnetic field to obtain continuous phase change of the microwaves passing through a ferrite mounted in the rotatory field. This generates a single frequency greater than the input microwave frequency by twice the rotation frequency. Such single side band generation is a novelty in microwave engineering.

ACKNOWLEDGMENT

The author is indebted to the Defense Research Board for permission to publish this article. He also wishes to thank Mr. P. M. Thompson and Mr. E. A. Walker for their assistance.

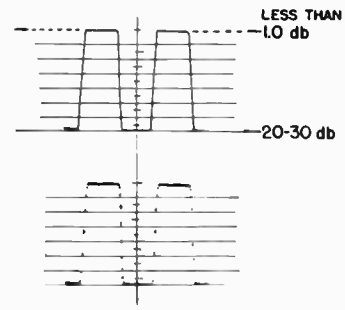


FIG.-13
TRANSMITTED SQUARE WAVE (100 kc/s)
OUTPUT FROM CRYSTAL DETECTOR
0.1 μ SEC. BRIGHTENING PULSES.

Applications of ferrites in rectangular guide with both fixed and variable magnetic fields, both longitudinally and transversely applied are foreshadowed by promising experimental work[37-39].

The gyromagnetic phenomena which have been discussed are contributing much to microwave techniques and there is no doubt that they will be employed increasingly in microwave engineering.

References

1. Birks "Measurement of the Permeability of Magnetic Oxide Materials at Centimetre Wavelengths", Nature 158, 671, 1946.
2. Miller "Magnetically Controlled Waveguide Attenuators", Journal of Applied Physics, Vol. 20, p. 878, September, 1949.
3. Rado, Wright & Emerson, "Ferromagnetism at U.H.F. III Two Mechanisms of Dispersion in a Ferrite", Physical Review, 80, 273, 1950.
4. K. J. Standley, "Ferromagnetic Resonance Phenomena at Microwave Frequencies", Science Progress, Vol. 38, No. 150, p. 231, April, 1950.
5. F. F. Roberts, "A Note on the Ferromagnetic Faraday effect at Centimetre Wavelengths" Le Journal de Physique et le Radium, 12, p. 305, March, 1951.
6. R. Malvano, "The Zeeman Effect and Magneto-Optical Effects in the Microwave Region", Nuovo Cimento 9, Suppl. 3, p. 340, 1952.
7. A. Kastler, "Polarimetry in the Region of Hertzian Waves" Nuovo Cimento 9, Suppl. 3, p. 315, 1952.
8. C. L. Hogan, "The Microwave Gyrator" Bell System Technical Journal, 31 p. 1, 1952.
9. Sakiotis & Chait, "Ferrites at Microwaves", Proceedings of the Institute of Radio Engineers, p. 87, Jan., 1953.

[10] R. E. Alley (Jr.) "A Review of New Magnetic Phenomena", Bell System Technical Journal, 32, p. 1155, September, 1953.

[11] J. L. Snoek, "Non-Metallic Magnetic Materials for High Frequencies" Phillips Technical Review, 8, p. 353, 1946.

[12] Snyder, Albers-Schoenberg & Goldsmith "Magnetic Ferrites", Electrical Manufacturing, 44, 86, 1949.

[13] J. L. Snoek, "New Developments in Ferromagnetic Materials", Monograph on Research in Holland, Elsevier, Amsterdam, 1949.

[14] R. L. Harvey, I. J. Hegyi, A. W. Leverenz, "Ferromagnetic Spinels for Radio Frequencies", RCA Review 11, p. 321, 1950.

[15] M. J. O. Strutt, "Ferromagnetic Materials and Ferrites", Wireless Engineer, P. 277, December, 1950.

[16] E. Albers-Schoenberg, "Ferrites for Microwave Circuits and Digital Computers", Journal of Applied Physics, Vol. 25, No. 2, Feb. 1954.

[17] Sakiotis, Simmons & Chait, "Microwave Ferrite Applications", Electronics, p. 156, June, 1952.

[18] J. W. Bryan, "A Method of Isolating Receiver and Transmitter Using Ferrites", NRL Report 4014, July, 1952.

[19] Reggia and Beatty, "Characteristics of the Magnetic Attenuator at UHF", Proceedings of the Institute of Radio Engineers, p. 93, January, 1953.

[20] P. J. Allen, "A Microwave Magnetometer", Proceedings of the Institute of Radio Engineers, p. 100, January, 1953.

[21] D. Olin, "An X-band Sweep Oscillator". Proceedings of the Institute of Radio Engineers, p. 100, January, 1953.

[22] J. N. Barry & W. W. H. Clarke, "A Ferrite Microwave Circuit Component for High Speed Switching or Modulation", Electronics, May, 1955.

[23] B. D. H. Tellegen "The Gyrator. A New Network Element" Philips Research Reports 3, p. 81, 1948.

[24] B. D. H. Tellegen "The Synthesis of Passive Resistanceless 4 poles that may Violate the Reciprocity Relation" Philips Research Reports 3, p. 321, 1948.

[25] B. D. H. Tellegen "Complementary Note on the Synthesis of Passive Resistanceless Four-Poles", Philips Research Reports 4, p. 366, 1949.

[26] H. B. G. Casimir, "Some Aspects of Onsager's Theory of Reciprocal Relations in Irreversible Processes", Nuovo Cimento, Vol. VI, Series IX, p. 227, 1949.

[27] D. Polder "On the Theory of Ferromagnetic Resonances" Philosophical Magazine 40, p. 99, 1949.

[28] E. R. Wicker "The Influence of Magnetic Fields on the Propagation of E/M Waves in Artificial Dielectrics" Journal Applied Physics 22, p. 1327, 1951.

[29] Suhl & Walker "Faraday Rotation of Guided Waves" Physical Review 86, No. 1, p. 122, April, 1952.

[30] C. H. Luhrs "Correlation of the Faraday and Kerr Magneto-Optical Effects in Transmission Line Terms" Proceedings of the Institute of Radio Engineers, Vol. 140, p. 76, Jan. 1952.

[31] C. Kittel, "Ferromagnetic Resonance Absorption" Physical Review 73, p. 155, 1948.

[32] C. Kittel, "Ferromagnetic Resonance" Le Journal de Physique et le Radium 12, p. 291, 1951.

[33] Griffiths "Magnetic Dispersion of Iron Oxides at Centimetre Wavelengths", Nature, 158, p. 671, 1946.

[34] M. L. Kales, "Modes in Wave Guides Containing Ferrites", NRL Report 4027, August, 1952.

[35] Suhl & Walker "Topics in Guided Wave Propagation through Gyromagnetic Media" Part I Bell System Technical Journal p. 579, May, 1954, Part II Bell System Technical Journal, July, 1954.

[36] J. Cacheris "Microwave Single Sideband Modulator Using Ferrites" Proceedings of the Institute of Radio Engineers, p. 1242, August, 1954.

[37] M. L. Kales, H. N. Chait & N. G. Sakiotis "A Non-reciprocal Microwave Component", Journal of Applied Physics, Vol. 24, No. 6, pp. 816-817, June, 1953.

[38] N. G. Sakiotis & H. N. Chait "Properties of Ferrites in Waveguides" Transactions of the Institute of Radio Engineers, Professional Group on Microwave Theory and Techniques, November, 1953.

[39] H. N. Chait, "Non-reciprocal Microwave Components" Institute of Radio Engineers, National Convention, 1954. Part 8, Communications & Microwaves.

For further data on advertised products use page 99.

NEW PRODUCTS

(Continued from page 70)

• *Dynamic Pickup For Measurement of Low Pressures*

Item 966

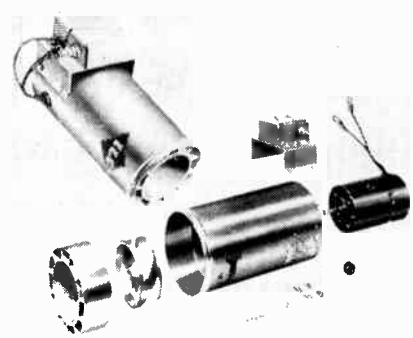
A versatile new low-range pressure transducer smaller and lighter than many existing types of low-pressure pickups, the new DYNISCO unit measures either gauge or differential pressure in the ranges 0.00-0.05 and 0.00 to 1.00 psi. High accuracy and high resolution characteristics make the new pickup particularly suitable for sensitive air-flow measurements, vacuum equipment studies, precision altimeters, and medical research equipment. Special construction minimizes acceleration sensitivity and facilitates use in aircraft and missiles.

The new dynamic pickup consists of a $1\frac{7}{8}$" diameter, beryllium-copper bellows fastened to the rigid pickup case and connected to a special, strain-sensitive resistance bridge. Separate input pressures are brought to bear on either side of the bellows through threaded connection holes in the pickup case. Movement of the bellows produces an electrical output signal proportional to the difference between the two pressures. The design can withstand overloads up to 15 psi. High acceleration effects are minimized by a specially-designed support which protects the entire resistance-bridge assembly. Acceleration sensitivity is held to 0.001 psi/g with the effect of lateral accelerations being negligible.

