

ELECTRONIC

design

ELECTRONIC

Transistor circuits as well as other types of miniature or standard sized electronic equipment can be powered by means of the "Transpac" miniaturized d-c power supply shown here. Available with a variety of inputs and outputs to suit user's needs, it is a compact, rugged, reliable unit which employs bridge rectification with semiconductor diodes, selenium regulators, and high efficiency filtering. The unit is designed to be wired into circuits as a component, thereby saving space, wiring and weight. The circuits at the right illustrate typical applications. The upper one is a transistorized i-f amplifier and the lower one is a computer integration circuit. Both employ a suitable Transpac as their source of d-c power.

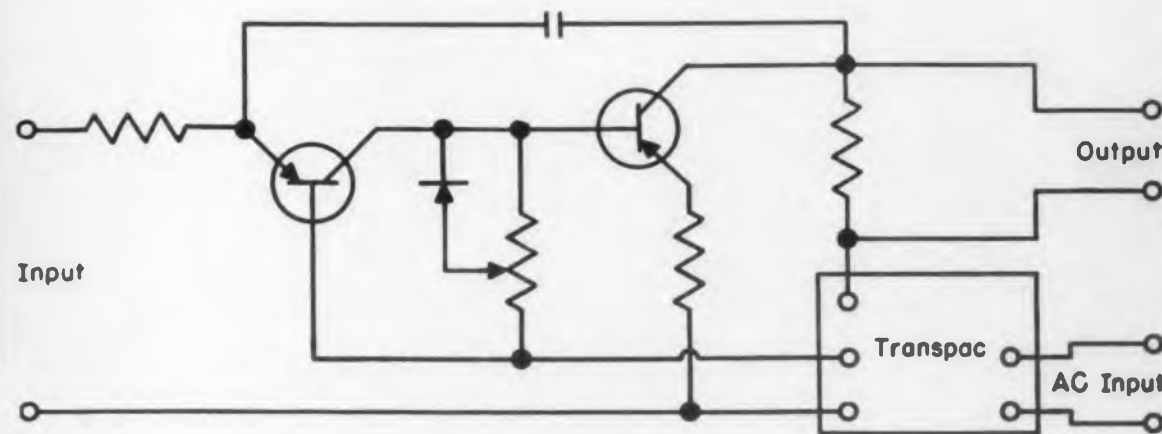
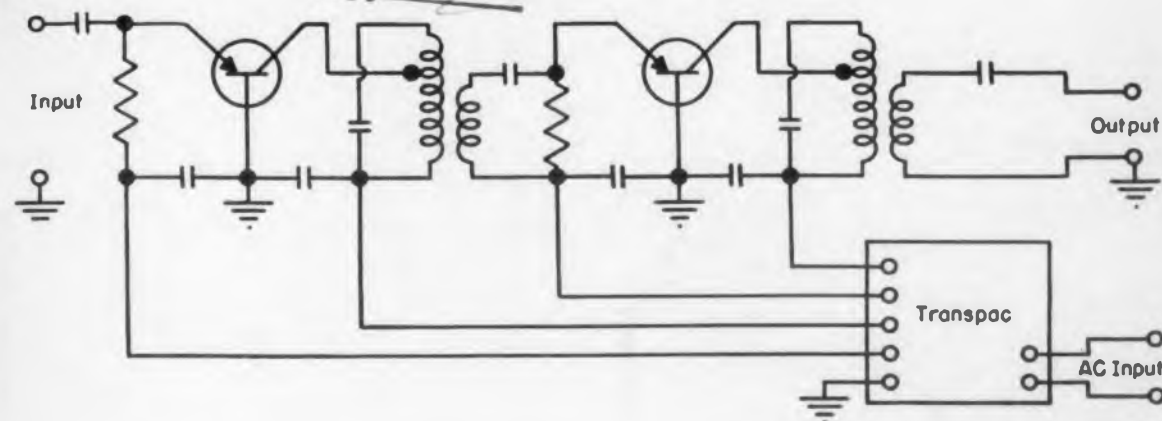


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November 1953



they had a problem . . . Guthman solved it!

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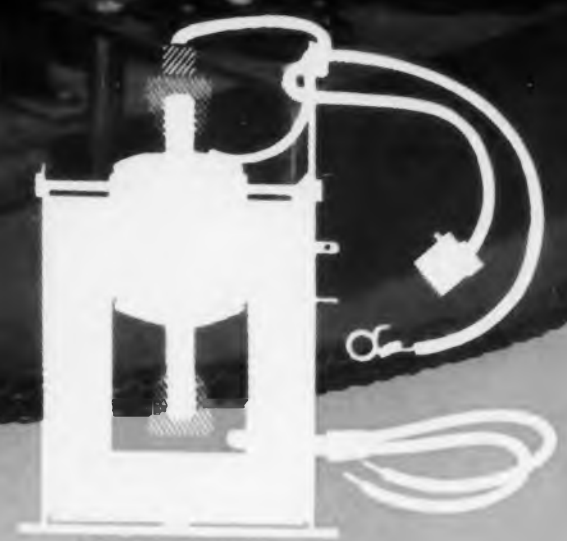
prominent manufacturer of television sets had a problem . . . a new set was being designed, utilizing new components.

They felt their TV set was sound, but they wanted a pre-production run of 100 sets to verify their engineering. And they wanted them in a hurry. They came to Guthman!

Without final engineering approval—and working with special hand-made materials—Guthman custom built 100 high-voltage transformers to be used in this pre-production run . . . and built them in a hurry.

The sets were produced on time and proved sound . . . Guthman engineering and manufacturing were subsequently credited by the set maker with a vital assist in the development of a new line. The diversity and magnitude of engineering knowledge found in the Guthman laboratory, and the flexible production setup, makes it practical for customers to bring such problems in . . . knowing that they'll be solved.

F I GUTHMAN CO. CHICAGO



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If design for manufacturing is your responsibility, you qualify for a subscription to **ELECTRONIC DESIGN** without charge. The following information is required: your name and title, your company's name, address, and main product.

These are some typical qualifying titles: chief engineer, electronic engineer, project engineer, development engineer, research engineer, and electrical engineer.

If you have a design responsibility, not indicated by your title, please add a description of those responsibilities.

Send the required information on your company letterhead.

◀ CIRCLE ED-1 ON READER-SERVICE CARD

ELECTRONIC *design*

Vol. 1
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November 1953

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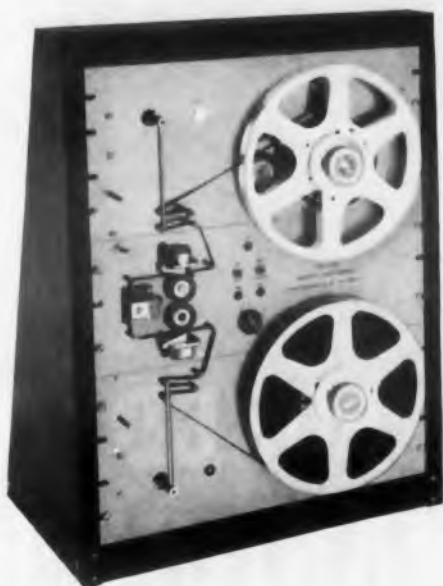


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It's New! THE **Potter**

DIGITAL

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Tape Speed	Dual-speed, 15 and 30 inches/sec.	
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*Greater number of tracks available on special order.

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1N93	300 v	75 ma
1N151	100 v	500 ma
1N152	200 v	500 ma
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1N158	380 v	500 ma

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GENERAL  ELECTRIC

Editorial...

Electronics in Business

We have all heard about the great possibilities for electronics in business. The popular press is full of stories on how the business office as well as the factory will be completely automatic in the future. We are told that an executive will be able to dictate a letter into a machine and a perfectly typewritten letter will emerge. The company salesman will carry a list of the 20,000 prospects in his territory on a tiny spool of wire which can be inserted into a miniature amplifier to read out the names and addresses as desired. A department store buyer will be able to feed previous sales, statistical records, the weather forecast, and other pertinent data into a special computer which will then tell him the best quantities to buy and his probable chances for a successful sale.

These things are not impossible to achieve, but we would caution the business executive not to expect too much too soon. It's going to take a lot of hard thinking on the part of the electronic designer and the potential user of the electronic business aid before much progress in the application of electronics to business is made.

The recent National Business Show held at the Grand Central Palace in New York City was a good place to see some of the business electronic applications. Naturally, the most spectacular equipment displayed were the large electronic data processing machines and computers and their auxiliary units. These were few in number. Another interesting device was an electronic printer which accomplishes facsimile reproduction by a combination of optics and electronics. This machine is designed to simplify the many repetitive writing jobs which are so common in business.

The only other units that could be classed as "electronic" were various types of dictating machines in the form of tape or wire recorders, and a number of electronic paging and intercommunication systems. Compared with the total number of exhibits at the show the number of "electronic products" was not impressive. It should be remembered, however, that only a few short years ago there were none. Each year has seen more and more new developments and a growing understanding by the designer and the business man of the remarkable possibilities for electronics in business operations.

As this understanding increases, the "business electronics industry" will continue to grow. To promote this growth, the designer must study business procedures to see if they can be speeded or perhaps simplified through the use of electronics. He can also point out to business executives that rather than waiting for an entire electronic system, the acceptance of small electronic units designed to perform only one or a few jobs, can often pay great dividends, and hasten the advent of the automatic office.

Engineering Review . . .

Information Services . . . Long range plans which will result in the utilization of scientific and technical literature on an entirely new basis are being evolved at Battelle Memorial Institute, 505 King Ave., Columbus 1, Ohio. A specialized staff has been assembled to meet the needs of expanding research activity, whose future effectiveness will depend on skillful use of information techniques, both old and new. This is necessary in order to take full advantage of research already done so that useless, costly repetition may be avoided.

Having investigated the limitations of conventional research methods and the possibilities of new information techniques, the staff is currently establishing a large-scale information center based on new developments in methods and machines. Simultaneously, it is studying the application of accumulated techniques to develop indexing and searching systems for special requirements.

Two new concepts are also being developed. The first, called "creative reading", would relieve busy scientific and management personnel of the need to read a large volume of publications and reports of no immediate interest. Instead, comprehensive reviews would provide a survey of current trends. Abstract bulletins are planned to permit comprehensive details of recent developments in any given field of specialization in a minimum of reading time. The second concept, "externalized memory", foresees the use of new electronic equipment to search, at high speed and low cost, accumulated files of appropriately encoded abstracts. The Battelle plan has been so designed that preparation of abstracts for specialized bulletins provide a form of indexing most appropriate for machine searching. An auxiliary aid provides immediate access to the file by conventional means while it is small but growing rapidly, and simultaneously permits full use of the new machines as soon as they are available commercially.

Pending the achievement of Battelle's plans, which are still in the formative stage, information service will be provided by conventional library methods augmented by the specialized knowledge of the Battelle staff. During the next few years, a transition phase is anticipated as new methods are applied on an ever widening scale. As soon as sponsors' requirements are defined, abstract bulletins covering specific

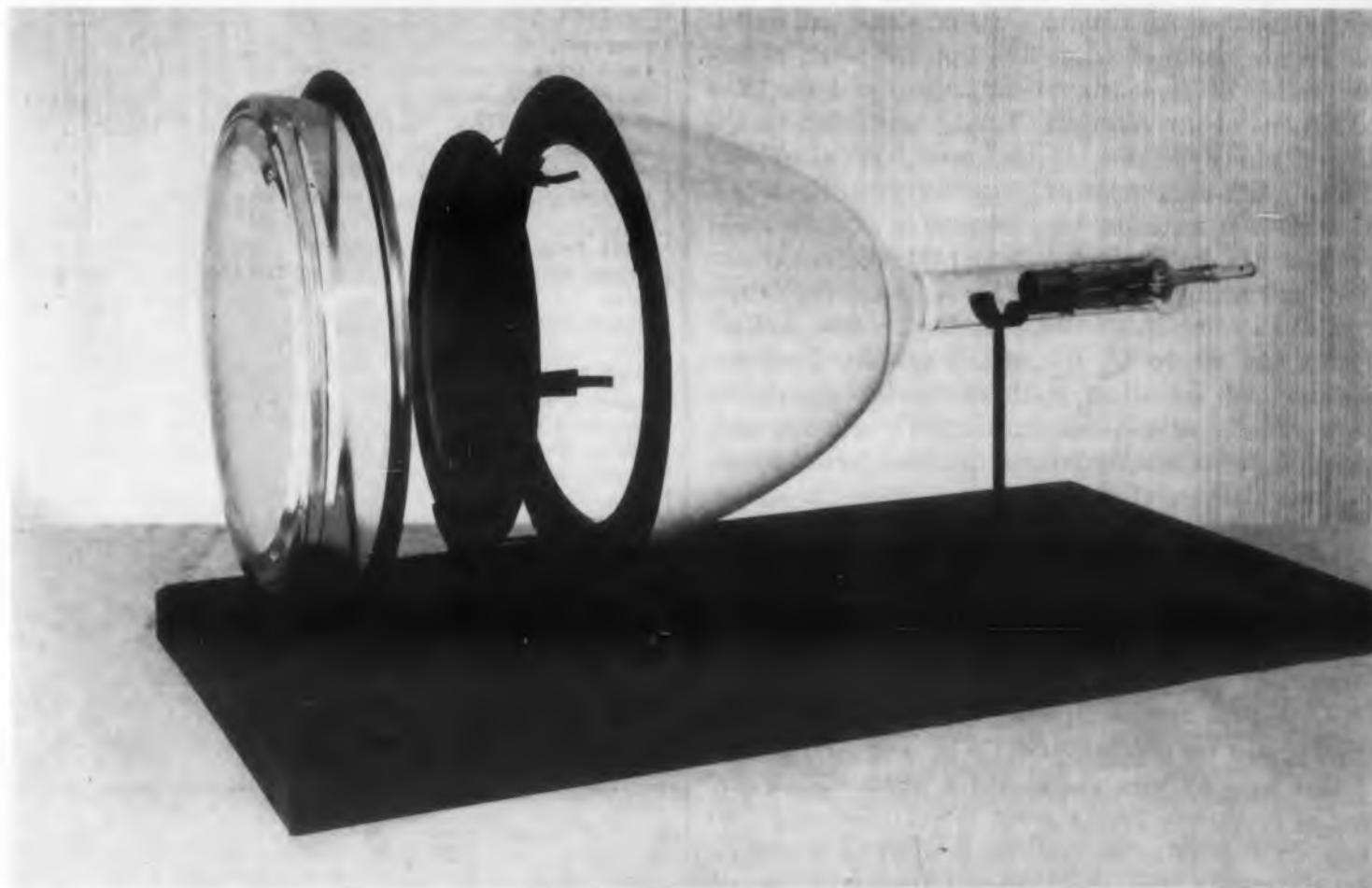
fields and geared for machine searching are to be initiated. The preparation of comprehensive reviews of current trends will follow and as the abstract bulletins build up extensive files, research based on machine methods will provide information on demand. Preliminary investigations have already resulted in indexing and abstracting systems, and experimental models of searching machines have been designed and tested. With the conviction that the effectiveness of research and development is a matter of prime im-

portance in an industrial era, Battelle also hopes to expand the literature-searching service to answer questions electronically.

Guided Missiles . . . A prediction that the use of piloted military aircraft as major weapons of war will decline sharply in the next ten years was recently made by John V. Sigford, of Minneapolis-Honeywell Regulator Co., Minneapolis, Minn. He pointed out that supersonic speeds and extremely high altitudes have put man into an environment with which he is no longer able to cope. Furthermore, the fact that 2/3 of the weight, space, and equipment of modern planes is needed only to carry and protect the human pilot also makes economy a consideration favoring increased reliance on guided missiles. To build today's planes requires 27 times as many engineering man-hours as it did in 1945, and these man-hours must be paid for with engineering dollars that buy less than they did a decade ago. Increasing complexity and cost is due to the high performance demands which must be met. In a guided missile, about 90% of the cost goes into electronic and automatic control equipment.

Color TV Picture Tube

The "CBS-Colortron", a new color TV Picture tube developed by CBS-Hytron, Danvers, Mass. It uses a thin, curved, perforated metal mask as a negative through which the red, blue, and green color phosphors are printed directly on the curved face plate by a special photographic process. The simple tube structure lends itself to the use of low cost mass production techniques. Large size tubes as well as rectangular types can be produced by the new process.



Engineering Review . . .

Radioisotopes for Tubes . . . Radioisotopes are now helping several large New England manufacturers build better tubes for use in radar, computers, and other electronic equipment. Tubes, such as voltage regulator and switching tubes used in radar systems, have a time lag before operating, similar to the delay that occurs before a fluorescent tube lights. Although the delay is short, it is undesirable, and tube makers have been anxious to eliminate it.

By placing a minute drop of radioactive cobalt solution prepared by Tracerlab, Inc., 130 High Street, Boston 10, Mass., on the tube electrodes, the tube "fires" instantly and consistently, thus preparing equipment for action sooner. In the case of military radar sets, for example, this could be of critical importance.

Product Performance Control . . . That the performance of industrial products in military and commercial equipment can be controlled and predicted to a great extent by the use of statistical mathematics was reported by Marcus A. Acheson, Engineering Consultant at Sylvania Electric Products, Inc., Kew Gardens, N. Y., to a gathering of the Institute of Mathematics Teachers. Discussing new trends in the application of industrial mathematics, he stated that much of the progress in electronic industries, was due in large measure to the successful application of the principles of statistical mathematics.

Greatest benefits from the use of statistical mathematics are obtained when it is applied to all phases of design, development, manufacture, and use. The conditions of use especially should be subject to statistical study because of the variety of conditions under which industrial products are used. By means of statistical methods, variations in a manufactured product can be attributed to important, less important, and negligible causes. This is useful for future trouble shooting in the field, quality control, and re-adjustment of product design and specifications. Application of statistical mathematics is expected to grow rapidly as a quick, inexpensive, and accurate tool to indicate and implement decisions in the design and manufacture of a wide range of products.

Electronic Engraving Machine . . . An electronically controlled engraving device has been developed by Consolidated Photo Engravers & Lithographers Equipment Co., 1112 N. Homan Avenue, Chicago 51, Ill. Called the "Engravaplate", the machine scans the original picture photoelectrically by a process similar to that used by wire photo, and a photoelectric current is produced. This current is amplified and controls an engraving stylus. To produce a screen, a screen frequency is superimposed upon the control

PREMIUM . . . COLLINS

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prove your equipment and effect a substantial saving in your development costs.

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TYPE	70E-1	70E-8A/B	70E-12	70E-15	70H-2	70H-3
Frequency Range	1.0-1.5 mc	1.6-2.0 mc	1.955-2.955 mc	2.0-3.0 mc	2.455-3.455 mc	1.5-3.0 mc
Calibration Linearity . .	±750 cycles	±750 cycles	±1000 cycles	±750 cycles	±500 cycles	±1000 cycles
Maximum Frequency . . .	250 cycles	400 cycles	600 cycles	400 cycles	100 cycles	600 cycles
Drift 40°F to 120°F . . .	250 cycles	400 cycles	600 cycles	400 cycles	100 cycles	600 cycles
Max. Drift with ±10% Plate Voltage Change . .	75 cycles	75 cycles	150 cycles	150 cycles	100 cycles	100 cycles
RF Output	13-30v rms 25 mmf load	5.5-12v rms 33 mmf load	0.5-2.0v rms 15 mmf load	1.2-2.5v rms 100 mmf load	2v rms 1000 ohms	5-13v rms no load
Plate Power	250v @ 7 ma	180v @ 8 ma	150v @ 12 ma	150v @ 12 ma	180v @ 10 ma	150v @ 12 ma
Heater Power	12.6v @ 150 ma	6.3v @ 300 ma	6.3v @ 600 ma	6.3v @ 600 ma	6.3v @ 300 ma	12.6v @ 300 ma
Oven Power	none	none	none	none	26v @ 2.0 amp	26v @ 3.0 amp
Electrical Connections . .	plug	plug	solder	solder	plug	plug
Tubes	one 12SJ7	one 6SJ7	two 6BA6	two 6BA6	one 5749	two 5749
Shaft Size	0.1869-0.1873	0.2488-0.2498	0.1869-0.1872	0.1869-0.1872	0.1869-0.1872	0.1869-0.1872
Rotation for Increased Frequency . .	clockwise	clockwise	counter-clockwise	counter-clockwise	counter-clockwise	counter-clockwise
Tuning Rate	50 kc/turn	25 kc/turn	100 kc/turn	100 kc/turn	100 kc/turn	150 kc/turn
Tuning Torque	3-4 inch oz	10 inch oz	10 inch oz	10 inch oz	10 inch oz	10 inch oz
Size	2 3/4" sq. x 5"	2 3/4" sq. x 4 1/16"	2 1/2" dia. x 6 1/16"	2 1/2" dia. x 5"	3 1/2" dia. x 6-5/32"	2-27/32" dia. x 6 5/16"

Collins Radio Co., Cedar Rapids, Iowa

Please send complete information on your permeability tuned precision oscillators.

