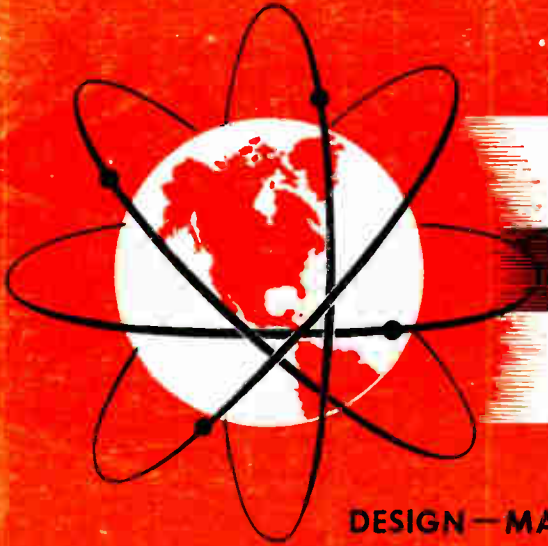


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# ELECTRONICS *and* COMMUNICATIONS

DESIGN — MANUFACTURE — ENGINEERING — DISTRIBUTION — APPLICATION

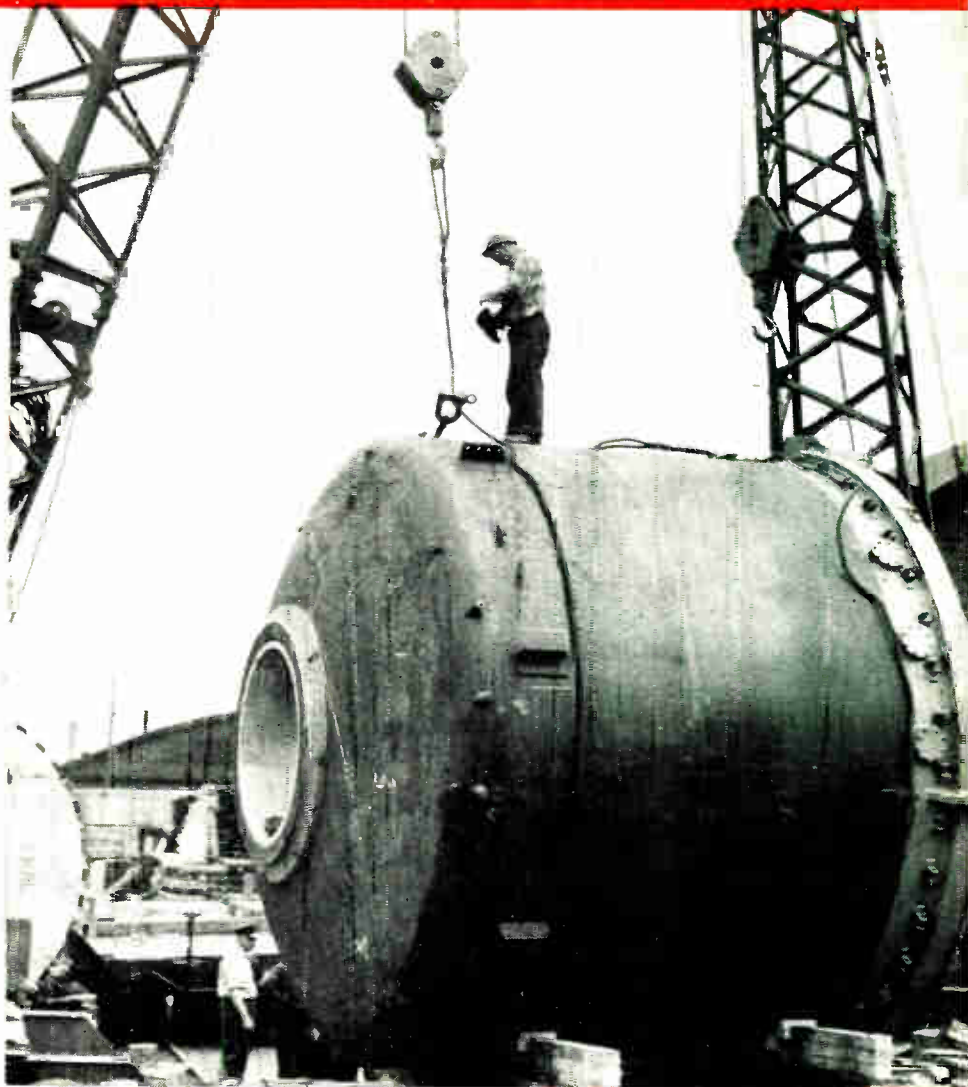
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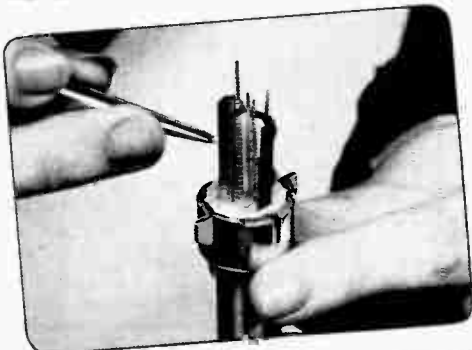
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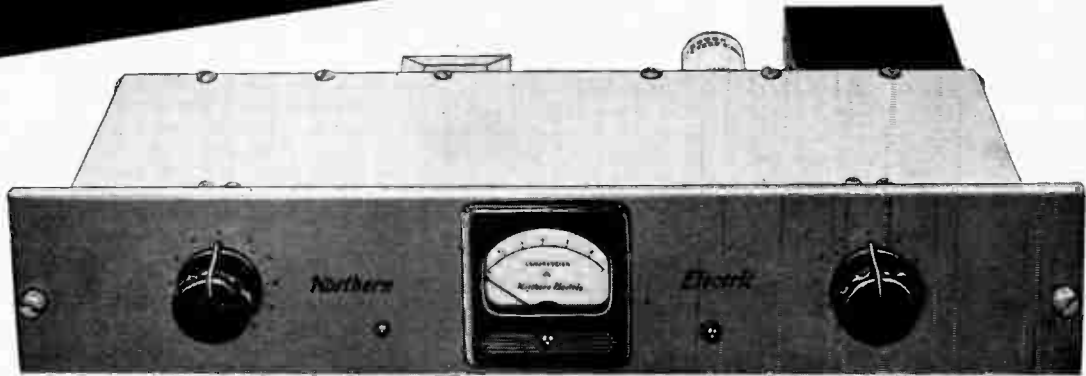
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for rack mounting

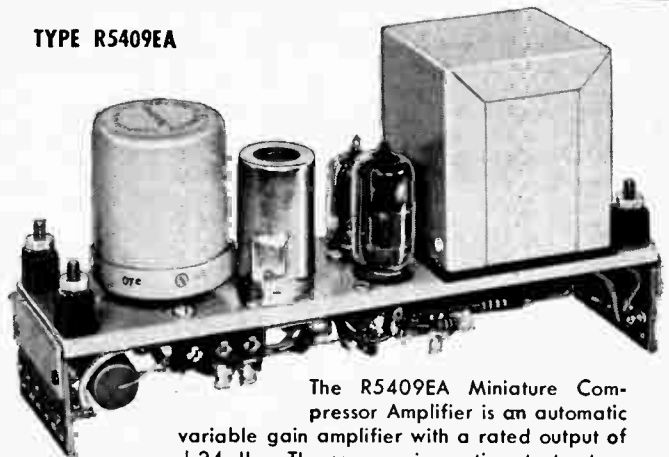


**TYPE R19703A** The R19703A Compressor Amplifier is an automatic variable gain amplifier assembly made up from the R5409EA Compressor Amplifier and an R17562B Power Supply. The front panel of the amplifier assembly is equipped with a meter measuring decibels of compression and marked at the 6 db level in order to conform with Department of Transport regulations which specify not more than 6 db of compression be used. Daven attenuators are provided on the front panel so that the input and output levels can be adjusted over the ranges of 40 db in 2 db steps and 20 db in 1 db steps respectively.

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## TYPE R5409EA



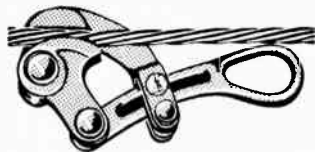
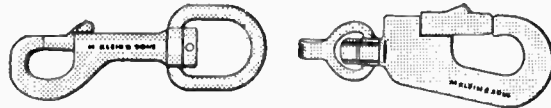
The R5409EA Miniature Compressor Amplifier is an automatic variable gain amplifier with a rated output of +24 dbm. The compressing action starts at an output level of approximately +14 dbm and the maximum amount of compression obtainable is 20 db. The Knee or Verge point of compression and the amount of compression are fixed quantities in this unit along with the attack and recovery times. These quantities are considered average for program service.

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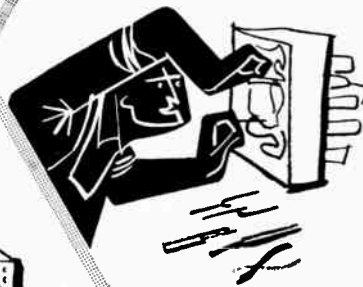
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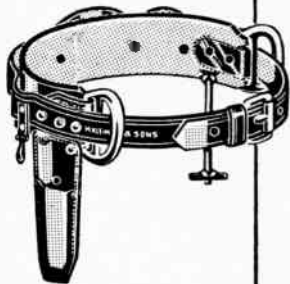
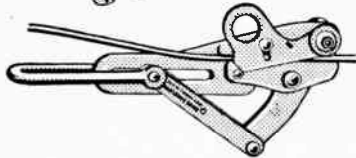
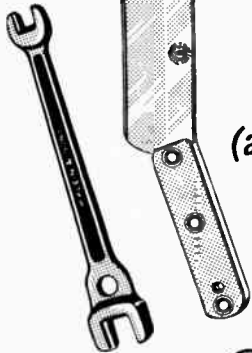
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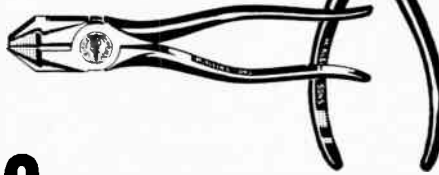
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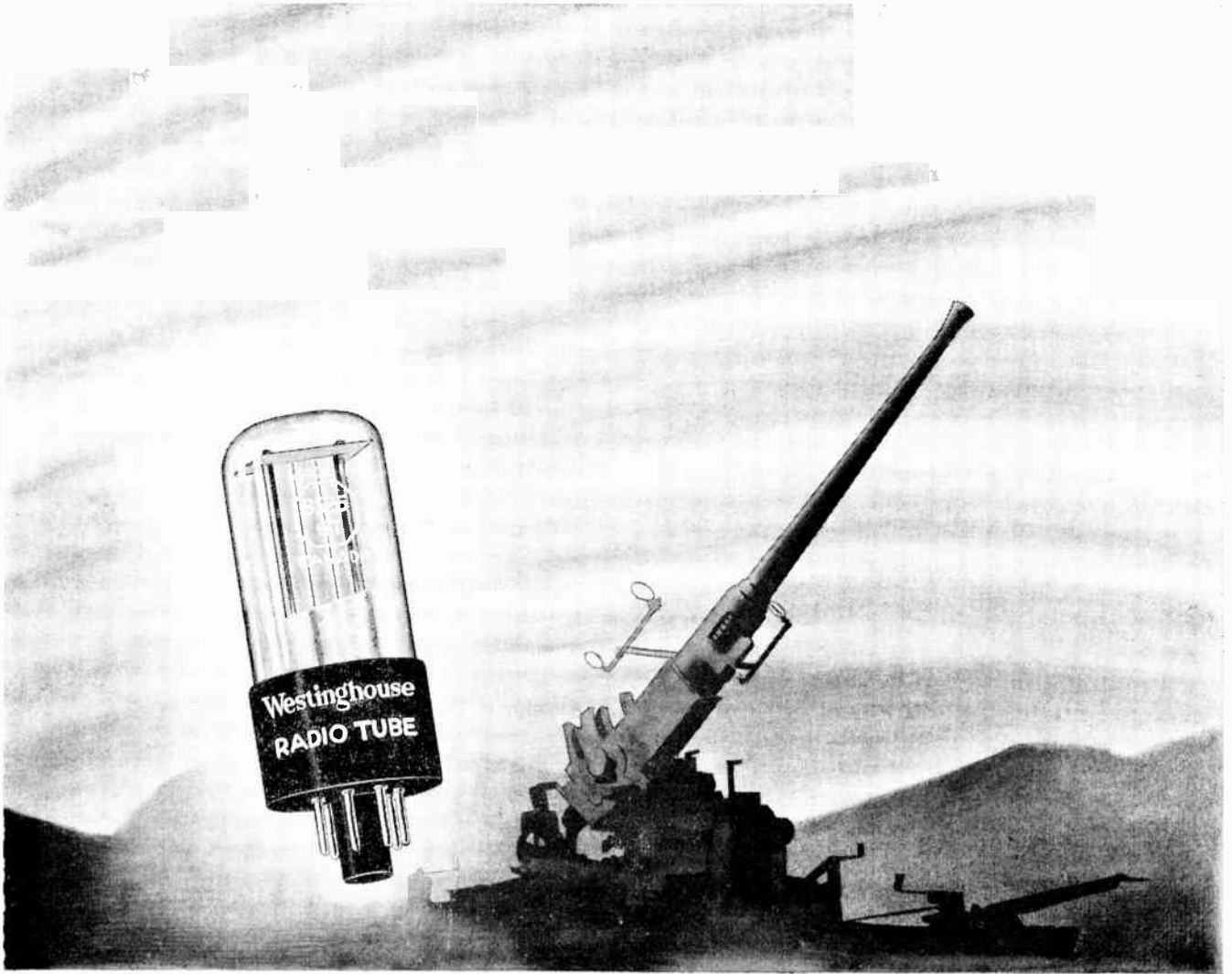
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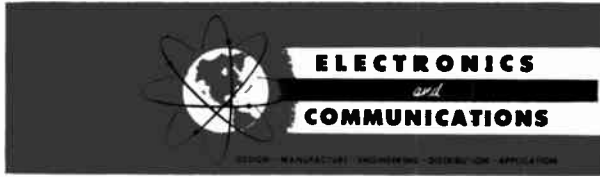
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THE ONLY CANADIAN JOURNAL DEVOTED SPECIFICALLY TO THE APPLICATIONS OF COMMUNICATIONS AND ELECTRONICS

**JULY** • **1956**  
**Vol. 4**      **No. 6**

Printed, Engraved and Produced in its entirety by AGE PRESS  
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 Room 504, Dominion Square Building  
 1010 St. Catherine Street West  
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Member Canadian Circulation Audit Board, Inc.



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CANADIAN GENERAL ELECTRIC COMPANY LIMITED

World Radio History



# RETMA REPORT

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

By  
BASIL JACKSON



## Electronic Research And Development In Canada

The vital need for research and development programs to be undertaken in Canada was further emphasized at a Research and Development Panel organized by the Electronics Division of RETMA at the 27th Annual Meeting held at Ste. Adele-en-haut, P.Q. recently.

The Panel was under the chairmanship of J. C. R. Punchard, Vice-President of RETMA and chairman of the Electronics Division. The speakers were E. Leaver, President, Electronic Associates Limited, L. T. Baird, Assistant Manager, Commercial Products Division, Canadian Marconi Company, and H. S. Dawson, Manager, Department of Engineering, Canadian General Electric Company Limited.

Mr. Leaver's address, entitled "The Need For Research And Development", emphasized the necessity for research and development for Canadian survival in both military and economic sense, and said that without a continual stream of technical ideas in the form of discoveries and inventions, our society would diminish. In stressing the need for more research programs in Canada, he stated that Canadians had "progressed" from political to intellectual colonialism, and he considered that this kind of colonialism was a greater threat to Canadian independence than the former type.

"In our economy," said Mr. Leaver, "confidence and hope produce prosperity. If they falter, so does the pace of production, and soon recession and depression engulf us. We have all within our lifetime seen striking and convincing evidence of this at least once. This should have taught us that the enterprise system of society is a rate society. It is not a status quo affair. Our system can change constructively, or it can change by falling apart, but change it most assuredly will!"

Rate societies lived by changing and, in the past, they prospered by fits and starts. Prosperity was generated by geographical expansion and as in most countries borders were now fairly stabilized, expansion could take place only in the domain of knowledge.

The speaker said that if we wanted a stable economy, we must diversify it by continually bringing forth new productive facilities, new products and new services.

"If we want to be a nation, we must act like one and be able to stand on our own feet," said Mr. Leaver.

"Research and development," stated Mr. Leaver must be encouraged by tax and other incentives that will encourage technological advancement from the idea stage to the replacement of obsolete machinery."

Mr. Baird, in his address entitled "Projected Scope Of Research And Development In Canada", suggested that Canadians generally exhibit the unhappy national characteristic of diffidence, amounting virtually to a sense of inferiority, in the matter of research. Dependence on research accomplished in the United States and Great Britain must cease if Canadians were to do a significant amount of research work of their own. He said that the scope of the Canadian electronics industry's research was to seek new knowledge with direct applications in mind, or to apply current knowledge for producing cheaper and more effective communication or control equipment, to meet the industrial needs of the future.

He emphasized that his remarks applied to research activity in industrial organizations in the general field of electronics, and not to public bodies.

The speaker said that Canadians took pride in being regarded as a country of pioneers and workers on the frontiers but that we were apparently still thinking of pioneering in the sense of exploitation of natural resources such as lumber, minerals, and water power. We bowed ourselves out when it came to pioneering in technology.

(Continued overpage)

# RETMA REPORT

He paid tribute to the research work being done by public organizations and thought that Canada should not attempt to carry on research on the same scale as the United States or Great Britain.

"We would do well perhaps to take over, from Canadian Government bodies," said Mr. Baird, "those projects which have direct and immediate applications to the design of specific equipment with a very definite practical end in view. Government controlled and financed research belongs properly, in my opinion, to that sphere in which intelligent experiments are performed on the fringe of current knowledge, looking for new ideas and new information that may be uncovered. The scope of Canadian industrial electronic research is to look for new knowledge with direct applications in mind, or to take knowledge recently uncovered and apply it to the everyday business of producing better, cheaper and more effective communication or control equipment, to meet the industrial needs of tomorrow, of next week and of next year."

Mr. Bird suggested that Canadian companies should allocate the same percentage of their gross sales to the financing of research as is common practice in the United States. Two percent was a low figure while four percent was not uncommon.

The speaker said that we should meet the weight of the research effort being conducted in other countries with vigor and agility. His experience had shown that well-trained workers with imagination and initiative, if given proper facilities and a reasonable supporting staff, can produce major contributions to the electronic art which match anything produced in other countries.

Mr. Dawson's address, entitled "Integration Of Canadian Research And Development Programs With Foreign Programs", mentioned the duplication of engineering projects that inevitably resulted due to the free enterprise system of doing business. Not only were companies in each of the allied countries vigorously competing with each other in military development but to some extent so were the Government laboratories of the various countries.

On the question of the shortage of engineers Mr. Dawson referred to the recent visit to Russia of James S. Duncan, President of Massey-Harris-Ferguson Limited. Apparently, while 23,000 engineers graduated from United States universities in 1954, the Russians graduated 54,000 engineers with 50% more hours of study to their credit than their American counterparts. If the 1,500 Canadians and 5,000 to 7,000 British engineering graduates a year were added to the United States quota, it was obvious that the Western World was not winning the race towards technical supremacy if the number of engineers can be regarded as any criterion.

"My question is, therefore, can we allow ourselves the luxury, under these circumstances, of the great engineering duplication that inevitably occurs in our free enterprise system of doing business," asked Mr. Dawson. "Not only are companies in each of the allied countries vigorously competing with each other in military development but so are, to some extent, government laboratories between countries." Mr. Dawson pointed out, however, "that there has been a certain amount of agreement between Canada, the United States and Great Britain as to which fields each of us would specialize in for our government development."

It had frequently been said that industry did not do enough development work financed from its own funds and in the military field a serious obstacle to this was due to a lack of government guidance regarding probable operational requirements and problems, a situation which is worse in Canada than in either the United States or Britain.

"What can we do about it?" asked Mr. Dawson. "One way is to persuade the Government to separate development engineering from equipment procurement and handle it on a directed basis with the objective of placing the work in the industry where the skills are without a lot of haggling and delay. It would also be necessary for the procurement people to take some responsibility for continuing the load to keep the engineering teams together."

In conclusion the speaker said that he had found the Canadian engineer fully capable of holding his own with engineers from other countries, even when less money was available for the work program. In fact, Canadian engineers had clearly shown on many occasions that, due to the carrying out of scientific work without an over-abundance of money or equipment, they are more accustomed to overcoming obstacles which would have stopped engineers elsewhere.

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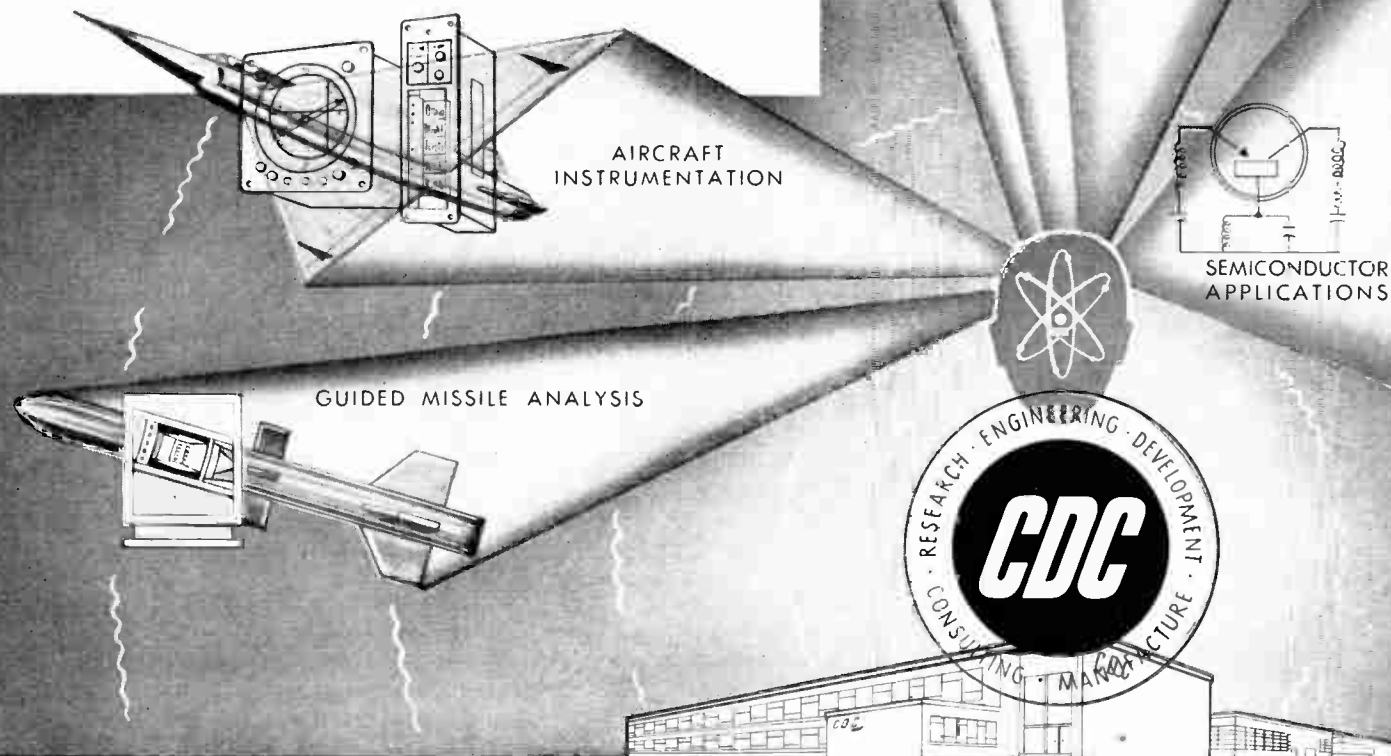
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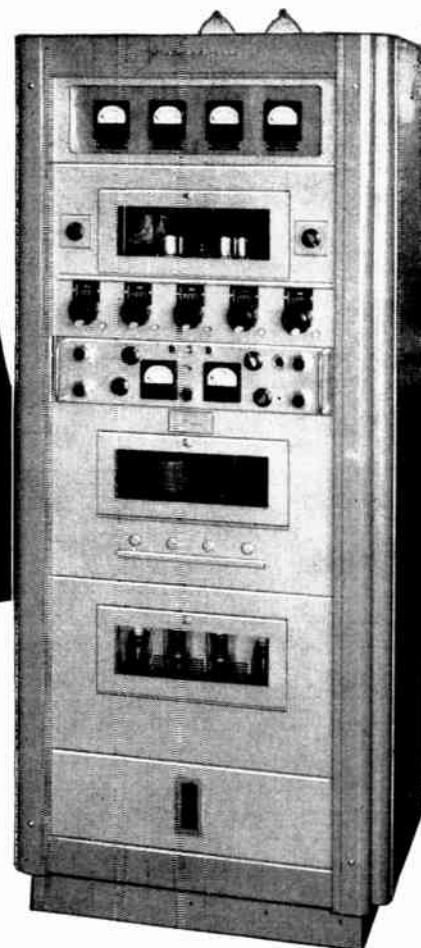
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For further data on advertised products use page 61.

# One More Step To Go!

*It has recently been announced by Canadian television receiver and transmitter manufacturers that they have formally adopted the color television engineering standards proposed by the Canadian Radio Technical Planning Board, and, with this move, there is but one more step to be taken to make color television an accomplished fact in Canada. The step is for the authorities to come to a decision on color television programming.*

*The Canadian electronics industry is now ready to proceed with the production of color television sets and transmitting equipment but most manufacturers, however, are reluctant to tool up their plants until a more positive move is made in the matter of telecasting color programs in Canada, and it is not likely that the public will indulge in the expense of color receivers if they cannot see color programs on them.*

*The question then arises: why the delay in an official announcement on color television policy? Does anyone know the reason?*

★ *If it is a question of finance, could not an appropriation be made from the general revenue? If it is a question of facilities, use should be made of the existing microwave networks linked to the United States over which U.S. color programs could be re-transmitted in Canada until such times as our own facilities are ready. If the delay is due to lack of color programming experience, television stations should have their licenses extended to permit them to telecast in color. Finally, if the delay in color telecasting in this country is due to reluctance on the part of the authorities because of the lack of color receivers, then it is significant to note that manufacturers have stated that color sets can be made available in a few months. Manufacturers have not been idle in this respect and have been experimenting with color for some time past. Color television in Canada is well out of the laboratory stages and service technicians have been given preliminary training in color.*

★ *The rational solution to the problem would be for telecasting authorities and manufacturers to fix a definite date on which color telecasts could commence in Canada, either as re-transmissions of American programs or as Canadian-produced programs. If some such decision is not forthcoming at an early date, it is conceivable that the Canadian electronics industry may be faced with a serious problem arising from the fact that the public could very logically put off buying replacement black-and-white receivers in the hope of making their existing sets do until color programs are available. This in turn would mean a reduction in consumer buying which would inevitably lead to serious factory lay-offs.*

*There is an earnest hope in the Canadian electronics industry that a decision on color television in Canada will be made this year. No doubt the Royal Commission on Broadcasting will produce some significant recommendations on the subject which are keenly anticipated by the industry.*

*The question, however, remains: is there any real necessity to await the findings of the Royal Commission before proceeding with the first practical step to Canadian color telecasting, namely, a policy decision on color telecasting. The manufacturers are ready, the microwave network covering a substantially large percentage of Canada's population is ready, and the public is ready. Why then the delay in proceeding with the first logical step toward making color television a reality in Canada?*



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5508

# business briefs & trends

★ The U.S. Army Signal Corps is presently carrying out extensive tests of the Decca Navigator System and it is reported that the Canadian Government has approved the installation of Decca Master and Slave Stations for the Western Atlantic side of the experimental Dectra system designed to provide long range coverage across the Atlantic.

★ Industrial development of the Ottawa area is further evidenced by the establishment there of the Canadian headquarters of Dawe Instruments Limited, manufacturers of electronic equipment and instrumentation.

★ Canadian Admiral Corporation Limited will offer a full year's service for \$15.95 covering their new portable television receivers. The new over-the-counter service contract covers all parts, tubes and labor for a twelve month period when the 10" set is brought or sent to an Admiral branch or distributor's service department, then picked up when repaired.

★ The factory shipment value of products of the Canadian electronics industry and services is now over \$½ billion dollars a year, and over 25,000 production workers are employed. If the distributive, sales, and servicing personnel are added to this figure, it is estimated that over 50,000 people are employed by the Canadian Electronics Industry, according to RETMA of Canada.

★ Contracts awarded to the Canadian electronics industry by the Department of Defense Production during the period April 1st to April 30th, 1956, amounted to \$8,278,517.00.

★ H. Leslie Hoffman, president of RETMA in the United States, reports that the U.S. electronics industry was manufacturing and producing services to a total of nine billion dollars per year at the end of 1955.

★ Bendix Pacific Division report the possession of Canadian rights for producing the Bendix-Decca Navigator System originally developed by Decca Navigator Company Limited of England.

★ Television and radio sales in the fiscal year ended April 30th, 1956, increased over the sales made in the fiscal year ended April 30th, 1955, it was announced at the 27th Annual Meeting of the Radio-Electronics-Television Manufacturers Association of Canada. During the fiscal year ended April 30th, 1956, 545,590 radio receivers and 747,988 television receivers were sold compared to 420,632 radio receivers and 679,344 television receivers sold during the fiscal year ended April 30th, 1955.

★ Latest progress reports on the Trans-Canada microwave system anticipate the Toronto-Winnipeg section will be completed this fall; the 800-mile Winnipeg-Regina-Calgary link will be brought into operation in early 1957; the 710-mile Quebec-Saint John-Sydney section to go into service in mid-1957, and the final 580-mile Calgary-Vancouver link scheduled to go into operation early in 1958.

★ The new type anti-submarine aircraft the P2V-7 Neptune now in use by the R.C.A.F. Maritime Command carries one and half tons of electronic equipment in its radome compartment in the nose of the aircraft.

★ Another data processing center will be opened in Canada in the near future by International Business Machines and will be located at the I.B.M. Don Mills Plant near Toronto. Other processing centers now in operation are those of Computing Devices of Canada Limited and Data Processing Associates both located in the Ottawa area.

★ Indicative of Canada's growing importance in the industrial sphere and particularly in the field of wire and cable manufacturing was the recent installation of North America's largest power cable impregnating kettle at the Toronto-Leaside plant of Canada Wire and Cable Company Limited. The kettle weighs 26 tons and is part of the company's nation-wide \$13 million expansion program.

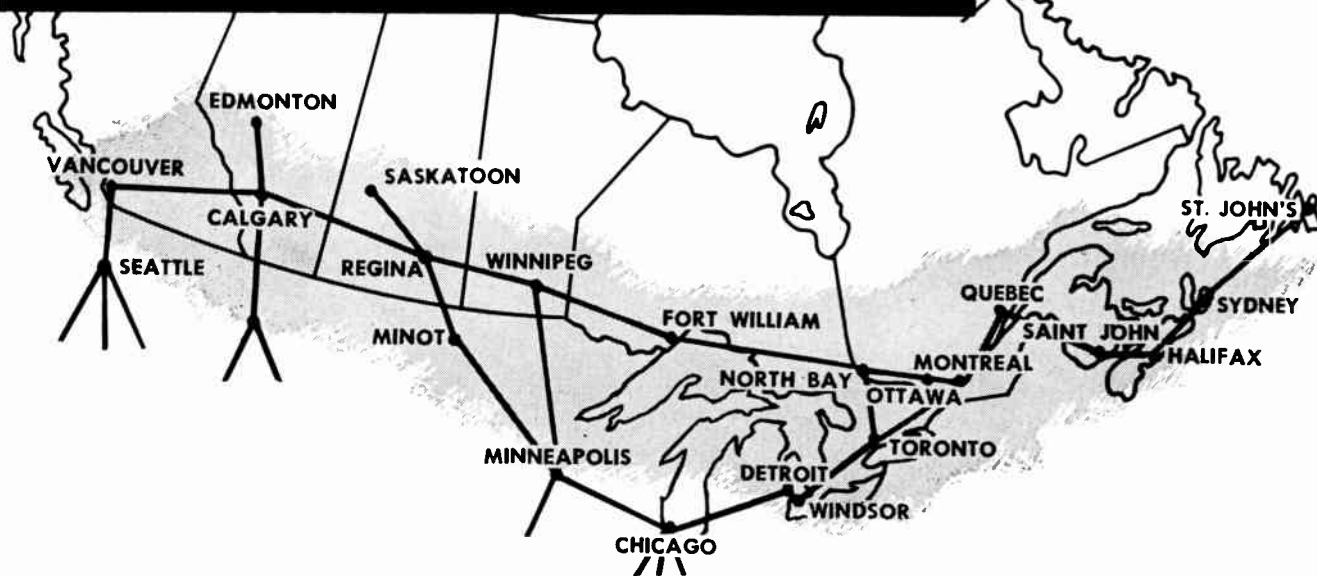
★ Britain's National Radio Show to be held this year from August 21st to September 1st, will have 110 exhibitors, including all the manufacturers of radio and television sets — some 35 in all.