• *Fan For Cooling Aircraft Electronic Units*

Item 967

This compact vane axial fan is being installed in planes of the U.S. Air Force to cool airborne electronic installations. Overall dimensions are less than 7" long x 4" wide x $5\frac{1}{4}$" high. The fan delivers 60



cfm at 5" pressure water guage and 112 cfm at 1" pressure water guage. It is designed and built especially to meet the

(Turn to page 75)

For further data on advertised products use page 99.

NEW PRODUCTS

(Continued from page 74)

service requirements of aircraft installation. is oil proof and explosion proof, and operates in either pressurized or non-pressurized aircraft. In the exploded view photograph of the unit, the major elements are (left to right): vanes, wheel, housing, and motor. The radio interference filter is directly above the housing.

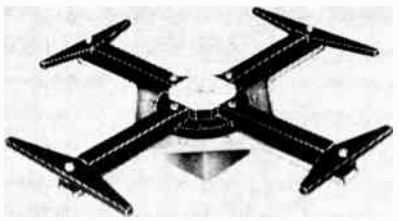
● *Magnetic ADF Antenna*

Item 968

This new antenna's primary feature is its improved anti-noise characteristics, higher sensitivity, lower weight, and zero drag.

Of flat construction it is designed for flush mounting in a shallow cavity in the skin of the aircraft being faired over with a plastic cover so that the aircraft lines remain unchanged.

At the center of the antenna is a small electrostatically shielded loop coil wound on an iron core. The position of the loop is controlled by a small motor and autosyn. Four ferrite collector bars extend radially from the center of the antenna at intervals



of 90°. These collector bars are sensitive only to electromagnetic energy and since the loop coil is extremely small the reception of electrostatic interference by the loop itself is minimized. The minimized pick up of electrostatic energy affords a more sensitive null point and further increases the usable sensitivity of the radio compass system.

It may be substituted for the MN36, MN-60, AS313, or AT269 Radio Compass Loop Antennas and its performance is equal to or better than these antennas.

● *New Molded Tipco Distribution Block Cuts Wiring Time*

Item 969

A new line of distribution blocks designed to simplify wiring of panelboards and switch-gear, cutting both wiring time and cost is now available.

These new blocks are available with either 2, 4, 6, 8 or 10 taps, each tap numbered for easy identification. Blocks are rated at 600 volts for either 70, 125 or 225 amperes service.

Underwriter-approved pressure connectors allow multiple connections, in a wide range of wire sizes, to be made in one tap. Vibration cannot be transmitted through the connector, since the distribution block is designed with the brass insert floating free in the block. When wired, the block offers protection from live power.

The distribution blocks eliminate bending and soldering leads, require no covers, special tools or extra parts.

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For further data on advertised products use page 99.

NEWS

(Continued from page 64)

Electronics Firm Names Sales Chief For Canada

New York — Kenneth C. Meinken, Vice-President of General Instrument Corporation, has been assigned to direct sales of the company's Canadian subsidiary, General Instrument-F. W. Sickles of Canada Ltd., which has its headquarters plant at Waterloo, Ont. His new duties, it was stated, shortly will take him to Canada to consult with leading Canadian radio and TV set manufacturers for whom the firm makes components. Hugh T. Watt, Vice-President of General Instrument-F. W. Sickles of Canada, will continue as heretofore in overall charge of the operation.

Mr. Meinken, who is widely known in the radio-TV industry, recently was named a vice-president of General Instrument when the company merged with Automatic Manufacturing Co., of which he had been Vice-President in Charge of Sales. General Instrument, with six plants in the U.S. and Canada, is a major producer of radio, television and electronic components.

Toronto Section I.R.E. Schedule of 1956 Meetings

Schedule of remaining meetings of the Toronto Section, I.R.E., for the 1955-56 season, with speakers and their subjects, is as follows:

Monday, January 16—Electronics In Atomic Energy Project, J. Hardwick, Atomic Energy of Canada Limited.

Thursday, February 9—Joint Meeting with A.I.E.E. Students' Night. Three papers to be presented by university students in competition for cash prizes.

Monday, February 27 — Teletype, Teleprinters and Facsimile, by J. S. Ford, Canadian National Telegraphs, Toronto.

Monday, March 26 — Tranisistor Applications in Electronic Equipment, by Richard Race, Motorola Inc., U.S.A.

Monday, April 9 (Annual Meeting) —Directional Broadcast ntennas, by E. W. Farmer, Canadian Marconi Company, Montreal.

Monday, April 30 — Ladies' Night, Banquet.

Toronto Section IRE Visit C.S.A. Laboratories

Members of the Toronto Section, Institute of Radio Engineers, were the guests of the C.S.A. Approvals Laboratories, Rexdale, last November 21st. The speaker on the occasion was Mr. G. R. Cates, of C.S.A., who described the function of the laboratories and showed how their work is conducted. The talk was followed by a tour of the laboratories connected with approvals work.

Beckman Instruments Appointments

Appointment of Donald C. Duncan as General Manager of the Berkeley Division of Beckman Instruments Inc., has been announced by Corporation President, Dr. Arnold O. Beckman.

At the same time, Dr. Beckman announced the appointment of Thomas Allinson as Manager of the Berkeley Division, located in Richmond, Calif. Allinson will report to Duncan, who will continue to serve as general manager of Beckman's Helipot and Arga divisions in South Pasadena.

D. C. DUNCAN

T. ALLINSON

Duncan, 37, received degrees in electrical and mechanical engineering from Pennsylvania State University. He was an industrial control test engineer for General Electric, Schenectady, N.Y., in 1940, and from 1941 to 1945 served with the Navy's Bureau of Ships in Washington, D.C., as an electrical engineer.

Allinson, 34, joined Berkeley in 1951 as plant manager. In 1954 he was named marketing manager directing advertising and sales promotion, market research and sales activities of Berkeley's nuclear instruments, analogue computers, counters, timers, recorders and high frequency measuring instruments.

Beckman's Helipot Division is represented in Canada by R.O.R. Associates of Toronto.

C.P.R. Combine Communications And Computers

Facilities of Canadian Pacific Communications will, it is announced, be used to telegraph information from principal points of the Canadian Pacific Railways Canada-wide system to supply the data for the company's electronic data processing machines. These machines will be used to process the 5,000,000 waybills, 9,000,000 passenger tickets, and 1,800,000 requisitions on stores which are part of the yearly transactions of the Canadian Pacific. The electronic calculators — manufactured by International Business Machines — are housed in a new seven-storey, air-conditioned Canadian Pacific headquarters' building situated at the back of Windsor Station, Montreal.

(Turn to page 78)

For further data on advertised products use page 99.

NEW PRODUCTS

(Continued from page 75)

• *"Q" Multiplier Kit*

Item 970

Here is the Heathkit Q Multiplier you hams have been asking for. A tremendous help on the phone and CW bands when the QRM is heavy. Provides an effective Q of approximately 4,000 for extremely sharp "peak" or "null". Use it to "peak" the desired signal or to "null" an undesired signal or heterodyne. Tunes to any signal within the IF band-pass of your receiver. Also provides "broad peak" for conditions where extreme selectivity is not required.

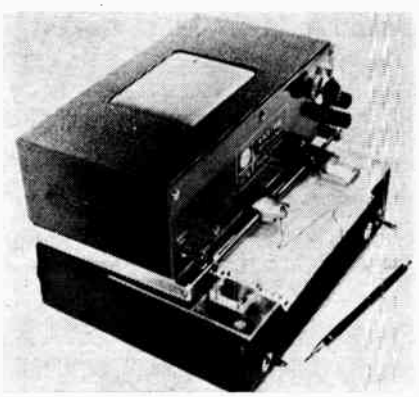
Operates with any receiver having an IF frequency between 450 and 460 kc. Will not function with ac-dc type receiver. Requires 6.3 volts ac at 300 ma. and 150 to 250 vdc at 2 ma. Derives operating power from your receiver. Uses 12AX7 tube, and special High-Q shielded coils. Simple to connect with the cable and plugs supplied. Measures only 4 1/16" h. x 7 3/8" w. x 4 1/8" d. A really vauable addition to the receiving equipment in your ham shack.

• *Graphic Recorder*

Item 971

A portable, modestly-priced graphic recorder, capable of widespread applications in the recording of data, has been introduced to the market.

The lightweight, compact Model G-10 Graphic Recorder has dimensions of 10" x 7 1/8" x 8". It may be used directly as a recording millivoltmeter or, with appropriate transducers, as a means for recording pressure, light intensity, temperature and many other physical quantities. Designed to conform to rigid electrical and mechanical specifications.



According to the manufacturer, the new, 15-pound model G-10 is the first instrument of its kind which combines practical low-cost with the operating characteristics necessary for dependable recording of scientific phenomena. The instrument is of the self-balancing potentiometer type, and features a standard full-scale response time of 2.5 seconds and a standard sensitivity of 100 millivolts full-scale. Accuracy is 1 per cent and maximum allowable signal source resistance is 0.5 megohms.

For further data on advertised products use page 99.

NEWS

(Continued from page 76)

Radio Electronic Television Schools Graduates First Students

The future in electronics is "tremendous", with television sets more than doubling in the next ten years in Canada, Ronald Robinson, vice-president and general manager of Canadian General Electric told 140 graduating electronics students November 19th. Mr. Robinson was addressing the first graduating class of the Radio Electronic Television Schools at a special convocation in the King Edward Hotel, Toronto.