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COMPANY _____
ADDRESS _____
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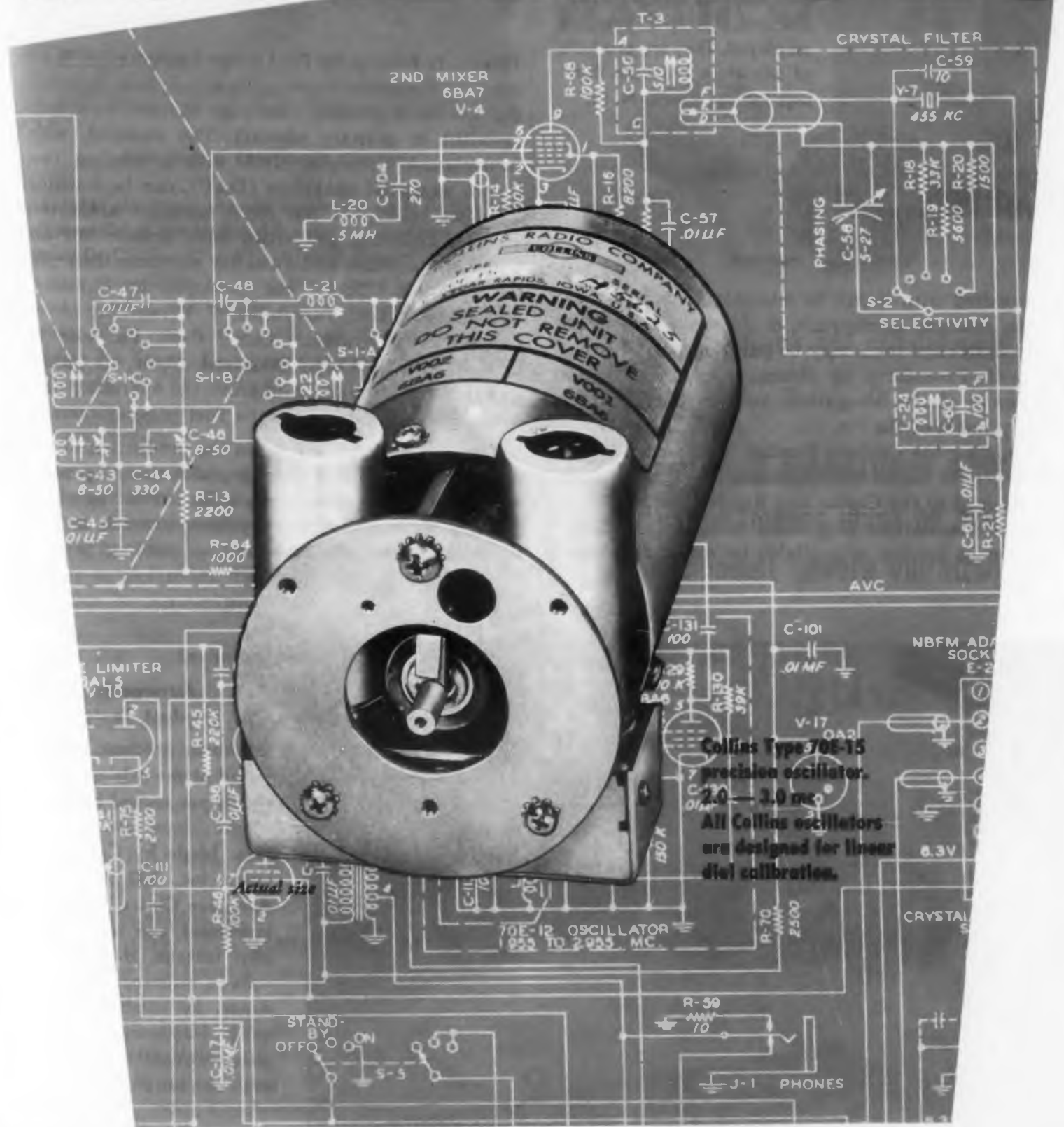
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Dallas 2
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Burbank



CIRCLE ED-4 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC DESIGN • November 1953

STABILITY and ACCURACY PERMEABILITY TUNED OSCILLATORS



CIRCLE ED-4 ON READER-SERVICE CARD FOR MORE INFORMATION

current, causing the stylus to engrave, point by point, a pyramid-shaped halftone printing plate. After the engraving is completed, it is reversed in the machine. The engraved surface is then scanned to engrave the opposite surface, making a relief of the photographed subject to produce a make-ready.

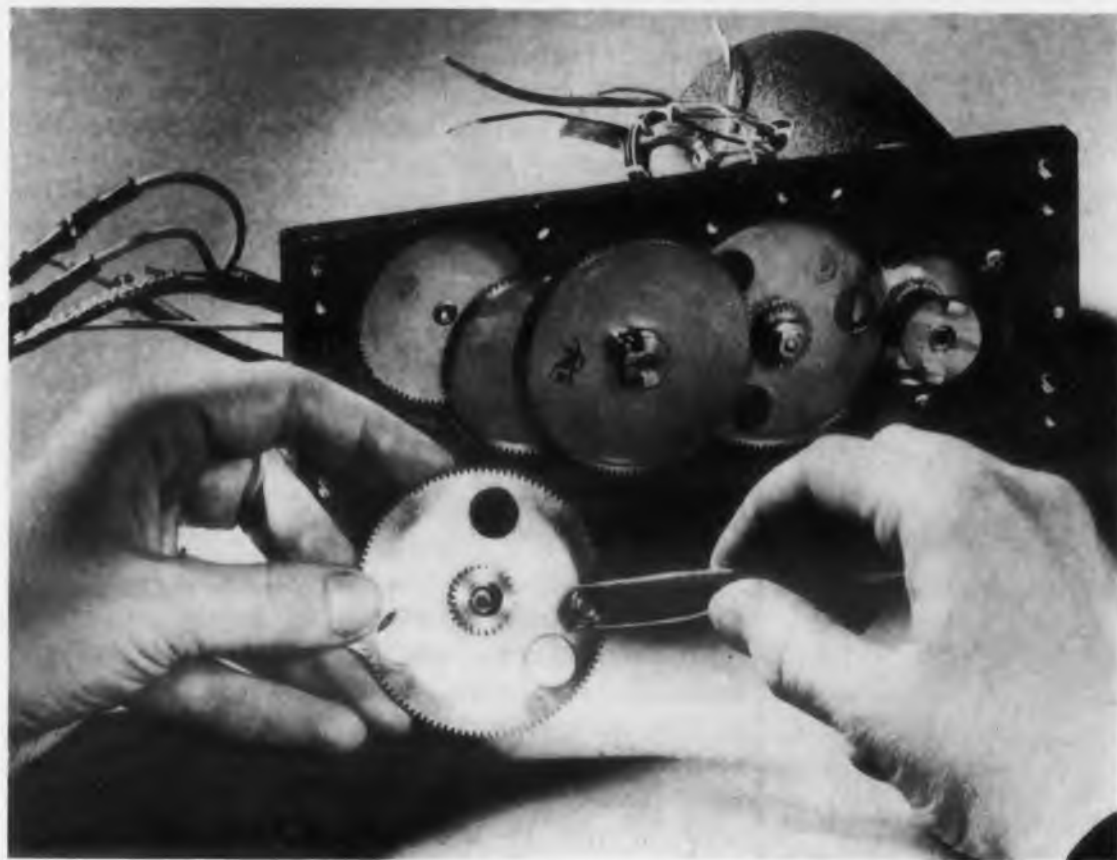
Mats and direct printing are improved because of the clarity of tones produced in the 20-25% added printing depth attained by the machine. "Engrava-plates" can be used for printing up to 200,000 copies, and the operating cost is exceptionally low. Speed and improved engravings are possible because of the pre-make-ready feature, an advancement of special value to newspaper, magazine, and letterpress printers and publishers.

Cutting X-Ray Tube Costs . . . In the production of their new x-ray tube housing, Machlett Laboratories, Inc., Springdale, Conn., have found that installing wire screw thread inserts in every hole is less costly than inspecting and salvaging units with damaged threads. The simple installation of the inserts, manufactured by Heli-Coil Corp., Danbury, Conn., and their ability to provide higher loading strengths and greater resistance to wear, seizing, stripping, galling, and corrosion prompted Machlett to incorporate them as original components of each aluminum housing.

Maintenance operations in the field often damage the threaded holes in aluminum housings of x-ray tubes, and salvage involved returning the units to the factory. With inserts installed in the equipment during manufacture, this condition is eliminated.

Color TV Details and Kits . . . At a color television symposium of engineers from virtually all competing TV manufacturers, the Radio Corporation of America gave full details on the RCA basic color TV receiver. The receiver described is the latest field-tested design from which the production design for color sets to be built and marketed under the RCA Victor trade mark will evolve. In addition to the technical information supplied, the symposium was also informed on the progress of color TV broadcast equipment, programming and network plans of the National Broadcasting Company, steps taken by the RCA Service Co. to prepare the industry for servicing problems, etc.

The RCA Victor Division offered to supply TV manufacturers with kits containing the latest tubes and parts required for the RCA color receiver. Although most of the tubes and components are still in developmental stages, the kits are being offered now to aid the industry in initiating experimental design and production programs for color sets. Items contained in the kits include a developmental RCA tri-color picture tube, specially designed receiver tubes, developmental transformers, coils, and complete technical and application information.



Tiny Bearings For Radar Antenna Rotator

Miniature bearings fit the low torque and limited space requirements of this radar antenna rotator designed by Bendix Radio and manufactured by the Akeley Camera and Instrument Corp. Two tiny bearings with a 0.3125" OD and a 0.1250" bore are employed. They are products of Miniature Precision Bearings Inc., of Keene, N. H.

Engineering Review . . .

More Tubes than Light Bulbs . . . Each of the nearly 24 million U. S. homes equipped with TV probably contains more electronic tubes than electric light bulbs. Researchers at the General Electric Tube Department, Electronics Park, Syracuse, N. Y., report that the average TV home has 21.5 tubes in the TV set, and 9.5 more in radios. This is a total of 31 tubes in contrast to the G-E estimate of 19.5 light bulbs in the average home. Tubes also lead in total numbers in all homes: estimated home light bulb total is 905 million; estimated home tube total, 964 million.

Russian Translations Center . . . The National Science Foundation in collaboration with the U. S. Atomic Energy Commission has recently established a Scientific Translations Center in the Science Division of the Library of Congress, (Washington 25, D. C.). The Center will place major emphasis on collecting, cataloging, and announcing available translations of Russian scientific and technical publications, and will eventually include material from other languages to provide a more comprehensive coverage of the world's scientific literature.

The Center will provide monthly listings of the translations arranged alphabetically by author under broad subject headings. Complimentary copies of the first three issues will be sent upon request. When possible, the lists will include notices of translations available by direct purchase from commercial and other translation services. While the Center will not supply photocopies of such material, translations lent

or deposited with it will be microfilmed so that photostats, enlarged microprints, or duplicate microfilms of the individual items may be purchased at a reasonable cost. Procedures for obtaining monthly listings and copies of the translations will be announced in te early issues of the list.

In making the Center's Russian list as complete as possible, it is hoped that organizations will deposit with or lend to the Center any Russian scientific and technical translations they hold, or send entries for inclusion in the list as available by direct purchase.



Automatic Product Tester

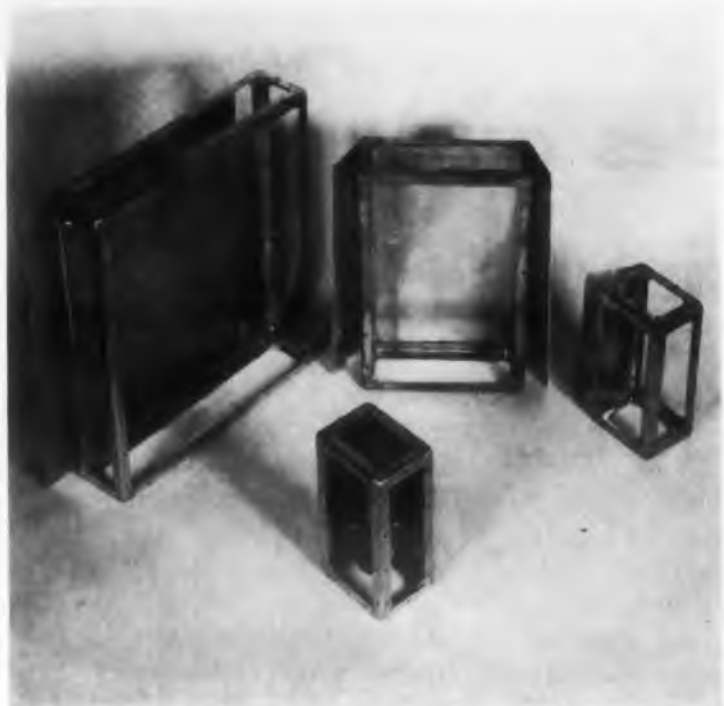
Electronic products can be tested at the rate of several checks per second by means of the "Supertester" shown here. Made by Color Television, Inc., 932 San Carlos Ave., San Carlos, Calif., the instrument can test continuity, leakage, d-c and a-c voltage, resistance and impedance. By combining tests, gain, frequency response, phase relationships and noise levels also can be determined.

Cooling Telephone Equipment . . . Air conditioning is suggested as a way of combating the problem of heat generated by communications equipment in a technical paper by J. A. Coy of Bell Telephone Laboratories, Inc. The paper, entitled "Heat Dissipation From Toll Transmission Equipment", points out that more tubes are being used in this equipment which, in turn, is being made smaller, thus posing a new heat generating problem.

While the use of transistors will reduce heat and space problems, they must be kept relatively cool, and increased demand for toll service and automatic switching increases the total amount of heat to be dissipated. Enclosing heat generating equipment in separate rooms also is recommended.

Fiberglas Tubing for Fuel Gage Systems . . . A new kind of Fiberglas rolled tubing has been developed for use in electronic fuel gage systems now being installed in military aircraft. The material, which incorporates Fiberglas cloth with a binding resin known as diallyl phthalate (DAP), can be machined to closer tolerances, has lower moisture absorption, and its dielectric properties have greater stability under temperature and humidity extremes than similar materials. "DAP" was developed by Simmonds Aerocessories, Inc., Tarrytown, N. Y., working in conjunction with Synthane Corp., Oaks, Pa., and the U. S. Polymeric Corp., Stamford, Conn., as part of an extensive program to improve the operating characteristics of capacitance-type fuel gage systems.

First use of DAP will be in the production of new two-tube tank units or sensing probes that, depending on the installation, can reduce the overall weight of Pacitron aircraft fuel gage systems as much as 25%. In these systems, the tank unit, or sending probe is



Adaptable Electronic Chasses

Adaptable electronic chasses developed by I. Rotkin and J. Guarracini of the National Bureau of Standards, Washington, D. C. The 3" x 4" x 4" unit (foreground) shows the easy accessibility to components, even in the smallest model. Circuits are readily added by mounting components on a proper size plate and then screwing the plate to the frame. The chasses are made in four sizes, all 3" high: 16" x 13", 13" x 8", 8" x 4", and 4" x 4".

immersed in the fuel where it acts as a capacitor in an electric circuit. The capacitance of the tank unit changes to correspond with variations in the proportion of fuel and air between two concentric tubes serving as electrodes. This difference is shown on an indicator in the cockpit.

Technical Meetings

November 18-20, 1953: AIEE-IRE-ISA Sixth Annual Conference on Electronics and Nucleonics in Medicine, New Yorker Hotel, New York, N. Y.

December 8-10, 1953: AIEE-IRE-ACM Eastern Computer Conference, Statler Hotel, Washington, D. C.

January 18-22, 1954: AIEE Winter General Meeting, Statler Hotel, New York, N. Y.

January 26-27, 1954: Scintillation Counters Conference, Washington, D. C.

February 10-12, 1954: AIEE-IRE-ACM West Coast Computer Conference, Ambassador Hotel, Los Angeles, Calif.

March 22-25, 1954: IRE National Convention, Waldorf Astoria Hotel and Kingsbridge Armory, New York, N. Y.

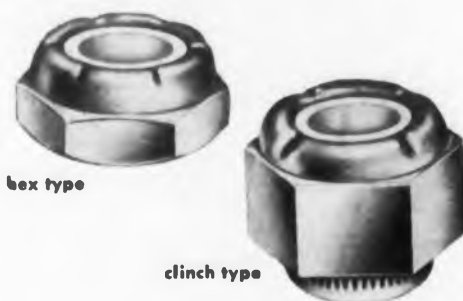
April 22-23, 1954: Conference on Feedback Control, Claridge Hotel, Atlantic City, N. J.

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Elastic Stop Nut Corporation of America
Dept. N 21-1157, 2330 Vauxhall Road, Union, New Jersey

Please send me the following free fastening information:

- Elastic Stop Nut Bulletin
 Rollpin Bulletin
 AN-ESNA Conversion Chart

Here is a drawing of our product. What fastener would you suggest?

Name _____ Title _____

Firm _____

Street _____

City _____ Zone _____ State _____

CIRCLE ED-5 ON READER-SERVICE CARD FOR MORE INFORMATION

Photodiodes and Phototransistors—II

Richard G. Seed, Roland B. Holt
Transistor Products, Inc., Boston, Mass.

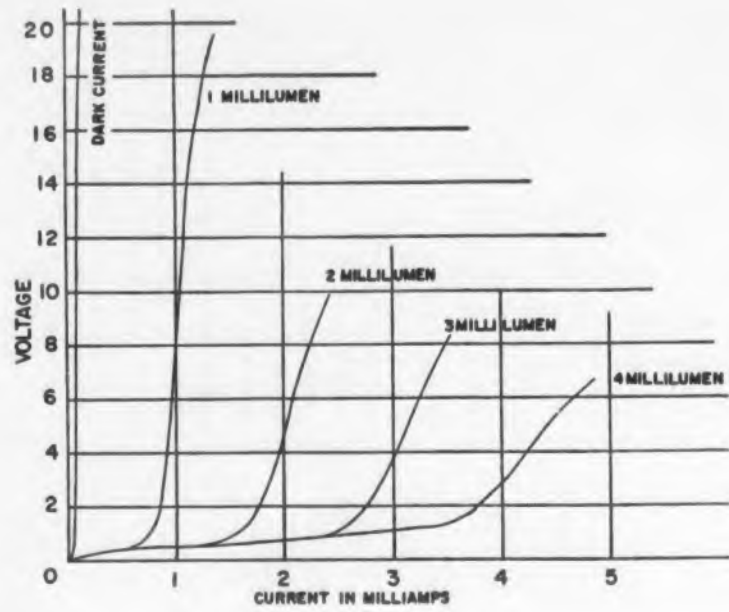


Fig. 1. Average characteristic curves for good phototransistors.

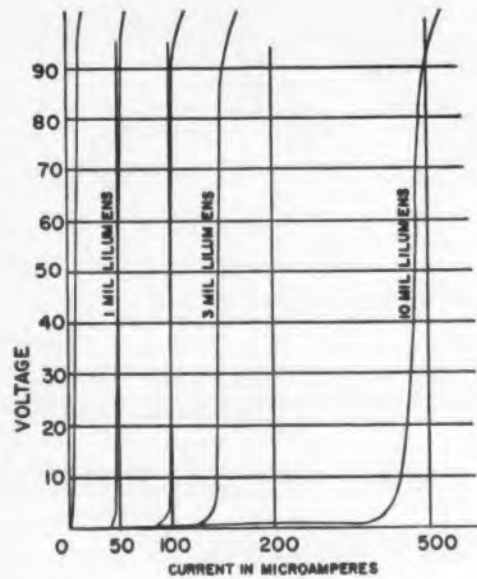
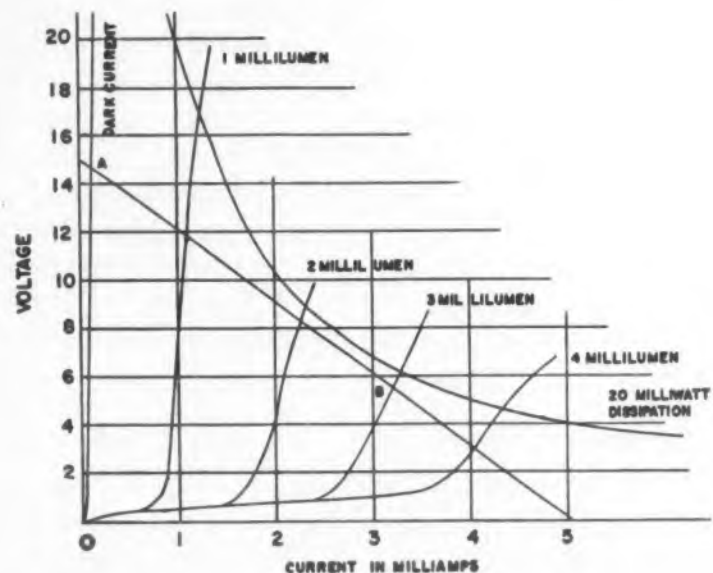


Fig. 2. Average characteristic curves for photodiodes.

Fig. 3. Characteristics for a phototransistor with 3000 ohm load line and 20mw dissipation line.



Editor's Note: In the September issue (pages 8 and 9), photodiode and phototransistor mechanism of operation, device characteristics, advantages and disadvantages, and a list of possible applications were described. This article presents some simple application circuits for these units and also covers germanium photoconductor and photovoltaic cells.

GERMANIUM photodiodes or phototransistors can be used to advantage in practically any device presently employing vacuum diodes and gas filled diodes of the photoemissive type. The first device requirement is to analyze the amount of light available and the amount of light falling on the sensitive area of the element. In the case of these germanium photoelements, the sensitive area is extremely small, generally smaller than 0.01 sq in, so a collecting lens is required. This lens need not be particularly precise nor expensive. A simple double convex lens costing no more than 50 cents will usually suffice, but it cannot be emphasized too strongly that the light must be collected and placed on the sensitive area of the element. A germanium photoelement cannot simply be placed in the physical layout of a gas filled photodiode.

After calculating the amount of light available, and the amount which can be collected and directed to the point where the sensitive element is placed, the output of the device can be analyzed by consulting the typical characteristic curves for photodiodes and phototransistors given in Figs. 1 and 2.

Basic Circuits

Photodiodes and phototransistors can be used in several fundamental ways:

1. Simple d-c output.
2. Simple a-c output.
3. D-c output plus d-c amplifier.
4. A-c output plus a-c amplifier.
5. Balanced bridges with either a-c or d-c outputs.

In these arrangements, point contact or junction transistor as well as vacuum tube amplifiers may be employed.

Photosensitive germanium elements may be used to

yield a continuously variable output current as a linear function of the continuously variable light input. Considering the newness of the device, however, it is recommended that immediate applications be limited to OFF-ON types. This permits a larger safety factor to compensate for variations caused by lack of production uniformity and temperature effects. The devices can be used to obtain an output voltage, an output current, or an output power as a function of light intensity.

The simplest type of circuit is shown in Fig. 9. The relay is the load. In simple circuits, the output of phototransistors is sufficient to actuate a moderately sensitive relay. Interruption of the light beam energizes or de-energizes the relay.

The low voltage supply for the phototransistor may be obtained from a battery power supply or from the 110 a-c line by using a suitable transformer and rectifier. In this simple circuit three parameters are available for manipulation: the amount of light, the

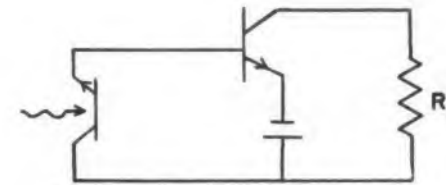


Fig. 4. Simple d-c detector with one stage of d-c amplification.

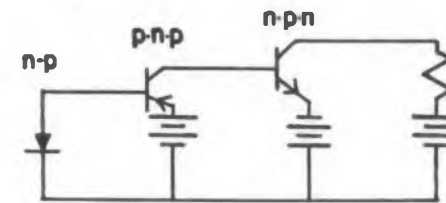
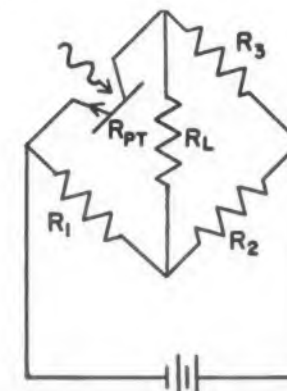


Fig. 5. Two stage d-c amplifier using complementary symmetry.

Fig. 6. Where dark currents are a problem, a balanced bridge circuit such as the one shown may be employed. The bridge is in balance when no light falls on the phototransistor.



applied voltage, and the load resistance values.

Fig. 3 shows the operating characteristics of a phototransistor with a 15v power supply, 3000 ohm load and 3 millilumens of incident radiation. In the dark, the operating point is at A ($V = 15v$, $I = 0.06ma$), and in the light, the operating point is at B. ($V = 55v$, $I = 3.2ma$). These curves bear a striking resemblance to the characteristic curves for operation (grounded emitter connection) of an ordinary transistor. The conditions shown in Fig. 3 are characteristic of a first grade phototransistor. Present production gives many units with larger dark currents. A photodiode may be used in the circuit shown in Fig. 9. Generally speaking, however, the current output is too small for use without amplification.