★ Japanese electronics equipment is well designed, well manufactured and of quality comparable to that produced in North America, according to Mr. Louis Potvin, managing director, S & T Sales (Import) Ltd., Vancouver. Mr. Potvin has recently returned from a purchasing mission in Japan for his firm. He is convinced that Japanese component parts would be of great value to manufacturers of Canadian electronic equipment, and would result in a decrease in their manufacturing costs, with a resultant increase in production and sales. A desirable factor in the opinion of Mr. Potvin would be the increase in Japanese imports as a means of balancing the trade differential which now exists. Japan is now Canada's third best customer.

★ A national conference on scientific and engineering manpower aimed at finding a solution to the existing and acute shortage of scientists, professional engineers and skilled technicians is to be held September 10th to 11th. Announcement of the conference which will see the participation of some 50 leading Canadians in the fields of education, government, the professional societies, labor and industry, was made by Crawford Gordon, Jr., president of the A. V. Roe Canada Ltd., at the annual meeting of the Canadian Manufacturers' Association held recently.

★ Canadian television manufacturers have approved the color engineering standards which will make color television possible in Canada, and it is now up to the authorities responsible for Canadian telecasting to make color television programs available in Canada. The Radio-Electronics-Television Manufacturers Association of Canada, said that at the last meeting of their Board of Directors the color television standards proposed by the Canadian Radio Technical Planning Board had been adopted for use in Canada by the 121 members of their Association.

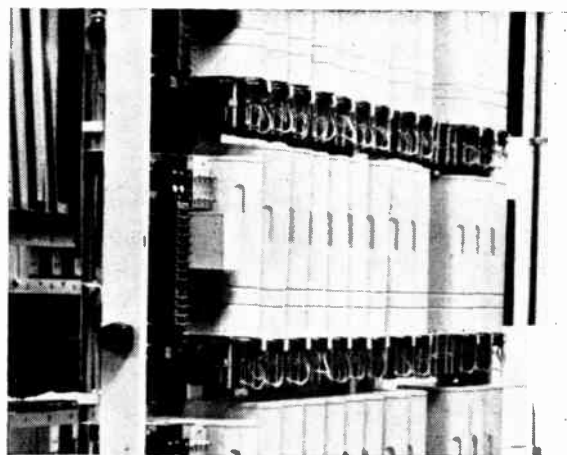
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ENJOY TOP ECONOMY, TOP EFFICIENCY *TODAY*—



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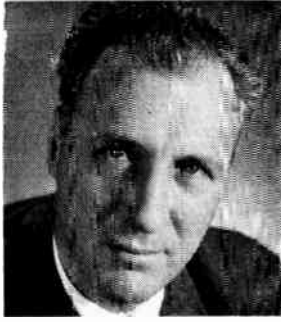
**AUTOMATIC  ELECTRIC**

ORIGINATORS OF THE DIAL TELEPHONE

5634

For further data on advertised products use page 61.





# The EDITOR'S PAGE

The lack of research and development in Canada has been a lively subject of discussion over the past few years, and it is not surprising that the subject was dealt with to some considerable extent at the recent annual meeting of the Radio-Electronic-Television Manufacturers Association in Ste-Adele-en-haut, P.Q., last June.

Speakers who dealt with the subject on that occasion were Mr. E. Leaver, president, Electronic Associates Limited, Mr. L. T. Bird, assistant manager, Commercial Products Division, Canadian Marconi Company, and Mr. H. S. Dawson, manager, Department of Engineering, Canadian General Electric Company Limited.

While the remarks of all three speakers were highly pertinent to the subject, it remained for Mr. Dawson to strike upon a point of discussion that may well be elaborated upon and which may hold the seed of greater research possibilities for Canadian industry generally.

In speaking on the subject, Mr. Dawson remarked that industry has often been blamed for not carrying on research and development work financed by its own money, and suggested that insofar as research on defense equipment was concerned, one of the serious obstacles standing in the way of private activity in this sphere was a lack of government guidance regarding probable operational requirements and problems. Mr. Dawson inferred that the lack of liaison between private industry and government in this respect was worse in Canada than it is in either the United States or Britain.

On this latter observation we are in complete agreement with Mr. Dawson, but it would be wrong to lay the entire blame for this lack of co-operation on the steps of the defense building in Ottawa.

If memory serves correctly, there was in existence during the years of the Korean War an organization known by the name of the Canadian Industrial Preparedness Association comprised of members representative of a broad section of Canadian industry. The function of this organization was to maintain close liaison with government and defense authorities for the express purpose of keeping Canada industrially prepared for an emergency. Since the head office of this organization is still listed in the Montreal telephone directory, it is presumed that it is still in existence, and it is through such an organization that industry should direct a strong voice to government authorities for closer co-operation in the matter of taking industry into fuller confidence with respect to logistics planning and equipment requirements.

Any suggestion that industry should take upon itself the task of research and development on defense equipment without prior knowledge of requirements is obviously ridiculous. In the past the government has issued many development contracts to private industry for research on specific projects, and if industry is now really anxious to engage to a fuller extent in research work without financial obligation on the part of the government, then it behooves government authorities to seriously consider this desire which could best be made known to government authorities through the collective voice of an organization such as the Canadian Industrial Preparedness Association.

There must be within the defense department alone many problems awaiting solution for which there is not sufficient current funds to allocate development contracts to industry.

If industry is prepared to assume these tasks, it would seem reasonably worth while for defense authorities to divulge more fully their plans and requirements, so that industry may, if it so chooses, initiate its own research programs.

\* \* \*

It is refreshing to note that from among the welter of comments being made on the subject of automation, many of which contain doleful prophecies for the future, there is emerging at last some straightforward, constructive thinking in the matter of how society should prepare itself to meet the problems that automation will give rise to.

According to John Diebold, president of John Diebold and Associates, Inc., New York management consultant firm specializing in automation, education, not unemployment, is the problem that automation presents to us.

"Automation is here — right now — and so are the problems it presents," said Mr. Diebold. "The time has come when we must take a positive approach toward solving these problems."

Mr. Diebold described the "positive approach" as involving a four-step program of education and retraining not only of workers but of management:

First, workers must be trained in the skills required for automation. Workers that have neither the aptitude nor the motivation to fit into these new jobs must be retrained to take over jobs in other fields.

Second, management itself must be educated in the use of the new technology. "Automation is a way of thinking as much as it is a way of doing," Mr. Diebold said. "Executives must be prepared for the 're-thinking' necessary to apply properly the techniques of automation and to understand its long-range impact."

Third, conventional jobs and professions are being fundamentally changed by automation. For example, the nature of management control is being altered substantially because of the use of automation techniques by various parts of business organizations. Secondary schools, as well as colleges and business graduate schools, must educate their students accordingly.

Fourth, as a long-run problem, we must "educate for the leisure that automation will make possible." "A three-day weekend would indeed be of doubtful value," Mr. Diebold said, "if people were not able to use the additional time constructively."

To consider the social implications of automation as being limited to the question of unemployment, Mr. Diebold stressed, would be very misleading.

"The real problem that automation poses for our society is one of education," he said. "If we begin to tackle the problem now, there is a great deal that can be done."

Mr. Diebold, who has been called the "elder statesman" of automation, has, in our opinion, presented a truly positive approach to automation, placing emphasis where it rightly belongs, namely on the retraining and education of workers. The kernel of Mr. Diebold's analysis is contained in his statement to the effect that workers must be trained in the skills required of automation. Workers that have neither the aptitude nor the motivation to fit into these new jobs be retrained to take over jobs in other fields.

Doppler navigation is applicable to many problems facing military and civilian aviation and in addition to global navigation it may be used to aid in bombing, aircraft carrier operations, aircraft early warning, map making, magnetic surveys, jet stream research, missile guidance, weather reconnaissance, air-sea rescue, in-flight refueling, and strip film synchronization for aerial photography.

# Details Of Advanced Doppler Navigation System - - -

Modern military aircraft are now using production models of Doppler Navigation systems known as AN/APN-66 sets, the most advanced air navigation system in operational use. Using a new concept in air navigation, the Doppler effect, the AN/APN-66 is reported to be the first equipment to be produced that directly measures ground speed and drift angle, the "heart" of air navigation. The system can operate automatically anywhere in the world. Self-contained, it does not require any outside aids, such as ground-based stations or celestial fixes and navigates in any weather, including zero visibility, and over all types of terrain. Designed for the most modern aircraft, the system accommodates extremely high speeds and altitudes.

The AN/APN-66 system was developed for the Weapons Guidance Laboratory of Wright Air Development Center, Dayton, Ohio, by General Precision Laboratory Incorporated, in co-operation with the U.S. Air Force.

The AN/APN-66 system achieves a

significant technological break-through since the delay in computation using optical or radar fixes often makes the information obsolete because of the high speeds of modern aircraft. Furthermore, optical ground fixes are impossible in bad weather and very limited at night, and search radar fixes are not available over open water. Celestial navigation is difficult, slow, subject to large human errors, and cannot be used when flying through an overcast sky. The new systems advance over all classes of navigation systems in operational use that employ ground-based aids such as VOR-DME, TACAN, LORAN, etc., is apparent in their lack of world-wide coverage and war-time limitation due to their possible aid to enemy aircraft.

## *Basic Principle Of Doppler Navigation*

The AN/APN-66 operates on the following basic principle. If an aircraft in motion transmits electromagnetic pulses to the ground, the return pulses will be slightly shifted in frequency.

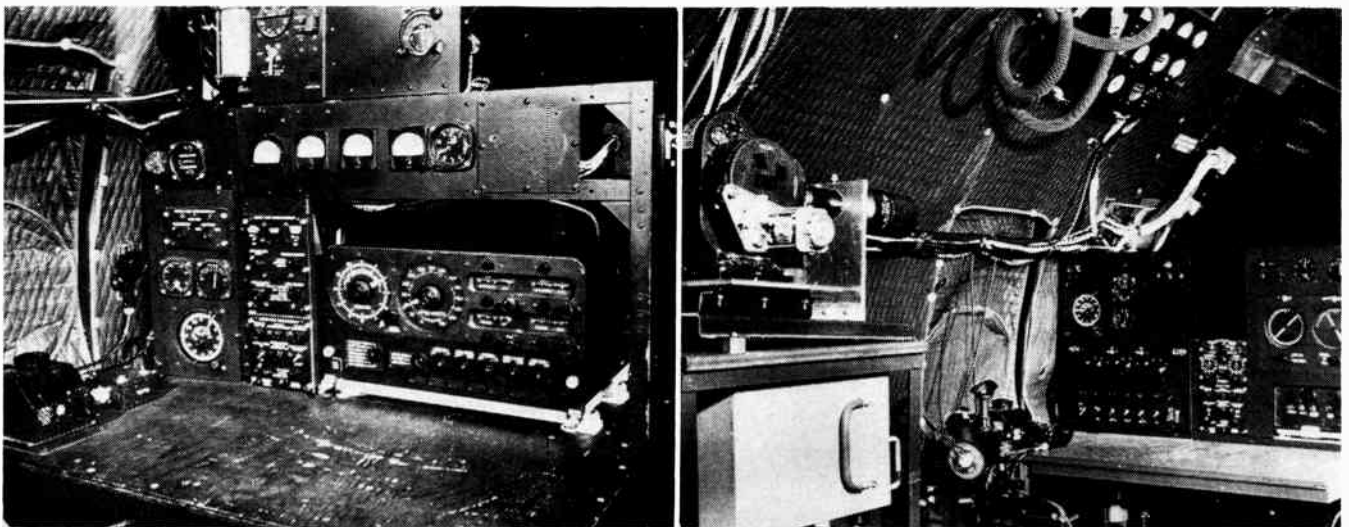
This frequency shift is due to the "Doppler effect", the same effect observed when you stand on a railroad platform and notice a change in the pitch of a train whistle as the train moves by. From this Doppler shift of pulses, the aircraft ground speed and drift angle (due to winds) are determined by the AN/APN-66. This information is continuously combined with compass heading to provide an instantaneous indication of aircraft position.

After the pilot flips one switch at the start of flight, the aircraft can be flown automatically along the shortest route to any desired destination. The aircraft's present position is shown on latitude and longitude counters every moment of the flight. The system also displays all other information needed for air navigation, such as ground speed, drift angle, wind speed and direction, shortest course to destination, steering signal, etc. System accuracy is reported to be the best ever achieved by a global navigator. For instance, toward the end of a flight of several thousand miles, the pilot can look at the earth below and see his destination.

A unique feature of the equipment is its "memory" operation which enables it to compute and indicate accurate data even if Doppler pulse contact with the ground is interrupted or if the pulsing system is temporarily shut off.

If any revision in flight plans occurs it is readily handled by automatic computation of the desired course to destination.

System reliability has been emphasized in the design of the equipment. Flight records have proven the design to be exceptionally successful in this respect. Emphasis in design was also placed on maintainability. Equipment malfunctions can be located without opening any "black boxes". Inside these units, rapid maintenance is achieved by the use of electronic plug-



● *Left:* Navigator's Control Panels of prototype Radar Navigation Set AN/APN-66 installed for the Air Force in a C-54 type aircraft. Some of the electronic gear shown is additional instrumentation for flight testing purposes. *Right:* Special installation at navigator's position in a B-29 type aircraft showing controls and instrumentation for Radar Navigation Set AN/APN-82.

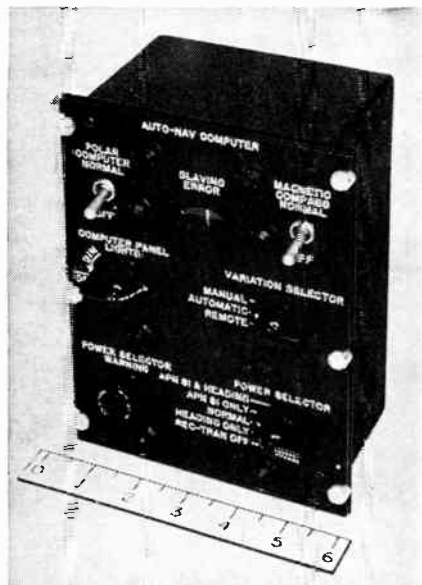
in assemblies that are interchangeable. Only the controls and indicators used by the operator need be installed in the crew compartment. Other units of the system may be installed in remote locations in the aircraft.

Test flights of the equipment have been carried out over all parts of the United States, over the North Pole and to England, Spain, Turkey, and Japan, operating successfully over all types of



● Auto-Nav Radar Control Panel shown forms a part of all military doppler radar systems presently being built for the U.S. Air Force.

terrain, including the polar icecaps and the open seas. The equipment has proved particularly useful in polar flights due to the fact that in these areas the magnetic variation changes very rapidly making fast, accurate navigation unusually difficult. The



● Auto-Nav Computer Control Panel of AN/APN-66 Radar Navigation System.

close proximity of the aircraft to the magnetic pole and the problem of obtaining accurate compass readings make it impossible to use it for a reference point as in normal naviga-

tion. Therefore, the AN/APN-66 automatically switches to "transverse operation". This means that the set makes its calculations based on the establishing of a new "pole" on the equator near the 180° meridian. Present position, however, continues to be supplied without delay as all calculations involved are performed automatically and instantaneously by the equipment. This ability will permit the reduction of the normal complement of three navigators for polar flying to one.

### Applications

The AN/APN-66 is applicable to many problems facing military and civil aviation. In addition to global navigation, it may be used to aid in bombing, aircraft carrier operations, aircraft early warning, map making, magnetic surveys, jet stream research, missile guidance, weather reconnaissance, air-sea rescue, in-flight refueling, and strip film synchronization for aerial photography.

The AN/APN-66 system consists of two equipments. Radar Set AN/APN-81, the Doppler portion, provides continuous measurements of ground speed and drift angle. Navigational Computer Group AN/APA-95 accepts these quantities as inputs plus heading information and performs all the navigation and computation functions required. The AN/APN-81, with its outputs provides an excellent foundation for building navigation, reconnaissance, bombing and missile guidance systems.

For tactical and weather reconnaissance applications, the AN/APN-81 has been interconnected with a ground position computer to form Radar Navigation Set AN/APN-82. A smaller, lighter system providing slightly less complete navigational data than the



● Course and Position Indicator displays data used in airborne navigation and continuously indicates present position of aircraft in latitude and longitude. The Indicator is a vital part of the complete AN/APN-66 global Navigation Systems.

AN/APN-66, the AN/APN-82 is being used in several types of Air Force aircraft. Systems are being installed on a production basis in RB-66 aircraft, whose primary mission is reconnaissance. Air Weather Service's WB-50 aircraft are also being equipped with production quantities of the AN/APN-82. Systems installed in B-29 and B-47 aircraft are being used daily to investigate the jet streams (high speed winds at higher altitudes which enable aircraft to fly with maximum tail winds or minimum head winds). It is the "wind computer" portion of the AN/APN-81 which enables these aircraft to minimize flight time, such as one B-29 which traveled from Texas to Florida in less time than a much faster bomber which did not have a Doppler wind computer.

It is interesting to note that the positions, speeds, and directions of the recent hurricanes, "Connie" and "Diane" were accurately determined by an AN/APN-82 equipped plane.

## Push-Button Station Control

THE push-button age for television stations has been ushered in with the introduction by a Canadian company of a new line of broadcast station remote control equipment.

Designed for the unattended operation of broadcast transmitters — both radio and television — the new equipment is in production, with deliveries scheduled for this summer.

The new equipment represents another step in the series taken in recent months by Canadian industry in electronic programming of the future. It has been designed to remove obstacles to many small-town stations faced with increasing operating costs.

The new equipment, called "Ultracon", incorporates two basic philosophies of transmitter remote control — direct reading and marginal indication. It controls, telemeters and guards broadcast apparatus and property over a microwave link or a single

metallic telephone pair. "Ultracon" scans the circuits it telemeters by means of a sequential synchronizing pulse which assures that each reading and indication is correct. It also provides a fail-safe indication in case of line failure. Circuit by circuit visual light and alarm indication is given, showing normal or abnormal status of the equipment.

According to company officials "Ultracon" is to be made available in Basic, Advanced and Master Units. The Basic system provides one control function and two telemetering channels as well as monitoring facilities required by the Department of Transport for radio transmitters. If additional control functions and telemetering channels are required, additive units are incorporated providing up to 20 raise or "on" functions, 20 lower or "off" functions, and 20 telemetered channels.

# Communications Speed Canada's Atomic Future

Two-way radio has joined the bulldozer, bush plane and rock drill as a major weapon for advancing Canada's mining frontiers. In the uranium rich Blind River district where half a dozen big mining developments, new roads, construction camp and a town site for 15,000 people are being rushed to completion, veteran construction and mining men are loud in their praise of this electronic addition to their equipment.

**B**ECAUSE of the government contracts covering production of the uranium mines nearly all construction in the Blind River district involves a race against time. The second factor contributing to the vital importance of two-way radio in the area is the formidable transportation problem. Every form of supplies and materials unloaded at the nearest railroad sidings must be hauled to the mine properties over a single road. Twisting and climbing through 35 miles of rugged wilderness this route is crowded daily with hundreds of trucks, jeeps and other vehicles.

Slim steel masts poised atop small hills and big rocks near the railroad sidings provide visible evidence of two-way radio's importance to the Blind River projects. Antennae wires from them lead into the trailers and field offices of nationally-known mining and construction companies. These include Consolidated Dennison Mines Ltd., Algom Uranium Mines Ltd., Lake Nordic Uranium Mines Ltd., and B. Perini and Sons Canada Limited. Thirty or forty miles away other masts tower over bunk houses, offices, dining halls and construction work on the mining properties, the Elliot Lake townsite, and other developments linked to uranium.

Food and lumber, reinforcing steel and cement, pumps and compressors, steel girders and mill equipment are among the hundreds of items unloaded at the railroad sidings. Since starting operations at Blind River last fall, Perini has moved over 30,000 tons of such material to the Consolidated

Dennison and Stanmet mines. Its \$15,000,000 worth of contracts in the Blind River district include construction of a headframe and 5,000 ton mill for Consolidated Dennison, a mill and a 10 mile highway for Can-met. Upwards of 1,000 men are now housed on its job sites where construction machinery roars 16 hours a day and powerful flood lamps illuminate the scene at night.

Perini's big use of two-way radio is an extension of its teletype system which feeds into the railroad siding from the company's offices in Sudbury and Toronto. Office personnel at the siding relay each incoming teletype bulletin verbally to the Consolidated-Dennison and Can Met projects. Messages flowing back from the mines are teletyped out to the cities.

A typical day's file of radio and teletype traffic handled by Perini deals with a hundred and one subjects ranging from illness among a power shovel operator's family to technical details about a new type of pump. Most of them are brief, business-like bulletins dealing with requisitions and purchase orders, freight car numbers and load priorities, time-tables and progress reports, custom releases and executives' movements. Thanks to two-way radio and Perini's systematic methods, this vital information flows back and forth across the bush as smoothly as it does between two offices in its Toronto headquarters. The result is an orderly flow of supplies and material, quick action in the event of emergencies, and up-to-the minute information on problems and progress.

(Turn to page 60)

**MAKE YOUR CHOICE**

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**MAGNET WIRES**

BONOEL - sizes = 21 to 32

SOLDERESE - sizes = 17 to 36

ENAMELLED MAGNET WIRE (round) - 8 to 40 AWG

BARE COPPER (round) sizes = 2 to 40 AWG

BARE COPPER (square) sizes - minimum width .050  
maximum width .500

BARE COPPER (rectangular) sizes - minimum thickness .050  
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FORMEL (square) sizes - minimum width .050  
maximum width .500

FORMEL (round) sizes = 8 to 36 AWG

FORMEL (rectangular) sizes - minimum thickness .050  
maximum width .500

FORMEL (cotton covered)

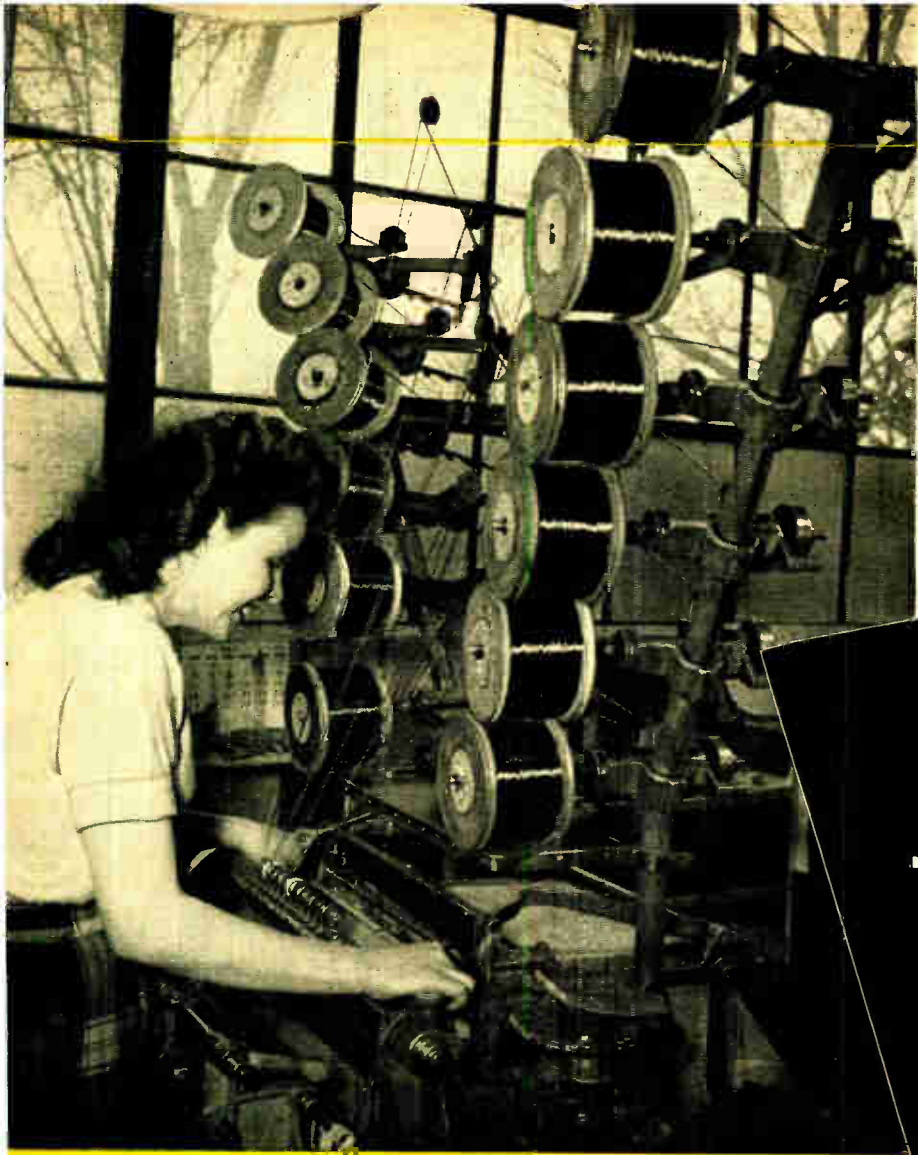
FORMEL (double cotton)

FORMEL (1 paper - 1 cotton)

FORMEL (3 papers)

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Paper and Cotton Insulated Magnet Wires are available in  
ROUND and RECTANGULAR in BARE, ENAMELLED or FORMEL.



*COIL WINDING  
for Defence equipment  
at Hammond Manufacturing.*

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**Magnet wire**

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

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

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

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

5504



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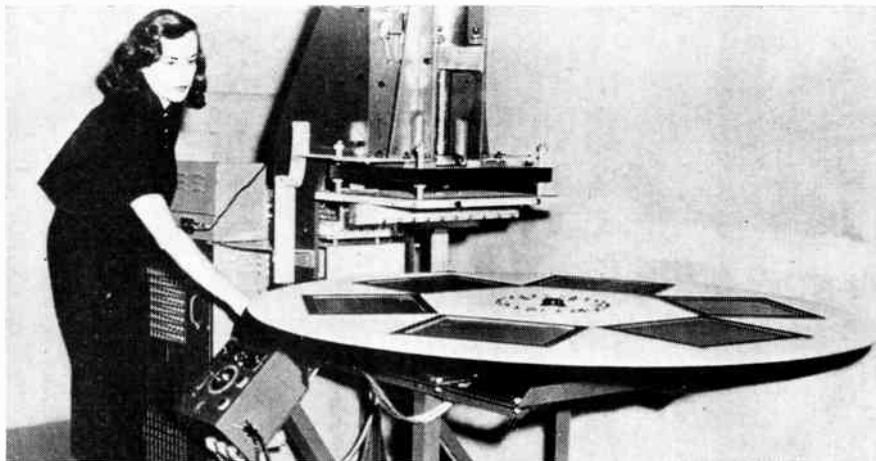
Sales Offices and Warehouse Stocks: St. John's, Nfld., Truro, Montreal, Winnipeg,  
Regina, Saskatoon, Calgary, Edmonton, Vancouver.

# Electronic Heat Sealing For Vinylfoam Products

New Technique Performs Several Operations Simultaneously

**T**HE advantages of "electronically fabricated" vinylfoam are amply demonstrated in the extensive line of attractive and useful mats, cushions and accessories for beach, bath and the home which are now being produced by industry. These range from a newly introduced beach-mat, thick and soft, but light and compact and able to be carried like a grip when folded, to the "Bathmaster" mit, a novel bath accessory which produces lather along with a massage.

There are non-skid shower and bathroom mats, roomy exercise mats, automobile seat pads, portable cushions and even a "kneeling pad" for children's prayers. Largest selling item is the bath pillow, which attaches to the tub by suction cups.



● On the type of heat sealing equipment shown above several operations such as cutting, cushioning, sealing and trimming can be carried out simultaneously.

All of these items utilize the new vinylfoam which has all the desirable qualities of foam rubber, and unlike the latter, is capable of being welded electronically.

As in all types of electronic heat sealing, the high frequency heat generated by these machines brings the materials to their flow temperature, causing the several layers of material to weld to each other. Pressure is exerted at the same time by a press, and this combination of heat and pressure produces a bonding of the various layers at all points of seal. The materials cool almost instantly when the ram of the press raises, and the result is an airtight, waterproof seal.

Special built-in features of some makes of equipment makes it possible for most items to be produced in a

single operation. Cutting, cushioning, sealing and trimming are carried out simultaneously in a matter of seconds. It is possible, too, to emboss them at the same time. Subassemblies, performed in a separate operation, are also joined to the finished product at the time of sealing.

Some manufacturers utilize several sizes of these heat sealing machines in their varied operations including one of the later model giant Thermatron units which turns out large items, such as a 70" x 30" exercise mat. An arc suppressor is attached to each machine in one plant to protect its expensive dies, and as a safety measure. The Thermatron devices detect an arc, or flashover, in the fraction of a second when they begin and automatically cut

off the generator before damage can take place.

Androl Industries, which now market thousands of their products through leading department stores, had a modest beginning only two and a half years ago with a new "gadget", sold primarily through mail orders. This was a plastic ice bag for migraine and sinus sufferers, an item still produced by the company.

The electronic welding was "farmed out" at first, but Androl soon purchased its first Thermatron machine so that "Betty's Ice Bag" might be produced from start to finish in its own plant. With the company's expansion into the bath and beach accessory field, more machines were added until today there are over a dozen of them humming in Androl's very busy operation.

## Transistors In Industry

**A**LTHOUGH the development of transistors is not yet at the stage where industrial applications are widespread, control engineers are now finding applications where the transistor's properties can be utilized to unique advantage. Two experimental designs recently developed by engineers give an indication of future possibilities.

In the metal-working industry, many instances require a device with the ability to sense the presence of hot metal. A new hot-metal detector utilizes a photo-transistor as an infrared sensing device, and also uses transistors in the amplifying circuit. It can be used in any application where a metal object at 700 degrees F. or more must be detected and a signal transmitted to indicate that presence.

One example is in the rolling of steel tubing: with a specified volume of metal to start with, and a constant outside diameter, the thickness of the tube wall can be determined by tube length. If the pipe is rolled with too thin a wall the pipe will be longer than average, and conversely, if the wall is too thick, the tube will be shorter. Wall thickness can thus be determined from tube length. By placing several hot-metal detectors at specified distances apart, the length of the pipe can be measured and thus the wall thickness is determined.

An experimental constant-current motor control uses static, semi-conductor elements, mainly transistors and silicon diode rectifiers. Such a control might be used for maintaining constant horsepower on a steel mill reel drive. In an experimental model developed by company engineers a  $\frac{3}{4}$  h.p. d.c. shunt motor is used as a driving motor. The voltage drop across a shunt in the d.c. armature circuit provides a signal proportional to armature current. This signal is fed to the regulator, which automatically adjusts the shunt field of the d.c. motor to maintain constant armature current and thus constant horsepower. In addition to the advantages that accrue because of the all-static nature of this control, the regulator is also extremely small and has very rapid response. The experimental model, while it utilizes a  $\frac{3}{4}$  h.p. motor, has sufficient capacity for motors up to 3 h.p. The same basic regulator could also be used for speed control. While still in the development stage, this application indicates that semi-conductor devices have a promising future in industrial control applications.

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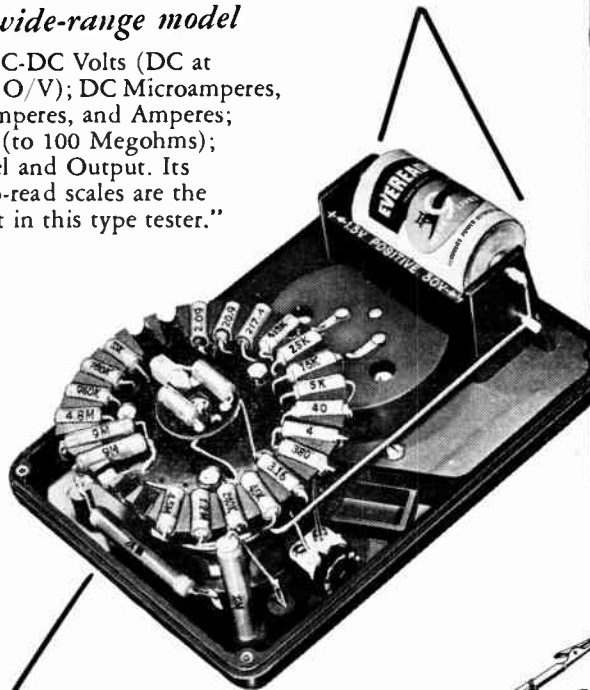
— $\frac{1}{4}$ " thick for high impact.  
Fully insulated.