There are now 1.5 million television sets in the whole of Canada, Mr. Robinson told the grads, "but by 1964 there will be more than four million sets. There will also be more television stations, and then there will be color television too. It will be a billion dollar business, and a bright future for qualified technicians is assured. If you are good enough, you will get your share of that future."

He estimated Canada would need some 20,000 qualified technicians per year. This graduating class, the first from R.E.T.S. in Canada, has completed a one-year course, under the supervision of expert instructors, some of them qualified engineers.

Radio Electronic Television Schools of Canada, Ltd., is associated with an international training organization with schools throughout the U.S. Canadian headquarters was established in Toronto a year ago. This graduating class is the first turned out by the school, which has a current enrollment of 3,600 in branches across the country, as well as at its two Toronto locations. Branches have been established in the first year at Montreal, Hamilton, London, Winnipeg and Vancouver.

In their course students work with and repair various power supplies, super heterodyne radio receivers and modern television receivers. Full instruction is given in test equipment such as the multi-tester, vacuum tube voltmeter, tube tester, capacity tester, signal generator, square wave generator, sweep generator and oscilloscope

Toronto Section I.R.E. Hold Last Meeting Of 1955 Series

The last session in the 1955 series of meetings of the Institute of Radio Engineers, Toronto Section, was held on Monday, December 19th, at the University of Toronto.

Speaker on the occasion was Mr. D. M. Simkins, Canadian Radio Manufacturing Corporation, Toronto, who addressed the meeting on the subject of "Power Tubes and Associated Rectifiers". Mr. Simkins' talk was illustrated with motion pictures and demonstrations.

For further data on advertised products use page 99.

Plans Well Under Way For 1956 Canadian IRE Convention

Keen interest is being shown throughout the electronic industry in the Canadian I.R.E. Convention and Exposition which will be held in Toronto on Octotber 1, 2 and 3, 1956.

The event will be held in the Automotive Building, Canadian National Exhibition Park, Toronto. This magnificent building has been described as one of the most beautiful exhibition buildings on the continent. It is completely equipped with all facilities for convention and exhibition purposes and is ideally located with unlimited parking space.

The Convention Committee's plans are now well under way. A brochure giving complete details, including floor plans and space rates, will be mailed to prospective exhibitors. Copies are available from the Convention manager, Grant Smedmor, at 745 Mt. Pleasant Road, Toronto.

The exhibition will include a wide variety of products of the industry and of allied fields such as instrumentation, laboratory apparatus, materials, packaging and so on. There will be displays of electronic equipment as used by all branches of the Canadian Armed Forces, and it is also expected that equipment relating to the industrial applications of atomic energy will be shown.

Dr. George Sinclair of the Department of Electrical Engineering, University of Toronto, Chairman of the Technical Papers Committee, has invited authors to submit titles and abstracts of 100 to 200 words on papers offered for presentation. The deadline for receiving titles and abstract is May 31, 1956. The papers may be on any subject pertaining to radio or any allied field of interest to members of the I.R.E.

A complete program of technical papers and symposia is planned for the convention.

M. J. Martin Sales Manager 3-M Company of Canada

The appointment of M. J. Martin to the position of sales manager, administration of Minnesota Mining & Manufacturing of Canada Limited, London, Ontario, has been announced by Roy W. Keeley, director of sales.

M. J. MARTIN

Mr. Martin will assume his new duties immediately.

As sales manager, administration, Mr. Martin will act as liaison between various product managers and supervisors assisting them, through the director of sales, in formulating merchandising and sales plans. In addition, he will continue as administrator of the advertising and sales promotion departments.

CESCO Distributes PRI Geiger Counters

Canadian Electrical Supply Co. Ltd., Montreal, has been appointed as distributor of precision radiation instruments, geiger counters and scintillators for Eastern Canada. This distributorship covers all the Maritimes, Quebec and Ontario.

In this new arrangement CESCO will carry in stock the complete line of precision radiation instruments.

Lake Engineering Appointed Canadian Reps For Gulton Industries

Lake Engineering Co. Ltd. announce their appointment as Canadian Representative for Gulton Industries Inc. of Metuchen, New Jersey. Associated with Gulton Industries Inc. are Gulton Mfg. Corp., Glenco Corp., Greibach Instruments Inc., Thermister Corp. of America and Vibro-Ceramics Corp., all of Metuchen, New Jersey.

Many of the products of these firms will be manufactured in Canada by their Canadian Associate, Titania Electric Corporation of Canada Ltd., at the company's new plant which is nearing completion at Gananoque, Ontario.

Automatic Electric Develops New Telephone Switch Unit

A new telephone switch for use in railroad communications systems has been developed by the Automatic Electric Company. The unit is a small desk type unit and has a capacity of two to 11 pairs and includes all the equipment required for connecting a telephone to any one of the pairs for which it is wired.

The company designed the new switch to improve on an earlier model which employed the jack-box-and-dummy-plug method for switching one telephone among a number of telephone lines.

(Turn to page 82)

For further data on advertised products use page 99.

Background Music

Considered to be the largest installation of its kind in Canada, the background music system fitted in the new Toronto store of Henry Morgan & Company Ltd. boasts 101 loud speakers.

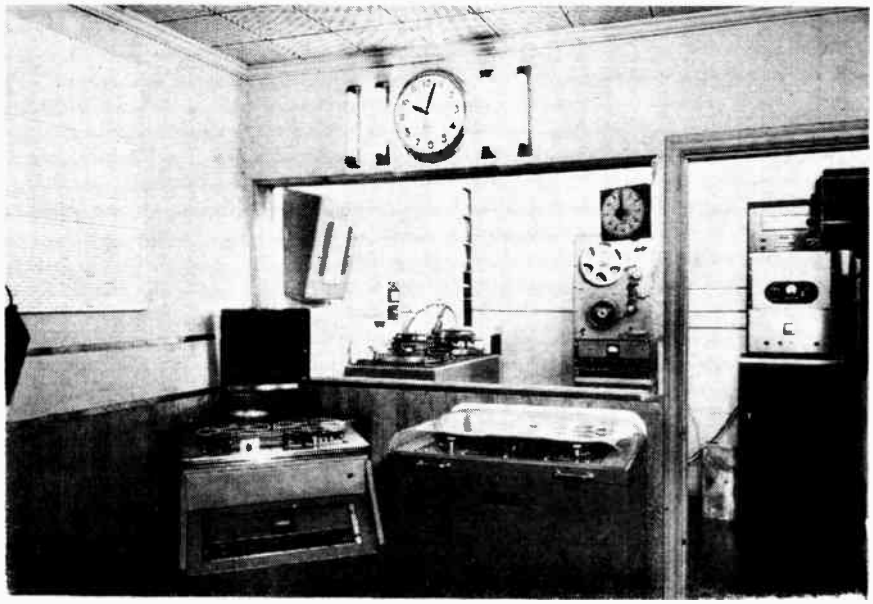
WHAT is believed to be the largest Canadian installation for the express purpose of providing background music has been fitted in the new Henry Morgan and Company Limited store in Toronto. The installation was carried out by Instantaneous Recording Service of Toronto. The system provides background music through the medium of eight-hour playing tapes which originates in the studios of Instantaneous Recording Services in downtown Toronto and is delivered through the medium of 101 loudspeakers installed in the Henry Morgan store.

The originating source consists of a battery of Presto eight-hour continuous long-playing tape reproducers with associated pre-amplifiers and power amplifiers. These units, which are continuous in operation, will repeat an eight-hour tape which consists of approximately 175 different musical selections automatically if the tape is not changed. However, in the library of I.R.S. are sufficient long-playing tapes to provide musical reproduction for 25 days without repetition.

The installation at I.R.S. incorporates several unique features. Since it is unattended after normal business hours, it has been designed to assure against breakdown or failure of service to subscribers. This has been achieved by the design of control equipment that automatically cuts in a second or third complete reproducing system in the event of breakdown of the primary service.

Unique Tape Injector

The most recent innovation designed and being used in the I.R.S. system of background musical transmission is a unique tape injection system. Every two months I.R.S. produce a new two hour tape that contains hit musical numbers featured in current New York shows — musical selections that are destined to become "Standard" numbers. One of these injection tapes is placed on an auxiliary long-playing tape reproducer. Through the use of inaudible notes, recorded on the primary 8 hour tape, the injection unit is controlled automatically. After any pre-determined numbers have been reproduced from the primary tape, the injection unit is cut in and any pre-determined number of new up-to-date numbers from the injection tape are reproduced over the net-work. A further inaudible note on the primary tape cuts out the injection unit and the reproduction reverts to the primary unit and this cycle is automatically repeated. This unique injection system makes possible the automatic injection of seasonal music such as Christmas and Easter selections.



● Part of the wired music distribution studios of I.R.S. showing left two long-playing tape reproducers and in the rear tape duplicating equipment.

For further data on advertised products use page 99.