In certain cases these elements may be used with a-c voltage applied directly to the terminals. In such applications, the dark current must be about the same, regardless of the polarity of the applied voltage. This condition is satisfied by most production phototransistors, but the same condition violates the nature of the photodiode. The backward direction as far as light sensitivity is concerned is the direction of easy current flow for the diode. The phototransistor usually will not be able to take the 110v line voltage so a transformer is needed.

A simple d-c detector plus a d-c transistor amplifier is shown in Fig. 4. Here a phototransistor is used as the sensitive element. A photodiode will do equally well. If several stages of amplification are required (greater than 40db gain), a direct-coupled amplifier employing complementary symmetry may be utilized. A generic circuit is presented in Fig. 5.

A-C Circuits

Circuits employing an a-c signal have the advantages of ease and low cost of amplification plus the elimination of dark current.

An a-c signal eliminating dark current may be achieved by chopping the light beam or by modulating the light beam. A convenient source of modulated light useful for frequencies up to 6000cy is an ordinary neon bulb activated by a simple oscillatory power supply. Chopping the output electrical signal mechanically (with a vibrator) or electromagnetically does not eliminate the dark current, which is chopped and subsequently amplified with the signal. The a-c amplifier may in turn be tuned to the chopper frequency. If low level intensity is a problem, a phase

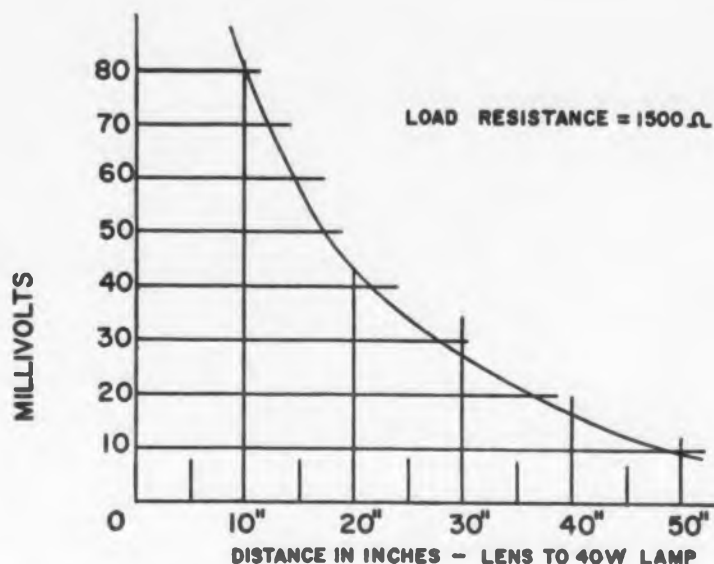


Fig. 7. Voltage across a load in series with a photovoltaic cell vs distance from light source.

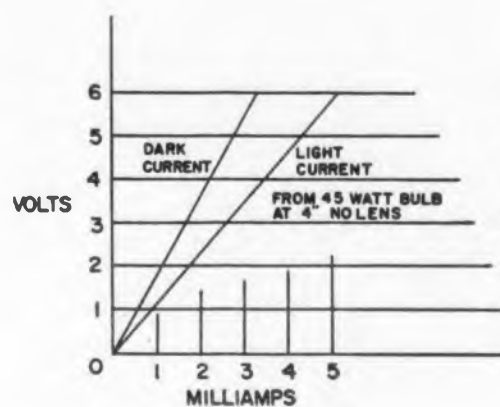


Fig. 8. Characteristics for Type X-47 photoconducting cells.

sensitive detector may be employed. A simple a-c detector and amplifier circuit appears in Fig. 10.

As shown in the diagram, for low levels (small currents), it may be necessary to bias the transistor to the appropriate operating region, especially if point contact transistors are utilized.

Where dark current may be a problem and for the detection of small currents, operation in a balanced bridge circuit may be desired (Fig. 6). The bridge is in balance when no light falls on the phototransistor. The condition of balance is:

$$(R_{PT \text{ in dark}})/R_1 = R_3/R_2$$

For this condition no current flows through the load. As light falls on the element, the effective resistance is drastically reduced, the bridge is unbalanced and a correspondingly large current flows through R_L .

The temperature dependence of phototransistors (one of their few disadvantages) may be greatly

compensated for by the use of the balanced bridge. To do this, the resistor R_1 is replaced by a second transistor not exposed to light. Temperature effects then would be identical in both elements, and the bridge would remain in balance. As the use of two phototransistors may prove expensive, a semiconductor thermistor having temperature properties matched to those of the phototransistor, may be used for R_1 .

Photovoltaic Cells

It has been previously stated that n-p germanium diodes also function as excellent photovoltaic cells. A photovoltaic cell is a device which generates electrical power from the incident light energy. In other words the device acts as a current generator, and the current generated is in some sense proportional to the amount of incident light.

These germanium photovoltaic cells are remarkably sensitive. A current sensitivity of $40\mu\text{amp}$ per millilumen has been observed. This approached 80% of the value for the photodiode with voltage applied. The curve in Fig. 7 shows how the voltage across a 1500 ohm load in series with a photovoltaic cell varies with distance from a 40w light source and a 2" collecting lens. These cells have the disadvantage of a very small sensitive area. Compared to ordinary selenium photovoltaic cells, they have the advantage of low noise level.

Photoconducting Germanium Cells

Recently, Transistor Products, Inc. has developed a photoconducting germanium cell, called the X-47, which consists of a simple bar of 20 ohm-centimeters resistivity single-crystal germanium. A photoconducting device is simply defined as a linear resistive circuit element, whose resistance value is affected by the amount of light falling on the element. Typical dark resistance values are 1800 to 2000 ohms. These devices are enclosed in plastic and are sensitive over the entire surface area (about $1 \times 1 \times 6\text{mm}$). Average X-47 characteristics appear in Fig. 8.

The current sensitivity approaches that of a germanium photodiode. The device, however, has the disadvantage of a very large dark current corresponding to the low dark resistance. This large dark current also can be largely compensated for by the use of a balanced bridge similar to that illustrated in Fig. 6. To compensate for temperature effects the techniques previously mentioned also may be utilized.

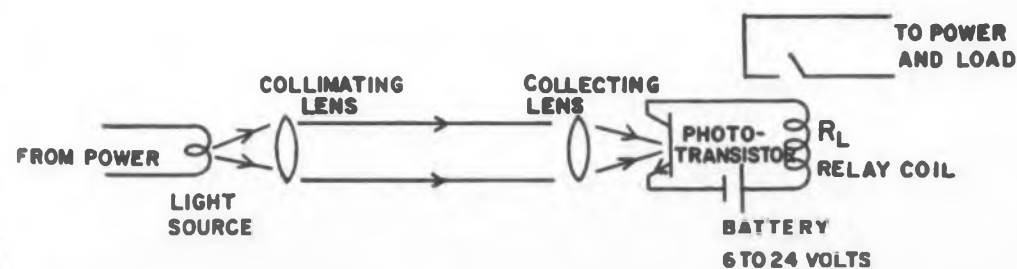
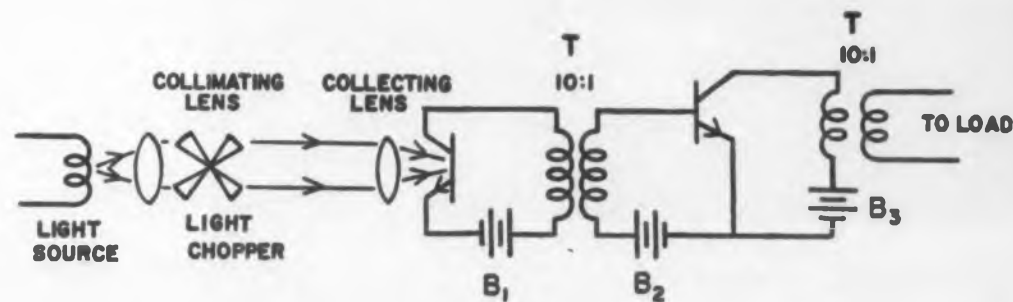


Fig. 9 (left). Phototransistor control circuit.

Fig. 10 (right). An a-c detector and amplifier.



RECENT and continuing surge of interest in the complex frequency plane as a means of designing electrical networks and automatic control or servo-mechanism systems has prompted the development of a new computing instrument known as the Complex Plane Analyzer. This instrument (Fig. 1) greatly facilitates complex vector calculations and permits rapid and accurate solution of frequency response.



Fig. 1 (above). Complex vectors can be multiplied and divided quickly and accurately by the Complex Plane Analyzer. The vector measuring unit is at the right.

transient behavior, root locus problems, and vector multiplications and divisions.

The analysis of physical systems on the complex frequency plane (Fig. 2) requires a knowledge of the roots, or "singularities", of the particular system in question. These roots are of two types: *ZEROS*, marked with an *O*, which are located at all values of the complex frequency *s* for which the system per-

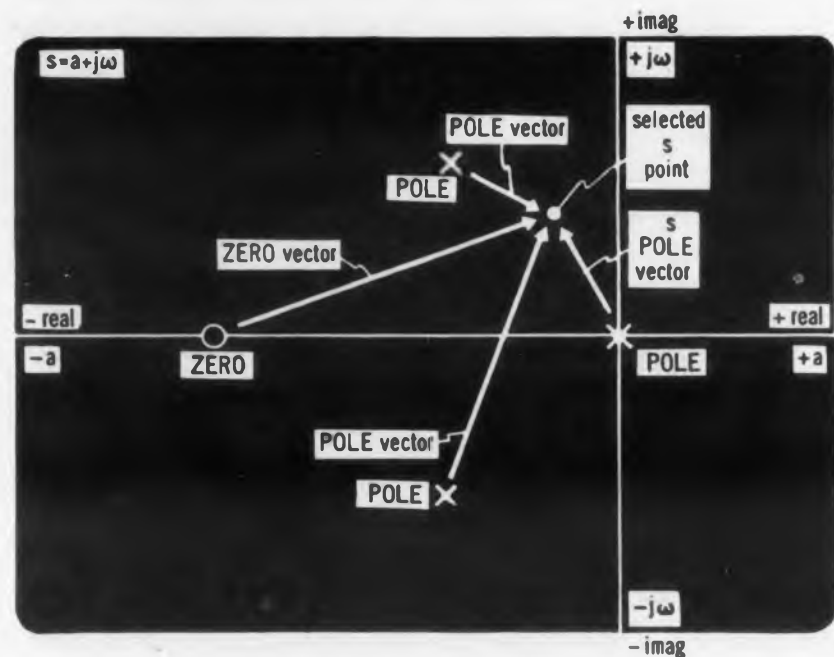


Fig. 2. "POLE" and "ZERO" vectors on complex frequency plane.

An Instrument for Complex Plane Analysis

A. D. Ehrenfried

Technology Instrument Corporation, Acton, Mass.

formance expression becomes zero; and *POLES*, marked with an *X*, which are located at all values of *s* for which the system performance expression becomes infinite. *ZEROS* are thus roots of the numerator of the performance expression, and *POLES* are roots of the denominator. If one knows the location of the system *POLES* and *ZEROS*, and the value of the system gain setting *K*, the system is completely and uniquely defined.

Complex Plane Analysis

In complex plane analysis, it is frequently desired to evaluate system performance for a selected value of the complex frequency *s*. This value of *s* (it may be real or complex) is located on the complex plane (Fig. 2), and vectors are drawn from the *POLES* and *ZEROS* to this point. The problem remains to take the product of the *ZERO* vectors and divide it by the product of the *POLE* vectors. The magnitude of the resultant product vector is the gain (or attenuation) of the defined system for the selected frequency *s*; the angle of the product vector is the phase shift of the system for the frequency *s*.

Such use of vector multiplication to evaluate system performance is extremely informative for the

system or network designer. If the selected values of *s* are taken along the imaginary *jw* axis, the resultant phase and magnitude dimensions, read directly from the Complex Plane Analyzer, are the sinusoidal frequency response of the represented system. If the value of *s* is chosen at one of the *POLE* locations, the angle and magnitude dimensions represent one of the system "residues" and permit a term in the system transient response to be written directly. If exploratory values of complex frequency *s* are taken, the complex plane locations where the open-loop system phase shift is 180° can be found. These points define the root locus and permit the closed-loop system to be evaluated.

The advantages of working on the complex frequency plane are thus apparent. Frequency and transient responses are equally accessible and can, at last, be closely correlated. Frequency response to exponential and complex driving functions can now be calculated as easily as sinusoidal performance. Transient behavior for step and ramp inputs, as well as impulses, can also be found by the described complex vector calculations.

Vector multiplications can be performed arithmetically or by ruler and protractor graphical procedures; but by either of these methods, the operation is

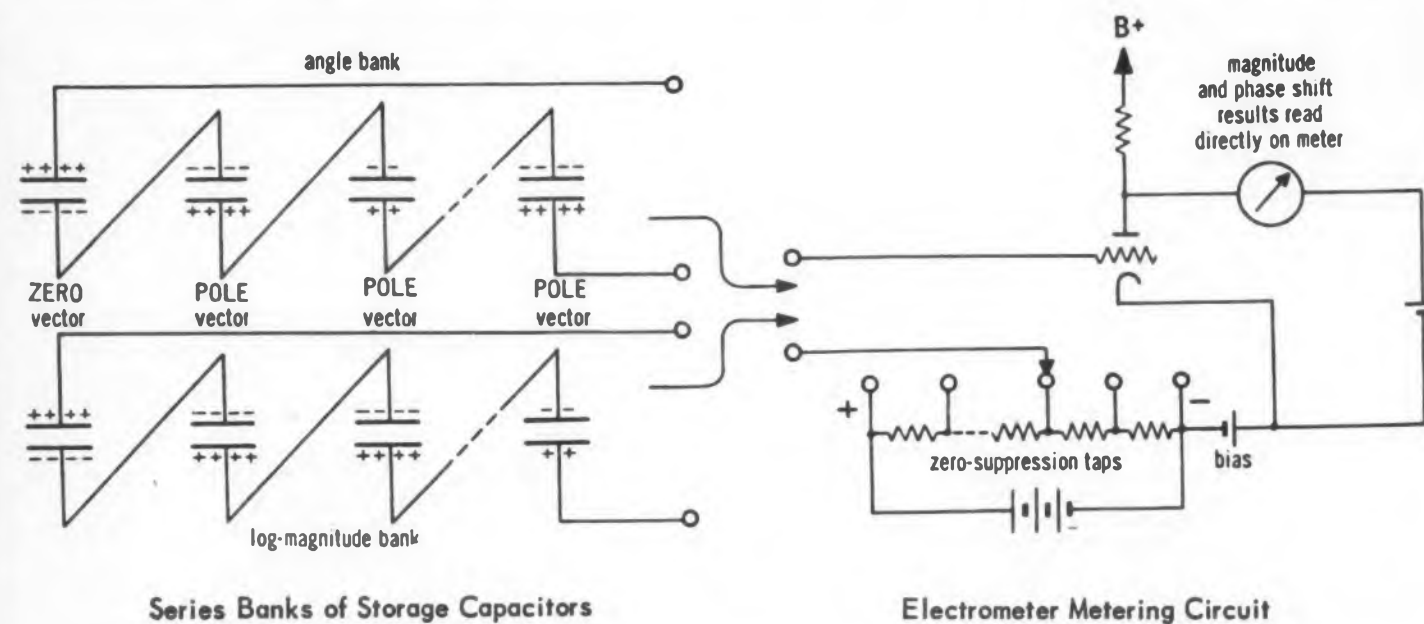


Fig. 3. Angle and magnitude dimensions of the desired product vector are represented by the total voltages of two capacitor banks and are read directly on the meter of an electrometer circuit.

tedious and time consuming. It was because of this increasing need for complex vector multiplications that the Complex Plane Analyzer (a product of Technology Instrument Corp., 531 Main St., Acton, Mass.) was developed. The instrument is an analog computer consisting of two parts: a vector measuring unit which converts vector angle and magnitude dimensions into precision d-c voltages, and a vector multiplying circuit which combines the vector voltages to yield the desired product vector.

Principles of Operation

The Complex Plane Analyzer multiplies vectors in the polar form R/θ by summing the vector angles θ and multiplying the vector magnitudes R . The magnitudes are multiplied by summing the logarithmic vector magnitudes, $\log R$. The complex vector multiplications are thus performed by means of two d-c voltage summations. The polarity of the summation voltages determines whether the vector is multiplied or divided; *ZERO* vectors have positive angle and log-magnitude voltages and are multiplied; *POLE* vectors have negative angle and log-magnitude voltages and are divided.

The vector measuring unit (Fig. 1) measures complex vectors one at a time with a self-winding steel tape. This tape controls two precision potentiometers which provide angle and log-magnitude d-c voltages. By pressing either a *POLE* or a *ZERO* button, these two voltages are made to charge a pair of storage capacitors in the vector multiplying circuit (Fig. 3). In like fashion a pair of capacitors is charged for each of the *POLE* and *ZERO* vectors to be multiplied. Because the angle capacitors are wired in one series string and the log-magnitude capacitors in another, the required angle and log-magnitude summations are performed by the series summation of the stored d-c voltages.

Total voltages of the angle and log-magnitude capacitor strings are metered by an electrometer circuit having a million megohms input impedance. This high impedance prevents charge leakage from the critical storage capacitors. A special technique of zero-suppression is employed to subtract out multiples of 2π in angle and decades of magnitude. Because of this technique, angles up to 3600° and log-magnitudes up to ten billion can be metered quickly and accurately. Final gain and phase results are read directly on a meter.

Angle and log-magnitude computing precision of the Complex Plane Analyzer averages better than 1%. The operating procedure is straightforward and can be learned in a few minutes by computing personnel. The circuit is battery operated and dissipates less than 75mw. Two calibration settings fully adjust both angle and magnitude systems. The instrument is compact enough to be used at one's desk and can be transported easily.

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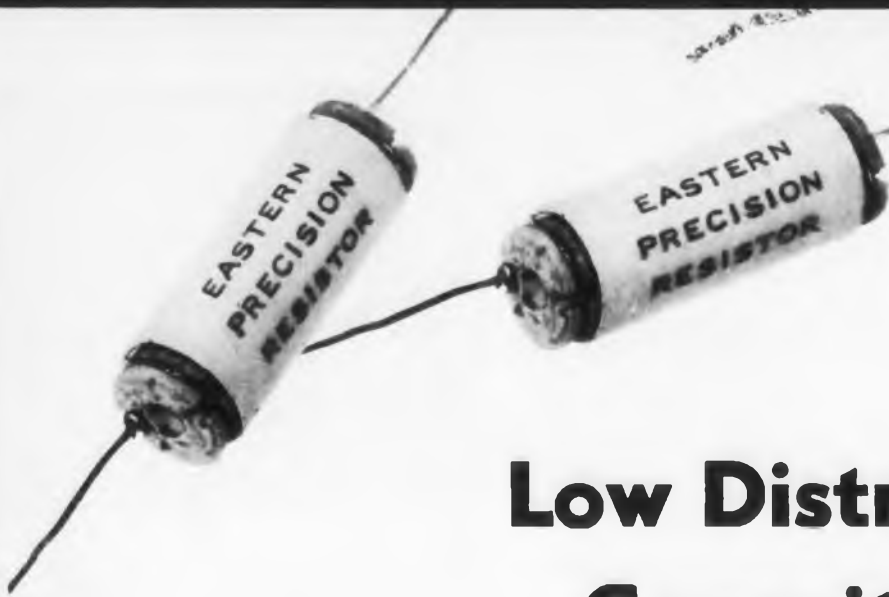
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Low Distributed Capacitance Matched Resistors

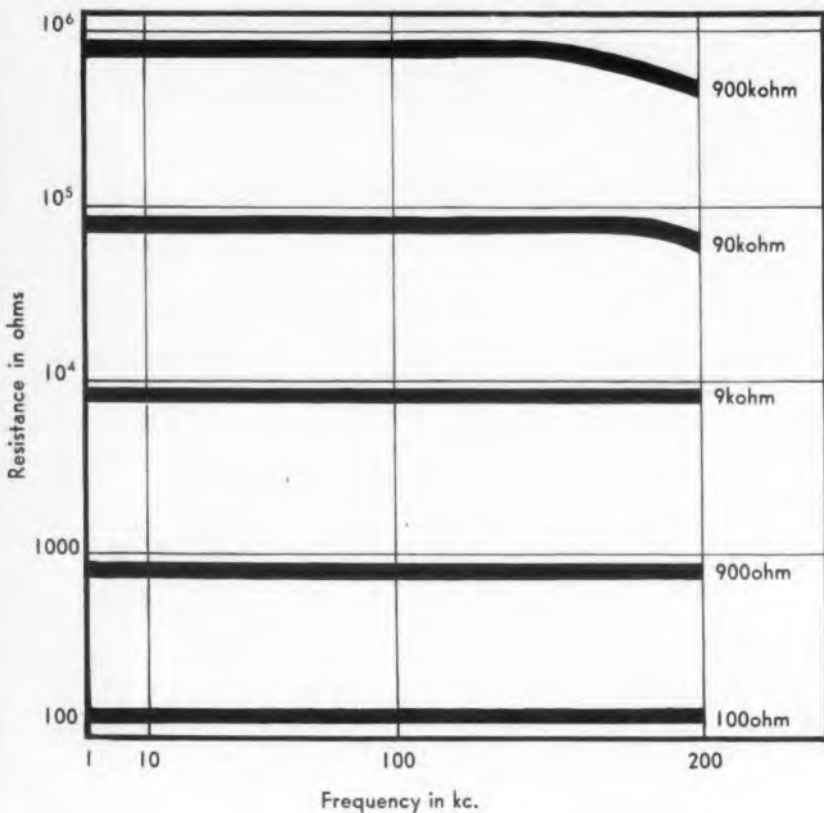


Fig. 1 (left). These curves show how the values of five resistors built into a 1 megohm attenuator vary with frequency. This is an indication of how well their distributed capacitance characteristics are matched.

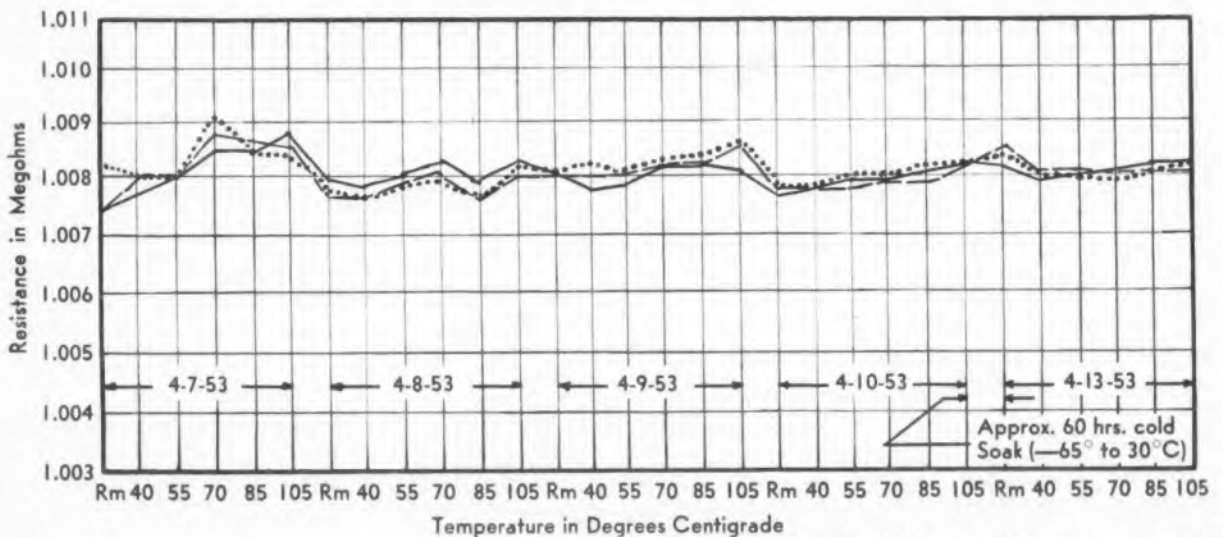


Fig. 2 (below). Resistance variation with respect to temperature over an extended test period for three matched resistors.

