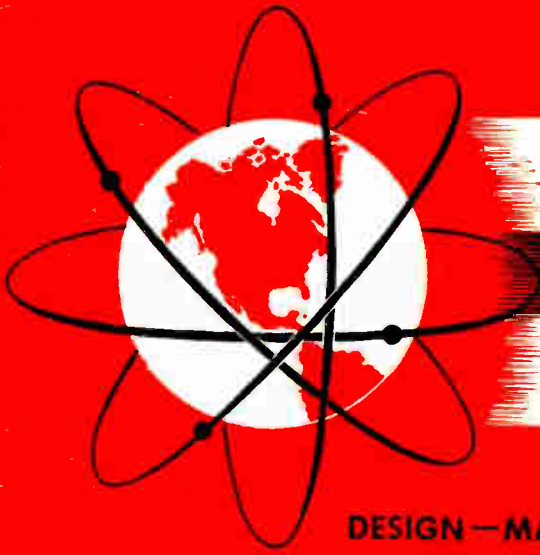


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ELECTRONICS *and* COMMUNICATIONS

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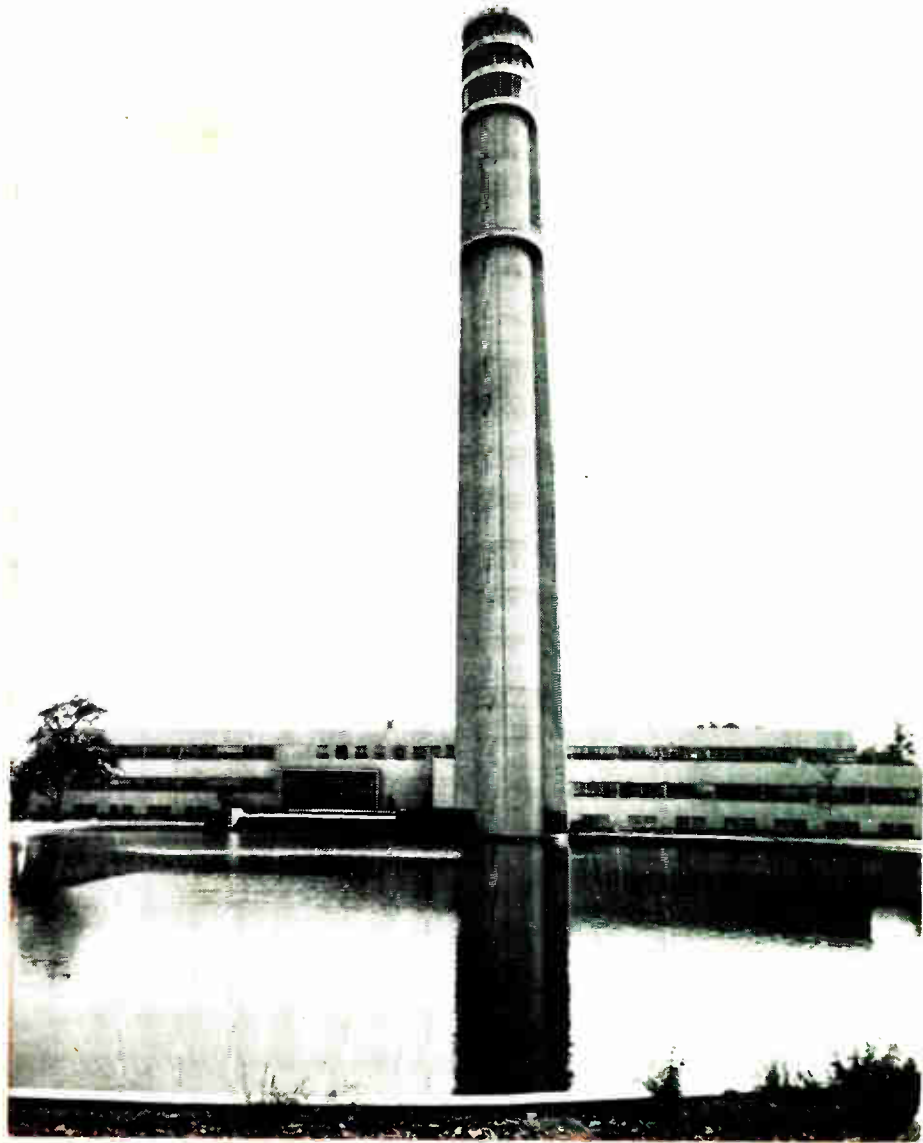
New Equipment
Records Television
Programs On Tape 22

Television For Armed
Service Use Poses
Difficult Problems 24

Twenty-One Building
Blocks Constitute
Automatic Control
System For Varied Industries . 26

Telephone Lines
Used For Other Than
Verbal Communication . . 30

An Office Memory
System That
Facilitates Record Keeping . 52



Symbolic of the Electronic Age is the 300 foot Aluminum-Sheathed Microwave Research Tower of the Federal Telecommunications Laboratories at Nutley, N.J. The Tower constitutes a unique approach to High-Frequency Radio Propagation Experimentation being conducted in these Laboratories.

May, 1956 ★ \$5.00 a year
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Adjustable Power Wirewound Resistors



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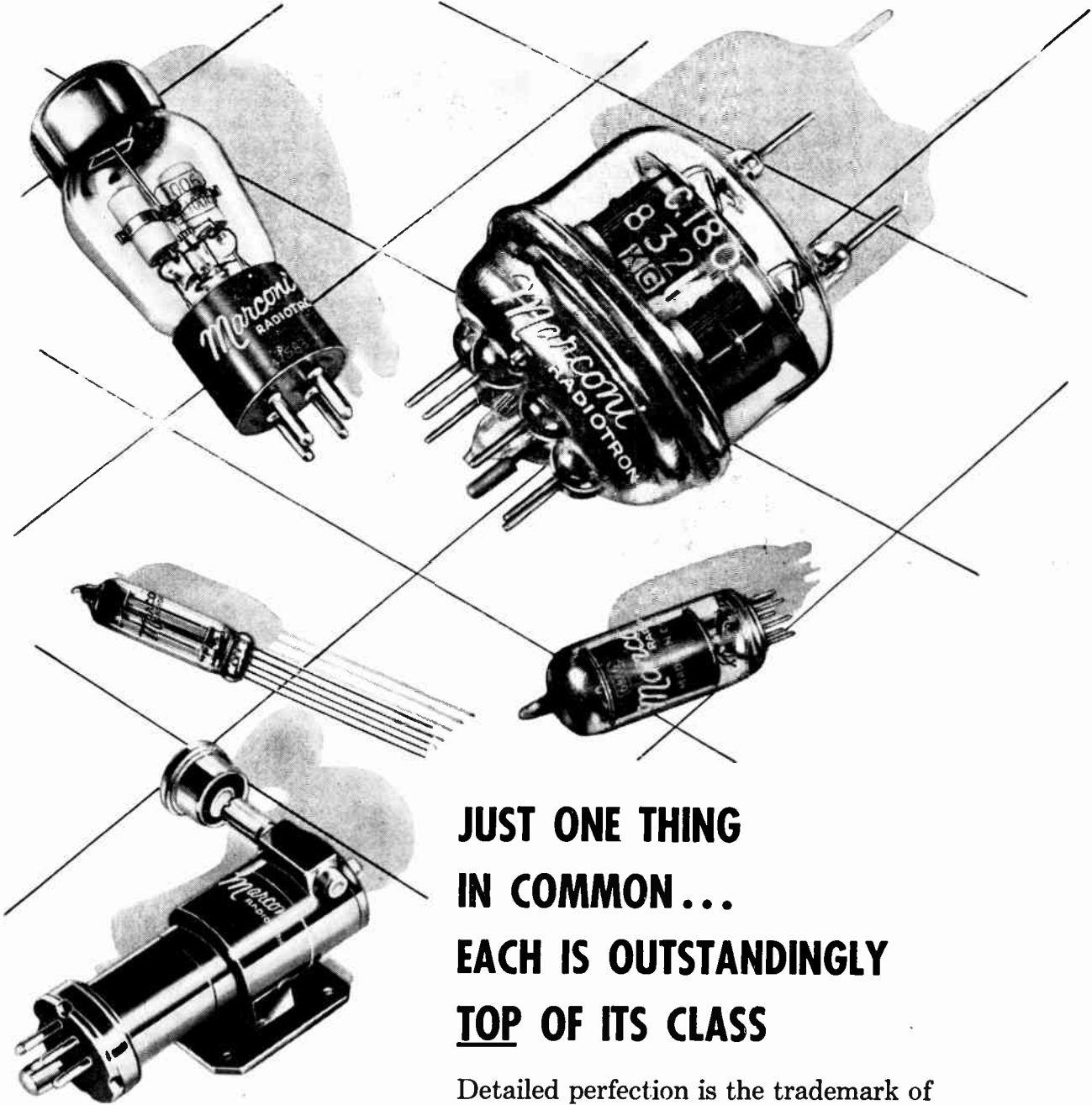
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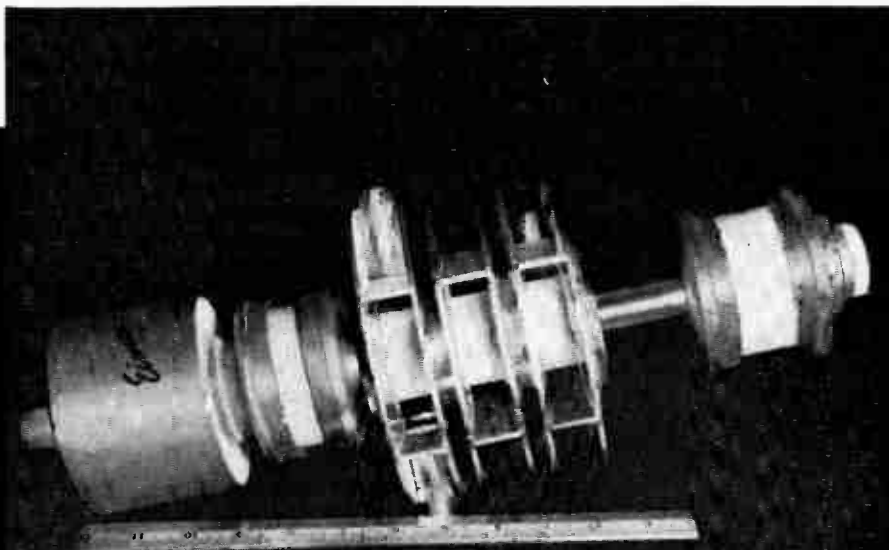
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One kilowatt CW power output is now commercially available with the new Eimac 3K2500SG amplifier klystron, specifically developed for reliable forward-scatter microwave systems. This three-cavity klystron operates at power gains of 1000 times and an efficiency of 35 to 40 percent.

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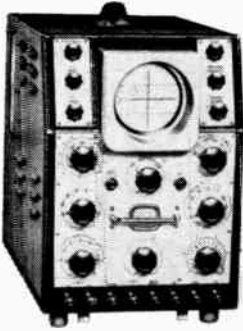
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EVOLUTION IN PRECISION INSTRUMENTS



MODEL 1049 Double Beam meets industrial and laboratory requirements, recording frequencies from zero to 400 Kc/s (A1) and 800 Kcs. (A2).

4-inch flat-screen double beam tube operates at 2KV and provides for operation at 4KV when recording of fast transients is undertaken. 2 independent channels with gains 900 and 25.

The complete range of Cossor oscilloscopes provide instruments that are designed to meet plant and laboratory requirements and are an evolution in precision.

Write for complete specifications and details to Cossor (Canada) Ltd.



MODEL 1037C provides the basic facilities required for radio, television, radar and industrial electronics servicing and testing. Its small dimensions and universal power supply operation make it of universal application.

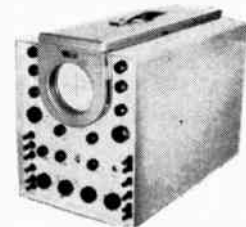


MODEL 1058 is fitted with a 4-inch diameter P.D.A. tube and provides a display of 6 cm. amplitude from zero frequency to 6 Mc/s. It has a direct-coupled Y amplifier with a sensitivity of 0.25V. cm. and accurate calibration facilities and a symmetrical X amplifier. The time base is free running or triggered and has a wide range of scanning velocity.



MODEL 1035 incorporates a 4" flat screen Double Beam Tube and independent amplifiers providing high and low gain channels with a frequency range of 20 c/s to 7 Mc/s and 20 c/s to 100 Kc/s respectively. Voltages of applied signals can be measured directly on calibrated front panel dials.

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MODEL 7514C Oscilloscope is a versatile high gain wide band instrument for general laboratory and industrial applications. The Amplifier handles signals from 5 cycles to 10 Mc.

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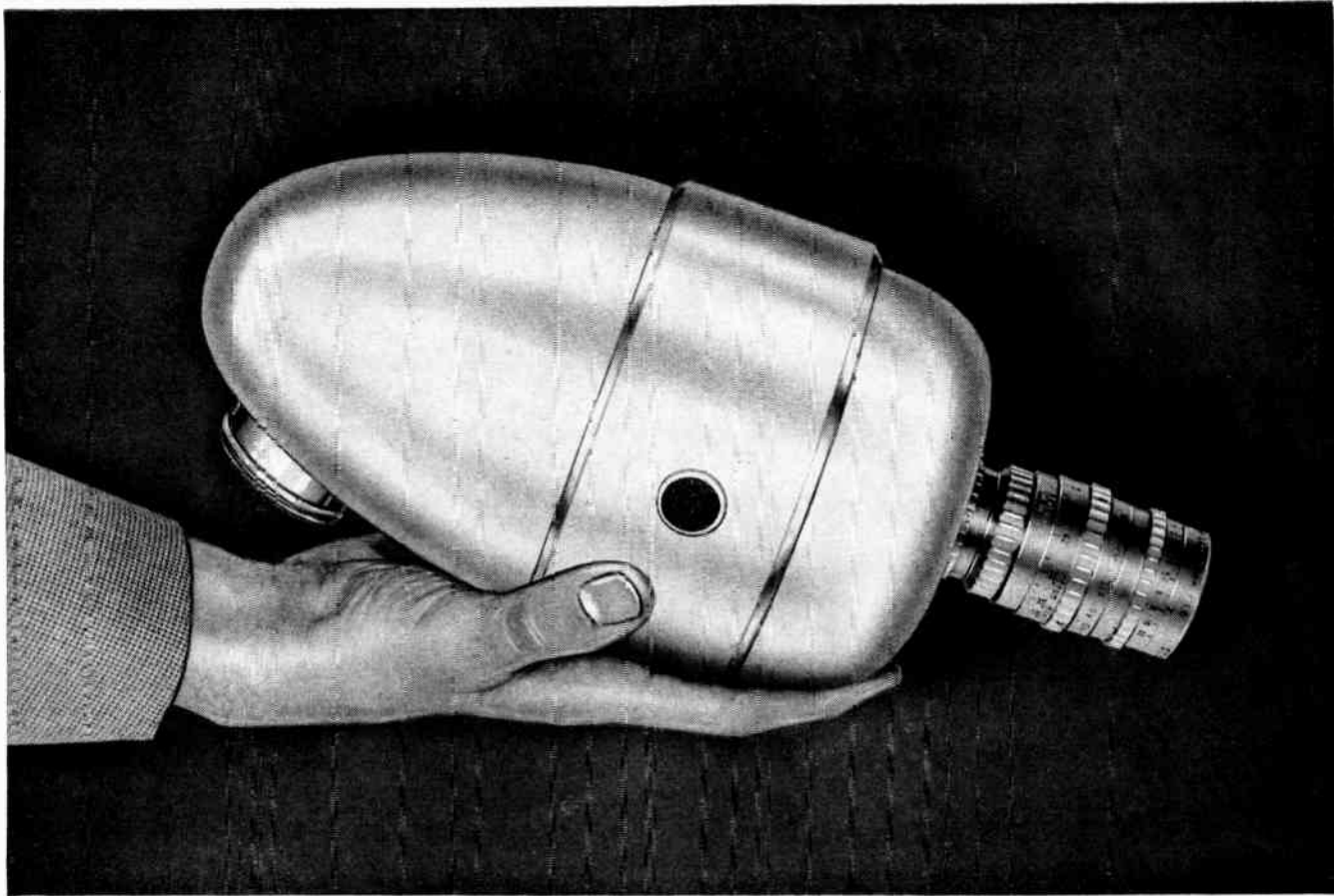
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NO . . . this is the new style in television cameras.

Designed for closed circuit industrial TV, for which there are some 5000 known applications in almost every field of commerce, this hand-sized camera is only one example of the diversity of television equipment available from Westinghouse. "Remote supervision" with the aid of industrial TV, is one of the fastest growing cost-saving techniques in use today.

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For further data on advertised products use page 65.

An Event To Be Attended---

Dr. George Sinclair, associate professor at the University of Toronto's department of engineering, who has been nominated by the Institute of Radio Engineers to head up the technical papers program at the I.R.E. Convention and Exposition to be held in Toronto this October, has outlined the objective of the convention part of the exposition.

According to Dr. Sinclair, the purpose of the convention part of the exposition is to highlight Canadian developments in electronics, thereby affording Canadian engineers the really first opportunity they have had to describe to a widely representative audience of fellow countrymen the technical advances made by them in this field. Up to now, Dr. Sinclair points out, the alternative has been to attend the New York I.R.E. Show where, because it is the world's largest annual convention of engineers, Canadian papers have tended to become lost in the mass of material presented at the New York gathering.

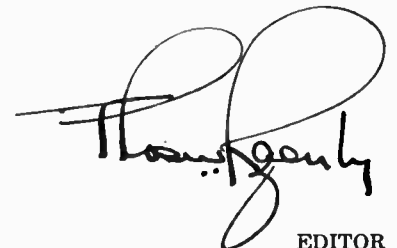
In this respect, Dr. Sinclair asserts, it is important that we bring our technical developments to the attention of Canadian engineers in order that the electronics industry in our own country may be further advanced by the dissemination of new Canadian findings.

Already some forty technical papers have been received including such subjects as medical electronics, the application of electronics to atomic energy projects, scatter propagation, the use of computers in automation and engineering problems, and several papers dealing with transistors.

There is little doubt that the quality of papers to be presented at the forthcoming I.R.E. Convention will leave little to be desired, and although Canadians in the past have been inclined to hide their light under a bushel, the stature of Canadian achievement in many fields of endeavor has leaked out and established for the scientists and engineers of this country a reputation second to none in the eyes of co-workers in many lands. For this reason it is logical to expect that many engineers and scientists from abroad will attend the Canadian I.R.E. Convention in the knowledge that Canadian enterprise is a source of scientific information that cannot be ignored.

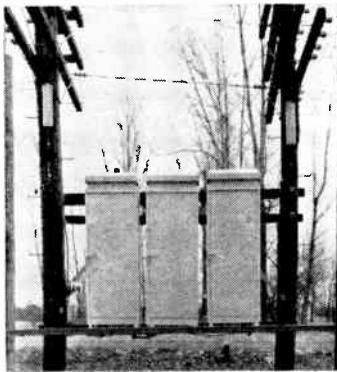
While the papers to be presented at the convention will be substantially those of Canadian authors, it should be borne in mind that the information contained in them will be of as much importance to Canadian engineers as it will be to engineers from abroad, and for this reason management of Canadian firms should note the importance of planning adequate representation of their engineering personnel at this Canadian engineering symposium.

Though the general tenor of the I.R.E. Convention and Exposition will be based on the science of electronics, it should also be recognized by business management generally that electronics has now become so widespread in its industrial applications as to make the forthcoming Canadian I.R.E. Convention and Exposition an event to be attended by engineers from industry at large, be they engaged in the design of baby buggies or ballistic missiles.


EDITOR



But there's no need to build anything for "out of the way" telephone equipment



The weatherproof cabinet is adaptable to either single pole mounting, or multiple cross arm mountings, as illustrated above. Mounting instruction with each cabinet. The cabinets illustrated contain a repeater, stand-by power supply and cross-talk suppression filters.

Now—without using a foot of land, without building any kind of shelter—voice or carrier repeaters, and filters can all be neatly, safely housed in the specially designed LENKURT TYPE 565A WEATHERPROOF CABINET.

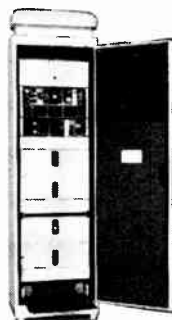
This strong steel cabinet features thermostatically controlled ventilation! Plus such optional features as a 15 amp. circuit breaker, forced draught ventilation and dual a-c outlets. The LENKURT 565A Cabinet is not only more efficient, but also cheaper than a building.

The cabinet is made of enameled steel, insulated with 1" thick fibre insulation. It stands 87" x 23" x 18" and has the facilities for mounting standard 19" equipment. There are 38 vertical mounting positions. A weather shield is provided. A folding shelf with convenient working surface is attached near the bottom of the door opening. The wiring for the temperature control and blower motor is always supplied as a basic part of the cabinet.

Specially designed for housing out-of-the-way telephone equipment, the 565A WEATHERPROOF CABINET keeps the equipment working at peak efficiency . . . is cheaper to buy and easier to erect. This cabinet is made for Lenkurt Electric and distributed by Automatic Electric. Write today for complete details. Automatic Electric Sales (Canada) Limited, 185 Bartley Drive, Toronto 16, Ont. Branches in Montreal, Brockville, Ottawa, Hamilton, Winnipeg, Regina, Edmonton, Vancouver.



A 45A Repeater installed in a weatherproof cabinet, which is also ideal for the AT-2 and AT-3 repeaters.



The cabinet housing a complete Lenkurt 33A three channel terminal assembly.



For further data on advertised products use page 65.

RETMA REPORT

*A Monthly Bulletin Of Association Activities
Prepared For Electronics And Communications*

By
BASIL JACKSON



27th Annual Meeting Of RETMA

The 27th. Annual Meeting of the Radio-Electronics-Television Manufacturers Association of Canada is due to take place at the Chantecler Hotel Ste-Adele-en-haut P.Q., on Thursday and Friday 7 and 8 June. Ste-Adele is about forty-five miles north of Montreal and was the location of the very successful 2nd. Annual Meeting of the Electronics Division of RETMA held last September.

An outstanding feature of this year's Annual Meeting will be a speakers' panel organized by the Electronics Division. This is the Division made up of member companies in the electronics industry who produce transmitters, electronic communication equipment, electronic equipment for commercial, industrial and military use, electronic instruments for scientific and medical applications, and data handling electronic equipment such as computers.

Another panel will be arranged by the Industrial Relations Committee of RETMA and this, together with the Electronics Division's panel, will prove of great interest to the industry.

RETMA Participation In "Town Meetings"

In conjunction with the National Advisory Committee of Town Meetings, RETMA is taking part in organizing a series of Town Meetings in the Maritimes in June. "Town Meetings" is the name given to the intensive series of technical lectures given to television service technicians in the town or city in which the meeting is organized.

In the past few years, Town Meetings have been held in Vancouver, Edmonton, Calgary, Regina, Winnipeg, Toronto, and Montreal. The Maritime Town Meetings will be held in Halifax, N.S. on June 19, 20, and 21 and in Saint John, N.B. on June 26, 27 and 28.

It is estimated that, between 1949 and 1954, over 3,000 television service technicians have attended these meetings and have acquired valuable knowledge in servicing and maintaining the products of the electronics industry.

The two lecturers for the Maritimes will be G. L. Stewart and H. Jackson of the Ryerson Institute of Technology in Toronto.

The technical program for the Maritime Town Meetings has been established and further details about the meetings can be had from the RETMA Office, 200 St. Clair Avenue West, Toronto 7, Ontario or by writing to the local Town Meeting Committee chairman, Jack T. Mather, 129 Hollis Street, Halifax, N.S.

Parts And Accessory Division Hold Panel Meeting

The Parts and Accessory Division of RETMA recently held a meeting in Hamilton, Ont. at which an Industrial Relations Speakers' Panel was a successful part of the proceedings. Speakers were Dexter McDonald, Keith Richan, and Alex Hill, of the Industrial Relations Departments of their respective manufacturing companies, and Harold Ireland, manager of the Institute of Supervisory and Personnel Development.

(Continued over page)

RETMA REPORT

RETMA's New General Manager

The new General Manager of RETMA of Canada, Fred. W. Radcliffe, took up his appointment on April 16. Mr. Radcliffe is very well known in the Canadian electronics industry and relinquished his position of Vice-President of the RCA Victor Company to take on the General Managership of RETMA. He was with the RCA Victor Company for thirty-six years and has been a director of RETMA for twenty years. In addition to his extensive knowledge of the electronics industry, Fred. W. Radcliffe has exceptional ability as a public speaker, and he is often requested to present his thought-provoking addresses to many groups.

Canadian Radio Technical Planning Board News

The Canadian Radio Technical Planning Board has formulated and approved frequency allocations for highway transport. The proposals have been forwarded to the Department of Transport for their consideration.

RETMA Presents Panel At Dealers' Convention

On April 30 RETMA provided a panel of speakers representing the electronics industry at the Canadian Association of Radio, Television and Appliance Dealers' Convention in Toronto. The two morning speakers were Paul Dixon, National Sales Manager of Motorola Canada Limited, whose address was entitled "Transistors Come Of Age", and William A. Grant, Product Manager, Musical Equipment Division, Philips Industries Limited, who spoke on "High Fidelity In Canada". In the afternoon Stuart D. Brownlee, chairman of the RETMA Color Television and UHF Committee, Executive Vice-President of Canadian Admiral Corporation Limited, spoke on "Color Television", and William A. White, chairman of the RETMA Service Committee, Manager, Service Division, RCA Victor Company Limited, dealt with the subject of "Planning Service For Color Television".

The luncheon address was delivered by Fred. W. Radcliffe, General Manager of RETMA. His talk, entitled "Over The Horizon - In Electronics", presented a very clear picture of the likely future course of electronics in Canada.

He mentioned the interesting fact that the electronics industry in Canada has grown over three times as fast as the growth of the gross national product and said that over three-quarters of the products to be produced in ten years' time probably do not exist in commercial form today.

Automation - Mr. Radcliffe explained that automation was simply a method for the self-control of machines or processes of production. It will affect dealers because it will allow goods to be produced at lower prices, creating wider markets and faster turnovers. Also, automation will eventually increase the amount of leisure time customers will have available to enjoy the use of the products of the electronics industry.

Guided Missiles - After briefly reviewing the role of the guided missile for military operations, the speaker forecast the use of such missiles for peaceful transportation - for mail, and express freight. The missiles would be electronically guided over great distances - he foresaw the delivery of products in Vancouver from a factory in eastern Canada in one hour.

Radar - On the peaceful applications of radar, Mr. Radcliffe mentioned the possibility of providing a guide for sightless persons and the current use of radar for determining weather.

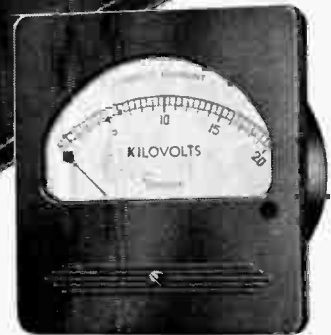
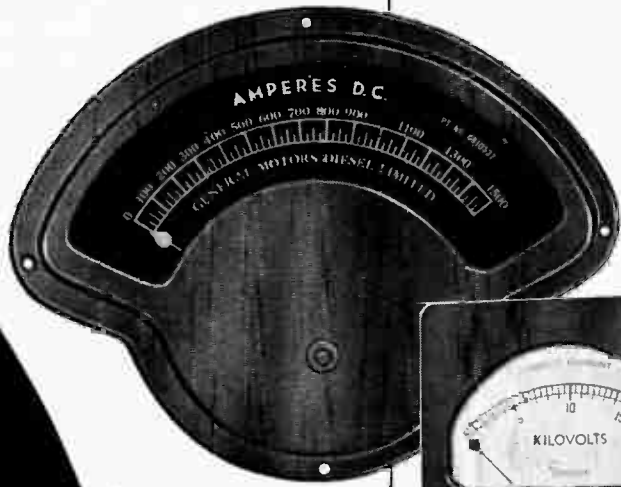
New

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SWITCHBOARD INSTRUMENTS

CANADIAN PRODUCTS
DESIGNED TO MEET
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7" FAN TYPE
A large rugged instrument for every use from locomotives to fixed switchboard applications.



4" RECTANGULAR
A large open scale instrument for use on small generating plants and fixed installations.

Special ranges and dials available to any manufacturer's specifications.



ELAPSED TIME METER
Totalizes elapsed time in up to five digits with two available ranges — 99999 hours or 9999.9 hours. A useful instrument to indicate the total time the electrical equipment has been in service. Three case styles to match other Simpson Instruments.

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

business briefs & trends

★ Burroughs Corporation have announced through their general manager L. T. LaPatka that they will enter the component manufacturing business and will go into volume production of tape wound cores and pulse transformers for use in memory and switching units.

* * *

★ The U.S. Department of Commerce anticipate that 35 billion dollars will be spent on plant expansions during 1956. The electronics industry which forms a substantial part of this expansion has at the present time in excess of one million square feet of new plant facilities under construction.

* * *

★ In the next eight years it is estimated that the American electronics industry will grow by 66 per cent by which time it is anticipated the annual volume of production will reach 18 billion dollars.

* * *

★ The necessity for specialized training in electronics for members of the armed services is evidenced by the creation of a new rank in the Royal Air Force. The rank is that of air electronics officer, a category which has been brought about in order to man Britain's V-bomber force.

* * *

★ General Electric's Dr. W. R. G. Baker says that it will be 1958 before the sale of color TV sets reaches the million mark in the United States. Dr. Baker also believes that it may be 1959 or 1960 before the number of color TV sets sold reaches that of black and white sets sold.

* * *

★ The Department of National Defense will spend \$19,350,000.00 for signal and wireless equipment for the Royal Canadian Navy during the fiscal year 1956-57 and \$45,389,000.00 for signal and wireless equipment for the Royal Canadian Air Force in the same period.

* * *

★ The Hon. Ralph Campney, Minister of National Defense, states that Canada spent \$175,067,690 as her share in building, manning and maintaining the Pine Tree Radar Line. Canada's cost with respect to the Mid-Canada system for similar services amounts to \$26,673,816.

* * *

★ In the period February 1 to February 29, 1956, the Department of Defense Production awarded contracts for electronic equipment valued at \$4,682,628.00. This total includes only contracts over \$10,000.00 and does not include contracts for classified equipment.

* * *

★ Continued imposition of the 15 per cent excise tax on radio and television receivers in the recent Canadian budget makes these two items the only durable consumer goods taxed at 15 per cent.

* * *

★ The Raytheon Manufacturing Company of Waltham, Mass. have established a Canadian operation under the name of Raytheon Canada Limited, with headquarters in Kitchener, Ontario. The new firm is owned jointly by Dominion Electrohome Industries Limited and Raytheon Manufacturing Company. An initial contract for the development and manufacture of \$5,000,000 worth of surveillance radar has been awarded to Raytheon Canada by the Department of Transport.

* * *

★ The bulk of defense contracts in the United States is definitely shifting to that segment of industry made up by the aircraft and the electronics industries. With the exception of General Motors and the Ford company the ten top contracts awarded in the last six months have gone to aircraft and electronic manufacturing firms.