In the I.R.S. system automatic voltage regulators control the putput signal at a constant level — an important requirement in downtown Toronto where line voltages vary throughout the day and night. The taped music is fed to a 100 terminal Bell Telephone set-up located in the studio and maintained at a constant DB level. The music is then carried by special equalized lines to the Bell Telephone's Empire exchange from whence it goes out on similar equalized lines to the Orchard exchange in the north west section of the city, a distance of approximately eight miles. There it terminates in a ten channel bridging amplifier. A further Bell line carries the music from one of the output channels of the bridging amplifier to the Morgan store. Here it is fed into an elaborate hi-fidelity power amplifier set-up. Duplicate amplifiers

● Dual 50 watt amplifiers, monitor speaker and control relay rack used in the Henry Morgan store.

are installed so that at the flip of a switch the second amplifier can be cut in, in the event of a tube — capacitor or resistor breakdown in the primary amplifier. In addition to the main volume control on the power amplifiers, due to the varying acoustical conditions, on each of the three floors a separate and concealed volume control has been installed. As a further assurance of maintaining proper background level in specific areas where the number of patrons vary, further separate controls have been installed.

To provide an added service to the Henry Morgan store, special wiring to the central telephone switchboard enables the switchboard operator to lift a hand microphone from a convenient hook, which automatically cuts off the background music and makes possible the use of the entire installation as a highly efficient public address system.

For further data on advertised products use page 99.

NEWS

(Continued from page 79)

Canadian Made Electronic Equipment For H.M.C.S. Bonaventure

Electrical and electronic equipment valued at $2,834,000 has been ordered from Canadian firms for the Royal Canadian Navy's new aircraft carrier, Bonaventure. In addition, some $200,000 worth of orders for such equipment have still to be let by the Department of Defense Production, which places all contracts for the Navy.

While the Bonaventure is being built in Northern Ireland by Messrs. Harland and Wolff Limited of Belfast, every endeavor has been made, where possible, to fit this ship with equipment and material of Canadian manufacture.

Among the major Canadian equipments to be installed in the carrier are several electronic fire control and radar units, worth some $2,181,000, which make up part of the ship's internal communications and fire control system. Radio transmitters and receivers, along with other items of radio equipment, have also been ordered in Canada to the value of about $264,000. In addition, there has been ordered $313,000 worth of electrical fittings and fixtures, such as transformers, distribution panels, lighting units, etc.

Mobile Radio Aids Seaway Construction

Duties of the engineering staff of the St. Lawrence Seaway Authority is being facilitated by the use of a private mobile radio system which consists of a base station and 14 mobile units which have been supplied by the Bell Telephone Co. of Canada.

The equipment is being used by hydrographic engineers who are carrying out surveys between Montreal and Cardinal, Ontario. Disposition of the equipment is divided between three groups, two of which are working on both sides of the river, and the third group, who are working on board ship.

Further use of mobile radio equipment is planned by the Ontario Hydro-Electric Power Commission, who plan the installation of mobile radio apparatus in eight station wagons for use in co-ordinating the relocation of communities which will be submerged during the building of the seaway.

I.R.E. Members Tour Marconi Plant

More than two hundred members of the Institute of Radio Engineers, the American Institute of Electrical Engineers and the Engineering Institute of Canada were given a conducted night-time tour of the Canadian Marconi Company head office and factory on Trenton Avenue, Montreal, recently. In addition, the guests were shown the company's research laboratories and facilities, as well as the aviation department and radio relay department on McEachran Avenue, Outremont.

The visitors were welcomed by Mr. S. M. Finlayson, Canadian Marconi president, who gave a brief summary of the company's history and outlined the type of work Marconi was presently engaged in with particular emphasis on electronic products and equipment for the home, for defense purposes and for industrial use.

Ontario Hydro Awards Large Order To Enfield Cables

Enfield Cables Limited of Brimsdown, Middlesex, England, have announced that they have been awarded a contract to the value of approximately $500,000 by the Hydro-Electric Power Commission of Ontario, Canada. The cables will be laid in Ottawa, and they will cross the well-known Rideau Canal in the capital city.

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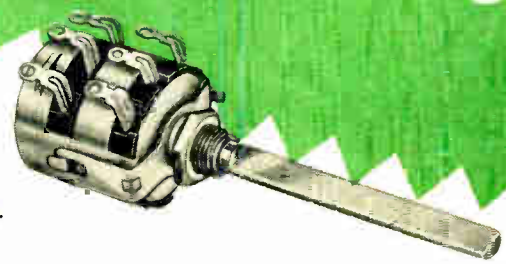
For further data on advertised products use page 99.

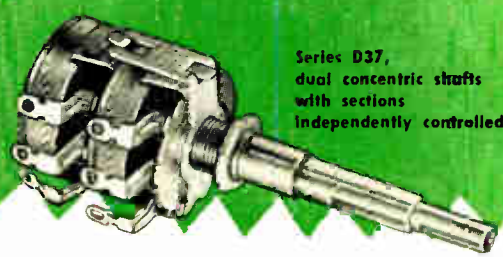
STAND PAT WITH CLAROSTAT

Composition-Element CONTROLS

Series 37.



Series D37, dual with single shaft.



Series D37, dual concentric shafts with sections independently controlled.

It's better, quicker, cheaper, to specify CLAROSTAT for those carbon control requirements, because:

For **usual needs**, there's an adequate choice of standard Clarostat types such as:

SERIES 37: 1-1/8" d. 0.5 watt. Linear or tapers. One to three taps. Available with switch. Choice of shafts. Singles or duals. 500 ohm to 5 megohms Approved for Type RV3, characteristic U, MIL-R-94 specification.

SERIES 47: 15/16" d. 0.5 watt. Linear or tapers. One tap, choice of three positions. Available with switch. Choice of shafts. Singles or duals. 500 ohms to 5 megohms.

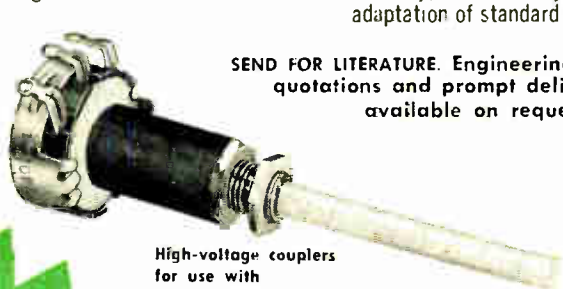
SERIES 48: For miniaturization. 5/8" d. 0.2 watt. 500 ohms to 5 megohms, linear, or 2,500 ohms to 2.5 megohms, tapers. Singles or duals. Available with switch.

SERIES 51: For high-voltage high-resistance electronic circuitry. 1-17/32" d. phenolic case. 1 watt. 5,000 ohms to 50 megohms. 10,000 V.D.C. breakdown test between terminals and mounting bushing. Maximum operating voltage, 4,000. Tapers available.

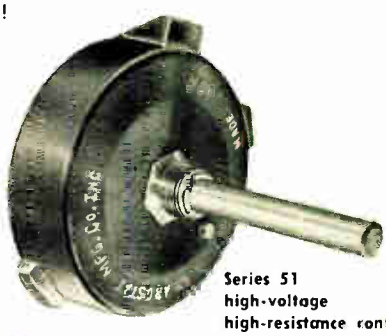
And for **unusual needs**, Clarostat can design and put into production those special types—quickly, satisfactorily, economically — often based on ingenious adaptation of standard features and available tooling.

SEND FOR LITERATURE. Engineering collaboration, quotations and prompt delivery cycles, available on request!

Series 47.



High-voltage couplers for use with elevated potentials.



Series 51 high-voltage high-resistance control.

Series 47S, with switch, and twist-tab mounted.

Series D48 dual control for miniaturization requirements.

CLAROSTAT

Controls & Resistors *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.

For further data on advertised products use page 99.

C.G.E. Gets Contract For Installation Of Horn Antennas

Canadian General Electric Company has announced the signing of a contract with the Bell Telephone Company of Canada for the installation of microwave horn antennas and waveguides at 39 relay points between Uxbridge, a few miles north of Toronto, and Lake of Two Mountains on the Manitoba border.

These relay stations are being constructed by the Bell Telephone Company of Canada and will form part of the transcontinental microwave radio relay system which will provide for coast-to-coast television programs and additional telephone circuits.

The overall network is being constructed in stages by the telephone companies which comprise the Trans-Canada Telephone System, and is scheduled for completion early in 1958.

Distinguished South Americans Visit Canadian Aviation Electronics

Col. Mariano Ospina, Chief of Staff, and Col. Gerardo Varela, Senior Financial Officer of the Air Force of the Republic of Colombia — recently visited North America to acquaint themselves with the latest developments in electronics. CAE was chosen by them as one of the leading representatives of Canadian effort in this field. In Montreal the itinerary included a visit to ICAO Headquarters and a meeting with ICAO's Secretary General, Mr. Carl Ljungberg. In Canada's capital, Ottawa, Col. Ospina had an opportunity to inspect Department of Transport facilities, among them the CAE manufactured OMNI-RANGE at Uplands Airport.