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Balanced double-spring tension grip assures permanent contact.

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tests AC-DC Volts (DC at 20,000 O/V); DC Microamperes, Milliampere, 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.

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*for convenience in reading*

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

*for most efficient meter use*

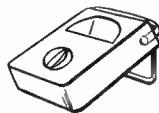
—With every Model 630 you receive complete, simplified instructions on how to use and maintain most efficiently.

*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.



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Bluffton, Ohio

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Time-consuming hand adjustment and scraping eliminated in the production of mica capacitors and wastage cut from 40 to 50 per cent by the use of . . . . .

# "K" Gaged Mica

By IRV GLERUM  
Chief Engineer, Perfection Mica Company

**T**HE splitting and fabricating of Mica from its natural state in the earth to its final shape, silvered and encapsulated, involves many costly hand and machine operations, some of which the capacitor engineer is entirely unaware.

Tiny mica capacitors having the same capacity but only 1/2 to 1/4 the size previously used in transistorized and other printed circuits, may be manufactured from new "K" gaged mica. "K" gaging is a new electronic method of accurately gaging mica film which permits utilizing smaller area mica to obtain pre-determined capacity. Any desired tolerance can be held on electronically "K" gaged mica film including tolerances as close as the mechanical equivalent of .00025. After silvering, costly time-consuming hand adjusting or scraping on mica may be entirely eliminated because capacity is accurately pre-determined by "K" gaging. In addition, wastage is cut 40% to 50% by using "K" gaged mica. "K" gaged mica is offered to design engineers as

an aid in creating new transistorized printed circuits utilizing much smaller components than formerly possible.

This method of gaging is a measuring technique which evaluates realizable capacity per unit area of any given film. Gaging may be mechanically accurate, yet result in widely varying capacities with indential silvered areas because the dielectric constant of all mica varies in accordance with its gas and impurity content. "K" gaging, on the other hand, selects equivalent mechanical thickness by rejecting mica having excessive gas and oxide content as well as cracked or perforated films, since the measurement is based on the dielectric constant of the film being evaluated. Only films with uniform dielectric constant are chosen, resulting in greater production uniformity of capacity and "Q" at lower over-all cost.

Maximum capacity attainable in any given area may be determined by the following formula:

$$C = \frac{2.244 \times K \times A \times 10^{-1}}{T}$$

A = effective silvered area in sq. inches.

C = capacity in micro farads (mmfd)

T = dielectric thickness in inches

K = specific inductive capacity (average K factor used in computations is 6.66).

For example, assume the allowable dimension for film is 0.5" x 0.5" with a guard edge of 1/8". This leaves an effective capacity area of .4375 x .4375, or a total of .192 sq. in. Accordingly, A = .192 and using a film thickness of .0005 (this is the thinnest mica film which is practical to silver) then "T" = .0005 or 5.0 x 10<sup>-4</sup>.

$$C = \frac{2.244 \times 6.66 \times .192 \times 10^{-1}}{5.0 \times 10^{-4}}$$

$$= \frac{2.864 \times 10^3}{5.0}$$

$$= 0.573 \times 10^3 = 573 \text{ mmfd.}$$

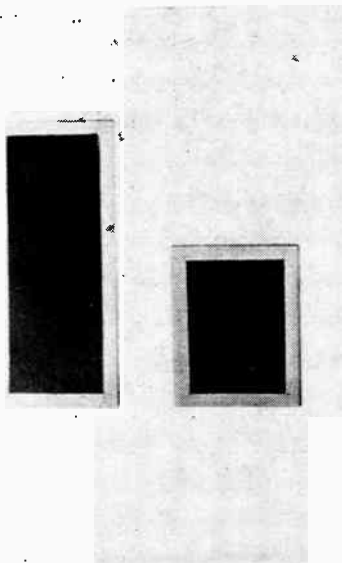
By proper techniques in manufacturing and assembly, a capacitor like this can be made to have a temperature coefficient not to exceed 30 parts per million per degree Centigrade and always positive.

Capacitance control to extremely close tolerances may be maintained because "K" gages are direct reading over a large scale area. The resultant yield of acceptable silvered films virtually eliminates scraping away silver to put a capacitor within tolerance. Film puncturing during adjusting is also eliminated. High capacities in much smaller areas without such losses are obtainable because "K" gaging is effective on films as thin as 5.0 x 10<sup>-4</sup> ± 5.0 x 10<sup>-5</sup>.

Films as thick as 0.0005 ± 0.00005 in commercial quantities are now economically feasible for silver mica capacitor manufacturing and yields of over 90% are realized. It is generally accepted that films thinner than .001 should not be scraped as handling damage is prohibitively high.

To effectively utilize "K" gaged mica in an application, two steps are necessary. First, the film thickness for the available area must be determined. Secondly, a thickness tolerance must be approximated.

The widest possible tolerance within required limits should be specified for economy reasons. The closer the tolerance the more mica film must be gaged to obtain sufficient quantity within specified tolerances. "K" gaging not only uses less mica film because of more accurate measuring, but also wastes no mica film. This is how "K" gaging brings greater economy as well as greater accuracy.



● The above photo shows a comparison of mechanically gaged film and "K" gaged film of equal capacity.



● The above photograph shows the "K" gage being used in a mica splitting operation.





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Although available only to special order, there is no increase in price over the conventional Simpson instrument of similar style and range.

Write for complete dimensional details.

With the trend towards miniaturization in electronic apparatus requiring instruments, and to much more compact design in general, the need for panel meters with conventional readable faces — yet using a minimum of space behind the panel — is growing greater.

Bach-Simpson have met this need with the new Simpson Shallow Case line of instruments, requiring only standard 2½" or 3½" panel mounting holes, yet using only 1" of depth behind the panel.

Such a space saving instrument is only made possible by the famous Simpson Core Magnet Movement, which, in addition reduces the weight by better than one-half and provides a fully shielded movement.

The Simpson Shallow Case instrument can be mounted on magnetic or non-magnetic panels without a change in calibration, and has no external field to affect C.R. tubes, navigation compasses or any other device sensitive to magnetic fields.



1255 Brydges St.  
London, Ontario

SIMPSON ELECTRIC COMPANY, 5200 W. KINZIE ST., CHICAGO 44, ILLINOIS

Investigation of the various methods of electronic organ tone production has led to the development of an optical angular position encoder representing an innovation in precision analog to digital conversion. Production techniques employed permit manufacture of code discs at a heretofore impossible high rate of production.

# Optical Type Analog To Digital Encoders

**N**EW 13-digit and 16-digit optical angular position encoders of high accuracy, small size, light weight, and rugged construction which represent an innovation in precision analog to digital conversion are now being manu-

factured in the United States.

The unit, shown in Fig. 1, a 16-digit encoder, weighs 9 lbs., 2.88 oz., and contains in a single housing, 9" in diameter x 8.5" in height, including shaft, a binary code disk, transistorized reading head with suitable preamplifiers and a pulsed light source. Fig. 2 shows a breakdown of the major components of the encoder.

## Code Disk And Disk Mounting

The high-precision 16-digit cyclic binary code disk used in the Baldwin Encoder is the heart of the unit. The disk is of glass, on which the binary code pattern is applied photographically. Diameter of the disk is 8½" and the 16 tracks vary from 4.9" to 7.8" in diameter. Each track has a useable width of  $\frac{1}{16}$ ". The encoder functions with an accuracy of plus or minus 10 seconds of arc, well within the limit which would result in the transmission of an improper sequence of numbers. Readout is accomplished in 65,536 discrete steps, the boundaries of these steps being accurate to within eight parts per million in relation to each other.

The manufacturer has designed and built a special machine to produce photographic masters for these code disks. This is a unique circular dividing engine which operates on a combination of photographic, electronic and mechanical principles to produce digital patterns of very high accuracy, much faster than is possible using conventional dividing engines.

The code disk, Fig. 3, is rigidly mounted in a bearing housing, consisting of a spindle, shaft and hub assembly. The shaft rotates on bearings having a radial accuracy better than a small fraction of a quanta. This assembly also contains a readout or defining slit (see Fig. 2) uniformly five microns in width, either produced photographically or by a diamond engraving process removing silver de-

posited on glass. Distance from the code disk to the readout slit is maintained at 0.003".

## Reading Head

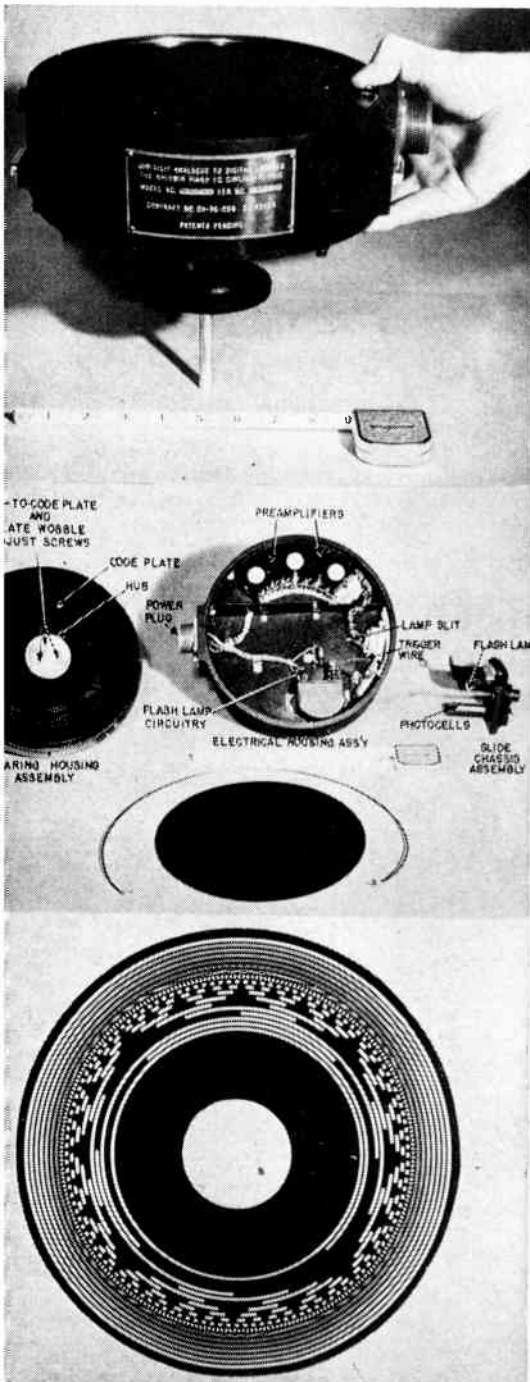
The reading head (see Fig. 2) contains a removable flash lamp, a mirror for directing the light from the flash lamp through the code disk and readout slit, and an array of photo transistors. These photocells, one for scanning each track on the code disk, are firmly fixed in a removable block. Each photocell has a positioning screw to locate the photocell junction precisely with respect to the readout slit. Transistor preamplifiers for each photocell can be mounted in the electrical housing of the encoder. This housing also contains the power input plug; amplifier to photocell connecting plug, necessary circuitry for the flash lamp, and signal output plug. An electrostatic shield contained in this housing shields the preamplifiers from the flash lamp and associated circuitry.

To accomplish a reading of the disk at any desired instant, a step-up transformer is incorporated so that a comparatively low voltage trigger pulse will flash the lamp. Such a trigger pulse can be obtained from a 6BQ6 tube in a flyback-type circuit. A 600 volt, low current d.c. supply is used for the lamp. At the instant of lamp flash, the angular position of the shaft is read by the array of photocells energized by the light. The output voltage transmitted from the preamplifiers gives a faithful reproduction of the photocell output and at low impedance so that the signal can be transmitted via cable over an appreciable distance, if necessary.

An extra photocell is provided in the reading head which scans a clear zone provided on the code disk. This serves as a light intensity reference and provides pulses which can be used to compensate the code reading circuits for changes of intensity due to voltage variations and aging of the flash lamp.

Output signals obtained are approximately 5-7 volts at an impedance of less than 1000 ohms, suitable to operate into transistor or vacuum shift registers, magnetic flip-flops, or a cyclic to ordinary binary translator. Shaft angles are sampled at rates up to 60 per second. Satisfactory operation of the encoder is maintained over a temperature range of minus 55 to plus 85°C with only plus or minus 10 per cent change in output voltage.

Further encoder research is being conducted by The Baldwin Piano Company. Now in the development stage are smaller size encoders; reading heads which use a low-voltage, tungsten steady light source in lieu of a flashing lamp; binary-decimal codes, and encoders giving non-linear function outputs, such as sine and cosine. Encoders having more than 16 digits are also being considered, without an appreciable increase in the size of the code disk.



Top: Fig. 1 — Baldwin 16-digit Analog-to-Digital Encoder.

Center: Fig. 2 — Major components of the Baldwin 16-digit Encoder.

Bottom: Fig. 3 — Baldwin 16-digit code on 8½" diameter disk.



The new plant, recently opened in Toronto by PYE CANADA LTD. is consistent with PYE'S policy of continual advancement with the times. World famous for the design and manufacture of radio communication systems, electronic equipment and closed circuit television, PYE can now offer their many Canadian customers the finest products and services available.

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# NEWS



## C.D.C. Opens One Plant — Plans Another

A pioneer Canadian firm in the fields of electronic data processing, instrumentation and automation, officially opened an 80,000 square foot head office and plant recently at Bells Corners, a mile west of Ottawa.

Computing Devices of Canada Ltd., started in Ottawa in 1948. Now, after eight years, CDC has nearly 500 employees, of whom more than 100 are science graduates and engineers.

In the new building are well equipped electronics and instrument laboratories, model shops, electrical test and assembly shops, a modern machine shop and Canada's first privately owned data processing center.

These new facilities enable Computing Devices of Canada — formerly housed in three separate parts of Ottawa — to continue and expand its primary purpose, of serving government and industry through research, development and manufacture of electronic equipment.

CDC's specialized efforts are directed mainly in the fields of aircraft instrumentation, electronic computers, data processing, automatic control of manned and unmanned vehicles, as well as the automatic control of machine tools and processes in industry.

Typical of the work CDC has done in the past, is the development for the RCAF, of a push button navigation system for aircraft known as the Position and Homing Indicator.

The sprawling plant, built at one corner of a 92-acre former farm, is entirely self-sufficient. It has its own water supply, heating plant, two cafeterias, protective staff, photographic and printing service and graphic artist.

## Bayly Engineering Named NLS Canadian Rep

Bayly Engineering Limited, Ajax, Ontario, has been named Canadian sales representative for Non-Linear Systems Inc., manufacturer of automatic precision measuring instruments.

Andrew Kay, NLS president, announced that the Bayly organization will serve all of Canada except British Columbia. Their main office is at First Street, Ajax, Ontario.

Bayly will handle the complete NLS line of digital voltmeters, digital ohmmeters, luminous readout systems and other precision instruments.



● The new head office and plant of Computing Devices of Canada Limited at Bell's Corners, near Ottawa, Ontario, provides 82,000 square feet of office, laboratory, and manufacturing space to accommodate the rapidly expanding activities of the company.

## CAE Erects New Premises At Vancouver

Begun in October, 1955, a new \$150,000 building is being erected in Vancouver by Canadian Aviation Electronics Ltd. at Marine Drive and Fraser Street.

The new CAE home, comprising 16,000 square feet, will provide sales offices, warehouse facilities and service depots for the consumer products, engineering and commercial sales departments of the company.

The walls are of reinforced concrete, with a zolotone paint application on the exterior face. Glass is used extensively throughout, with few partitions, and there is room for expansion.

## T.M.C. (Canada) Ltd. Sales Appointment

D. V. Carroll, president and managing director of T.M.C. (Canada) Limited, has recently announced the appointment of Mike Yurko to the sales engineering staff of his organization.



M. YURKO

Mr. Yurko has been with the Electrical - Engineer - in - Chief Branch of the Department of National Defense, Naval Service, in Ottawa for the past five years, where he has gained experience in contracts administration, communications equipment design, systems engineering, etc., and has planned most of the shipborne antenna arrangements for the Royal Canadian Navy.

## 3M Canada Names K. J. Shea Vice-President & Gen. Manager

Kenneth J. Shea has been appointed Vice-President and General Manager of Minnesota Mining and Manufacturing of Canada Limited, London, Ontario.

Mr. Shea will direct the manufacturing and marketing operations of the Canadian-Company through its seven regional sales offices at Halifax, Montreal, Toronto, Calgary, Winnipeg, Saskatoon and Vancouver.



K. J. SHEA

Mr. Shea has been with 3M since 1923 and for the past two years has been with the International Division as Vice-President and General Sales Manager. In this position he was responsible for the sales of 3M products through the company's subsidiaries and its International Export Division.

## Winnett Boyd Ltd. To Represent NRC Equipment

It has recently been announced that Winnett Boyd, Ltd., of 745 Mount Pleasant Road, Toronto, Ontario, have been appointed exclusive agents for NRC Equipment Corporation in the provinces of Ontario and Quebec. This firm has strong representation in the area in aircraft, electrical and electronic industries. The firm is also experienced in many phases of the nuclear power equipment field.

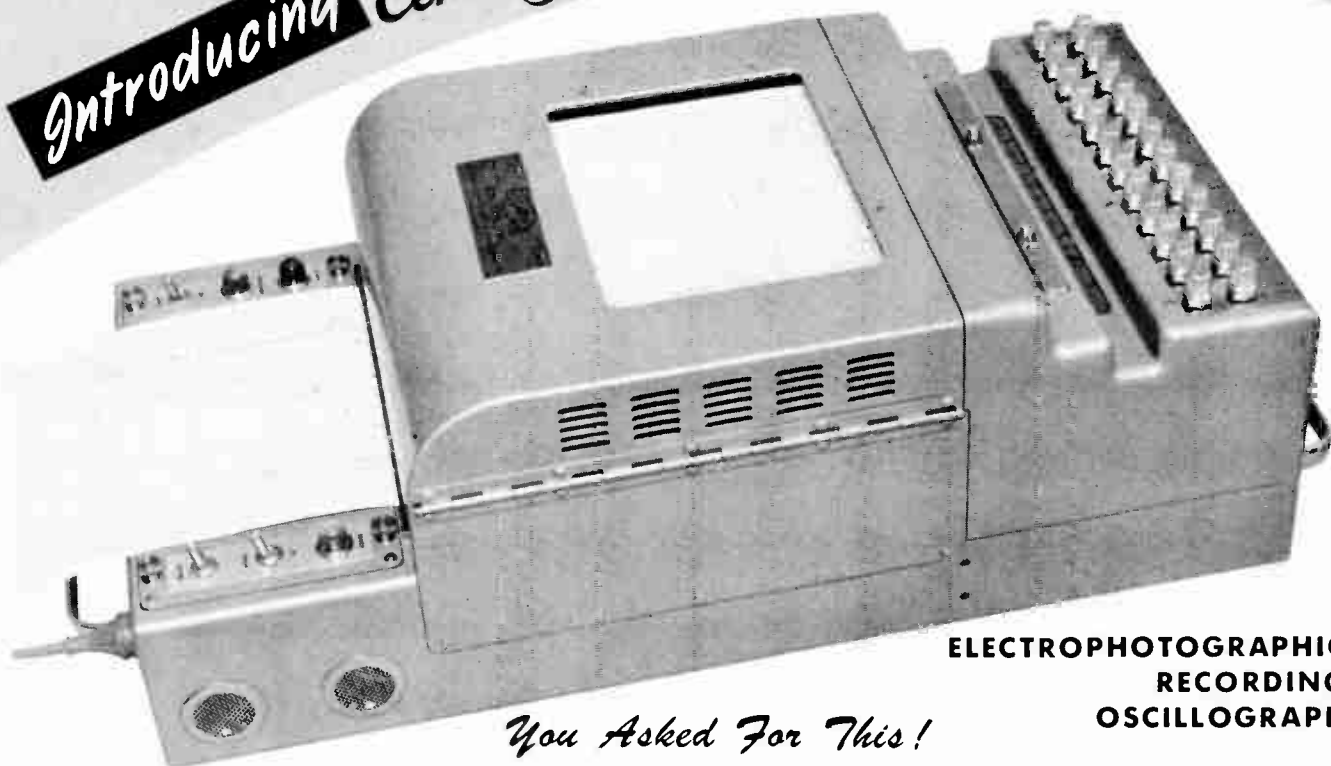
(Turn to page 32)

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## Canada Wire And Cable Expansion Program

Canada Wire and Cable Company Limited, as part of its \$13 million expansion and decentralization program, is completing the doubling of its Vancouver plant this year.

In addition, two other major steps are intended: expansion of its B.C. operations by increasing present capacity and adding facilities for further lines including underground cable manufacture; and transfer of high voltage and submarine power cable facilities from the Leaside-Toronto main plant to a deep-water site in Eastern Canada.

In commenting on his company's long-range expansion program, O. W. Titus, vice-president and general manager, said that Canada Wire is vitally concerned with the need for decentralization and the bold utilization of Canadian capital.

Since 1948 the company has followed a policy of decentralization-expansion, in some instances by product, and in other cases geographically. From Leaside the company's activities have spread to Smiths Falls and Simcoe in Ontario, to Fort Garry in Manitoba and to Vancouver on the West Coast. "Decentralization will assist materially in the balanced development of our economy," Mr. Titus explained, "and at the same time increase security of highly essential production against the paralyzing effects of modern warfare."

On the other hand, in the hoped-for atmosphere of peace, Mr. Titus said, the company believes that many benefits accrue from conducting an operation economically in a relatively small plant of from 50 to 200 employees, where greater intimacy of contact between employee and management is a vital consideration.

## Western Ontario Has Two New Radio Stations

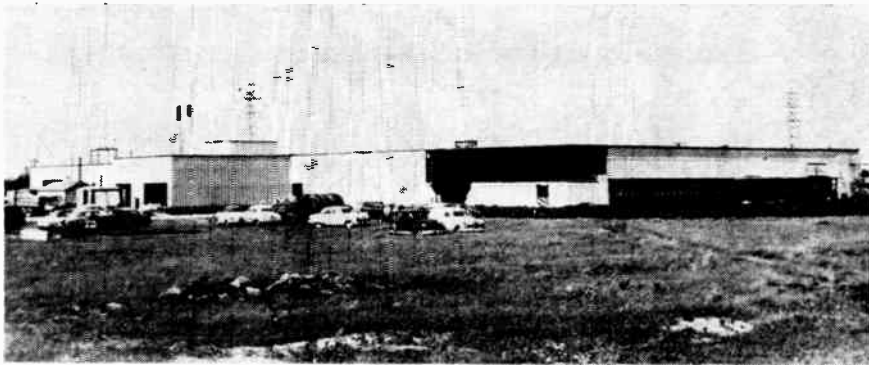
Two new radio stations have begun broadcasting in Western Ontario — one in Simcoe and one in London.

Simcoe's new station, CFRS, began operating officially on June 23rd. Broadcasting at 1560 on the dial, it will reach several nearby towns, in addition to Simcoe itself. These include Port Dover, Waterford, Jarvis and Delhi.

All equipment for the station, Simcoe's first, has been supplied by RCA Victor Company, Ltd. It includes an RCA type 250M transmitter and a BC6A studio console, according to company officials.

CKSL, the new London station, owned by London Broadcasters Ltd., came in at 1290 on the dial on June 25th. A five kilowatt AM installation, it is London's second radio station.

Most of the equipment for CKSL was supplied by RCA Victor, too. It includes an RCA type BTA5H transmitter.



● Adjoining plants of Canada Wire and Cable Co. Ltd. and Telecables and Wires Ltd. near completion at Fort Garry, Man. Canada Wire section of plant is part of a long-range \$13 million expansion and decentralization project. The Telecable plant, an associated company, will produce a complete line of telephone wires and cables. The two plants will begin production Sept. 1956 and include some 87,000 sq. ft. of space.

## C. F. Pattenson Elected Chairman IRE, Ottawa Section

Announcement was made recently that Mr. C. F. Pattenson, head of the instruments section, Division of Radio and Electrical Engineering of the National Research Council of Canada, has been elected chairman of the Ottawa Section of the Institute of Radio Engineers.

## New "Atom Smasher" For Chalk River Project

A new type of particle accelerator or "atom smasher" that will permit important advances to be made in fundamental physics research will be installed at Chalk River early in 1958. Atomic Energy of Canada, Limited, have announced.

To be known as the Tandem Accelerator, the ten-million-volt machine will be developed and constructed by High Voltage Engineering Corporation, Cambridge, Massachusetts.

Chalk River physicists will be able to study in continuous detail the nuclear energy level of heavy elements which they know only in patches today. Until the tandem-style Van de Graaff accelerator became feasible, it was possible with the accelerator at Chalk River to study only certain of the light atomic nuclei.

It will now be possible to carry out research programs on heavy nuclei with an accuracy and efficiency never before possible.

Chalk River has at present a three-million-volt Van de Graaff generator which has been used to bombard material with proton and helium<sup>3</sup> ions to study the structure of the nuclei or core of light elements. The Physics Laboratory is also using two smaller cascade accelerators which generate 100,000 electron volts at 350,000 electron volts.

The new machine consists of two specially designed Van de Graaff generators placed end to end in a horizontal position, giving the accelerator an overall length of 34 feet and a diameter of 8 feet.

## Westinghouse Announces Organizational Changes

Organizational changes within the Industrial Products Division at Canadian Westinghouse were announced recently by R. H. Williams, general manager of the Industrial Products Group. Four new departments, Industrial Control and Panelboard; Distribution Apparatus; Meters, Instruments and Relays; and Small Motors, were announced.

Coupled with the reorganization came the appointment of three department heads. They are: W. A. Eskil, manager, Industrial Control and Panelboard; Stanley Thurgar, manager, Distribution Apparatus; T. B. Lounsbury, manager, Meters, Instruments and Relays. The manager of the small motors department will be announced at a later date.

Each of the departments will be a self-contained unit under the manager and will have its own marketing, engineering and manufacturing departments.

## J. R. Pernice To Head Collins European Operations

Joseph R. Pernice, chief of the electronics section of NATO's Production and Logistics Division, has been appointed managing director of Collins Radio Company of England, Ltd., the company announced today.

Pernice, an international expert on electronics, assumed his new position with the organization on July 1 after release from his North Atlantic Treaty Organization assignment in Paris.

Collins Radio Company of England, Ltd., 242 London Road., Middlesex, England, was organized last year as a subsidiary of Collins Radio Company in Cedar Rapids, Iowa, U.S.A.

The subsidiary has functioned as a sales office for the United Kingdom and the Continent and as a maintenance facility for Collins equipment used by international air carriers and other commercial customers. Pernice will have charge of all Collins operations in Europe.

(Turn to page 34)

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ELECTRONICS & COMMUNICATIONS, JULY, 1956



R. F. Bogart, one of National's staff of applications engineers, shown holding a postformed copper clad PHENOLITE printed circuit.



Reverse bends and small radii—toughest problems in forming—were involved in shaping this spring-action, snap-on cover for a switch voltage changer. National's postforming technicians used PHENOLITE C-534-F to achieve a  $\frac{1}{16}$ " radius bend.



Corrugated, bent, and punched after forming, this insulator had to be made of extraordinary stock to withstand unusual stresses. National made use of a double die and PHENOLITE C-534-F to form the corrugated component without cracking or fracturing the piece.



Bending and drawing in one operation were difficulties faced in forming this bus bar joint cover. National ended the trouble by using PHENOLITE X-114-A. PHENOLITE can be formed or deep drawn easily—without damage to the material and without expensive dies.

For further data on advertised products use page 61.

## Instronics Limited Canadian Reps For U.S. Firms

John E. Knowles, who directs Instronics Limited of Stittsville, Ontario, reports that his firm has opened for business and will represent a number of U.S. firms in Canada.

Exclusive agreements have been concluded with the following: Empire Devices Products Corporation of Bay-side, N.Y.; Electro Impulse Laboratory, Inc., of Red Bank, N.J.; Potter Instrument Co. Inc., Great Neck, N.Y.; Donner Scientific Company, of Berkeley, California; and Byron Jackson Electronics Division, Borg-Werner Corporation, of Santa Ana, California.

In addition several other leading U.S. electronic manufacturers are expected to finalize representation agreements with Instronics Limited within the next few weeks.

The new firm operates at 11 Spruce Street, Stittsville, Ont. (P.O. Box 51).

## Vancouver Plant For Phillips Wire And Cables

Plans have been announced by T. A. Lindsay, president of Phillips Electrical Co. Ltd., for the erection of a 1¼ million dollar factory in Vancouver. Building and land will cost \$650,000 and a further expenditure of \$600,000 will be made for machinery and equipment for the new plant.

A complete line of plastic covered telecommunications wires and cables, as well as a full range of all types of building wires and cables, also plastic insulated, will be produced in the new plant.

Later in the year E. G. Purdy, currently secretary of the company, will be transferred to Vancouver to become general manager of the new Pacific Division, and he will be responsible for manufacturing, sales and administration in the provinces of British Columbia and Alberta.



● Recently announced executive appointments at Standard Wire and Cable Limited are: (Above Center) Donald A. Campbell, secretary-treasurer; (Left) G. V. Taylor, plant manager; and (Right) G. W. Vogan, sales manager.

## R. G. Powers Toronto Rep For Computing Devices

R. G. (Bob) Powers has been appointed Technical Sales Representative in Toronto for Computing Devices of Canada Limited.

In announcing the appointment, CDC Marketing Director W. S. Kendall said that the increased business activity of the Ottawa Company has necessitated a full time representative

to serve the Toronto area. CDC already has an office in Montreal, and an office is to be opened soon in Edmonton to serve Western Canada.



R. G. POWERS

In 1946, after service with the RCAF, Mr. Powers joined RCA Victor as a sales engineer for the Maritime Provinces, and has been with that Company until he came to CDC in July of this year. He has had considerable experience in the electronics industry, and is well known in Toronto, where he has been located for the past three years.

## Charles W. Pointon Ltd. Sales Agent For Garrard

Charles W. Pointon Ltd., of 6 Alcina Avenue, Toronto 10, is the Canadian sales agent for Garrard Engineering and Mfg. Co. Limited of Swindon, England, makers of Garrard record changers. Three new three-speed models have recently been announced.

## Collins Radio Demonstrates "Scatter Propagation"

A new concept of radio communication called "scatter propagation" was demonstrated before governmental and industrial officials in Ottawa, June 18-22, by the Collins Radio Company of Canada, Ltd., using its new "Transhorizon" communication equipment.

This technique, based on the scattering of a radio wave, offers reliable communication to points well beyond the horizon without intermediate relay stations, an important consideration where terrain is rugged or otherwise inaccessible.

The demonstration was operated over a path of 120 miles between trailer terminals located at Ottawa and Montreal. The two demonstration terminals were housed in standard 30-foot semi-trailers, self-sufficient except for primary power. The 15-foot dish antennas were erected on 35-foot towers at each end. The equipment inside each trailer consisted of a 1,000-watt transmitter, highly sensitive receiving equipment, and multiplex equipment for sending and receiving several channels simultaneously.

Transmission was in the Ultra High Frequency range, with the scattering effect of the signal occurring in the troposphere. The equipment accommodated voice as well as teletype-writer channels.

Some of the advantages of the "Transhorizon" technique include high reliability throughout the year; capability of transmitting and receiving several communication channels simultaneously; interference reduction; and utilization of frequencies outside of the more crowded communication bands.

(Turn to page 40)

● The Kingmere, Quebec, installation of the Scatter Propagation demonstration of the Collins Radio Company of Canada. The second installation was located 120 miles distant about 15 miles south of Montreal.







DR. GEORGE SINCLAIR

"All engineers concerned with the electronics industry in Canada should plan to attend the Canadian I.R.E. Convention. The technical program offers 25 sessions on a wide range of topics to suit all interests. Attending the Convention is the best way of keeping informed on new developments in electronics in Canada."

**GEORGE SINCLAIR,**  
Technical Program Director  
Canadian IRE Convention  
& Exposition.

## Canadian I.R.E. Convention - Oct. 1st to 3rd, 1956

# Technical Program

### MONDAY AFTERNOON, OCTOBER 1

#### Broadcast

## Paper No.

- 36 *A New Broadcast Remote Control System*  
F. Mathers,  
Canadian General Electric Co.  
Ltd., Toronto.
- 66 *A Portable Speech Input System Employing Transistor Amplifiers*  
W. J. Ives,  
Northern Electric Co. Ltd.,  
Belleville.
- 74 *A Graphic Volume Unit Recorder*  
D. H. McRae,  
Canadian Broadcasting Corp.,  
Montreal.
- 123 *A Canadian Transcontinental Microwave System*  
S. Bonneville,  
Canadian Broadcasting Corp.,  
Montreal.
- 37 *The London-Windsor Microwave System*  
R. D. Pynn,  
Canadian General Electric Co.  
Ltd., Toronto.