* * *

★ RETMA's brief to the Royal Commission on Canada's Economic Prospects has urged government assistance in the form of tax exemptions as a means of stimulating research in Canada. In the United States it is estimated that ten billion dollars will be spent in 1956 for industrial research.

* * *

★ Commenting on the upward trend of business in international markets President Mitchell of Sylvania has announced that Sylvania Electric of Canada enjoyed a 50 per cent increase in sales in 1955 over the preceding year.

* * *

★ K. R. Patrick, president of Canadian Aviation Electronics Limited, predicts that within ten years Canada will likely have an advanced air defense system involving the use of a new \$2,000,000,000 "electronic atmosphere". Mr. Patrick envisions this "atmosphere" as gathering information from the many radar installations now being built and funneling it through a master computer for analysis and ultimate use in guiding interceptor planes and missiles.

* * *

★ Collins Radio have announced the acquisition of Communications Accessories Company of Hickman Hills, Mo., manufacturers of toroidal coils, magnetic amplifiers and filters used in communications equipment and guided missiles.

* * *

★ The value of exports of electronic equipment from the United Kingdom in 1955 amounted to 13 million pounds sterling, the highest export figure achieved so far for the U.K. electronics industry.

* * *

★ S. M. Finlayson, president of the Canadian Marconi Company estimates that the Canadian electronic industry will expand to three times its present volume by 1980.

* * *



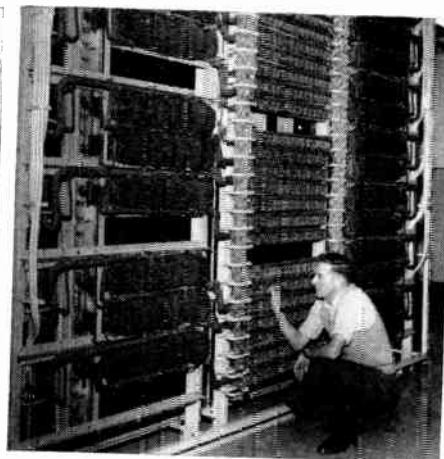
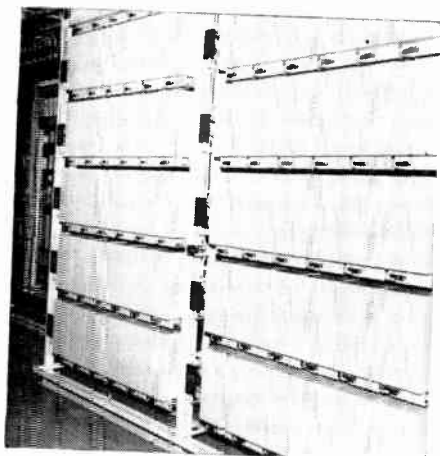
The new integrated toll board is cordless and completes calls by remote control. Transmission paths are not carried through the switchboard, but through automatic switching equipment, controlled by the operators at the board.

Chief operator's control console. The control and supervision of traffic is centralized. Automatic signals adjust themselves to the prevailing conditions during overload. Service information and intercept boards are also provided.



UNIQUE TELEPHONE FACILITIES AT NEW WESTMINSTER, B.C. FEATURES AUTOMATIC ELECTRIC EQUIPMENT

On January 29th, 1956 in New Westminster, the B.C. Telephone Company made the largest cut-over in its history to meet the phenomenal growth of the city. By means of two and one-third 10,000 line units of Strowger Step-by-step Equipment, the Company now provides local and extended area service to more than 21,000 subscribers between New Westminster and neighboring Vancouver.



A unique feature of this ultra-modern exchange is the complete provision for handling toll traffic. With the inter-toll dial trunks illustrated, an operator may dial direct to some 40 toll centres. Automatic alternate routing is provided where advantageous.

A bay of inter-toll selectors shown in the toll switchroom. Here toll switching, both terminating and through, are handled by Automatic Electric's Type FW-1 Intertoll switching system, which incorporates many new features for the switching of toll traffic.

Using a new high speed method of call distribution, incoming traffic is received by any available operator. Calls are served through a "gate" system, practically in the order of their arrival, with preference being given automatically to certain classes of calls. The illustration shows primary distribution bay.

The facilities at New Westminster represent another large installation of Strowger Step-by-step equipment in Canada . . . proving once again that Strowger is your safest investment in telephone equipment. Contact our engineers for their recommendations on your specific problems.

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Branch Offices: Montreal, Ottawa, Brockville, Hamilton, Winnipeg,
Regina, Edmonton, Vancouver.

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LABORATORY TESTING, OR
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accurate measurements are required, use

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Precision-made, British-built Dawe Instruments are simple to operate and eliminate all guesswork. They help to speed up production and raise engineering standards.

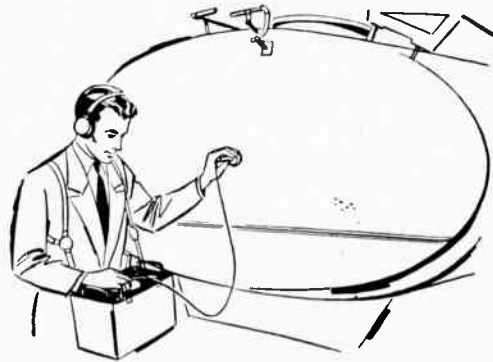
If your business requires fast, accurate measurement of noise, vibration, thickness, balance, or speed—call Dawe Instruments for technical information and advice without obligation. Ask for the free booklet. "Dawe Instruments In Industry".



Checking a rotating anode X-ray tube for acceleration and smooth operation in a matter of minutes, with a Dawe Stroboscope.

STROBOSCOPES

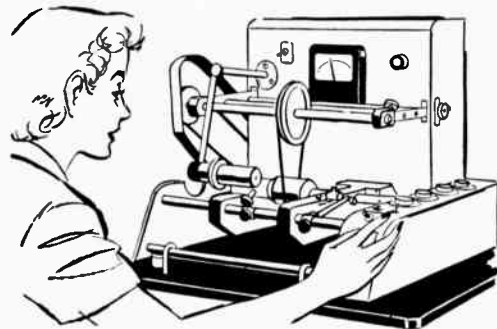
Type No. 1200 Series. Measures high-speed operations and observes fast-moving objects in apparent slow motion. Direct-reading range 250-18,000 r.p.m.



Measuring the thickness of the dished-end of an acid tanker during overhaul. Inspection by mechanical means is practically impossible.

ULTRASONIC THICKNESS GAUGES

Measure the thickness of materials where only one surface is accessible. Ranges: (Type 1101) 0.060 in. to 12.0 in. of steel. (Type 1101-1) 0.020 in. to 4.0 in. of steel.



Balancing the armatures of electric hand-drills.

DYNAMIC BALANCING MACHINES

Type 1250. For rotors weighing 1 oz. to 10 lbs.



DAWE INSTRUMENTS LIMITED

CANADIAN DIVISION—1654 Bank Street, Ottawa, Ontario 5502

For further data on advertised products use page 65.



The

EDITOR'S PAGE

It is a little disappointing to note that a certain guided missile development program carried out by a country geographically located north of the United States is reported to have fallen flatter than a broken note in a church solo. Despite the fact that Canadian scientists working on the project found themselves hopelessly behind the times in producing a guided missile of domestic design is certainly no reason why the general idea of developing a guided missile in this country should be shelved. Although duplication of effort with American activity at this time may be regarded as wasteful of both time and money, the experience and backlog of know-how that could be built up would be of inestimable value.

From an economic standpoint, of course, there is no denying the fact that it is much cheaper to let the United States carry out the development and design of these weapons and then join the bandwagon on a manufacturing basis. Somewhere along the line, however, as was the case in the aircraft industry, it is conceivable that Canada will be called upon for reasons, strategic or otherwise, to produce guided missiles on her own hook.

If such a time comes, it may be that the time element involved will be of far greater significance and value than the cost of producing such equipment.

This is, without doubt, an air age in which the aircraft and guided missiles have taken precedence over other means of defense and the cost involved in keeping this country to the fore in the matter of producing them is in itself surely ample justification for the expenditure of the large sums of money involved.

Observing that defense authorities have spent millions of dollars over the past ten years or so in the development of a new class of anti-submarine escort vessel, the first of which has only recently been put into service eight years after its conception, is considered ample reason to presume that defense authorities are not entirely averse to carrying through to completion costly programs of development productive of equipment not entirely unobsolete. If defense authorities are of the opinion that the development and construction of a new type of escort vessel is justified in order to build up a shipbuilding know-how in this country, then there surely must be equal justification for carrying on with the development of guided missiles for the same reason. There is little reason to doubt that the equipment and propulsion machinery carried by Canada's new escort vessels is of modern nature and well worth the cost of its development, but it is questionable whether money spent on hull design for the new vessels — the basic principles of which have not changed since Archimedes took his historic bath and Noah built the Ark — could be justified. If, however, authorities have found justification for such an expenditure, it is hoped that in the future they will also find conviction to continue with guided missile development, a sphere of knowledge which needs far greater support in this country than a knowledge of shipbuilding, an industry in which we have excelled since 1831 when Canadian craftsmen built and sailed the "Royal William" from Pictou to London, the first vessel to cross the Atlantic by steam.

* * *

It has been noted that considerable publicity has been afforded the fact that a fourth year class at the Royal Military College in Kingston have successfully completed the construction of an electronic bagpipe. While there is little doubt that the cadets who have built this instrument are entitled to that sense of pride and satisfaction which comes from the creation of something well done, we wonder if the instructors in charge of the class could not have guided the students into the construction of some piece of apparatus, a knowledge of which would be more appropriate to the advancement of their careers in the military sphere. While we hesitate to go on record as saying that the bagpipe can hardly be regarded as an instrument of defense or offence, we do believe that there is a wide choice of other projects any one of which would have afforded the students equally practical experience in the field of electronics, together with the combined characteristics requisite to stimulating interest and advancing their knowledge of more significant military equipment.

* * *

Although the comparison in the number of engineers being trained in Russia and the number being trained in the United States and Canada is becoming a bit hackneyed, we are among those who believe that a continuous reference to the subject may have some effect in helping to accelerate the output of engineers in this country. The scramble to obtain trained engineers for Canadian industry was well illustrated at the recent New York I.R.E. Show and Convention, where several recruiting teams from Canada were attempting to sign up technical personnel for their companies.

While the greatest source of engineers for industry at this time is our universities, there is one category of engineering student in our universities who may not apparently, by virtue of immigration department red tape and governmental myopia, look forward to pursuing an engineering career in Canada. They are the non-resident students who are studying at Canadian universities who, despite their academic qualifications, are not conceded any special consideration by the government in the matter of remaining in Canada, should they choose to do so. A specific case in point is that of a St. Francis Xavier University student who has consistently led his class and who next year intends to pursue a Ph.D. course in physical chemistry. He is a British subject from Jamaica, but because of Chinese lineage, it is reported that authorities have indicated that he is "expected to effect his departure from the country" when he has completed his studies.

In view of the crying need for persons of such training in Canada, it is considered that Mr. Pickersgill, Canada's Minister of Immigration, would be well advised to effect a departure of his own — a departure from the hidebound ludicrous immigration laws that prevent such students from remaining in Canada, should they so desire. A telephone call from Mr. Pickersgill to his Cabinet colleague in the Department of Labor, may bring him up to date on just how many vacancies there are in Canada at the present time for persons of the academic caliber of this St. Francis Xavier student.

* * *

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Telephone type relays
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Relay banks

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relays

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push & turn keys

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Other special
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- Tremendous growth of the Canadian electronics industry has inspired C. P. CLARE & Co., leaders for many years in the industrial relay field, to extend their engineering service to product designers in Canada.

- A new district office of C. P. CLARE & Co. is now open at 659 Bayview Avenue, Toronto. District Sales Manager Ronald W. Price is in charge. His wide experience with the electronics industry in Canada makes him an ideal consultant on all types of design problems which involve relays.

- C. P. CLARE & Co. are manufacturers of superior relays, switches, and allied control components for electrical, electronic and industrial applications. We invite you to contact our new Toronto office for information on CLARE products and their application to your specific problems.

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For further data on advertised products use page 65.

FOR WINDING
OR REWINDING
ELECTRICAL
EQUIPMENT



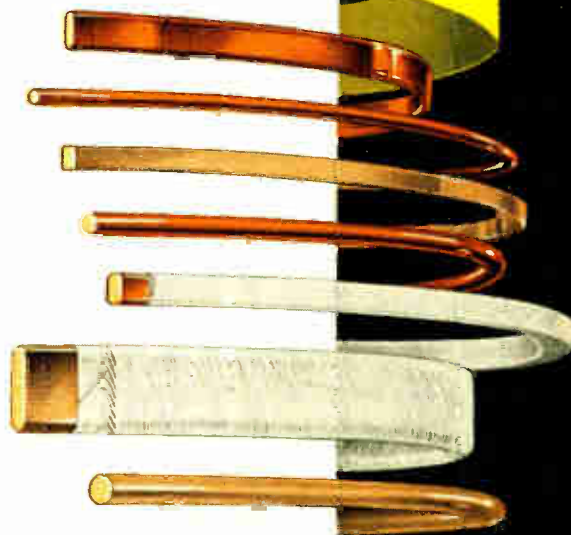
FEDERAL magnet wire

Quality control at every stage of production is your guarantee of satisfaction. All shapes and sizes from stock or specially produced to your requirements.

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Unusual magnet wire problems need special solutions. Call on our engineering and production experts at any time.

5605



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Polluted air and particularly the eye-smarting smog has become a necessary evil in our urban civilization. To banish this brown-shrouded evil cloud from our boundaries, millions of dollars are being spent in research by cities and the affected industries.

Mass Spectrometry In Air Pollution Research

ANALYTICAL chemistry and electronics have been joined in a unique instrument — the mass spectrometer — which can measure offending air pollutants. Research has shown that the two major ones are hydrocarbon and sulphur compounds. The Consolidated Electrodynamics analytical mass spectrometer and the newer "process monitor" type are both already being used in air pollution research and control.

This electronic wizard makes rapid and highly accurate analysis of gases and light liquids from samples as small as 1/10th of a drop. Its operation is based on the fact that every molecule has a unique construction pattern, its individual atoms having a definite geometric arrangement with

bonds of definite strength between them.

The manner in which each type of molecule will break when it is bombarded by electrons and the quantity of each type of fragment depends on the strength of these atomic bonds, so that pattern of breakage and the number of fragments produced is an unmistakable "fingerprint" of each specific chemical compound. The characteristic is so unique and accurate for each compound as to constitute one of today's most widely used methods of analysis of complex mixtures.

This unique ability makes it the perfect "sleuth" for ferreting the sources and composition of air pollutants.

Smog Research

The analytical mass spectrometer is being used by a number of public agencies in air pollution work. The County of Los Angeles, for example, used the instrument in smog research. Samples of air were collected by isolating gaseous pollutants on a glass-wool filter at liquid-oxygen temperatures. The frozen concentrate then was separated by isothermal distillation or sublimation at low temperatures and pressures, and the components identified and concentration estimated by the mass spectrometer.

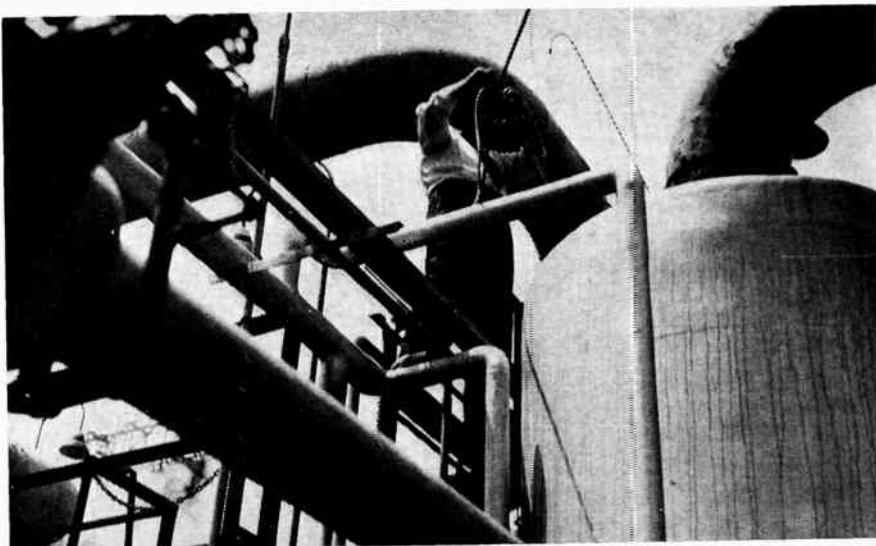
About 60 chemical compounds or families of compounds were identified, or tentatively identified, with the mass spectrometer, and the amounts of some of these were determined. It was shown that the gaseous phase of the smog was primarily a mixture of hydrocarbons and other substituted compounds.

A study of all the mass spectra obtained from the smog concentrate permitted identification of some materials and indicated the probability or possibility of the presence of many others. It was also possible to rule out many compounds on the basis of their absence from the spectra.

Auto Engine Exhaust Studied

The mass spectrometer has been successfully used in the past for the analysis of exhaust-gas samples, but a major problem has always been the obtaining of a representative, discrete sample. Tedious and time-consuming special techniques were required to avoid the possibility of sample condensation, absorption, adsorption, and even reaction. In addition, batch-type analysis could not be made under conditions of continuous engine operation.

The two new "process monitor" mass spectrometers, the 21-610 and the 21-620, are proving of particular importance.



● Left: Taking samples at the sulphur recovery plant. Minute quantities of the sample taken were fed to the inlet system of the Consolidated 21-610 Process Monitor Mass Spectrometer installed in the mobile laboratory. Right: The Consolidated Type 21-610 "Process Monitor" Mass Spectrometer.

ance in this study because they were designed to provide continuous on-the-line monitoring from a small, compact, mobile instrument. The continuous sample-inlet system eliminates the discrepancies which may result from use of sample containers.

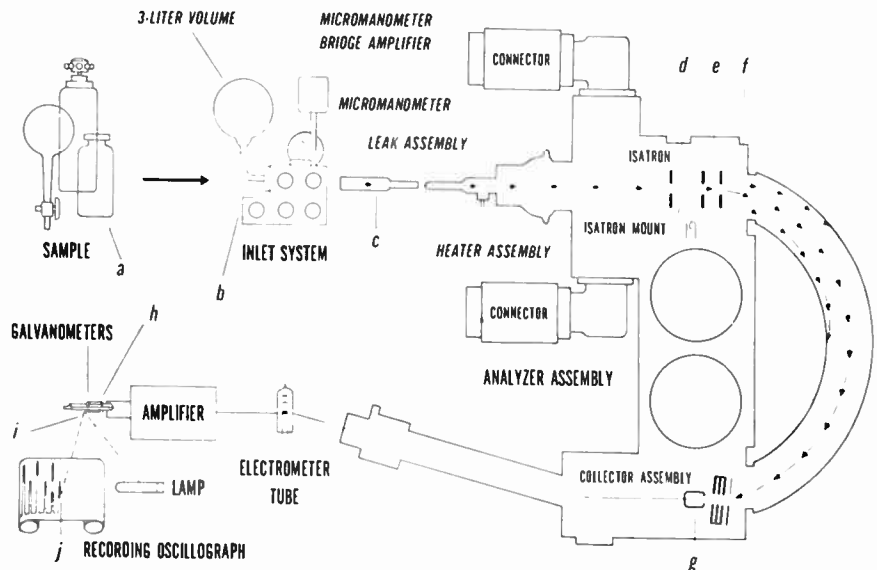
In actual tests, the sample was taken from a point on the exhaust manifold approximately one foot downstream from the nearest exhaust port. A short 1/4-inch metal line delivered the sample directly to the instrument. The only utilities required by the mass spectrometer were standard 115-volt power and a small flow of cooling water. The investigations have been enlightening not only because the results showed how the automobile is a source of smog, but also because they provided a means of studying engine efficiency.

Sulphur Dioxide Control

In one recent test at an oil refinery's sulphur recovery plant, the 21-610 mass spectrometer not only showed how much sulphur dioxide was being vented into the atmosphere, but also showed how the plant efficiency could be increased to get higher yield of recovered sulphur.

Nearly all petroleum and natural gas contains hydrogen sulphide, a corrosive, toxic, and odorous gas which is usually removed in treating plants. The hydrogen sulphide was formerly burned to sulphur dioxide and then vented to the air. While not quite as objectionable as hydrogen sulphide, sulphur dioxide is also a major cause of air pollution. Now, largely because of growing concern over air pollution, an increasing number of refineries and natural-gas treating plants are converting hydrogen sulphide to elemental sulphur.

To keep these sulphur-recovery



How the Mass Spectrometer Works

- A sample of the unknown substance is stored in a small container at relatively low pressures, usually in the vapor phase.
- The molecules are introduced through a series of special valves called the inlet system.
- The conglomerate mixture of molecules passes through a restriction called a gold leak. The tiny openings allow only a limited number of molecules to pass.
- In the ionization chamber, called the Isatron, a much higher vacuum is maintained. Here the molecules are bombarded with a stream of electrons from a heated filament. Some become positively charged ions, others are fragmented and positively charged.
- Ions thus formed leave the Isatron chamber through a narrow slit. They are next accelerated to a high velocity by a strong electrostatic field, and pass through a second slit.
- A magnetic field, parallel to the slits, diverts the fast-moving ions into circular paths, the radius of which is proportional to the mass and velocity of the ion. Thus, the single beam is split into individual beams.
- Sorted in this manner, ions of a given mass pass through resolving slits and strike a collector 180° away from their starting point. The charges given up to the collector are amplified by an electrometer tube.
- Having now been translated into an electric signal, the results are amplified and fed to a bank of five galvanometers, each set for a different sensitivity.
- A tiny beam of light reflected from each galvanometer mirror is photographed on a moving roll of sensitive paper in the oscillograph.
- Thus, the complete mass spectrum is obtained, focusing the separated ion beams successively on the collector by varying the ion-accelerating voltage. As each beam sweeps across the collector, its intensity is recorded on the moving paper.

plants at peak operating efficiency requires considerable laboratory tests, through the use of a ratio flow controller which increases or decreases the combustion air as the feed rate increases or decreases.

Using the 21-610, concentrations of hydrogen sulphide and sulphur dioxide were monitored in the tail gas for a period of nine weeks. Completely automatic operation of the instrument was

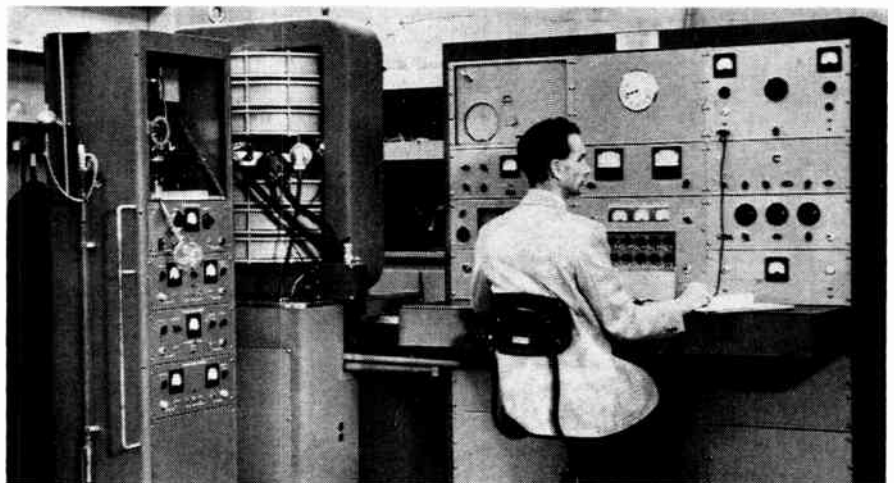
provided by the accessory automatic peak selector, a device which may be used to record up to six components on a repetitive cycle.

During two 12-hour periods the air ratio of the plant was controlled on the basis of the analysis shown by the 21-610. When the ratio was off from the ideal 2 to 1 enough to justify a change, the plant operator was in-

(Turn to page 52)



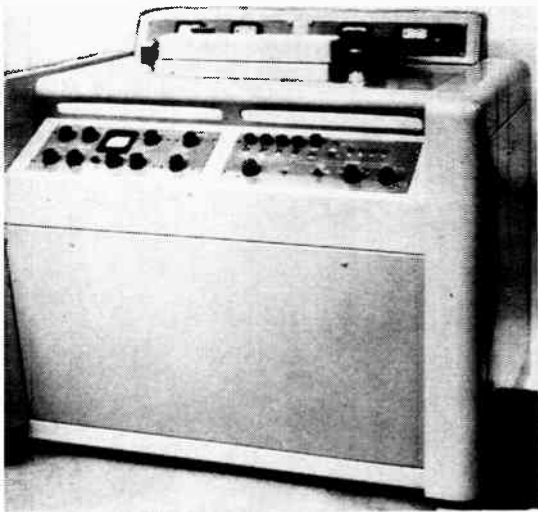
● Left: The Consolidated Type 21-610 "Process Monitor" Mass Spectrometer with side panels removed to show unit construction. All electronics circuits are contained in the "electronics drawer" in upper left of cabinet. The combination recorder-and-inlet-system housing on top of cabinet is an accessory. Right: Consolidated Electro-dynamics' Analytical Mass Spectrometer, showing (l. to r.) inlet cabinet with micromanometer, the magnet and its pedestal, and control console. The recording oscillograph is in the upper left hand corner of the console.



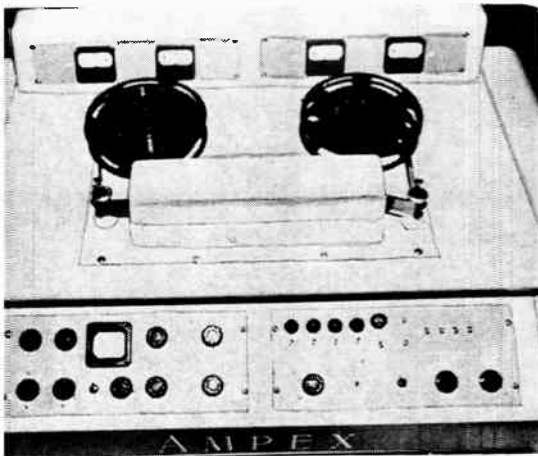
TV-On-Tape

TV-On-Tape

TV-On-Tape



● A revolutionary concept in the recording of television programs is embodied in the video magnetic tape recorder shown above.



● A top view of the recently developed magnetic tape recorder for television programs. The unit will record both pictures and sound for a full hour's program on a reel of magnetic tape two inches wide and 14 inches in diameter.



● Senior project engineer and Phillip L. Gundy, manager of the audio division, inspect the magnetic head assembly of the new television tape recorder.

New Equipment Makes Possible The Direct Recording Of Programs From A TV Camera From A TV Receiver From TV Transmission Lines Or From Microwave Relay Systems

A REVOLUTIONARY new process for the recording and reproduction of television programs on tape was recently announced to the public by Ampex Corporation officials, designers and builders of the unit. Known as the VTR (video tape recorder) the equipment will operate at only 15 inches per second providing for a full hour television program which can be recorded and reproduced on fourteen-inch reels of two-inch magnetic tape.

The new system records both picture and sound and picture quality is claimed to be considerably better than that obtained with current kinescope techniques using photographic film. The "gray scale" — the ability to reproduce accurately all shades from black to white, is inherent in this new video magnetic tape recording system. On the other hand, the gradient from black to white is not uniform in photographic film.

Resolution — the measure of the clarity of the picture — is far beyond the capability of the average television receiver. Thus, when a tape recorded program is telecast, the limitation of picture quality will be in the home receiver rather than in the quality of transmission.

Perhaps even more important than the reproduction of recorded programs with "live" telecast quality are the operational and economic advantages the Video Tape Recorder offers the television industry. Programs can be recorded directly from the TV camera, from a TV receiver, from television transmission lines or from microwave relay systems. Just as with the company's audio tape recorders, the program can be immediately replayed with no processing of any kind necessary. Considerable economy can be effected by erasing the recorded signal when it is no longer needed and re-using the tape to record another program. This is in contrast to photographic film which cannot be re-used after it has once been exposed.

Picture Reproduction

To reproduce the picture, the tape is passed across the same magnetic head. The magnetic pattern on the tape

induces a current in the coil around the head. Since the pattern corresponds to the original picture, the induced current can be fed to a television transmitter just as though it were coming directly from the TV camera.

To obtain the resolution of 320 lines, the Video Tape Recorder must record frequencies as high as 4 megacycles (4,000,000 cycles per second). Sound magnetic tape recorders need only record frequencies as high as 15,000 cycles per second. Present day magnetic recording techniques demand that, to increase frequency response, the tape must be moved past the head at higher rates of speed. To obtain a frequency response of 15,000 cycles per second, Ampex audio tape recorders use a tape speed as low as 7½ inches per second. By direct ratio, to obtain the 4-megacycle response needed for video recording, tape speed would have to be 2,000 inches per second. At that rate, a reel of magnetic tape 14 inches in diameter would record only 29 seconds of program material.

Design engineers for the new system have developed a method which permits a tape speed of only 15 inches per second, permitting more than a full hour's program to be recorded on a single 14-inch reel of tape. To achieve this relatively low tape speed — a standard speed used in some recording — a magnetic head assembly which rotates at a high speed is used, giving an effective tape speed sufficient to record and reproduce the full 4-megacycle band width. Thus, while the tape moves slowly, the heads move across the surface of the tape at a very high speed. The head assembly actually consists of four heads placed on a rotating drum. One head is always in contact with the surface of the tape. As one head leaves the tape, the next head makes contact. The magnetic pattern is recorded transversely across the tape instead of longitudinally as in conventional audio recorders.

The sound that accompanies the picture is recorded in the ordinary manner along one edge of the magnetic tape.

50% Lighter...



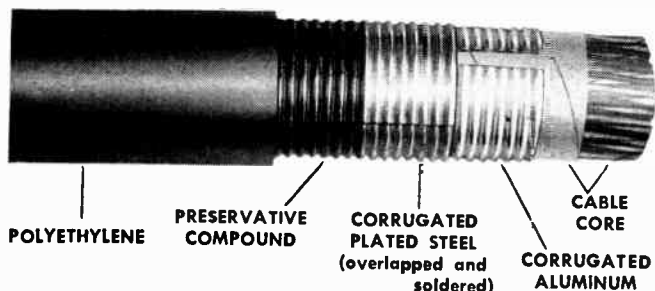
... and CORROSION PROOF



in the air — FEWER POLES & SPLICES, SMALLER MESSENGERS

in ducts — EASIER PULLING IN, FEWER MANHOLES & SPLICES

You can now save 50% in cable weight by using Northern Electric's corrosion-proof, Stalpeth-sheathed telephone cable for underground duct and aerial installations. Stalpeth sheath — a combination of steel, aluminum and polyethylene — is available as a replacement for lead on paper-insulated telephone cables having core diameters of from 0.88 inches to 2.65 inches.



Its amazing lightness and low coefficient of friction make Stalpeth sheathed cable much easier to handle and install. Its corrosion resistance makes factory-applied protective coverings unnecessary in even the most corrosive environments. And, in aerial installations, failure from fatigue-cracking is virtually eliminated.

These features combined with Stalpeth's flexibility, electrical conductivity and resistance to moisture, weathering and physical abuse ensure more econom-

ELECTRONICS & COMMUNICATIONS, MAY, 1956

ical installations, better service and longer life.