G. C. W. Browne Honored On Retirement

Believed to have been the first occasion in which Federal civil servants of the United States thus honored a civil servant af Canada, a unique ceremony took place in Ottawa recently when the Department of Transport's retired Controller of Telecommunications, G. C. W. Browne was presented with a scroll and a wrist watch from his many friends and acquaintances in Washington. The presentation was made by Philip S. Bogart, Transport and Communications Attache of the United States Embassy in Ottawa on behalf of United States officials in the communications field of the State Department, Military Services, Coast Guard, Civil Aeronautics Administration, as well as Federal Communications Commission, the Department of Agriculture and the Department of the Interior.

George Cecil Watson Browne is a native of Ireland and a graduate in civil engineering from Trinity College, Dublin. He was engaged in radio development activities in the United States for a number of years and later in marine radio work in Great Britain. He entered the Canadian Government radio service in 1914. During World War I, he served with the Royal Canadian Navy ending up in charge of technical and practical instruction at the Naval Wireless School at Ottawa. Returning to the then Department of Marine, he was placed in control of a group of Direction Finding Stations on the East Coast. In 1936, with the formation of the Department of Transport by the merging of the Department of Marine and the Department of Railways and Canals, Mr. Browne was appointed Assistant Controller of Radio. In 1947 he was appointed Controller of Radio, later changed to Controller of Telecommunications.

● G. C. W. Browne, recently retired from the Department of Transport in which department he held the position of director of telecommunications is shown left being presented with a scroll by Philip S. Bogart, Transport and Communications Attache of the United States Embassy in Ottawa.

For further data on advertised products use page 99.

For further data on advertised products use page 99.

DOMINION FASTENERS APPOINTMENTS

E. G. BRADNER

L. WILLS

● Following a recent directors' meeting, Mr. George A. Tinnerman, president, Dominion Fasteners Limited, exclusive Canadian manufacturer and licensee of Tinnerman Speed Nuts, announces the appointment of Mr. E. G. (Ernie) Bradner as vice-president and general sales manager, and Mr. L. (Bus) Wills as vice-president and secretary-treasurer.

Quebec Hydro To Have Longest Private Commercial Microwave System In Canada

The longest private commercial microwave communications system in Canada will link Hydro-Quebec's giant new power development on the Bersimis River to Montreal.

Hydro-Quebec's Bersimis No. 1 plant, now under construction in Northeastern Quebec on the North Shore of the Gulf of St. Lawrence, some 400 miles northeast of Montreal, will have an ultimate capacity of 1.2 million h.p. Timed with the scheduled operation of its generators, the system will be completed by September 1st, 1956. The Bersimis No. 2 plant, 18 miles down river from Bersimis No. 1, with a scheduled capacity of 600,000 h.p., will also be linked to this microwave system upon completion.

The system will cost approximately 1 million dollars. It will include 30 telephone circuits as well as teletype, telemetering and load frequency control circuits, all utilizing microwaves as means of transmission. The electric power produced at, and transmitted from Bersimis will be remotely indicated at the Hydro-Quebec Building from where power consumption will be controlled by means of the load frequency control circuits. Hydro-Quebec's engineers will be in a position to make fast and vital decisions on the control of power from the new plant. The combination of control and telephone circuits will enable them to initiate any necessary changes with the utmost speed and accuracy.

MARCONI APPOINTMENTS

J. S. OGILVY

C. S. STEPHENS

● T. C. Adams, comptroller of Canadian Marconi Company, has announced two new appointments in the Finance Division of the Company. Charles S. Stephens, C.A., has been appointed assistant to the comptroller, and John S. Ogilvy, C.A., has been named internal auditor for the Company. Mr. Stephens and Mr. Ogilvy will both make their headquarters in the head office of Canadian Marconi Company in Montreal.

For further data on advertised products use page 99.

Canadian Aviation Electronics Expand West Coast Operations

Work has started on the new 16,000 sq. ft. Vancouver plant of Canadian Aviation Electronics Limited, with headquarters in Montreal. The building on Fraser Street is scheduled for completion by late Spring, 1956. Plans allow for a further 24,000 sq. ft. expansion.

The plant will house the engineering, manufacturing, repair and overhaul and consumer products division of CAE's West Coast branch.

D. MANDERS

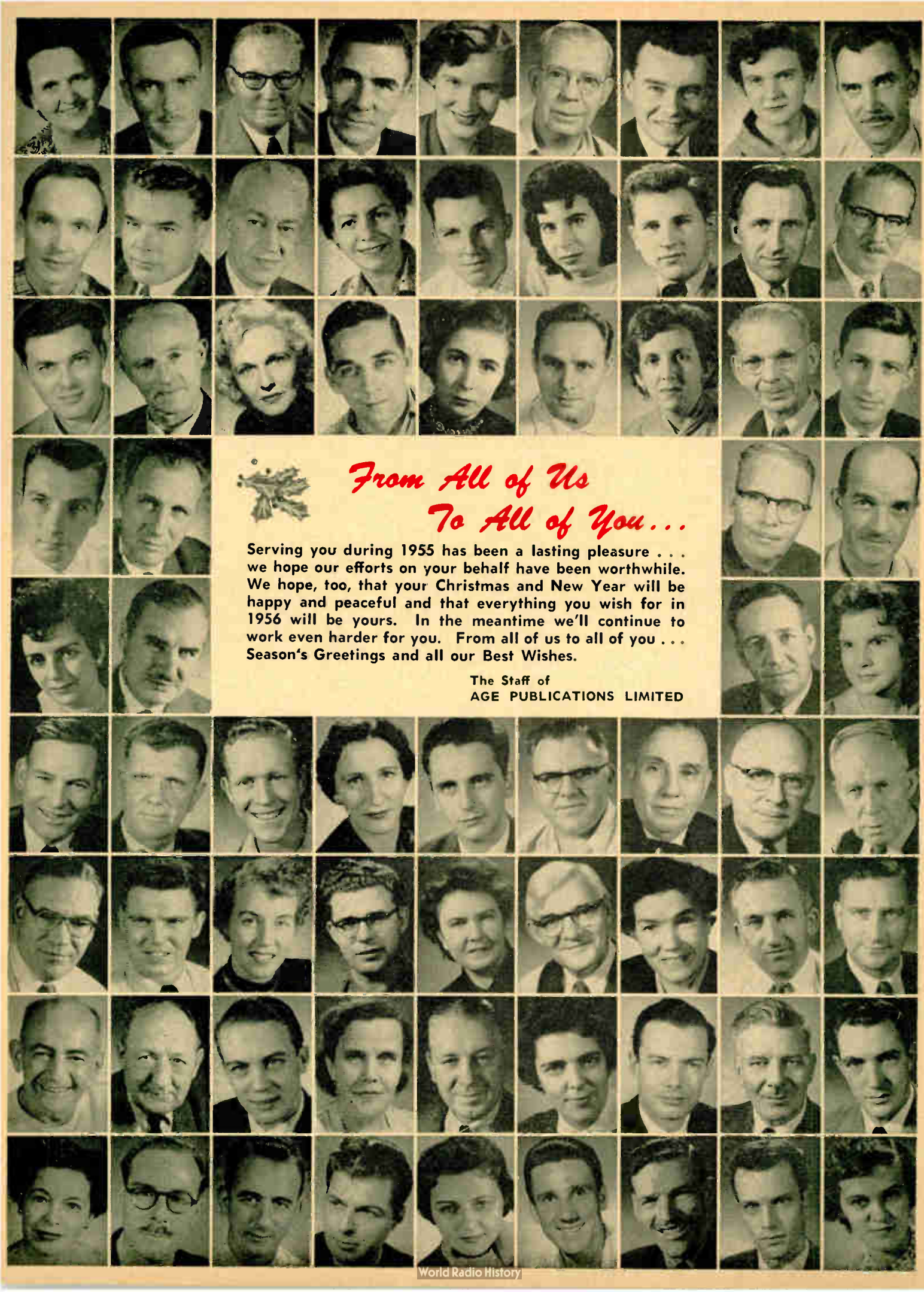
The lay-out of the new Vancouver plant follows closely the principle of visual control, as applied in CAE's modern electronics headquarters in Montreal — considered as one of the finest examples of up-to-date factory planning in North America. Unobstructed areas can be adjusted to particular work projects. At present, the following areas are planned for: office, machine shop, repair and overhaul, service, maintenance, warehousing, maintenance stores. The same flexibility is maintained in internal power distribution.

CAE's West Coast operations are under the management of Mr. Dave Manders, OBE, a Science Graduate of the University of British Columbia and former B.C. representative of the National Research Council, Ottawa. Mr. Manders was awarded the OBE in recognition of his war-time services as a radar specialist with the RCAF.

Pye Mobile Radio Equipment For Seaway Contractor

The St. Lawrence Seaway, now becoming a modern reality, is a century-old idea. Several contracts have already been awarded by the Seaway Authority to different companies and already work is well under way in the Montreal area. McNamara Construction Company Ltd., of Toronto, which is taking part in this multi-million dollar operation, has been supplied with a Pye V. H. F. radio communications system. The dredges "Charlie M", "John Holden" and "George M. Jr.", together with the tug "Marny M" and the houseboat "Tanti II" have been equipped with Pye model PTC 117 "Reporter" mobile radio-telephones, all using PTC 3GP ground-plane antennas for maximum coverage. Installed at the McNamara office on the Department of Transport wharf, Coteau Landing, Quebec, is a Pye model PTC 704 15-watt fixed station, also using a PTC 3GP ground-plane antenna.