EXCELLENT matched characteristics over wide temperature and frequency ranges, combined with very low distributed capacitance are the outstanding features of the Type SS5 Matched Precision Resistors shown at the left. These attributes make the units useful for such applications as high frequency precision test equipment, for computers where input capacity is important, for many types of bridge networks, in d-c amplifiers, and in servomechanisms where phase shift may be critical.

The distributed capacitance of these wire wound units is held to values as low as 0.5mmfd to 1mmfd on a 1 megohm resistor. This feature is especially valuable in high frequency applications.

Typical matching characteristics are illustrated by the following specifications: Three or more units can be furnished with resistance values that will remain within a 0.1% range of each other, over a temperature range from 0° to +120°C. Curves for three typical units are shown in Fig. 3 which indicates how the resistance values vary with temperature over an extended test period.

Units can also be matched so that their distributed capacitance will be held to within 0.5mmfd of each other for frequencies up to 50Mc and higher. The nominal distributed capacitance is 0.5 to 1mmfd. These characteristics are shown in Fig. 2.

Individual resistors are accurate within $\pm 0.05\%$, and are available in resistance values from 25 ohms to 2 megohms in 1/4w to 1w ratings. A typical 1 megohm unit is 1-3/8" diam.

A product of Eastern Precision Resistor Corp., (130-11 90th Ave., Richmond Hill 18, N. Y.), the resistors can be provided with axial, radial, or special mounting provisions to suit individual requirements. They will withstand humidity and are fungus-proofed for military applications. A temperature coefficient calibration at various temperature points can be provided to meet certain requirements.

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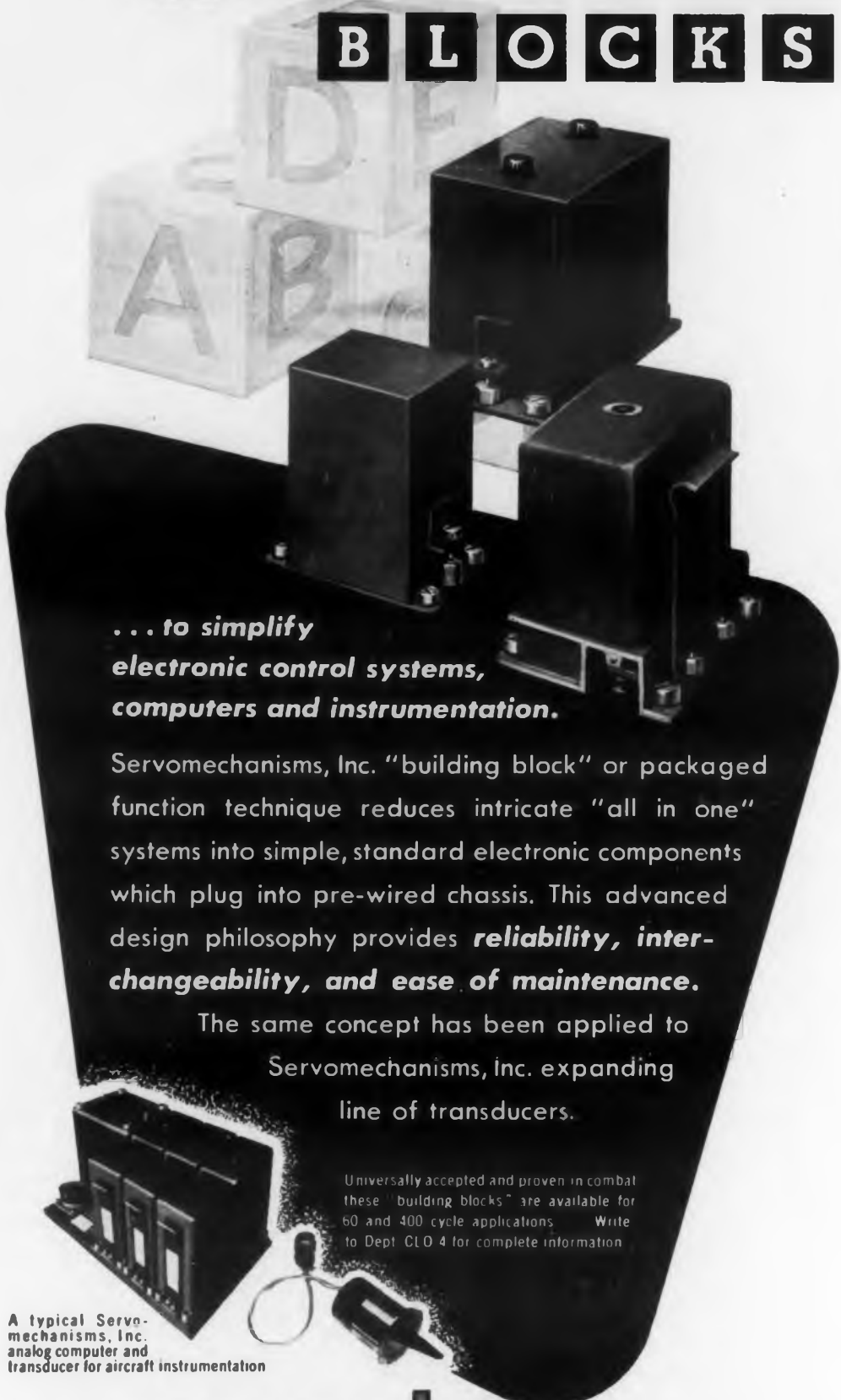
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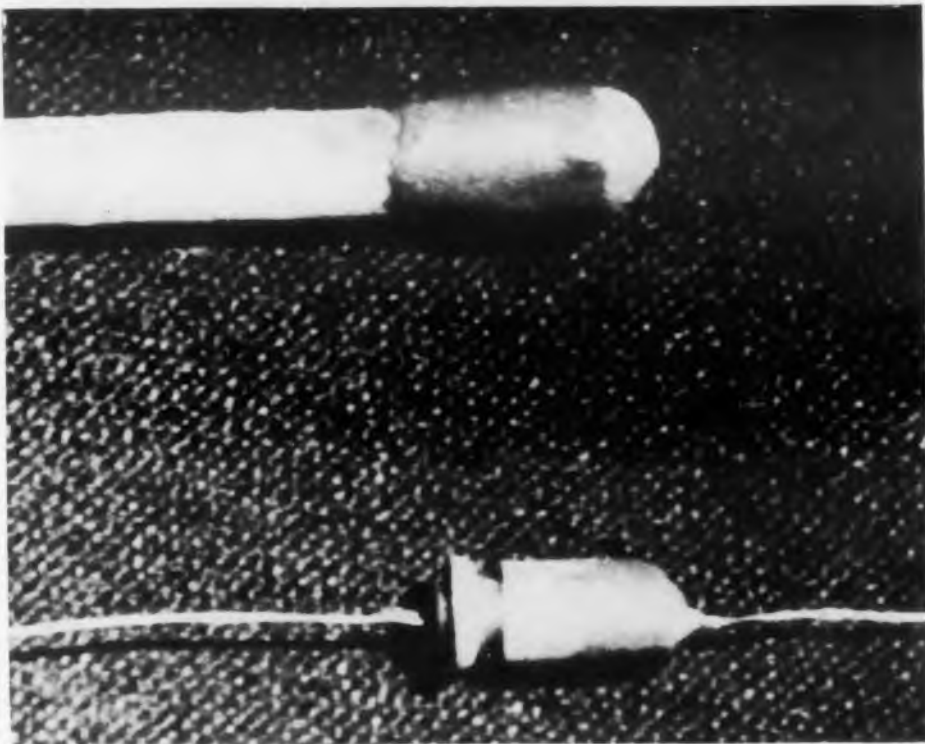


Fig. 1. The new "Micro - Miniature" Tantalum capacitor compared with a wooden match head. Actual size of the capacitor is only $1/8$ " diam x $5/16$ " long, which makes it especially useful in miniaturized equipment applications.

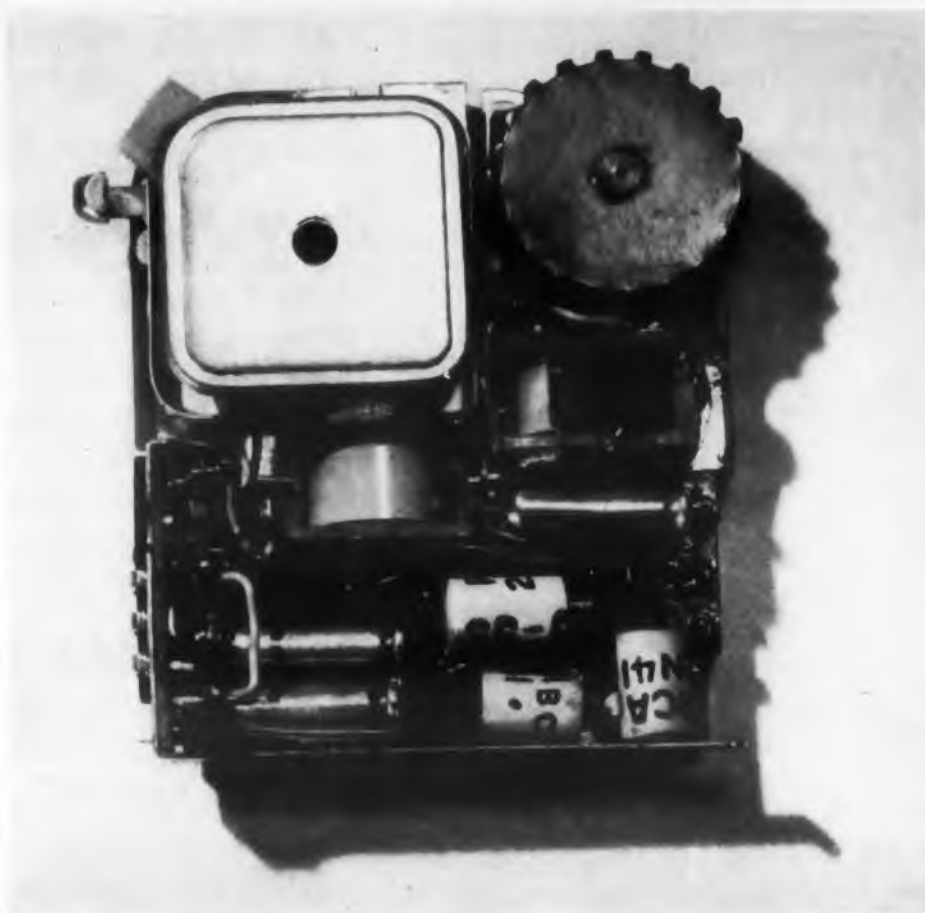


Fig. 2. A typical application for the capacitor is in hearing aids as shown here. At the lower left and center right are three of the capacitors, at the lower right are three transistors, and at the upper left is the microphone.

CHIEF feature of the "Micro-Miniature" Tantalum Capacitor, which has been especially designed as a companion component for transistors, is its advantage in size per volt-microfarad over ordinary electrolytic capacitors. At 3v, this unit, which is shown in Fig. 1, has 9 volt-microfarads in a 0.00385 cu in volume or 2325 volt-microfarads/cu in, compared with 1300 volt-microfarads/cu in for small aluminum electrolytic capacitors at the same voltage.

This characteristic, combined with other features such as long shelf and operating life, low leakage current, and wide temperature operating range, afford electronic designers wide application possibilities. When the unit is employed in printed circuits along with transistors, maximum miniaturization of many kinds of electronic devices can be achieved.

The capacitor, a product of the Apparatus Department, General Electric Company, Schenectady, N. Y., is only 5/16" long and 1/8" diam. It is available in ratings from 2v to 16v, 4mfd to 0.7mfd respectively, or in any multiple of volts times microfarads not exceeding 11.2 volt-microfarads. Typical leakage current is about 0.1 μ amp/mfd/v.

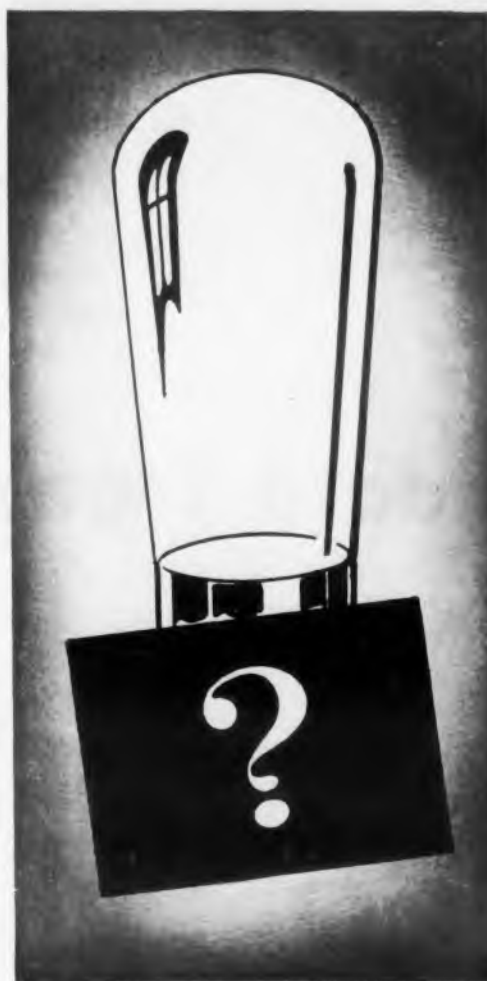
Operating temperature range is -20°C to $+50^{\circ}\text{C}$, and the capacitor can be stored at -65°C . While temperatures below -20°C result in loss of capacitance, the unit continues to be operable and often gives satisfactory capacitance values at much lower temperatures. At 10v or higher, and at -55°C , the capacitor will maintain at least 65% of its 25°C value, according to advance tests. It is also possible to obtain satisfactory performance above 50°C with some life restrictions.

Another larger capacitor, 1/2" long, with similar characteristics also is available. This unit has the same voltage range as the smaller type, but a capacity of 8mfd to 1.5mfd.

The capacitors are intended for low voltage, d-c circuits, in nonresonant, noncritical applications such as coupling, by-pass, and filtering where bulk capacity is useful. A typical application is shown in Fig. 2. This is an all-transistor hearing aid, and at the lower left and center right are three of the new, small tantalum capacitors. At the lower right are three transistors and at the upper left is the microphone. This illustration shows how well the new units fit into designs where space is extremely limited.

Construction of the capacitors consists of a tantalum anode oxidized to the voltage rating, enclosed in a silver case, and impregnated with a nonacid solution. A synthetic plug in the end of the case is roll-cripped into place and a solderable tin-coated nickel lead is lap-welded externally to the projecting tantalum anode lead, permitting connection up to the case. The case itself is the cathode, and is equipped with a tin-coated copper lead soldered to the case. The units are of the polarized type, and are sealed against leakage or contamination.

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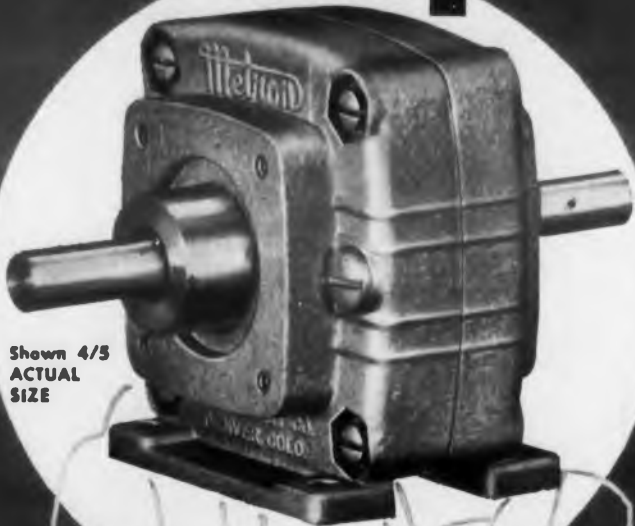
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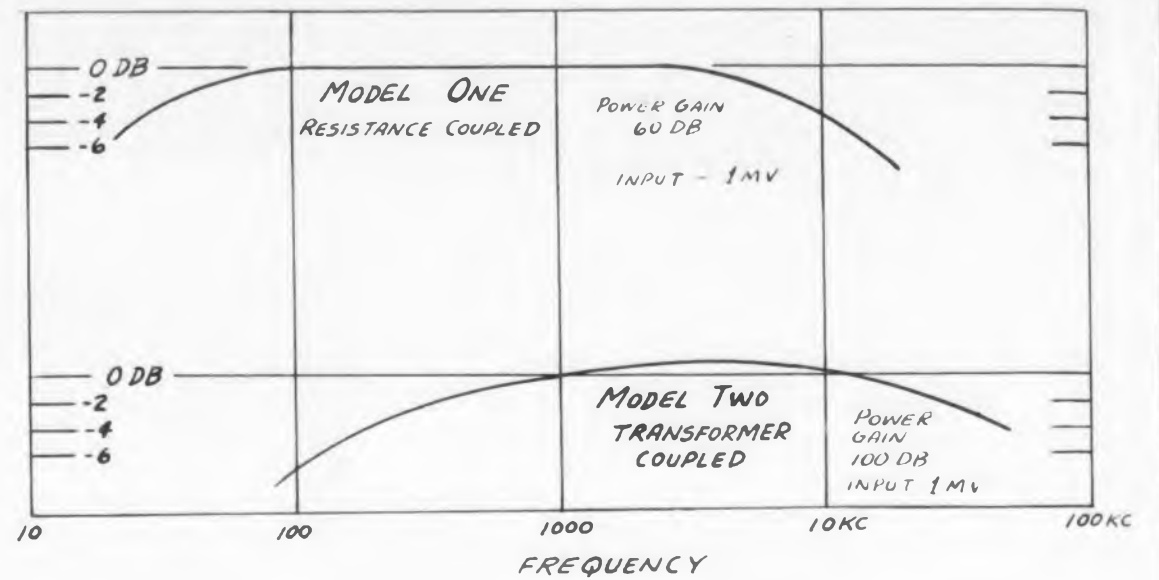
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Fig. 1. Frequency response curves for two Standard Transistor Amplifiers.



Standard Transistor Amplifiers

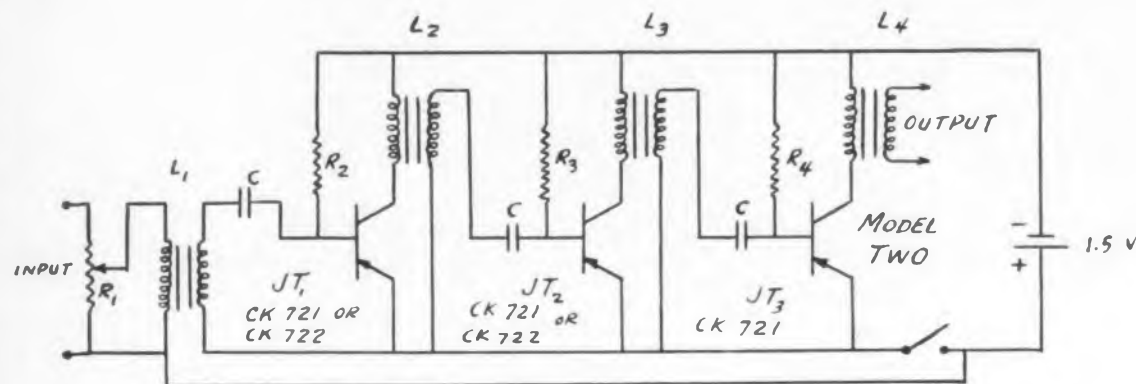


Fig. 2. Circuit diagram of the Model Two transformer-coupled transistor amplifier intended for low power a-f applications.

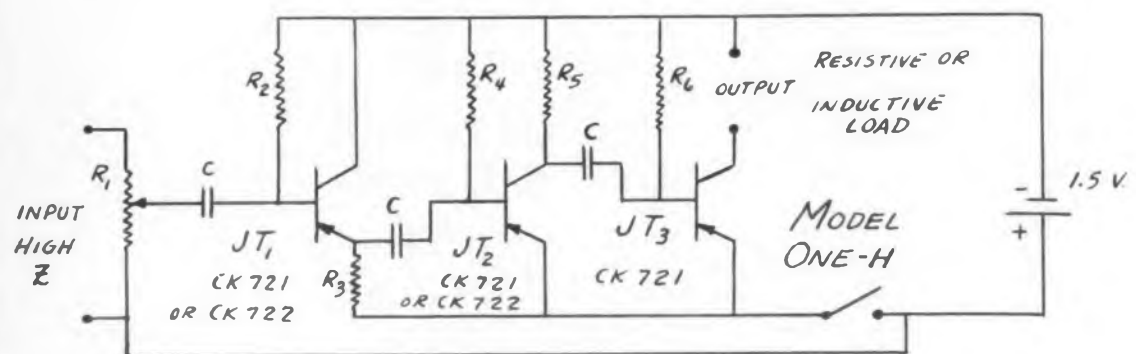


Fig. 3. Circuit of the Model One resistance-coupled amplifier designed for high impedance inputs.

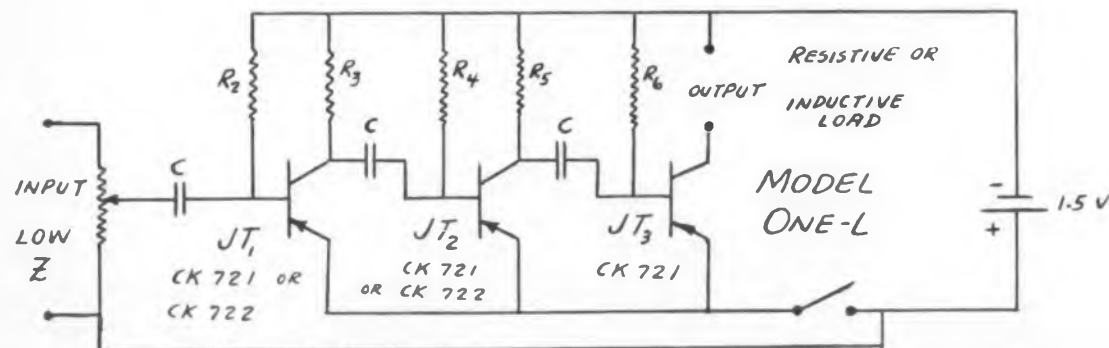


Fig. 4. This version of the Model One unit has a low impedance input. Both types of Model One can be used up to about 2Mc.