Millions of feet of Stalpeth sheathed telephone cable are now in use. Five years of field experience has fully confirmed its excellent performance and many economies.

The following table gives a comparison of the weight of No. 26 gauge cables with the two types of sheath. A similar pattern of weight-savings is followed by cables of other gauges.

No. 26 GAUGE	WEIGHT OF CABLE (lbs./ft.)			
	303 pairs	808 pairs	1818 pairs	2727 pairs
STALPETH	0.8	1.9	4.1	5.8
LEAD	1.7	3.6	7.0	10.2

For more details of Stalpeth sheathed telephone cable, ask your Northern Electric Sales Office for "Product News No. 36". Full splicing details are also available upon request.

Northern Electric

COMPANY LIMITED

DISTRIBUTING HOUSES THROUGHOUT CANADA

For further data on advertised products use page 65,

Twenty-one building blocks constitutes necessary units for the remote control of — Automatic Alarm Systems—Long Distance Metering—Discreet Control Proportional Control — Transmission Systems.

Building Block Control Systems

A METHOD by which industry can select from a series of 21 standard "building block" components the best electronic control system to regulate push-button manufacturing operations from remote points is one of the most recent advances in the development of plant automation.

Developed after four years of research, this novel method is already in use in the oil industry, in petrochemical plants, and in municipal water pumping systems providing a "brain" and a "nervous system" to control vital production operations. A number of special features make the new method unique in industry and susceptible to broad industrial applications. The modular units are inexpensively mass-produced, are hooked up merely by plug-in units which can be expanded or regrouped by semi-specialist personnel, and utilize a single standard communications channel which can handle hundreds of control and supervisory functions even at distances up to hundreds of miles, at major economies.

Most conventional control systems for in-plant or outdoor monitoring

functions require a large number of communications channels to accommodate varied or multiple functions. Also, most present systems require substantial amounts of companies' engineering staff time to install and maintain custom fabricated units.

This recent innovation will have far-reaching significance because it is believed it punches through the limits of existing control systems and provides a whole new set of highly flexible control tools which will make it possible to extend automation much more broadly in industry.

A large percentage of industry's control applications can now be handled by the present units available in the assortment of 21 electronic building blocks. Merely by connecting the strategic components dictated by the specific applications, companies can secure control systems at costs from one-half to two-thirds less than the traditional concept of made-to-order systems.

Five standard control systems are now available utilizing the modular units: (1) automatic alarms; (2) remote metering; (3) discreet control; (4) proportional control; and (5) transmission systems. They are all complete, integrated systems with all needed components supplied; and installations can be made by any plant electrician. The systems will function over telegraph and carrier circuits and co-axial cable; and to span long distances or difficult terrain, radio and VHF, UHF, and micro-wave circuits can be used.

The system is presently in use remotely controlling and supervising widely separated unattended high-power pumping stations in municipal water works and they are immediately applicable to long-distance highly accurate control over petroleum and natural gas field pump lines, power generating stations, power transmission lines, chemical processing plants, and sewage systems. In addition they

are also applicable to steel mills, mining operations, process industries, and many other types of mass-production processes where control and supervision are required for complicated machinery.

By proper selection of the right pre-fabricated modular units, industries can build their own systems which are versatile enough to measure and transmit operational information to distant control centers on quantities of pressure, vacuum, speed, current, rate of flow, temperature, position, load, and count. The building block components, in properly integrated systems, will even report on the level of supplies of raw materials in a bin, vat, tank, or similar storage container.

Flexible Control Features

Control features of the varied systems, which can readily be assembled from the standard modular units, are sufficiently flexible to turn any type of manufacturing process on or off, regulate sequence in a factory operation, apply proportionate amounts of control, or supply step and selective controls to plant production lines.

To achieve the building block approach, Sparks Withington engineers undertook the mammoth task of analyzing and classifying the majority of machine and equipment control and supervisory requirements of present-day industry. Then they designed and engineered appropriate "packages" of individual control units, which, when added together, could provide whole systems of regulation for machines or processes.

Two main classes of systems may be provided using the modular units: completely automatic, and centrally controlled where a single operator can check the condition of a whole manufacturing process by glancing at an integrated control panel incorporating meters, indicator lights, or a variety of alarm signals.

They will control processes operated electrically, mechanically, pneumatically, or hydraulically; and they are sufficiently sensitive to regulate fractional horsepower motors as well as powerful enough to control 1,000 horsepower units or more.

The miniaturized building blocks used to make up the systems take up approximately one-half to two-thirds less space than has been required in the past for control networks.

All adjustments and calibrations are built into the building block units. Routine maintenance checks are required no more than three times a year and can be carried out by plant electricians merely using a test meter and logging readings which are compared to fixed performance standards.

Maintenance of the modular units is on a calendar basis with standard units simply unplugged and spares plugged in until the original unit is serviced and reinserted into the system. Recommended replacement time cycles are after 10,000 hours of service, or 415 days of use.

● Shown at the left are the twenty-one modular units with which a pushbutton control system can be developed for a variety of industries.

THE LATEST NEWS IN PRINTED CIRCUITS

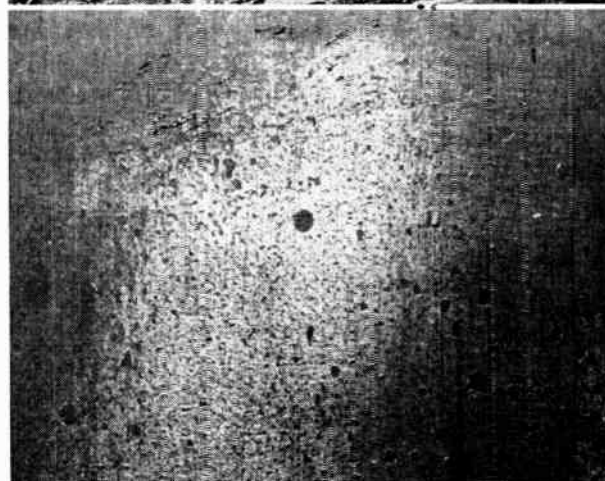
New HP Series Copper Clad Laminates Give Double Bond Strength—Assure Perfect Circuits In Less Dip Solder Time

Bond strength—12 to 15 pounds! Dip solder temperature resistance—30 seconds at 500°F.! These unique features of National's new HP Series of copper clad laminates may well revolutionize printed circuits.

Base of these laminates is National's PHENOLITE® laminated plastic—most widely used material for printed circuits. To this we apply a new surface conditioning process and a super-strong bonding adhesive. Result; faster processing and fewer rejects—better printed circuits than any made by other methods.

In production, HP Series laminates speed dip soldering and provide cleaner joints. In service, they minimize bridging in the printed circuit. The high heat resistant bonding adhesive also assures unusual retention of bond strength—even after repeated heating and cooling, which occurs in electronic circuits when current is turned on and off.

Manufacturers using automatic assembly machinery will find HP series clad laminates especially useful. The new process uniformly conditions the bonding surface of both electrolytic and rolled copper foil. And the speed-up in soldering, *without* sacrificing perfect connections, permits production line assembly of printed circuits—particularly when cold punching grades of PHENOLITE are used.



Unretouched photographs show effect of 5 seconds dip soldering at 500°F. on conventional copper clad laminate and 30 seconds at 500°F. on the new HP Series laminates made by National Vulcanized Fibre. Note severe blistering of conventional laminate (top) and the virtually unmarred surface of National's HP Copper Clad (bottom).



WRITE FOR NEW HP SERIES EDITION—PRINTED CIRCUIT CATALOG. Etchers and users of printed circuits will find the key to better production, reduced costs and improved products in our new HP Series manual "Mechanize Your Wiring." Write for free copy to Dept. O-5.



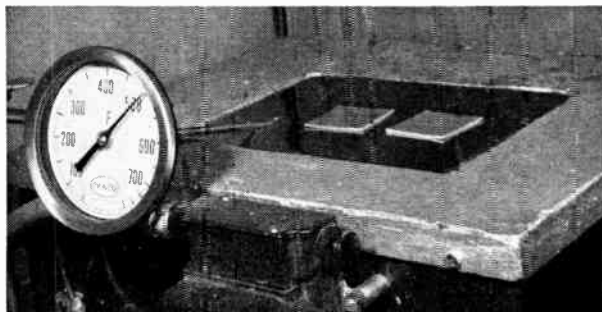
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FIBRE COMPANY OF CANADA, LTD.

ATLANTIC & HANNA AVENUES, TORONTO

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VULCANIZED FIBRE • PHENOLITE LAMINATED PLASTIC • PEERLESS INSULATION
KENNETT MATERIALS HANDLING RECEPTACLES • VUL-COT WASTEBASKETS
LESTERSHIRE TEXTILE BOBBINS • VULCOT PRODUCTS FOR THE HOME



At 500°F., 5 seconds in a dip solder bath is enough to ruin ordinary printed circuit laminates. Bonds lose their strength. Cladding develops blisters. Production becomes impossible. But *not* with new National HP Series Copper Clads. These take the punishing temperature for up to 30 seconds—without damage.



Accuracy And
Reliability In - - -

Transistorized Fuel Gage

THE first transistorized aircraft fuel gage to operate at 100 degrees C providing increased gaging accuracy and reliability at high temperatures for today's high performance aircraft is one of the latest instrument developments that will be of inestimable value to the aircraft industry.

The new gage, which uses silicon

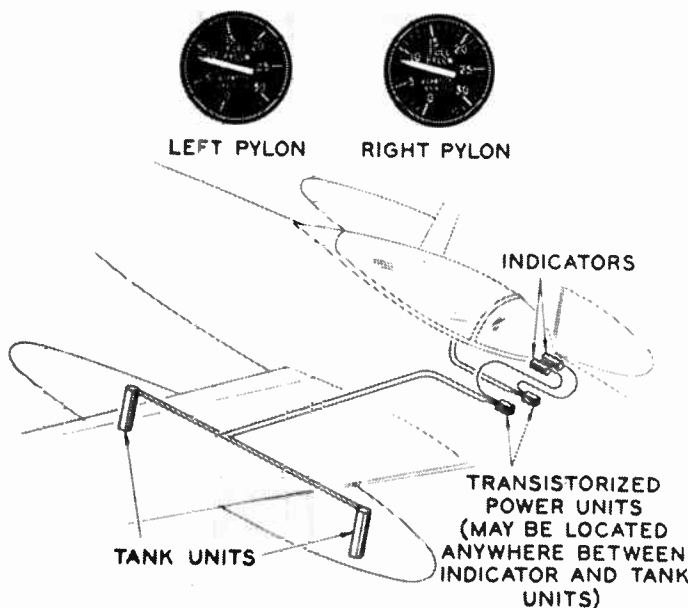
● Compact components of the auxiliary-tank gaging kit, fit easily into a man's hands. Shown are the power unit of Liquidometer's new silicon transistorized fuel gage and the indicator, which measures only 1½ in. in diameter.

transistors, is less than half the size of current vacuum tube models. It operates as an integral part of a capacitor-type measuring system.

Engineers have also designed a kit around a version of the transistorized gage to meet the fuel-measurement needs of the growing number of jet aircraft that carry auxiliary tanks to increase their range. The kit consists of an indicator (1½ inch in diameter), a silicon transistorized power unit and the required number of sensing units for each tank. It can be installed both on new aircraft and on those already in service. A special switch in the indicator moves the pointer back to zero if the auxiliary tanks are jettisoned with fuel still in them.

Elimination of vacuum tubes on the new gages — and of the tube replacement problem — means longer life and reduced maintenance. No shock mounting is required. According to designers the gage meets or surpasses the applicable sections of specifications MIL-G-7817 and 7818. Power is 115 volts, 400 cycles.

The silicon transistorized systems can also be supplied for control of center of gravity travel, repeater indicator applications, indicator totalizing systems and a wide range of fuel programming functions. The capacitor-type system uses a self-balance bridge network to measure tank unit capacitance. The bridge output operates a motor, which drives a rebalance element and the indicator pointer.



● Drop-Tank Kit employing Liquidometer's new silicon transistorized fuel gage is shown in this diagram installed on a jet aircraft. Side-by-side mounting of right and left tank indicators enables the pilot to tell at a glance whether both tanks are emptying at the same rate.

No-Hands Telephone System

*Tests So Far Carried Out
Between Places As Far
Apart As Rome, Paris,
London, And Madrid
Assure The Success Of
This New Technique In
Communications.*

TWO people thousands of miles apart can now have a telephone conversation without even picking up a receiver. This has been made possible by a loud-to-loud "no hands" telephone system.

The new instrument, which is designed principally for export, makes use of radar techniques to operate an electronic switching system. This, it is claimed, eliminates all the disadvantages suffered by similar installations in the past — from the clipping of speech to the monopoly of the channel by the instrument picking up the most background noise.

All that the person on the receiving end needs to do to switch the speech channel in his direction is momentarily to raise his voice. Any number of speakers can be connected up to participate in the conversation. The microphone will pick up speech when the speaker is up to 20 feet from the microphone.

Tests so far carried out between places as far apart as Rome and Paris and London and Madrid have been completely successful.

The system has been designed to serve either as a complete unit with its own cabinet, or in the form of an adaptor-plinth used in conjunction with an ordinary desk telephone.

When the user wishes to make a call, he depresses the line key which loops the line and causes the dialling tone to be heard on the loudspeaker. He can then use the dial fitted to the hand set.

Microphone, loudspeaker, volume control and adjustment lever are incorporated for local, long distance or international telephone calls. The volume control enables the user to adjust the output from the loudspeaker to suit his personal requirements or environmental conditions.

The flick of a switch restricts the conversation to the hand set in a confidential call. The main electronic sections are installed in a box which can be placed up to 100 feet from the set.

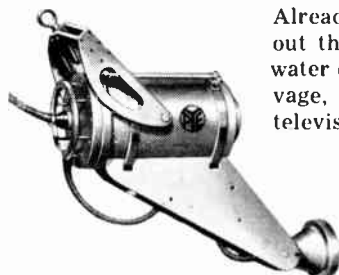
The new loud-to-loud system can be used in conjunction with any normal public telephone network instrument and it can also be installed in factories to provide a complete internal communications link-up. Only four valves have been incorporated and these are universally obtainable.

Down to the Sea

WITH MARINE EQUIPMENT

Pye Canada Limited world famous for radio communications and allied electronic systems has now gone "down to the sea" with a fine new range of thoroughly tested and proved Pye marine equipment.

PYE UNDER WATER TELEVISION



Already in use throughout the world for underwater exploration and salvage, Pye underwater television is available for deep sea work up to 3500 ft. or as a hand held model for depths to 350 ft.

THE PYE "FISH FINDER"

Years of research have produced the most accurate and sensitive echo sounding fish finder yet available. Detection and location, within a few feet, of the smallest school is accomplished with the adjustment of only a few simple controls. Sturdily constructed for years of trouble-free use. Vessels already equipped with Pye Fish Finders have shown record catches.



THE PYE "SEA LION"

85-watt Marine Radiotelephone. Meets D.O.T. specification 110 for compulsorily-fitted vessels. Nine crystal-controlled channels. Every component has been designed for rugged sea-going duty. Optional remote control is available at slight extra cost.



THE PYE "MARLIN"

20-watt Marine Radiotelephone. 5 crystal-controlled channels — for operation on ship-to-ship, ship-to-shore and distress frequencies plus a standard broadcast band for pleasure listening. Smartly designed, sturdy construction. Optional remote control available at slight extra cost.



THE PYE "LEADSMAN" DEPTH SOUNDER

Completely functional flashing light depth indicator. An inexpensive yet high quality instrument for all types of vessels.

direction finders, transailers and a complete line of marine antennas for every application

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Telephone Channels For - - -

Data Transmission

Although telephone channels are used primarily for the transmission of voice conversations, they can also be used to transmit a variety of other kinds of signals. These other signals are sometimes given the broad name "data".

This article discusses the meaning of data, various methods of transmitting data, and the conditions limiting the operation of voice telephone channels for data transmission.

Courtesy Lenkurt Demodulator

THE purpose of a communication system is to transmit intelligence from one place to another. The intelligence may originate in many different ways, but before transmission it must be converted into either of two forms — continuous or pulse-type electrical signals. A generalization is sometimes made in which all communication by means of electrical impulses is called *data transmission*.

The most familiar forms of data transmission are telegraph, signaling, remote control, and telemetering. More recently, different forms have been developed which include photo facsimile, high-speed telegraph, air warning data from radar installations, and numerical information for the operation of electronic business machines. In each case, alphabetical, numerical, or symbolic data must be transmitted.

The high-speed operation of these new systems has created a need for rapid transmission of large amounts of data with minimum error. As a result of this need, scientists and engineers have been taking a closer look at what constitutes *information* and how it can be transmitted most efficiently with presently available types of facilities.

Information

One of the first steps in determining the exact nature of information was the selection of a unit, or yardstick, by which information could be measured. This unit had to be such that it could easily be determined and did not depend upon the importance of the message, since a message's importance is difficult to evaluate mathematically.

It turned out that the simplest and most basic unit was the amount of information necessary for a receiver (person or machine) to make the correct choice between two equally possible messages. This choice may be between the messages yes-or-no, on-or-off, A-or-B, 0-or-1, black-or-white, etc. Since the two possible messages

correspond to the two symbols in the system of numbers called the binary digit system, a unit of information based on two symbols (messages) came to be called binary digit and was abbreviated *bit*.

A simple electrical pulse has the informational value of one bit because the presence or absence of the pulse

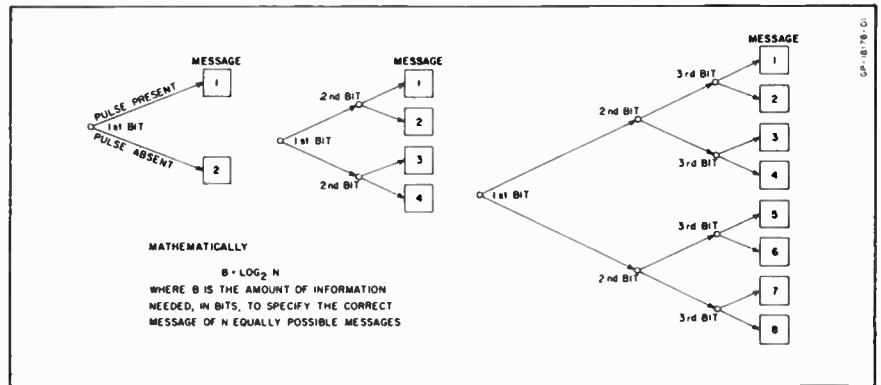
permits the receiver to choose the correct message from a set of two. As shown in Fig. 1, the transmission of two pulses permits the receiver to select the correct message from four equally possible messages. Three pulses, or bits, will enable the correct selection from a set of eight. This selection process gives the average amount of information which must be transmitted to specify a message from a set of equal possibilities. There is no method of transmitting information which uses less than this amount of information per message.

The letters of the alphabet are an example of a practical set of possible messages. The desired message might be any particular letter. If all the letters appeared equally as often, about five bits of information would be needed to select an individual letter. However, only about two bits per letter are needed because certain letters appear much more frequently than others.

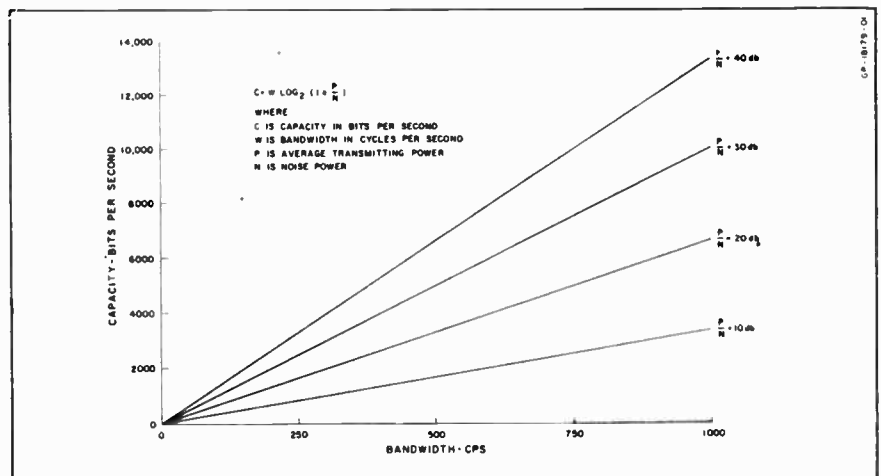
Channel Capacity

An important factor in evaluating the utility of a communication channel for data transmission is its maximum information carrying capacity. Using the bit as a measure of information, the maximum capacity of a com-

(Turn to page 32)



● FIG. 1. Information requirements for specifying a particular message.



● FIG. 2. The relationship between bandwidth, signal-to-noise ratio, and capacity.

OUTSTANDING DEVELOPMENTS IN TRANSISTORS!

POWER TRANSISTOR, Type 355

A germanium P-N-P alloy junction unit. Internal dissipation of 12W. Capacity up to (1.5 amperes). Power gain ranging up to 60 db. Max. collector voltage is 35V.

VHF SILICON TRANSISTORS, Types 925 and 926

Grown-diffused N-P-N tetrodes offering 15 db power gain at 12.5 megacycles and 14 db at 30 megacycles respectively. Rated dissipations are 125 mw. Maximum collector voltage is 30 volts.

VHF GERMANIUM TRANSISTOR, Type 501

Grown-diffused P-N-P tetrode giving 10 db power gain at 100 megacycles over a bandwidth of 10 megacycles. Maximum frequency of oscillation is greater than 250 megacycles, frequency cut-off 200 megacycles. Collector dissipation at 75 C is 25 mw. Maximum collector voltage is 15 volts.

SILICON RECTIFIERS, Types 1N543, 1N543A, 1N544, 1N544A

Each rectifier has a single grown junction. PIV's are 1500 volts with reverse currents of 100 microamperes. In the range -55 C to 100 C forward currents are 10, 35, 25 and 100 milliamperes respectively.

HIGH CONDUCTANCE SILICON DIODES, Type 660 Series

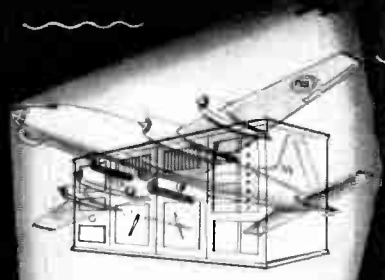
Single grown junction units encased in glass envelopes with coaxial leads. They offer a forward resistance of only 10 ohms (100 milliamperes at 1 volt), peak inverse voltage of 200 volts. The glass envelope is about $\frac{3}{8}$ " long.

VACUUM TUBE RECTIFIER REPLACEMENT, Type TI/680

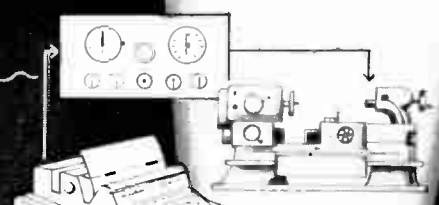
Plug-in device using standard 7-pin miniature base. Its two built-in grown junction rectifiers give the same performance as a 6X4 tube with smaller overall volume.

Engineers — You'll find major opportunities by joining our fast growing company. For full details, contact our personnel manager.

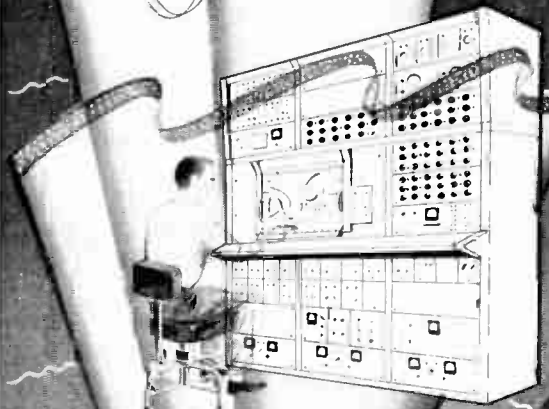
5607



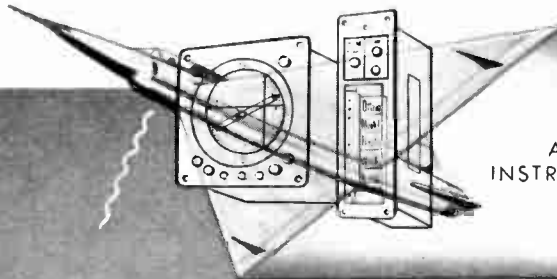
SIMULATION



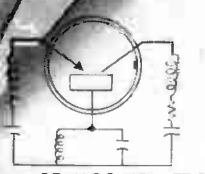
INDUSTRIAL AUTOMATION



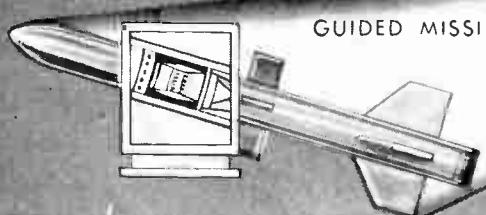
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COMPUTING DEVICES OF CANADA LIMITED

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World Radio History

DATA TRANSMISSION

(Continued from page 30)

munication channel can be determined from the channel bandwidth, signal power, and noise.

The relationship between bandwidth, signal power, and noise is complex and depends upon many factors such as the kind of noise present in the channel, the nature of the power limitation, the type of modulation used, and the method of encoding the information. The relationship for the particular case where the noise in a channel of limited bandwidth is assumed to be random noise (equal noise power across the frequency band) and the channel is operating at a particular signal-to-noise ratio is shown in Fig. 2.

This figure shows that increasing the bandwidth or the signal-to-noise ratio will increase the capacity of the channel. A wider bandwidth permits shorter pulses to be transmitted well enough to be detected. Consequently, more pulses can be sent in the same period of time, thereby increasing the capacity of the system. Increasing the signal-to-noise ratio permits easier detection of the pulses. This permits faster transmission and results in an increase in capacity.

Because of the inter-relationship of factors affecting channel capacity, it is possible to exchange bandwidth for signal-to-noise ratio and still maintain the same channel capacity. For a given system, the occupied bandwidth can be decreased provided that the signal-to-noise ratio is increased sufficiently, or vice versa. Roughly, the bandwidth can be decreased one-half if the signal-to-noise ratio in db is doubled.

Transmission Methods

The most common method of transmitting alphabetical and numerical data is by binary pulse transmission; that is, pulses which are either present or absent. Familiar examples of this method are Morse and machine telegraphy. The transmission of information by Morse telegraphy is accomplished by means of coded pulse groups utilizing both long and short pulses (Fig. 3a). The more frequent characters are given the shortest code groups. For example, one short pulse represents E while a short and a long pulse represents A. The use of different length pulses permits the transmission of an extra bit of information which shortens the code groups.

Machine telegraphy is a somewhat different type of data transmission. It utilizes a standard length code group in which there are five possible information carrying pulse positions (Fig. 3b). A pulse may or may not appear in any of these positions. The five bits of information contained in the code group would permit selection of only 32 characters if each character appeared equally as often. However, since certain characters appear very infrequently, the information necessary to transmit over 50 different

characters averages less than five bits per character.

Machine telegraph systems usually transmit information at a rate of 60 words per minute. This is achieved with a pulse rate of 30 pulses (bits) per second, plus the necessary synchronizing pulses, over a channel 120 cps wide.

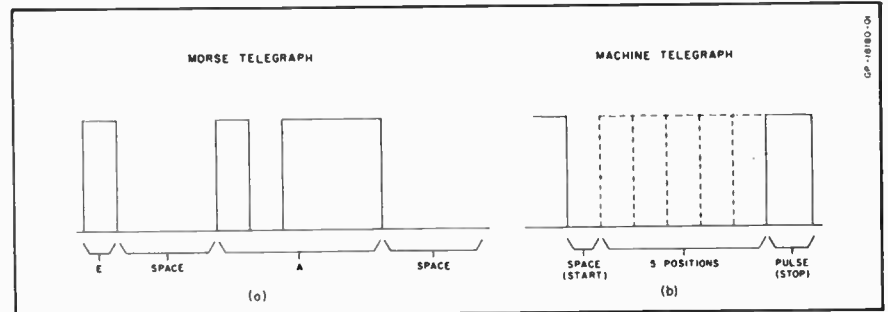
The transmission rate of a binary system, such as machine telegraphy, can be increased by transmitting more pulses per unit of time. Information theory shows that this can be most easily accomplished by increasing the bandwidth of the channel, enabling the transmission of shorter pulses at a faster rate.

Another method of transmitting information more rapidly is by causing each pulse to contain more informa-

formational capacity increases. For example, the correct message of a set of eight can be specified by a pulse which has eight possible steps. The pulse therefore contains three bits of information as compared to one bit when a single step pulse is transmitted.

Systems utilizing pulse modulation are relatively sensitive to noise because it obscures the transmitted amplitude of a pulse and also causes a slight variation in the precise location of the pulse. Therefore, as the number of modulation steps is increased, the signal-to-noise ratio must also be improved to enable the receiver to detect exactly the transmitted amplitude or position.

The limiting capacity of a channel can be approached most closely by using modulated pulses with a large



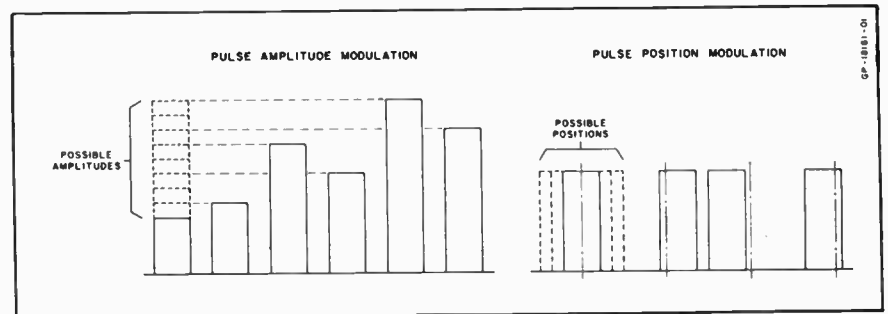
● FIG. 3. Pulse code systems for two types of telegraph.

tion. This permits the pulse repetition rate to remain constant, but more information is transmitted per pulse. The increase in the information carried by the pulse is accomplished by pulse modulation.

Pulse Modulation

The informational content of a pulse can be increased by modulating it with respect to amplitude or position. In

number of steps. Of course, as this is done the transmitters and receivers must become more complex to interpret the large amount of information contained in each pulse. Consequently, a point is reached where the maximum theoretical capacity of a channel is not yet reached, but where further increase of the information rate is impracticable.



● FIG. 4. Methods of increasing the informational content of a pulse by modulation.

pulse amplitude modulation, the distance between pulses remains constant, but the height of the pulse may be any one of a specified number of possible amplitudes. By modulating a pulse's position, its amplitude remains constant and its time of occurrence is varied over a range of discrete positions. These methods are shown in Fig. 4.