#### Semi-Conductors

- 27 *Thermal And Field Effects In Point Contact Diodes*  
R. E. Burgess,  
University of British Columbia,  
Vancouver.
- 52 *Inertia Phenomena in Photoconductors*  
Z. Szepesi,  
Canadian Marconi Co.,  
Montreal.

## Paper No.

- 53 *Optical Shuttering With Barium Titanate*  
H. W. Jaderholm,  
Canadian Marconi Co.,  
Montreal.
- 62 *Double Junction Phototransistor Theory*  
H. J. Goldie,  
Northern Electric Co. Ltd.,  
Montreal.
- 63 *Recent Developments In The Diffusion Technique Used To Produce Semi-Conductor Devices*  
J. Y. Perron,  
Northern Electric Co. Ltd.,  
Montreal.

#### Radio Relay System

- 47 *A Subcarrier Type Microwave Communication System For 36 Voice Channels*  
C. R. Hill,  
Canadian General Electric Co.  
Ltd., Toronto.
- 61 *An FM Demodulator Linearity Test Set*  
B. N. Sherman,  
Canadian Marconi Co.,  
Montreal.
- 99 *On Distortion in FM Subcarrier-AM Carrier Systems*  
R. Sandri and A. G. W. Timmers,  
Canadian Westinghouse Co. Ltd.,  
Hamilton.
- 79 *Supervision and Control of a Multi-hop Radio Relay System*  
R. J. Beddie and J. E. Raftis,

## Paper No.

- Rogers Majestic Electronics Ltd.,  
Leaside.
- 135 *The Quebec Hydro Microwave Communication System*  
J. G. Sutherland, J. Leahy and  
G. F. Baylis,  
RCA Victor Co. Ltd., Montreal

#### Measurements

- 17 *A Standing Wave Line for Low Radio Frequencies*  
E. A. Walker,  
D.R.T.E., Defence Research Board,  
Ottawa.
- 20 *High Precision Standard of Frequency*  
S. N. Kalra,  
National Research Council,  
Ottawa.
- 26 *Automation in the Laboratory — Description of a Strain Recording and Plotting System*  
G. F. Kelk,  
G. F. Kelk and Co., Toronto.
- 28 *Improved Calorimeters and Loads for Better Measurement and Absorption of Microwave and Lower Frequency Power*  
S. Freedman,  
Chemalloy Electronics Corp.,  
Santee, Calif.
- 75 *Video Transmission Requirements and Testing Techniques*  
A. Ste. Marie,  
Canadian Broadcasting Corp.,  
Montreal

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**Electronics For Defence**

Paper No.

- 96 *Electronics For Defence*  
M. L. Card,  
Dept. of National Defence,  
Ottawa.
- 35 *Automatic Range Radar For The F.86 Aircraft*  
L. W. deCocq,  
Canadian General Electric Co.  
Ltd., Toronto.
- 98 *Packaging Guided Missile Electronics*  
J. W. Keenan,  
Canadian Westinghouse Co. Ltd.,  
Hamilton.
- 101 *The Control of Guided Missiles*  
A. Ratz,  
Canadian Westinghouse Co. Ltd.,  
Hamilton.
- 105 *Radio Telemetering in Guided Missile Development*  
A. L. Lortie,  
C.A.R.D.E., Quebec.

**TUESDAY MORNING, OCTOBER 2****Antennas — I**

- 48 *Development Report on Tunable Microwave Bandpass Filters and Duplexing Filters*  
B. Vural,  
Canadian General Electric Co.  
Ltd., Toronto
- 119 *Some Aspects of Band Pass and Band Reject Filters Used for Duplexing*  
W. V. Tilston,  
Sinclair Radio Laboratories Ltd.,  
Toronto.
- 72 *Pattern Range for HF Shipborne Antennas*  
J. Y. Wong and J. C. Barnes,  
National Research Council,  
Ottawa.
- 118 *Investigation of the Pattern of a Ground Plane Antenna*  
A. H. Secord,  
Sinclair Radio Laboratories Ltd.,  
Toronto.
- 130 *Some Conductivity Characteristics of Canadian Terrain at Medium Radio Frequencies*  
P. A. Field,  
D.R.T.E., Defence Research Board,  
Ottawa.

**Nucleonics — I**

- 100 *Practical Implications in the Routine Measurement of Low Concentrations of Alpha Emitting Isotopes*  
J. Nicholls,  
Canadian Westinghouse Co. Ltd.,  
Hamilton
- 109 *Problems in Radiation Instruments for Defence*  
A. Hendrikson,  
D.R.T.E., Defence Research Board,  
Ottawa
- 110 *Use of Transistors in Nucleonics*  
F. S. Goulding,  
A.E.C.L., Chalk River.
- 111 *Millimicrosecond Time Measurements*  
R. E. Bell,  
McGill University, Montreal

Paper No.

- 112 *New Scaling Techniques*  
W. D. Howell,  
A.E.C.L., Chalk River.

**Color Television**

- 129 *Testing Facilities for Color Television Receivers*  
R. Anthes,  
Canadian Westinghouse Co. Ltd.,  
Brantford, Ontario.
- 131 *Video Transmission Testing Techniques for Monochrome and Color*  
J. Raymond Popkin-Clurman,  
Telechrome Mfg. Corp.,  
Amityville, L.I., New York.
- 138 *Measuring Equipment for Chrominance Channel Characteristics*  
P. A. Wigley and W. Shurben,  
Canadian Radio Mfg. Corp. Ltd.,  
Toronto.
- 139 *Design Considerations for Color Television I.F. Amplifiers*  
K. R. Van der Keyl,  
Canadian Radio Mfg. Corp. Ltd.,  
Toronto
- 137 *Sub-Carrier Matrixing in Color Television*  
A. E. Kimmel,  
Canadian Radio Mfg. Corp. Ltd.,  
Toronto.

**Circuits**

- 8 *Design of Oscillators to Temperature Compensate Inductance Type Transducers*  
A. G. Christensen,  
Phoenix Engineered Products  
Ltd., Toronto.
- 19 *Wide Band Power Amplifiers*  
P. Gomard,  
T. S. Farley Limited, Hamilton.
- 54 *A.C. Gain Stabilization by Use of D.C. Degeneration*  
H. P. Moen and D. A. Anderson,  
Canadian Marconi Co., Montreal.
- 60 *A New Approach to Variable Frequency Oscillator Design*  
F. A. Baily,  
Canadian Marconi Co, Montreal.
- 78 *The Application of Phase-Locked Frequency Control Systems*  
E. H. Hugenholtz,  
Rogers Majestic Electronics Ltd.,  
Leaside.

**Symposium: Reliability and Quality Control**

- 43 *Introduction of Panel Discussion*  
R. A. Muller, Chairman,  
Canadian General Electric Co.  
Ltd., Toronto.
- 44 *Design Considerations for Reliability*  
P. E. J. Wilburn,  
Canadian General Electric Co.  
Ltd., Toronto.
- 45 *Production Practices for Reliability*  
P. D. Balmer,  
Canadian General Electric Co.  
Ltd., Toronto.
- 46 *Organization and Analysis of Field Reports for Reliability*  
A. S. Best,  
Canadian General Electric Co.  
Ltd., Toronto.

Paper No.

- 56 *Applications of Statistical Quality Control*  
J. J. Fitzsimmons,  
Canadian Marconi Co., Montreal.
- 136 *Fundamentals of Statistical Quality Control*  
J. B. Pringle,  
Bell Telephone Co. of Canada,  
Montreal

**TUESDAY AFTERNOON, OCTOBER 2****Antennas — II**

- 31 *Broadband Center-Fed Slotted Cylinder Antenna*  
N. Tomcio,  
Canadian General Electric Co.  
Ltd., Toronto
- 70 *Two-Dimensional Slotted Arrays*  
G. C. McCormick,  
National Research Council,  
Ottawa.
- 71 *Design Procedures for Small Annular Slot Antennas*  
W. A. Cumming,  
National Research Council,  
Ottawa.
- 50 *A Broadly Tunable Antenna System*  
S. Presentey,  
Canadian Marconi Co., Montreal.
- 133 *Development of Cross-Polarized Antennas*  
R. Meier,  
RCA Victor Co. Ltd., Montreal.

**Nucleonics — II**

- 113 *Electronic Instrumentation for the Location and Assaying of Radio Active Ores*  
G. G. Eichholz,  
Dept. of Mines & Technical  
Surveys, Ottawa.
- 114 *Nuclear Power Plant Analog for NPD*  
W. S. Brown,  
Canadian General Electric Co.,  
Peterborough.
- 115 *System Reliability in Reactor Control*  
E. E. Siddal,  
A.E.C.L., Chalk River.
- 116 *Magnetic Amplifier Servo Control for NRU*  
N. F. Wood,  
Ferranti Electric Ltd, Toronto.
- 117 *Instrument Reliability in Reactor Instrumentation*  
A. Pearson,  
A.E.C.L., Chalk River

**Monochrome Television**

- 140 *A Tuning Indicator for Television Receivers*  
W. E. Liddell,  
Canadian Radio Mfg. Corp. Ltd.,  
Toronto.
- 80 *Closed Circuit Television*  
W. M. Booth,  
Rogers Majestic Electronics Ltd.,  
Leaside.
- 106 *Television Distribution Systems*  
E. O. Swan,  
Ernie Swan Television Co. Ltd.,  
Toronto.
- 146 *VHF Television Relay and Booster System*  
V. E. Isaac, A. Hodgson,  
J. E. Pauch, RCA Victor Co., Ltd.,  
Montreal.

## Paper No.

- 128 Interference Immunity of TV Receivers  
E. Luedicke,  
RCA Victor Co. Ltd., Renfrew.
- Electronic Tubes**
- 10 Microphonic Testing of Tubes  
S. Love,  
Radio Valve Company of Canada Ltd., Toronto
- 141 Cold Cathode Tubes  
A. K. Knowles,  
Rogers Majestic Electronics Ltd., Leaside.
- 143 The 6CW5 and its Application in a Biamplic High Fidelity System  
R. J. A. Turner,  
Philips Industries Ltd.
- 144 Design and Performance of a 2KW CW Klystron Amplifier for C-Band  
E. A. Conquest,  
Varian Associates of Canada Ltd., Georgetown.
- 51 An Investigation Into Simple Methods of Forecasting the Life of Electron Tubes with Indirectly Heated Cathodes  
R. H. Taplin,  
Canadian Marconi Co., Montreal.

**Data Processing**

- 4 Some Applications of Electronic Data Processing Systems in the Air Transport Industry  
L. E. Richardson,  
Trans-Canada Air Lines, Montreal.
- 25 Automatic Recording and Processing of Operating Data at Hydro's Niagara River Plants  
J. R. Leslie,  
H.E.P.C., Toronto.
- 104 Direct Simulation of Analog Computers Through Signal Flow Graphs  
L. P. Robichaud,  
C.A.R.D.E., Quebec.
- 86 Magnetostriction Delay Lines  
J. V. Scott,  
Ferranti Electric Ltd., Mount Dennis, Toronto.
- 65 Applications of Symbolic Logic to Electronic Engineering  
G. B. Thompson,  
Northern Electric Co. Ltd., Belleville.

**TUESDAY EVENING, OCTOBER 2****Electronic Sorting of Mail  
A First for Canada****Part I**

*The Canadian Post Office  
Electronic Mail Sorter*  
Mr. W. J. Turnbull,  
Deputy Postmaster General

**Part II**

*Fundamental Principles of the  
Canadian System*  
Dr. M. Levy,  
Post Office Dept., Ottawa.  
*The Route Reference Computer*  
C. G. Helwig, H. B. Brown,  
L. R. Wood,  
Ferranti Electric Ltd., Toronto.

**WEDNESDAY MORNING, OCTOBER 3  
Scatter Propagation**

- 1 A Reflection Theory for Beyond

## Paper No.

- the Horizon Propagation*  
H. T. Friis, A. B. Crawford and  
D. C. Hogg,  
Bell Telephone Laboratories,  
Holmdel, N.J.
- 69 2700 MC/S Scatter Propagation Between Ottawa and Toronto  
L. H. Doherty,  
National Research Council,  
Ottawa.
- 82 Detailed Performance Characteristics of Communication Circuits Employing Tropospheric Scatter Propagation  
R. M. Ringoen,  
Collins Radio Co. of Canada Ltd., Toronto.
- 84 System Design Problems Associated with VHF Scatter Circuits  
John W. Smith,  
Collins Radio Co. of Canada Ltd., Toronto.
- 108 Scatter Propagation  
P. L. Rice,  
C.R.P.L. Bureau of Standards,  
Boulder, Colo.

**Transistor Circuitry**

- 15 High Frequency Transistor Amplifier Design  
G. T. Lake,  
D.R.T.E., Defence Research Board,  
Ottawa.
- 22 Transistor D.C. Converters  
G. M. Kerrigan,  
Computing Devices of Canada Ltd., Ottawa.
- 24 Transistor Circuitry for Wide Ranges of Environmental Temperature  
W. Greatbatch,  
Consultant, Taber Instrument Co.,  
N. Tonananda, N.Y.
- 88 Transistor Parameter Variations  
S. V. Soanes,  
Ferranti Electric Ltd., Toronto.
- 124 Logical Use of Transistors in Communications Applications  
S. Kagan,  
Crosley Defence and Electronics Div., Moffats Ltd.

**Medical Electronics**

- 68 Analysis of Heart Murmurs by Electronics  
R. S. Richards,  
National Research Council,  
Ottawa.
- 73 Electronic Applications in Cardio-Vascular Surgery  
J. A. Hopps,  
National Research Council,  
Ottawa.
- 6 Low-Frequency Analyzers in Electro-Physiology  
John F. Davis,  
McGill University, Montreal.
- 18 The "Scad"—A Servo Calibrating Auto Densitometer  
P.E.P. Smith,  
Electrodesign, Montreal.
- 95 A Demonstration Oscilloscope and Electro-Physiological Unit  
P. Sekelj and B. D. Burns and  
C. Pinsky,  
McGill University, Montreal.

## Paper No.

- 148 Electronics in Medicine  
W. E. Hodges,  
Consultant, Toronto.
- Manufacturing Techniques**
- 7 The Quality Control of Printed Circuit Board Manufacturing  
Frank H. Edwards,  
United-Carr Fastener Co. of  
Canada Ltd., Hamilton.
- 89 Mechanized Processes for Design and Manufacture of Printed Wiring Units for Data Processing Systems  
D. E. Nuttall,  
Ferranti Electric Ltd., Toronto.
- 33 Discussion of Methods of Producing Prototype Printed Circuit Boards  
I. Meitlis,  
Canadian General Electric Co.  
Ltd., Toronto.
- 34 Epoxy Casting of Electronic Circuitry  
D. L. Harvey,  
Canadian General Electric Co.  
Ltd., Toronto.
- 134 Development and Installation of a 250 KW Low Frequency Transmitter  
V. Ziemelis,  
RCA Victor Co. Ltd., Montreal.

**Components and Materials**

- 23 Magnetic Recording Tape  
L. F. Bennett,  
C.A.M.E.S.A., Ottawa.
- 16 A Study of Sintered Oxide Mixtures as Resistive Materials  
J. A. Cowan, D.R.T.E.,  
Defence Board, Ottawa and  
J. H. Simpson,  
National Research Council,  
Ottawa.
- 59 Microwave Hybrids Using Strip Line  
R. McClelland,  
Canadian Marconi Co., Montreal.
- 97 Ferrites in Microwave Work  
D. J. Whale,  
Canadian Westinghouse Co. Ltd.,  
Hamilton.
- 121 General Design Factors and Characteristics of Foil Tantalum Capacitors  
F. R. Flood,  
Canadian General Electric Co.  
Ltd., Hudson Falls, N.Y.

**WEDNESDAY AFTERNOON,  
OCTOBER 3  
Propagation**

- 57 The Cost of Decibels  
Frederick Gall,  
Canadian Marconi Co., Montreal.
- 76 Microwave Refractometer Measurements of Atmospheric Refractive Index  
Albert W. Adey and W. J. Heikkla,  
R.P.L., Defence Research Board,  
Ottawa
- 77 An Experimental Investigation of the Diffraction of Electromagnetic Waves by a Dominating Ridge  
J. W. B. Day, J. H. Crysdale and  
W. S. Cook, R.P.L.,  
Defence Research Board, Ottawa.

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# Technical Program — IRE Convention

## Paper No.

- 102 *Electronics in Meteorology*  
W. R. Smith,  
Department of Transport, Ottawa.

### Applications of Transistors to Computers

- 12 *A P-N-P-N Bistable Element suitable for Digital Computers*  
N. F. Moody,  
D.R.T.E., Defence Research Board, Ottawa.
- 13 *Computer Circuits Using the P-N-P-N Transistor Element*  
C. D. Florida,  
D.R.T.E., Defence Research Board, Ottawa.
- 125 *Transistorized Logical Building Blocks*  
D. C. Redpath,  
Crosley.
- 126 *The Systems Design of a Transistorized General Purpose High Speed Digital Computer*  
D. F. Parkhill and  
G. G. Desloovere, Crosley.
- 87 *A Design Method for Direct-Coupled Transistor Computer Circuits*  
G. S. Collins, C. G. Helwig,  
D. K. Ritchie and  
R. S. Wedgewood,  
Ferranti Electric Limited,  
Toronto.

### Communications

- 2 *Public Mobile Telephone Service Problems*  
S. H. Whitaker,

## Paper No.

- Bell Telephone Co. of Canada,  
Montreal.
- 32 *Some Considerations in Radio-Telephone Interconnections*  
A. Lovas,  
Canadian General Electric Co.  
Ltd., Toronto.
- 58 *A Canadian Designed 150 mc Vehicular Communication Equipment*  
G. M. Koch and W. Ornstein,  
Canadian Marconi Company,  
Montreal.
- 83 *High Frequency Single Sideband Techniques*  
W. S. Bruene,  
Collins Radio Co. of Canada Ltd.,  
Toronto.
- 3 *An Experimental Radio Teleprinter Broadcast Service for North-Atlantic Air Routes*  
B. G. Doutré,  
Trans-Canada Air Lines, Montreal.

### Electronic Applications

- 9 *Magnetoresistive Amplifiers*  
A. Aharoni and E. H. Frei,  
Weizmann, Institute of Science,  
Rehovoth, Israel.
- 55 *Automatic Direction Finder Type CMA-301*  
E. W. Beasley and Th Janssen,  
Canadian Marconi Company,  
Montreal.
- 67 *A Microwave Position-Fixing System*  
F. R. Park and K. Ayukawa,

## Paper No.

- National Research Council,  
Ottawa.
- 122 *Some Considerations Affecting the Design or Servos in Flight Simulator Applications*  
F. Borlace,  
Canadian Aviation Electronics  
Ltd., Montreal.
- 132 *Electronic Power Supplies*  
T. C. Gams,  
NJE Corp., Kenilworth, N.J.

### Management

- 143 *Cost Reduction and Product Improvement*  
E. H. Tovee,  
Canadian Westinghouse Co. Ltd.,  
Hamilton.
- 40 *Planning, Controlling and Measuring Engineering Projects*  
J. M. Toye,  
Canadian General Electric Co.  
Ltd., Toronto.
- 64 *Common Errors in Measurement and Design*  
W. C. Benger,  
Northern Electric Co. Ltd.,  
Belleville.
- 14 *The Organization of a Transistor Measurements Laboratory*  
D. P. Henderson,  
D.R.T.E.,  
Defence Research Board, Ottawa.
- 142 *Cascade Co-Operative Education*  
Richard Scott,  
Canadian Aviation Electronics  
Ltd., Montreal.

Date and Time	SESSIONS				
Monday October 1st 2:30 p.m. 5:00 p.m.	BROADCAST	SEMI- CONDUCTORS	RADIO RELAY SYSTEMS	MEASUREMENTS	ELECTRONICS FOR DEFENSE
Tuesday October 2nd 10:00 a.m. 12:30 p.m.	ANTENNAS I	NUCLEONICS I	COLOR TELEVISION	CIRCUITS	SYMPOSIUM RELIABILITY AND QUALITY CONTROL
Tuesday October 2nd 2:30 p.m. 5:00 p.m.	ANTENNAS II	NUCLEONICS II	MONOCHROME TELEVISION	ELECTRONIC TUBES	DATA PROCESSING
Tuesday October 2nd 8:00 p.m.	ELECTRONIC MAIL SORTATION				
Wednesday October 3rd 10:00 a.m. 12:30 p.m.	SCATTER PROPAGATION	TRANSISTOR CIRCUITRY	MEDICAL ELECTRONICS	MANUFACTURING TECHNIQUES	COMPONENTS AND MATERIALS
Wednesday October 3rd 2:30 p.m. 5:00 p.m.	PROPAGATION	APPLICATIONS OF TRANSISTORS TO COMPUTERS	COMMUNICATIONS	ELECTRONIC APPLICATIONS	MANAGEMENT

# why

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# 71.2%

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\*The complete survey of Business Newspaper readership by Gruneau Research Limited is exciting news. Respondent and interviewer went through current issues of B.N.A. papers page by page. Interviewers' kits included (1) current issues of General Business Publications for business classifications, (2) current issues of Horizontal Industry Publications for surveying all manufacturing classifications, (3) current issues of all other publications that applied to the particular business category within which the respondent came. Get your copy of this survey!

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## Strong Secondary Industry For Canada Urged

In a recent interview, Edmund S. Rose, president of Standard Wire and Cable Limited, expressed his reasons for believing that it is supremely logical that Canada should develop and expand its wire and cable industry to the greatest possible degree. Mr. Rose said: "We are one of the world's leading producers of two of the major raw material components in the manufacture of electrical conductors, copper and aluminum. It is unfortunate that we (Canada), as a rising young industrial power, should be content to export so much of our raw materials and semi-finished materials, rather than develop a strong secondary industry. How much better it is that Canadians should not only mine and smelt the metals, but also design, manufacture and market their products for Canadian consumption, and for a growing but neglected export market throughout the world.

Mr. Rose continued: "The tremendously increased requirement for electrical conductors brought about by the applications of 'automation' and 'electronics' during the past ten years creates an almost insatiable demand, and during the next ten years the electric energy output from hydro



E. S. ROSE

and atomic sources will be increased over 100 per cent. In addition, a much-needed Adequate Wiring Program to encourage and facilitate the rewiring of more than seventy-five per cent of all the residential buildings in Canada is just getting under way, and receiving enthusiastic acceptance. Large scale developments and projects are, even at present, finding the supply of electrical conductors to be a major bottleneck in their schedules, and their requirements are really only beginning. It all adds up to more appliances and units installed for the comfort and convenience of our people . . . more controls and systems to enable our industries to produce better products faster . . . and ever increasing demands for electrical conductors!

"What is the answer? With the few domestic suppliers of wire and cable producing to their utmost capacity, and suppliers in the United States and Great Britain unable to cope with commitments already made in every part of the globe, the answer lies in the development and expansion of our domestic manufacturing potential."

Mr. Rose's comments are backed up by the fact that his organization, Standard Wire and Cable Limited, has utilized every new advancement and development in the sciences of automation and engineering to make its



● At the annual meeting of the Canadian Manufacturers' Association, recently held in Toronto, announcement was made by Crawford Gordon, Jr., president of the A. V. Roe Canada Ltd., of a national conference to be held September 10th-11th on scientific and engineering manpower aimed at finding a solution to the existing extreme shortage of scientists, professional engineers and skilled technicians. Leading Canadians in the fields of education, government, the professional societies, labor and industry are expected to participate. With Mr. Gordon (center above) are Col. T. M. Medland (left), executive director, The Association of Professional Engineers of Ontario, and (right) T. A. Rice, president of the C.M.A.

new plant at Toronto, a plant which, in many respects, is unique in Canada.

## TV-Electronics Firm Names Canadian Vice-President

Appointment of John M. McLean as Vice-President and General Manager of General Instrument — F. W. Sickles of Canada, Ltd., major Canadian producer of television components, was announced here today by General Instrument Corporation, parent of the Canadian firm. Mr. McLean, one of Canada's outstanding



JOHN McLEAN

radio-TV production specialists, the announcement stated, is immediately putting into effect a four-point expansion program at the Company's Waterloo, Ont., plant designed "to keep pace with a heavy volume of orders from Canadian TV

set manufacturers for the Company's made-in-Canada products and to permit production in the Dominion of additional radio, television and electronic parts."

## CGE To Equip New Radio Station At Oakville

Canadian General Electric Company has announced the signing of a contract with CHWO Radio Limited for complete transmitting and studio equipment to supply the new radio broadcasting station in Oakville, Ont.

The contract calls for the supply and installation of a 1 Kw/500 Watt AM transmitter operating into a 2-tower array as well as monitoring and control facilities and complete broadcasting studios. The station will operate on an assigned frequency of 1250 Kc. The transmitter is of Canadian design and was manufactured at Canadian General Electric's Royce Works in Toronto. Shipment of the equipment is scheduled for late summer.



● Opening of a new radio monitoring station at Almonte, 35 miles southwest of Ottawa, finds Department of Transport officers inspecting the high precision equipment used to ensure national and international regulations covering radio and television transmission. Radio operator Albert Berry demonstrates. Standing, left to right, are F. G. Nixon, Controller of Telecommunications; W. B. Smith, Senior Radio Engineer; and Air Vice Marshall A. de Niverville, Director of Air Services.

# OPPORTUNITIES IN CANADA

## FOR

# TECHNICAL PERSONNEL

A MEETING PLACE BETWEEN EMPLOYERS IN  
CANADA — AND EMPLOYABLE TECHNICIANS IN  
THE ELECTRONIC AND COMMUNICATION FIELD.

### Designers and Draughtsmen

Excellent opportunity to develop your full capabilities in tackling diversified projects in the fields of

- Electronic Computers
- Instrumentation
- Electronic test and measuring equipment
- Guided Weapons

Enjoy working in a new modern building located in the Ottawa district and benefit from our extensive welfare plans which include group insurance, retirement plan, credit union, cafeterias, and many others.

For further information, write, quoting File EC-1.

Personnel Manager

**COMPUTING DEVICES OF  
CANADA LTD.**

P.O. Box 508  
Ottawa, Ontario

### APPLICATION ENGINEER

#### Electronics

A stimulating engineering and sales position with an expanding electronics company is open to a graduate engineer with approximately two years' experience in electronic instruments and/or microwave circuitry.

An individual with the appropriate technical background, plus the ability to meet and get along well with people, will find a challenging opportunity for professional growth and personal advancement in this position. Send resume in writing to:

Personnel Manager,  
Varian Associates  
of Canada Ltd.,  
45 River Drive,  
Georgetown, Ontario.

### Electronics Technicians

#### Defense Research Board

Vacancies exist for Electronics Technicians especially in the Telecommunications Establishment, Ottawa, and the Canadian Armament Research and Development Establishment, Valcartier, Quebec. Some technicians are also required for northern locations during the International Geophysical Year (1957-1958). The work will be in such fields as radio communications, transistor circuitry, components, printed circuits, radar and radio countermeasure, guided missiles.

There are excellent working facilities, including up-to-date laboratories, and the latest electronic test instruments. Employee benefits include a five-day week, a pension plan, generous vacation and sick-leave benefits, medical-hospital insurance plans, and for those in the north, special northern allowances. There are excellent opportunities for the furthering of formal education and for advancement.

Qualifications should preferably include high school graduation or the equivalent, advanced technical training and relevant experience. Salaries will depend upon qualifications and will range from \$1920 to \$4860 a year. Applicants must be Canadian citizens or British subjects.

Apply in writing to the Director of Personnel, Defense Research Board, Daly Bldg. Annex, Mackenzie Avenue, Ottawa, Ontario. Please refer to file 56-D of P-2.

### Engineers

Outstanding opportunities in the fields of Computers, Instrumentation and Guided Weapons available to

- Electrical Engineers
- Electronic Engineers
- Electromechanical Engineers
- Mechanical Engineers
- Aeronautical Engineers
- Engineering Physicists

Positions are now open for systems and design engineers with experience in

Pulse Circuitry  
Analogue and Digital Techniques  
Electronic Test and  
Measuring Equipment  
Aircraft Instruments  
Semiconductors

If you are interested in stimulating assignments offering a real challenge and calling for creative imagination, investigate these positions by writing to

Personnel Manager

**COMPUTING DEVICES OF  
CANADA LTD.**

P.O. Box 508  
Ottawa, Ontario

Please quote File EC-2

### ELECTRONIC TECHNICIAN

— with sound theoretical background and at least 5 years experience required by components manufacturer. Duties to include construction and maintenance of high frequency test equipment and to assist in the eventual development of production projects. Interesting job and good working conditions in Toronto Suburban area.

Box S. 33  
**ELECTRONICS AND  
COMMUNICATIONS**

### Radio Technician Required

experienced in component testing, laboratory instruments and practice. Reply giving full particulars to

**T. S. FARLEY LTD.,  
HAMILTON, ONTARIO**

## H. J. Davie Appointed President R. H. Nichols

Announcement has been made that Mr. Henry James Davie has been promoted to the position of president and general manager of R. H. Nichols Limited, Toronto, Ont. Mr. Davie joined the R. H. Nichols firm in 1946 following return from military service overseas and became director of the company in 1948 since when he has held progressively higher positions until his recent appointment as president and general manager of the firm.



H. J. DAVIE

## London Free Press Experiments With Recorded Music

**M**USIC's power to soothe has been put to good use at The London (Ont.) Free Press with addition of a tape recorder to the office equipment of the classified ad department.

The recorder was installed in October, 1955, to counteract the noise of the adjoining accounting department. It has proved successful not only in offsetting noise but in lifting the morale of the department's 20 ad takers, especially towards the end of a day on the phones.

The experiment is being conducted by department manager, W. B. White, working in conjunction with CFPL Radio. CFPL is owned and operated by the same company which owns The Free Press. Tests were made with speakers located in various parts of the office and with several kinds of

## B. G. Ballard Receives Recognition From Queen's University

The National Research Council of Canada announced recently that Mr. B. G. Ballard, vice-president (Scientific) and Director of the Division of Radio and Electrical Engineering, has been awarded the honorary degree of Doctor of Science from Queen's University, Kingston, Ontario.

## Ellis Industries Introduce New Line

J. W. Ellis Industries have recently introduced to the Canadian market the products of their Danish principals, A. S. Danbridge of Copenhagen, manufacturers of laboratory instruments and equipment.

## Measurement Engineering Announces Appointments

D. A. Bamford, president and general manager, Measurement Engineering Limited, of Arnprior, Ontario, recently announced the following appointments in the Contracts and Sales Department.

Ernest E. Whittaker, previously contracts administrator, has become manager, Contracts and Sales. Mr. Whittaker will be active in the Ottawa Valley area.

Miss Lee A. Denault has been appointed Contracts and Sales Office Manager. Miss Denault brings to her new position six years' experience in the Sales Department.

W. Evan-Jones has been appointed sales representative for Central and Western Ontario, effective August 1st, 1956. Mr. Evans-Jones, who has had long experience in the sales departments of the Canadian electronics industry, will operate from his office at 5 Harris Crescent, Burlington, Ontario.

Fred Ball, who has been associated with the Contract Administration, Purchasing and Expediting Departments of Measurement Engineering Limited, has been appointed sales representative for Quebec and the Eastern Provinces. Mr. Ball will work out of the head office at Arnprior, Ontario.

## T. J. Bell President Of Fiberglas Canada Limited

W. E. Phillips, vice-chairman of the board of Fiberglas Canada Limited, has recently announced the appointment of T. J. Bell as president of the company. Mr. Bell was previously executive vice-president of the organization.

After graduation from the Commerce and Finance course at the University of Toronto in 1936, Mr. Bell joined Federal Wire and Cable Company Limited at Guelph, Ontario, as cost accountant and later rose to secretary-treasurer and, in 1941, to assistant to the president.



W. EVAN-JONES



T. J. BELL

music. Popular music has been found most successful. Light instrumentals give best results, while vocals too often prove distracting.

A Tapomatic recorder is used with magnetic recording Audiotape. Each tape plays for 30 minutes. With proper care, the tapes will last indefinitely according to Mr. White.

The music forces the noise into the background through a psychological, rather than a physical, effect. With the speaker located in a central part of the office, it is now possible to regulate the volume so that the music doesn't drown out the noise of the nearby adding machines, billing machines, and air conditioning equipment. Instead, the mechanical noises are gently cushioned by the calming melodies provided by CFPL librarians.