THE standard transistor amplifiers illustrated in Fig. 5 below are simple, basic building blocks intended for low-power audio and r-f applications up to about 2Mc. They are packaged component units for incorporation into such devices as hearing aids, miniature radios, intercom systems, industrial photo-cell amplifiers, alarm systems, electronic test instruments, low power servo systems, high and low impedance transducer units, and for control applications.

Frequency response characteristics of two models are shown in Fig. 1, and their circuits in Figs. 2, 3, and 4. The Model One unit will produce an undistorted sine wave output of about 0.6v across a 1250 ohm load, using a 1.5v supply to all three stages. Doubling



Fig. 5. Model Two (left) and the Model One (right) amplifiers next to a subminiature tube and a transistor to show relative size.

the supply approximately doubles the output. If good output wave shape is not needed (as in control applications), about 30% greater output can be obtained by driving the amplifier harder. For higher undistorted sine wave output with voltage gains of 60db and more, a transformer (primary impedance of 1000 ohms and step-up ratio 10:1) can be used as the load. This arrangement results in a 6.0v output, using a 1.5v supply. The Model One amplifier will perform satisfactorily in r-f applications up to about 2Mc.

The Model Two unit low-power a-f amplifier is available with any one of four impedance characteristics: high input and output, low input and output, high input with low output, and low input with high output impedance. Model 2H-H in this group (with 20,000 ohm input and output impedances) will deliver about 7.5v output across a 1 megohm load at 1000cy and with a supply of 1.5v. Doubling the supply voltage approximately doubles the output voltage.

Available from Plasties and Electronics Corp., (272 Northland Ave., Buffalo 8, N. Y.), the amplifiers are very compact: 1.25" x 1.53" x 0.53" (Model One) and 1.60" x 2.25" x 0.53" (Model Two).



Hughes Diodes ...

A New Standard of Reliability

Reliability in a germanium diode is determined principally by permanent freedom from the two major causes of diode failure—moisture penetration of the diode envelope, and electrical instability under extreme operating conditions.

HUGHES GERMANIUM DIODES are designed to prevent such failures through two exclusive features:

1. Fusion Sealing—The glass-to-metal seal, proved in billions of vacuum tubes, is incorporated to full advantage in diode manufacture by the Hughes-developed process of fusion sealing at

high temperature. The result is a rigid *one-piece* glass envelope impervious to moisture.

2. 100% Testing—Hughes 100% testing procedures *invite* instabilities to occur prior to shipment, assuring rejection of every defective diode. Each **HUGHES DIODE** is humidity-cycled, temperature-cycled, JAN shock-tested, and electri-

cally tested under vibration. This testing procedure insures the operation of **HUGHES DIODES** under adverse conditions of moisture, temperature, vibration and severe shock.

Reliability of **HUGHES DIODES** has been proved in airborne military electronic equipment for navigation, fire control, and guided missiles.

HUGHES GERMANIUM DIODE ELECTRICAL SPECIFICATIONS AT 25° C.

Description	RETMA Type	Test Peak Inverse Voltage* (volts)	Maximum Inverse Working Voltage (volts)	Minimum Forward Current @ +1 v (ma)	Maximum Inverse Current (ma)
High Peak	1N55B	190	150	5.0	0.500 @ -150 v
	1N68A	130	100	3.0	0.625 @ -100 v
High Back Resistance	1N67A	100	80	4.0	0.005 @ -5 v; 0.050 @ -50 v
	1N99	100	80	10.0	0.005 @ -5 v; 0.050 @ -50 v
	1N100	100	80	20.0	0.005 @ -5 v; 0.050 @ -50 v
High Back Resistance	1N89	100	80	3.5	0.008 @ -5 v; 0.100 @ -50 v
	1N97	100	80	10.0	0.008 @ -5 v; 0.100 @ -50 v
	1N98	100	80	20.0	0.008 @ -5 v; 0.100 @ -50 v
High Back Resistance	1N116	75	60	5.0	0.100 @ -50 v
	1N117	75	60	10.0	0.100 @ -50 v
	1N118	75	60	20.0	0.100 @ -50 v
General Purpose	1N90	75	60	5.0	0.800 @ -50 v
	1N95	75	60	10.0	0.800 @ -50 v
	1N96	75	60	20.0	0.800 @ -50 v
JAN Types	1N126**	75	60	5.0	0.050 @ -10 v; 0.850 @ -50 v
	1N127†	125	100	3.0	0.025 @ -10 v; 0.300 @ -50 v
	1N128‡	50	40	3.0	0.010 @ -10 v

*That voltage at which dynamic resistance is zero under specified conditions. Each Hughes Diode is subjected to a voltage rising linearly at 90 volts per second.

**Formerly 1N69A. †Formerly 1N70A. ‡Formerly 1N81A.

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Address inquiries to Dept. D



In addition to RETMA-registered types, HUGHES DIODES are also supplied 100% factory-tested to a wide range of customer specifications, including high-temperature requirements.

FUSION SEALED IN GLASS

for electrical stability

CIRCLE ED-12 ON READER-SERVICE CARD FOR MORE INFORMATION



**IF IT'S ELECTRICAL
... AND IF IT ROTATES**

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A roster of all Eicor products, in their various types and sizes, shows an astonishing number and diversity. But of special interest to users of rotary electrical equipment is our ability to produce units unusual in design or performance . . . and do it quickly, accurately, and at reasonable cost.

Serving in an endless list of special applications, these developments include . . . the smallest commercially produced dynamotor, for 10 watts continuous output, in a 2-5/16" diameter frame and weighing only 34 ounces . . . a motor rated 1/5 hp at 3800 rpm for intermittent duty, 2-5/16" in diameter, weight 38 ounces . . . an aircraft inverter to supply output of 100 va, 400 cycle, single or three phase, in a 3" frame and unit weight of 5 3/4 lbs. . . . a .6 hp, 4000 rpm, intermittent duty motor, 4" in diameter and 9 1/2 lbs. weight . . . a dynamotor 4-1/16" in diameter which supplies 32 watts continuous output per pound weight . . . a 12 vdc motor rated 1/4 hp at 1700 rpm with 150 in. lbs. lock torque in a 5 1/4" frame.

These highlights are an indication of what EICOR has done in the past. In the days to come our creative engineering will solve similarly difficult problems involving motors, dynamotors, and generating equipment for industry. Your inquiry is invited.



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and a complete line of TAPE RECORDERS

CIRCLE ED-13 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniaturized D-C Power Pack

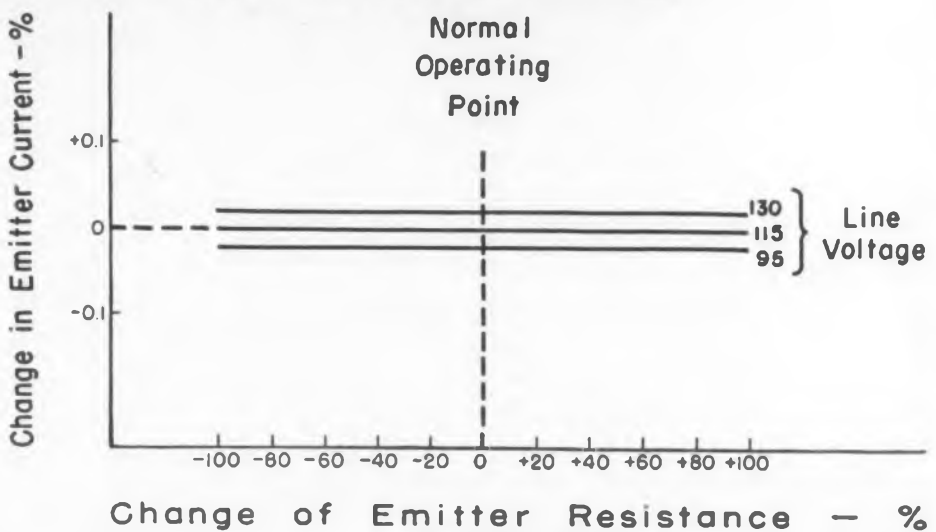


Fig. 1. These miniaturized d-c power packs come in many sizes with inputs and outputs to suit a wide variety of electronic applications.



Fig. 2. A typical application of the "Transpac" is this transistorized computer unit. The transistors and other components are in the can at the right.

Fig. 3. Regulation curves of a constant current 60cy unit showing variation in output current for changes in load resistance and line voltage.



TRANSISTORIZED equipment, guided missile circuits, computer units, and many other kinds of electronic devices, both miniature and standard sized electronic devices, can be powered by the "Transpac" units shown on the front cover and in Fig. 1. They are miniaturized d-c power packs, designed to be used as components in equipment. They save space, wiring, and weight, and provide a rugged, reliable, stable source of d-c power for a wide variety of electronic applications.

Design features of these compact units include line isolation by means of an input transformer, bridge rectification using semiconductor diodes, use of selenium regulators, and high efficiency filtering. All units are in transformer type housings, and specially potted to resist shock and vibration. When required, they can be hermetically sealed and made to meet special commercial or military specifications.

Three of the many types available are shown in Fig. 1. The unit at the left is a constant voltage, 600cy, input-regulated, tubeless type designed for guided missile applications. Its size is 3" x 3" x 3-1/2"; input is 115v, 600cy; and the outputs are 30v and 150v, 25ma max. Ripple is less than 5mv.

The center unit is the 2" x 2" x 2" Model CC-15, a constant current source intended for supplying emitter bias in multi-stage transistor circuits. The input is 115v, 60cy, and the output provides five separate 1ma taps for feeding up to five separate stages. These taps can be interconnected to give either positive or negative current or a combination of both. The taps can also be combined to yield a variety of current values in 0.5ma steps from 0.5ma to 5ma max. Internal impedance of each tap is greater than 250,000 ohms, and there is negligible d-c interaction between taps. The a-c coupling between output taps is less than 5.0mmfd. The unit is line regulated for input variations of 95v to 125v a-c, and it weighs 14 oz.

The unit at the right is a low internal impedance design for miniaturized i-f circuitry. Size is 1-1/2" x 1-1/2" x 2"; input is 115v, 400cy; and output is 135v d-c at 20ma. Ripple is less than 15mv.

Other types in both 60cy and 400cy models, as well as subminiature and special types can be furnished to customer's specifications. They are made by Electronic Research Associates, Inc., 715 Main Street, North Caldwell, N. J.

Fig. 2 shows a typical application of the Transpac. It is a transistorized computer unit. The transistors and circuit elements are located in the shielded compartment at the right, the Transpac is at the left, and the entire circuit is used to perform the functions of addition and subtraction. The circuits illustrated on the front cover show other typical applications, one being a transistorized computer integration circuit, and the other an i-f amplifier.

Regulation characteristics of a constant current, 60cy Transpac appear in Fig. 3. These show the variation of output current for a change of load resistance and input line voltage.

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Utilizing General Electric components, manufacturers are assured of precision-engineered products which surpass the most stringent stability requirements. Designed with performance as the primary objective, these units are also *mass produced at low component cost!* And, General Electric's tremendous manufacturing capacity erases your unit supply problems!

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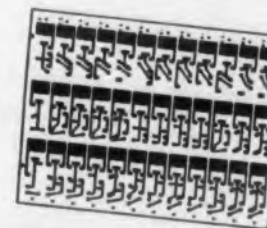
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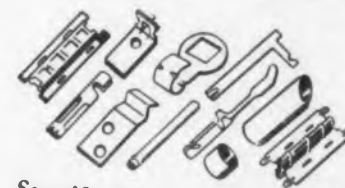


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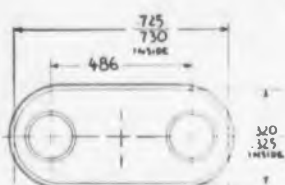
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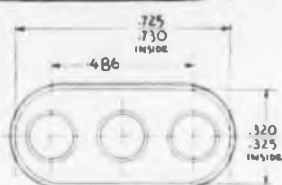
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CRYSTAL FUSITE CAN HEADERS

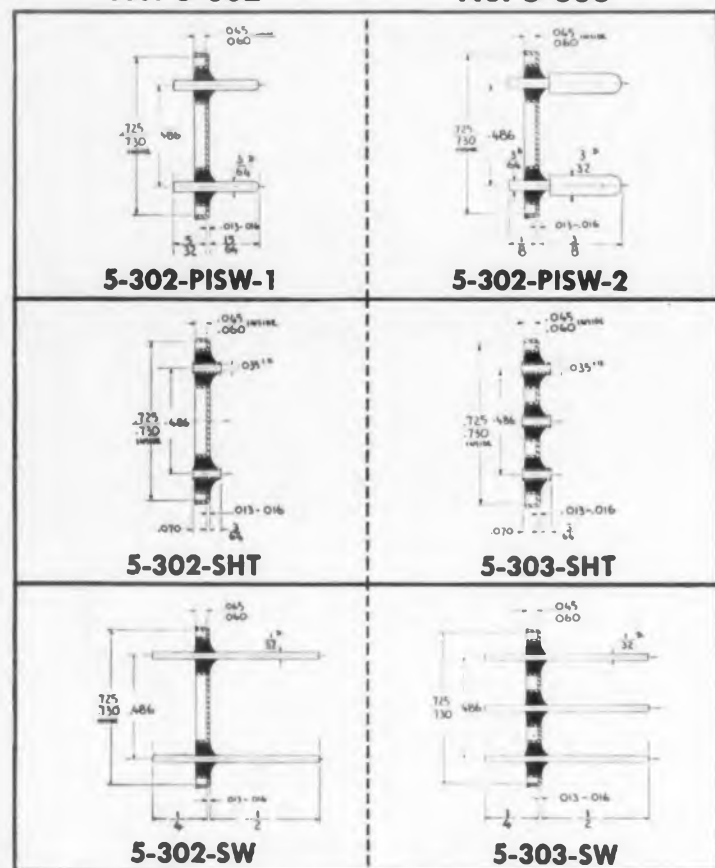
1500 V (RMS)



No. 5-302



No. 5-303



Fusite's design of Crystal Can Headers combines the ruggedness of a metal base with large size glass areas surrounding the electrodes, assuring a safe rating of 1500 V(RMS). Several of the terminals shown are available with attached crystal springs to your specification. They fit standard crystal cans. As an optional feature these terminals can be furnished with adjusting hole for thermostat applications.



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CIRCLE ED-15 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Front End Chasses For All-Channel U-H-F Reception



"Hideaway" units UJ5 and UJ6 are adaptable to any TV chassis for the purpose of obtaining built-in u-h-f reception. They are intended for all-channel and fixed channel reception by means of inside cabinet mounting.

Model UJ5 is especially useful for fringe area reception. It tunes the entire u-h-f band, utilizing three coaxial tuned cavity elements, two as preselectors, and one controlling the local oscillator. The unit also contains a Type 6AF4 oscillator and a cascode i-f amplifier. Power requirements are 200-240v at 30ma, 6.3v at 1amp for filaments. Input and output impedances are 300 ohms.

Model UJ6 is a two-cavity unit for all-channel reception. It may be powered from the TV set. Power requirements are 100-130v (B+) at 20ma, and 6.3v at 450ma for filaments. A Type 6AF4 u-h-f oscillator is included, but no i-f amplifier is furnished. Granco Products, Inc., Dept. ED, Long Island City, N. Y.

CIRCLE ED-16 ON READER-SERVICE CARD FOR MORE INFORMATION

Filters

Eliminate Signal Distortions



Type DE Filters will eliminate harmonic frequencies from the 2nd to the 8th by a minimum of 60 decibels. They are designed so that a drift of $\pm 3\%$ in the frequency of the signal source will not affect the filtering action.

The filters are available in a variety of impedances and can be made for any frequency from 20cy to 20ke. They can be made for use in balanced or unbalanced circuits. The design makes it possible to make low distortion measurements using any available signal generator. Ortho Filter Corp., Dept. ED, 196 Albion Ave., Paterson, N. J.

CIRCLE ED-17 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature I-F Transformer Has Single-End Tuning



I-F Transformer Type TX100 is designed to permit fast set alignment and greater freedom of radio chassis design. Both coils can be tuned either from top or bottom. Terminals are permanently

soldered directly to the capacitors. Coil leads are not subject to breakage, because they are soldered directly to the tops of the terminals. Delay line type winding provides high Q.

The Type TX100 can be used for any application requiring a 3/4" i-f transformer. It is available in many inductances and Q's for a-m, f-m, TV, and military applications. Electrometric Co., Woodstock, Ill.

CIRCLE ED-18 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature Fixture

Aids Precision Assembling



The "Tiny-Fix" is a versatile Miniature Assembly Fixture which is adjustable radially through 360° in either direction for equipment up to 2" wide. If complete radial motion is not essential, larger equipment (up to 6" wide) may be mounted with more than 180° of rotation available in either direction.

Equipment is set up simply by mounting it into the universal adapters and locking the wing nut. By freeing both hands for work, the fixture simplifies wiring and other assembly work on miniature prototype equipment. Production Tool & Fixture Co., Dept. ED, Oyster Bay, N. Y.

CIRCLE ED-19 ON READER-SERVICE CARD FOR MORE INFORMATION

Subminiature Resistor

Resistance Values to 175,000 ohms



The Type 1101 Subminiature Resistor is especially designed for space saving applications in military equipment. It measures only 1/4" diam x 13/32"

long, yet can be wound in all values up to 175,000 ohms. Resistance tolerances to $\pm 0.1\%$ are available with power rating of 0.10w.

Special impregnation for resistance to humidity and extremes of temperature is provided for all military applications. The Daven Co., Dept. SR, 191 Central Ave., Newark 4, N. J.

CIRCLE ED-20 ON READER-SERVICE CARD FOR MORE INFORMATION

Integrating Motor

Sensitive to Minute Power Sources



The Model 120 Integrating Motor has a power sensitivity of $0.1\mu\text{w}$ and a current sensitivity of 0.02ma. Minimum starting voltage is 0.005v. It will function on

light energy translated through a photoelectric cell. The motor is used as an integrating force to effect response of gyro components in guided missile control systems or aircraft autopilots, and in many other applications.

It has an acceleration time constant of 0.003sec, and torque-to-inertia ratios in the order of 10^4sec^{-2} to 10^6sec^{-2} . It weighs 1.3 pounds and measures 2-1/2" diam x 3-3/8" long. It is fitted with a precision gear train and a 5w potentiometer. Summers Gyroscope Co., Dept. ED, Santa Monica, Calif.

CIRCLE ED-21 ON READER-SERVICE CARD FOR MORE INFORMATION

High Speed Stop Clock

Hermetically Sealed



A hermetically sealed, panel-mounted unit, this high-speed stop clock timer totalizes hundredths of a second up to a minute. It is available with automatic reset and accrued seconds indicator, and other intervals are also available. Weight is only 2 lb.

It is built for operation on 50cy, 60cy, or 400cy a-c, or 20-30v d-c, and 400cy units that have a d-c clutch. A. W. Haydon Co., Dept. ED, 232 Elm St., Waterbury 20, Conn.

CIRCLE ED-22 ON READER-SERVICE CARD FOR MORE INFORMATION

The Problem

To design and build a computer for airborne automatic control systems—with severe restrictions imposed on size, weight and operation under extreme environmental conditions; in short, a computer that would be small, simple, reliable, rugged—and easy to build and maintain.

Midget with the giant brain

At HUGHES RESEARCH and Development Laboratories this problem was examined exhaustively, and it was concluded that a digital computer offered the best means for satisfying the requirements because of its ability to solve complex problems accurately and quickly.

Because the requirements of this application could not be met by existing digital computers, owing to their large size, the following developments were undertaken:

1. Simplification of the logical structure of the computer through the use of a mathematical theory of computer design based on Boolean algebra—but with retention of the operational versatility of a general-purpose computer.

2. Development of ingenious circuitry to utilize the new logical designs.

3. Achievement of minimum size by the use of subminiature techniques, including germanium diodes, subminiature tubes, and etched circuits.

4. Employment of unitized construction: plug-in units of flip-flop circuits and diode networks.

Need for subminiaturization, then, was a governing factor. Consequently, entire new techniques for making things not only vastly smaller, but at the same time easier to build and service, were developed by Hughes. This is a continuing process and there is indication of even more significant advancement in miniaturization for the future.

A major effort at Hughes is also devoted to adapting electronic digital computer techniques to business data processing and related applications—destined for far-reaching peacetime uses.

One of the subminiature switching circuits from the Hughes airborne electronic digital computer is examined by Dr. Eugene M. Grabbe (right), Associate Head, Computer Systems Department, Advanced Electronics Laboratory, and Phil A. Adamson of the Technical Staff, Radar Laboratory.



ENGINEERS AND PHYSICISTS



Activities at Hughes in the computer field are creating some new positions in the Laboratories. Experience in the design and application of electronic digital computers is desirable, but not essential. Engineers and physicists with backgrounds of component development or system engineering are invited to apply.

Assurance is required that the relocation of the applicant will not cause the disruption of an urgent military project.

ADDRESS: Scientific and Engineering Staff

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CIRCLE ED-24 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Timing Unit

Integrates Total Time



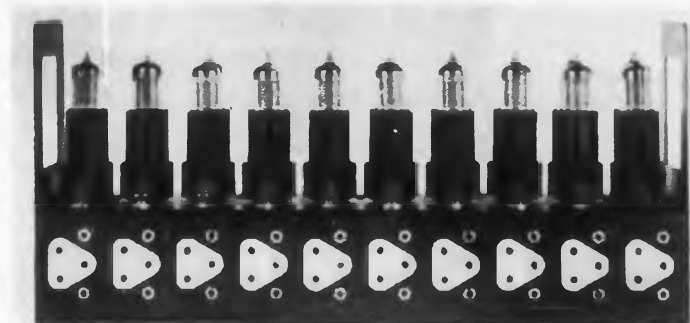
The Model 2D Nuclear Timer integrates total time from 1sec minimum to a maximum of 60 minutes. Regardless of periodic starts and stops, accuracy to 1/10sec is maintained as time is accumulated. Dual dial markings permit direct reading of preset and elapsed time.

A switching mechanism provides for both normally open and normally closed circuits. The timer is available with any one of four standard motors: 115v, 50cy or 60cy; 230v, 50cy or 60cy. Special motors are available on order. The timer is supplied for wall or panel mounting, as specified. The Liebel-Flarsheim Co., Dept. ED, Cincinnati 15, Ohio.

CIRCLE ED-25 ON READER-SERVICE CARD FOR MORE INFORMATION

Analog Computing Unit

Incorporates 10 Amplifiers



The Model HK Operational Manifold Component Comprises a set of 10 Model K2-W Operational Amplifiers plugged into a special chassis to form a basic Analog Computing facility. All common service connections are provided. An arrangement of computing connections is featured in which circuit elements and input and output leads are readily plugged in to form feedback circuitry.

Positive and negative inputs to each amplifier, both at high impedance, are available. Of the four amplifier poles comprising plus input, minus input, output, and ground, the jacks for every pair are spaced on 3/4" centers for double banana plugs.