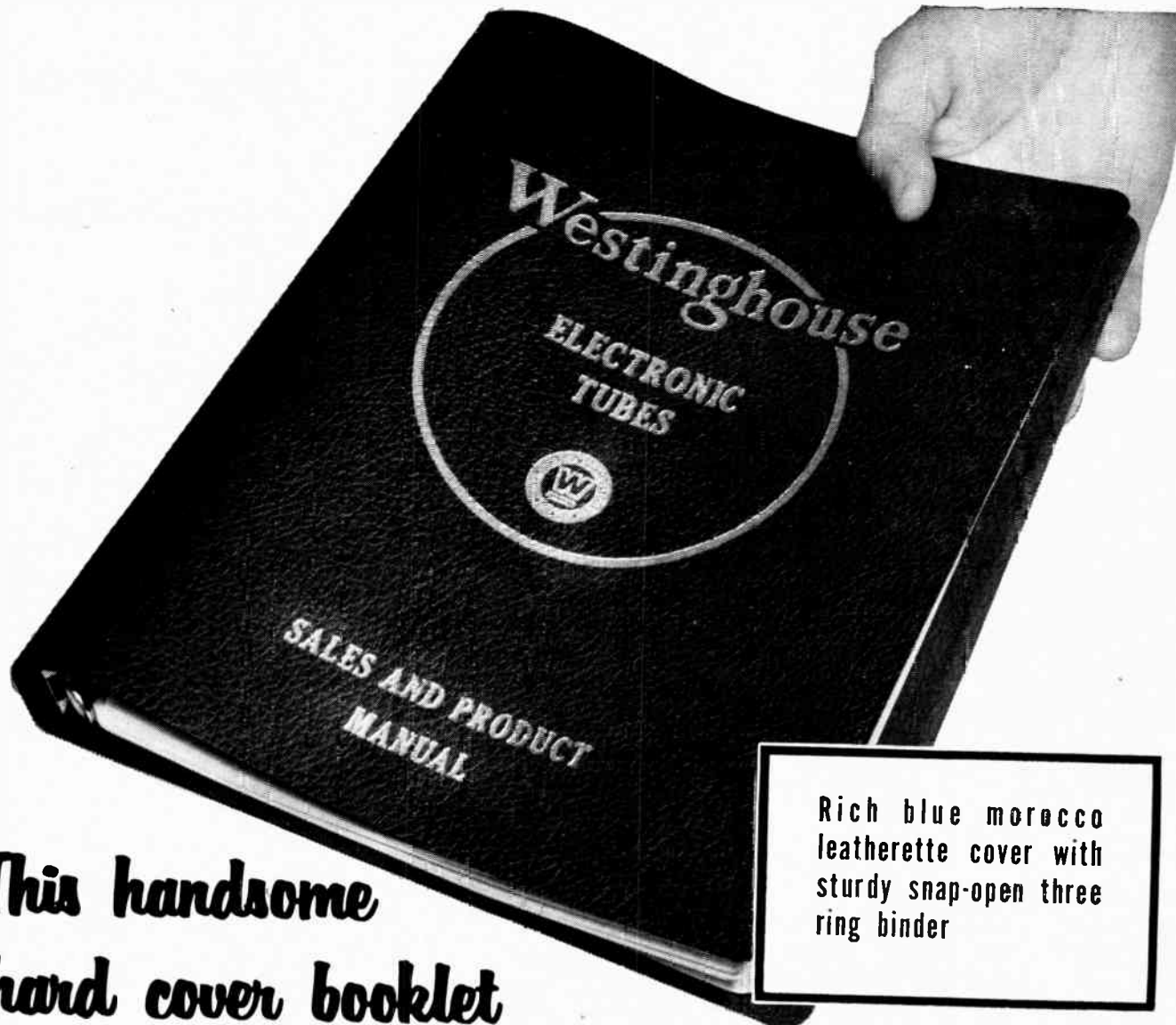
In either type of pulse modulation, each step of amplitude or position has a definite code value. As a pulse is permitted to occupy more steps, its in-

A Data Transmission System

A practical example of a high-speed data transmission system using telephone channels is the SAGE (Semi-Automatic Ground Environment) network. This network is being established to increase the speed of information processing and weapon direction in the national air defense system.

Data transmission for SAGE is basically similar to machine telegraphy; however, information must be transmitted at rates up to 1600 bits per

(Turn to page 53)



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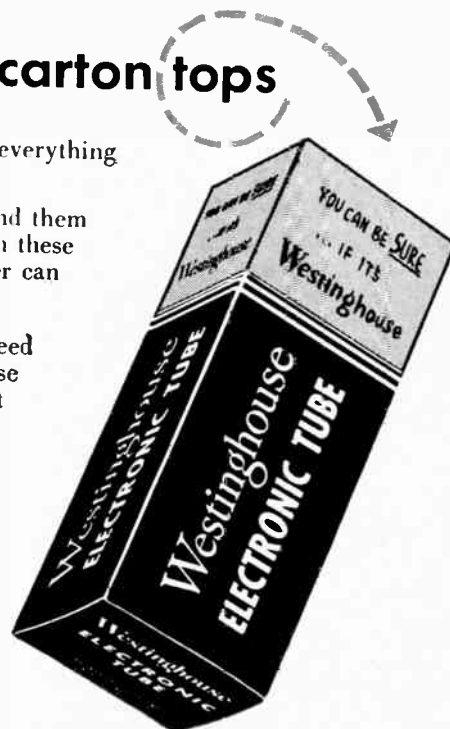
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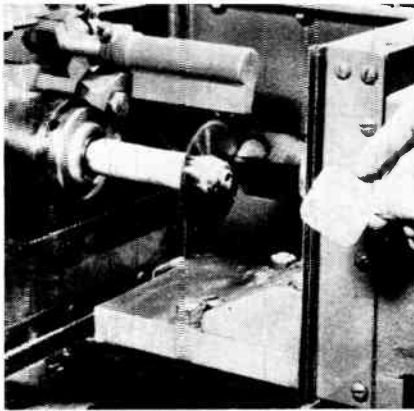
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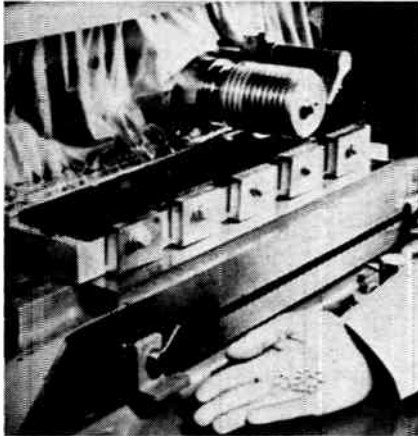




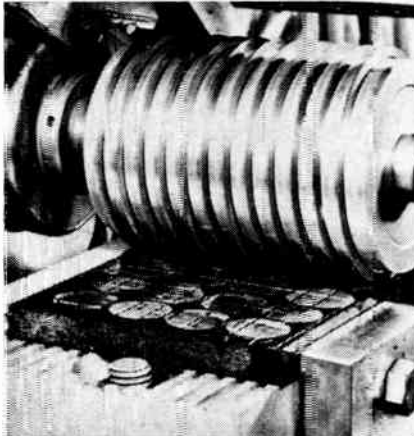
● Compound headstock permits aligning proper crystallographic plane to cutting plane of saw. Shown here is a germanium crystal cemented to headstock and aligned in proper plane.



● Close-up of Microtomatic work table with guards removed for visibility and slicing fixture in place. Work piece is rotated so that small diameter thin circular saws may slice more wafers.



● View of the machine arranged for the dicing operation on the germanium wafers.



● Close-up of dicing operation.

A Precision Slicing Machine known as the Microtomatic is one Company's answer to the problems confronting manufacturers of Transistors and other devices employing brittle Crystalline Semi-Conductors such as Germanium and Silicon used extensively in the Electronics Industry.

Slicing Technique Reduces Germanium Waste

THE transfer of transistors, those minute substitutes for vacuum tubes, from the laboratory to the production line, has posed some important problems. One is how to cut these critical materials into the tiny but dimensionally accurate pieces that form the working part of a transistor at the production rates required to meet a rocketing demand. Another problem is that of reducing waste in

cutting these extremely expensive materials; germanium, for example, sells at about \$400.00 per pound.

Raw germanium prior to cutting, is a crystal, generally in the form of an ingot four to five inches long and up to 1½ inches in diameter, though its shape is often more triangular or rectangular than cylindrical. For most transistors it must first be sliced into thin wafers .010 to .015 inches thick.

Where power transistors are the end product, the entire wafer may be used but more often it is cut or "diced" into squares as small as .050 inches on a side, after which it is lapped and etched to its final thickness.

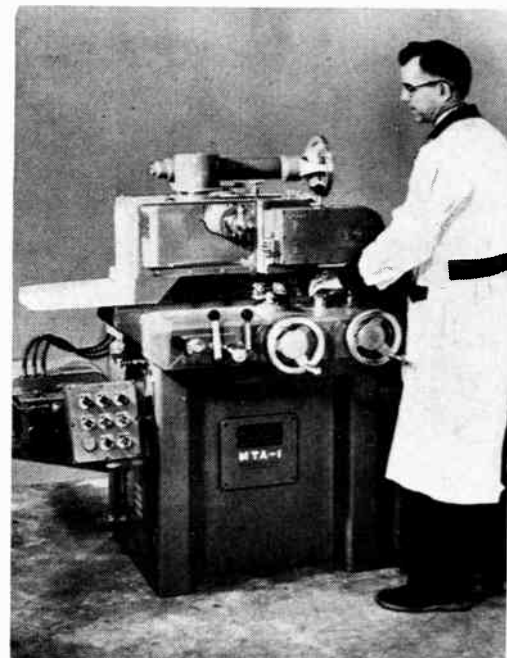
To achieve the desired electrical characteristics in the finished transistor, the crystal must be sliced relative to its crystallographic planes which are determined by X-ray examination. Because of this requirement slicing is not always done at exact right angles to the longitudinal axis of the crystal bar. As most commonly done up to now, the crystal is cemented to a work holding plate and set up on a work table in proper relation to the cutting plane of a circular diamond saw blade large enough in diameter to cut through the entire cross section of the crystal. For a 1½ inch diameter crystal bar, the thinnest practical circular diamond saw for this method, cuts a kerf (slot) .030 inches wide. Obviously, in producing .015 inch or .020 inch thick wafers, more of this expensive material is reduced to dust than to usable wafers.

Slicing With Microtomatic

The new Model MTA-1 Microtomatic precision slicing machine is an automatic, hydraulically actuated, circular sawing machine employing a thin circular diamond saw blade for slicing ingots. A 6 inch by 18 inch work table provides ample room for work holding fixtures. The table moves on hand-scraped ways feeding the germanium or silicon ingots into the cutting wheel at rates as low as one

(Turn to page 50)

● Microtomatic precision slicing machine, Model MTA-1, equipped with motorized slicing fixture. Operator is adjusting table feed which affords cutting stroke down to less than one inch per minute with quick return. Cross index adjustable from zero to .250" occurs at the return stroke.



SPECIALIZATION IN

Communication

The excellence now attainable in communication systems is a product of 20 years of electronic research at Collins. Collins engineering research, development, and manufacturing facilities are without equal. Staffs of communication experts assure the highest level of radio communication performance, which backs the Collins reputation. A Collins installation incorporates the most advanced techniques—Transhorizon "Scatter" Propagation, Microwave Relay, and Single Sideband HF Developments—all compatible with existing communication systems.

TRANSHORIZON

Multi-channel Transhorizon circuits offer highly reliable and economical long range communication over water, mountainous or sparsely populated terrain where construction of microwave facilities is impractical. Collins is the only company to have available now the entire "Scatter Propagation" line of basic equipment including transmitters, exciter modulators, frequency standards, RF filters and VHF and UHF antennas, together with multiplex and predicted wave signalling equipment. Complete system planning is tailored to meet the individual installation's requirements.

MICROWAVE

Collins Microwave Systems provide extremely reliable channels for long distance communication and remote control. Collins Mechanical Filters assure the most efficient channel usage, and permit reduction of the number of components to facilitate maintenance. Building block construction gives flexibility in future expansions as system requirements change.

HIGH FREQUENCY SSB

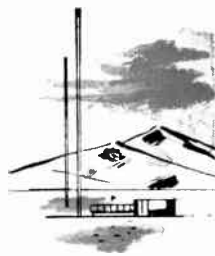
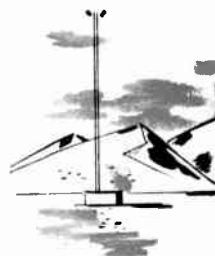
New single sideband transmissions solve many problems in HF communication. Concentrating RF power in the sidebands conserves spectrum space and reduces adjacent channel interference. Selective fading and interference problems of multipath transmissions are also minimized by SSB. Collins pioneering in SSB has produced the most advanced line in HF equipment.

When planning a radio communication system, consult Collins for assistance in all phases of the engineering. Technical literature is available for the over-all design and individual equipment.

CREATIVE LEADER IN COMMUNICATION

Collins

COLLINS RADIO COMPANY OF CANADA, LTD.,
11 Bermondsey Road, Toronto 16, Ontario



NEWS



RETMA Annual Meeting June 7 And 8

The 27th annual meeting of Radio-Electronics-Television Manufacturers Association of Canada will take place on Thursday and Friday, June 7 and 8, at the Chantecler Hotel, Ste-Adele-en-haut, P.Q.

Ste-Adele is approximately forty-five miles north of Montreal and is easily accessible from Montreal and from the city airport, where seven-passenger limousines are available for the journey to Ste-Adele.

Persons desiring accommodation at the Chantecler Hotel should write at once to the hotel and refer to the RETMA annual meeting.

John Inglis Co. Add S. M. Finlayson To Directorate

Mr. S. M. Finlayson has been elected a director of the John Inglis Co. Limited, and its associated company the English Electric Company of Canada Limited. Mr. Finlayson is President of the Canadian Marconi Company — Montreal and also President of the Montreal Board of Trade. The John Inglis Co., the English Electric



S. M. FINLAYSON

Company of Canada and the Canadian Marconi Company are all members of the English Electric Group.

Canadian Westinghouse Sets Up Student Training Program

The appointment of E. R. Bushfield as supervisor for the Canadian Westinghouse Company's graduate student training program has been announced by M. J. McAuliffe, manager, graduate training and placement. He will coordinate the company's new engineering training program and be responsible for supervision of all undergraduate personnel training at Westinghouse.

Mr. Bushfield joined the company in 1947 as a student engineer and was engaged in industrial products and switchgear engineering for several years. He is a graduate of the University of British Columbia and holds a Master of Commerce degree from the University of Toronto.

License Agreement Permits Exchange Of Patents

A license agreement for exchange of patents has been concluded between two companies who manufacture kindred products. The announcement of this arrangement was made by D. V. Tuttle, president of Tuttle Electric Products, Inc. of Kirkland, Illinois, and J. R. Longstaffe, president of Renfrew Electric and Refrigerator Company, Ltd. of Renfrew, Ontario, Canada.

This liaison is intended to bring into the United States the benefits of the Renfrew Electric's engineering and research resources and at the same time to extend to Canada the opportunity to benefit from the patents and methods developed by Tuttle Electric.

This license agreement includes the exclusive right for the manufacture and distribution of each company's products in their respective countries.

Diamond Division Of Cannon Electric Co. Is Formed

It has been announced that the Cannon Electric Company has completed the purchase of the facilities of the Diamond Manufacturing Corporation, of Wakefield, Mass., manufacturers of R. F. Co-axial and Pulse connectors and associated components.

IRE Toronto Section Elects Officers For 1956-1957

The annual general meeting of the Toronto Section, Institute of Radio Engineers, was held on April 9th, 1956.

The following officers were elected for the 1956-1957 season: Chairman: F. J. Heath, Canadian General Electric Company; Vice-Chairman: H. W. Jackson, Ryerson Institute of Technology; Secretary-Treasurer: H. F. Shoemaker, Radio College of Canada.

The meeting, which was the last regular session of the 1955-1956 season, was addressed by E. Farmer, Supervisor of Communications Systems, Engineering Group, Canadian Marconi Company, on the subject of directional broadcast antennas.

Mr. Farmer sketched briefly the history of broadcasting in Canada and dealt with the need for directional transmitting antennas in terms of service area and minimum interference with other stations.

Walter A. Cole Joins Computing Devices Of Canada

Walter A. Cole, P. Eng., has been appointed manager of central planning and organization for Computing Devices of Canada Limited. He will also act as an executive assistant to the president.

Mr. Cole was formerly manager of sales, eastern region, for the electronic equipment and tube department of Canadian General Electric Company Ltd. He has had extensive experience in the electrical field and is a member of the Association of Professional



W. A. COLE

Engineers of Ontario and a Senior Member of the Institute of Radio Engineers.

Glendon Company Takes Over New Lines

Announcement was recently made by The Glendon Company Ltd. of Toronto that they had concluded arrangements with several U.S. firms to handle their products. The companies The Glendon Company will represent are: Danbury-Knudsen, Inc., Industrial Products Company, The Fusite Corporation, Lundey Associates, and Frenchtown Porcelain Company.

Hunting Companies Mark Tenth Anniversary

The Hunting companies celebrated their tenth anniversary of operations in Canada and the official opening of the PSC Applied Research laboratories in Toronto on May 16th. These are the first privately-supported environmental test laboratories in Canada and their opening marked a stage in Canada's growth as an industrial power.

PSC Applied Research was originally set up in 1946 as an electronics department of the original company, The Photographic Survey Corporation, to develop instruments connected with aerial survey work. It now has developed many new significant devices for other purposes, such as the R-Theta Computer, the current holder of the McKee Trophy, Canada's premier aviation award.

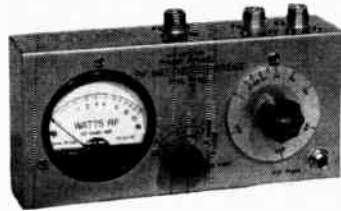
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- measures R-F — output
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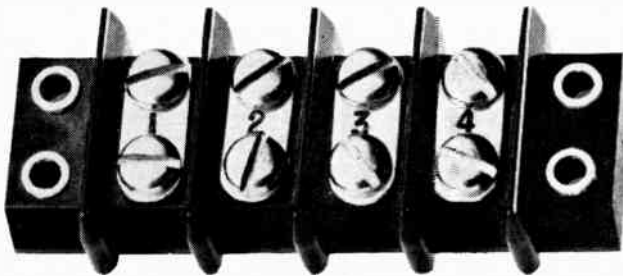
Price (f.o.b. Toronto) \$162.00 complete with R-F probe, attenuator, and three interconnecting cables.

The R-F Wattmeter-Bridge, Type 28A combines in a single small portable unit an R-F wattmeter, an R-F bridge and an R-F probe of high sensitivity.

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- Available MIL Spec. materials from stock.
- From 1 - 27 terminals.

CONSOLIDATED ELECTRONIC EQUIPMENT
Company Limited

1156 YONGE ST., TORONTO PHONE WA. 4-4812

Only HAMMOND gives you

A COMPLETE TRANSFORMER SERVICE!

For Radio, Electronic &
Industrial Applications

- ★ Over 1,000 different stock items listed.
- ★ Over 41,000 different special designs built.
- ★ Over 9,000 different fabricated metal types built!

When you have a requirement for transformers, ask for "Hammond" at leading jobbers coast-to-coast.

If the type of transformer you need is not listed in the Hammond catalogue, the factory will gladly build you a "special".

Your enquiries are invited for small or large quantities.

TRANSFORMERS • REACTORS • CABINETS
CHASSIS • RACKS • PANELS



Manufacturers of transformers FOR OVER 25 YEARS!

LYNCH

Unsurpassed



CARRIER SYSTEMS

In availability of complete, expandable carrier systems to meet the requirements of telephone, radio and power industries.



SHORT HAUL

LONG HAUL

SUBSCRIBER

POWER LINE

RADIO CHANNELING

TELEGRAPH AND DATA TRANSMISSION

OTHER EQUIPMENT

- B28 — 3-Channel, stackable, 3.5 to 35 kcs. Out-of-band signaling.
- B121 — 5-Channel, stackable, 3.5 to 62 kcs. In-band signaling.
- B37 — 5-Channel, stackable, 3.5 to 62 kcs. Out-of-band signaling.
- B60-J — 12-Channel, group modulated, 40 to 150 kcs.
- B120 — Single-sideband, subscriber loop service, stackable to 5-channels, 3.5 to 62 kcs. 10-party full selective ringing. Pole mounting facilities also available
- B60-PL — Provides toll quality telephone circuits on high voltage transmission lines, four channels each phase to ground. Coordinates with standard telephone plant. Ringdown or dial signaling.
- B37-R — 1 to 10 channels, single sideband, for party line, push to talk and breakout service.
- B60-R — 60 channels or more, stackable in groups of 12. First channel at 40 kcs, individual channels 4 kc spacing. Signaling for either dial or ringdown . . .
- B121-R — 27-Channels, in-band signaling, single sideband, 300 to 3,400 cycle frequency response. Auxiliaries for party-line operation.
- B49 — Carrier-shift telegraph, for teletype service. 82-Channels to 30 kcs. No common equipment between channels.
- B89 — Amplitude modulated telegraph for teletype service.
- B5 — Data transmission equipment
- Speech privacy equipment. (Scramblers and inverters).
- Emergency power supplies.

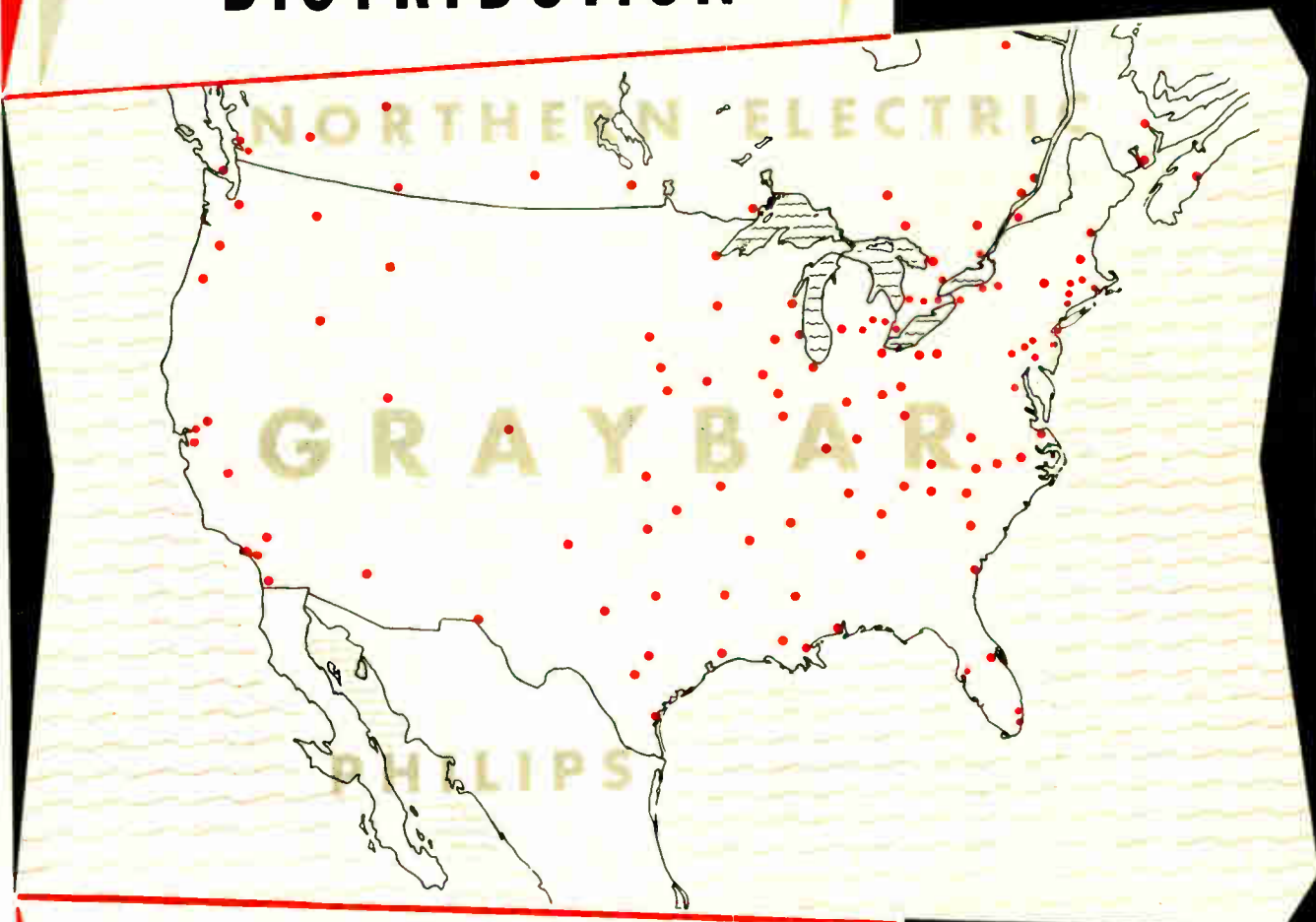
FILTERS: Line, band-pass, band-elimination, waystation, balances, longitudinal stop, repeat coils, equalizers, coupling networks.

LYNCH CARRIER SYSTEMS INC.
 695 BRYANT STREET, SAN FRANCISCO, CALIFORNIA

For further data on advertised products use page 65.

CONSULTATION SERVICE DISTRIBUTION

NORTHERN ELECTRIC
GRAYBAR
PHILIPS



Through their distributing organizations, Lynch makes available to you hundreds of highly skilled telephone experts. You are assured of the most competent assistance in advisory service, in systems planning and in rearrangements and expansions. There are no geographical limitations. Graybar, with dozens of branches, places experts at your immediate disposal regardless of your location. Northern Electric provides the same high order of expert personnel for the Canadian market. The services of both firms are augmented by Lynch field engineering personnel from factory-maintained offices in mid-west and west.

Philips Export Company, a division of North American Philips Company Inc., distributes Lynch carrier equipment internationally, provides the same telephone engineering competence, renders the same expert assistance.

LYNCH EQUIPMENT

to meet every carrier system requirement

LYNCH SERVICE

consultation and distribution facilities . . .

Unsurpassed



CANADIAN DISTRIBUTORS
Northern Electric
COMPANY LIMITED



PHILIPS EXPORT COMPANY
Division of
North American Philips Company, Inc.

NEWS (Continued from page 36)

Two Honeywell Divisions To Be Supervised By Company's Aero Division

Activities of the Ordnance and Doelcam Divisions of Minneapolis-Honeywell Regulator Co. Ltd. will be handled by the company's Aero Division, according to Carl A. Anderson, manager of the Aero Division.

"Taking over the responsibility for these divisions," Mr. Anderson said, "includes Canadian design and development of weapon systems and electro-mechanical instruments similar to those developed by the parent company but incorporating requirements which are specifically Canadian."

Mr. Anderson, who was named manager of the Canadian company's Aeronautical Division when it was formed last July, also said that, where applicable, the sale of products manufactured in the United States by the Ordnance and Doelcam divisions would also be an important function of the Aero Division.

General Instrument Corp. Announce New Merchandising Plans For K-Trans

The General Instrument Corporation of Newark, New Jersey, has recently announced its intention of taking over the manufacture, as well as the direct sale, of all K-Tran I. F. transformers in Canada through its regular Canadian sales department with headquarters at their Waterloo plant.

Manufacturing facilities at the Waterloo plant are in course of being doubled and should be ready in approximately three months.

While construction is proceeding and in order to insure continuity in the use of K-Trans, the company will ship from its American facilities at Newark, New Jersey, and from Beckley, West Virginia. During this interim, such shipments will be made f.o.b. the Canadian border point of entry. All orders will be processed through the Waterloo office.



● A new mobile public address system was presented to the Weston (Ontario) Police Department by the Weston Lions Club recently, supplied and installed by Canadian Marconi Company.

Harry DeWolfe, second from right, above, president of the Weston Lions Club, talks into the microphone of the new mobile public address system. Watching the demonstration, left to right, are Cliff Winder, chairman of the Lions/Traffic Safety Committee, Mayor Harry Clark, Mr. DeWolfe and Police Chief A. Webster.

Two New Divisions Formed By Canadian Westinghouse Company

The formation of two new company divisions, to be known as the Atomic Energy Division and the Defense Apparatus Division, has recently been announced by George L. Wilcox, president of Canadian Westinghouse Company Limited.

"The creation of an Atomic Energy division recognizes the future importance of atomic energy in the generation of electric power," said Mr. Wilcox. "The formation of a Defense Apparatus division brings together in one division all the engineering and related activities required by the company's growing participation in national defense."

Manager of the Atomic Energy Division is J. D. Houlding. L. C. Sentance is manager of the new Defense Apparatus Division.

The Atomic Energy Division will operate as a part of the company's Project Development Group, of which J. A. Campanaro is general manager; the Defense Apparatus Division will be a part of the Apparatus Products Group, of which J. W. Kerr is general manager.

Frank Apple Appointed Advertising Manager

W. S. Parsons, president of Centralab, a division of Globe Union Inc., Milwaukee, Wisconsin, announced the appointment of Frank Apple as advertising manager. Mr. Apple replaces Mr. Sutherland, who resigned February 3.

Mr. Apple comes to Centralab from Indiana where he has been associated in the graphic art field and industrial



FRANK APPLE

advertising for the past eleven years. Many in the electronic industry know him best for his past years at Potter & Brumfield Co., Inc. and P. R. Malory & Co., Inc., manufacturers of electrical relays and electronic

components respectively.

As advertising manager, Mr. Apple will be responsible for the presentation of Centralab's broad line of electronic components to both the original equipment and the distributor markets.

* ITEM OF THE MONTH . . .



Model AU-57 Amplifier
On CP-57 Panel

Extremely wide range response, low distortion.

Arranged for mixing four microphones or 3 Mic. & Phono (Magnetic or crystal).

Bass & Treble boost or cut controls.

Balanced output seven taps.

Accessories:

Remote Control
Plug-In Mic. Transformers
Carrying Case including
Speakers.
Panel Kit.

Available at

HACKBUSCH ELECTRONICS LTD.

Call or Write:—

23 Primrose Avenue

TORONTO, ONTARIO

LENNOX 1-2453

● STROMBERG-CARLSON PRODUCTS ● SYLVANIA ELECTRIC PRODUCTS (ELECTRONICS DIVISION) ● TECHNICAL APPLIANCE CORP. (TACO ANTENNAS) ● CALEDONIA ELECTRONICS AND TRANSFORMER CORP. ●

Raytheon Awarded Radar Contract

A contract totalling more than \$5,000,000 to develop and manufacture radar installations for 15 major airports across Canada has been awarded by the Canadian Government to Raytheon Manufacturing Company of Waltham, Massachusetts.

The radar network will be a major factor in the Federal Department of Transport's comprehensive program of trans-continental airport development and air traffic control, specifically aimed at equipping Canada's airways for the jet age.

A major portion of the development and production of the radar installations will be carried out in Canada under a subcontract to Raytheon Canada Limited, Kitchener, Ontario, a firm jointly owned by Dominion Electrohome Industries, Ltd., and Raytheon Manufacturing Company. Carl A. Pollock, president of Dominion Electrohome, and head of Canada's Radio-Electronics-Television Manufacturers Association, is president of Raytheon Canada Limited.

ELECTRIC CLUB PRESIDENT



I. M. MacLEAN

● Ian M. MacLean has been elected president of the Electric Club of Toronto for the 1956-57 term. Mr. MacLean has been continuously with the Canadian General Electric Company since 1919 and is now Manager-Market Development, Apparatus Department.