For further data on advertised products use page 99.



From All of Us To All of You...

Serving you during 1955 has been a lasting pleasure . . . we hope our efforts on your behalf have been worthwhile. We hope, too, that your Christmas and New Year will be happy and peaceful and that everything you wish for in 1956 will be yours. In the meantime we'll continue to work even harder for you. From all of us to all of you . . . Season's Greetings and all our Best Wishes.

The Staff of
AGE PUBLICATIONS LIMITED

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

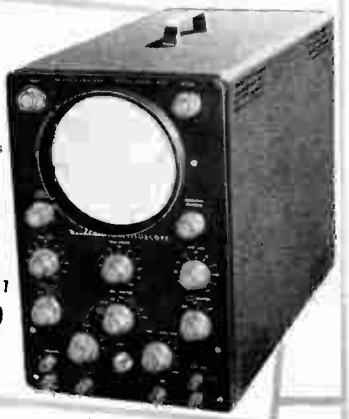
This full-size 5" Oscilloscope incorporates many outstanding features.

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

MODEL CM-1

$29.50

Shpg. Wt. 7 lbs.

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.

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

MODEL S-2

$23.50

Shpg. Wt. 11 lbs.

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.

Heathkit VOLTAGE CALIBRATOR KIT

MODEL VC-2

$11.50

Shpg. Wt. 4 lbs

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.

HEATH Company

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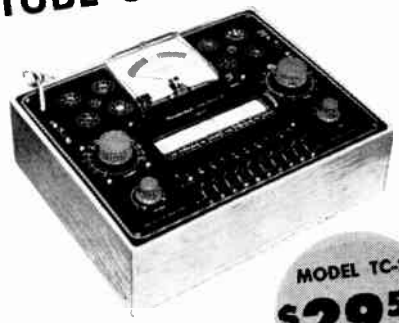
BENTON HARBOR 3, MICHIGAN

For further data on advertised products use page 99.

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.

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

Heathkit SIGNAL GENERATOR KIT

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
$5.50
Shpg. Wt. 2 lbs.

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.

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.

Model LG-1

Heathkit LABORATORY GENERATOR KIT

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 99.

THESE HIGH QUALITY INSTRUMENTS

Heathkit HARMONIC DISTORTION METER KIT

MODEL HD-1
$49.50
Shpg. Wt. 13 lbs

Performs the functions of more elaborate and much more expensive audio distortion testing devices and yet is simple to operate and inexpensive to own. Used with a sine wave generator, it will check the harmonic distortion output of audio amplifiers under a variety of conditions. Essential in audio design work.

The HD-1 reads harmonic distortion directly on the meter as a percentage of the original signal input. It operates from 20 to 20,000 cps in 3 ranges, and incorporates a VTVM circuit for initial reference settings and final harmonic distortion readings. VTVM ranges are 0—1, 3, 10, and 30 volts full scale. 1% precision voltage divider resistors used. Distortion meter scales are 0—1, 3, 10, 30 and 100% full scale. Having a high input impedance the HD-1 requires only .3 volt input for distortion tests.

Heathkit AUDIO ANALYZER KIT

MODEL AA-1
$59.50
Shpg. Wt. 13 lbs.

The AA-1 consists of an audio wattmeter, an AC VTVM, and a complete IM analyzer, all in one compact unit. It offers a tremendous saving over the price of these instruments purchased separately.

Use the VTVM to measure noise, frequency response, output gain, power supply ripple, etc. Use the wattmeter for measurement of power output. Internal loads provided for 4, 8, 16, or 600 ohms. VTVM also calibrated for DBM units so db gain or loss can be noted quickly.

High or low impedance IM measurements can be made. High (6 Kc) and low (60 cps) frequency generators built-in. Only 4 meter scales are employed, and one of these is in color so that results are easily read on the scale. Full scale VTVM ranges are .01 to 300 volts in 10 steps, full scale wattmeter ranges are .15 mw to 150 w in 7 steps. IM analyzer scales are 1%, 3%, 10%, 30% and 100%.

Heathkit AUDIO GENERATOR KIT

MODEL AG-8
$29.50
Shpg. Wt. 11 lbs.

This basic audio reference generator deserves a place in your Laboratory. Complete frequency coverage is afforded from 20 cps to 1 Mc in 5 ranges, and output is constant within ±1 db from 20 cps to 400 Kc, down only 3 db at 600 Kc., and 8 db at 1 Mc. An extremely good sine wave is produced, with a distortion percentage below 0.4% from 100 cps through the audible range.

Plenty of audio output for all applications; up to 10 v. under no load conditions. Output controllable with a continuously variable or step-type attenuator with settings of 1 μv, 100 μv, 1 v, and 10 v. Cathode follower output.

Heathkit VARIABLE VOLTAGE POWER SUPPLY KIT

Model PS-3
$35.50
Shpg. Wt. 17 lbs.

Provides regulated DC output for B+, and 6.3 v. AC at 4 amps. for filaments. Output variable from 0 to 500 v. DC at no load, linear from 0—10 ma at 450 vdc and 0—130 ma at 200 vdc! Essential for circuit design and development. Voltage or current read on 4½" meter.

Heathkit "Q" METER KIT

Model QM-1
$44.50
Shpg. Wt. 14 lbs.

Will measure Q of condensers, RF resistance and distributed capacity of coils, etc. Uses 4½" 50 μa meter for direct indication. Will test at 150 Kc to 18 Mc in 4 ranges. Measures capacity from 40 mmf to 450 mmf within ±3 mmf. Useful for checking wave traps, chokes, peaking coils. Indispensable for coil winding and determining unknown condenser values.

Heathkit AUDIO OSCILLATOR KIT

MODEL AO-1
$24.50
Shpg. Wt. 10 lbs.

(SINE WAVE — SQUARE WAVE)

Features sine or square wave coverage from 20 to 20,000 cps in 3 ranges. An instrument specifically designed to completely fulfill the needs of the serviceman and high fidelity enthusiast. Offers high-level output across the entire frequency range, low distortion and low impedance output. Uses a thermistor in the second amplifier stage to maintain essentially flat output through the entire frequency range. Produces good, clean square waves with a rise time of only 2 microseconds.

Heathkit IMPEDANCE BRIDGE KIT

Model IB-2
$59.50
Shpg. Wt. 12 lbs.

Measures resistance, capacitance, inductance, dissipation factors of condensers, and the storage factor of inductance. Employs 2-section CRL dial. D, Q and DQ functions are combined in one control. ½% resistors and capacitors used in critical circuits. 100—0—100 microammeter for null indications. 1000 cycle oscillator, 4 tube detector-amplifier, and power supply built-in.

Heathkit 6-12 VOLT BATTERY ELIMINATOR KIT

Model BE-4
$31.50
Shpg. Wt. 17 lbs.

Furnishes 6 or 12 volt output for the new 12 v. car radios in addition to 6 v. models. Two continuously variable output voltage ranges; 0—8 v. DC at 10 A. continuously or 15 A. intermittent, 0—16 v. DC at 5 A. continuously or 7.5 A. intermittent. Output voltage is clean and well filtered by two 10,000 mfd condensers. Panel meters read voltage and current output.

Heathkit BROADCAST BAND RECEIVER KIT

MODEL BR-2
$17.50
(Less Cabinet)
Shpg. Wt. 10 lbs.

Build your own receiver with confidence. Complete instruction book anticipates your every question.

Features transformer-type power supply, high-gain miniature tubes, built-in antenna, planetary tuning from 550 Kc to 1600 Kc, 5½" speaker. Also adaptable for use as AM tuner or phono amplifier.

CABINET: Fabric covered plywood cabinet available, complete with aluminum panel and re-inforced speaker grille. Part No. 91-9, Shpg. Wt. 5 lbs., $4.50

HEATH Company

A SUBSIDIARY OF DAYSTROM INC.

BENTON HARBOR 3, MICHIGAN

For further data on advertised products use page 99.

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 $20\frac{7}{8}$" wide x $13\frac{3}{4}$" 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

For further data on advertised products use page 99.

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 except with preamplifier stage. Shpg Wt. 10 lbs., $17.50

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.

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.

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NOTE: ALL PRICES SUBJECT TO CHANGE WITHOUT NOTICE.

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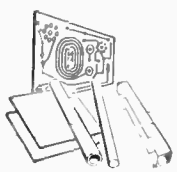

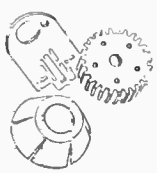

With the many materials now available, and new ones coming on the scene, how can a designer be sure he's got the right answer?

Here's one way. Work with a company that has an exceptionally broad line of basic engineering materials, plus the research facilities and production experience you need to support your decision.

NVF materials—Vulcanized Fibre, Phenolite Laminated Plastic, Metal-Clad Phenolite and Fibre, Peerless Insulation—are surprisingly adaptable. Each is manufactured in many forms, grades, and combinations, with various degrees of hardness, resilience, flexibility, insulating ability, dielectric strength, moisture resistance, and ease of fabrication. What they can do—to reduce costs and preserve product quality—has raised many a manufacturer's eyebrows *and profits!*

NVF design assistance is complete. Our technical people can work with you while your project is in the head-scratching stage—make sure that you get exactly the right material or product for the specific job. But even more important, they stick with the project until it's completed to your satisfaction.