Speeds of computation range from a repetitive or single-shot period of 0.001sec down to a solution time of many minutes. Power requirements are $\pm 300v$ d-c at 50ma, and 115v a-c at 0.5amp. George A. Philbrick Researches, Inc., Dept. ED, 230 Congress St., Boston 10, Mass.

CIRCLE ED-26 ON READER-SERVICE CARD FOR MORE INFORMATION

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counterbored hole and
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CATALOG illustrating how
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CIRCLE ED-27 ON READER-SERVICE CARD

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MALLORY

**SILVERLYTIC
CAPACITORS
and
MERCURY
BATTERIES**



**Ideal for
TRANSISTOR
CIRCUITS**

If you are designing equipment around transistor circuits, Mallory Mercury Batteries will deliver the constant-current, constant-voltage needed for best performance. There is no significant deterioration or loss of energy even after long periods of storage.

Mallory Silverlytic Capacitors are also designed to meet the special requirements of transistor and other low voltage circuits.

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CIRCLE ED-28 ON READER-SERVICE CARD

Inductance Decades

High Q, Plug-in Toroids



This development permits any number of precision toroids to be combined in decade steps of inductance simply by plugging them together. Each plug-in decade is equipped with a

male plug at one end and a female plug at the other. When joined together, the decades are automatically connected in series.

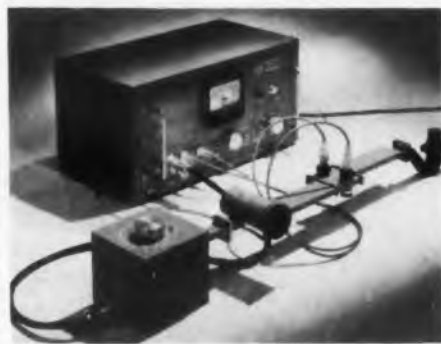
One basic set of four decade units will provide inductance values in decade steps of 1 to 10. This is accomplished by the use of a 1, 2, 3, 4 system. An 8-unit coil is also available; when included in the basic set, it makes it possible to use no more than two coils for any decade value up to 12, and provides a total range up to 18. All units are high Q toroids.

A series of plug-in units is available over the entire inductance range of 1mh to 180h, with a useful frequency range of 100cy to 10,000cy (for the lower inductance values). Another set is for the higher frequency range (200cy to 50kc) with decade steps of 1mh to 180mh. Special coils can also be designed. Burnell & Co., Dept. ED, Yonkers, N. Y.

CIRCLE ED-29 ON READER-SERVICE CARD FOR MORE INFORMATION

VSWR Meter

Tests Waveguide Components



The Model 110A X-Band Voltage Standing Wave Ratio Indicator covers a frequency band from 8500Mc to 9600Mc. It includes an oscillator, (an accurate wavemeter to sup-

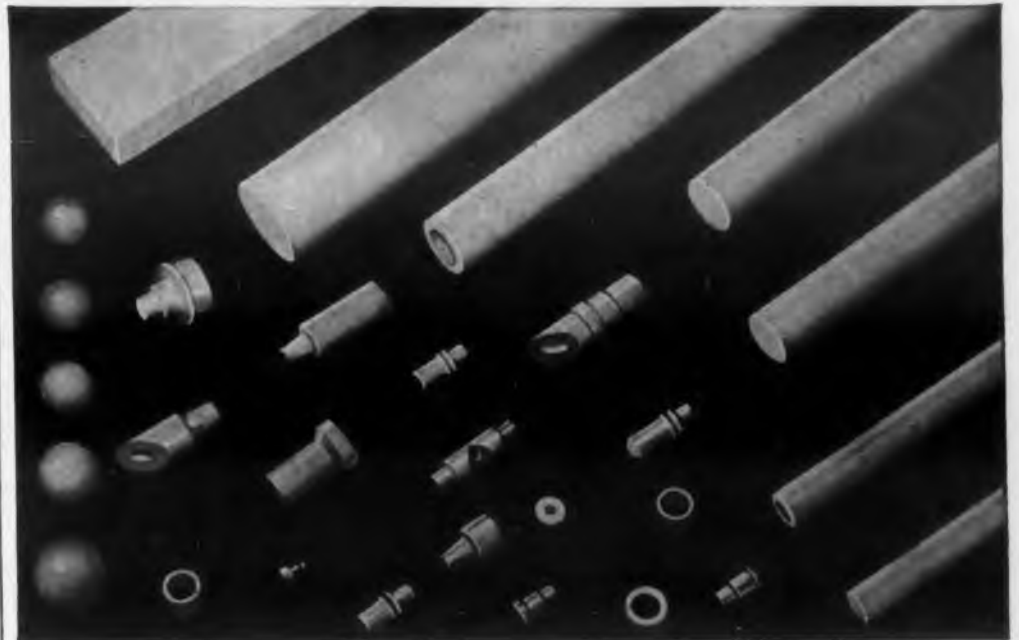
plement the approximate direct-reading dial of the oscillator), a forward-and-reverse directional coupler with bolometer takeoffs for source and reflected power, and a direct-reading ratiometer having dual scales calibrated in vswr 1.06 to 1.3, and 1.3 to 2.5

The unit has the advantages of rapid operation, the absence of probe or slot error, no adjustments necessary for frequency changes, and no effect on readings due to changes in r-f power. Overall accuracy is within 2%. Primary power is 115v, 60cy. Color Television, Inc., Dept. ED, 932 E. San Carlos Ave., San Carlos, Calif.

CIRCLE ED-30 ON READER-SERVICE CARD FOR MORE INFORMATION

teflon*

... and We Can Deliver!



EXTRUDED MOLDED ROD and TUBE

Small Machined Parts! Sheets!

Heavy demand has put many TEFLON fabricators in a "back ordered" condition. The effect—stymied or crippled production on your end.

At FLEXROCK we have licked this problem. New TEFLON producing equipment has been added. We have substantially increased capacity. We can't take on all things just yet. But soon we will be ready to "throw the book at you" with a complete range of TEFLON services. RIGHT NOW we are set to ship you TEFLON Rod and Tube, extruded or molded, Sheets, and small parts—no matter how intricate—machined from Rod and Tube. We can promise good delivery—yes, FAST DELIVERY

... with closest possible tolerances on your small parts. Tell us your needs—we will be happy to quote delivery and price.

*DuPont trade-mark for
tetrafluoroethylene resin

for teflon it's
FLEXROCK
PHILADELPHIA 4, PA.

SEND US YOUR "SPECS"
LET US QUOTE

FLEXROCK COMPANY, 3608-B Filbert St., Phila. 1, Pa.

- We are enclosing sample, specs, and quantity for our TEFLON requirements. Please furnish quotation.
 Please send us your TEFLON Bulletin including stock list.

Name

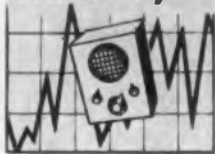
Company

Address

City Zone State

CIRCLE ED-31 ON READER-SERVICE CARD FOR MORE INFORMATION

What is your Delay or Regulating Problem?



For the most effective solution use the
**SIMPLEST, MOST COMPACT
MOST ECONOMICAL
HERMETICALLY SEALED**

AMPERITE THERMOSTATIC DELAY RELAYS

Provide delays ranging from 2 to 120 seconds.

- Actuated by a heater, they operate on A.C., D.C., or Pulsating Current.
- *Hermetically sealed.* Not affected by altitude, moisture, or other climate changes.
- Circuits: *SPST only*—normally open or normally closed.

Amperite Thermostatic Delay Relays are compensated for ambient temperature changes from -55° to $+70^{\circ}$ C. Heaters consume approximately 2 W. and may be operated continuously. The units are most compact, rugged, explosion-proof, long-lived, and — very inexpensive!

TYPES: Standard Radio Octal, and 9-Pin Miniature.

PROBLEM? Send for Bulletin No. TR-81



STANDARD

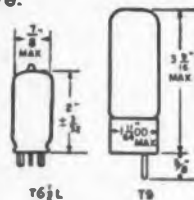
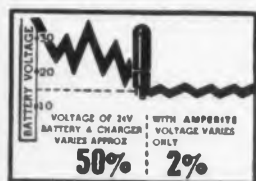


MINIATURE

BALLAST-REGULATORS

Amperite Regulators are designed to keep the current in a circuit *automatically regulated* at a definite value (for example, 0.5 amp).

- For currents of 60 ma. to 5 amps. Operates on A.C., D.C., or Pulsating Current.
- Hermetically sealed, light, compact, and most inexpensive.



Maximum Wattage Dissipation:
T6 1/2 L—5W. T9—10W.

Amperite Regulators are the simplest, most effective method for obtaining *automatic regulation* of current or voltage. *Hermetically sealed*, they are not affected by changes in altitude, ambient temperature (-55° to $+90^{\circ}$ C), or humidity. Rugged; no moving parts; changed as easily as a radio tube.

Write for 4-page Technical Bulletin No. AB-51



T9 BULB

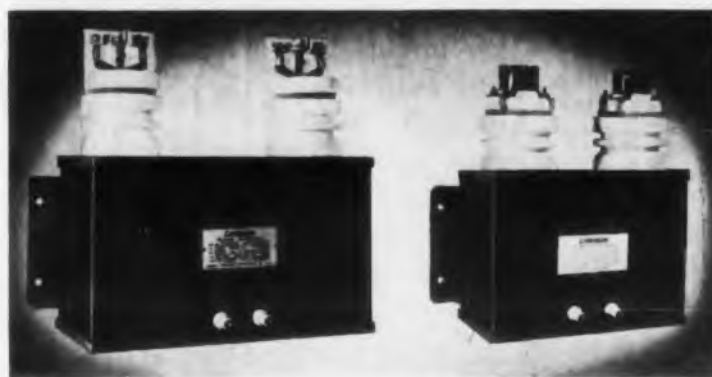


AMPERITE CO., Inc. 561 Broadway, New York 12, N. Y.
In Canada: Atlas Radio Corp., Ltd., 560 King St., W., Toronto 2B

CIRCLE ED-32 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Filament Transformers For Rectifier Tube Application



Each of these Dual Filament Transformers furnishes power for two rectifier tubes normally operated under conditions of high voltage to ground or between tubes. This combination of dual duty within a unit enclosure saves space, improves appearance, and simplifies mounting, wiring, and handling.

Two transformer sizes are available, 100va and 200va, 115 volt primary, dual 5v filament supply. Both are equipped with insulating bushings and tube sockets. Each unit is compound filled; and insulated to withstand maximum d-c operating voltages of 12kv and 17.5kv respectively. The 100va size has sockets for tube type 575A; the 200va has sockets for tube type 869B. Transformer Div., Lindberg Engineering Co., Dept. ED, 2450 W. Hubbard St., Chicago 12, Ill.

CIRCLE ED-33 ON READER-SERVICE CARD FOR MORE INFORMATION

Rectifier Unit

Magnetic-Amplifier Controlled



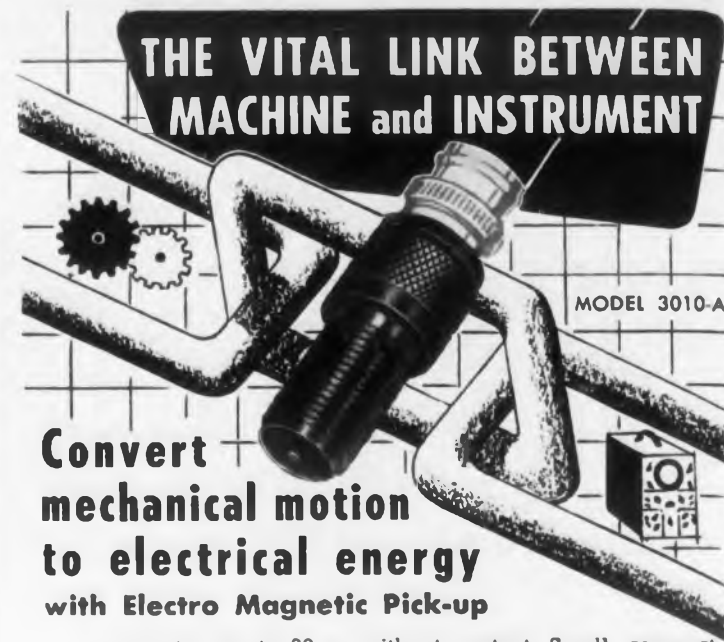
The "Magnivolt" is a high-performance a-c to d-c regulated selenium rectifier with magnetic amplifier control. Compact and light in weight, it is designed for a wide variety of

electronic and electrical applications requiring a d-c source. With all static components, its construction eliminates expendable units such as vacuum tubes and other moving parts.

Regulation is better than $\pm 1\%$ from no load to full load with $\pm 10\%$ a-c line variation. Response is faster than 0.2sec under extreme load conditions. Ripple is less than 1%rms (to 0.1% at extra cost). Output ratings are 1.2-30.0v d-c and 2.5-40.0amps full load. Input rating of the unit is 115v, single phase, 60cy. Inet, Inc., Dept. ED, 8655 S. Main St., Los Angeles 3, Calif.

CIRCLE ED-34 ON READER-SERVICE CARD FOR MORE INFORMATION

THE VITAL LINK BETWEEN MACHINE and INSTRUMENT



Convert mechanical motion to electrical energy with Electro Magnetic Pick-up

... generates up to 28 v. without contact. Small, compact and rugged, this Electro Magnetic Pick-up generates electrical voltages proportional to the rate of speed of any object with magnetic properties. It produces useful output voltages at frequencies up to 75,000 cps. Self-energized by built-in magnet. Low cost permits use in production machinery.

A few of many applications

- Indicates RPM
- Acceleration and velocity studies
- For precision ignition timing
- For ballistic research



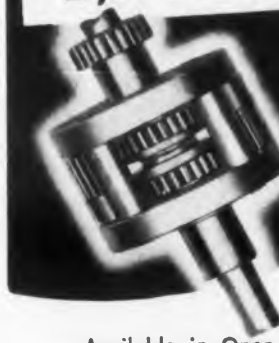
Write for Bulletin MT-592

ELECTRO PRODUCTS LABORATORIES
4501-DEu Ravenswood, Chicago 40

Canada: ATLAS RADIO CORP., LTD., Toronto
CIRCLE ED-35 ON READER-SERVICE CARD FOR MORE INFORMATION

Solve Control Problems of Speed - Torque - Instruments

WITH
Milwaukee
SMALL DIFFERENTIALS



Available in Open Style
(as illustrated) or in En-
closed Style.

Design Engineers! Use these small, precision made, mechanical differentials where measuring or controlling of speeds is

involved. They are adaptable to many other applications, such as: Control of Torque, Speed Changing, Remote Controls, Broad Range Step Transmission, Position Controllers or Follow-up System, Clutches, Sequence Controllers.

Further detailed information available upon request.

MILWAUKEE LOCK & MFG. CO.

5040 N. 37TH STREET • MILWAUKEE 9, WIS.

CIRCLE ED-36 ON READER-SERVICE CARD FOR MORE INFORMATION

D-C Power Supply

Delivers 6v, 5amp; 12v, 3amp



Type 205 D-C Power Supply is a regulated, low voltage source, whose applications include supplying power to heaters in d-c and low frequency amplifiers, and replacing storage batteries

where a constant d-c source of low voltage at high current is required, such as colorimeter and spectrometer light sources.

Specifications include a rating of 6v at 5amp, or 12v at 3amp, with less than 0.05% variation for line voltage changes from 105v to 125v; a ripple of less than 2mv; a regulation of more than 0.5% from zero to full load; and an instantaneous recovery time for line voltage changes and in the order of 0.2sec for load changes. Hanover Developments, Dept. ED, 401 E. 74th St., New York 21, N. Y.

CIRCLE ED-37 ON READER-SERVICE CARD FOR MORE INFORMATION

Magnetic Pick-up

Operates Without Physical Contact



The Model 3010-A Magnetic Pick-up is an electrical impulse generating device which produces a voltage output proportional to the rate of motion or speed of

the magnetic object without contact or loading. It can be actuated by the keyway in a shaft, teeth of a gear, spokes, a slot in the rim of a wheel or shaft, a screw head or pin on a moving part—or by any vibration or displacement of magnetic material in the field of the pick-up.

The device can indicate rpm, operations, cycles, and angular or linear motion. It can actuate electrical counters, serve as a tachometer when used with a voltmeter, provide synchronizing voltage for oscillographs, be used for precision ignition timing, control electrical equipment when used with amplifiers and relays, and for many other applications. Output is up to 5v. Resonant frequency is 50,000 to 60,000cps. Impedance is 500 ohms at 1000cps. Overall length is 2". Body is 3/4" hex, with 5/8" x 18 mounting thread. Electro Products Laboratories, Inc., Dept. ED, 4501 Ravenswood Ave., Chicago 40, Ill.

CIRCLE ED-38 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC DESIGN • November 1953

DON'T MISS THIS...

Handy New Guide to TR and ATR Tubes

Yours **FREE** from Sylvania!

Be sure to get one of these time-saving reference guides to Sylvania's complete line of TR and ATR Tubes.

At a glance it tells you about power rating and frequency, and shows which tubes are band-pass and which are tunable. Color code identifies power rating quickly and accurately. Folds to compact, wallet size.

If your Sylvania Representative can't supply you, mail the coupon for a copy NOW!

SYLVANIA

In Canada: Sylvania Electric (Canada) Ltd.
University Tower Bldg., St. Catherine St., Montreal, P. Q.

Sylvania Electric Products Inc.
Dept. 3E-4011, 1740 Broadway,
New York 19, N. Y.

Please send me a copy of the new handy guide to TR and ATR Tubes.

Name _____

Street _____

City _____ Zone _____ State _____

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CIRCLE ED-39 ON READER-SERVICE CARD FOR MORE INFORMATION

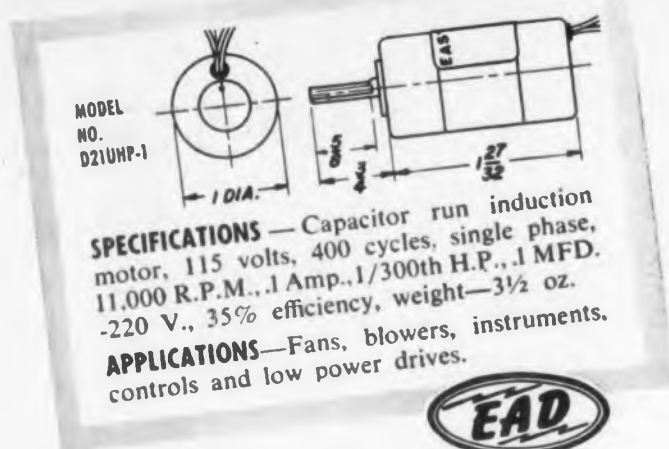
"miniaturized" FOR MAXIMUM EFFICIENCY



EAD's

MODEL NO. D21UHP-1

new versatile 1" motor



Another outstanding EAD contribution to the miniaturization program is this extremely small, precision motor. Engineered for *long life and high efficiency*, it is especially designed for operation in confined areas where minimum size and weight is essential.

Units are available in this small frame size for 400 cycle or variable frequency operation, with 400 cycle power ratings ranging up to approximately 1/100 H.P. Modifications include high ambient and high altitude versions as well as servo, synchronous and gear motors.

400 CYCLE OPERATING CHARACTERISTICS

APPROXIMATE R.P.M.	7,000	10,500	21,000
PHASES	1, 2	1, 2, 3	1, 2, 3
INPUT VOLTAGE (MAXIMUM)	115	115	115

EASTERN AIR DEVICES, INC.
585 DEAN ST., BROOKLYN 17, NEW YORK

CIRCLE ED-40 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Quick-Connect Terminal Kit

For Rapid Solderless Wiring



This new Kit of "AQC" Solderless Terminals is housed in a pocket-size steel carrying case. It provides 500 assorted "Quick-Connect" terminals which are easily applied to electrical equip-

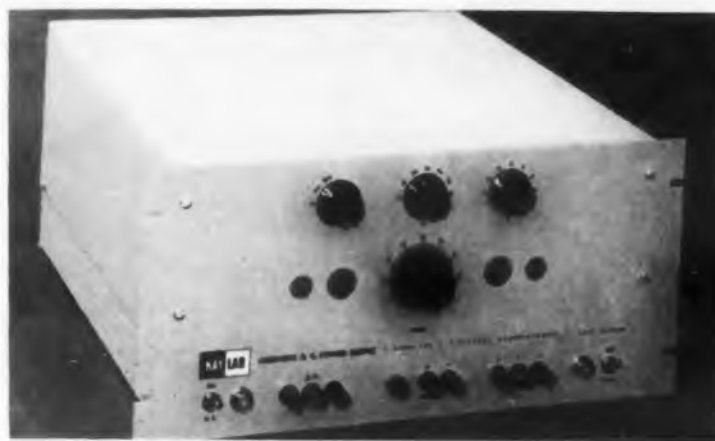
ment that does not use screw or solder-lug terminals. Included are six line connectors for making insulated connections between in-line terminals, and two specially designed crimping tools.

Terminals are of right-angle and in-line types, male and female, for #10, 12, 14, 16 and 18 wire sizes. The crimping pliers, one for right-angle and one for in-line connections, easily apply force to assure tight, low-resistance contact between wire and terminal. Ark-Les Switch Corp., Dept. ED, 51 Water St., Watertown 72, Mass.

CIRCLE ED-41 ON READER-SERVICE CARD FOR MORE INFORMATION

D-C Power Supplies

Utilize Standard Cell



These Absolute D-C Power Supplies automatically compare the output voltage to a standard cell, assuring long time stability and absolute calibration of the output voltage independent of line and load characteristics. Optimum output impedance, and low hum and noise characteristics are features.

The supplies are designed so that a number of complex circuits may be operated from them without cross-coupling. High gain amplifiers afford immunity to line voltage and load current variations. Kalbfell Laboratories, Inc., Dept. ED, P. O. Box 1578, 1090 Morena Blvd., San Diego 10, Calif.

CIRCLE ED-42 ON READER-SERVICE CARD FOR MORE INFORMATION



C-D-F takes duPont's Teflon and processes it into insulating tapes with exceptional resistance to moisture, arcing, and high heat. Available in unsupported or glass fibre fabric base; wide range of thicknesses and widths. For the best in tapes of Teflon, buy from C-D-F!

TEFLON SHEETS

C-D-F makes news with Teflon. A variety of Teflon glass base laminates are available with copper foil surfaces, suitable for etching of printed circuits. Exceptionally good bond strength, high heat resistance, low and stable dielectric loss properties. C-D-F glass supported or unsupported sheets may be formed for channel blanks or armature and field coil insulation.

WRITE NOW! C-D-F offers a valuable technical folder on Teflon, complete with samples, sizes, specifications, applications. If your work involves insulating materials . . . you need this information from C-D-F.



Continental-Diamond Fibre Company

NEWARK 107, DELAWARE

CIRCLE ED-43 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniaturized

DECADE AMPLIFIER

2 mc frequency response, low noise levels

This miniaturized voltage amplifier features 2-mc frequency response, gains of 10 and 100 (20 and 40 db), 10-microvolt equivalent input noise, 40-volt rms maximum output, and high stability. Several inexpensive 140-A Amplifiers may be connected in series for gains such as 60 or 80 db. A typical use is as a pre-amplifier to extend sensitivities of oscilloscopes and other indicating or recording instruments. An accessory high-impedance vacuum-tube probe has an input impedance of 100 megacycles. This allows its use on high-impedance circuits without loading or other disturbance.