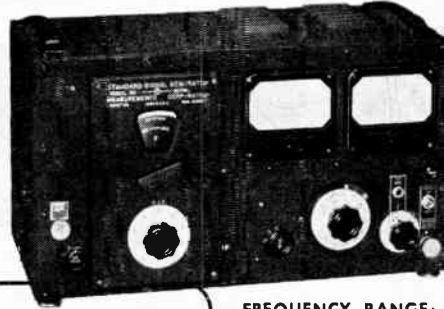
Photoswitch Products To Be Handled By Canadian Marconi Co.

An agreement has recently been signed between Canadian Marconi Company and the Electronics Corporation of America, Photoswitch Division, whereby the Commercial Products Division of the Marconi organization will be exclusive representatives in Canada for the latter's line of products.

(Turn to page 42)

EXTENDED FREQUENCY RANGE

with these STANDARD SIGNAL GENERATORS



MODEL 80
2 Mc to 400 Mc

MODEL 80-R
5 Mc to 475 Mc

SPECIFICATIONS

FREQUENCY RANGE: (Model 80) 2 to 400 Mc in 6 bands.
(Model 80-R) 5 to 475 Mc in 6 bands.

FREQUENCY ACCURACY: $\pm 0.5\%$

FREQUENCY DRIFT: Less than .1% after warm-up.

OUTPUT VOLTAGE: Continuously variable from 0.1 to 100,000 microvolts (-7 to -127 DBM).

OUTPUT ACCURACY: $\pm 10\%$ at 0.1 volt from 5 to 200 Mc.
 $\pm 15\%$ at 0.1 volt from 200 to 475 Mc.

MODULATION: AM is continuously variable from 0 to 30%.
Internal modulation, 400 and 1000 cycles.
External modulation, 50 to 10,000 cycles.

RESIDUAL FM: Less than 500 cps at 450 Mc for Model 80-R, and correspondingly lower for both models at lower frequencies.

POWER SUPPLY: 117v, 50-60 cycles, 70 watts.

FEATURES

- Direct-Reading scales and dials; individually calibrated.
- Convenient microvolt and DBM output scales.
- Accurate indication of output voltages at all levels.
- Low residual FM due to hum and noise.
- Provision for external pulse modulation.

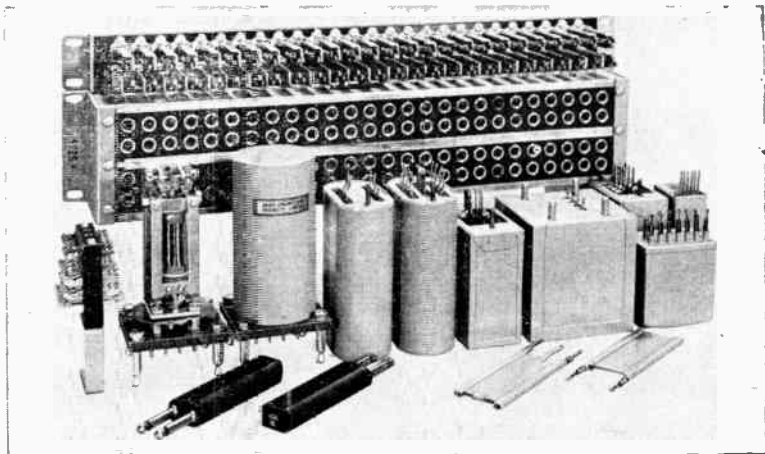
Laboratory Standards



MEASUREMENTS CORPORATION
BOONTON · NEW JERSEY

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

COMPONENTS FOR COMMUNICATION SYSTEMS



Radio Engineering Products produces a wide range of standard components for use in communication systems. In most cases these components can be delivered from stock.

FILTERS: Filters of advanced design are available for carrier telegraph, carrier telephone, and telemetering systems. These include channel filters, low-pass filters, and line filters.

JACKS and MOUNTINGS: Two standard $1\frac{3}{4}$ " by 19" jack mountings are available. Type F6097A mounts 52 single jacks, and type F6097B 26 single jacks. Type F8410 jack is a double jack with parallel break contacts, interchangeable with type 410A.

REPEATING and RETARDATION COILS: A large number of standard types are carried in stock. These include voice-frequency and carrier-frequency line coils, hybrid coils, and retard coils for telephone and telegraph applications.

RADIO ENGINEERING PRODUCTS

1080 UNIVERSITY ST., MONTREAL 3, CANADA

TELEPHONE
UNiversity 6-6887

CABLES
RADENPRO, MONTREAL

ECLIPSE-PIONEER SYNCHROS



FOR SERVO MECHANISMS AND COMPUTING DEVICES

A complete line of high accuracy transmitters, receivers, resolvers, differential and linear synchros is available in sizes 10, 11, 15 and 22 — standard or corrosion resistant models.

Fast delivery on small quantities for your engineering prototypes.

AVIATION ELECTRIC
LIMITED

CANADIAN AFFILIATE OF BENDIX AVIATION CORPORATION

STARK

Canada's first manufacturer of PANEL, PORTABLE and SWITCHBOARD METERS



MODEL 605



MODEL 604

Available in Standard Sealed
or Ruggedized Styles.



MODEL 46-250
250 Degree



MODEL 804
Standard Panel Type

STARK ELECTRONIC INSTRUMENTS LTD.

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

NEWS

(Continued from page 41)

G. P. Adamson Named Defense Contracts Manager

The appointment of G. P. Adamson, as manager, Defense Contracts has been announced by D. D. McLean, sales manager of the Canadian Westinghouse Company's Electronics Division.



G. P. ADAMSON

He will be responsible for the marketing and contract administration of all defense electronics equipment. During the past five years Mr. Adamson was with the Canadian General Electric Radar product line and manager general sales. He is a graduate of the University of Toronto and has taken post-graduate study from McGill University and the University of Toronto.

He will be responsible for the marketing and contract administration of all defense electronics equipment.

During the past five years Mr. Adamson was with the Canadian General Electric

Ladies' Night Concludes Season For Toronto I.R.E.

The annual ladies' night festivities of the Toronto Section, Institute of Radio Engineers, brought the 1955-56 season to a close with a dinner, speeches and dancing at the Boulevard Club, Toronto, on April 30th.

Master of ceremonies for the evening was B de F. (Pat) Bayly.

A. P. H. Barclay terminated his year of office as chairman of the Toronto Section. He is succeeded by F. Heath, who will be chairman for the forthcoming season.

C. Pollock, representing RETMA, made a brief speech in which he said that engineers are beginning to gain a measure of recognition of their efforts to make the radio industry one of the foremost industries in Canada.

The guest speaker was Bruce Smith from the staff of CJBC. Mr. Smith spoke on the subject: Television, Menace or Must. Handled properly, Mr. Smith said, television can be one's servant rather than a monstrous master.

The evening concluded with dancing.

Sperry Produces First Canadian Naval Gyro Compass

Senior officers of the Royal Canadian Navy and Department of Defense Production officials recently inspected the first Canadian-built naval gyro compass at the Cote de Liesse plant of the Sperry Gyroscope Company of Canada Limited.

Built in Canada at the request of the Department of Defense Production and the Royal Canadian Navy, the Mark 23 gyro compass is superior in performance to its American predecessors as well as being lighter and smaller.

In producing this first Canadian naval gyro compass, members of the engineering staff of the Sperry Gyroscope Company of Canada had to overcome many difficult manufacturing

problems. To produce the "liquid level", which is the master sensing device, special glass blowing techniques were used. A dust-free room, with humidity, temperature and pressure controls, was constructed so the compass assembly could be done at the extreme precision required.

In order to test the complete compass system, the largest test equipment of its kind in Canada was built at Sperry's Montreal plant. This testing platform simulates the pitch, roll and yaw of a ship under extreme conditions. In addition special electronic testing equipment to measure minute signal difference was designed and built by Sperry engineers at the Cote de Liesse factory.

(Turn to page 44)



● Royal Canadian Navy officers and Department of Defense Production officials view the first Canadian built naval gyro compass at the Cote de Liesse plant of the Sperry Gyroscope Company of Canada Limited in Montreal. From left to right: Commodore W. H. G. Roger, electrical engineer in chief of the Royal Canadian Navy; S. I. Comach, assistant director of the electronics branch of the Department of Defense Production; Lieutenant-Commander J. M. Cutts, staff officer of the directorate of navigation and direction of the Royal Canadian Navy; Captain J. M. Doull, deputy electrical engineer in chief of the Royal Canadian Navy; and B. W. King, managing director of the Sperry Gyroscope Company of Canada Limited.



time on our hands

Here's a handful of microtime . . . doled out in hundredths of a millimicro-second. 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 $\pm 1\%$ " . . . 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?



Canadian Factory: No. 3 Six Points Rd., Toronto 18, Ont.
Sales Representative: R-O-R Associates, Ltd.
290 Lawrence Ave. West, Toronto 12, Ont.
a division of Beckman Instruments, Inc.

*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 507.*

NORTH RELAYS STEP-SWITCHES for DEPENDABILITY



More than 40 years' experience in manufacturing "Brains" to meet critical industrial or military specifications for:

- SWITCHING
- SUPERVISING & RECORDING
- COMMUNICATIONS
- REMOTE CONTROL
- MISSILE GUIDANCE
- OTHER AIRBORNE AUTOMATIC CONTROLS
- MANY OTHER "AUTOMATIONS"

Canadian Distributors for NORTH ELECTRIC CO.

ERICSSON

TELEPHONE SALES OF CANADA LIMITED

Industrial Division

130 Bates Road, Montreal 8, P.Q. REgent 1-6428

KESTER



Absolutely non-corrosive and non-conductive, KESTER "RESIN-FIVE" CORE SOLDER contains an activated type of resin that gives you that fast, positive action on all your jobs . . . including the most difficult.



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

SOLDER

NEWS

(Continued from page 42)

New Marconi Vice-President

John J. Kingan was appointed a vice-president of Canadian Marconi Company at a recent meeting of the Board of Directors.

In addition to his responsibilities as vice-president, Mr Kingan will continue as general manager of the company.

Mr. Kingan joined the service of the Canadian Marconi Company in



1920 as a sea-going radio officer and for many years was associated in increasingly important positions with the Company's marine and transoceanic services.

J. J. KINGAN

From 1939 to 1945 he served

with the Armed Forces; first as Lieutenant Colonel commanding a Signal Construction Unit, later transferring to the Royal Canadian Navy with the rank of Commander to direct naval electronic engineering design and construction. This appointment he held at the close of hostilities.

From 1946 to 1948 Mr. Kingan directed a substantial portion of the company's sales engineering work and in 1948 was pointed assistant to the general manager. In 1951 he became general manager of the company, which position he has held continuously.

CGE Introduce New Television Transmitter

The Canadian General Electric Company have announced the introduction of a new television broadcast transmitter, available in the last quarter of 1956, which will allow prospective VHF broadcasters to take advantage of low power television channel allocations.

According to Edgar J. Gareau, broadcast equipment specialist, this 400 watt television transmitter will provide the stepping stone that some stations require in order to bridge the gap in income which they face from the on-the-air date to the date that a sufficient audience is established in the area to provide the required advertising income.

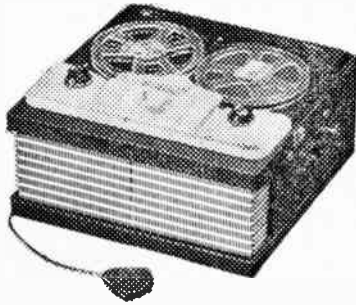
The transmitter has been designed so that it may be remotely controlled by the "Ultracon" remote control. When the new area justifies it, personnel can be increased and additions made to station facilities.

(Turn to page 46)

For further data on advertised products use page 65.

for OFFICE & INDUSTRY WEBCOR TAPE RECORDERS

- CONFERENCES
- LABORATORIES
- SALES MEETINGS
- RECORDS



For any application calling for a Tape Recorder a WEBCOR will handle the job more efficiently and with greater simplicity of operation. The tape recorder is proving useful for many different uses in industry and commerce. The WEBCOR is one machine with those extra features that meet every requirement. Write today for complete FREE information on the latest WEBCOR MODELS.

FREE! A booklet giving some of the many applications of a tape recorder in industry.

Wholesale Distributors

CANADIAN ELECTRICAL SUPPLY CO. Ltd.

MONTREAL
275 Craig St. W.
UN. 1-2411

OTTAWA
836 Somerset St. W.
8-5675

TORONTO
522 Yonge St.
WA. 1-5111

FOR PRECISION
LABORATORY OR PRODUCTION
TESTING



FREED

1110-AB INCREMENTAL INDUCTANCE BRIDGE

AND ACCESSORIES

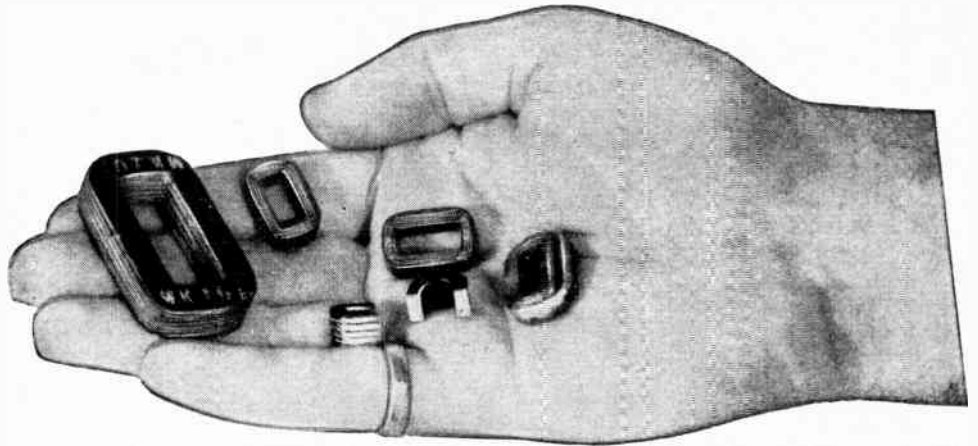
Accurate inductance measurement with or without superimposed D.C., for all types of iron core components.

- INDUCTANCE — 1 Millihenry to 1000 Henry
- FREQUENCY — 20 to 10,000 Cycles
- ACCURACY — 1% to 1000 Cycle, 2% to 10KC
- CONDUCTANCE — 1 Micromho to 1 MHO
- "Q" — 0.5 to 100
- SUPERIMPOSED D.C. — Up to 1 Ampere
- DIRECT READING — For use by unskilled operators.

ACCESSORIES AVAILABLE: 1140-A Null Detector, 1210-A Null Detector — V.T.V.M., 1170 D.C. Supply and 1180 A.C. Supply.

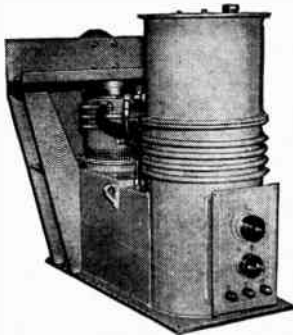
INSTRUMENT DIVISION

FREED TRANSFORMER CO., INC.
1716 Weirfield St., Brooklyn (Ridgewood) 27, N.Y.



YES...

No core too small—No transformer too large!



Illustrated above and reading counter-clockwise: HyperCores, Chokes, Power, Pulse, Filament, and Plate Transformers.

563

MOLONEY ELECTRIC COMPANY OF CANADA LIMITED

Factory and Head Office: 213-219 Sterling Road, Toronto 3, Ont., Regional Offices: Montreal, Calgary



● A precisely timed schedule of circuit cutover enabled the Canadian National Telegraphs to transfer its plant operations from 347 Bay St., Toronto, to its new national headquarters at 151 Front St. W. Seen at the testing and regulating panels are R. B. Steele, left, general superintendent, eastern line, and John R. White, general manager of the system.

Canadian National Telegraphs Open Modern Headquarters

A precisely timed schedule of circuit cutovers enabled the Canadian National Telegraphs to transfer its plant operations from 347 Bay Street to its new national headquarters at 151 Front Street West. Circuits controlling the coast to coast network of telegraph, teletype, telephone, radio and television systems were cut out at the old address and opened at the new without any break in service.

The new plant is designed for the

future and is equipped with the latest innovations in communication facilities. It can handle a fifty per cent increase over its present traffic load.

Nerve center for the entire operation is the testing and regulating room where all circuits are tested and regulated at set intervals round the clock. The room's array of panels control all communication facilities into and out of Toronto. These include commercial telegraph channels, private wire circuits for business firms, weathermap facsimile transmission, and communication facilities for CNR and TCA.

Honors And Distinctions Announced By National Research Council

The following announcements by the National Research Council of Canada are of interest.

Dr. John T. Henderson, M.B.E., head, electricity and mechanics group, Division of Applied Physics, has been appointed to the Executive Committee of the Institute of Radio Engineers. Dr. Henderson, who is currently chairman of a Canadian commission on international radio measurements and standards, is the only Canadian serving on the executive of this 48,000-member organization.

Dr. A. E. Covington, microwave section, Division of Radio and Electrical Engineering, has been named president of the Astronomical Society of Ottawa, a local branch of the Royal Astronomical Society of Canada. The group was formed under Dr. Covington's guidance.

Electromechanical Products To Be Canadian Rep

Electromechanical Products of Markham Road, Agincourt, Ontario, has been appointed Canadian Representative for Advanced Electronics Manufacturing Corporation of Los Angeles, California.



with TMC CARPENTER POLARIZED RELAYS

They are used in submerged telephone cable repeaters — in stratosphere aircraft — in many varieties of telecommunication and scientific equipment — in metallurgical heat treatment recorders — in biological research — even in swimming bath temperature controllers. It can help you to perfect your project.

With its high sensitivity, the Carpenter Polarized Relay can replace complex amplifying equipment — its almost perfect contact performances enables it to convert minute d.c. signals into a.c. and so simplify electronic amplification — it will operate direct from valves — it will repeat signal impulses with great accuracy as is required in telegraphy, tele-metering, protection and tele-control schemes.



Four generic types are available, each in several versions, with a wide range of standard windings. Illustrated is the Type 5; dimensions, Height 2.5 in., Width 1.6 in., Depth 0.8 in., Approx. Weight 4.8 oz.



New Directors For Canadian Admiral Corporation

Vincent Barreca, president of Canadian Admiral Corporation Ltd., announced the election of two new directors at the recently held annual meeting of the company.

Stuart D. Brownlee, who joined Canadian Admiral Corporation early in 1956 as executive vice-president, becomes a director of the corporation and its subsidiary companies, Canadian Admiral Sales Limited and Ensign Acceptance Corporation.

William Hummel, vice-president and treasurer, is the other newly elected director of the corporation and its two subsidiaries. Mr. Hummel has been with the company since its inception in 1946.

Data Processing Associates Report Half Million Dollar Sales Volume

George Glinski, president of Data Processing Associates Limited, Ottawa, has reported the sales volume of the company at over a half a million dollars over the period of one year.

In commenting on the growing use of electronic data processing systems in Canada, Mr. Glinski mentioned that several Canadian organizations have placed orders for large scale Datatron electronic data processing machines and a sizable volume of Mid-Century Instrumentatic electronic analog computers.

Marconi Equipment For Empress Of Britain

The new 26,000 ton Canadian Pacific liner *Empress of Britain* is equipped with communication facilities unsurpassed in any ship of her class.

The installation of radio equipment, designed to meet all requirements for transmission and reception on the marine medium, intermediate and high frequency telegraphy bands, provides for intermediate and high frequency telephony operation for passengers' messages and ship's traffic. The vessel's internal telephone system can be linked with the radiotelephony installation, and three telephone booths — one in the First Class and two in the Tourist Class accommodation — are installed. Speech inversion equipment ensures complete privacy of conversation.

The requirements of this service are met by two of the Marconi-Marine "Globespan" transmitters, two "Atlantia" receivers, and a telephone terminal assembly which includes a CR150/6 receiver and the speech inversion unit.

New CESCO Hi-Fi Studio

Canadian Electrical Supply Co., Ltd. have announced the opening of their new High-Fidelity Demonstration Studios in their Montreal branch.

The main Demonstration Studio has shelving to permit the display and demonstration of merchandise to the best advantage. By means of a simple push-button switching control, it is possible to hear recordings played through any combination of amplifier, speaker, or record changer, in turn. This system connects, at the touch of a button, any amplifier to any speaker, thus enabling the buyer to hear varying combinations and to select the components that he personally finds most desirable.

Town Meetings For Radio And TV Technicians

An outstanding program of technical papers, discussions and demonstrations is scheduled for the Town Meetings of the radio and television service technicians due to take place in the Maritimes in June. These Town Meetings, each an industry school at which lectures are given on the theory and practice of television servicing, have been held in past years in Vancouver, Edmonton, Calgary, Regina, Winnipeg, Toronto and Montreal.

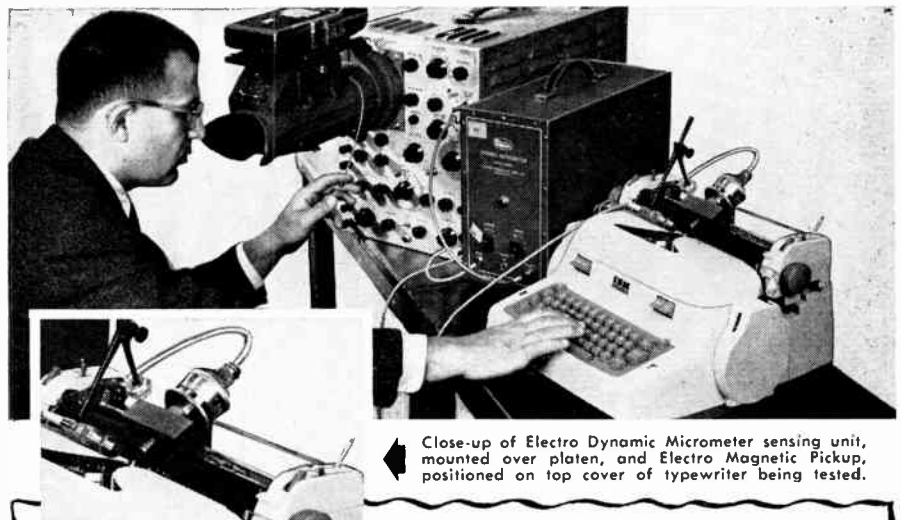
The Town Meetings are organized jointly by the Radio-Electronics-Television Manufacturers Association of Canada (RETMA of Canada) and the National Advisory Council of Town Meetings. The Town Meetings will be held in Halifax, N.S. on June 19th, 20th, and 21st and in Saint John, N.B. on June 26th, 27th and 28th.

ASL Wins Blue Ribbon Mining Award

Aeromagnetic Surveys Limited, of Toronto, Canada, have been selected to receive a 1956 "Blue Ribbon Mining Award" by a panel of American mining, metallurgical and contracting experts. The award was made for "a significant contribution to the technological advancement of mining in the form of a new product", the company's own developed airborne electromagnetic survey device.

The largest airborne geophysical service in the world, Aeromagnetic Surveys has achieved phenomenal results with its electromagnetometer since it was introduced over a year ago. The company is also now operating a newly-developed helicopter borne electromagnetometer for use in precipitous terrain. So successful has ASL's electromagnetometer been that it was recently introduced to the United States, Europe and Africa.

(Turn to page 48)



Close-up of Electro Dynamic Micrometer sensing unit, mounted over platen, and Electro Magnetic Pickup, positioned on top cover of typewriter being tested.

Electro Dynamic Micrometer helps IBM perfect transcript of new typewriters

The Dynamic Micrometer accurately measures dynamic and static displacement, vibration, and movement of metal bodies. IBM used it on their electric typewriter to determine the exact penetration of the type face into the platen. Correlation of this reading with a measurement of the speed of the type bars obtained through another Electro instrument, the Magnetic Pickup, contributed substantially to superior type-script appearance and legibility for the new IBM Typewriters.



125-55

Can the Dynamic Micrometer help improve your product? Write for details!

ATLAS RADIO CORP LTD.

50 Wingold Avenue, Toronto 10, Ontario



● At official opening, April 27th, of Lenkurt of Canada plant, left to right: C. G. Pritchard, branch manager, Bank of Montreal; L. G. Erickson, president of Lenkurt; James Eckman, chairman of Greater Vancouver Metropolitan Industrial Development Commission; George Koth, production manager of Lenkurt and William H. Heflin, vice-president and general manager, Lenkurt of Canada.

Lenkurt Opens New West Coast Plant

Some 50 telephone executives and Vancouver area civic officials and business leaders were guests of Lenkurt Electric Co. of Canada Ltd. on April 27th when the carrier and microwave manufacturing firm officially opened its new factory and office building in Burnaby, British Columbia.

At a luncheon gathering which preceded a tour of the plant, James Eckman, chairman of the Greater

Vancouver Metropolitan Industrial Development Commission hailed the firm's expansion.

He said Lenkurt will be a major supplier of communications equipment as requirements grow with the certain expansion of primary industry in B.C.

In thanking Mr. Eckman, William H. Heflin, general manager of the company, said the move to the new plant was only the first step in Lenkurt's expansion. He gave a brief outline of the firm's history in Canada, starting with the sale of one carrier system in 1947 and going on to the establishment

of an assembly plant two years later in a leased building.

Steady sales progress in succeeding years resulted in the decision to plan a new home for Lenkurt of Canada.

L. G. Erickson, president of the firm, noted that sales in Canada this year will exceed \$3,000,000.

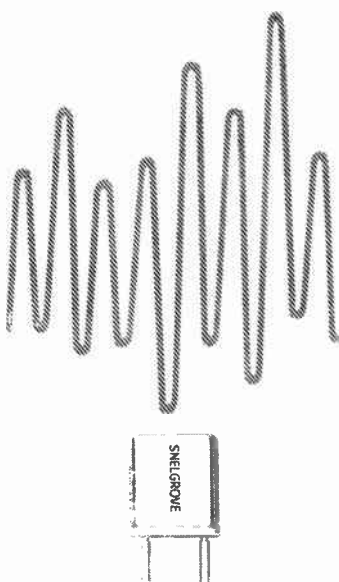
"Although I have no crystal ball," Mr. Erickson said, "further growth is assured because scientists in Canada and the United States are creating a steady flow of new inventions, thereby providing Lenkurt with a challenge to keep pace with developments."

A. C. Simmonds And Sons Ltd. Enlarge Plant Facilities

A. C. Simmonds and Sons Limited report that the growth of the electronic parts and components business has compelled them to add 4500 square feet to their premises at 100 Merton Street, Toronto.

This company moved from King Street East to Merton Street on April 3rd 1950, and, on the sixth anniversary of the opening of their existing premises, the ceremony of turning the first sod for the additional building was performed by Mrs. A. C. Simmonds, wife of the president and a director of the company.

The additional premises to be erected will be used for office purposes, and the present plant will then become the company's warehouse.



99% IS NOT ENOUGH



QUARTZ CRYSTALS
(PRECISION LOWDRIFT)
ALL TYPES AND FREQUENCIES

You can't afford even a single failure. That's why Snelgrove craftsmen seal maximum safety into every crystal . . . make it resistant to wide temperature changes . . . prevent field failures by exacting pre-tests . . . reduce crystal ageing to the absolute minimum. Insist on these *extra* Snelgrove precautions, at no extra cost. Make sure of full 100% Snelgrove value and dependability. It pays — and pays again time after time.

C. R. Snelgrove Co. Limited
NEW ADDRESS: BOND AVE., DON MILLS
Mail Address: P.O. Box 10 — Stn. R, Toronto

Sorensen Announces European Merger

Albert H. Blanc, president of Sorensen & Co., Inc., Stamford, Conn., manufacturers of precision voltage regulators and other electrical and electronic equipment, has announced the merger in Switzerland of the company's European subsidiary, Sorensen Ltd. of Zurich, with Applied Research and Development Ltd., also of Zurich. The newly-formed firm will be known as Sorensen-Applied Research and Development Ltd.

Mr Blanc stated that the merger, approved by stockholders at a recent meeting in Zurich, provides Sorensen with a well organized sales force in Europe as well as additional technical personnel.

New Electronics Firm For Waterloo, Ontario

Operating under the name of Waterloo Electronics Supply Company Limited, Messrs. M. E. Bodman and Gord Russel have established business at 7 Dupont Street in Waterloo. The new firm will handle tubes, components, accessories and equipment for the electronics industry, the radio and TV serviceman and amateur radio operators.

Prior to entering the new business Mr. Russel was on the engineering staff of Dominion Electrohome Industries of Kitchener and on the electronic maintenance staff of the Good-year Tire and Rubber Company, New Toronto.

Mr. Bodman has been associated with the electronic jobbing business since 1945 having been employed with the Toronto branch of the Canadian Electrical Supply Company Limited and Electro-Sonic Supply Company Limited.

\$7½ Million Expansion Planned By Phillips Wires And Cables

Following closely on their \$3,000,000 expansion just completed last fall, Phillips Electrical Company Limited are again enlarging their facilities. Mr. T. A. Lindsay, president of the wire and cable company, today announced plans for a \$7,500,000 expansion program to commence at once. It is expected that the first sod will be turned for the new building extension by May 15th.

The new plans call for a 35 per cent extension of their large Brockville plant plus the addition of other facilities over a 5 year period.

The new buildings to be erected in Brockville will add over 100,000 sq. ft. to the company's plant. They will consist of three new wings to house the Enamel Room, the Plastics Department, and new Aluminum drawing and stranding equipment. In keep-

ing with the new structure recently added, each will be of standard modern design with flat roof and aluminum siding on a masonry foundation built at box-car level. The high ceilings permit of a mezzanine floor where raw materials can be stored for gravity feed to the machines below, thus leaving floor - space free for a fast flow of production through the plant.

As well as the new factory buildings, the large addition to the main office will be erected to provide 18,000 square feet of floor space for office staff. This will be of standard brick construction with large window areas.

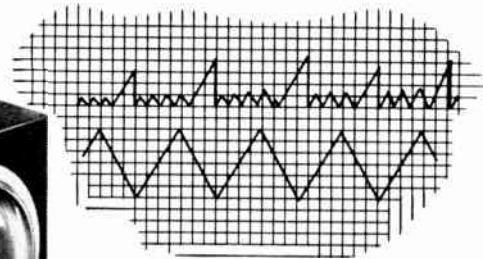
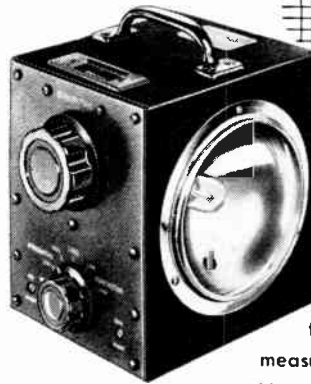
Electrics Limited Appointments

The appointment of H. S. Willson and T. E. Cordell as factory district managers for Electrics Limited, Brantford has been announced by Ricardo Muniz, manager of the Canadian Westinghouse Company's TV-Radio division.

Mr. Willson, factory district manager for Ontario, joined Westinghouse in 1950. He was formerly consumer products sales manager at Toronto.

Mr. Cordell is now factory district manager for Quebec.

STROBOTAC stops it for the eye



To thousands of industrial companies today, STROBOTAC is bringing a type of measurement and observation that cannot be achieved by mechanical tachometers or other instrumentation. The reputation it has gained for convenience, rapidity and accuracy is world-wide.