NVF maintains complete facilities for machining and forming ready-to-use parts. This saves you operating steps and gives you 100% usable parts. Working with a single integrated supplier often turns red figures into black ones.

If you have a design problem, call on National. It's the job of our engineering staff to discover ways and means of applying NVF materials to your difficult applications. Full details of our materials and services are yours without obligation.

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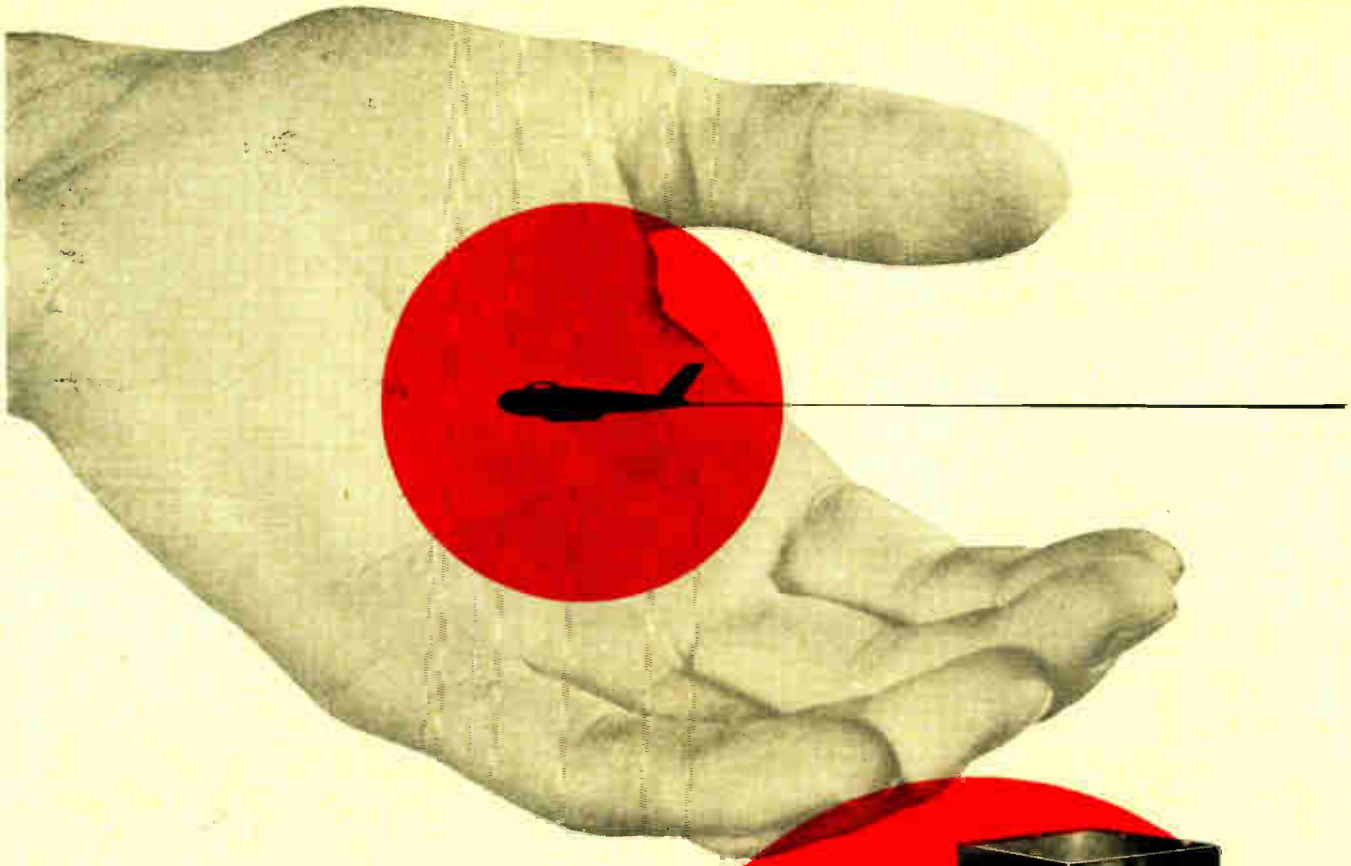
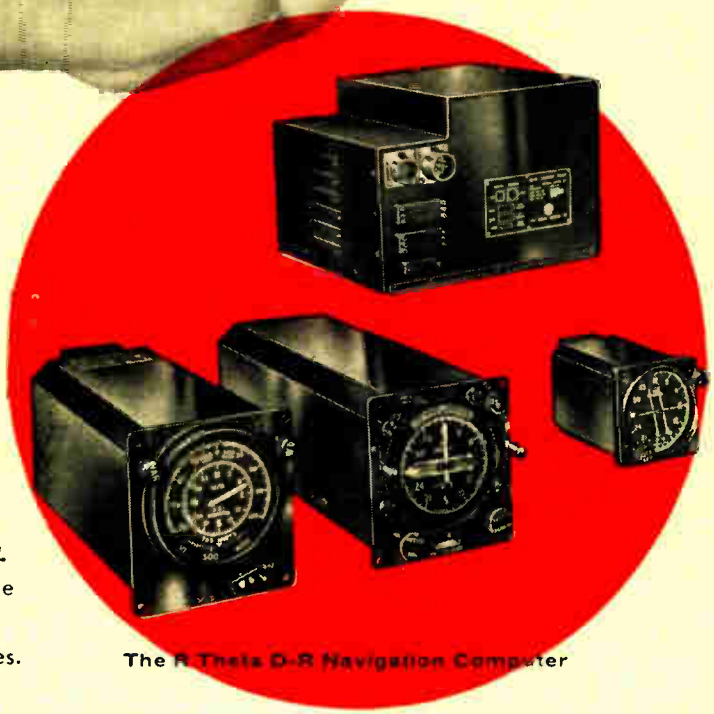


The STRAIGHT WAY Home

The R Theta D-R Navigation Computer, produced for the RCAF, is the first of its type in the world. Completely electro-mechanical in operation, no ground or airborne transmitted information is needed. Now under evaluation by the USAF and the RAF, the R Theta, will guide the pilot the straight way home no matter where he flies.



The R Theta D-R Navigation Computer

This new milestone in aviation was invented by Wing Commander J. G. Wright, RCAF. He was awarded the McKee Trans-Canada Trophy for 1954 for this contribution to Canadian aviation. The R Theta was developed and is being produced for the RCAF by PSC Applied Research Ltd.

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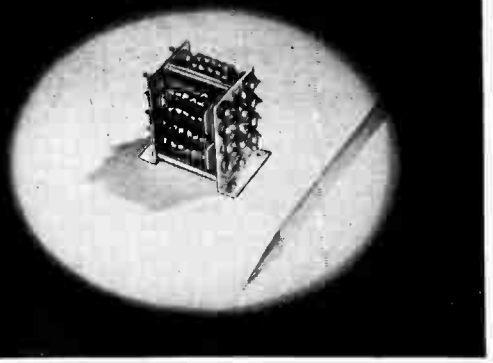
MUST YOUR EQUIPMENT BE RADIO INTERFERENCE FREE?



8 circuit miniaturized filter for wide band RF Interference Suppression.

IF YOURS IS A TOUGH RF INTERFERENCE PROBLEM — LET FILTRON SOLVE IT....

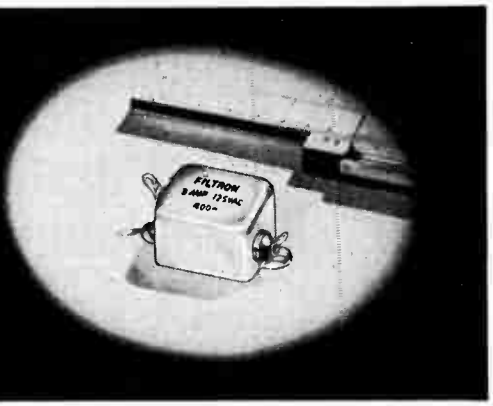
FILTRON'S engineering department, cooperating with engineers of leading companies, has solved RF Interference Suppression problems throughout the country.

If your equipment must meet the RF Interference limits set by the military specifications, consult with FILTRON'S engineers in the earliest stages of design. FILTRON can furnish RF Interference Suppression Filters whose size, weight and overall configuration will fit into your equipment.

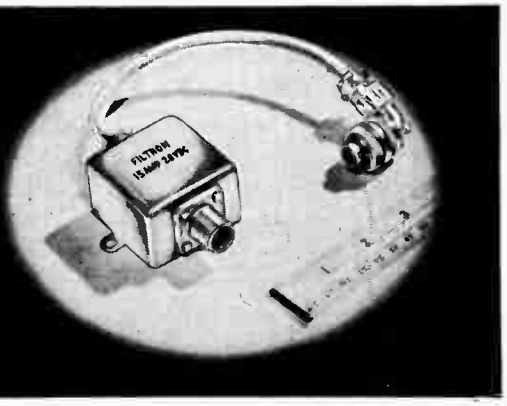
FILTRON has custom designed over 1000 different types of RF Interference Suppression Filters for equipment that meets military RF Interference Suppression limits and specifications.