While the music, if played at strategic times, is completely effective, continuous melody becomes monotonous. Experimenting with different hours, Mr. White has found that best results are achieved if the recorder is on from 10:30 to 12:00 in the mornings and from 3:00 to 5:00 in the afternoons.

Another hazard which The Free Press has overcome through the trial and error method is the danger of the music losing its effect through repetition. New tapes run off at CFPL are added to the rapidly increasing collection each week.

Suggestions from the staff have revealed that variety is necessary, but everyone is willing to listen to the other fellow's favorite tune if he knows his own is coming up before too long.

● Soft music played by tape recorder is used by the classified ad department of The London (Ont.) Free Press to counteract the noise created there and in the adjoining accounting department. W. B. White, classified ad manager, is seen giving a helping hand to his secretary, Carole Webb, who is in charge of changing the tapes.





## Phillips Electrical Co. Appoints A. Sandilands Sales Manager

F. W. Barnhouse, general sales manager of Phillips Electrical Company Limited, Brockville, recently announced the appointment of A. Sandilands, B.Sc., as sales manager of the company.



A. SANDILANDS

Mr. Sandilands has been western regional manager of Phillips Electrical Co., in Winnipeg, for the past three years, and will shortly be transferred to the company's head office in Brockville to take up his new duties there.

A graduate of Manitoba University, Mr. Sandilands has been with the company for 16 years and brings a wide experience of the wire and cable field to his new position.

To obtain further information on New Product items in this issue use postcards on page 62.

## Century Electronics & Instruments Elects New President

T. A. Manhart, former senior partner of Manhart, Millison & Beebe, geophysical consultants, has been elected president of Century Electronics & Instruments, Inc., Tulsa, Oklahoma. Opie Dimmick remains chairman of the board and chief executive officer.

Manhart has a Master of Science degree from the Colorado School of Mines where he served as an instructor of geophysics. He also served with Shell Oil Company as seismologist and as a consultant to the U.S. Reclamation Service before joining Seismograph Service Corporation in 1933.

Manhart spent 16 years as a director and executive vice-president of Seismograph Service Corporation in charge of domestic and foreign operations. Since 1949, he has served as president of Petroleum Consultants, Inc., geophysical director of Geophysical Consultants, Inc., both of Tulsa, and as director of Exploration Consultants, Inc., Calgary.

He has been a director of Century Geophysical Corporation, parent company of Century Electronics, since 1950.

## Aerovox Appoints Marty Howard Sales Representative

J. Cartwright, sales manager of Aerovox Canada Limited, recently announced the appointment of Marty Howard, of Electronic Sales Associates, as a sales representative for the complete Aerovox line.



MARTY HOWARD

Mr. Howard, who has had a wide experience in the electronic component industry, will be located in Ottawa, and will represent Aerovox in Ottawa and Eastern Ontario.

**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.

*Standardized Electronic Hardware*

**IMMEDIATE  
DELIVERIES**



**Complete  
Stock in  
Canada**

COMPLETE REPRESENTATIVE STOCK of world's largest selection of standardized electronic hardware manufactured by USECO now warehoused in Canada. Supported by factory inventory of 21-million pieces. Also prompt service on etched circuits and standard and special terminal boards. Write your distributor or to our Canadian representative, Lake Engineering Co., 36 Upton Road, Scarborough, Ontario.

See us at the WESCON Show — Booth 239

**U. S. ENGINEERING CO., INC.**  
A Division of Litton Industries, Inc.  
521 COMMERCIAL STREET • GLENDALE 3, CALIFORNIA

## Canadian Westinghouse Staff Appointments

The appointment of Edward R. Nary to the newly-created post of manager, headquarters manufacturing department, was recently announced by



E. R. NARY

George L. Wilcox, president of Canadian Westinghouse Company Limited.

Mr. Nary is a former executive member of the Westinghouse headquarters manufacturing staff at Pittsburgh and served for the past year as a consultant to the European Productivity Agency of the Organization for European Economy Recovery.



A. A. PETERS

The appointment of A. A. Peters, as sales manager, electronic tube division of Canadian Westinghouse has been announced by L. A. McCalpin, general manager, lamp-tube divisions. Mr. Peters is also responsible for market research and order service pertaining to electronic tubes.



R. R. GUENETT

Richard R. Guenett, a former sales engineer for Westinghouse at the company's Montreal office, has joined the Electronics Division in Hamilton

to engage in special market development assignments for industrial electronic controls related to the field of automation.

Mr. Guenett will be directly responsible to John H. Fletcher, commercial sales manager for the Westinghouse Electronics Division at Hamilton, Ont.

## Canadian IRE Convention Exhibitors Grow in Number

Indicative of the interest shown by the Canadian electronics and communications manufacturing industry in the forthcoming Canadian I.R.E. Convention and Exposition to be held in Toronto at Exhibition Park from October 1st to 3rd is the latest official list of firms who have reserved exhibit space at the exhibition. The list of manufacturers includes firms engaged in practically every phase of endeavor in the electronics and communication industries as well as users of equipment such as the National Research Council, Defense

Research Board, Atomic Energy of Canada Limited and the Department of National Defense.

Of additional interest to electronic and communications engineers will be an engineering symposium at which will be presented a wide range of technical papers dealing with a variety of subjects. The symposium is expected to attract engineers from every section of Canada and many from the United States.

Firms which will have exhibits at the exhibition are as follows:

Adams Engineering Ltd.  
Aerovox Canada Ltd.  
Aircraft-Marine Products of Canada Ltd.  
Alford Manufacturing Co. Inc.  
Alpha Wire Corporation.  
Ampex American Corporation.  
Amphenol Canada Ltd.  
Andrew Antenna Corp. Ltd.  
Atlas Radio Corp. Ltd.  
Atomic Energy of Canada Ltd.  
Automatic Radio of Canada, Ltd.  
Aviation Electric Limited.

Bach-Simpson Limited.  
Bayly Engineering Limited.  
Beaconing Optical & Precision Materials Limited.  
Beama Engineering Limited.  
Budd-Stanley Co. Inc.  
Bomac Laboratories Inc.

Canada Wire & Cable Co. Ltd.  
Canadian Aviation Electronics Ltd.  
Canadian Electric Resistors Ltd.  
Canadian General Electric Co. Ltd.  
Canadian Marconi Co. Ltd.  
Canadian Westinghouse Co. Ltd.  
Cannon Electric (Canada) Limited.  
Capitol Radio Engineering Institute  
Caprin Limited.  
Centralab Canada, Limited.  
Collins Radio Co. of Canada Ltd.  
Computing Devices of Canada Ltd.  
Conrad, Inc.  
Copper Wire Products Limited.  
Cossor (Canada) Limited.

Dawe Instruments Limited.  
Decca Radar (Canada) Limited.  
Defence Research Board.  
Department of National Defence (Joint Services Electrical and Electronics Committee).  
Desser E-E Limited.  
Diamond State Fibre Co. of Canada Ltd.  
Dominion Electrohome Industries Ltd.

Edwards High Vacuum (Canada) Ltd.  
Eitel-McCullough Inc.  
Electrodesign.  
Electro Impulse Laboratory, Inc.  
Electromechanical Products.  
Electro Sonic Supply Co., Ltd.  
Electronic Sales Associates.  
Electronics & Communications Magazine (Age Publications Limited)  
Erie Resistor of Canada Ltd.  
Essex Electronics of Canada Ltd.

T. S. Farley Limited.  
Ferranti Electric Limited.  
Filtron Co. Inc.  
Fleet Manufacturing Ltd.

General Communications Ltd.  
The Glendon Co. Ltd.  
Hackbusch Electronics Limited.  
Hammond Manufacturing Co. Ltd.  
Hellermann of Canada Limited.  
John Herring & Co. Ltd.  
The Holden Co. Ltd.

The Indiana Steel Products Co. of Canada Ltd.  
Industrial Electronics of Canada Ltd.  
The Institute of Radio Engineers.  
International Resistance Co. Ltd.

G. F. Kelk and Company.  
Kester Solder Co. of Canada, Ltd.

E. G. Lomas Company.  
J. R. Longstaffe Co. Ltd.

Marsland Engineering Limited.  
McCurdy Radio Industries Limited.

Measurement Engineering Ltd.  
Measurements Corporation.  
Microwave Systems.  
Minneapolis-Honeywell Regulator Co. Ltd.  
Moffats Limited.  
Mycalex Corporation of America.  
National Carbon Co.  
National Fibre Co. of Canada Ltd.  
National Research Council.  
R. H. Nichols Limited.  
Norden-Ketay Corporation.  
Northern Electric Co. Limited.  
Northern Industrial Products Ltd.  
Oki & Willadsen Limited.  
Panelyte Division, St. Regis Paper Co. (Canada) Ltd.  
The Plessey Co. of Canada Ltd.  
Charles W. Pointon Limited.  
Potter & Brumfield Inc.  
Powerlite Devices Limited.  
Precision Electronic Components (1956) Limited.  
PSC Applied Research Limited.  
Pye Canada Limited.  
Quality Hermetics Limited.  
Radelin-Kirk Limited.  
Radio College of Canada.  
Radio Condenser Co. Ltd.  
Radio Engineering Products Ltd.  
Radionics Limited.  
Raytheon Canada Limited.  
Rogers Majestic Electronics Ltd.  
R-O-R Associates Limited.  
Rotron Manufacturing Co.  
Rutherford Agencies.  
Sigma Instruments Inc.  
A. C. Simmonds & Sons, Ltd.  
Sinclair Radio Laboratories Ltd.  
Sparton of Canada, Limited.  
Sperry Gyroscope Co. of Canada Ltd.  
The Sphere Co., Inc.  
Sprague Electric International Ltd.  
Standard Telephones & Cables Mfg. Co. (Canada) Limited.  
Stark Electronic Instruments Ltd.  
The Superior Electric Co.  
Tektronix Incorporated.  
Tenatronics Limited.  
Tensolite Insulated Wire Co. Inc.  
TMC (Canada) Limited.  
United-Carr Fastener Co. of Canada Ltd.  
Varian Associates of Canada Ltd.  
White Radio Limited.  
Wind Turbine Co. of Canada Ltd.

## Minnesota Mining Names

### M. H. Patterson Vice-President

Maynard H. Patterson has been named Vice-President and General Manager of the International Division of Minnesota Mining and Manufacturing Company, St. Paul, Minnesota.

Prior to this appointment Mr. Patterson served as Vice-President and General Manager of Minnesota Mining and Manufacturing of Canada Limited with its head office in London, Ontario. He has headed 3M Canada since its formation in 1951.

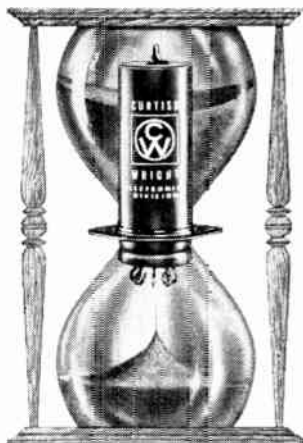


M. H. PATTERSON

In his new capacity Mr. Patterson will direct 3M's International operation which consists of fourteen manufacturing plants in Canada, England, France, Germany, Brazil, Mexico and Australia; with sales offices throughout the world. Included also is the 3M Company's Export Division with headquarters in New York City.

# The Curtiss-Wright "SNAPPER"

NEW CONCEPT...  
ADVANCED DESIGN  
IN THERMAL TIME  
DELAY RELAYS



U. S. Pat. No. 2658975

Designed for high performance and long life, the Curtiss-Wright "SNAPPER" Thermal Time Delay Relay is proving itself in countless applications involving time delay in electrical circuits. Such applications include circuits to provide definite on-off time intervals to delay the application of high voltage until after warm-up period and for over and under voltage protection with simultaneous fault indication.

These relays have single-pole double-throw contact action, high ambient temperature range, freedom from chatter and arcing, and are small in size. The "SNAPPER" thermal time delay relays are factory pre-set from 3 to 120 seconds. They are available in metal envelope, miniature (7 and 9 pin) or octal (8 pin) and in a glass envelope in 9 pin only.

Curtiss-Wright manufactures the High-Low "SNAPPER" Differential Thermostat with high precision characteristics. Write to Thermal Devices for complete data.

Canadian Representative:  
Consolidated Electronics  
Equipment Company, Ltd.  
1156 Yonge St., Toronto, Ont.



# ATLAS

## TRANSFORMERS

*Hermetically Sealed & Encapsulated*

- Power Transformers to 10 KVA
- Filter Reactors
- Smoothing Chokes
- Charging Reactors
- Audio Matching Transformers
- Audio Output Transformers
- Pulse Transformers

JACNAFT-2 & MIL-T-274 Specifications

### POWER SUPPLIES

Magnetically and electrically regulated . . . and unregulated power supplies.

### FILTERS

Low Pass - High Pass - Band Pass

**CANADIAN ATLAS TRANSFORMER COMPANY**  
LIMITED

17 CARLAW AVE., TORONTO Phone RI. 5513

# Coloured Television Course

*being prepared by*

## Radio Electronic Television Schools

Under the direction of one of  
**AMERICA'S FOREMOST ENGINEERS**

*R.E.T.S. is delighted to announce that*

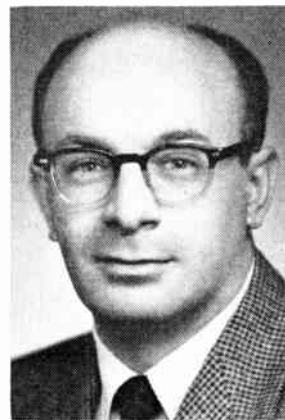
**Mr. George Chernish, Professional Engineer**  
One of America's foremost Coloured Television Experts

at present working on a coloured television project in Santa Monica, California, with Sylvania-Paramount Studios, will join the teaching faculty on Sept. 1st next to assist in launching the new course.

Mr. Chernish will later be going to the United States, where R.E.T.S. plans on opening a chain of schools.



**LESLIE L. HILL**  
D. ENG. Ph.D. (Eng.)



**DAVID FORDE**  
B.Sc. P.Eng.

Mr. David Forde, who is a graduate of R.E.T.S. and Director of Education for the schools, will supervise the new course, assisted by Dr. Leslie L. Hill, who has had extensive experience in electronics including studies on Image Tubes and their application for colour television.

### THE COURSE WILL CONSIST OF

Five Hours of combined lecture and practical bench-work

### EACH WEEK

supplemented by extensive home study

### FOR 12 WEEKS

**APPLICANTS WISHING TO TAKE THIS COURSE IN COLOURED TELEVISION MUST HAVE R.E.T.S. GRADUATION CERTIFICATES OR EQUIVALENT. ONLY THOSE HAVING THESE QUALIFICATIONS ARE SUITABLE.**

For further information apply to:

## RADIO ELECTRONIC TELEVISION SCHOOLS OF CANADA LIMITED

261 SPADINA AVE., TORONTO, ONT.  
EM. 6-9618 — EM. 6-5967

SCHOOL OPEN DAILY FROM 9.00 A.M. until 11.00 P.M.  
(Saturdays 9.00 A.M. until 2.00 P.M.)

**COMPLETELY AIR CONDITIONED**

## R.E.T.S. Extends Training Facilities Through New Staff Appointments

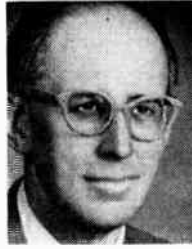
Radio Electronic Television Schools of Canada Ltd., in looking to the imminent need for trained workers in industry, has recently made new appointments to strengthen its training staff.

Mr. David Forde, B.Sc., himself a graduate of R.E.T.S. and now Director of Education in the Toronto school, announces the appointment of Dr. Leslie L. Hill, D.Eng., Ph.D. (Eng.), Dr. Chem., who has had extensive training and experience in Europe and on the American continent, and is now being briefed to become Director of Education in one of the newly proposed R.E.T.S. schools in Canada.

Professor Hermann McGuire, M.A., B. Paed., who has spent many years as a professor in the history and philosophy of education in the College of Education, University of Toronto, has been appointed as Registrar and Counsellor-in-Chief.

Radio Electronic Television Schools of Canada Ltd. operates currently ten schools across Canada, with the prospect of further expansion, and has the reputation of being one of the largest evening training schools in America for the training of technicians.

## Radio Electronic Television School Appointments



Dr. L. Hill Ph.D.



David Forde B.Sc.

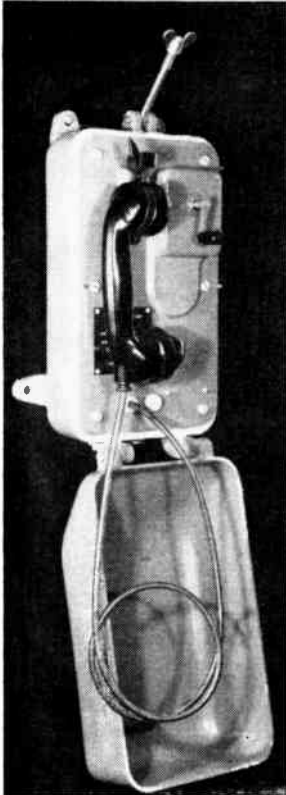


H. McGuire M.A.

## RETMA Elects New Executive Officers

At the 27th Annual Meeting of the Radio-Electronics-Television Manufacturers Association of Canada, held at the Chantecler Hotel, Ste. Adele-en-Haut, P.Q., the following executive officers were elected: President and Chairman of the Board — J. D. Campbell, Canadian Westinghouse Co. Ltd., Hamilton, Ontario; Vice-President and Chairman of Receiver Division — J. J. Kingan, Canadian Marconi Co., Montreal, Quebec; Vice-Chairman of Receiver Division — W. H. Peffrey, Philco Corporation of Canada Ltd., Toronto, Ontario; Vice-President and Chairman of Components Division — J. R. Longstaffe, International Resistance Co., Toronto, Ontario; Vice-Chairman of Components Division — A. L. Stopps, El-Met-Parts Ltd., Dundas, Ontario; Vice-President and Chairman of Electronics Division — J. C. R. Punchard, Northern Electric Co. Ltd., Belleville, Ontario; Vice-Chairman of Electronics Division — W. Jones, Pye Canada Ltd., Toronto, Ontario.

The following were appointed: Director of Engineering — R. A. Hackbusch, Hackbusch Electronics Ltd., Toronto, Ontario; General Manager and Secretary — Fred W. Radcliffe, Toronto, Ontario.



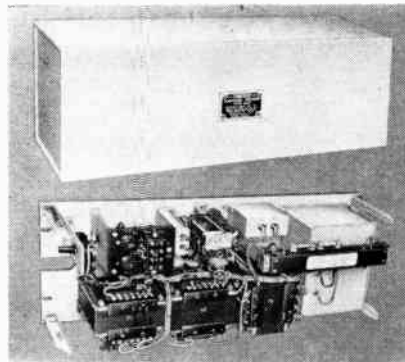
Weatherproof Hood Telephone (walling fixing) Dial, C.B., Magneto or Sound Power models available.

## MAGNETO TELEPHONE EQUIPMENT FOR *RURAL* AREAS

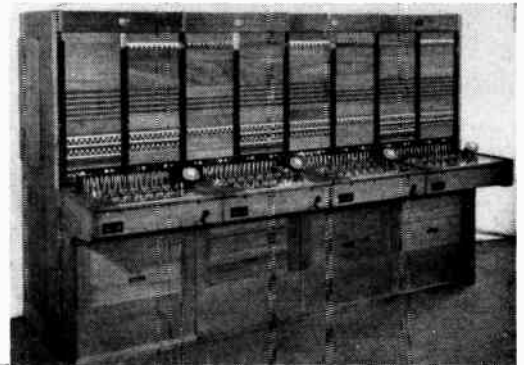
T.M.C. telephone equipment is in great demand in all countries of the Commonwealth. Production has yet to fully catch up with this ever increasing demand in Canada and elsewhere although thousands of units are to-day operating at high efficiency keeping open vital communications in all the rural areas of this country.

Users realize that over forty years' experience is embodied in to-day's T.M.C. telephone equipment which is designed, manufactured and tested to operate under the most arduous conditions.

Call at our showrooms and see the full range of Magneto Wall and Desk Telephones, Cordless Switchboards, both C.B. and Magneto, etc. Prices by reason of large production are highly competitive.



Syncycle — Synchronous Converter.



Four Positioned C.B. Switchboard.



For further data on advertised products use page 61.

# 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 61. Just mark the products you are interested in on the coupon on Page 61 and the information will be in your hands within a few days.

## ● 2-Watt Rheostat Potentiometer Item 1138

A new compact unit with an improved design featuring long dependable service and superior performance, has been announced recently. It is comparable in size to IRC'S former Type "W" Control. Known as Type 2W, this variable wire wound control provides maximum adaptability to meet rheostat and potentiometer applications within its power rating. The resistance element is uniformly wound with the highest grade alloy resistance wire on winding machines especially developed by IRC. The deep housing, pressure molded of a high grade phenolic, is designed to provide good heat dissipation, accurate location of terminals, true location of bushings and greater rotational accuracy. In addition, the cover has been so styled that the control is, for all practical purposes, dust proof.

The Type 2W is widely used for many electronic applications such as "Outdoor Movie" speaker controls, test and measuring instrument controls, and a wide variety of government applications.

## ● High Resistance Megohmmeter Item 1139

An informative folder is available on the Model L-7 Megohmmeter, which is designed to meet the requirements of modern laboratory, maintenance and production testing involving the extremely high resistance values of the newer insulating materials.

The Model L-7 Megohmmeter is especially adaptable to permit measurement of insulation resistance of large capacitors, or where residual capacity exists in parallel with the resistance to be measured. The versatility of the instrument is reflected in its range of from one megohm to 50,000,000 megohms and the continuously variable test voltage of from 100 to 600 volts. The latter is important in determining the voltage coefficient of insulation of various materials, where readings must be taken at various voltages.

A unique feature of the Model L-7 is the near linear scale which is the result of using a modified logarithmic meter movement, thus minimizing the crowded divisions normally found at the high end of the scale. This, combined with the large 4½" scale, improves the readability of the meter.

The L-7 operates from standard 115V, 50-60 CPS Power line, thus requires no batteries.

## ● Electronic Cabinet Cooling Fan Item 1140

Production has been announced of a new Model 2E610 Electronic Cabinet Cooling Fan designed for mounting on a standard 19" wide rack with a 10½" panel height. The new fan is a larger version of Model No. 2E408.

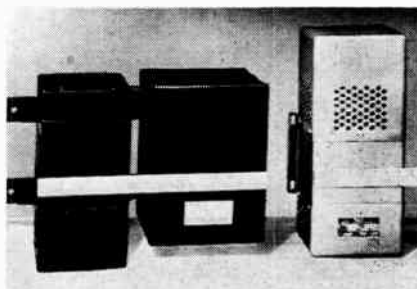
The 2E610 is a twin 6½" centrifugal blower with each wheel double inlet, resulting in exceptionally high air delivery and adequate motor cooling. It is equipped with a ½ h.p. double shaft motor and produces 800 c.f.m. under normal operating conditions. The model 2E610 is equipped with permanent air filter and 19 x 10½ stainless steel grille — covering the entire front of the unit. Modifications of this unit are available to customer specifications.

## ● Small-Size Design For Harmonic-Neutralized Regulator Item 1141

A design improvement of Type CVH Harmonic-Neutralized Constant Voltage Transformers in three capacities has been announced. Prime advantages of the new Type CVH regulator design are smaller size and lighter weight. Size is reduced up to 60 per cent; and weight as much as 54 per cent. Also, the new design offers greatly-reduced external field.

Minimized size and weight result from redesign of the main core-and-coil assembly so as to eliminate the separate neutralizer component. This, in turn, permits use of a simple, single, rectangular housing assembly in place of the two-unit assembly formerly used on larger sizes.

Essentially, electrical characteristics of the new Type CVH stabilizer are unchanged. Regulation is  $\pm 1$  per cent over a newly-expanded primary voltage range of 95 to 130 volts. Sinusoidal output is delivered with less than 3 per cent harmonic



distortion at rated load. The Harmonic-Neutralized Constant Voltage Transformer may be used for the most exacting applications with equipment having elements which are sensitive to power frequencies harmonically related to the fundamental. It is especially suitable for input to a rectifier when close regulation of the dc output is required.

## ● Oscillator For Low Frequencies Item 1142

Model 202C is a new, multi-purpose low frequency oscillator providing pure waveforms for subsonic, audio, and supersonic measurements in the laboratory, field or factory.

The new 202C offers a high output power of 160 milliwatts delivered from a transformer-coupled balanced matched source. The instrument covers frequencies 1 cps to 100 KC in five ranges. Accuracy is  $\pm 2$  per cent under normal conditions including warm-up and tube aging. Frequency response is  $\pm 1$  db full range, output is either 160 milliwatts or 10 volts into 600 ohms or 20 volts open circuit. Output balance is better than 0.1 per cent lower frequencies and approximately 1 per cent at 100 KC. Distortion is less than 0.5 per cent above 5 cps and is independent of load impedance. Hum voltage is less than 0.1 per cent of rated output. Recovery time is less than 5 seconds at 1 cps. Model 202C contains extra quality features such as long-life electrolytic condensers and ceramic insulation at high impedance points.

## ● New Coverage And Gain For 450 MC Band Item 1143

For the 450-470 MC communication system that requires coverage in all directions, but where the heavy traffic or a problem area lies in one general direction, a new antenna system to handle such a service requirement has been developed.

The basic part of this new system is the Type 201 base station antenna which provides a measured gain of 10.8 db over a half wave dipole in the direction of maximum radiation, while still providing gain considerably higher than unity in all directions. The transmitter station may now be located in an off-center position in relation to the general service area, yet provide concentrated high gain into the selected area where communications need is the greatest. The base station antenna is fed by a flexible air dielectric cable, HELIAX, which can save as much as 2 db over less efficient cable. Complementing the Type 201 base station installation is the new Type 233 mobile gain antenna, which will add 1.8 db gain to the system, when compared to conventional quarter-wave roof-top antennas fed with RG-58/U cable. The total relative gain of this new antenna system can best be measured by the following relative gain chart showing system improvement compared to a typical antenna installation.

Typical Existing System:	Relative Gain, db		
	Front	Side	Back
Base Station Antenna (Typical) .....	5.0	5.0	5.0
Station Cable Loss, 100 feet RG-17/U ....	(2.5)	(2.5)	(2.5)
Mobile Antenna, ¼ Wave Whip (RG-58) .....	0*	0*	0*
Combined Antenna System .....	2.5	2.5	2.5
Type 201 System			
Base Station, Type 201 .....	10.8	6.1	3.3
Base Station Cable Loss, 100 feet .....	(1.0)	(1.0)	(1.0)
Type HO HELIAX Mobile Antenna, Type 233 .... (RG-8) .....	1.8*	1.8*	1.8*
Combined Antenna System .....	11.6	6.9	4.1
IMPROVEMENT .....	9.1 db	4.4 db	1.6 db

\* Gain of Type 233 is relative to assumed 0 db gain of ¼ wave whip with RG-58/U, and includes allowance for lower loss of RG-8/U feed cable.

## ● First Miniature Backward Wave Oscillator Item 1144

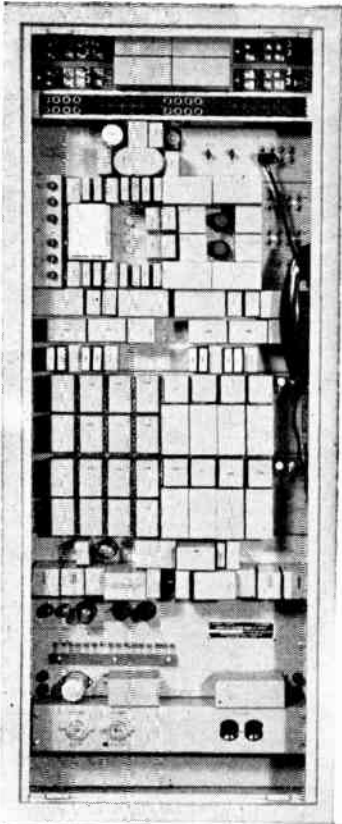
The first miniature backward wave oscillator has recently been announced.

The Model VA-161 combines low power requirements, small, compact size and light weight with rugged construction to provide the only miniature backward wave oscillator now available. Designed for modern, miniaturized equipment the new Varian tube is instantaneously tuned by changing voltage. Used for radar systems, signal generators, search receivers and related microwave equipment, the VA-161 tube operators over the normal 8.5 to 9.6 kMc radar band on less than 300 volts, making possible the use of existing radar system power supplies.

The new backward wave oscillator contains a permanent magnet which weighs less than five pounds, eliminating the need for an electromagnet and its associated power supply. The overall size of the tube is approximately 4" long by ¾" diameter. Because of its metal and ceramic construction, this backward wave oscillator will withstand severe shock and vibration, according to the manufacturer.

The power output of the Model VA-161 is said to be smooth across the entire tuning range, with relatively minor fluctuations.

(Turn to page 48)



## TELEPHONE REPEATER TYPE TA-289/FCC

This is a packaged voice-frequency repeater adapted for use on almost any type of two-wire or four-wire line facility. The principal components are amplifiers, hybrid circuits and balancing networks. It also includes line protectors, monitoring telephone set, d-c telegraph composite sets, adjustable line equalizers, v-f signal converter type CV-339/FCC, and rectifier for a-c operation. It has a maximum net gain of 24 db on 2-wire circuits and of 30 db on 4-wire circuits, between nominal 600 ohm impedances.

Type TA-289/FCC Repeater, Telephone, manufactured for the U.S. Army Signal Corps. This is a recent redesign of the type OA-7/FC Repeater, Telephone, and is moisture- and fungus-proofed. It meets all applicable MIL specifications.

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 Inductance, 0 to 1100 henrys.

Accuracy:  
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 Capacitance,  $\pm(0.25\% + 1 \text{ dial division})$   
 Inductance,  $\pm(0.9\% + 1 \text{ dial division})$

Generator and Detector: Self-contained for both AC and DC. AC operating frequency 1 kc (100 cycles to 10 kc with auxiliary plug-in networks).

Power Supply: 115 to 230 volts, 50 to 60 cycles. \$495.00.

Battery-operated model also available.



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## NEW PRODUCTS (Continued from page 47)

### • Avo Signal Generator Item 1145

A new addition to Avo Test Instruments is the general purpose Type III Signal Generator. Designed especially for portability, it covers a wide frequency range, from 150KC to 220 MC — ideal for lab, shop or the active serviceman.

All controls are grouped on the front panel of the aluminum case. Direct reading bands cover the following frequencies:

150 KC-500 KC	5.5 MC- 18 MC
500 KC-1.6 MC	18 MC- 70 MC
1.6 MC-5.5 MC	70 MC-220 MC

A 4-position control provides 3 outputs: Unmodulated RF, RF modulated at 1000 cycles, and a 1000 cycle LF signal.

RF signals are fed through a screened concentric socket at an output impedance of 80 ohms through a continuously variable attenuator and a 4-step decade multiplier, giving a very low minimum, and maximum signals of 100 microvolts, 1 millivolt, 10 mV and 100 mV. In addition, a fixed force signal of approximately 250 mV may be obtained through the same output socket.

The entirely new design of attenuator, coupled with adequate double RF screening, has resulted in remarkably close adherence of the output to the attenuator calibration, and with very low leakage. Except at the extremities of the scale, the instrument maintains an RF calibration accuracy of  $\pm 1$  per cent. The long calibration scale combined with smooth dial action permits excellent discrimination even at the highest frequencies.

The Avo Signal Generator is complete with output lead and dummy antenna — operates on 110V, 60 cycle. It weighs only 10 lbs. and is easy to use.

### • A New Transducer Unit Item 1146

A new transducer unit, designated "Nultrax", has recently been developed. It makes possible the measurement of linear displacement to accuracies of one part in 100,000 over its full length. The manufacturer is now quoting on applications where effective travel lengths of up to 10 feet are involved.

The accuracy is accomplished by converting dimensional data into precise electrical equivalents. The name "Nultrax" is derived from the fact the device operates by seeking or "tracking" a null point in a sinusoidal function.

Incorporated in either simple measuring systems, or in complete positioning systems, the new unit provides the extreme accuracy necessary to the automatic control and programming of machine tools. Although particularly applicable to automatic control and programming, the new unit can be applied to any operation requiring precise linear measurement.

A few typical applications in the machine tool field are: lathes, jig borers, boring mills, milling machines, grinders, drilling machines, gear cutters and other special machines. It can also be applied to precision instruments such as microscopes, testing machines, gages and comparators.

High accuracy and a repeatability of better than 20 microns makes the unit suitable for a variety of operations in the aircraft, automotive, chemical, petroleum and other industries.