TYPE 140-A DECADE AMPLIFIER \$99.50
TYPE 150-A HIGH-IMPEDANCE PROBE \$35.00
F.O.B. Cambridge, Mass.



HERMON HOSMER SCOTT, INC.
"PACKAGED ENGINEERING"
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CIRCLE ED-44 ON READER-SERVICE CARD FOR MORE INFORMATION

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widely used
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Simplify and speed your purchasing of electronic supplies and equipment. Send your orders to us for quick shipment from the world's largest stocks of special-purpose electron tubes, test instruments, audio equipment, electronic parts (transformers, capacitors, controls, etc.). Our expert Industrial supply service saves you time, effort and money. Send today for your Free ALLIED Catalog—the complete, up-to-date guide to the world's largest stocks of Electronic Supplies for Industrial use.

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for everything
in electronics

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Chicago 80, Illinois



CIRCLE ED-45 ON READER-SERVICE CARD FOR MORE INFORMATION

AUTOMATIC VOLTAGE REGULATION

**Sola Static-Magnetic Transformers
Regulate Voltage Within $\pm 1\%$**



Much electrical and electronic equipment requires voltage regulation for best operation. Sola constant voltage transformers are ideal means for providing the voltage at which equipment was designed to operate. The Sola Constant Voltage Transformer is a static-magnetic regulator. It has the following advantages over

regulators which depend solely upon saturation of core materials for their regulation action or electronic types employing tubes.

1. Ultra-fast regulating action, 1.5 cycles or less.
2. No moving or renewable parts for manual adjustments.
3. Completely automatic, continuous regulation.
4. Self-protecting against short circuits on output or load circuit.
5. Current-limiting characteristic protects load equipment.
6. Can be substituted for conventional non-regulating transformers.
7. Relatively compact.

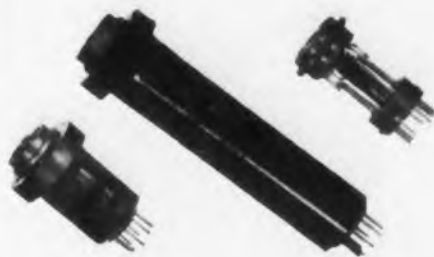
These units are described in a 24 page catalog. Write on your letterhead for a copy of Bulletin P-CV-142. SOLA ELECTRIC CO.

4633 West 16th Street, Chicago 50, Ill.

CIRCLE ED-46 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC DESIGN • November 1953

**Tube Socket Test Adapters
For Nine Socket Types**



These adapters are used for making voltage, resistance and wave form measurements from the tube side of electronic equipment.

An adapter is inserted between the tube and its socket, completing the circuit and providing convenient test tabs.

Adapters are made for nine socket types. For most work, the short, unshielded adapters (left, in illustration) are adequate, but for hard-to-reach locations a longer adapter with shielded leads is available (center). Where there is a need to break tube circuits or alter pin connections, the "Experimenter" type is available; this third type also provides means for adapting tubes to non-mating sockets. Vector Electronic Co., Dept. ED, 3352 San Fernando Rd., Los Angeles 65, Calif.

CIRCLE ED-47 ON READER-SERVICE CARD FOR MORE INFORMATION

Potentiometer Calculator

Covers Linear to Non-Linear Functions



This disc calculator computes combined potentiometer resistance and shunt resistor values, required in converting a linear potentiometer to a non-linear function. On the C scale, a value corresponding to a maximum increment of resistance change is readily

found. The four increments of resistance change between taps, which have been determined on a graph, are readily located on the rotor, which is locked or aligned with a hair line, permitting a reading of the value of the R shunt scale opposite the arrow.

This quickly provides the value of the shunt resistor to the total desired resistance, providing actual ohmic value of the shunt resistor to be connected across the respective section. A pull-out slide provides instructions for use as well as a series of typical applications. The calculator is available as part of a "Pot-Kit" or by itself (in single or multiple units). Servotrol Co., Dept. ED, Framingham Centre, Mass.

CIRCLE ED-48 ON READER-SERVICE CARD FOR MORE INFORMATION

**The LFE OSCILLOSCOPE
Model 401 FEATURES:**



PRICE \$895

- LINEARITY OF VERTICAL DEFLECTION
- HIGH SENSITIVITY AND WIDE FREQUENCY RESPONSE OF Y-AXIS AMPLIFIER
- ACCURATELY CALIBRATED SWEEP DELAY
- BUILT-IN TRIGGER GENERATOR

Linearity of Vertical Deflection. The vertical amplifier provides up to 2.5 inches positive or negative uni-polar deflection with negligible compression.

High Sensitivity and Wide Frequency Response of Y-Axis Amplifier. The vertical amplifier of the LFE Model 401 provides high sensitivity, 15 Mv./cm. at D-C and A-C, and wide band response to a 3 db. point at 10 Mc. Alignment of the amplifier is for best transient response, resulting in no overshoot for pulses of short duration and fast rise time.

Accurately Calibrated Sweep Delay. The accurately calibrated delay of the LFE 401 provides means for measuring pulse widths, time intervals between pulses, precisely calibrating sweeps and other useful applications of time measurement.

The absolute value of delay is accurate to within 1% of the full scale calibration. The incremental accuracy is good to within 0.1% of full scale calibration.

Built-In Trigger Generator. Provides triggers from 500 — 5,000 cps. for internally triggering sweeps. These triggers are simultaneously available, delayed or undelayed, for external use.



For complete information and specifications write:

LABORATORY for ELECTRONICS, INC.

75-5 Pitts Street • Boston 14, Mass.

CIRCLE ED-49 ON READER-SERVICE CARD FOR MORE INFORMATION

KULKA Single and Double Pole "Toggle" Handle Type
AIRCRAFT SWITCHES
For Electronic and Communications Use



Made to JAN specs for DC, or AC circuits up to 1600 cycles. Available with screw terminals and with soldering lugs. Switching characteristics provide for changes in electric circuits by use of SPST, SPDT, DPST and DPDT. Has bakelite housing and only one mounting hole.

TERMINAL BLOCKS
Barrier type, made of molded bakelite in varied styles & sizes up to 26 terminals. Send for catalogue.



FULL SIZE

KULKA ELECTRIC MFG. CO., Inc.
MOUNT VERNON, N. Y.

CIRCLE ED-50 ON READER-SERVICE CARD FOR MORE INFORMATION

Ceramic Coil Forms

A wide variety of ceramic coil forms is available from C.T.C. Made of grade L-5 silicone impregnated ceramic, they meet strict government specifications, come in the following sizes:

CERAMIC COIL FORM SPECIFICATIONS

Coil Form	Mounting Stud Thread Size	Form O. D.	Mounted O. A. Height
*LS1	8-32	.205"	19/32"
*LS6	10-32	1/4"	21/32"
*LS5	1/4-28	3/8"	1 1/16"
LS8	1/4-28	2 1/4"	2 3/32"
*LS7	1/4-28	1/2"	1 11/16"

*ALSO AVAILABLE as Type C with silicone fibreglas terminal retaining collars permitting 2 to 4 terminals. Type C forms excellent for bifilar windings, and for single pie windings, permit terminals to be located above or below winding thus shortening wiring to circuit elements. Type C also have twice as many soldering spaces.

Kit (X1897) containing three each of forms listed above is also available.

Wind these forms to your specifications, then let C.T.C. make them up for you in quantity.

For prototypes and pilot models, designers will also find the new C.T.C. (Type X2060) ceramic coil kit a handy aid. Contains 10 slug-tuned LS6 Type C coils with silicone fibreglas collars. Range: from 2 Microhenries to 800 Microhenries. Kit includes color-coded chart listing data of interest to designers. For details and prices, write Cambridge Thermionic Corporation, 457 Concord Avenue, Cambridge 38, Massachusetts.

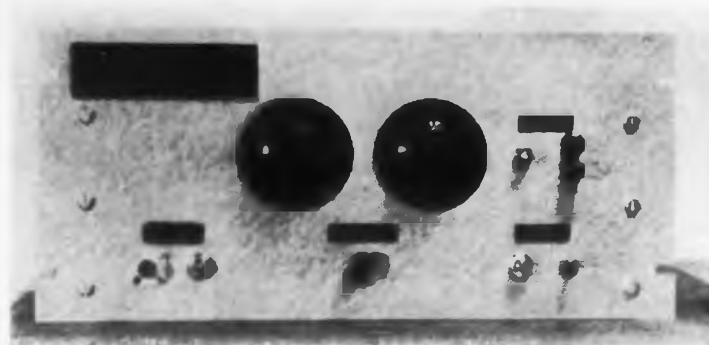
CIRCLE ED-51 ON READER-SERVICE CARD FOR MORE INFORMATION

30

New Products . . .

Power Supplies

Provide Precision Control



The Beva Models 300 and 301 Precision Power Supplies are designed for use in proportional counting in the radioactivity laboratory and in conjunction with pulse height analyzer systems, mass spectrographs and other research equipment demanding rigidly precise high voltages.

Output voltage for the Model 300 is 500v to 1600v d-c and for the Model 301 is 1000v to 5100v d-c. Maximum current output for both units is 1ma. Regulation is 0.01% for load variations from 0 to 1ma, and a line voltage change from 105v to 130v. Voltage variations over several hours are less than 0.01%, and less than 0.1% per day. Noise and ripple effect is less than 0.02v at 5kv. Voltage control is obtained by means of 0.1% accurate decades and potentiometers. The Atomic Center for Instruments & Equipment, Dept. ED, 489 5th Ave., New York 17, N. Y.

CIRCLE ED-52 ON READER-SERVICE CARD FOR MORE INFORMATION

Desk Cabinet Racks

Available in Four Sizes



Two desk cabinet rack models are available knocked down with all necessary bolts for easy assembly. The bolts are invisible from the outside. Both models, "Standard" and "Super De-

luxe," are constructed of 16ga cold-rolled steel, finished in black or gray wrinkle, and available in four sizes.

The top door, with a rounded front corner, opens to 90° and is provided with a piano-type hinge and snap catch. Panel mounting holes are tapped for 10/32 machine screws on universal spacings. The cabinets are trimmed top and bottom with red striped chrome finished moulding. Premier Metal Products Co., Dept. ED, 3160 Webster Ave., Bronx 67, N. Y.

CIRCLE ED-53 ON READER-SERVICE CARD FOR MORE INFORMATION

A COMPLETE STOCK OF

Relays

FOR EVERY APPLICATION

Melvin maintains in stock a complete inventory of Potter & Brumfield Relays to meet every electrical and electronic requirement.

- Sensitive
- Power
- Impulse
- Shock Proof
- Miniature
- Telephone
- Multiple Leaf
- Latching
- Plate Circuit
- Motor Starting

Write, wire or phone: your order shipped the same day received.

164-Page Melvin Catalog

Melvin is your complete supply source for the finest electronic parts and equipment. If it's electronic, you'll find it in the Melvin catalog. Write for your free copy today.



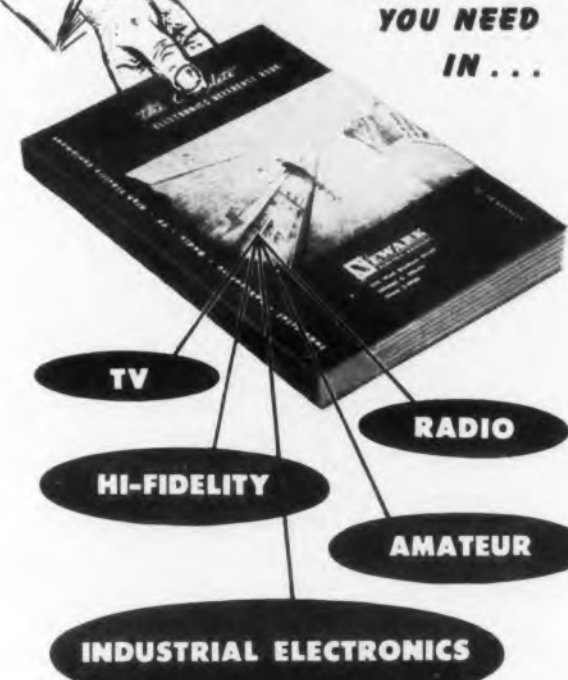
Melvin ELECTRONICS, INC.

COlumbus 1-7273

238 Chicago Avenue, Oak Park, Illinois

CIRCLE ED-54 ON READER-SERVICE CARD FOR MORE INFORMATION

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INDUSTRIAL ELECTRONICS

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Department E-11

NEWARK
ELECTRIC COMPANY
223 W. Madison St., Chicago 6, Ill.

CIRCLE ED-55 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC DESIGN • November 1953

PLASTIK-707



ONLY
\$1.25
per 12 oz.
CAN

THE NEW
Spray-On

**PROTECTIVE
AND
INSULATING COATING**
For GENERAL and
INDUSTRIAL USES

ONE COAT LASTS indefinitely
DRIES IN 10 minutes
There are hundreds of uses HERE ARE A FEW:

A CRYSTAL CLEAR - WATER WHITE
ACRYLIC RESIN

- On electrical, television, and ignition components to prevent leakage and reduce corona.
- On all polished silver, brass, copper, chrome to prevent tarnish and corrosion.
- On steel parts and hardware to prevent rust and deterioration.
- On record cards, labels, important papers, documents, prints, drawings to moisture-proof and prevent smudging.
- On canoes, boats, model aircraft to replace dopes and varnishes.
- On sports equipment, outdoor furniture, auto chrome to preserve against moisture.

Unusually inert to attack by acids, alkalis, alcohols, mineral and vegetable oils, salt spray, chemical fumes, sun and weather.

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CIRCLE ED-56 ON READER-SERVICE CARD FOR MORE INFORMATION

Eliminate Transformer Cases WITH ACME STAR COMPOUND For MIL-T-27, Grade 1, Class A Specifications

- Non-toxic
- Non-corrosive
- Eliminates voids
- Thorough impregnation
- Complete moisture-proof seal
- Simple one-phase molding process
- For Specification MIL-C-16923 (Ships) Compound, Embedding (Electronic Equipment) Type C



This is a Raytheon Transformer molded with Acme Star Compound

Acme Wire



THE ACME WIRE CO., NEW HAVEN, CONN.
Magnet Wire • Coils • Varnished Insulations • Varnishes

CIRCLE ED-57 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC DESIGN • November 1953

Data Recorder Expedites Test Recordings



The Data Recorder takes 100 identifiable readings on an 8-1/2" x 11" chart. This chart may be removed and replaced with accurate indexing permitting the collection of test data, taken at different times, on a single chart. A non-technical operator can take up to 600 bridge readings per hour.

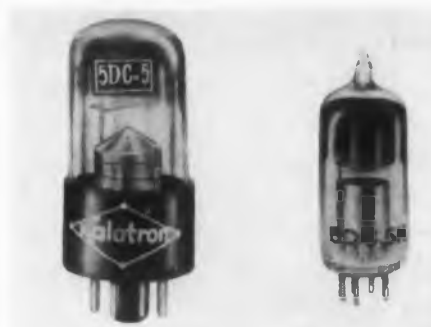
The instrument can be used for any bridge or potentiometric type measurement. The print drive servo has a sensitivity of 25µv. Full scale, spans as low as 15mv are practical.

A valuable application is in testing resistors. For this application the instrument is supplied to read deviation from nominal value, with two ranges from -5% to +5%, and -25% to +25%, zero center. Accuracy is better than 0.5% of full scale. Barnes Development Co., Dept. ED, 213 W. Baltimore Pike, Lansdowne, Pa.

CIRCLE ED-58 ON READER-SERVICE CARD FOR MORE INFORMATION

Vacuum Diodes

With Temperature Limited Emission



The 5DC-5 and 5DC-5M "Kalotron" diodes have temperature limited emission characteristics, where the anode current is a direct function of the filament voltage.

Small changes in filament voltage result in relatively large changes in anode current.

Ratings are as follows: cathode voltage 5.6v a-c/d-c; cathode current 55-75ma; plate voltage 500v; plate current 0.450-0.575ma. The 5DC-5 uses a T9F1 bulb and a No. 8537 8-pin intermediate octal base. The 5DC-5M uses a T5-1/2 bulb and a T5-1/2 7-pin miniature button base. Use of a pure tungsten filament maintains ratings throughout the normal life of the tube. Thermosen, Inc., Dept. ED, 361 West Main St., Stamford, Conn.

CIRCLE ED-59 ON READER-SERVICE CARD FOR MORE INFORMATION

NEW! PERKIN

Magnetic Amplifier Regulated

POWER SUPPLY

MODEL MR532-15
5.32 Volts DC @ 15 Amps

1%

REGULATION AND RIPPLE

From 5.32 Volts DC
From 1.5 to 15 Amps. DC
From 105-125 Volts AC Input

NO TUBES!

RESPONSE TIME 1/10 SEC.!

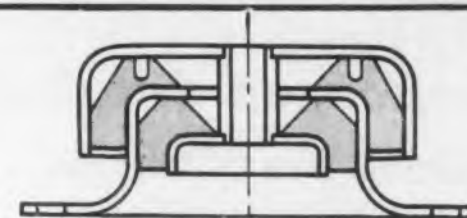


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for literature
and quotations*

**345 Kansas Street
El Segundo,
California**

CIRCLE ED-60 ON READER-SERVICE CARD FOR MORE INFORMATION

SHOCK - VIBRATION - NOISE ISOLATION NOTES



**SHOCK ISOLATOR
EFFECTIVE IN ALL DIRECTIONS**

High-impact shocks from any angle are absorbed, vibrations above 2700 cpm (45 cps) are isolated, and noise transmission is reduced by BARRYMOUNTS in the 1000, 2000, 3000, and 4000 series.

These unit isolators use rubber in compression in all directions to give smooth load-deflection curves with substantially equal stiffness in all directions. The design and assembly of the metal parts make the units self-captivating for maximum security. Unit isolators are available to handle loads from 7 pounds to 1800 pounds.

Catalog 504-B, free on request, gives further details on these BARRYMOUNTS, and on others for shipboard, mobile, and industrial service. Write to The Barry Corporation, 775 Pleasant Street, Watertown 72, Mass.

CIRCLE ED-61 ON READER-SERVICE CARD FOR MORE INFORMATION



Fact-filled folder on request . . . showing how economies in costs, labor and time are achieved with the GREEN ENGRAVER.

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Etching attachment and other special equipment for industrial uses are available.

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CIRCLE ED-62 ON READER-SERVICE CARD FOR MORE INFORMATION

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... first in precision potentiometers



CIRCLE ED-63 ON READER-SERVICE CARD FOR MORE INFORMATION

32

New Products . . .

Precision Potentiometer

Long Life, Versatile Unit



The Type 756 Potentiometer has a service life of up to five million cycles with relatively no increase in noise level or change in linearity. With a maximum resolution of 0.05%, the unit is available in both linear and

non-linear construction to produce nearly all mathematical functions and many purely empirical functions. Standard functional tolerances for linear windings are as low as $\pm 0.25\%$, while for non-linear windings accuracies of $\pm 0.35\%$ can be achieved with a 3:1 slope ratio in high resistance ranges. Mandrel type windings and an inside wiper arrangement limit the noise level to far below average requirements.

Maximum electrical function angle is $350^\circ \pm 1^\circ$. Tolerance on the overall resistance value is as low as $\pm 3\%$. Standard winding is 320° nominal with tolerance of $\pm 5\%$ in the resistance range of 800 to 40,000 ohms. By the addition of special terminal boards, as many as 13 taps accurate to $\pm 1\%$ can be provided for non-linear functions. Potentiometer Div., Fairchild Camera and Instrument Corp., Dept. ED, Robbins Lane, Syosset, N. Y.

CIRCLE ED-64 ON READER-SERVICE CARD FOR MORE INFORMATION

TV Sync Separator Tube

Also Suppresses Noise



The Type 6CS6 tube is designed for combined sync separator and noise suppressor use. It is for use in circuits that accomplish sync separation by feeding the video signal extending in a positive direction to grid three, where the negative grid leak bias development automatically adjusts the clipping level.

Noise suppression is obtained by applying a video signal extending in a negative direction to grid one.

Strong noise impulses will cause tube cutoff momentarily and thus reduce noise effects on picture tube sweep circuits. The tube is in the T-5-1/2 bulb style and has a 6.3v heater. Sylvania Electric Products, Inc., Dept. ED, 1740 Broadway, New York 19, N. Y.

CIRCLE ED-65 ON READER-SERVICE CARD FOR MORE INFORMATION

PHALO *Lords*



argus
300 Watt Projector

Projecting Themselves Through

QUALITY

argus, world-famous producers of cameras and projectors depends on PHALOCORD cord sets to carry the current load for their amazing new line of projectors.

Colorfully contrasting PHALOCORD cord sets add a bright, smart touch to the handsome ARGUS projector — but the big reason for their nationwide demand is, of course, complete dependability on the job!

Use PHALOCORD and you'll use the finest!

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Insulated Wire and Cables—Cord Set Assemblies

CIRCLE ED-66 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature Continuously Variable Delay Lines



Miniature continuously variable delay lines are capable of providing continuously variable time delay from zero to several hundred microseconds. Time delay is made constant from 0 to over 20 megacycles by means of optimum equalization. As a result, the transmission characteristics are superior to those of an ordinary commercially available variable delay line, distributed—or lumped parameter type. Other features include fast rise time, excellent stability, hairline accuracy, and complete freedom of time jitter hermetically sealed upon request.

Time delay is continuously variable from 0 to 0.25 microseconds in Type 506, 0 to 0.8 microseconds in Type 507, and 0 to 0.45 microseconds in Type 508. The rise time is less than 10% of the time delay at any point in all types. The small size and weight of these units make them particularly suitable for incorporation in any instrument where a continuously variable delay line is needed. Write Dept. ED1 for data: Advance Electronics Company, P. O. Box 394, Passaic, New Jersey.

Time delay is continuously variable from 0 to 0.25 microseconds in Type 506, 0 to 0.8 microseconds in Type 507, and 0 to 0.45 microseconds in Type 508. The rise time is less than 10% of the time delay at any point in all types. The small size and weight of these units make them particularly suitable for incorporation in any instrument where a continuously variable delay line is needed. Write Dept. ED1 for data: Advance Electronics Company, P. O. Box 394, Passaic, New Jersey.

CIRCLE ED-67 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC DESIGN • November 1953

Tiny parts for the DC-6 get THOROUGH check-up with FLASH-O-LENS



Small parts for the hydraulic system of the famous Douglas DC-6 are inspected for symmetry with FLASH-O-LENS—the handy device that *lights* the work and *magnifies* it.

It will pay *you* to put FLASH-O-LENS to work on your inspection jobs. Built-in bulb throws light *only* on field of vision—*not* in worker's eyes. Accurately ground lens gives sharply detailed enlargement.

Write for free descriptive literature on battery-operated and plug-in types.

E. W. PIKE & COMPANY

492 NORTH AVE.

ELIZABETH, N. J.