By generating a series of high-speed, accurately-timed flashes of stroboscopic light, each lasting about 30 millionths of a second, the STROBOTAC permits you to study fast-moving components in STOP or S-L-O-W motion.

Cyclic or repetitive movements may be measured by synchronizing the STROBOTAC's rate of flash to them. A calibrated scale gives readings accurate to 1% from 60 to 14,500 rpm, and this range can be extended by the use of simple multiple relationships.

Under the "visual arrest" of stroboscopic light, mechanical defects such as slipping, excessive torsion, or misalignment are readily revealed.

Use a STROBOTAC to study the operation of your machinery in action.

Simple to Operate

Main control knob
adjusts flash
rate till action
appears to "stop".
Read rpm on
calibrated scale at top.

Marconi 

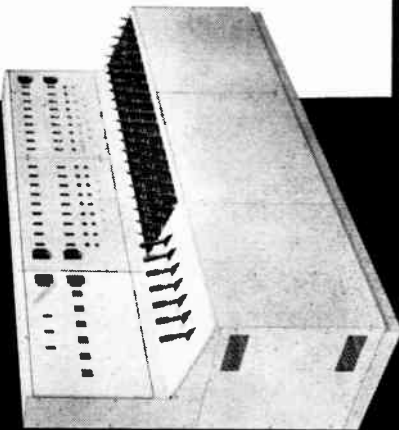
CANADIAN MARCONI COMPANY,
Electronic Instruments Dept., Montreal 16
Canada's Largest Electronics Specialists

Illustrated is one of the two custom-designed Dimmer Boards engineered and built by D. M. Fraser Limited for CKLW-TV Windsor. The high quality Ward Leonard components used in conjunction with a patchboard assure perfect lighting control and flexibility.

Our engineers will work directly with you to assure proper design and operation of your complete electrical system.

D. M. FRASER LIMITED

1070 Birchmount Road, Box 70, O'Connor
Postal Station, Toronto 16, Ontario
Branch Office: 1570 St. Matthew Street
Montreal, Quebec



TV STATION
CKLW WINDSOR

chooses

**WARD LEONARD
DIMMERS**

SLICING TECHNIQUE

(Continued from page 34)

sixteenth inch per minute. Easily adjusted trip dogs control the length of cutting stroke and provide automatic quick return at speeds up to 50 f.p.m. When slicing, automatic cross indexing takes place on the return stroke. Cross indexing can be set at the hydraulic control panel to produce slices of any desired thickness accurate to plus or minus .0005 inches. Stops are provided so that cross indexing can be adjusted to the length of the ingot or ingots being sliced. Whether one or more ingots are held in fixtures on the table or whether the slicing fixture is used, the slicing operation is automatic requiring no attention by the operator until the entire work-load is reduced to wafers.

The slicing fixture designed for use on the new Microtomatic precision slicing machine makes it possible to use smaller, thinner wheels, thereby reduces waste and increases the number of usable transistor blanks obtained from each crystal ingot. Setting up for precise automatic slicing on the Microtomatic is not difficult. Essentially, the fixture is a motorized precision headstock that can be mounted on the work table and accurately aligned parallel to the cutting spindle. Adjustable keys on the fixture base permit quick, accurate alignment of fixture to spindle. The face plate to which the end of a germanium crystal can be cemented, is a compound assembly which can be adjusted to bring the crystallographic plane into coincidence with the plane of rotation. The crystal can then be rotated at an appropriate speed during the cutting stroke. Consequently, a saw only large enough to cut to the center of the work piece will suffice. For crystals under 1½ inches in diameter, a 3-inch saw may be satisfactory. Such a circular blade reduces only .015 inches of material to dust.

Dicing

Some large power transistors make use of a complete wafer as produced by the slicing operation but most transistor blanks are made by cutting the thin wafers into tiny squares. The wafers are held for dicing by cementing them to ceramic plates which are, in turn, held by a fixture on the work table of the Microtomatic. The fixture is a serrated chuck with back stop and clamps to hold up to five 4½ inch square plates. Each plate can be covered with germanium or silicon wafers so that a full work-load might be 20 or more wafers.

The Microtomatic spindle for dicing is a special high-speed unit with a 3½ inch extension to permit mounting and spacing of a number of 3-inch diameter circular diamond saw blades. A typical setup might be 12 blades spaced .250 inches apart so that the entire width of the fixture is covered at a single

pass. Slow table feed is used and the depth of cut is set to cut through the wafers in one stroke. If wheel spacing corresponds to the desired blank size, the plates are turned 90 degrees and the strips of wafers are diced in a second pass. If very small blanks are required, it may be desirable to space the blades twice or three times the width of a single blank because the adhesive area on very small blanks is reduced to a point where the force of the blades cutting simultaneously at both edges, tends to tear the blanks away from the ceramic mounting plate. Using wider spaced blades, the blanks are cut on one side. Then, the accurate cross index is brought into play to position the work for a second cut along the other side.

The extremely slow and smooth feeding table, coupled with the vibrationless spindle, makes the Microtomatic capable of slicing a wide range of hard-to-machine materials. It can be used effectively on piezoelectric crystals and for slicing test blanks from small, hardened steel or tungsten carbide tools.

Large Microtomatic machines with bigger drive motors are available for precision parting of materials of larger cross section and greater resistance.

Noteworthy Design Features

The Microtomatic incorporates design and construction principles that have made DoALL surface grinders known for stability and accurate response to controls. The high-speed, anti-friction bearing spindle is belt driven by a one and one-half horsepower motor, more than ample power for the .015 to .030 inch thick slicing saws. Table and cross index ways are automatically lubricated through a metering pump from a reservoir of special high surface tension lubricant. Table travel and cross index movement are accomplished hydraulically. Bleeder valves on both hydraulic cylinders make it possible to exhaust any traces of trapped air after a setup, change or an idle period, thus insuring positive table travel and accurate indexing from the very first cut. Table and saddle are provided with generous coolant troughs to carry coolant and grinding dust back to the reservoir which is equipped with an ultra-fine paper filter to purify the coolant and salvage valuable metallic dust. Metal shielding, flexible curtains and transparent plastic splash panels completely enclose the work area, yet permit visibility. Except when equipped with the slicing fixture, a work light incorporated in the table end panel illuminates the work area. A single NEMA 1 control panel, mounted at the rear, includes magnetic starters for spindle, hydraulic, coolant and slicing fixture motors. Heavy duty, oil-tight, start-stop push buttons for all motors are conveniently located in a gasketed cast enclosure at the front end of the machine.

For further data on advertised products use page 65.

Westinghouse Build Loop Equipment For NRU Reactor

Engineering work on the Canadian Westinghouse Company's first nuclear project is now under way at the firm's Hamilton, Ontario, electronics division, where a team of specialists is preparing to build two loops for Atomic Energy of Canada's giant NRU reactor. The reactor, Canada's third and largest to date, is now under construction. When completed it will enable Chalk River scientists to carry on advanced research projects.

The loop equipment, which will carry either heavy or ordinary water through the reactor, must be capable of circulating up to 300 gallons per minute at pressures of up to 3200 pounds per square inch. Temperatures will range as high as 675 degrees F. According to the firm's electronics engineers, this is approaching "the sound barrier of plumbing". Slightly beyond this temperature no amount of pressure will prevent the water from vaporizing.

Canadian Marconi Receives Government Order For Equipment

An order for almost a quarter of a million dollars' worth of electronic test equipment has been placed with Canadian Marconi Company, Montreal, by the Department of Defense Production, Ottawa. The order was placed with Canadian Marconi Company as Canadian representatives for General Radio Company, of Cambridge, Mass., and Marconi Instruments Limited, of St. Albans, Hertfordshire, England.

Specifically the order calls for General Radio signal generators, power output meters, low pass filters, dummy loads, crystal diode modulators, mixer rectifiers, plus Marconi portable frequency meters, universal bridges and signal generators. All of these instruments will be used in connection with the installation and maintenance of the various communications systems associated with the defense of the entire country.

Associated Electronic Components Appointed Reps.

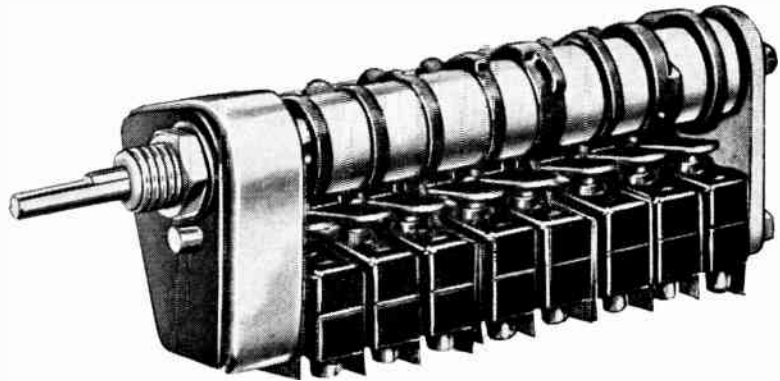
Associated Electronic Components of Toronto announce their appointment as Canadian sole distributors for Torotor A/S, Copenhagen, Denmark.

This old established firm was founded more than a quarter of a century ago by Mr. Niels Hansen, an engineer of wide repute as a pioneer in variable condenser design.

Torotor offers one of the most extensive lines of variable condensers, toggle switches, standard and special r.f. switches, instrument switches, r.f. coils and complete coil assemblies for short wave broadcast and f.m. receivers.

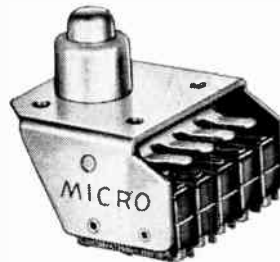
In recent years Torotor has added to its production program a complete range of components for the television industry.

MICRO SWITCH PRECISION SWITCHES FOR MULTIPLE CIRCUIT CONTROL



SUBMINIATURE ROTARY SELECTOR SWITCH

MICRO SWITCH rotary selector switches provide a means of switching two to eight different circuits with one small compact assembly. The switch consists of two to eight single-pole, double-throw subminiature basic switching units operated by cams on a common shaft. The cams are pre-set to operate the basic switches at 45° detents. Cams can be set to your specifications at the factory, permitting any combination of the switching units to be actuated in any position.

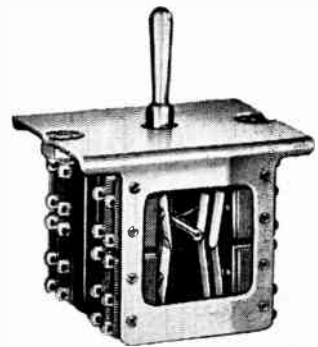


MULTIPLE CIRCUIT PANEL MOUNTING PUSH BUTTON SWITCH

Small, panel mounting manually operated push button switch containing two to fourteen basic switching units. Each unit may be wired either normally open or normally closed providing numerous combinations of "off" or "on" circuits in either depressed or released plunger positions.

SUBMINIATURE TOGGLE ASSEMBLY

An assembly of up to sixteen subminiature basic switches operated by a single bat handle. Eight switches can be operated with each direction of the toggle motion. This assembly makes an unusually efficient, compact, lightweight component . . . each of the subminiature switches are less than 3/4" long and weigh less than 1/15 ounce.



2-POLE PANEL MOUNTING TOGGLE SWITCH

Conforms to "AN" and "JAN" specifications and provides superior service and life characteristics through (1.) greater over surface creepage and clearance distances; (2.) sealed toggle lever; (3.) no return springs in momentary versions; (4.) solid silver contacts; and (5.) copper moving contact carrier to provide maximum conductivity.



**MICRO SWITCH
A PRINCIPLE
OF GOOD DESIGN**

MICRO SWITCH produces a complete line of extremely reliable snap-action precision switches for single and multiple circuit control. For complete information, write to Honeywell, Dept. EC-EC-5.



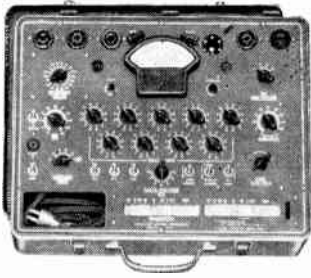
MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY, LTD.
LEASIDE, TORONTO 17

for more accurate
testing

WESTON

980 LINE instruments



**MODEL 981
TYPE 3 TUBE CHECKER**

Features filtered d-c plate, screen grid and control grid potentials. Precision voltage divider network and selector switch for testing tubes with transconductances of up to 30,000 micromhos. Provides signal voltages of 5.2, 2.6, 1.3, and 0.65 volts peak-to-peak with a frequency of 5,000 cycles. 9 single circuit, 12 position, selector switches. Built-in roll chart provides complete tube test data. Measures 17.50" by 13.25" by 6.00". Weighs 23½ lbs.



**MODEL 980
VOLT-OHM-
MILLIAMMETER**

for a wide range
of applications.

Accurate to 2% d-c., 3% a-c. Etched circuit and combination of functional ranges for many applications. D.C. sensitivity: 20,000 ohms/volt; A-C sensitivity 1000 ohms/volt. Voltage ranges—d-c at 20,000 ohms/volt; a-c at 1000 ohms/volt: — 1.6, 8, 40, 160, 400, 1600. Ohms range: R x 1, R x 10, R x 100, R x 1000, R x 10,000. Single dial for all ranges and functions. Measures 6.25" x 7.50" x 3.25". Weighs 2 lbs., 11 ozs.

VACUUM TUBE VOLTMETER

MODEL 982
Self
contained,
battery
operated



Completely isolated from spurious response due to stray a-c fields and circulating ground currents. Power consumption less than 25 milliwatts. Range function switch for direct measurement of negative and positive d-c potentials. No zero scale drift. No warming up. No resetting of zero corrector when switching from range to range. Reset button for rapid reading on peak-to-peak or a-c measurements. Battery "A" life: 8 hours per day for 90 days. Battery "B" shelf life: Approx. 1 year. Measures 10" by 7.38" by 3.63". Weighs 6 lbs. complete with batteries and accessories. For full information on the complete range of Weston electrical and electronic instruments, contact:

Powerlite
devices limited

Toronto Montreal Vancouver

5612

The File Processor

A new Electronic Memory System which reduces the contents of 1600 conventional file cabinet drawers to less than three cubic feet of space.

AN electronic memory system which reduces the contents of 1600 conventional file cabinet drawers to less than three cubic feet of space was introduced recently by its manufacturers.

In addition to "filing and remembering", the File Processor as the unit is known also feeds desired information via magnetic tape to a companion electronic computer. The two units, which are intended to be sold or leased together or separately, are known as the Elecom 125 System.

According to the makers the File Processor automatically sequences, selects, collates and separates information recorded on tape.

It can be used for such purposes as billing, taking inventory, figuring salesmen's commissions and other routine functions.

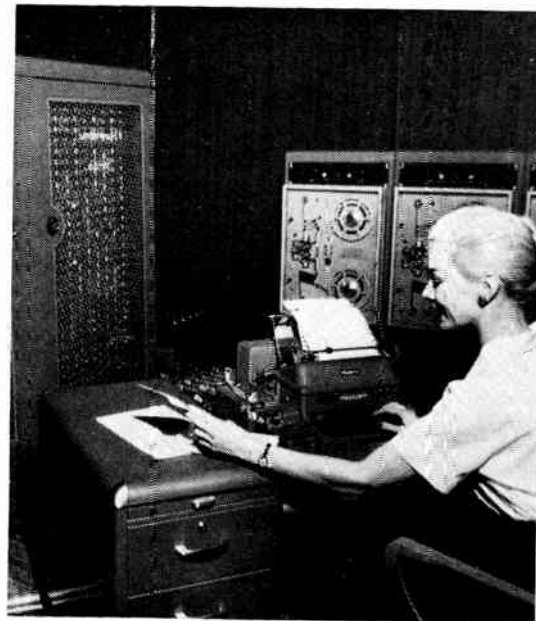
Engineers estimate that 3,000 cubic feet, normally occupied by records filling 1600 file cabinet drawers, can be compressed 1,000 times to only 2.8 cubic feet — the space occupied by 200 reels of tape.

An important advantage of the File Processor is that it will relieve its more expensive companion computer of handling many routine business data operations so that the computer, working independently of the File Processor, can concentrate on fast and selective computation.

The File Processor itself is operated by means of a punched-tape reader or typewriter keyboard which "keys" the File Processor as to which digits in an item are significant for the operation about to take place.

The operator at the keyboard selects the kind of operation he wishes to

carry out by pushing an appropriate button at the control panel. Then, after the "pattern" is chosen at the keyboard, the rest of the operation is automatic except for any necessary changing of reels.



● The new electronic memory system which reduces the contents of 1600 conventional file cabinet drawers to less than 3 cubic feet of space.

According to company officials, as many as 30 items can be processed in one second. Results are recorded on magnetic tape which can be fed to a high speed printer for visual study or to the computer for further processing.

SPECTROMETRY

(Continued from page 21)

structed to increase or decrease the air ratio, as required. Average recoverable loss during normal plant operation without the 21-610 was 1.3 long tons per day. Thus, the average increased sulphur production resulting from the 21-610's use was 1.2 long tons per day in this plant of about 40 tons per day production. The increase in production would be correspondingly greater in a larger plant.

Tests showed the instrument to be satisfactory and reliable when used for this purpose. Production of this 40 tons/day plant could be increased

enough to pay off the instrument in less than one year.

Use of the instrument has a distinct public-relations value, in that the plant is demonstrating that the latest scientific means of minimizing air pollution are being used.

These are but a few of the current experiments which are being carried out in the air-pollution field. Experts agree that they are still a long way from solution of the air pollution problem. However, they also feel that it is only by the use of super-sensitive instruments such as the mass spectrometer that they can gather the data necessary to make a solution possible.

For further data on advertised products use page 65.

DATA TRANSMISSION

(Continued from page 32)

second. This is equivalent to a telegraph system operating at a speed of over 2000 words per minute. While maintaining this high speed, the system must operate with a maximum error rate of 1 bit per 100,000.

SAGE transmission consists of pulse groups of standard length. The beginning of the pulse group is signified by a high-amplitude pulse, and the transmitted information is contained in pulses which may or may not be present in 11 positions following the start pulse. Also being transmitted continually at the pulse repetition rate is a low-amplitude pulse which maintains synchronization of the system.

Because the system is binary, the receiver must determine only if a pulse is present or absent at every position. Therefore, a well-shaped, square pulse is not necessary for proper detection. This results in conservation of bandwidth because the higher component frequencies of the pulse need not be transmitted. It is necessary, however, that the component frequencies which are transmitted remain at the same amplitude and that they all be delayed by the same amount of time.

Most telephone channels can transmit the component frequencies without amplitude distortion because they normally have a flat attenuation characteristic over their passband; however, they may require delay equalization.

For SAGE data transmission, telephone channels are required to be relatively flat between 500 and 2500 cps (no more than 3 db deviation from midband to band edge). Also, the difference in transmission time of any two frequencies in the band from 1000 to 2500 cps should not exceed 500 microseconds, and the number of impulse noise peaks which come within 18 db below the synchronizing signal level should not exceed 1 per minute.

SAGE-type data transmission usually can operate over any type of facility which provides these necessary requirements. However, certain types of facilities require special treatment such as delay equalization and impulse noise reduction to make them suitable. When the circuits are provided by carrier, the delay equalization requirement is not too great a problem since most of the data circuits are expected to be relatively short and simple in make-up. Thus, the primary consideration on carrier data circuits is the suppression of impulse-type noise.

The control of impulse noise on carrier channels is principally a matter of plant layout, since very little such noise is contributed by the carrier equipment itself. In general, a conservatively designed system which provides high-grade toll service without companders is probably satisfactory for data transmission.

Direct-reading, multi-purpose

SIGNAL GENERATORS

10 to 21,000 MC



-hp- 608D

Hewlett-Packard offers nine precision signal generators providing, collectively, direct-reading test signals between 10 and 21,000 MC. Whether you are measuring gain, selectivity, sensitivity, image rejection; driving bridges, slotted lines, antennas, filter networks; determining signal-noise ratio, SWR or transmission line characteristics, there is one of these wide range, high power instruments to answer the need. All have broadest usefulness, simple operation, wide modulating, pulsing and other output choices. Direct output calibration: no charts or tedious interpolation.

Only Hewlett-Packard offers this broad selection of direct-reading signal generators

Instrument	Frequency Range	Characteristics	Price
-hp- 608C	10-480 MC	Output 0.1 μ v to 1 v into 50 ohm load. Pulse or CW modulation. Direct calibration.	\$ 950.00
-hp- 608D	10-420 MC	Output 0.1 μ v to 0.5 v into 50 ohm load. Pulse or CW modulation. Direct calibration.	1,050.00
-hp- 612A	450 to 1,200 MC	Output 0.1 μ v to 0.5 v into 50 ohm load. Pulse, CW or AM to 5 mc. Direct calibration.	1,200.00
-hp- 614A	800 to 2,100 MC	Output 0.1 μ v to 0.223 v into 50 ohm load. Pulse, CW or FM modulation. Direct calib.	1,950.00
-hp- 616A	1,800 to 4,000 MC	Output 0.1 μ v to 0.223 v into 50 ohm load. Pulse, CW or FM modulation. Direct calib.	1,950.00
-hp- 618B	3,800 to 7,600 MC	Output 0.1 μ v to 0.223 v into 50 ohm load. Pulse, CW, FM, square wave mod. Direct calib.	2,250.00
-hp- 620A	7,000 to 11,000 MC	Output 0.1 μ v to 0.071 v into 50 ohm load. Pulse, CW, FM, square wave mod. Direct calib.	2,250.00
-hp- 626A	10,000 to 15,000 MC	Output 1 μ watt to 10 mw. Internal or external pulse, FM, or square wave mod. Direct calib.	3,250.00
-hp- 628A	15,000 to 21,000 MC	Output 1 μ watt to 10 mw. Internal or external pulse, FM, or square wave mod. Direct calib.	3,000.00



Data subject to change without notice
Prices f.o.b. factory

HEWLETT-PACKARD COMPANY

3037G Page Mill Road • Palo Alto, Calif.
Cable: "HEWPACK"

Represented in Canada by

ATLAS RADIO CORPORATION, LTD.
50 Wingold Avenue, Toronto 10, Ontario

NEW PRODUCTS

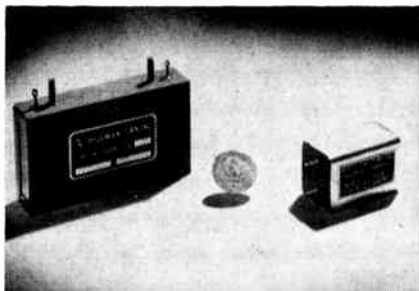
New Product specifications published in *Electronics and Communications* have been briefed for your convenience. If you require further information on any of the items published you may readily obtain such by using our Readers' Service, Page 65. Just mark the products you are interested in on the coupon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

● Crystal Filters For FM Reception

Item 1068

Crystal Filters with extremely high selectivity, at frequencies which eliminate the need for multiple conversions in VHF-UHF f-m receivers, have recently been announced.

The low insertion loss, linear transfer characteristics, and non-microphonic quality of these filters permit their location at any point of low signal level such as between the mixer and the i-f amplifier. Using Crystal Discriminator, Type WB, in combination with Crystal Filter Type 44F, completely eliminates the need for any lower intermediate frequency. These filters can be produced on short notice in large or small quantities to meet exact performance requirements.



Electrical specifications are: Center Frequency 13 m.c. (available 10-20 m.c.); Bandwidth at 6 d.b. Attenuation: 30 k.c. (available with 20-50 k.c. bandwidth); Shape Factor 60 d.b. Bandwidth 1.7

tor: $\frac{6 \text{ d.b. Bandwidth}}{1} = \text{Maximum}$

Power Insertion Loss: 6 d.b. Maximum; Passband Response Variation: ± 1 d.b. Maximum; Ultimate Attenuation: 80 d.b. Minimum.

Other features are: Small size; High selectivity; Low insertion loss: Operating Temperature — 55°C. to + 85°C.; Extreme stability with variations in temperature. Frequency shift less than $\pm .005$ per cent total from — 55°C. to + 85°C.; Non-microphonic; Unaffected by impedance variations commonly encountered in transistor circuits; Works directly tube-to-tube or transistor-to-transistor with no padding; Hermetically sealed, no alignment or readjustment necessary; Vibration and shock per MIL-E-5422.

● Century Electrograph

Item 1069

The Century Electrograph, Model 420, offers 24 trace light-beam recording on electro-sensitive paper with automatic sensitizing, dry developing and fixing. Darkroom facilities are not needed with this unique process which produces 8-inch wide oscillograms that may be read instantly after recording. Recording on rectilinear coordinates—timing lines optically impressed from a synchronous timer — it combines the advantages of direct-writing oscillographs but allows the traces to cross. The Electrograph is capable of recording to 100 c.p.s., without amplification using Century galvanometer elements. Featuring high input sensitivity, trace identification, seven paper speeds with 200 foot supply capacity, and low power consumption, the Electrograph operates from 115 volts, 60 cycles.

● Magnetic Shields Catalog

Item 1070

A Magnetic Shields Catalog which contains a wealth of information on the extremely large number of standard shields which the company manufactures is now available.

Catalog MS-104, "Performance-Guaranteed Magnetic Shields", describes the shield alloys which are used, the dry hydrogen annealing process used for controlling shielding properties, fabrication and finishes. Some discussion is devoted to mounting brackets and availability of single or multiple nested shields made from NuMetal alone or with alternate layers of NuMetal and copper.

Thirty-three pages of working drawings are included showing the diversity of shields which the company manufactures, and describing materials used.

To obtain further information on New Product items, use coupons on page 65.

● Polarizing Screwlocks For Easy Release Continental Connectors

Item 1071

Continental E-Z release power connectors can be supplied with the polarizing screwlock feature to provide a positive mechanical means of locking plug and receptacle against vibration or accidental disconnection. The screwlock also eliminates any need to force or pry apart plug and receptacle when disconnecting the connector.

Series E-Z 16 is available in 12, 18, 24 and 34 contacts with solder cup for No. 16 AWG wire or solderless wiring taper pin for "AMP Series 53". Individually spring loaded pin contacts assure quick release with low insertion force and practically no disengagement force. Aluminum hoods with cable clamp and cable mounting bracket for top or side cable opening, can also be supplied on order.

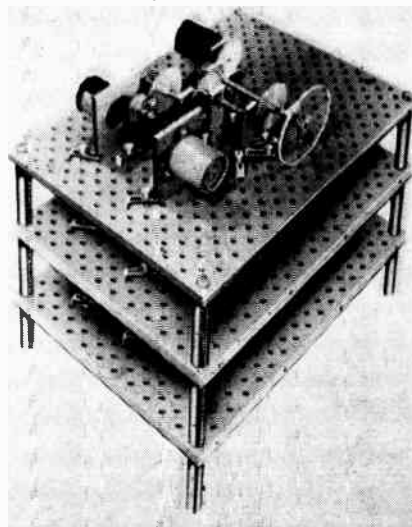


A choice of molding compounds includes mineral filled Melamine, Plaskon reinforced (glass) Alkyd 440A or Orion filled Diallyl Phthalate.

● Electro Mechanical Assembly Kits

Item 1072

An electro-mechanical precision assembly kit has been completely revamped by the addition of five times as many new parts. Fourteen component hangers, prebored to various sizes, make mounting easy for most electrical components, and four blank



hangers may be bored to take care of the rest. Gears, previously available as only "solid-hub" components are now available as split hub gears as well. Adapter gears, miter gears, bevel gears and anti-backlash gears have been added to the list. Bearing hangers, dial assemblies, shaft adapters, couplings, terminal assemblies, a hand-crank, magnetic clutches, a differential (with various end gears) and inertia load discs are included. Limit stops — wafer, mechanical lead screw and electro mechanical lead screw types are also available. A micro-switch assembly and its associated cams and pulse disc are included.

● Magnetic Laminations Catalog

Item 1073

A large manufacturer of magnetic laminations has just issued a greatly expanded magnetic laminations catalog, describing the company's standard lines of laminations, laminated cores and dies.

Catalog ML 201, "Performance Guaranteed Magnetic Laminations", includes 16 pages of lamination specification sheets, showing both the individual laminations to actual scale, as well as properties of square cross-section core stacks, and weights and counts for different materials. Provision is made for additional data as it becomes available.

Catalog sections are devoted to laminated core assemblies, mechanical and magnetic parameters and lamination tolerances.

The catalog also includes a section on the proper information needed in determining and ordering quantities of magnetic laminations.

● Bulletin On Resistors

Item 1074

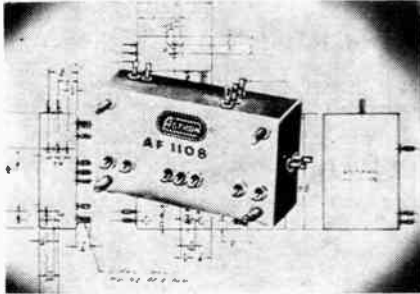
A four-page bulletin describing new Series PH encapsulated precision wirewound resistors is available. Complete specifications and descriptions are given for more than 50 types of resistors, ranging from 0.1-watt sub-miniature with a maximum resistance of 50 k ohms to the 4-watt units having 20 megohms resistance. Resistors described are all capable of accurate performance in environments of high humidity, wide temperature ranges and mechanical shock. Full information is provided on units with axial and radial leads, lug types and units designed for use in printed wiring assemblies.

● Miniature RF Noise Suppression Filter

Item 1075

A leading manufacturer of capacitor and RF noise suppression filters has announced the development of a new miniaturized RF noise suppression filter.

Carefully constructed of specially chosen components and materials, this newly designed filter meets and surpasses the requirements of specification MIL-1-11748. Containing 14 toroids and 8 capacitor sections, the AF1108 features a noise suppression range of .15 to 1000 megacycles. Its rugged construction enables it to withstand great amounts of shock and vibration as well as elevated operating temperatures.



This hermetically sealed RF noise suppression filter is extremely small in size and light in weight and can be custom-engineered without shape limitations. It is currently being produced for portable field equipment.

● Communications and Business Machines Tape Winder

Item 1076

A new Universal Model "Tape-Winder" to supplement the Standard Model will find a wide application for a variety of tape-producing equipment — teletype, ticker, automatic typewriter, accounting, computer.

The Universal Tape-Winder features greater flexibility of use. Three sizes of winding reels are available and are interchangeable on the basic machine, making the machine useful for changing requirements. Reels are quick-threading, instantly removed or replaced and available with either large cores for re-transmitting (unwinding) or small cores for filing.

An exclusive operating arm coupled to a long-interval on-off switch provides delayed-action winding which operates the fan-cooled motor only one-sixth of the total operating time. This same operating arm is built integral to a clutch release mechanism which permits an operator to spin the reels for back reference. A spring-latch is also built into the clutch release which makes it possible to fix the arm in a down position to free both hands for tape inspection.