FILTRON'S completely equipped screen rooms are always available for the RF Interference testing of your units and equipment.

An inquiry on your company letterhead will receive prompt attention.



Miniature 3 amp. – 125 VAC – 400~ filter – hermetically sealed – size 1⅛" x 1" x 11/16"



15 amp. – 28 VDC filter, size 2" x 2" x 1¼", with pressurized AN connectors – high attenuation from 150 KC to 400 MC.

FILTRON can best solve your RF Interference problems because:

- **FILTRON'S** engineering, research and design divisions are staffed by experienced RF Interference Suppression filter engineers.
- **FILTRON'S** modern shielded laboratories are equipped to measure RF Interference from 14 KC to 1000 MC in accordance with military specifications.
- **FILTRON'S** production facilities, comprising a capacitor manufacturing division, coil winding division, metal fabrication shop, metal stamping and tool and die shops, are exclusively producing the highest quality components for FILTRON'S RF Interference Suppression Filters.
- **FILTRON'S** extensive production facilities permit us to meet your delivery requirements. NOW!

RF INTERFERENCE SUPPRESSION FILTERS FOR:

Motors	Dynomotors
Generators	Power Plants
Inverters	Actuators
Electronic Controls	Gasoline Engines

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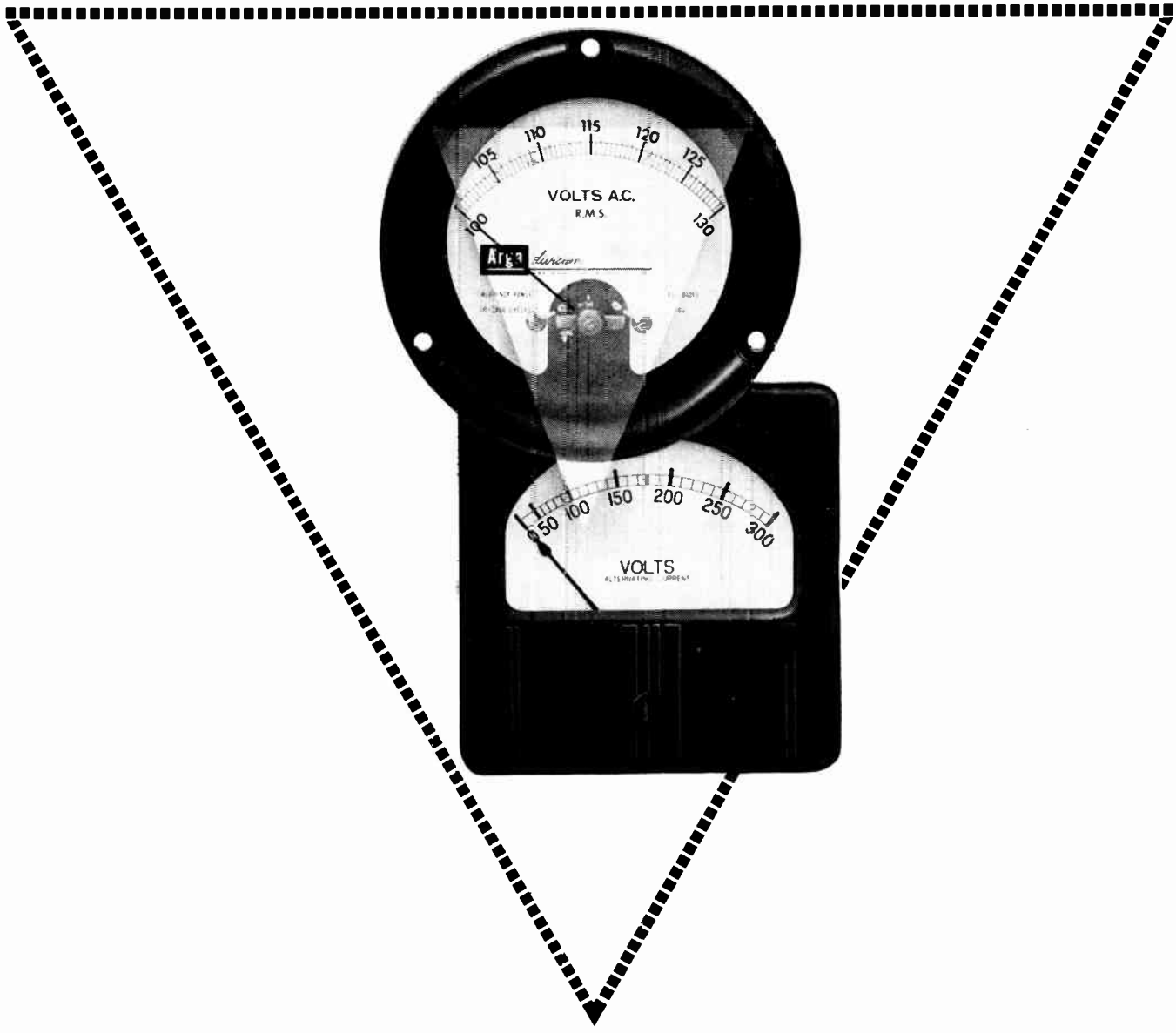

with **ARGA EXPANDED SCALE A-C VOLTMETERS** for panel mounting

Expands useful portion of conventional scale... eliminates the rest. Expansion is accomplished by exclusive, non-linear bridge in balance at only one value of input voltage. Any deviation results in bridge unbalance which is demodulated and applied to a standard milliammeter movement. Ideal for power supply, generating units, test equipment, line monitoring, etc. Available from stock in many standard sizes and types with 115 volt base. Write for data file 1205

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A-48

Sales Representative: R-O-R Associates, Limited, 290 Lawrence Ave. West, Toronto 12, Ont.

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Bendix Aviation Corp. Appoints A. J. Lewis To Toronto Post

The Scintilla Division of Bendix Aviation Corporation, Sidney, New York has recently appointed Mr. A. J. Lewis of Toronto as Sales Application Engineer for the various types of electrical connectors manufactured by Scintilla Division.

Mr. Lewis, who will make his headquarters at 2444 Bloor Street West, Toronto, will assist Canadian airframe and related equipment manufacturers with electrical connector requirements and applications. Prior to actively assuming his duties, Mr. Lewis received extensive training at the Scintilla Division factory.

H.M.C.S. Labrador Fitted With Pye Underwater TV

Canada's largest and most modern icebreaker, H.M.C.S. Labrador, operated by the Royal Canadian Navy in conjunction with the Defense Research Board, has distinguished herself by being the first Canadian vessel to acquire a permanent underwater television installation. The Labrador, last year became the first warship to navigate the northwest passage and circle the North American continent.

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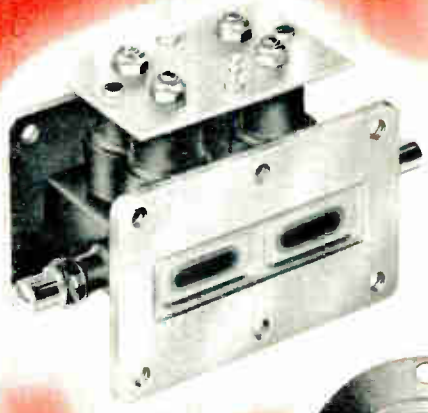

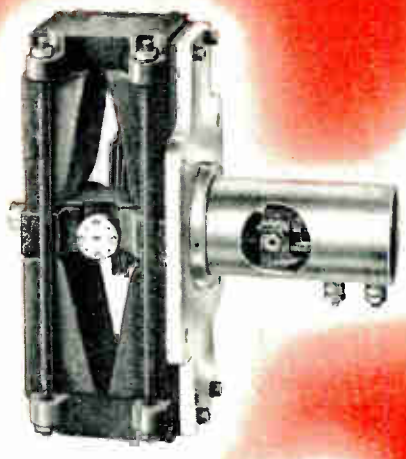

microwave tubes and components

GAS SWITCHING TUBES — Bomac produces the most extensive line of TR, ATR, Pre-TR, attenuator tubes, duplexers and shutter tubes available, for ali frequency bands and power levels.

HYDROGEN THYRATRONS — Bomac offers a complete line for use as switch tubes in line type modulators for pulsing magnetrons in radar equipment. Also used for precise triggering at high power levels.

PRESSURIZING WINDOWS — Bomac has windows available for all wave guide sizes, broad band characteristics with low insertion loss, temperature range —55°C to 100°C and 30 lb./sq. in. pressure differential either direction.

SILICON DIODES — Bomac diodes are manufactured to high standards to assure electrical uniformity, high burnout and humidity resistance.

MAGNETRONS — Bomac has available tunable and fixed tuned magnetrons with high peak RF powers for pulsed service in the higher frequency bands.

REFLEX KLYSTRONS — Bomac now offers X band klystrons having improved local oscillator performance and dependability.

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Speaking of resistor quality

. . . it is worthy of note that Stackpole Fixed Resistors are one of the most widely used brands in meeting today's exacting specifications.

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