### • New UHF And Microwave Test Equipment Catalog Item 1147

A 28-page catalog, "Microwave and UHF Test Equipment," which has recently been published, covers a complete line of coaxial and UHF equipment, microwave test equipment, and bolometers and thermistors. Text, specification tables, and photographs describe existing equipment and such recent additions as fixed and variable attenuators, high power impedance meters, tees, fixed and sliding terminations, and UHF coaxial directional couplers.

## ● Underwater Splicing Kit

Item 1148

Moisture-proof low voltage "branch" or "tap" splices that can be insulated in less than 10 minutes and used under water have been made possible by the "Scotchcast" splicing kit No. 90-B1, containing single-use branch splice mold and self-mixing package of "Scotchcast" electrical insulation resin No. 4.

The 90-B1 makes possible the complete encapsulation of the splice in liquid epoxy-type resin — a synthetic, thermosetting plastic — which hardens into a durable jacket, sealing out moisture and eliminating electrical leakage as efficiently as the cable insulation itself under even the most critical conditions.

Designed for use in application such as street lighting systems or traffic signal systems, under or above ground or where moisture is a problem, the kit requires no special tools, equipment or skills, according to the manufacturer. The splice can be used successfully even where it must function when totally immersed in water.

## ● Bulletin On Semi-Conductor Crystal Production

Item 1149

Bulletin SMEL No. 1, "Control Systems for Semi-Conductor Crystal Production", was prepared to assist those connected in any way with the development or production of germanium silicon crystals.

The first part of the bulletin outlines the crystal growing process and the function performed by the element of control systems. The second part describes the specific components of the control systems and the final part combines the components into control systems.

Although instrumentation for the seed crystal growing method is the primary concern of the bulletin, control systems applicable to the zone leveling method of producing crystals are also described.

## ● Free Gyro Combines Compactness And Efficiency

Item 1150

Compact versatility is the primary characteristic of Model F10A-1 Free Gyro. It is a unit small enough to meet space requirements for missile applications and capable of delivering full efficiency in both missile and piloted aircraft systems.

Compactness centers around its dimensions — length of 6.250 inches, diameter of 3.297 inches and weight, 4.5 pounds. Versatility is summed up by a review of some of the Free Gyro's electronic virtues. A unique feature is the AC pickoff adjustment which can be made on the exterior of the gyro case, leaving the hermetic seal unbroken. DC pickoffs are furnished in resistance ranges from 100K to 500K. AC pickoffs can be either synchro or two-phase resolver. Uncaging cycle is 0.030 to 0.050 seconds with caging accuracy with 0.1°. Sensibility during the standard Scorsby test is  $\pm 0.1^\circ$  per minute.

In spite of intricate characteristics, the Free Gyro's gimbal floatation design enables it to perform satisfactorily under acceleration and shock stresses up to 75 g's. It performs to specifications with vibration of 10 g's from 10 to 2500 cps.

Model F10A-1 also provides a comprehensive selection of single, double and three-phase AC and DC motors to meet r.p.m. requirements from 14,000 to 23,000.

## ● Oscilloscope With Two Identical High Gain, DC, Stable Amplifiers

Item 1151

A new low frequency oscilloscope Model 130A, recently announced, has nearly identical horizontal and vertical amplifiers. The amplifiers provide a maximum sensitivity of 1 millivolt/cm or 10 millivolts full scale deflection with pass bands from dc to 300 KC, and can accept balanced in-

puts on the five most sensitive ranges. The manufacturer states that the balanced inputs are most useful in industrial, medical and other applications where balanced low level signals come directly from transducers. The amplifiers also accept single ended inputs, either ac or dc coupled. Conservative design, regulated power supply, and precision components promote stability, increase reliability and virtually eliminate adjustment during operation.

The Model 130A sweep circuit employs a linear Miller-integrator triggered sweep instead of the relaxation oscillator or bootstrap types normally found in its price range; producing an accurate calibrated sweep from 1  $\mu$ sec/cm to 15 seconds/cm.

Etched circuitry is used extensively to stabilize capacities, sectionalize circuitry and increase operating dependability. These circuits are broken down into accessible sub-assemblies to ease servicing and tube replacement.

The mono-accelerator cathode ray tube replaces through the front panel by removing a twist-off bezel which also locks in place to support conventional camera equipment.

## ● Booklet To Assist Test And Plant Facility Engineers

Item 1152

"Tips and Trends" is the title of a pamphlet recently published on the subject of design specification and selection of environmental test chambers. The information contained in this booklet is the result of fifteen years of continuous experience in development and design of environmental test chambers. This information contains answers to questions which always arise during engineering planning and procurement phases, and is offered for its informative and educational value both to engineers and buyers.

(Turn to page 50)

# Quartz CRYSTALS

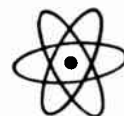
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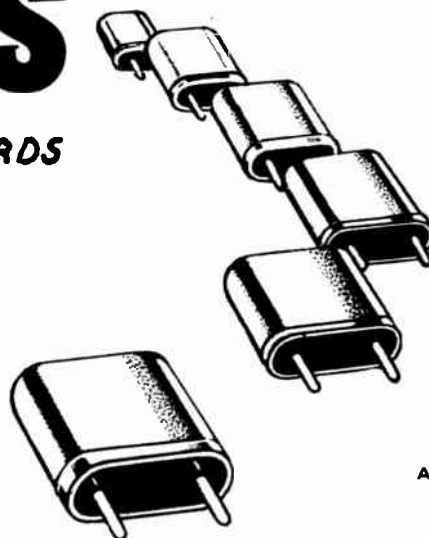
Snelgrove specializes in the highest industrial standards of crystal efficiency, endurance and long life. Make those standards your own. Insist on the extra values Snelgrove builds into every crystal — at no extra cost to you.

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## NEW PRODUCTS

(Continued from page 49)

### ● Miniature Trimming Potentiometer

Item 1153

Miniature Trimming Potentiometer, Model 303-00 is rated as the "big brother" to Sub-Miniature 300-00 version, but the "bigness" is concentrated mainly in resistance capacities. Model 303-00 offers a broader range of resistance values — from 25K to 100K — with corresponding wider applications in electronic, electric or electromechanical systems as compared to the 300-00's 10 ohm to 25K ranges.

The 300-00 only measures 0.500 inch square by 0.187 inch thick, making it the smallest potentiometer on the market by far. The "big brother" is a pretty small article itself — 0.750 inch square by 0.280 inch thick with a 6.5 gram maximum weight. A geared adjustment ration assuring exact wire to wire contact between resistance element and precious metal slider is another feature combined with general ruggedness and stability giving the Miniature Trimming Potentiometer adaptability for all design possibilities. Any number of units may be stacked together.

Accuracy of resistance value is set at  $\pm 5$  per cent; dielectric strength at 500V ac 10 seconds; electrical continuity  $345 \pm 5^\circ$ ; insulation strength at 10 megohms minimum, 500V dc potential. Temperature coefficient of resistance wire is  $\pm 0.00002$  ohm/ohm  $^\circ\text{C}$  from  $0^\circ\text{C}$  to  $100^\circ\text{C}$ .

### ● Brochure On "Scatter" Communications System

Item 1154

An illustrated brochure has been prepared on the latest type radio relay communication equipment for "beyond the horizon" communications. Known more commonly as "scatter" communications system, it is intended primarily for use over routes of greater distance than optical or quasi-optical paths, to carry multi-channel telephone and telegraph traffic. It is of considerable advantage in rough and inaccessible terrain or over long paths where building of conventional repeaters may be prohibitive, hazardous or a security risk. It is complementary to existing systems and in some cases replaces previous techniques.

Complete equipment for "beyond the horizon" multichannel radio links designed to high mechanical and electrical standards is available in several frequency bands. For applications where channel drop-off at intermediate points is not required, hop distances of 200 miles or more makes an attractive alternative to the 30 or 40 miles spacing of repeater stations of conventional optical systems.

Less maintenance because of fewer sites; reduced outage time because of quicker

access; terminals easily located near local power supply, are vital factors in assessing system merit.

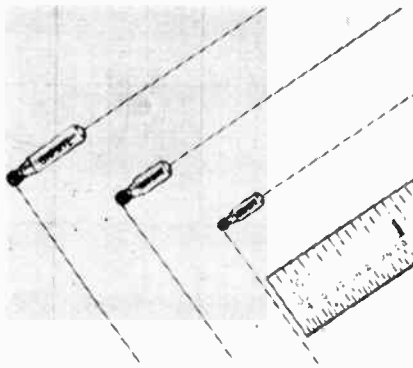
### ● Ultrasmall Tantalum Capacitors

Item 1155

A line of ultrasmall tantalum capacitors, designated as Series TW "Tan-O-Mite" capacitors, has recently been announced.

The "Tan-O-Mite" capacitors are sub-miniature size units specially designed and developed for transistorized electronic equipment where small space and high reliability are of great importance. Tantalum capacitors are more stable, have much better shelf-life, produce greater capacity in a given size, and are usable over a wider temperature range than aluminum electrolytic capacitors.

Three nominal sizes, the tiniest, Size A, .095 by  $\frac{1}{4}$ "; Size B,  $\frac{1}{8}$ " by  $\frac{1}{16}$ "; and Size C, only  $\frac{1}{16}$ " diameter by  $\frac{1}{2}$ " long, cover a range of capacitance from .02 to above 30 mfd. Coupling, filter, and by-pass requirements at low voltage DC, in hearing aids, miniature portable radios, and military equipment are met by these units.



"Tan-O-Mite" capacitors have a usable temperature range from  $-55^\circ\text{C}$  to  $-85^\circ\text{C}$ . Capacitor construction consists of a tantalum wire anode, having a specially processed oxide film, contained in a tiny silver cylindrical cup, which is the cathode (negative). The case is electrically "live" and has the negative wire lead fastened to the end. The case is filled with an electrolyte and sealed by a "Teflon" bushing.

The positive lead wire is radial, emerging from a small plastic embedment which protects the tantalum lead and the welded joint. The wire can be bent readily to an axial position when both leads are desired this way. The plastic protection feature makes "Tan-O-Mite" capacitors easy to connect with a minimum of care. Every capacitor is aged under operating conditions. They are tested 100 per cent for capacitance, power factor, and DC leakage current.

### ● 1.1 MC Electronic Counter

Item 1156

A new multipurpose electronic counter measuring frequency 10 cps to 1.1 MC, period 0.00001 cps to 10 KC, and time interval 3 microseconds to 27.8 hours has recently been announced.

The new counter, Model 523B, presents direct reading results in seconds, milliseconds, microseconds, or kilocycles. Accuracy of frequency measurement is  $\pm 1$  count  $\pm$  crystal stability of 2 parts per million per week. A special pulse output permits Z-axis modulation of an oscilloscope to visually observe time interval start and stop points on an input waveform, shown in the figure as bright spots on the input signal.

The instrument includes a wide selection of gating and display times or may be controlled manually. An automatic illuminated decimal point facilitates interpretation.

The use of compact etched circuitry and conservative component ratings increases both reliability and portability. The etched circuits are laid out for optimum visibility and their sectionalized design together with trouble localizing lights in the circuit greatly eases servicing.

Model 523B is designed for maximum dependability and operating simplicity and may be used readily by non-technical as well as semi-skilled or professional personnel, the manufacturer states.

To obtain further information on New Product items in this issue, use postcards on page 62.

### ● New Epoxy Laminate

Item 1157

Added to a line of glass-base sheet laminates bonded with an epoxy resin is a new epoxy laminate. Identified as Grade G-10-865, it is similar to Grade G-10-860. It is superior in its lower water absorption, lower dissipation factor, and higher bond strength and meets MIL-P-18177.

The new material is primarily for electrical and electronic uses where the unique properties of the epoxy resin offer definite advantages. For applications in this field, particularly notable are its high insulation resistance (1,000,000 megohms) and dimensional stability, due to low water absorption.

The new epoxy laminate is available in sheet sizes of 39 by 47 inches with thicknesses from  $\frac{1}{32}$  to  $\frac{1}{2}$  inches. Standard finish is a semigloss and standard color in natural (light brown). It is supplied as either a standard laminate or with copper foil on one or both sides for printed circuits — where its high bond strength and excellent dip solder resistance are particularly notable.

## \* ITEM OF THE MONTH \*



Type 2N95 Junction Transistor.



Plus Sylvania Electronic Tubes—Crystal Diodes—Microwave Crystals—Transistors—Strobotrons—Flash Tubes—Klystrons—Thyratrons—Magnetrons—Rocket Tubes—Pencil Tubes—"TR" & "ATR" Tubes—Glow Modulators—Trigger Tubes—Counter Tubes—Gas Pressure Measuring Tubes—Photo Tubes—Travelling Wave Tubes—Waveguide Windows.

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For further data on advertised products use page 61.



● **Catalog On Amrecon Relay Models**

*Item 1158*

A newly released Catalog R-29 gives complete information on the four popular Amrecon relay models — DOS, DOSY, DO and CRU, which are available from stock in 65 different types.

Models DO and DOS fill many industrial needs for a compact, lightweight relay that handles power loads usually requiring much larger, heavier units. They are particularly adaptable to aircraft and mobile equipment where severe shock and vibration are encountered.

The increased operating sensitivity of Model DOSY relay, equipped with twin coils, makes the DOSY adaptable to a wide range of electronic control circuits, such as plate circuit controls.

Model CRU relay is outstanding for its wide range of available contact combinations. This feature, together with its relatively small size, and rugged construction makes the CRU relay ideal for general applications, such as vending machines, recorders, etc.

● **Antenna Multicoupler Model AMC-6**

*Item 1159*

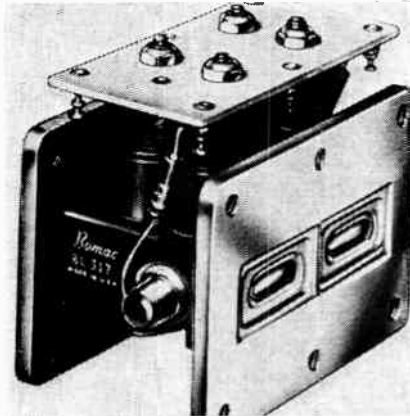
The AMC-6 Antenna Multicoupler is a broadband coupling device covering the frequency range of 2 to 30 megacycles. A single AMC-6 provides for the operation of up to six HF receivers from a single antenna without interference or interaction. The unit provides an average power gain of 10 db with a noise factor comparable to a good communications receiver.

Particular attention has been paid to "cascade operation" permitting a larger number of receivers to operate from a single antenna. Complete details available on request.

● **Dual TR Shutter Tube**

*Item 1160*

The BL-317, a new dual TR tube with integral shutters for X-band, is designed to give complete crystal protection over a frequency range from 8500 to 9600 mc. when used between a balanced pair of short-slot hybrid couplers. The TR electrical characteristics of the BL-317 are identical with those of the 6334-BL-27, in addition to which the shutters, when closed, present an insertion loss considerably in excess of 40 db.



The shutters operate on 28 volts dc with a maximum current requirement of 320 ma. The ignitor dropping resistors of 5.2 megohms are included and attached to the ignitors with leads brought to solder terminals on the terminal board. The ignitor voltage required on these terminals is -1000 volts dc minimum.

The maximum cubic volume required for the BL-317 is only 10.2 cubic inches. The total weight increase resulting from the shutter mechanism is approximately 4 ounces.

● **Power Supply - Demodulator Unit**

*Item 1161*

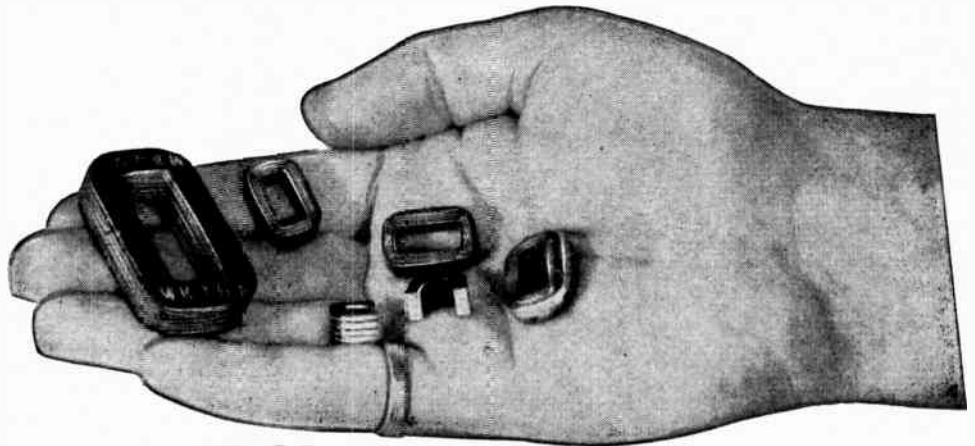
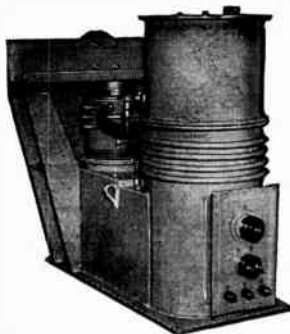
A new regulated Power Supply — Demodulator Unit, Model DV-1 has been developed for use with gyros in flight test applications where 115-volt 400-cycle single-phase primary power is available. A small unit, the Model DV-1 is 6 1/2" wide x 7 1/8" high x 12 3/4" long and weighs only 13 pounds. It has been designed for use with 1 to 3 Model K Rate Measuring Gyroscopes to comprise a complete rate measuring system. The Model DV-1 properly energizes the motor and pickoff of each gyro and converts the AC output signal of each pickoff to DC for use with oscillograph galvanometers. Inasmuch as a change in speed of the gyro motor due to input-voltage frequency variation would directly affect over-all gyro sensitivity, compensation has been incorporated to vary the excitation current to the gyro pickoff in order to maintain constant system sensitivity.

● **Portable Logarithmic Survey Meter**

*Item 1162*

The new single scale Logarithmic Radiation Survey Meter makes possible direct readings of x-ray, gamma and beta radiations over a full scale ranging from 3.0 to 3,000 milliroentgens per hour. Designated Model 414 the portable Logarithmic Survey Meter eliminates errors in scale selection and the need for switching scales found in conventional linear-type survey meters. A large meter face with a specially designed scale gives extra visibility for easy reading. The time constant is inversely proportional to radiation intensity which minimizes reading time and personnel exposure when in fields of high intensity radiation.

(Turn to page 52)



**YES...**

**No core too small—No transformer too large!**



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

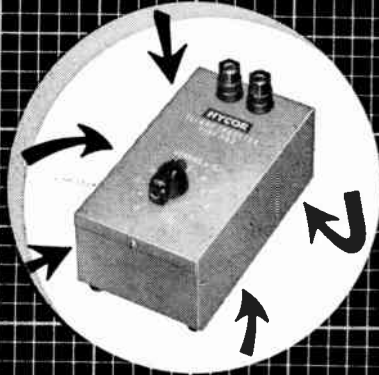
565

**MOLONEY ELECTRIC COMPANY OF CANADA LIMITED**

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

## LOW COST DECADE INDUCTORS

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: 5¼" L. x 3" W. x 2¼" H.

Net Price: \$29.90  
f.o.b. North Hollywood, Calif.

Representatives  
in Principal Cities

**HYCOR**

Company, Inc.

Subsidiary of  
International Resistance Company

11423 Vanowen Street  
North Hollywood 9, Calif.

## NEW PRODUCTS

(Continued from page 51)

The new and unique one-tube circuit (Pat. app. for) used in the Model 414 provides highly reliable performance and accuracy of  $\pm 20$  per cent throughout the entire range. This simplified circuit increases battery life and reduces operating cost to approximately 20c per 40 hours operation.

Model 414 has a built-in internal current source for calibration, eliminating need for radioactive sources to calibrate the unit for operation.

Battery life ranges from 1000 hours for filament batteries to approximately 3,000 hours for the B+ battery and shelf life for chamber batteries. The control switch (6 position type) may be switched to each battery source and the strength of each is registered directly on the meter face, supplying an easy battery condition check without opening the instrument.

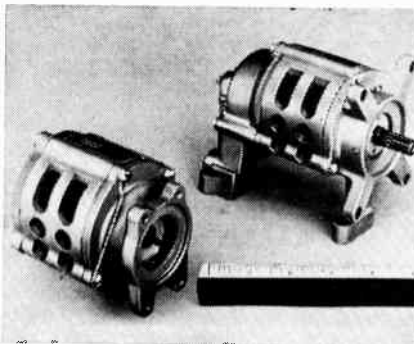
### ● Air Motor For Missile Applications

Item 1163

A new air motor has been announced which will be of particular interest to those engaged in missile engineering and production.

Faced with the problem of locating a prime mover to operate an alternator and a hydraulic pump for an electro-hydraulic supply to power a missile control system, the manufacturer made a careful evaluation of various motors. For the application at hand these motors proved to lack the desired efficiency and were excessive in weight and size. As a result, the newly announced air motor was developed, tested and produced, and is now offered for sale to others who are in missile work.

The new air motor is of a constant displacement rotary vane design. With the exception of the blades and bearings, the motor is fabricated entirely of aluminum. The basic motor weighs 1½ lbs. and develops 2¾ horsepower per 100 p.s.i. of inlet pressure. It will perform satisfactorily with inlet pressure of 300 p.s.i. Overall efficiency approaches 70 per cent at speeds between 3000 and 6000 r.p.m.



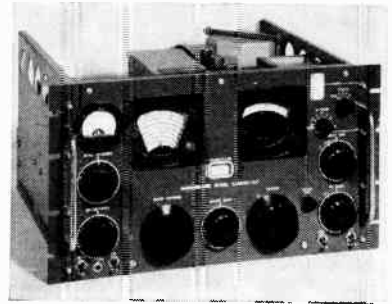
The motor has been completely qualified for missile applications over an ambient range of -20°F to 160°F and accelerations of 60 G. Recent tests have illustrated the ability of the motor to withstand inlet gas temperatures in excess of 1000°F for as long as two minutes. Unlike conventional motors of this type, no in-line lubrication is required.

The motor on the right contains a unique governor which maintains a constant speed within 2 per cent for load transients of 10 per cent. The governor regulates motor speed from regulated inlet pressures of 300 to 600 p.s.i. without the use of a reference spring. Latter feature permits the use of motor with a 1000°F power source. Upon application of the supply pressure the motor will stabilize at regulated speed within .2 seconds. This motor with its governor is used to run an alternator, while the one at the left, without a governor, is presently used for hydraulic drive.

### ● Communications Receiver Measures Reradiation Of TV Receivers

Item 1164

The new Hammarlund SP-600-VLF Communications Receiver meets the requirements set forth by the FCC Docket No. 9288 on reradiation of radio receivers as it affects television set manufacturers. Operating over an extremely low frequency range, 10 KC to 540 KC, the SP-600 VLF is ideally suited to the indication and measurement of low frequency radiations common to television flyback circuits, and other sources of spurious emissions.



Negligible drift, plus very accurate tuning, team up in the SP-600-VLF to permit laboratory-quality tracing and measuring of VLF signals. In addition to the reradiation tests, the SP-600-VLF may be used as a laboratory-quality demodulating device in countless applications.

Available as either rack-mounted, or in an enclosed steel cabinet, the SP-600-VLF is entirely self-contained with its own power supply. Taps are provided for operation on 90 to 270 volts, 50/60 cycle.

### ● New Catalog On Radio And Carrier Accessories

Item 1165

A reference source of all Lenkurt radio and carrier accessory equipment is now available in catalog G.C. 2.

All the equipment listed was originally designed for Lenkurt radio, carrier and telegraph systems. However, the use of this equipment is sufficiently general to have found wide application in other communicating systems. The catalog contains such varied items as db meters, patch cords, power supplies, line filters, four-wire terminating sets, voice frequency signalling equipment and voice frequency terminal equipment.

The catalog is divided into 5 sections: test equipment, power supply equipment, line and filter equipment, V-F and signalling equipment; and miscellaneous equipment.

### ● Telephone Calls Recorded Automatically

Item 1166

An instrument designed to answer a telephone automatically in the absence of a subscriber has been announced.

This instrument answers the calls with a recorded message of up to 50 seconds duration then records the caller's message which can be as long as three minutes. On completion of the recording, the line is cleared automatically.

Total recording time is one hour and automatic erasure allows the recording tape to be used indefinitely. Should insufficient recording time remain available, the machine will not answer the caller, avoiding partially recorded calls.

During playback, the machine is disconnected from the line and recorded messages are reproduced via a loudspeaker or headset. A wide range of recording levels can be reproduced successfully to cover local and long distance calls.

For further data on advertised products use page 61.

● **Seven New Calibrated Variable Attenuators**

Item 1167

Seven new calibrated variable attenuators Models, 701, 702, 749, 751, 752, 753 and 754, have been developed, representing an uninterrupted series for the frequency range of 2600 to 18,000 mc.

These precision attenuators are all of the parallel vane type with dissipative element of pyrex glass vane and an evaporated nichrome film. The precise lead screw is driven by duo-dial to provide convenient, accurate measurement of the displacement of the dissipative element. Calibration is accurate to 0.3 db, precise, permanent and not affected by humidity or temperature variations. A large calibration chart is supplied with each attenuator.

The calibrated variable attenuators range from frequencies of 2.60-3.95 kmc in Model 754 to 8.20-12.4 kmc for Models 701 and 702. The general attenuation range is 0.5 to 40 db except in model 702 where the range is 0.5 to 10 db with a calibration accuracy of 0.2 db. Maximum VSWR is 1.15.

To obtain further information on New Product items in this issue, use postcards on page 62.

● **A New Hydrogen Thyatron**

Item 1168

A new hydrogen thyatron that is electrically similar to an E37A but ruggedized for vibration and high impact service, especially — mobile and aircraft applications requiring moderately high power, is known as the BL-257.

The tube is conservatively rated for 5G vibration from 60 to 500 c.p.s. and 3G from 500 to 1200 c.p.c., and also for 60G high impact shock in any direction.



Electrical ratings are 8.0 kv. peak anode voltage, 90a peak current and 100 ma maximum anode current. It is rated for ambient temperature range of -50°C to 90°C and for an altitude of 10,000 feet in air. The tube may be immersed in oil for high altitude application.

(Turn to page 55)

# New Honeywell High Gain Weld-Seal TRANSISTORS



← New rugged terminals permit easy soldering of connections without harming the transistor.

← New welded case — hermetically sealed for superior ruggedness and durability.



**TYPES H5, H6, H7, AVAILABLE NOW!**

**They're welded**—so you can build new ruggedness and durability into your equipment! And the new line of Honeywell transistors gives you superior electrical performance and high, uniform power gain over a wide range of collector current values. You get long life, outstanding stability and performance. Take advantage of these new and improved transistors *now*. Mail coupon for full information today!

**A COMPLETE LINE OF POWER TRANSISTORS TO MEET YOUR SPECIFIC NEEDS.**

	H5	H6	H7
Input Resistance	24-48 ohms	27-54-48 ohms	30-60-48 ohms
Power Conductance	17.5-35 mhos	35-71-35 mhos	71-141-35 mhos
Current Gain, Median	30	40	60

(for collector current of 2 amps.)

# Honeywell



Power Transistors

HONEYWELL REGULATOR COMPANY LTD.  
 DEPT. EC-TC-7, LEASIDE, TORONTO 17.  
 Please send data sheet TR-14 on Honeywell Weld-Seal Power Transistor.

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

**30TH ANNIVERSARY**

Thirty-five per cent weight reduction in TV towers achieved by the use of a recently developed "T-1" alloy promises to usher in an era of . . . .

# Tall TV Towers

A MAJOR breakthrough in the height barrier of television towers has been accomplished by the engineers of a large firm of American tower builders, and the prototype of the "tall tower of the future" will be constructed for WSM-TV, Channel 4, Nashville, Tennessee, owned by the National Life and Accident Insurance Company.

Pioneering metallurgical research by the United States Steel Corporation, resulting in the development of a new constructional alloy "T-1" steel, coupled with design study by Blaw-Knox engineers, has produced the technological advances necessary for construction of the new tower.

Practical limitations to significant increases in the height of towers, which now range up to 1,600 feet, were previously imposed by the basic strength of steel. The new tower, the world's third in height at 1,379 feet when completed, will be the first to be constructed principally of the new "T-1" steel.

This alloy steel is approximately three times as strong as structural steels used in many of today's modern skyscrapers. Also, the steel is readily weldable and has the added advantage of having four times the atmospheric corrosion resistance.

Development of the new alloy means that TV stations across the country and those to be built in the future will get more tower for their dollar, and now with contractors in possession of steel and designs, a new era of tall towers is about to be ushered in.

Company officers report that the towers will be proportionately less expensive to the buyer because of the properties of the steel itself.

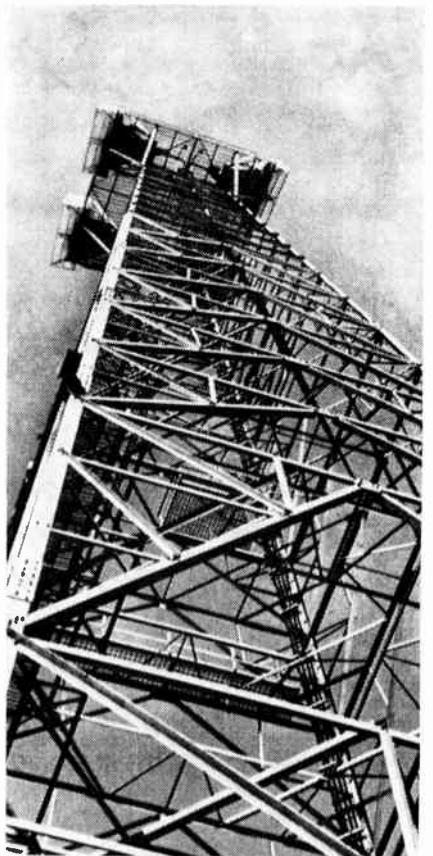
Engineers explain it this way: "Even though the steel is higher per pound, because of the cumulative savings which can be made through design, the cost per tower is less. Because 'T-1' is so much stronger than carbon steel, each component member of the tower will be appreciably smaller in diameter, thus exposing less tower surface to the heavy winds for which they must be designed."

Cumulative savings to the buyer pyramid as the weight of the tower goes down. Shipping charges, erection costs, smaller guy wires to support the tower in place and less concrete for

anchors and supporting base all figure in the tower bill.

Engineers claim all items are substantially reduced through use of "T-1". In evidence, Blaw-Knox says the steel in the WSM-TV tower will reduce weight by over 100 tons, or 30 per cent of the total weight which would be required with ordinary structural steel.

When completed, the massive 225-ton structure will be poised on a 3½ inch diameter steel peg, 10 inches long and pressed-fit into an alloy steel forging six inches thick. This forging is mounted atop a 109 cubic yard concrete pyramid, which will be buried in the ground. The tower will be guyed by four sets of dual cables attached at four intervals from bottom to top. It will be the tallest man-made structure in Tennessee.



● This worm's eye view of a television tower is typical of the taller TV towers of the future that have been made possible by the development of a new light weight alloy.

For further data on advertised products use page 61.

**NEW PRODUCTS**

(Continued from page 53)

● **Tube Selector Chart**

*Item 1169*

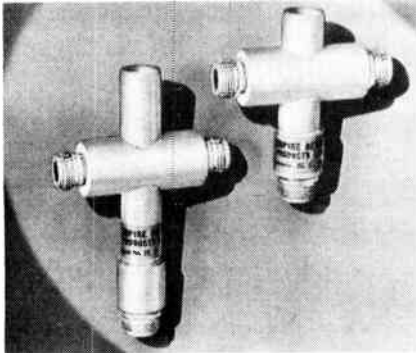
Two new time-saving features have been introduced into the re-designed Jackson Model 648 Tube Tester Chart. The tube types are printed on the chart so as to allow for continuous reading without the necessity of "chart twirling". Tubes are listed from top to bottom in the first column, from bottom to top in the second, and from top to bottom in the third. With this "zig zag" listing, servicemen no longer have to twirl the chart to the top of the next column after reading one, but can continue from the bottom of the first column to the bottom of the second and from the top of the second to the top of the third without interruption.

Separate radio and TV tube listings are another feature of the re-designed Jackson chart. Tube types listed have been split into two general sections on the chart: tubes used primarily in TV circuits are listed in the TV section; those used most in radio or other electronics applications are listed in the Radio section. Both Radio and TV sections have the new zig zag listing.

● **Divider Splits Microwave Power Without Losses**

*Item 1170*

The new Power Divider, Model PD-90 has zero insertion loss since the division of power is accomplished by means of matched transformers rather than by dissipative networks. The power at each output is exactly half of that at the input (i.e. 3 DB) with a balance between outputs



of 40 DB or better. Model PD-90 has type "N" female connectors at each arm. Five models cover the entire frequency range from 800 MC to 10,000 MC.