● Industrial Light Meter

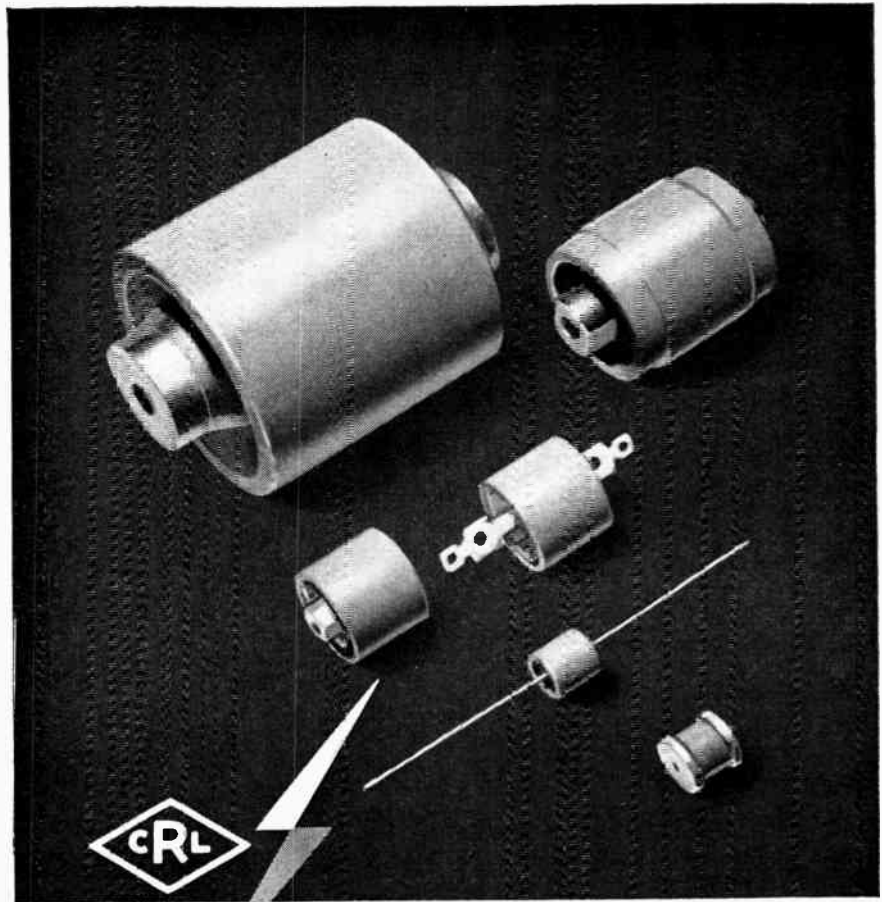
Item 1077

Designed primarily for industrial and military lighting surveys, and as a portable standard for light measurement.

This ruggedized unit consists of a 3½" meter with attached handle, and a photoelectric cell assembly in a bakelite housing connected by a 6-foot cord. The hermetically sealed meter assembly conforms to MIL-M-10304 military specifications. All components fit into a compact black steel carrying case that measures only 9½" wide, 3¼" high, and 4¼" deep.

Sensitivity of the entire unit is 10-foot candle minimum, maximum unlimited. Entire range is available on order — dual or single. Scale length is 2.2", and has a 90° arc. An unbreakable plastic window protects the scale face from damage. Meter housing and handle assembly is constructed of black anodized, die-cast aluminum.

(Turn to page 62)



the ONLY COMPLETE LINE of Ceramic Transmitting Capacitors

Increasingly used
in equipment
like this:

*Transmitters
Induction heaters
Diathermy equipment
Mobile transmitters
Tuned tank circuits
Antenna circuits
X-ray equipment
Electronic welding
equipment
Cyclotrons
Other applications*

**Smaller and more economical
than mica, vacuum, or oil-filled
paper types for the same
applications**

- ◆ Eleven terminal styles. Capacitance, 3 to 1,000 mmf., 5 KV to 20 KV d. c. Special sizes, shapes fabricated to specifications.
- ◆ Extremely low power factor — down to .1%.
- ◆ Temperature coefficients controlled to your specifications.
- ◆ Low moisture absorption. Meets applicable MIL specifications.
- ◆ Double-cup design affords long leakage paths — provides large area to dissipate heat.

Centralab Canada Ltd.

804 Mt. Pleasant Rd., Toronto 12, Ontario

D-956

Write for Technical Bulletin 42-102R.

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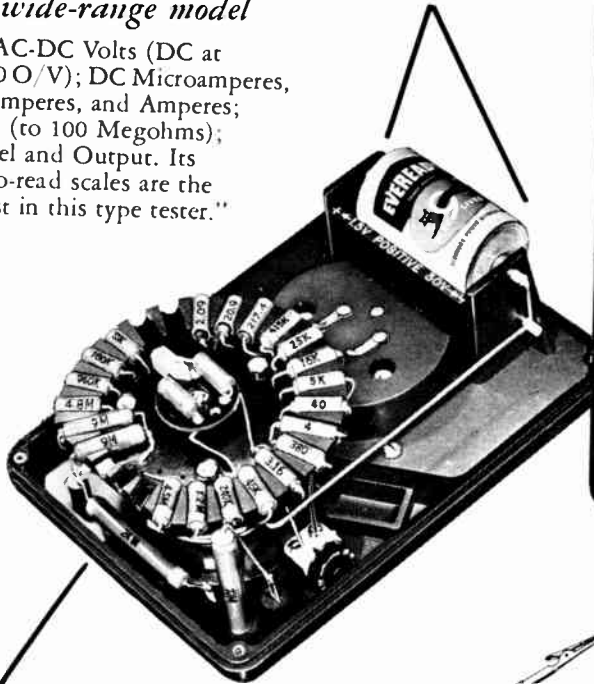
you can't match **TRIPLET** model 630 VOM

for **SPEED
ACCURACY
DURABILITY
CONVENIENCE!**

heavy molded case
—1/4" thick for high impact.
Fully insulated.

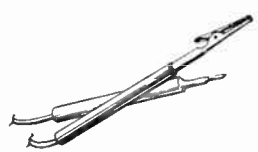
sure grip battery contacts
Balanced double-spring tension grip assures permanent contact.

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



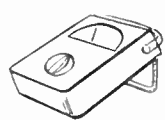
streamlined design
No protruding knobs on switch or ohms control—both are flush with the panel.

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



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

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



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

no slip feature
Four rubber feet furnished as standard equipment fit in back of the case to prevent slipping on smooth surfaces.

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

TRIPLET ELECTRICAL INSTRUMENT CO.
Bluffton, Ohio

MODEL 630

\$55.30
Suggested Canadian Dealer Net



THE MIGHTY NINE VOM LINE

- 631**
Combination V-O-M—VTVM
- 630-NA**
For Best Testing Around The Lab, Production Line or Bench
- 630**
The Popular All-Purpose V-O-M
- 630-A**
A Good Lab and Production Line V-O-M
- 310**
The Smallest Complete V-O-M With Switch
- 630-T**
For Telephone Service
- 666-HH**
Medium Size For Field Testing
- 625-NA**
The First V-O-M With 10,000 Ohms/Volt AC
- 666-R**
Medium Size With 630 Features



Heathkit PRINTED CIRCUIT 5" COLOR TV Oscilloscope Kit

MODEL
0-10
\$69⁵⁰
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 mono-chrome 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 9 1/2" H x 6 1/2" W x 11 3/4" 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
\$29⁵⁰
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/2 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
\$49⁵⁰
Shpg. Wt. 26 lbs.



Heathkit PRINTED CIRCUIT VACUUM TUBE VOLTMETER KIT

MODEL V-7

\$24⁵⁰

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 ma 4 1/2 meter-transformer power supply—11 megohm input impedance—1% precision resistors—high quality components used throughout.

Heathkit VOLTAGE CALIBRATOR KIT

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



MODEL VC-2
\$11⁵⁰
Shpg. Wt. 4 lbs



Heathkit 20,000 ohms/volt MULTIMETER KIT

MODEL MM-1
\$29⁵⁰

Shpg. Wt. 6 lbs.

Features comprehensive range coverage, 20,000 Ω/V D.C. and 5000 Ω/V A.C. Ranges: D-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
\$29⁵⁰

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
\$29⁵⁰

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
\$23⁵⁰

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.

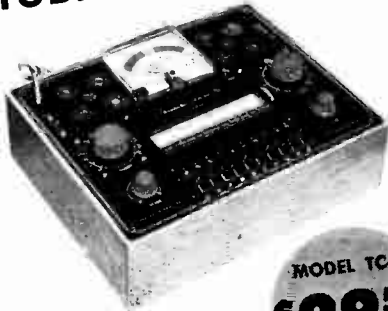
HEATH Company

A SUBSIDIARY OF DAYSTROM INC.

BENTON HARBOR 3, MICHIGAN

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, experienced time servicemen, as well. Will test all tubes commonly encountered in radio and TV service work. Simple "GOOD-BAD" scale on the 4 1/2" 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

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 CS-1
\$5.50
Shpg. Wt. 2 lbs.



Model DR-1 Heathkit DECADE RESISTANCE KIT



Twenty 1% precision resistors provide resistance from 1-99,999 ohms in 1 ohm steps. Indispensable around service shop, laboratory, ham shack, or home workshop.
\$19.50
Shpg. Wt. 4 lbs.

Heathkit DECADE CONDENSER KIT

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



Model DC-1
Shpg. Wt. 3 lbs.
\$16.50

Heathkit CONDENSER CHECKER KIT



Measures capacity in four ranges from .00001 to 1000 mfd. 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 C-3
\$19.50
Shpg. Wt. 7 lbs.

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 Hz 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



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 locator circuit, wattmeter, and terminals for "patching" output transformer or speaker into external circuit.
\$23.50
Shpg. Wt. 9 lbs.

Model M-1 Heathkit HANDITESTER KIT



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.
\$14.50
Shpg. Wt. 3 lbs.

HEATH Company

A SUBSIDIARY OF DAYSTROM INC.
BENTON HARBOR 3, MICHIGAN

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 GENERATOR KIT

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 0.1% 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 μ v, 100 μ v, 1 v, and 10 v. Cathode follower output.



MODEL AG-8
\$29.50
Shpg. Wt. 11 lbs.

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%.



Model PS-3
\$35.50
Shpg. Wt. 17 lbs.

Heathkit VARIABLE VOLTAGE POWER SUPPLY KIT

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 to 10 ma at 450 vdc and 0-130 ma at 200 vdc! Essential for circuit design and development. Voltage or current read on 4 1/2" meter.



Model QM-1
\$44.50
Shpg. Wt. 14 lbs.

Heathkit "Q" METER KIT

Will measure Q of condensers, RF resistance and distributed capacity of coils, etc. Uses 4 1/2" 50 μ a 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

Measures resistance, capacitance, inductance, dissipation factors of condensers, and the storage factor of inductance. Employs 2-section CRT dial. D, Q and DQ functions are combined in one control. 1/2% 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.



Model IB-2
\$59.50
Shpg. Wt. 12 lbs.

Heathkit 6-12 VOLT BATTERY ELIMINATOR KIT

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.



Model BE-4
\$31.50
Shpg. Wt. 17 lbs.



MODEL BR-2
\$17.50
(Less Cabinet)
Shpg. Wt. 10 lbs.

Heathkit BROADCAST BAND RECEIVER KIT

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, 5 1/2" 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

New

Heathkit DX-100 PHONE AND CW TRANSMITTER KIT



MODEL DX-100

\$189.50

Shpg. Wt. 120 lbs.

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

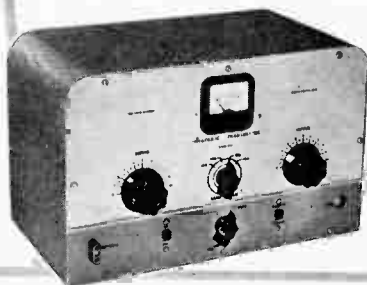
This one compact package contains complete transmitter, with built-in VFO, modulator, and power supplies. Provides phone or CW operation—VFO or crystal excitation—and band-switching from 160 meters through 10 meters. R.F. power output 100—125 watts phone, 120—140 CW. Parallel 6146's modulated by push-pull 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 trans-

formers—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 3/4" wide x 13 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.

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-quality components throughout. Instruction Book simplifies assembly. Uses 6AG7 oscillator, 6L6 final and 5U4G rectifier. Up to 35 watts plate power input.



Model GD-1B

\$19.50

Shpg. Wt. 4 lbs.

Heathkit GRID DIP METER KIT

This is an extremely valuable tool for Hams, Engineers or Servicemen. Covering from 2 Mc to 250 Mc, it uses 500 μ a 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 μ a 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.



Model AC-1

\$14.50

Shpg. Wt. 4 lbs.

Heathkit ANTENNA COUPLER KIT

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—5 1/2" PM speaker. CABINET: Fabric covered plywood cabinet. Part No. 91-10. Shpg. Wt. 5 lbs. \$4.50



Model AR-2

\$25.50

Shpg. Wt. 12 lbs. (Less Cabinet)

HEATH Company

A SUBSIDIARY OF DAYSTROM INC.
BENTON HARBOR 3, MICHIGAN

Heathkit DUAL-CHASSIS WILLIAMSON TYPE HIGH FIDELITY AMPLIFIER KIT



Main amplifier and power supply each have their separate chassis for flexibility of installation. Features the Acrosound "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 . . . \$5975
W-5: Consists of W-5M Kit listed above plus Heathkit Model WA-P2 Preamplifier. Shpg. Wt. 38 lbs., Exp. Only . . . \$7950

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 normal home installation, and frequency characteristics are $\pm 1 \frac{1}{2}$ db from 20 to 20,000 cps. Push-manual—detailed construction 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 20-WATT HIGH FIDELITY AMPLIFIER KIT



Model A-9B
\$35.50
 Shpg. Wt. 23 lbs.

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

Heathkit HIGH FIDELITY PREAMPLIFIER KIT



Model WA-P2
\$19.75
 Shpg. Wt. 7 lbs.

Beautiful modern appearance blends with any interior color scheme.

Completely fulfills all the requirements for remote control, compensation, and preamplification for the Heathkit Williamson-type Amplifiers or any conventional Hi-Fi Amplifier. Five separate input channels, each with separate audio level control. Full record equalization accomplished with 4-position turnover and roll-off controls. Separate bass and treble controls. Overall frequency response within 1 db from 25 cps to 30,000 cps. Hum and noise level extremely low. This brilliant performer will do justice to the finest available program sources.

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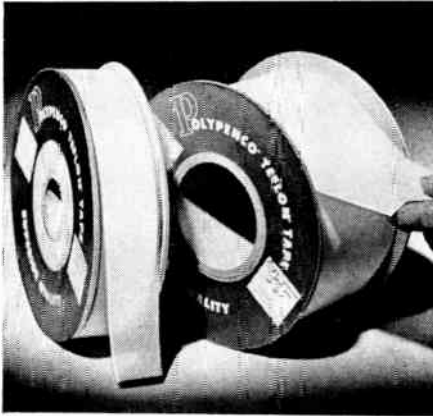
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NEW PRODUCTS

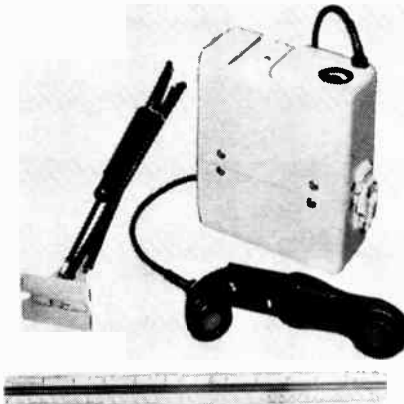
(Continued from page 55)

• Transistorized Portable Communications Set

Item 1078

New standard of design and performance for portable communication equipment offers unusual versatility, high power, simplified operation, small packages.

Ability to withstand rough handling, extreme temperatures — even total immersion in water — make it ideally suited to rugged-service applications. Remarkable range (up to 30 miles, ground to ground), with telephone convenience and simplicity. One-half of the two-part molded fibreglass case contains the transistorized receiver and transmitter, the other a battery power supply, complete with hand driven generator.



Each section is hermetically sealed. Transmit-receive switch is incorporated in the handset handle. Antenna fits to top of case, automatically switching on set.

Specifications

Weight: 7 lbs., with antenna and headset. Dimensions: 8" x 6 1/2" x 3". Transmitter Power Output: 3 watts (may be increased to 5 for special applications). Power Supply: 6 volt battery weighing only 12 oz., operates set for 500 hours on receive, 3 1/2 hours on transmit, and may then be recharged with self-contained generator. Receiver sensitivity: 1.5 microvolts at signal to noise ratio of 10 db. A Canadian design.

• Waveguard Detector For KU Band

Item 1079

Model 509, a new versatile waveguide detector for the KU band has been developed. Designed for broad band operation, the Model 509 has one-tenth the voltage standing wave ratio of currently available detectors in the 12.4 to 18.0 k.m.c. frequency range. Its low VSWR characteristic (less than 1.5) makes the detector extremely valuable as a measuring instrument for evaluating radar components, where the optimum VSWR is 1.5.

The Model 509 may be used for absolute or relative power measurement when used with appropriate bolometers and thermistor or as a conventional crystal detector, the detector is used with standard KU band crystals such as the 1N78 or 1N26; for precise attenuation or power measurements, it is used with the N-610B bolometer or N-333 thermistor.

The Model 509 Detector is readied for use as crystal detector by merely unscrewing a cap and inserting the crystal firmly in an adapter. The variable short is then tuned by micrometer for optimum VSWR or maximum detected output. The detected output capacity of this detector is sufficiently low for it to be used either as a detector or crystal mixer. To convert it into a bolo-

meter mount, the knurled crystal adapter and contact are removed. The bolometer is then inserted and secured by the screw-on cap.

• High Power Coaxial Termination

Item 1080

A new high power coaxial termination for the 900 to 10,000 mc frequency range, Model 369, has been announced by manufacturers of microwave and UHF test equipment. With a power rating of 200 watts average and 50,000 watts peak, Model 369 is provided with efficient heat-dissipating cooling fins to minimize temperature rise.

Capable of withstanding temperatures in excess of 500°F., the terminating element is a long tapered molding which results in very low VSWR (1.10) over the entire frequency range and in even distribution of the power dissipation along the length. A new termination material developed by engineers, consists of powdered iron dispersed in plastic and cast to shape.

Model 369 is useful for terminating directional couplers and other devices in high power systems in actual operation or for test purposes. The low VSWR of the terminating element increases the effective directivity of directional couplers and facilitates more accurate VSWR measurement of all types of coaxial components. The termination is 11 inches long and is available with a type N female connector.

• New Audio Oscillator

Item 1081

Precise attenuation, broad frequency coverage, compact size and a low price are features of a new audio oscillator, Model 201C.

The new oscillator covers frequencies 20 c.p.s. to 20 k.c. in three bands with calibration accuracy of ± 1 per cent, frequency stability of ± 2 per cent or 0.2 c.p.s., and full range frequency response of ± 1 d.b. Output is 3 watts or 42.5 volts into 600 ohms. Distortion is less than 0.5 per cent from 50 c.p.s. to 20 k.c. at 1 watt, and less than 1 per cent, 20 c.p.s. to 20 k.c. at 3 watts output. An output attenuator lowers the output 40 d.b. in steps of 10 d.b. With zero attenuation the internal impedance is approximately 75 ohms. With 10 d.b. or more attenuation the output impedance is approximately 600 ohms over the entire frequency range providing a constant internal impedance for precise audio measurements. Hum voltage is less than 0.03 per cent of rated or attenuated output.

To obtain further information
on New Product items, use
coupons on page 65.

• Snap-In Control Takes Less Space In Printed Circuits

Item 1082

A self-supporting, snap-in variable resistor for printed wiring has recently been announced. This control, known as the Stackpole Type LR-70, measures only 57/64" dia. and stands 1/8" off the mounting board. It is supported by four legs—the three regular voltage taps, and a larger, case ground leg. No mounting hardware is required since the legs merely snap-in to the printed wiring board to form a strong support. Terminals are heavily tin-lead coated for fastest soldering with dip solder techniques.

These variable composition resistors find wide applications in TV, FM, AM receivers auto radios, and other printed circuits chassis where space and cost must be held to a minimum. Gold-plated ring-spring and contact hub-spring contactors assure smooth, quiet operation. Cases are nickel plated.

(Turn to page 64)

For further data on advertised products use page 65.

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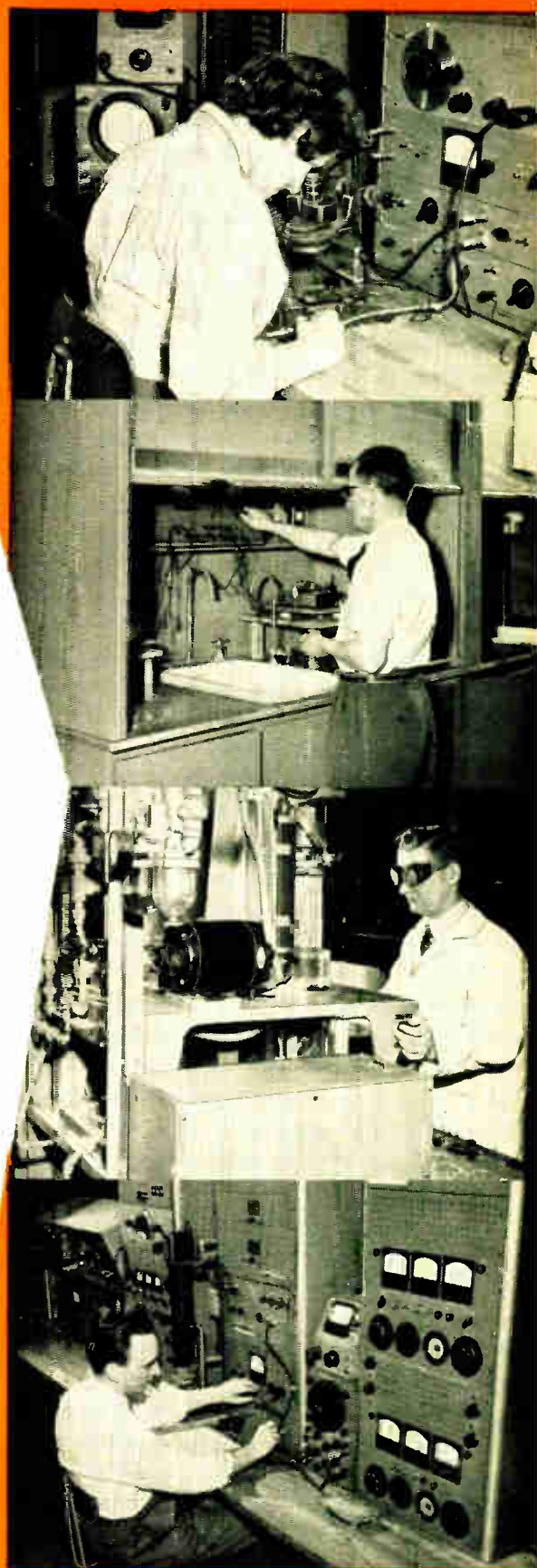
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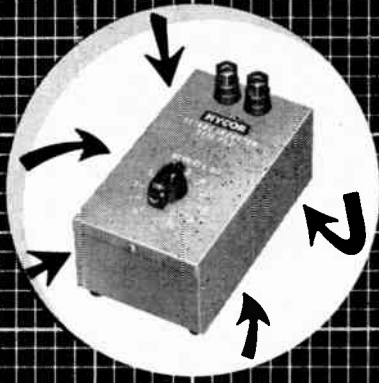
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the NEW 700 series



Indispensable for design and experimental work on audio filters, equalizers and tuned circuits at frequencies between 150 to 20,000 cycles.

Four units are available in ranges from 10 x .001 Henry to 10 x 1.0 Henry. When all four units are connecting in series, 11,110 steps from .001 Henry to 11.11 Henries are obtained.

Four HYCOR type EM-1 toroid coils are used as elements in each unit. The 10 steps are obtained by series switching. "Q" factor remains essentially constant over all ranges.

The Decade-Units have excellent stability in respect to current and temperature changes and reasonable amounts of D.C. may be run through the units with small effect on inductance.

Dimensions of all types: 5 1/4" L. x 3" W. x 2 1/4" H.

Net Price: \$29.90
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NEW PRODUCTS

(Continued from page 62)

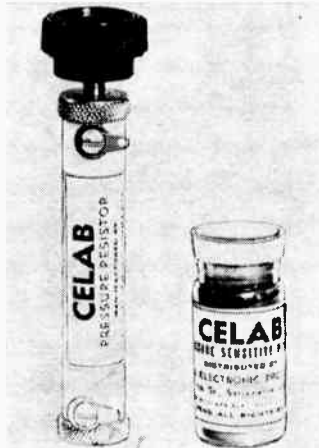
● Pressure-Sensitive Materials

Item 1083

Type 1. — Resistance at zero pressure — infinity. High R — Resistance at 12 lbs. pressure — .2 x 10 k. ohms.

Type 4. — Resistance at zero pressure — 20 x 1 k. ohms. Low R — Resistance at 15 lbs. pressure — 150 ohms.

Note: Type 4 material is highly sensitive at low pressures, having a useful scale at 1/4 oz. up.



Type 401. — Resistance at zero pressure — infinity. Ultra — Resistance at 5 lbs. pressure — infinity. High R — Resistance at 15 lbs. pressure — 3 x 100 k. ohms.

Note: Type 401 Pressure-Sensitive Resistance Material never reaches zero resistance with hundreds of tons pressure. It is valuable as a high pressure indicator, or for shock, explosion and force indicators. A modification of this type can be supplied that will give a useful scale at any high pressure needed.

All measurements taken on sample 1/4" thick by 1 1/4" dia. after original compression with 25 lbs. in "teflon" tube at 23 C ambient with 1.4 volts.

Any of these materials may be molded in neoprene or other plastics which are flexible, without dropping pressure-sensitivity.

● Precision Components

Folder

Item 1084

A four-page bulletin covering a manufacturer's complete, expanded line of precision electrical components for industrial control, guidance, telemetering and audio equipment is now available.

Included in the illustrated bulletin are basic specifications for encapsulated precision wire-wound resistors, encapsulated toroid coils, miniature magnetic clutches, precision wave filters, telemetering filters, precision ratio transformers, miniature toroid power transformers, magnetic amplifiers, decade inductor units, program equalizers, variable filters and variable attenuators.

● Reference Chart For Variable Resistors

Item 1085

A handy new file-size chart giving the essential electrical and mechanical characteristics of variable composition resistors has recently been published.

Called "A Quick Guide to Variable Resistors," the new chart is printed in two colors on heavy stock suitable for wall, desk-top, or file drawer use. Illustrations and specifications for over 18 basic single and dual-section controls are shown with a tabulation of all possible modifications available on each control, such as printed wiring or wire-wrap terminals, tab or bracket-mounting devices, line switches, phenolic shafts, and so forth.

● Oscillography That Remembers

Item 1086

Combining the unique quality of information persistence with all the features of a first quality standard laboratory oscilloscope, the Memo-Scope 103 is a storage oscilloscope. It forms and retains traces at constant intensity until they are deliberately erased. This is accomplished by means of a storage "mesh" immediately behind the viewing screen. Electrically charged wherever it is struck by the writing electron beam, the mesh retains the charge pattern locked in place; the effect is achieved by the secondary-emission characteristics of the mesh and a low velocity beam of electrons from the flood gun in the cathode ray tube.

Immediately visible on the phosphor-coated face of the tube because of a 5-kilovolt accelerating potential between the mesh and the screen, the stored trace is of constant high brightness. It is readily visible in a brightly-lighted room, and may be easily photographed. For comparison purposes, a number of traces may be written and stored, a display that may be studied and recorded and that will persist as long as voltages remain on the cathode ray tube. Whenever desired, the stored traces are removed, erased, in less than 1/4-second simply by depressing a push-button which applies the proper waveform to the storage mesh.

● Marine Radio Telephones

Item 1087

Two new radio telephones to "round out" a manufacturer's line of marine electronic equipment are announced.

The "Marlin" is a compact transmitter-receiver unit rated at 20 watts RF power output. With 5 crystal-controlled channels this unit offers operation on ship-to-ship, ship-to-shore and distress frequencies commonly used on the Great Lakes as well as the Atlantic and Pacific coastal regions. In addition, the standard broadcast band provides pleasant listening at sea.

Where greater range and additional channels are required the more powerful "Sea Lion" is recommended. This model is type approved under D.O.T. specification 110 and is a fully modulated 85-watt transmitter with nine crystal-controlled channels.

These radio telephones are designed for use on pleasure craft, fishing vessels and commercial ships. Both are easy to install and will provide reliable, trouble-free communications at a reasonable cost.

● Electronic Switch Kit —

Model S-3

Item 1088

A completely redesigned version of the Model S-2. Allows simultaneous oscilloscope observation of two input signals by producing both signals, alternately, at its output.



Four switching rates selected by panel switch. Provides gain for input signals, and features frequency response of ± 1 db 0-100 kc. Employs 7 miniature tubes. Sync output provided to control scope sweep. Ideal for observing input and output of amplifiers simultaneously, etc.

(Turn to page 68)

For further data on advertised products use page 65.

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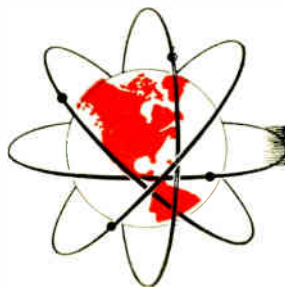


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KITCHENER, ONT., CANADA

NEW PRODUCTS

(Continued from page 64)

● Expanded-Scale Frequency Meter Item 1089

A new high-accuracy frequency meter with expanded scale for industrial and laboratory use has been developed.

The compact new instrument is the 500B Frequency Meter, covering frequencies 1 cps to 100 KC and providing direct readings accurate within ± 2 per cent full scale. A feature of the new instrument is an expanded scale permitting any 10 per cent or 30 per cent segment to be viewed full



meter range for high accuracy. Input requirements are 0.2 volt on sine waves and 1 volt minimum to 250 volt peak maximum on pulse signals. A pulsed output is provided to synchronize a stroboscope, and continuous recordings of readings may be made on an Esterline-Angus recorder. The instrument includes a self-check based on line voltage frequency. Readings are never affected by signal or line voltage variations. Model 500B is extremely compact, weighing only 17 pounds and measuring less than 12" high.

● M2 Amplifier Item 1090

A new M2 amplifier uses only a single tube, yet is capable of amplifying input signals as low as 5 millivolts d.c. with an input energy requirement of 0.01 microwatt. This means that at 5 millivolts only 2 microamperes d.c. will be drawn from the measured circuit. Yet the output of this amplifier is sufficient to drive a recorder requiring up to 2.5 milliamperes and with a resistance of 10,000 ohms. In other words, the output is 62.5 milliwatts giving a power gain in a single stage of over 6,000,000!

This remarkable power gain is achieved with no loss in accuracy or stability. Nor is the response sacrificed, as the instrument has a response speed of 0.2 seconds full scale.

On the other hand, in cases where the signal voltage may be higher, but current drain must be kept low, the input can be arranged to be 1.5 volts, and at this input, the current drain will be only 0.006 microamperes. Or, if the recorder is calculated on the basis of ohms per volt input impedance, this means well over 200 megohms per volt, a figure far in excess of the average vacuum tube voltmeter.

The recorder which incorporates this amplifier has rectangular chart, high speed response (0.2 seconds); ruggedness and reliability. The amplifier design inherently is unaffected by tube variations or drift; aging of components will not affect the performance.

● Channel Analyzer Item 1091

Newly available in Canada is a 256 channel analyzer based on the Argonne National Laboratory design. Known as the Mark 20, Model 2603, it has 256 windows and a count storage capacity of 65,536 counts per window.