The ranges are:

Model	Frequency Range
PD-90A	800- 1400
PD-90B	1300- 2500
PD-90C	2400- 4200
PD-90D	4200- 7000
PD-90E	7000-10,000

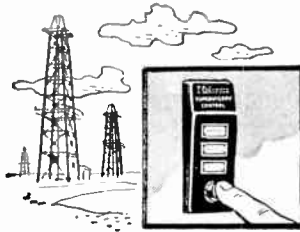
● **Optical Filters For Radarscopes**

*Item 1171*

A new light-filter that kills reflections on a radarscope, or any cathode ray tube instrument has been announced. The new filter traps between 98 and 99 per cent of all reflections from surrounding windows and lights. By removing these reflections, which tend to wash out the display, it makes the image sharp and easy to read. It eliminates the need for bulky hoods or other light-shielding.

The filter gets its "one-way" properties through circular-polarization of the light striking it from outside sources. Lightweight and sturdy, it can be laminated in either glass or plastic, for easy mounting on any size scope.

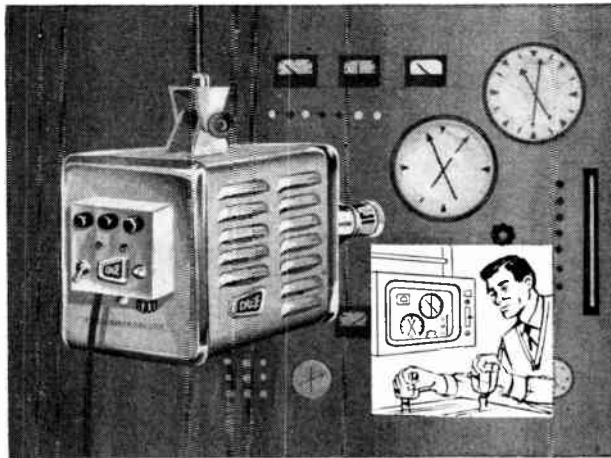
The new reflection-trap filter can also be combined with a linear-polarizing filter so the observer can vary the brightness of the display, simply by pushing a knob, without readjusting the scope.



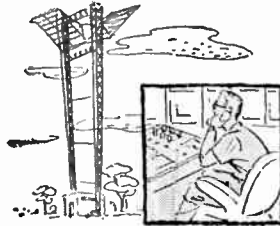
**SUPERVISION AND CONTROL**



**MOBILE TWO-WAY RADIO**



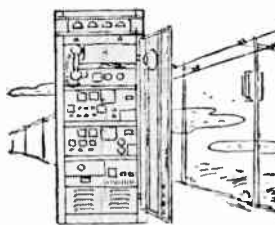
This ROGERS closed circuit television installation makes possible meter and gauge readings from a remote location. Television spotted throughout this plant saves energy, speeds up work, enables valuable supervisory people to be more places, do more things.



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Unexcelled engineering skill, quality products, and efficient service stand back of the Rogers Majestic representative in your area. Let him show you how the various time-saving, profit-making communications tools and electronic control instruments can help you.

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**TYPE GG22 LINEAR ACCELEROMETER**  
**RUGGED • HERMETICALLY SEALED**  
**NO CROSS TALK**

Developed by Honeywell's Aeronautical Division, the GG22 Linear Accelerometer is a true linear, non-pendulous type designed for aircraft and missile applications. It is capable of sensing positive or negative acceleration or both, depending upon requirements, in either vertical or horizontal planes.

The GG22 has a centrally located mass supported on a linear type ball bearing. This mass is restrained by coiled springs and damped by

the viscous action of a fluid surrounding the cylindrical gap between mass and damper plate.

As the specifications below indicate, the GG22 is an extremely rugged, lightweight unit providing the versatility and sensitivity so necessary for a wide variety of aircraft and missile applications.

For details on the Type GG22 Linear Accelerometer, write to Honeywell, Aeronautical Division, Dept. EC-CC-7, Leaside, Toronto 17.

**Specifications**

**POWER SUPPLY:** 28 volts dc at a power of 0.5 watts. Potentiometer resistance is 2000 ohms. Can be varied to meet requirements.

**RANGE:** From less than  $\pm 0.5$  g's to more than  $\pm 50$  g's depending upon requirements.

**LINEARITY:** 2% maximum, including scale factor and hysteresis. Can be as low as 0.5%.

**NATURAL FREQUENCY:** Varies with range.

**DAMPING:** Approximately 0.6 of critical at  $+ 25^{\circ}\text{C}$ .

**THRESHOLD:** Varies with range, but can be as low as 0.009 g.

**ENVIRONMENT:** Designed to meet requirements of MIL-E-5272A.

**WEIGHT:** Approximately 0.9 lb.

# Honeywell

**Aeronautical Division**



AIRCRAFT • ORDNANCE •  
 CONTROLS AND INSTRUMENTATION

## Radar Test Check

**I**N less than a minute, an accurate test of overall performance of airborne weather radar can be made by means of a new pre-flight test set.

Complete and accurate measure of performance without painstaking measurement of receiver sensitivity and transmitter power is now possible. The new equipment enables pre-flight and front line radar checking by relatively inexperienced communications maintenance personnel. This development is quite significant in view of the recent spurt forward in airborne weather radar installations by the major commercial airlines.

Small, light, and rugged for convenience and dependability, even under the most adverse pre-flight and front-line conditions, the test set operates from the 400 cycle power available in the aircraft.

The test set is used in conjunction with the Narda 833 Echo Box, a high Q resonant cavity tuned to the radar frequency and coupled to the radar transmission line through the radar's directional coupler. Narda Corp. is the maker of the test set. The echo box provides an artificial target to the radar; the pre-flight test set, which is connected to the radar video output, measures accurately the response of the radar to the target. The radar performance is read directly from the front panel of the test set. A variation in performance of even 1 or 2 db can be measured.

**How It Operates**

Here's how the test system operates. During the radar transmitted pulse, microwave energy is stored in the echo box. Immediately following the pulse, the energy is returned to the radar as from a target. The echo decays exponentially; the time interval between the beginning of the transmitted pulse and the point where the signal on the radar PPI scope just disappears (called the "ring time") is a measure of the radar performance.

Any decrease in transmitter power or loss of receiver sensitivity will shorten this ring time. Small changes in ring time caused by small departures from specified performance are resolved by the test set, without the complications of precise time base measuring equipment.

Although designed primarily for use with the Narda Model 833 Echo Box for testing C-band weather radars, the preflight test set may readily be adapted with very slight modification to pre-flight or front line checking of any radar in conjunction with any good echo box tuned to the radar frequency.

For further data on advertised products use page 61.

**ATTENTION!**  
designers and  
manufacturers

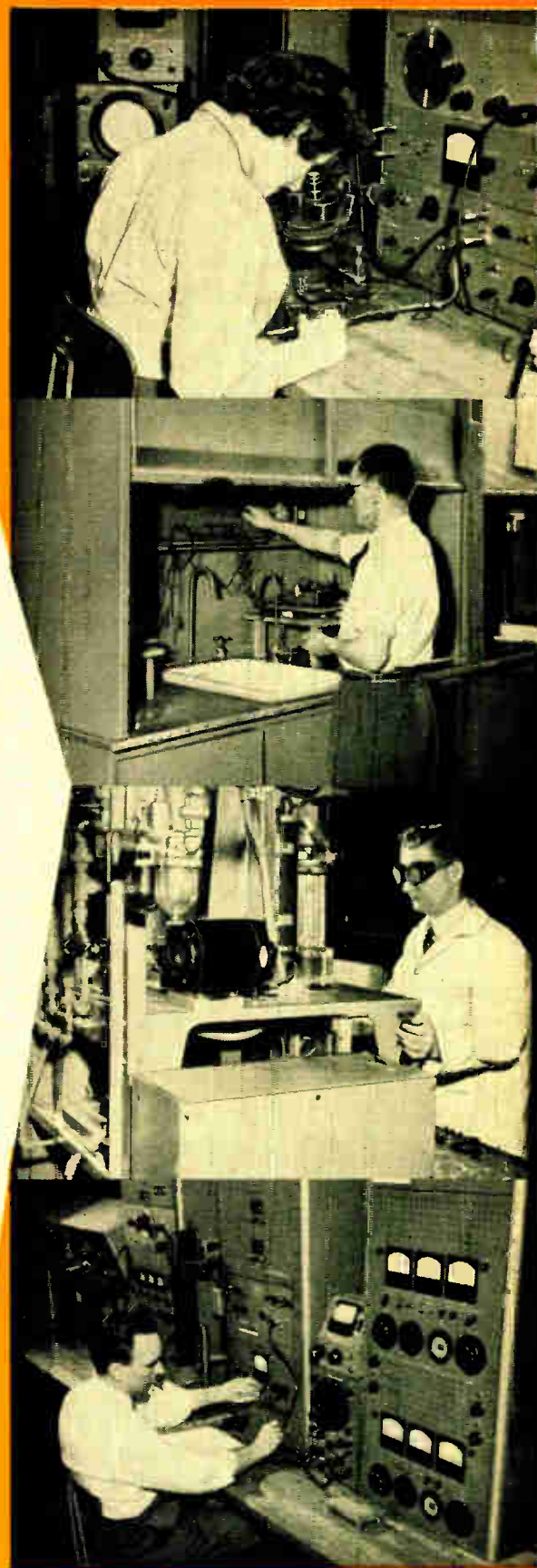
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*devices?*

From raw materials to finished product, all processes are under our rigid control to ensure uniformity and high quality. We have the "know how" and facilities for making Transistors and Diodes to meet your specific requirements. We can render assistance in basic circuit design problems. Let us help you.

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## Printed Circuit Connector Life Increased Up To 200% With—

# Beryllium Copper Contacts

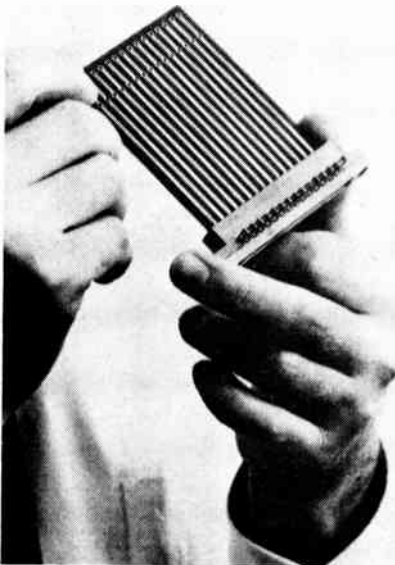
**F**ATIGUE resistance of two or three times that of other spring-type contact materials, such as spring brass or phosphor bronze, plus excellent electrical characteristics — these are the primary reasons claimed for the selection of beryllium copper as a contact material in printed circuit connectors.

Where connectors are used for insertion or removal of printed circuit cards, a beryllium copper alloy will assure positive contact for up to 1,000 or more insertions. At all times, the connector is the vital link between cards or between the power source and cards so that the reliability and accuracy of the electronic equipment depends to a large degree upon the efficiency of this spring-type contact.

One manufacturer last year used over 6,000,000 beryllium copper contacts in connectors supplied to a variety of printed circuit users. Applications include television and radio, radar, guided missiles, computers, telephone equipment, and the like.

The average printed circuit connector is a proportionately long flat insulator, with multiple bifurcated contacts, which engage both sides of

the circuit board. Copper laminations, however, are printed on only one side of the card. The beryllium copper



● Fig. 2 — Typical printed circuit card is inserted in receptacle type connector.

contact is in the form of a U-shaped strip which grips the printed circuit card or terminal pin, see Fig. 1.

A phenolic plastic insulator base houses one or more of these contacts. They are mated to the card by dip-soldering or by friction. Dip-soldering is recommended because it permits the contact to absorb the punishment of connect-disconnect. Otherwise, the connector outwears the copper cladding which tends to peel back or wear through. The contacts are generally formed by stamping, although sometimes by machining.

For the severe forming operation, heat-treatable beryllium 25 alloy strip, 0.015 or 0.022 in. thick, was selected. This alloy after heat treatment provides the strength and other final properties required. The finished heat-treated part has the high fatigue limit desired, together with excellent wear resistance and high conductivity.

The contact is held in the insulator by crimping, twisting, or two piece captivation. Localized annealing, accomplished by both induction heating or the flame method, is used to soften the spot in the beryllium copper contact which is to be crimped. If the contact is connected with wires, the

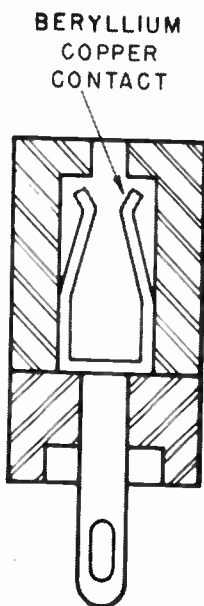


FIG. 1

● Fig. 1 — Cross-section view of connector showing beryllium copper contact encased in phenolic plastic insulator.

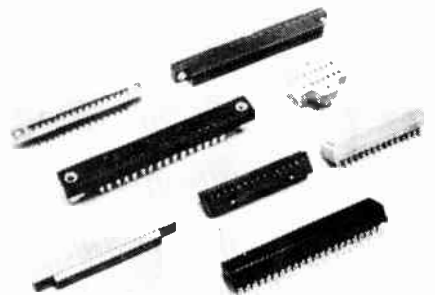


● Fig. 3 — Some of the different styles of beryllium copper contacts are shown here, compared to a paper clip for scale.

wires are attached either by soldering or mechanical means.

Standard Buggie connectors employ a plating of gold over silver on the beryllium copper contacts to provide low resistance, even with light contact pressures. Other plating metals, such as rhodium, are sometimes used where special electrical or corrosion-resistant characteristics are necessary — including high frequency conductance and low contact resistance. Rhodium, for example, is used for an unusual combination of corrosion and wear resistance, hardness, as well as low and stable contact resistance. Whichever metal is used, plating baths do not cause hydrogen embrittlement in beryllium copper; consequently, do not adversely affect its endurance.

The company's standard line of connectors for printed circuits includes three designs which employ beryllium copper contacts with a plating of gold over silver. One design (Fig. 2) is a card receptacle for up to 15 contacts with solder tabs which are permanently connected to a base board circuit.



● Fig. 4 — Typical examples of the line of printed circuit connectors.

A variation of this employs terminal pins in place of the solder tabs, for attachment to the base board by hot dip soldering. The third type is a terminal connector strip which has a series of female mating sockets to receive terminal pins; solder tabs are provided for permanent connection of the strip to a base board. Through custom designing, the firm has turned out between 50 and 75 modifications of these basic types.

Figure 3 shows some of the different styles with solder tabs in various positions. Connector assemblies are available for three card thicknesses;  $\frac{1}{8}$  in.,  $\frac{1}{16}$  in., and  $\frac{1}{4}$  in.





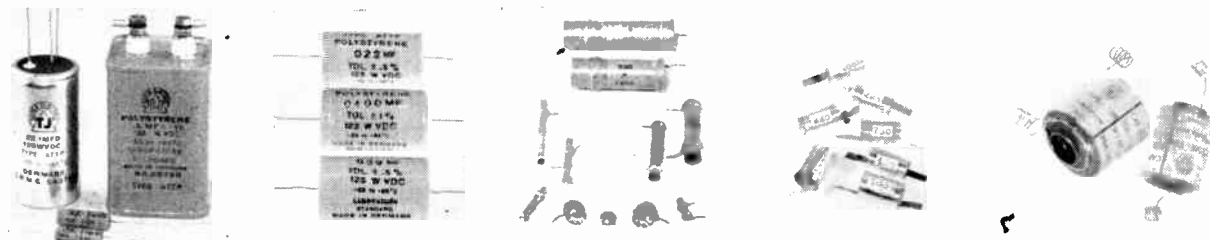
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TOBIAS JENSEN COMPANY ARE MANUFACTURING A COMPLETE RANGE OF CAPACITORS TO MEET ANY APPLICATION. THE "TJ" TRADEMARK IS RECOGNIZED AS A SYMBOL OF QUALITY. PLEASE CONSULT OUR APPLICATION ENGINEERING FOR PARTICULARS.



## PAPER & PAPER OIL

PAPER-OIL Capacitors type OA, hermetically sealed in metal tubing. Available with 100, 200, 400, 600, 1000, 1600, 2000, 2500, 3000, 5000 and 7500 volt ratings in capacities from 50pF. to several MF. — CHLORINATED DIELECTRIC type NA, or METALLIZED PAPER-OIL, available in low voltages for applications where space is at a premium in capacities from 100 pF. to several MF. PAPER-OIL Capacitors type OK, in steel cans, hermetically solder sealed with ceramic or glass insulated terminals. 1% stability, low temperature coefficient and wide temperature range. Standard ratings to 7500 volts. - Insulation resistance for both tubular and canned oil-impregnated types, min. 5000 megohm MF. An extremely large range of standard and special types and styles available for DC as well as AC service.



## PLASTIC FILM

## CERAMICS

## PLASTIC FILM

PLASTIC FILM CAPACITORS feature insulation resistance in excess of 500,000 megohm/MF., min. Q of 2000, high stability, neg. temperature coefficient, non-inductive construction and tolerances to better than .5%. Capacities from 10 pF. to several MF. in ratings of 60, 125, 250, 450 and 600 volts in open or hermetically sealed tubular types and in 1000, 1500, 2000, 3000, 4000 and 5000 volts in hermetically sealed steel cans with solder sealed ceramic or glass insulated terminals. Available in low priced types such as "T" and "AT" in ratings up to 600 and 1000 volts, and in the highly stabilized types "TTL", "ATTL", "TTP", "ATTP", "KTP", "TTM" and "KTTM". - The highest precision laboratory standard capacitors are made in the "TTP" and "TTM" series with polystyrene dielectric. - Plastic film dielectric is also preferred for many r.f. applications, tuned filters, pulse-network and critical high impedance circuits. Special types are available for energy storage where a charge has to be maintained in some cases for several years. - Other types to carry high frequency current in excess of 10 amps. at high potentials supplied for geophysical surveying equipment, etc.

CERAMIC CAPACITORS for tuned circuits and by-pass applications, ceramics for temperature compensation. Capacities from .22pF., voltages from 100 to 5000 volts as standard.



## ELECTROLYTICS

ELECTROLYTICS — Plain or etched foil, polarized or non-polarized in all ratings and styles, featuring extremely reliable performance and long life. Tubular miniature or standard, twist-prong, plug-in, screw base and bakelite or steel encased electrolytics are but a few of the many standard styles available. Electrolytic capacitors are supplied for DC filtering, Voltage doubling circuits, Audio and r.f. coupling and by-pass, Energy storage and AC filtering service. - Special close tolerance non-polarized electrolytics with low losses available for speaker cross-over networks and similar applications. - Motorstarting electrolytics with very low power factor supplied in capacities from 10 to 600 MF. with 125, 150, 250, 280 and 320 volts AC rating. - Photoflash and special welding capacitors can be supplied for heavy discharge service.

# Associated Electronic Components

37 ROSELAWN AVE., TORONTO 12, ONT., CANADA  
HU. 1-0144

**Jennings**  
RADIO<sup>®</sup>  
VACUUM ELECTRONIC COMPONENTS

**VACUUM VARIABLE CAPACITORS**

FIG.	TYPE	CAPACITY MMFO	PEAK VOLTAGE		AMPERES
			KILOVOLTS	RMS ①	
2 to 5 KV	E	UCSL	4-250	3, 5	30
	B	UCSL	5-500	3, 5	30
	A	UCSL	5-750, 7-1000	3, 5	42
	A	UCSL	20-2000	2, 3	42
7.5 to 15 KV	E	GCS	5-100	7.5, 10, 15	35
	I	UCSV	8-110, 125-250	7.5, 10, 15	35
	K	ATCS	10-150, 15-190	7.5, 10, 15	20
	L	UCS	5-200, 10-300	7.5, 10, 15	42
	L	UCS	10-400, 25-500	7.5, 10, 15	42
	A	UCSF	5-250, 12-500	7.5, 10, 15	60
	H	UCSX	25-700, 25-1000	7.5, 10, 12	60
	M	UCSXF	12-1000, 15-1200	7.5, 10, 12	70
10 to 20 KV	M	UCSXF	20-1500, 50-2000	7.5, 10, 12	70
	C	ECS	2-8, 3-30	10, 15	20
	K	TC	5-25	20	20
	K	ATC	10-50, 15-75	20, 30	20
	F	UC	50-250	10, 15, 20	60
	D	UXC	25-500	10, 15, 20	60
	M	UXCF	10-250, 20-500	10, 15, 20	100
35 to 60 KV	J	VMMC	50-1000, 100-2000	10, 15	125
	G	VMMC	100-5000	7.5, 10, 15	125
	I	UCSVH	8-35	25, 35	60
	F	UHC	10-75, 75-150	35, 45, 55, 60	60
	D	UXHC	25-150	35, 45, 55	60
	H	UCSXH	10-200	35, 45	60
	M	UCSXHF	25-450	35, 40	60
J	VMMHC	10-250, 25-450	35, 45, 55	125	
	G	VMMHC	60-1000	35, 40, 45	125

① Current ratings can usually be doubled with forced air cooling. Only standard units with copper construction are shown.

**JENNINGS** manufactures many vacuum capacitors with other capacity ranges and with voltage and current ratings up to 125 kv and 500 amperes.

JENNINGS RADIO MANUFACTURING CORPORATION • 970 McLAUGHLIN AVE. P.O. BOX 1278 • SAN JOSE 8, CALIF.

## ATOMIC FUTURE

(Continued from page 22)

Much of the two-way radio at Blind River is Motorola equipment supplied and installed by Rogers Majestic Electronics Limited. The antenna masts are 100 ft. to 150 ft. high depending on location and range. The automatic transmitter-receivers which act as the heart of each network are usually located in small huts built at the foot of each mast. Standard 250-watt base stations are employed at the sidings and job-sites. Mobile two-way sets in foremen's jeeps and other vehicles and Handie-Talkie portables complete the systems.

Perini and other big users of two-way radio in the Blind River district bought their equipment after starting operations there. Some sub-contracting companies like Eastern Electrical arrived with units which had demonstrated their value on previous jobs. The Canadian Pacific and Bell Telephone Companies use two-way radio equipment to carry teletype and telephone service into the Elliot Lake townsite and other places in the district where lines are not yet available.

Most of the messages handled by radio installations in the Blind River area deal with the routine business of mining and construction companies. The electronic equipment, however, has beneficial effects which extend beyond its aid to freight movements and project supervision. It enhances employee morale and it brings quick help in times of accident and sickness. Every one of thousands of workers in the area knows that he can be contacted in the event of an emergency at home, that radio will bring a doctor or ambulance if they are needed. Medical headquarters for the area are now located at Elliot Lake in quarters only a few yards away from a radio base station. Critical cases can be transferred from there by ambulance to the hospital at Blind River. When a few hours may mean the difference between life and death, radio can summon a plane bearing special medical supplies or stretchers for a quick journey to town.

"Radio has made a world of difference to us. Without it much of our progress would have been impossible and the turnover of workers very much higher," is the way the personnel manager of one leading uranium mine summed up its contributions to his company's projects.

In April as melting snows slowed freight movements to a minimum, radio sets at Perini's and other job sites carried a steady stream of messages 16 hours a day. This summer, as construction activity in the area reaches record levels, many additional sets will probably be in use. With the bulldozers, power shovels, rock drills and other equipment they will be advancing Canada's progress into the Atomic Era.

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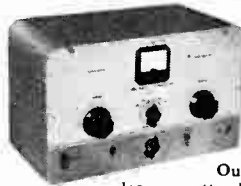
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*world's finest  
electronic equipment  
in kit form...*

# HEATHKIT

*High Quality  
Advanced Design  
Reliable Performance  
Real Economy*

## Heathkit AMATEUR CW TRANSMITTER KIT



MODEL AT-1  
**\$29.50**  
Shpg. Wt. 15 Lbs.

Outstanding dollar-per-watt value! 30-35 watts plate power input, bandswitching for 80, 40, 20, 15, 11, and 10 meters. Crystal or external VFO excitation. 52 ohm output—key click filter—copper-plated chassis—pre-wound coils. Uses 6AG7 oscillator, 6L6 final.

## Heathkit PHONE & CW TRANSMITTER KITS

Both the DX-100 and the DX-35 are designed especially for you—with the features most important to efficient and practical amateur operation!



MODEL DX-100

**\$189.50**

Shpg. Wt. 120 Lbs.  
Shipped motor freight unless otherwise specified.  
\$50.00 deposit required on c.o.d. orders.

This transmitter is rapidly becoming the accepted standard in its price class. An outstanding dollar value!

100 watts RF output—built in power supplies—built in VFO and modulator—bandswitching on 160, 80, 40, 20, 15, 11, and 10 meters—phone or CW operation. 100 watts output on phone, and 120 watts on CW. TVI suppressed—pi network output coupling—extensive shielding—matches 50 to 600 ohms—VFO dial and meter face illuminated—high quality components used throughout. Uses 1625 tubes in push-pull to modulate 6146 tubes in parallel. Complete schematic diagram and technical specifications available on request.



MODEL DX-35

**\$56.95**

Shpg. Wt. 24 Lbs.

This exciting new kit features phone and CW operation on 80, 40, 20, 15, 11, and 10 meters. Completely bandswitching. Plate power input up to 65 watts on CW, with controlled carrier modulation peaks to 50 watts on phone. Features built-in modulator, power supplies, pi network output circuit. Separate 12BY7 buffer stage assures plenty of drive to the 6146 final. Switch selection of three crystals, or may be excited from external VFO. Panel meter reads final grid or plate current. Complete schematic and specifications on request.

## Heathkit VFO KIT



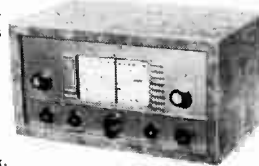
MODEL VF-1  
**\$19.50**

Shpg. Wt. 7 Lbs.

Go VFO for added convenience and flexibility. Functions with Heathkit AT-1 or DX-35- or with most modern transmitters. Covers 160-80-40-20-15-11 and 10 meters. Three basic oscillator frequencies provide better than 10 volt average RF output. Plug provided for crystal socket of transmitter. VR tube for stability. Requires only 250 VDC at 15 to 20 ma, and 6.3 VAC at 0.45A.

## Heathkit ALL BAND COMMUNICATIONS TYPE RECEIVER KIT

Unusual sensitivity and selectivity for price. Covers 550 kc to 30 mc in 4 bands. AC power supply—electrical bandspread—antenna trimmer—separate RF and AF gain controls—noise limiter—head-phone jacks—A GC—BFO. Cabinet available separately as shown.



MODEL AR-3  
**\$27.95**

(less cabinet)  
Shpg. Wt. 12 Lbs.

## Heathkit "Q" MULTIPLIER KIT



MODEL QF-1  
**\$9.95** Shpg. Wt. 3 Lbs.

Adds selectivity and flexibility to your receiver, and rejects undesired signal or heterodyne. Tunes any signal within IF of receiver with effective Q of approximately 4,000. Provides sharp "Peak" or "null." Surpasses crystal filter in flexibility of operation. Use with receiver having 450—460 kc IF. Will not function with AC-DC receivers. Requires 6.3 VAC at 300 ma, and 150-250 VDC at 2 ma. Cable and plugs supplied for connection.

## Heathkit GRID DIP METER KIT



MODEL GD-1B  
**\$19.50**

Shpg. Wt. 4 Lbs.

Use as a signal source, for determining unknown frequency, for checking resonance of tuned circuits, or for adjusting wave traps. Equally valuable in ham shack, service shop, or laboratory. Features 500 ua meter with sensitivity control, for indication. Covers 2 mc to 250 mc with five coils, supplied with kit. Coils pre-wound, dial scale pre-calibrated. Easy to build, and extremely valuable for literally hundreds of jobs.

## Heathkit ANTENNA COUPLER KIT



MODEL AC-1  
**\$14.50**  
Shpg. Wt. 4 Lbs.

This coupler matches between the transmitter, and a long-wire end-fed antenna, and incorporates an L-type filter to attenuate signals above 36 mc and reduce TVI. 52 ohm coaxial input. Tapped inductor and variable capacitor for matching antenna. Neon RF indicator—copper-plated chassis—simple to build. Handles power up to 75 watts, 10 through 80 meters. Use with Heathkit AT-1 or DX-35.

## Heathkit ANTENNA IMPEDANCE METER KIT

Use this instrument, with a source of RF signal, to determine antenna impedance, line impedance, and to solve impedance matching problems with fixed or mobile antennas or transmission lines. Also, will double as field strength indicator, or phone monitor. Uses 100 ua meter and features calibrated impedance scale on control knob. Covers 0 to 600 ohms. A valuable device in any ham shack.



**\$14.50** MODEL AM-1  
Shpg. Wt. 2 Lbs.

**HEATH COMPANY** A Subsidiary of Daystrom, Inc. **BENTON HARBOR 3, MICH.**

### Heathkit HARMONIC DISTORTION METER KIT



MODEL HD-1

**\$49.50**

Shpg. Wt. 13 Lbs.

Use with low-distortion audio generator to measure harmonic distortion of audio amplifiers. Reads distortion on meter as percentage of input signal. Operates between 20 and 20,000 cps. High impedance VTVM built in for initial reference settings and final distortion readings. VTVM ranges are 0-1, 3, 10, and 30 volts full scale. 1% precision resistors employed. Distortion scales are 0-1, 3, 10, 30, and 100% full scale.

### Heathkit 6-12 VOLT BATTERY ELIMINATOR KIT

MODEL BE-4

**\$31.50**

Shpg. Wt. 17 Lbs.



Will supply either 6 or 12 volt output to take care of auto radios on even the most modern cars. Output voltage is variable from zero to 8 volts DC or 0 to 16 volts DC. Will deliver up to 15 amperes at 6 volts or up to 7 amperes at 12 volts. Two 10,000 microfarad output filter capacitors insure smooth DC output. Panel meters monitor output current and voltage. Will double as a battery charger.

### HEATHKIT AUDIO TEST EQUIPMENT

You can equip your shop for complete analysis and test of high fidelity audio equipment by employing Heathkit instruments. Professional equipment you can afford!

#### AUDIO OSCILLATOR KIT (SINE-WAVE - SQUARE WAVE)



MODEL AO-1

**\$24.50**

Shpg. Wt. 10 Lbs.

Produces sine wave or square wave signals from 20 to 20,000 cps in three ranges. Designed for use in service shop, or home workshop. Employs thermister for output regulation. Features high level output, low distortion, and low impedance output. Produces sine waves for audio testing, or will produce good, clean square waves with a rise time of only 2 microseconds. Very simple to build from complete instructions supplied.

### Heathkit HANDITESTER KIT

This compact model easily slips into tool box, glove compartment, or coat pocket. Valuable as "extra" instrument in service shop, and ideal for the home experimenter. Very popular with appliance repairmen and electricians. Measures AC or DC voltage at 0-10, 30, 300, 1000, 5000 volts full scale. Direct current ranges are 0-10 ma and 0-100 ma. Attractive black bakelite case. Ohmmeter ranges are 0-3000 and 0-300,000 ohms.



MODEL M-1

**\$14.50**

Shpg. Wt. 3 Lbs.

### Heathkit VARIABLE VOLTAGE REGULATED POWER SUPPLY KIT

MODEL PS-3

**\$35.50**

Shpg. Wt. 17 Lbs.



Supplies regulated DC output that can be manually controlled from 0 to 500 volts. It will supply up to 130 ma at 200 VDC, and up to 10 ma at 450 VDC. Large panel meter monitors output voltage or current. Also provides filament voltage at 6.3 volts AC, up to 4 amperes. Filament and B+ circuits are isolated from ground. Ideal lab power supply.

### AUDIO GENERATOR

MODEL AG-9

**\$34.50**

Shpg. Wt. 8 Lbs.



This generator features low distortion (less than .1%). Ideal for use with Model HD-1, or in other applications requiring low signal distortion. Frequency accuracy within  $\pm 5\%$ . Features step-type tuning from 10 cps to 100 kc, with three rotary switches to provide two significant figures and a multiplier. Output monitored on a large  $4\frac{1}{2}$ " meter. Meter calibrated for output voltage or db. Output ranges are—.003, .01, .03, .1, .3, 1, 3, and 10 volts.

### Heathkit "Q" METER KIT

The Model QM-1 measures the Q of inductances and RF resistance and distributed capacity of coils. Employs a  $4\frac{1}{2}$ " 50 microampere meter for direct indication. Features built-in signal source for tests at frequencies of 150 kc to 18 mc in 4 ranges. Measures capacity from 40 mmf to 450 mmf within  $\pm 3$  mmf. Indispensable for coil winding, and for determining unknown capacitor values.