An analogous display of the data on an oscilloscope is available during and after accumulation. Automatic readout, either in analog or digital form, is available by means of an auxiliary printer.

Basically, the analyzer consists of a linear amplifier, an analog to digital converter, a simple digital computer, and a data display system.

A linearity of 0.2 per cent of full scale is claimed (except for the first two channels). Average channel dead time is less than 80 microseconds. No channel width adjustments are necessary, and there is no channel width drift. Positional channel drift is very small, but uniform.

Data distortion and energy shift are negligible for pulse rates as high as five million counts per minute.

● Type 72C Microwave System Item 1092

Here is the first publication describing Lenkurt's Type 72C microwave system — a new system that provides up to 360 voice channels, if desired. This capacity is greater than that of any other Lenkurt system now available to you. Type 72C is so versatile that it can be used for distances as short as ten miles. Yet it can be used, with repeaters, for system lengths up to 600 miles.

Exceptionally reliable operation makes Type 72C easy to operate and maintain. The circuits and components are similar to those used in low-frequency carrier and telephone equipment.

An available bulletin will acquaint you with the merits of this new system and its technical highlights.

● DX-35 Phone And CW Transmitter Kit

Item 1093

This brand new transmitter provides phone and CW operation on 80, 40, 20, 15, 11, and 10 meters. Plate power input is 65 watts on CW, and controlled carrier modulation peaks to 50 watts on phone. Completely bandswitching.

Husky power transformer and choke are potted and the circuit is well-shielded. Two-stage 12AX7 speech amplifier, 12AU7 modulator, 12BY7 oscillator, 12BY7 buffer and a 6146 final. The buffer stage assures plenty of drive to the final on all bands. Pi network output coupling employed for easy antenna loading.



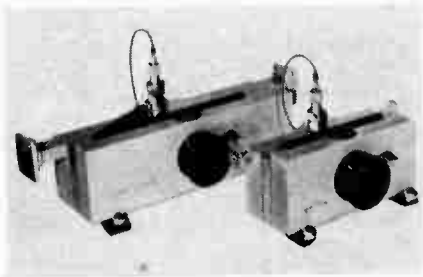
Provision for switch-selection of three different crystals. Can be changed without removing transmitter cabinet.

Front panel controls include a function switch with positions marked OFF-CW-STANDBY-PHONE, final tuning, antenna coupling, drive level control, and band change switch. Meter indicates final grid or plate current. Truly a remarkable transmitter package for the price. Ideal both for the novice and for the more experienced operator.

For further data on advertised products use page 65.

● **Standing Wave Detector**
Item 1094

A high-accuracy standing wave detector for measuring bandwidths ranging from 5.85 k.m.c. to 90 k.m.c. has recently been announced. The instrument uses a 5-point kinematic carriage suspension which assures maximum linearity of probe motion. The carriage rides on stainless steel ball bearings which are precision ground and spring loaded to keep perfect alignment. A large knob controls the carriage motion from a comfortable stationary position, leaving eyes free to watch the indicator. Knob speed is continuously variable, from "fast" to "vernier".



To eliminate mismatch due to imperfect milling, the waveblock is precision formed in one piece. This permits high internal uniformity, which in turn provides a uniform path for measured waves, and minimizes residual VSWR. The block is made of non-warping aluminum, precision milled to assure absolute alignment with the probe carriage. Three levelling screws support the instrument without rocking.

One instrument will handle another frequency band by using a different size waveguide block and probe. Of these, nine sizes of each are available — all interchangeable in 30 seconds, without loss of accuracy. Thus one carriage and six alternate blocks and probes will handle from 12.4 k.m.c. to 90 k.m.c. Another carriage and three alternate blocks and probes will handle from 5.85 k.m.c. to 12.4 k.m.c. Probes need no tuning over the allocated waveguide band, and yet are efficient at all frequencies.

● **High Resolution Precision Potentiometers**

Item 1095

The new series K-200 high resolution potentiometers are especially designed for low torque, high function angle applications.

These 2", ball-bearing potentiometers are completely enclosed and can be used as



single or multiple ganged units. Any practical number of potentiometer sections can be ganged on a single shaft by one piece stainless steel clamp rings. This arrangement permits precise phasing of each unit without disassembly and independently of other units.

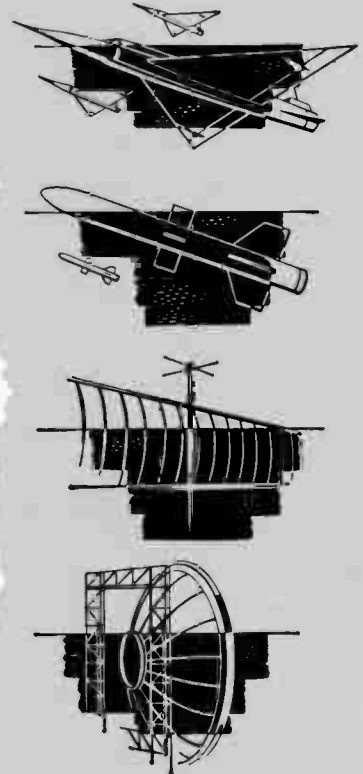
A new, illustrated technical data sheet gives complete specifications and outline drawing.

(Turn to page 71)

CANADIAN MADE Aerovox capacitors

have M.I.L. approval

TYPE DESIGNATION MIL OR JAN	AEROVOX PART
CM45	1459
CM20	1468 & 1469
CM30	1467 & 1464
CM35	1467 & 1464
CM45	1445, 1446, 1447
CM50	1445, 1446, 1447
CC20	CN-1
CC21	CI-1
CC25	CN-2
CC26	CI-2
CC30	CN-13 & CN-27
CC32	CN-7 & CN-19
CC36	CI-3
CE31	E
CE32	E
CE33	E
CE41	G
CE42	G
CE61, 62, 63 & 64	BT
CE53	AEP
CP04 thru CP10	PI23M
CP25 thru CP29	89
CP53, 54, 55	30
CP61, 63, 65	16
CP67 & CP69	18
CP70	09



Military
or Commercial...
whatever your
needs in capacitors...
meet them with
quality products
by Aerovox.



Standardize with AEROVOX

AEROVOX CANADA LIMITED
HAMILTON, CANADA

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

WESTERN SALES | IN U.S.A.

Chas. L. Thompson Ltd., Vancouver, B.C.

Aerovox Corporation, New Bedford, Mass.

5604



announcing

Canada's first
full scale

**ELECTRONICS
and NUCLEAR
SCIENCE**

CONVENTION

and exposition

**OCTOBER 1-2-3
1956**

**AUTOMOTIVE BUILDING
EXHIBITION PARK
TORONTO, CANADA**

A milestone in the development of electronics and nuclear science!

The three day programme of exhibits and technical papers by leading experts will be a must for thousands of engineers, technicians and buyers.

Plan your company's exhibit participation now. Write today for your copy of the descriptive brochure.



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**30th ANNIVERSARY in CANADA
The INSTITUTE of RADIO
ENGINEERS**



Book Review



High Temperature Technology, sponsored by The Electro-Chemical Society, Inc. of New York, N.Y., and edited by Dr. I. E. Campbell, Chief of the Division of Inorganic Chemistry and Chemical Engineering at Battelle Memorial Institute.

This book is divided into four sections: an Introductory Section tracing the development of modern refractories and modern high-temperature techniques; a Materials Section, a Methods Section; and a Measurements Section.

In the Materials Section, it has not been possible to include an extensive treatment of metallic materials. However, few metallic materials are potentially useful at the temperature range of primary interest in this monograph. A brief discussion of metallic materials is presented to point out their potential usefulness in special applications and their shortcomings as materials of construction for high temperatures. This is followed by a discussion of such refractory materials as oxides, carbon and graphite, and carbides which, though undergoing continuing development, have been, with certain exceptions, used industrially for some time. Finally the newer refractory materials such as the silicides, nitrides, and sulfides are reviewed along with the cermets, recently developed composite materials, designed to combine the desirable properties of both metallic and ceramic materials. Although some reference is made to intermetallic materials in the Introductory Section, no detailed discussion of intermetallic compounds is presented. Discussions of the fluorides, oxyfluorides, oxysulfides, and phosphides have not been included because of the relatively small amount of information available on these materials. However, it is not impossible that one or more of these materials may be of interest for special applications as further developments are made.

Although sintering is a well-established technique, a detailed discussion of sintering has been presented in the Methods Section because of the importance of sintering to the field of high-temperature refractories. This is followed by discussions of various types of furnaces and other means for securing very high temperatures.

In the final section on measurements, a critical discussion of temperature and equipment for its measurement is presented.

High Temperature Technology is published by John Wiley and Sons, Inc., 440 Fourth Avenue, New York 16, N.Y., contains 526 pages, hard cover bound, price \$15.00.

Inventions And Their Management by Alf K. Berle and L. Sprague de Camp, Third Edition (Revised).

This book tells the aspiring inventor how to approach the business of inventing and what to do once the invention has been made; and above all it tells him what not to do. This volume has been accepted by leading colleges and universities throughout the country for classroom use and is recognized as a standard handbook for inventors, investors, company executives and business men, as well as an excellent reference book for libraries. Many attorneys keep a copy on hand to lend to their clients.

Non-technical, but covering a highly technical subject, this book accurately teaches the language of the business of inventing as used by attorneys, engineers and executives working extensively in this field. By giving a logical grasp of the legal, technical and commercial terms having to do with the subject, it enables the inventor to understand the people he must work with, and to make himself understood by them.

Inventions And Their Management is published by D. Van Nostrand (Canada) Limited, 25 Hollinger Road, Toronto 16, Ontario, Canada, contains 742 pages, hard cover bound, price \$10.75.

Guidance, by Arthur S. Locke and contributing authors from the Naval Research Laboratory, being the Principles of Guided Missile Design, a new series edited by Grayson Merrill, Captain, U.S.N.

An increasingly large portion of scientific and industrial effort is being directed toward research and development on guided missiles. This first book in the Principles of Guided Missile Design series brings together the most recent information on the key topic of Guidance.

Every basic problem encountered in directing a controlled missile reliably to its target is considered. From a discussion of fundamental problems, the book proceeds to the different methods for obtaining intelligence of a target by employment of infrared, radio and acoustic waves, and fixing its location by terrestrial and celestial references. It covers the mathematical groundwork needed for solving guidance problems and gives an unusually lucid exposition of related servo system theory.

Tactical considerations limiting the employment of guided missiles, an analysis of the several flight trajectories, the uses of radar in tracking targets, and bandwidth studies are given in detail. Among the other topics covered are guidance problems arising during the prelaunching and launching phases, economic considerations, the influence of airframe design upon choice of guidance systems, and methods of simulation, computation and telemetry.

An invaluable survey of guidance devices and techniques, this book is an essential background for work with missile guidance systems, even for those already in the field.

Guidance is published by D. Van Nostrand (Canada) Ltd., 25 Hollinger Rd., Toronto 16, Canada, contains 729 pages, hard cover bound, price \$13.50.

Switching Relay Design by R. L. Peek, Jr. and H. N. Wagar, Switching relays are essential elements in a wide variety of computing devices, automatic control apparatus, and communication systems. This book employs a fresh analytical approach in developing the design relations of the mechanical contacting system and the actuating electromagnet of a switching relay, leading to an integrated treatment of the dynamic performance. Analytical procedures are given for evaluating the characteristics of an existing relay and for predicting those of a proposed design. Analysis is employed to determine the design conditions for attaining optimum performance.

The treatment of pull and magnetization characteristics is based on the relations between the field energy of an electromagnet and its mechanical output. Energy relations are similarly used in analyzing dynamic performance for the design of high speed and time delay electromagnets. The heating relations affecting coil design and capability are developed, as is the dependence of speed and sensitivity on coil dimensions and characteristics.

This book has evolved from texts for training courses in relay design given at Bell Telephone Laboratories and draws on the accumulated experience obtained there in developing central office switching apparatus. The presentation serves both as an engineering text and as a reference book and design manual for relay engineers.

Switching Relay Design is published by D. Van Nostrand (Canada) Ltd., 25 Hollinger Road, Toronto 16, Canada, contains 478 pages, hard cover bound, price \$10.25.

Orders for books reviewed should be addressed to the publishers or their Canadian agents.

For further data on advertised products use page 65.

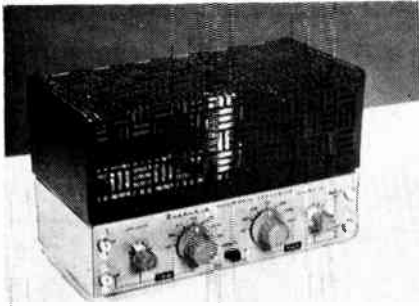
NEW PRODUCTS

(Continued from page 69)

● **Electronic Cross-Over Kit, Model XO-1**

Item 1096

This exciting new electronic cross-over system is designed to operate ahead of the main power amplifiers instead of between the amplifier and the speakers. It consists of two independent electronic filters, one high-pass and one low-pass, and each with a rotary switch for selecting the cutoff frequency. A single input is divided so that high frequency and low frequency portions of the spectrum are available at the outputs to feed separate amplifiers. The XO-1 represents a new approach to high fidelity music reproduction and offers many advantages over conventional cross-over systems.



Because high and low frequencies are amplified separately, intermodulation distortion problems are virtually eliminated. Handles unlimited power because frequency division is performed ahead of the power stage. No audio power consumed by the cross-over itself. Eliminates unstable loading conditions and matching problems. Does

not affect amplifier damping factor. Each channel has its own separate level control for more flexible frequency balance. There is negligible level change as the cross-over frequency is adjusted.

Cross-over frequencies are 100, 200, 400, 700, 1200, 2000, 3500 cps. Attenuation is 12 db per octave with sharp "knee" at the cut-off frequency, instead of a rounded slope as obtained with the usual RC filter. A unique answer to frequency division problems.

● **Regohm** *Item 1097*

Regohm is a compact, universal, electric-circuit controller used to regulate voltage, current or speed and to perform important control functions in many types of servo systems. It can be used for power amplifying, impedance matching, zero-error controlling, and system stabilizing. In circuit design, Regohm offers these advantages: low operating power, fast acting, lasts for years, performance is mathematically known, continuous control, versatile control characteristics, sturdy and temperature-stable — all the factors desirable for precise, efficient circuit regulation.

● **Microwave Tubes And Components**

Item 1098

—A manufacturer has recently released a new 6-page folder which gives a partial listing of their tubes and components. Included are specifications for TR, ATR, Pre-TR and attenuator tubes, special shorted TR and ATR tubes, dual and triple TR and ATR tubes, pressurizing windows, spark gap tubes, surge protectors, silicon diodes, magnetrons, reference cavities, shutter tubes, klystrons, hydrogen thyratrons and travelling wave amplifier tubes. Also included are representative pictures of different types of tubes, and a brief description of the firm's service to the electronics industry.

● **Flexible Ferromagnetic Plastic** *Item 1099*

A new ferromagnetic plastic in the form of flexible rod and tape and known as Ferrotron has been developed recently in the form of rigid powdered iron cores.

Both the flexible and rigid materials are said to be suitable for continuous operation to 200°C. They offer resistance to severe humidity conditions, very high impact strength, good machinability, high volume resistivity and positive "Q" temperature coefficients.



The flexible Ferrotron has been tested as a highly useful material for improved delay line construction. Other indicated uses include: combined insulation and core material around and between the winding of transformers, chokes and similar inductors; electromagnetic shielding where isolation around emissive components is desired; a magnetic base or overlay for printed circuit inductors; a means of trimming inductive devices; magnetic bobbins for coils, and various flexible constructions to produce variable inductance.

New design versatility can be based on the inseparability of the magnetic and dielectric properties in all forms of the material. This promises to be useful in venturing into the complex phenomena of electromagnetic transmission theory, particularly at radar frequencies.

(Turn to page 72)

Bendix

Builds a Better Cable Clamp—the

AN 3057B

Inexpensive, Efficient, Versatile

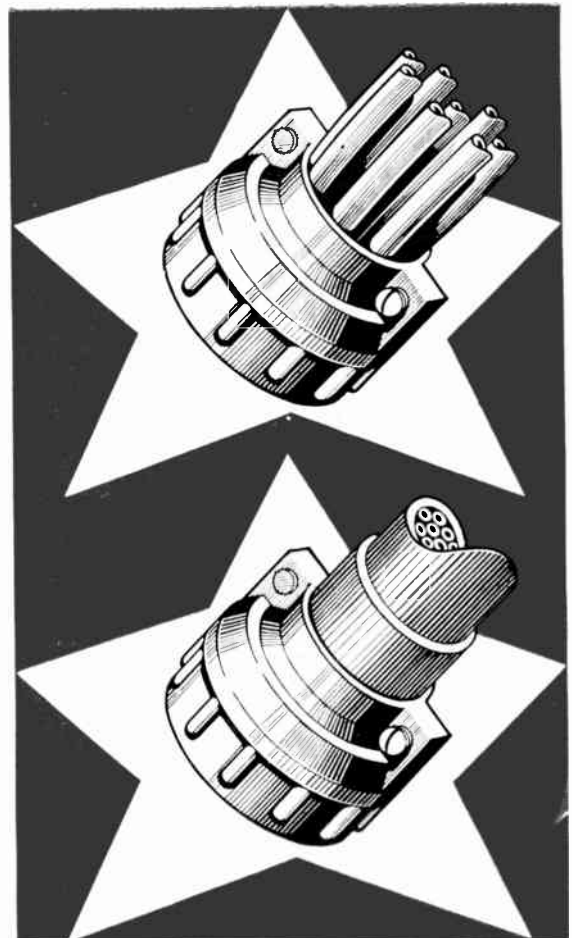
The new Bendix AN approved AN3057B cable clamp is now available. Engineered by Bendix to the highest-quality standards, this cable clamp offers major design improvements. The clamping action is radial and completely eliminates wire strain and chafing by holding the wire bundle firmly in rubber. This clamp will accommodate a wide range of wire bundle sizes, but an even greater range can be handled through the use of the Bendix AN3420A accessory telescoping sleeve.

The new AN3057B cable clamp will also waterproof multi-conductor rubber-covered cable on the rear of a connector, or where moisture-proof entrance through a bulkhead or into an equipment box is required.

Complete detailed information is available on request.



SCINTILLA DIVISION OF
SIDNEY, NEW YORK





AN3057



AN3057A

CABLE CLAMPS

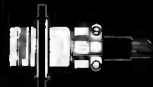


AN3420

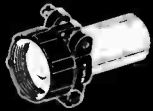
TELESCOPING BUSHINGS

The accessories you need for **AN type connectors!**

HOW THEY ARE USED

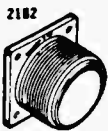


Hold cable or wire, prevent twisting or pulling of soldered connections, assist in moisture protection.



Eliminate need for taping or wrapping wires. Keep dirt, oil and moisture out of end bell.

Accessories in the AN Series were designed to take care of secondary special needs. You'll find the Cannon line complete . . . featuring the same high quality in materials and workmanship that characterizes Cannon "AN" Connectors . . . adaptable to all makes of AN connectors and to other connectors made by Cannon. Ask your industrial electronics distributor.



DUMMY RECEPTACLES



Act as holding receptacles for AN3106B and AN3108B plugs when not in use. Give you a place to put the plugs.

JUNCTION SHELLS



2120



2245



Eliminate cumbersome junction boxes, reduce costs in assembly, expedite inspection, save weight and space, cover terminals, shield wires behind panels.

DUST CAPS



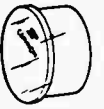
17530-20



2322



Protect contacts and insulators from moisture, foreign matter. Protect "live" circuits. With or without chains.

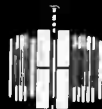


Plastic protective dust caps for all AN types and sizes of connectors.



AN3058

CONDUIT FITTINGS



AN3058 with AN3066 locknut. The Cannon line includes AN3054, AN3055, AN3056, AN3058, AN3064, AN3066, AN3068.



AN3111

BONDING RINGS



Used wherever there is need for bonding between plug end bell and wire shielding.

Please refer to Dept 5603



CANNON PLUGS

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

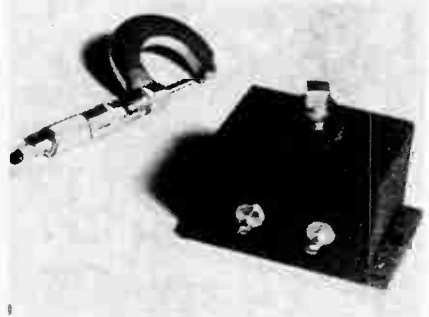
NEW PRODUCTS

(Continued from page 71)

● **New "V-Cap" Vernier Capacitor**

Item 1100

The Balco "V-Cap" vernier capacitor is a quality component specifically designed for computer applications. It is recommended, however, for any application where a 0.1 to 1 mfd. capacitor must be adjusted to an accuracy of better than 0.05 per cent and where very high orders of stability are needed. Customers have reported stabilities better than 0.01 per cent. Of particular interest is the almost undetectable dielectric absorption and insulation resistance of 10^{11} ohms. Dissipation factor is only .0005.



The range of adjustment is plus or minus one per cent on either side of the nominal capacitance and adjustment accuracy is limited only by the resolution of the measurement technique.

The unusual stability of these capacitors is attained by special treatment of the dielectric, by the use of extremely rugged mechanical design, and by a specially-developed system for accomplishing the capacitance variation. Hermetic sealing is maintained for the life of the unit by the use of soldered joints. The case is of one piece construction with wall thickness averaging a quarter of an inch. The movement necessary for the control of the capacitance is transmitted through a metal bellows.

● **New Concept In Precision Potentiometers**

Item 1101

Linearity — 0.005 per cent (Terminal) 10 turn Multiturn with continuous rotation extended frequency limits without phase shift. Other mechanical and electrical advantages.

The Dipot makes use of a double Kelvin-Varley circuit which is automated to give a continuous, precisely linear voltage division.



It depends on matched resistors instead of a helical coil for linearity. It is available in a 5 or 10 turn pot with or without centertap and also a special servo model which allows 180 degree over travel on each end to prevent overshoot or end sticking. The case size is 2 inch diameter 2 1/4 in. long. A descriptive brochure is available which gives specifications and application information.

(Turn to page 74)

Get the complete story. Write TODAY for Cannon AN Bulletin!



For further data on advertised products use page 65.

**this new crest  marks the beginning of
a new, leading source of supply for**

**R.F. CO-AXIAL CONNECTORS
R.F. PULSE CONNECTORS
and ASSOCIATED COMPONENTS**



**THE DIAMOND DIVISION
of CANNON ELECTRIC COMPANY**

The Cannon Electric Company has purchased the facilities of the Diamond Manufacturing Corporation, Wakefield, Mass. — leading manufacturers of radio frequency co-axial and pulse connectors and associated components.

Cannon now has a complete stock of Diamond products at their Canadian factory, and plans to manufacture the various types that are in demand in Canada.

a catalogue that includes the complete Diamond line is now available

Write for your free copy today!

Address all enquiries about Diamond products to:

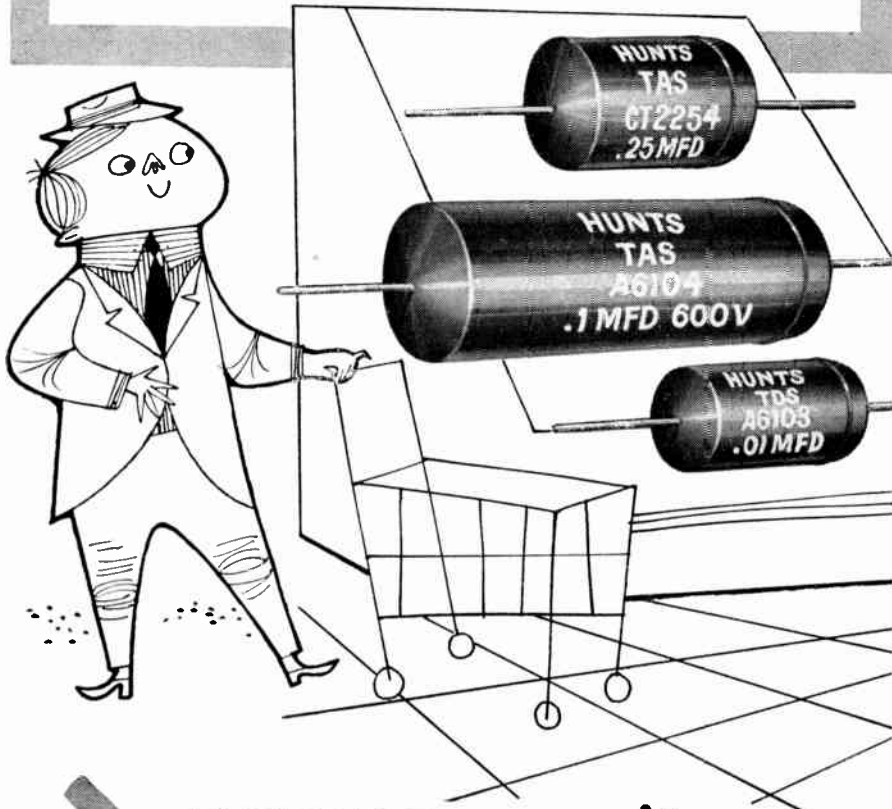
CANNON ELECTRIC CANADA LIMITED

160 BARTLEY DRIVE, TORONTO 16

Quebec: Cannon Electric Canada Limited, Montreal Airport, Dorval, P.Q.

5610

shopping for capacitors?



→ HUNT capacitors can fill all your needs

engineered to meet
Canadian requirements

CAPACITOR RANGES*

100 V	from .001 mfd to 2 mfd
200 V	from .001 mfd to 2 mfd
400 V	from .680 mmfd to 1 mfd
600 V	from 2.5 mmfd to .27 mfd
1000 V	from .001 mmfd to .1 mfd

*If your requirements are other than shown, Hunt Capacitors (Canada) Limited is fully equipped to engineer and produce capacitors to your exact specifications.

HUNT CAPACITORS (CANADA) LIMITED

830 BAYVIEW AVENUE, TORONTO, ONT.

Hunt Capacitors (Canada) Limited produce a wide range of finest quality capacitors in many shapes, sizes and materials to meet every need of the Canadian manufacturer. Standard Hunt Capacitors operate throughout the temperature range of -30°C. to $+85^{\circ}\text{C.}$ and tolerances of $\pm 20\%$. Closer tolerances are available on special order. See your Hunt representative or write us for information on the complete Hunt Capacitor line.

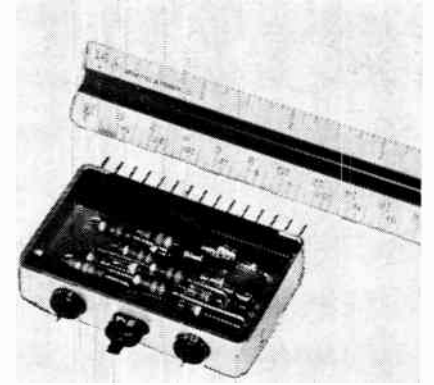
NEW PRODUCTS

(Continued from page 72)

• Transistorized Logical Building Blocks

Item 1102

These exclusive new Crosley transistorized computer elements offer the digital system designer, logician or computer engineer new freedom in using logical elements in system construction. They may be used with the same flexibility of application as resistors and capacitors.

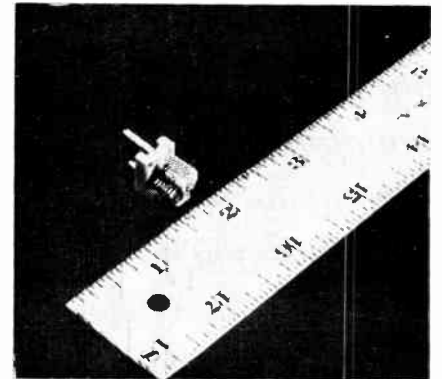


They are small, rugged, independent of environmental conditions, temperature stable from -50 to $+55^{\circ}\text{C.}$ No critical trigger impulse restrictions. Power consumption under $\frac{1}{2}$ watt. Units are designed for operation at pulse repetition rates as high as one megacycle and in general are able to supply clamped 10 volt output pulses into loads in excess of 25 ma. Maximum rise and decay times are below 0.15 microsecond. Seven types available. Canadian designed.

• Air Dielectric Trimmer Capacitors

Item 1103

Three new miniature air dielectric trimmer capacitors, the smallest ever made in the United States are now on the market. Designated Subminiature Trimmer Series 75, the new units are designed for tab mounting on dip-soldered printed wiring boards or screw-mounting on conventional chassis. The new trimmer capacitors measure just $\frac{3}{16} \times \frac{1}{16} \times \frac{1}{32}$ behind mounting surface.



The new trimmer capacitors have a minimum effective capacity range of 5, 10 and 15 $\mu\text{f.}$ The nominal minimum capacity of the three units is 1.2, 1.2 and 1.5 $\mu\text{f.}$ respectively. The sturdy and unique ceramic body design is responsible for the extremely low minimum capacitance. Insulation resistance, "Q" and thermal characteristics are excellent.

The brass stator and rotor assemblies and rotor contact spring are silver plated. The units are easily adjusted by means of a screwdriver slot provided in the rotor shaft.

For further data on advertised products use page 65.

indispensable for measurement and reception



MODEL R



with these special features:

- **HIGH SENSITIVITY & SELECTIVITY**
Automatic tracking, double-tuned cavity pre-selector.

- **EXCELLENT GAIN STABILITY** —
Equipped with AGC; "signal-lock" AFC.

- **SELF-CONTAINED** —
Electronically regulated low and high voltage power supplies.

- **UNI-DIAL CONTROL** —
tracks automatically, direct reading linear dial.

SPECIFICATIONS

Basic Receiver: Model R-B
 Tuning Unit Frequency Ranges:
 Model RL-T: 950 — 2,040 mc
 Model RS-T: 1,890 — 4,320 mc
 Model RM-T: 4,190 — 7,720 mc
 Model RX-T: 7,260 — 11,260 mc

Signal Capabilities:
 AM, FM, CW, MCW, pulse

Sensitivity:
 -80 dbm or better throughout range on all models

Frequency Accuracy:
 ±1%

IF Bandwidth: 3 mc
 Video Bandwidth: 1.5 mc
 Image Rejection: Greater than 60 db
 Gain Stability with AFC: ±2 db
 Automatic Frequency Control
 Pull-out range 10 mc off center

Recorder Output: 1 ma full scale
 Trigger Output:
 10 v. pulse across 100 ohms
 Audio Output:
 5 v. undistorted across 500 ohms

FM Discriminator
 Deviation Sensitivity: .7 v./mc

Skirt Selectivity:
 60 db — 6 db bandwidth ratio less than 5:1

IF Rejection: 50 db

Input AC Power:
 105-125 v., 60 cps, 440 watts

Input Impedance: (ANT) 50 ohms

VSWR: Less than 4:1 over band

Range of Linearity: 60 db

Receiver Type: Superheterodyne

Maximum Acceptable Input
 Signal Amplitude: 0.1 v. rms without external attenuation

Video Response: 20 cps to 1.5 mc
 Size: 17" w x 23" d x 19" h
 Weight: 180 lbs.

Price:
 Model R-B (Basic Unit): \$1,500
 Model RL-T: 2,500
 Model RS-T: 2,500
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