MODEL QM-1

**\$44.50**

Shpg. Wt. 14 Lbs.

### Heathkit IMPEDANCE BRIDGE KIT

MODEL IB-2

**\$59.50**

Shpg. Wt. 12 Lbs.



Features a built-in oscillator and amplifier. Measures resistance, capacitance, inductance, dissipation factors of condensers, and storage factor of inductance. D, Q, and DQ functions combined in one control. Employs  $\frac{1}{2}\%$  resistors and  $\frac{1}{2}\%$  silvermica capacitors. 100-0-100 ua. meter indicates null. Two section CRL dial provides ten separate units with accuracy of .5%. Fractions of units read on variable control.

### AUDIO ANALYZER KIT



MODEL AA-1

**\$59.50**

Shpg. Wt. 13 Lbs.

This combination instrument provides the functions of an AC VTVM, audio wattmeter, and intermodulation analyzer. Includes built-in high and low frequency oscillators for intermodulation distortion tests. VTVM ranges are .01, .03, .1, .3, 1, 3, 10, 30, 100, and 300 volts rms. Wattmeter ranges are .15 mw, 1.5 mw, 15 mw, 150 mw, 1.5 w, 15 w, and 150 w. IM scales are 1%, 3%, 10%, 30%, and 100%. Provides internal loads of 4, 8, 16, or 600 ohms. An extremely valuable instrument for the audio engineer, or serious audiophile.

### Heathkit CRYSTAL RECEIVER KIT



MODEL CR-1

**\$79.5**

Shpg. Wt. 3 Lbs.

This crystal radio covers the standard broadcast band from 540 to 1600 kc. It employs two high Q tank circuits that are tuned separately for the desired station. A sealed germanium diode is featured for detection. No critical "cat's whisker" to adjust. Kit includes a pair of high impedance head sets, and is easy to build, even for a beginner. Construction manual takes "educational" approach and explains theory of signal reception. Requires no external power for operation. Ideal standby unit for emergency reception of civil defense signals in case of power failure.

### Heathkit BROADCAST BAND RECEIVER KIT

You can build your own radio receiver with confidence, even if you are a beginner. Complete step-by-step instructions insure success. Features transformer-type power supply, high gain miniature tubes, built-in antenna,  $5\frac{1}{2}$ " speaker, and planetary tuning from 550 kc to 1600 kc.

**CABINET:** Fabric covered plywood cabinet with aluminum panel as shown. Part #91-9A, shipping weight 5 lbs. \$4.50.

MODEL BR-2

**\$17.50**

(less cabinet)

Shpg. Wt. 10 Lbs.



**HEATH COMPANY** A Subsidiary of Daystrom, Inc. **BENTON HARBOR 3, MICH.**

For further data on advertised products use page 61.

# HEATHKIT HIGH FIDELITY AMPLIFIER KITS

Proven circuit designs and step-by-step instructions insure successful construction, even if you have never built a kit before.



## Heathkit 25-WATT ADVANCED-DESIGN

This 25 watt amplifier incorporates the "extra" features required for really outstanding performance. Employs KT66 output tubes in push-pull, and features a Peerless output transformer. Response is within  $\pm 1$  db from 5 cps to 160 kc at 1 watt. Harmonic distortion only 1% at 25 watts, 20 to 20,000 cps. IM distortion only 1% at 20 watts. Output impedance is 4, 8, or 16 ohms. Hum and noise are 99 db below rated output.

**KIT COMBINATIONS:**  
**W-5M Amplifier Kit:** Consists of main amplifier and power supply, all on one chassis. Complete with all necessary parts, tubes, and comprehensive manual. Shpg. Wt. 31 lbs. **\$59<sup>75</sup>** Express only.  
**W-5 Combination Amplifier Kit:** Consists of W-5M amplifier kit listed above plus Heathkit Model WA-P2 Preamplifier kit. Complete with all necessary parts, tubes, and construction manuals. Shpg. Wt. **\$79<sup>50</sup>** 38 lbs. Express only.

## Heathkit 7-WATT

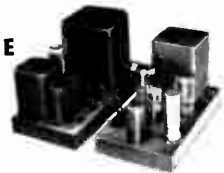
Using a tapped-screen output transformer of new design, frequency response of this unit is  $\pm 1\frac{1}{2}$  db from 20 to 20,000 cps. It provides good sensitivity, with surprisingly low distortion. Transformer tapped at 4, 8, and 16 ohms. Push-pull output. Separate bass and treble tone controls. Shpg. Wt. 10 lbs.  
**MODEL A-7E:** Same as Model A-7D, but with stage of preamplification. Extra gain for low-level cartridges. RIAA compensation. Shipping weight 10 lbs. **\$18<sup>50</sup>**



**\$16<sup>95</sup>** MODEL A-7D  
 Shpg. Wt. 10 lbs.  
**\$18<sup>50</sup>**

## Heathkit 20-WATT DUAL-CHASSIS WILLIAMSON TYPE

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



### KIT COMBINATIONS

**W-3M:** Consists of main amplifier and power supply for separate chassis construction. Includes all tubes and components necessary for assembly. Shpg. Wt. 29 lbs. **\$49<sup>75</sup>** Express only.  
**W-3:** Consists of W-3M kit listed above plus Heathkit Model WA-P2 Preamplifier described on this page. Shpg. Wt. 37 lbs. **\$69<sup>50</sup>** Express only.

## Heathkit 20-WATT SINGLE-CHASSIS WILLIAMSON TYPE



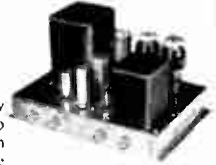
The original low-priced Williamson Amplifier kit. A Chicago output transformer and 5881 output tubes are featured. Frequency response is  $\pm 1$  db from 10 cps to 100 kc at 1 watt. Harmonic distortion only 1.5% at 20 watts. IM distortion only 2.7%. Output at 4, 8, or 16 ohms. Hum and noise 95 db below 20 watts.

### KIT COMBINATIONS

**W-4AM:** Consists of main amplifier and power supply for single chassis construction. Includes all tubes and components necessary for assembly. Shpg. Wt. 28 lbs. **\$39<sup>75</sup>** Express only.  
**W-4A:** Consists of W-4AM Kit listed above plus Heathkit Model WA-P2 Preamplifier described on this page. Shpg. Wt. 35 lbs. **\$59<sup>50</sup>** Express only.

## Heathkit 20-WATT

This amplifier can provide you with high fidelity at a surprisingly low price. Preamplifier built into same chassis as main amplifier. Four switch selected, compensated inputs are available, as are bass and treble controls. Features full 20-watt output using push-pull 6L6 tubes. Frequency response is  $\pm 1$  db from 20 to 20,000 cps. Harmonic distortion only 1% at full output.



MODEL A-9B **\$35<sup>50</sup>**  
 Shpg. Wt. 23 lbs.

## Heathkit HIGH FIDELITY PREAMPLIFIER KIT

MODEL WA-P2

**\$19<sup>75</sup>**

(with cabinet)  
 Shpg. Wt. 7 lbs.



Designed for use with Heathkit main amplifiers. Features five separate switch-selected input channels, each with its own input level control. Four-position turnover and roll-off controls for record equalization. Separate bass and treble tone controls. Special hum control to insure minimum hum level. Will do justice to finest program sources. Beautiful satin-gold finish.

## Heathkit ELECTRONIC CROSS-OVER KIT

The XO-1 separates high and low frequencies at selectable crossover points, to feed two separate power amplifiers, one for high frequencies and one for low frequencies. Speakers are then connected to the amplifiers directly, without the usual LC crossover. Separate level controls provided for both outputs. The XO-1 consumes no audio power. Crossover frequencies are 100, 200, 400, 700, 1200, 2000, and 3500 cps. Attenuation is 12 db per octave.



MODEL XO-1 **\$18<sup>95</sup>**  
 Shpg. Wt. 6 lbs.

## Heathkit TUNER KITS

These tuners measure only 12 9/16" long x 3 5/8" high x 5 7/8" deep, and are finished in beautiful satin-gold enamel. Easily stack one over another to form compact control unit.

### FM HIGH FIDELITY

MODEL FM-3

**\$24<sup>50</sup>**

(With cabinet)  
 Shpg. Wt. 7 lbs.



This FM tuner offers sensitivity, selectivity, and stability, not expected at this price level. Efficient 7-tube circuit is entirely new, and incorporates AGC, cascade front end, temperature-compensated oscillator, built-in power supply, and other outstanding design features. Pre-aligned IF and ratio transformers. Sensitivity is better than 10 microvolts for 20 db of quieting. Covers 88 to 108 mc.

### AM BROAD BANDWIDTH

MODEL BC-1

**\$24<sup>50</sup>**

(With cabinet)  
 Shpg. Wt. 8 lbs.



Designed for use with high fidelity systems. Low distortion voltage-doubler detector. Covers 550 to 1600 kc. 20 kc IF bandwidth. Audio response  $\pm 1$  db from 20 cps to 2 kc. 6 db signal-to-noise ratio at 2.5 microvolts. RF and IF coils pre-aligned. Power supply built-in. Efficient, modern circuit. Matches WA-P2 and FM-3 in color and style.

## Heathkit SPEAKER SYSTEM KITS

The models SS-1 and SS-1B are matched so that when the smaller unit is placed on top of the larger unit, the appearance of a single piece of furniture is achieved.

### SS-1 HIGH FIDELITY

MODEL SS-1 **\$39<sup>95</sup>**

Shpg. Wt. 30 lbs.



Employs two Jensen speakers to cover from 50 to 12,000 cps. Response is within  $\pm 5$  db. Built-in crossover functions at 1600 cps. System rated at 25 watts, with nominal impedance of 16 ohms. Enclosure is ducted-port bass reflex type. Merely assemble the cabinet, wire the speakers and crossover network, and finish to your taste.

### SS-1B HIGH FIDELITY RANGE EXTENDING

Employs woofer and super tweeter to cover 35 to 600 cps, and 4000 to 16,000 cps. Extends frequency range of SS-1 at both ends of the spectrum, for total of  $\pm 5$  db from 35 to 16,000 cps. The kit includes necessary crossover circuits and balance control. Power rating is 35 watts for speech and music. Impedance is 16 ohms.



MODEL SS-1B **\$99<sup>95</sup>**  
 Shpg. Wt. 80 lbs.

**HEATH COMPANY** A Subsidiary of Daystrom, Inc. **BENTON HARBOR 3, MICH.**



## NEW Heathkit PROFESSIONAL RADIATION COUNTER KIT

MODEL RC-1

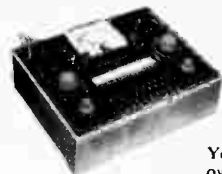
**\$79<sup>95</sup>**

Shpg. Wt. 8 Lbs.

- ▶ Completely modern design for maximum sensitivity and reliability.
- ▶ Both visual (4½" meter) and aural (panel-mounted speaker) indicators for radiation level.
- ▶ Meter calibrated in CPM and mR/hr. Four measuring ranges.
- ▶ Employs 900-volt Bismuth tube in beta/gamma sensitive probe.

This radiation counter provides design advantages found only in units costing several times its low kit price. It incorporates features essential to the serious prospector. High sensitivity is provided, with ranges of 0-100, 600, 6,000, and 60,000 counts per minute, and 0.02, .1, 1, and 10 milliroentgens per hour. A type 6306 Bismuth tube is employed in the probe, and the probe and a radiation sample are included in the kit price. The circuit employs 5 tubes (plus a transistor) to assure stable and reliable operation. High quality, 4½" 200 micro-ampere meter eliminates "guess work" and indicates radiation level directly in cpm, or mR/hr. In addition, transistor oscillator provides aural signal from panel-mounted speaker. High voltage power supply is "packaged" pre-built unit with reserve capacity above 900 volt level at which it is regulated. Merely changing regulator tube would allow use of scintillation probe if desired.

Fulfills requirements of those who want a prospecting instrument that can be relied upon. Has selectable time constant, to allow for different rates of travel over the area being investigated. Measures only 9½" high x 6½" wide x 5¼" deep, and weighs only 6½ lbs. Not to be confused with novelty radiation detection devices on the market. A top-quality instrument, yet simple to build.



## Heathkit TUBE CHECKER KIT

MODEL TC-2

**\$29<sup>50</sup>**

Shpg. Wt. 12 Lbs.

You can afford your own tube tester, even if you only do part-time service work. Uses a 4½" meter with 3-color meter face for simple "good-bad" indications of tube quality, on the basis of emission. Tests all tubes commonly encountered in radio and TV service work. 14 different filament voltages—built-in roll chart—ten 3-position lever switches for open or short tests on each tube element.

## Heathkit CATHODE RAY TUBE CHECKER KIT



Indicates condition of CRT on large "good-bad" scale. Spring-loaded switches protect operator. Checks all electromagnetic deflection picture tubes normally encountered in TV servicing. Supplies all operating potentials and tests for shorts, leakage, and emission on the work bench, in the carton, or in the set. Features shadowgraph test to indicate tube condition.

MODEL CC-1

**\$22<sup>50</sup>**

Shpg. Wt. 10 Lbs.

## Heathkit VISUAL-AURAL SIGNAL TRACER KIT



MODEL T-3 **\$23<sup>50</sup>**

Shpg. Wt. 9 Lbs.

Features a high-gain RF input channel for signal tracing and troubleshooting from the receiver antenna input clear through all RF and

IF stages. Separate low-gain channel for audio circuit exploration. Built-in loudspeaker provides audio response, while electron beam "eye" tube gives visual indication. Ideal for signal tracing in AM, FM, and TV receivers.

## Heathkit TV ALIGNMENT SWEEP GENERATOR KIT

All-electronic sweep eliminates mechanical hum or vibration. Features improved linearity—effective AGC—flat output—0 to 40 mc sweep. Covers all frequencies in FM, monochrome TV and color TV. Plenty of RF output for alignment of tuners, IF strips, boosters, etc. Fundamental output from 4 to 220 mc in four bands. Incorporates crystal oscillator (4.5 mc and multiples thereof), and variable marker covering 19 to 60 mc on fundamentals—up to 180 mc on harmonics. Effective two-way blanking.

MODEL TS-4

**\$49<sup>50</sup>**

Shpg. Wt. 16 Lbs.



## Heathkit SIGNAL GENERATOR KIT



MODEL SG-8

**\$19<sup>50</sup>**

Shpg. Wt. 8 Lbs.

This tried and proven generator covers 160 kc to 110 mc on fundamentals in five bands, and calibrated harmonics extend to 220 mc. Very popular in service shops, laboratories, and home workshops. RF output is in excess of 100,000 microvolts, controlled by a variable and a fixed-step attenuator. Output is pure RF, RF modulated at 400 cps, or 400 cps audio for amplifier testing.

## Heathkit CONDENSER CHECKER KIT

Measures paper, mica, ceramic, and electrolytic capacitors in 4 ranges from .00001 to 1,000 microfarads. It indicates condenser value and quality. Also measures resistance from 100 ohms to 5 megohms. All values indicated directly on panel scale, after adjusting for null on electron beam "eye" tube. No calculations necessary. A valuable instrument in service or laboratory applications.



MODEL C-3

**\$19<sup>50</sup>**

Shpg. Wt. 7 Lbs.

## Heathkit LINEARITY PATTERN GENERATOR KIT



MODEL LP-2

**\$22<sup>50</sup>** Shpg. Wt. 7 L

of TV set. Panel provision for external sync if desired. Covers channels 2 to 13. 5 to 6 vert. bars and 4 to 5 hor. bars.

Supplies information for white dots, cross-hatch pattern, horizontal bar pattern, or vertical bar pattern. Use for adjustment of vertical and horizontal linearity, picture size, aspect ratio and focus. Dot pattern is a must for color convergence adjustments. Clip merely connects to antenna terminals

## Heathkit LABORATORY GENERATOR KIT

MODEL LG-1

**\$39<sup>50</sup>**

Shpg. Wt. 16 Lbs.



This signal generator covers from 100 kc to 30 mc on fundamentals in 5 bands. 400 cycle modulation variable from 0 to 50% RF output up to 100,000 microvolts. Meter reads RF output or percentage of modulation. Fixed step and variable output attenuation. Voltage regulation, double copper-plated shielding for stability, and other "extras." Provision for external modulation. Output impedance 50 ohms.

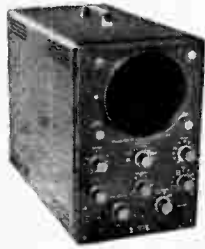
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## HEATHKIT ETCHED CIRCUIT OSCILLOSCOPE KITS

You may choose from three different oscilloscope models when you purchase a Heathkit scope. All three units employ printed circuit boards for increased circuit efficiency and simplified assembly. Construction time cut almost in half. Outstanding dollar values for you!

### 5" COLOR TV



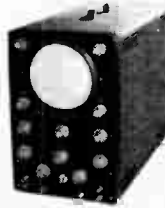
MODEL O-10  
**\$69.50**

Shpg. Wt. 21 Lbs.

Amplifier response essentially flat from plus 2 db -5 db from 5

mc down to 2 cps without extra switching. Extended sweep oscillator range allows single-cycle observation of signals up to 500,000 cps, and will sync signals even higher. Uses etched metal circuit boards. Push-pull vertical and horizontal amplifiers—built in peak-to-peak calibrating source—step attenuated input—preformed and cabled wiring harness. A professional oscilloscope, ideal for color TV work in the lab or service shop. The 11-tube circuit features 5UPI CRT.

### FULL SIZE 5"



MODEL OM-1  
**\$49.50**

Shpg. Wt. 21 Lbs.

The Model OM-1 with a 5", 5BP1 cathode ray tube has many big scope features—yet it is priced reasonably. Features etched-metal circuit boards. Incorporates 3-step input attenuator—phasing control—built-in peak-to-peak voltage calibrator—and push-pull vertical and horizontal amplifiers. Vertical amplifier flat within  $\pm 3$  db from 2 cps to 200 kc. Sweep circuit functions from 20 cps to 100,000 cps.

### 3" PORTABLE



MODEL OL-1  
**\$29.50**

Shpg. Wt. 14 Lbs.

Has many of the features of the Model OM-1, yet is smaller in physical size. Employs etched-metal circuit boards. Features vertical frequency response within  $\pm 3$  db from 2 cps to 200 kc. Sweep generator operates from 20 to 100,000 cps. The 8-tube circuit features a type 3GPI CRT.

## Heathkit AC VACUUM TUBE VOLTMETER KIT



MODEL AV-2  
**\$29.50**

Shpg. Wt. 5 Lbs.

This VTVM combines high impedance, wide frequency range, and high sensitivity. It is designed especially for audio work. Frequency response is substantially flat from 10 cps to 50 kc. Sensitivity allows measurements as low as 1 mv at high impedance. Ranges are .01, .03, .1, .3, 1, 3, 10, 30, 100, and 300 volts rms. Total db range is -52 to +52 db. 1 megohm input impedance at 1 kc. An outstanding instrument for your laboratory, service shop, or home workshop.

## Heathkit ETCHED CIRCUIT VACUUM TUBE VOLTMETER KIT



MODEL V-7A  
**\$24.50**

Shpg. Wt. 7 Lbs.

The Heathkit Model V-7A features a 200 ua meter, 1% precision resistors, and an etched metal circuit board. Very simple to build. Measures DC voltage, ACV (rms) ACV (peak-to-peak), and resistance. AC (rms) and DC voltage ranges are 0-1.5, 5, 15, 50, 150, 500, and 1500 volts. Peak-to-peak ranges are 4, 14, 40, 140, 400, 1400, 4000 volts. Ohmmeter ranges provide multipliers of X1, X10, X100, X1000, X10K, X100K, and X1 megohm. DB scale also provided. 11-megohm input impedance.

## Heathkit 20,000 OHMS/VOLT VOM KIT



MODEL MM-1  
**\$29.50**

Shpg. Wt. 6 Lbs.

pliers are X1, X100, and X10,000. DB range from -10 db to +65 db.

This instrument is especially valuable for portable applications where AC power is not available. Sensitivity is 20,000 ohms-per-volt DC and 5,000 ohms-per-volt AC. Black bakelite case -4 1/2" x 50 ua. meter-1% precision resistors. AC and DC ranges are 0-1.5, 5, 50, 150, 500, 1500, and 5000 volts. Direct current ranges are 0-150 ua., 15 ma., 150 ma, 500 ma, and 15 a. Resistance multipliers are X1, X100, and X10,000. DB range from -10 db to +65 db.

## Heathkit DIRECT-READING CAPACITY METER KIT



MODEL CM-1  
**\$29.50**

Shpg. Wt. 7 Lbs.

This unique measuring instrument indicates capacitor values in mmf, or mfd, directly on a large 4 1/2" x 50 ua meter. It provides ranges of 0-100 mmf, 0-1,000 mmf, 0-.01 mfd, and 0-.1 mfd. Residual capacity less than 1 mmf. Scales are linear. Merely connect the capacitor to the instrument and read its value directly on the scale. Instrument not susceptible to hand capacity effects. Will measure even small value trimmers or variable air capacitors.

## Heathkit ELECTRONIC SWITCH KIT



MODEL S-3  
**\$21.95**

Shpg. Wt. 8 Lbs.

This new instrument design allows simultaneous oscilloscope observation of two input signals by producing both signals, alternately, at its output. The all-electronic circuit provides 4 switching rates, selected by a panel switch. Provides actual gain for input signals, and features frequency response of  $\pm 1$  db from 0 to 100 kc. Employs 7 miniature tubes, Sync output provided to control scope sweep. Functions at signal levels as low as 0.1 volt. Ideal for observing amplifier input and output simultaneously for comparison purposes.

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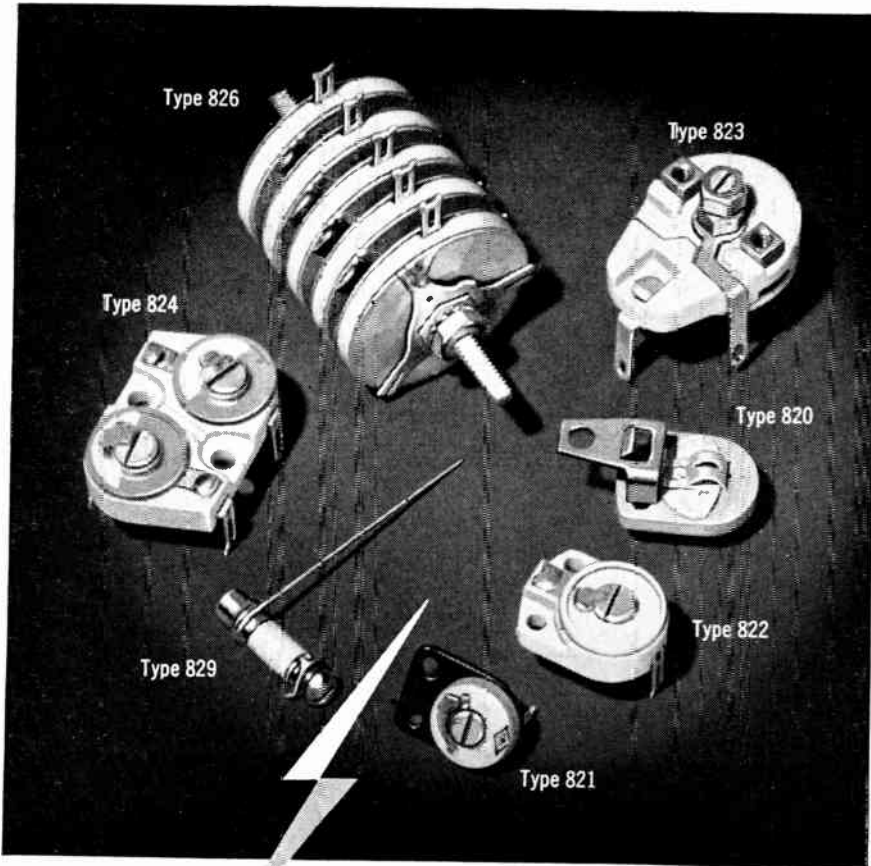
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**IRE Convention Plans Take Shape**

Keen interest is being shown throughout the electronics industry in the Canadian I.R.E. Convention and Exposition to be held in Exhibition Park, Toronto on October 1st, 2nd, and 3rd this year. Clare A. Norris, general chairman, announces that already over 120 exhibitors have booked space.

Among the branches of industry to be represented will be electronic components, antennas, audio equipment, broadcast transmission systems, aeronautical and navigational electronics, tubes, transistors, electronic computers, instrumentation, medical electronics, industrial electronics, radio telemetry and remote control, vehicular communications, ultrasonics engineering production machines, instruments and equipment, laboratory apparatus, measurement equipment, packaging, education, etc. In addition, the exhibits dealing with the industrial applications of nuclear science will add great interest to this important scientific exposition. There will also be a display of electronic equipment as used by the various branches of the Armed Forces of Canada.

A series of interesting papers will be presented in sessions on medical electronics, including a description of an electronic apparatus developed for use in cardio vascular surgery. This includes a device which allows the rate of the heart beat to be changed from half normal to double normal rates, and is particularly useful in heart operations.

One paper is from the Weizman Institute of Science, Rehovoth, Israel, covering magneto-resistive amplifiers.

The technical papers will be presented in rooms adjoining the exhibit space and therefore no time will be lost in traveling from convention rooms to the exhibition displays. Sessions will begin on Monday afternoon (October 1st), continue all day Tuesday, with an evening session that day, and finish at the end of the Wednesday afternoon.

Special entrance privileges are being arranged for university students to attend the technical papers sessions and exhibits.

A convention banquet will be held in the Concert Hall of the Royal York Hotel on Monday evening, October 1st. An outstanding speaker will address the gathering. A special program is being arranged for the ladies accompanying visitors. Organized visits are planned for them to a number of points of interest in and around Toronto, including the Royal Ontario Museum, the Toronto Art Gallery and the famed Casa Loma.

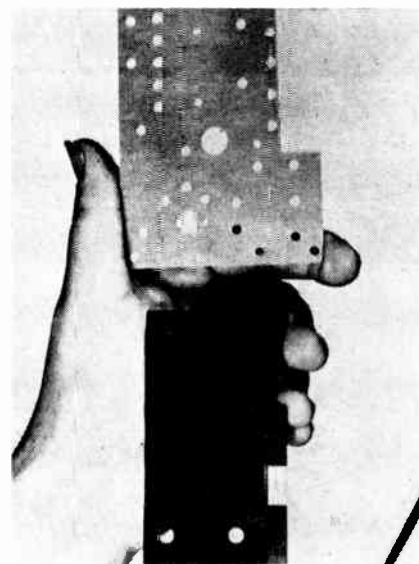
For further data on advertised products use page 61.

Recently developed copper clad laminate adds speed, efficiency and accuracy to the automatic production of printed circuit boards.

# New Cold Punching Laminate Adds Precision To Automation Of Circuits

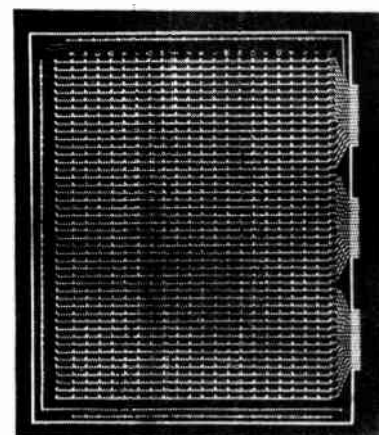
**A**N electrical grade phenolic laminated plastic which can be punched at room temperature has been identified as Grade XXXP-470 Phenolite and is particularly suited for copper clad printed circuits where automatic processes require close registration of punched mounting holes for component inserters. Permitting punching at temperatures as low as 68°F, the new grade assures precise dimensions of holes and hole spacings.

This new cold punching laminate is available in the same thickness range, tolerance, and sheet sizes as the maker's other XXXP grades. Its properties of high insulation resistance and low electrical losses, even under severe humidity conditions are claimed to match or exceed values of these properties for the company's hot punching grades. Also, copper clad bond strength and hot solder dip properties of the new product are



● *Top:* These two pieces illustrate the precision cold punching possible with the new electrical grade phenolite.

● *Bottom:* This typical printed circuit for a modern computer measures 18" by 21" and contains more than one thousand through holes for connection soldering. Such complex parts can be made automatically with greater precision with the new grade copper clad laminate.



comparable to other copper clad grades in the line.

Especially in the automation of processes involving larger boards for printed circuits (as may be used in computers, for example), precise spacing of punched holes is imperative. Up to now, XXXP phenolic laminated plastics could only be hot punched, but heating of the laminate made it difficult to hold dimensional tolerances. Expansion of the heated sheet along its length differs from expansion across its width and varies with the material involved. A cold punching laminate is the obvious answer to this problem.

In order to achieve its good cold punching characteristics, the new material has lower flexural strength and higher cold flow than other XXXP grades and these properties must be borne in mind in its application.

Table 1 — Summary of Properties — Grade XXXP-470 Phenolite

Property	Typical Values (for $\frac{1}{16}$ inch thick sheet)	
	XXXP-470	NEMA Standard
Flexural strength, p.s.i.		
MD	14,100	12,000
CD	11,600	10,500
Water absorption, % (D-24/23)*	0.48	1.00
Dissipation factor, $10^6$ cycles		
Condition A (as received)	0.268	0.030
Condition D-24/23*	0.281	0.035
Dielectric constant, $10^6$ cycles		
Condition A (as received)	3.75	
Condition D-24/23*	3.83	
Rockwell Hardness, 23°C	M94	
Cold flow, division change	43.0 div.	
Insulation resistance, megohms ( $1\frac{1}{8}$ " x $1\frac{1}{8}$ " specimen with $\frac{3}{16}$ " holes on $\frac{1}{2}$ " centers)		
Condition A (as received)	1,000,000	
Condition D-24/23*	900,000	
Density	1.27	

\*D-24/23 means test condition after immersion for 24 hours in water at 23°C.

Table 2 — Summary of Copper Clad Properties — Grade XXXP-470 Phenolite

Property	Typical Value
Bond strength, lb./in. of strip	
with 1 oz. copper	5
with 2 oz. copper	6
Dip solder test seconds (1" x 1" specimen)	
at 230°C (446°F)	27
at 240°C (464°F)	12-21
at 250°C (482°F)	8-13

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surprise  
Another product from Helipot!



Critics Captivated!



Discriminating engineers, the world's toughest critics, applaud the brilliant performance of Helipot's brand new trio - - series 5400, 5600 and 5700 single-turn precision potentiometers.

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A new rotor design reduces mass . . . permits lower contact pressure . . . results in decreased coil wear, more reliable operation, greater life expectancy. Incidentally, torque is lower.

They're a quiet trio, too. Maximum noise, at 100 rpm, with 1 milliamp of slider current, is 100 millivolts.

Sweet music to any electronic designer's ear!

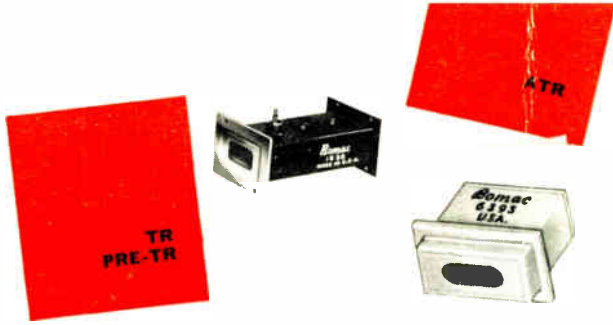
For complete information and specifications on these three new HELIPOT\* precision potentiometers, write for data file 707



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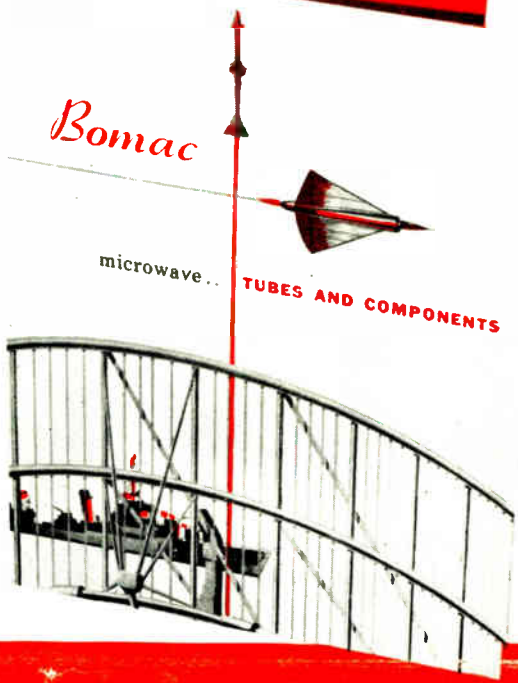
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- X - BAND
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- K - BAND
- Ku-BAND



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