CIRCLE ED-68 ON READER-SERVICE CARD FOR MORE INFORMATION

PIPELINE TO PRECISION



Model WWVR

Designed specifically to conveniently receive and make maximum use of all the Standard Frequency Transmissions of WWV without any special setup.

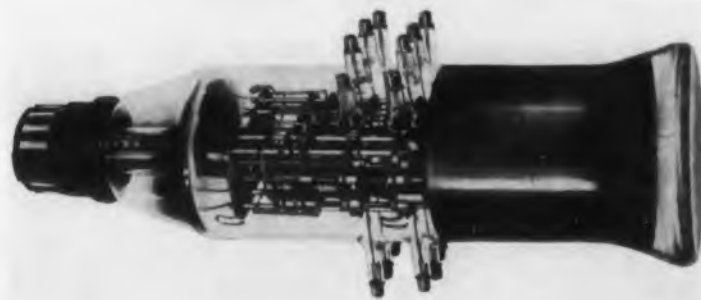
Send for complete specifications



CIRCLE ED-69 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC DESIGN • November 1953

Cathode Ray Tubes Employ Four Electron Guns

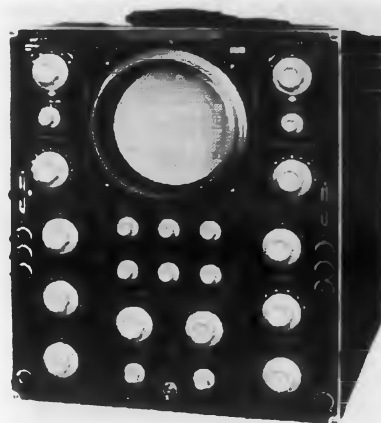


These tubes employ four independent electron guns. The four sets of deflector plates are brought out to side connections arranged on either side of the bulb. The pairs of Y-plates are screened from each other and from X-plates to give complete freedom from intermodulation. With proper design of associated equipment, the guns can be made as independent as four separate cathode ray tubes for many precision measurement applications.

Heater voltage is 6.3v, and heater current (four guns) is 4amp. Voltage of A_1 is 2kv max, of A_3 is 5kv max, and of A_2 is 300v (when voltage of A_3 is 2kv) and 600v (when voltage of A_3 is 5kv). Plate capacity is 4mmfd. 20th Century Electronics, Ltd., Dunbar Works, Dept. ED, Dunbar St., West Norwood, London SE 27, England.

CIRCLE ED-70 ON READER-SERVICE CARD FOR MORE INFORMATION

Oscillosynchroscope Checks Small A-C Signals



The Model OA-16 oscillosynchroscope features a calibrated buck-out voltage which allows balancing out of d-c levels accurately to 10%, so that small superimposed a-c signals can be expanded for more minute inspection of small changes in d-c

level. This represents a possible 40:1 expansion of the signal over that observable using conventional d-c methods.

Also featured are vertical and horizontal bandwidths from d-c to 5Mc and 1Mc; and sensitivities of 50mv/in peak-to-peak, and 120mv/in peak-to-peak, respectively. Triggered or recurrent sweeps from 0.4 μ sec/cm to 10sec total sweep are available. A video delay line permits observation of rising wavefronts of pulses. Browning Laboratories, Inc., Dept. ED, 750 Main St., Winchester, Mass.

CIRCLE ED-71 ON READER-SERVICE CARD FOR MORE INFORMATION

CANNON PLUGS

for
hermetic
sealing



SUB-MINIATURE U Series plugs for miniature switches, relays, transformers, amplifiers and other sealed components have steel shells and Silcan insulation, cable relief and moisture resistant sleeve. Bayonet-lock coupling method. Rated 1700 v. D.C.; 5 a.—Have 3, 6, and 12 contacts—one plug style and two receptacles. Refer to U-2 Bulletin.



GS TYPES (Top, right) and **RKH Types** (Bottom, right) have fused vitreous insulation providing a true hermetic seal for relays, position indicators, etc. Cadmium finish steel and bleached Iridite shells with

Dural coupling nut. Resist thermal shock—300°F. to 600°F.; pressures 200 to 900 psi—specials to 7500 psi. See GS-3 section in AN-8 Bulletin and KH-1 section in K Bulletin.

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Representatives in principal cities. Address inquiries to Cannon Electric Co., Dept. K143, Los Angeles 31, California.

CIRCLE ED-72 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC COMPUTER ENGINEER

a top flight position
is open for you.

If you can show strong background in:

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Here is the opportunity to apply creative engineering in a new Electronic Business Machine System.

The position is permanent, the company the established leader in the measurement and data handling field.

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POTTER INSTRUMENT CO., INC.

115 Cutter Mill Road Great Neck, New York

CIRCLE ED-73 ON READER-SERVICE CARD FOR MORE INFORMATION

*for rugged, moisture-proof
High Compression*
**MULTI-PIN
CONNECTOR PLUGS**
specify

Constantin

These quality-engineered high compression glass-to-metal vacuum sealed connecting plugs are ideal for generator filters, position indicators, tachometers, direction finding equipment, or almost any equipment which must be sealed against moisture or pressure changes. Construction is of glass and metal fused together to make a sturdy vacuum tight seal.

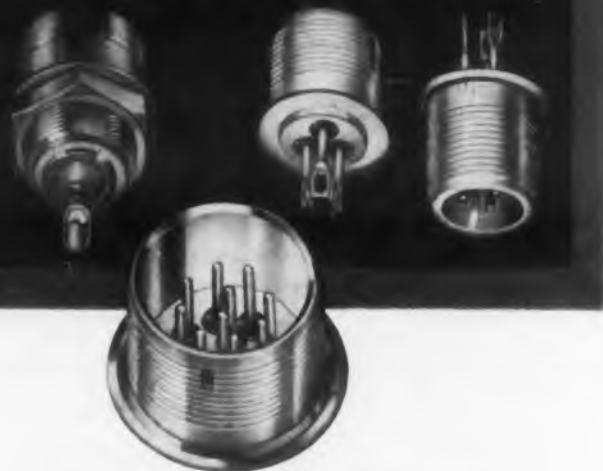
Available in a wide variety of pin configurations, these connectors may be furnished in many plating finishes for ease of soldering, appearance, and corrosion tests such as salt spray and humidity. Truly fine connectors—specified by leading manufacturers.

SEALS AVAILABLE IN EITHER HIGH COMPRESSION
OR HARD GLASS TO KOVAR TYPES.

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VACUUM COATING EQUIPMENT



CIRCLE ED-74 ON READER-SERVICE CARD

New Products . . .

Diffused Junction Transistors

Feature Low Noise



The characteristics of these p-n-p Diffused Junction Transistors make them useful for many audio frequency applications. They are available in three types: 2N39 for high gain applications, 2N40 for medium gain, and 2N42 for moderate gain. All three exhibit low noise characteristics.

The units are encapsulated in an epoxy thermosetting resin which makes them impervious to moisture and other contaminants. The resin also provides maximum resistance to shock and vibration.

Maximum ratings at 25°C are: collector dissipation, 50mw; collector current, —5ma, d-c; collector voltage, —30v, d-c; emitter dissipation, 20mw; emitter current, 5ma, d-c. Current amplification factor for the three units is: >0.94, >0.90, and >0.85, respectively. Under typical grounded emitter conditions, collector current is 1.0ma, collector voltage is —4.5v, emitter current is 1ma, input resistance is 500 ohms, output resistance is 30,000 ohms, noise figure is 25db (at 1000cy), and power gain is 38db (2N39), 36db (2N40), and 32db (2N42). National Union Radio Corp., Dept. ED, Hatboro, Pa.

CIRCLE ED-75 ON READER-SERVICE CARD FOR MORE INFORMATION

Wire-Wrench

Wraps Wire Around Terminals



This simple tool is used for wrapping either stranded or solid wire around terminals on boards or hermetic seals. One or more wires can be wrapped around a terminal with a single twist of the

wrist, making the Wire-Wrench as easy to use as a small screwdriver.

In use, the wire is placed against the terminal, the tool is placed over the terminal so that the wire is caught in the notch of the tool, and a simple twisting motion is applied, wrapping the wire around the terminal in a neat, tight connection, ready for soldering. As an additional feature, the tool has a hole and a flat for putting a hook in a wire. The tool can also straighten bent terminals. Three sizes are available: WW1, for miniature, WW2, for medium size, and WW3, for large terminals. Contact, Inc., Dept. ED, 238 Main St., Cambridge 42, Mass.

CIRCLE ED-76 ON READER-SERVICE CARD FOR MORE INFORMATION

**Don't Say
Resistors**

Specify **DAVOHMS**

*The Complete, Superior Line
of Precision*

WIRE WOUND RESISTORS

Made Only By **DAVEN**

ELECTRONIC SPECIALISTS FOR MORE THAN A GENERATION



- Accuracies to .05%
- All Temperature Coefficients
- All Types of Mountings
- Hermetically Sealed Types
- Manufactured to Famous Daven Standards of Precision
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FRY PLASTICS COMPANY

• Dept. ED-11, 7826 S. Vermont Avenue, Los Angeles 44, California

CIRCLE ED-78 ON READER-SERVICE CARD FOR MORE INFORMATION

CIRCLE ED-166 ON READER-SERVICE CARD ➤

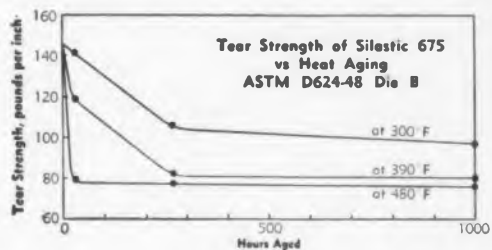
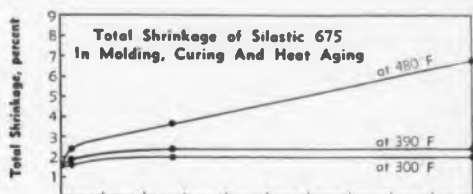
DOW CORNING

Silicone News

No. 3 of a Series • PUBLISHED BY DOW CORNING CORPORATION, MIDLAND, MICHIGAN

Remarkably Low Compression Set And Low Shrinkage Characterize New Extreme Temperature Silastic*

Silastic 675, a newly developed molding stock, has a combination of properties that is unique even among silicone rubbers. Serviceable from -100 to 500 F, Silastic 675 exhibits the lowest compression set of any extreme temperature silicone rubber. After 22 hours at 300 F, for example, compression set of this new molding stock is in the range of 15 to 20%; after 70 hours, 20 to 28%.



Silastic 675 is well suited for use in applications where low shrink in service is essential. Total shrinkage of molded test samples is below 2.5% after 1000 hours at 400 F; less than 7% after 1000 hours at 480 F. This low shrinkage characteristic also makes it possible to fabricate parts for many applications in the same molds used to form conventional organic rubber stocks.

Silastic 675 also has good dielectric properties. Dielectric strength is 550 volts per mil. Measured at 10^2 cycles, dielectric constant is 3.07 and power factor is 0.0032. After seven days at 25 C and 100 percent humidity, surface resistivity of Silastic 675 is 2.82 at 10^{13} ohms and volume resistivity is 8.58×10^{13} ohms.

In addition to its low set, low shrink and excellent dielectric properties, Silastic 675 contains no toxic additives. It can safely be used to fabricate parts which come in contact with cosmetics, food and pharmaceuticals.

Silastic 675 is therefore singularly well suited to the fabrication of resilient gaskets, seals, O-rings, bellows, switch boots and dielectric fittings and connectors. It is one of the most versatile

* T. M. REG. U. S. PAT. OFF.



WORLD'S LARGEST UTILITY COMPANY SPECIFIES SILICONE (CLASS H) INSULATION FOR RELIABILITY

When millions of customers depend on you for 24 hour a day service, you can't take chances with your equipment. That's why the Consolidated Edison Company of New York took action when a 350 hp Class A insulated sludge pump motor failed three times in one year.

Although repeated overloading was the primary cause of failure, ambient temperatures were kept high by an enclosure built around the motor for flood protection. Failure rate was cut to once a year by rewinding with Class B insulation. The motor was then rebuilt with Class H insulation made with Dow Corning silicones. That was 9 years ago, and it is still in service.

That was Consolidated Edison's first experience with Class H insulation. Since then, many other motors have been rewound with Class H to withstand tough operating conditions. Over 79% or 71,700 out of a total of 90,500 horsepower in new motors bought for major auxiliary installations have been Class H insulated.

In buying new Class H equipment, they found that the frame size of motors rated at 200 hp or more could be reduced to such an extent that manu-

facturing economies often resulted in getting the added life and reliability of Class H insulation at no increase in total cost. Many solenoid coils and replacement coils for motors are also insulated with Class H materials.

facturing economies often resulted in getting the added life and reliability of Class H insulation at no increase in total cost. Many solenoid coils and replacement coils for motors are also insulated with Class H materials.

Consolidated Edison has also pioneered the use of Class H insulation in sealed dry-type unit substation transformers.



They estimate that the cost of such units is more than competitive with conventional installations for power plant auxiliary supply. Convenient and safe, the Class H transformers can be located almost anywhere. And the cost of cable, switchgear, fire protection and related equipment is greatly reduced. That's why Consolidated Edison has already bought eighty-one 1250 KVA Class H transformers for unit substation work, and twelve 1000 KVA units for miscellaneous light and power.

(continued pg. 2)

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(ADVERTISEMENT)

MORE

DOW CORNING **Silicone News**

NEW DEVELOPMENT AND TECHNICAL DATA

For copies of any of the publications reviewed in this column or for data relating to any of the articles printed in this issue of the Dow Corning Silicone News, simply circle the corresponding reference number on the coupon below.

New pressure sensitive adhesives that stick to almost any material remain serviceable and can be applied at temperatures from -67 to 480 F. Uses include bonding silicone treated electrical insulating materials, sealing and wrapping tapes and assembly of small electronic parts prior to mechanical installation. **No. 25**

A reprint from Precision Metal Molding magazine describes various applications of silicone die lubricants in metal fabricating. Article includes information on effectiveness, concentrations used and methods of application. **No. 26**

Heat-stable, nonflammable, foamed structures can be produced from two new Dow Corning expandable resins. Such structures resist direct flame and thermal shock; undergo practically no structural or dimensional change at 700 F; show less than 0.05 percent moisture absorption after 7 days at 96 percent relative humidity. Both resins can be expanded to densities of 6 to 24 pounds per cubic foot. **No. 27**

Leather footwear, linemen's belts and gloves, and sporting goods, treated with Dow Corning 1109, remain water repellent for long periods of time; show greater resistance to oils and many chemicals. Silicone water repellent treatment does not impair "breathing" characteristics of leather. **No. 28**

Over 80 rubber companies, ready to make Silastic parts to your specification, are included in a revised listing of Silastic Fabricators. **No. 29**

For dependable service under the severe operating conditions frequently encountered in power distribution, welding and electronic applications, Class H transformers may be obtained from the companies included in the list of nearly 100 manufacturers of Class H Transformers. **No. 30**

"Tall Tales and Fabulous Facts" is a new 24-page booklet in which a parallel is drawn between the tall tales our ancestors told about such legendary characters as Paul Bunyan, Davy Crockett and Pecos Bill and some of the equally fabulous facts about Dow Corning silicone products. **No. 31**



Silicone Aluminum Finish On Cyclone Furnace Intact After 4 Years At Temperatures From 70 to 1400 F

In the manufacture of perlite, a lightweight plaster aggregate, Panacalite Pacific Inc., of Los Angeles expands crushed volcanic rock in a cyclone furnace. Originally the furnace stood outside, exposed to the weather. Four times a day it was charged, raising its surface temperature from 70 F to 1400 F.

Three different attempts were made to protect the furnace with aluminum pigmented organic paints. Each application failed completely in a few hours.

Then in December, 1949, the furnace and its hopper were sandblasted, treated with a phosphoric solution and painted

with a silicone-aluminum finish, Dutch Boy No. 5542, formulated by the Pacific Coast Branch of the National Lead Company. Exposed to the weather for a year, including rain which fell when the surface was at peak temperature, the finish was still in excellent condition when a building was erected around the furnace and the photo at left was taken.

The second photograph was taken 3 years after the building was constructed. No repainting or other maintenance has been done to date. After 4 years service, the silicone based finish has suffered no visible deterioration or loss of film continuity. **No. 23**

CLASS H RELIABILITY *continued*
That's the attitude that a steadily increasing number of engineers and management men are taking toward Class H insulation made with Dow Corning silicones. Used to uprate equipment by

as much as 50% or extend its service life more than 10 times, Class H gives maximum efficiency and maximum reliability at surprisingly little more cost than the next best class of insulation. **No. 24**

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Silicone Water Repellents
Silicone Bonding Resins
Silicone Electrical Insulating Resins
Silicone Molding Compounds
Silicone Expandable Resins
Silicone Defoamers
Silastic

In Canada: Fibreglas Canada Ltd., Toronto
In England: Midland Silicones Ltd., London

Cabinet Components For Electronic Equipment



These components permit manufacturers and users of electronic equipment to build finished cabinets without special tools. Known as "Widney - Dorlec" Cabinet Components, they consist of a series of pre-fabricated, die-cast

corners, extruded sections, and other special parts. Also available is an extensive group of telescopic mountings and hardware.

Framework components are available in three different radii: standard gage (1-3/16"), small gage (13/16"), and miniature gage (7/16"). By varying the combination of standard, slope, or flat-top die-cast corners with appropriate crossbar and main frame sections, any desired size or shape of cabinet may be assembled. British Industries Corp., Dept. ED, 164 Duane St., New York 13, N. Y.

CIRCLE ED-79 ON READER-SERVICE CARD FOR MORE INFORMATION

Frequency Meter

Has 2400 to 10,200Mc Range



The Model 802 Frequency Meter, able to tune the entire radar spectrum, has a frequency range from 2400Mc to 10,200 Mc and an accuracy of 0.2%. It provides a transmission indication on a built-in 50 μ -amp meter.

Specifications include a sensitivity

of 10mw to 5w and a temperature coefficient of 15 parts per million per degree C. The resonant elements consist of High Q coaxial cavities tuned by a precision micrometer head. A vernier type crank knob allows rapid tuning and precise setting of frequency. Broad band non-contacting shorts are used to eliminate all sliding contacts. The cavities are plated with silver and rhodium, insuring a high conductivity surface that will not tarnish or corrode.

An output jack is provided for connection to an external amplifier or galvanometer for increased sensitivity. Nassau Research & Development Associates, Inc., Dept. ED, 66 Main St., Mineola, N. Y.

CIRCLE ED-80 ON READER-SERVICE CARD FOR MORE INFORMATION

◀ CIRCLE ED-166 ON READER-SERVICE CARD

ENGINEERS:

DOES YOUR
PRESENT JOB
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ADVANTAGES?

POSITIONS NOW OPEN FOR SENIOR DEVELOPMENT AND DESIGN ENGINEERS:

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IN YOUR CITY.** A copy of our booklet "Challenge and Opportunity," describing the role of the engineer in RCA, will be mailed upon request. Please send a complete resume of your education and experience to:

MR. JOHN R. WELD
Employment Manager, 201-K
Radio Corporation of America
30 Rockefeller Plaza
New York 20, N.Y.

CHECK SHEET

Yes No

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RADIO CORPORATION of AMERICA

CIRCLE ED-81 ON READER-SERVICE CARD FOR MORE INFORMATION

FORD control motors...

for extremely low inertia and high frequency response

HIGH VOLTAGE MOTORS
60 Cycle, 1 1/2 - 5 - 10 watt models
Designed specifically for electronic systems—operate directly in the plate circuit of a vacuum tube amplifier.

LOW VOLTAGE MOTORS
60 and 400 Cycle, 2 1/2 - 5-10 watt models
Recommended for normal two-phase applications.

advantages

- Linear torque—voltage characteristics
- Linear torque—speed characteristics
- Withstand continuous stalling
- High torque efficiency
- Flexibility of mounting

Write for Descriptive Brochure about all Ford Control Motors.

FORD INSTRUMENT COMPANY
Division of The Sperry Corporation
31-10 Thomson Avenue, Long Island City 1, N.Y.

CIRCLE ED-82 ON READER-SERVICE CARD FOR MORE INFORMATION

INTERNATIONAL RECTIFIER CORPORATION
EL SEGUNDO CALIFORNIA

Selenium Diodes



Actual Size

DIAMETER: From 1/4" to 13/32"
LENGTH: From 1/4" to 1/2"
RMS applied voltage: From 26 volts to 208 volts
DC output voltage: From 20 volts to 160 volts
DC output current: avg. from 200 microamperes to 11 milliamperes

Reverse Leakage at 10 volts RMS: 0.6 microamperes to 2.4 microamperes
Potted in thermosetting compound
Temperature Range: From -60° C to 100° C
Available in 1, 2, 3, 4, 5, 6, 7 and 8 cell Diodes.

WRITE FOR BULLETIN SD-1

INTERNATIONAL RECTIFIER CORPORATION

1521 E. Grand Ave., El Segundo, Calif. Phone: ORegon 8-3778
CHICAGO 205 W. Wacker Drive. Phone: Franklin 2-3889
NEW YORK 501 Madison Avenue. Phone: Plaza 5-8665

CIRCLE ED-84 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products...

High Frequency Cables

Have Low Radiation Loss



"Rotaxial" Cables are designed to give exceedingly low radiation losses

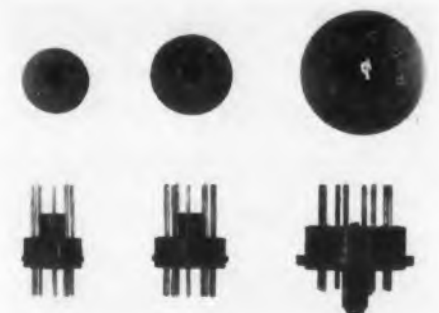
and consistent peak performance over the entire u-h-f range. They are constructed in double braid, single jacket, and double braid, double jacketed types. These units also fulfill general high frequency needs as required for JAN uses and correspond to the RG 11/U and RG 59/U JAN types. The cables are also available in single braid, air capacitance, and armored types. U. S. Wire and Cable Corp., Dept. ED, Progress & Monroe Sts., Union, N. J.

CIRCLE ED-85 ON READER-SERVICE CARD FOR MORE INFORMATION

Tube Base Plugs

Fit Miniature and Octal Sockets

These three plugs fit seven and nine pin miniature sockets and the eight pin octal socket, respectively. Bodies are mica-filled phenolic and may be mounted by means of a center



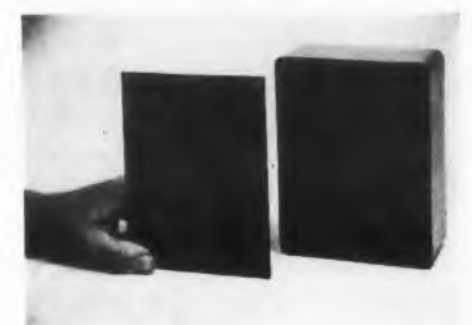
screw or retaining ring. Uses include application to small plug-in units, potted circuits, and tube adaptation. Round cans to slip over the plugs are available. Vector Electronic Co., Dept. ED, 3352 San Fernando Rd., Los Angeles 65, Calif.

CIRCLE ED-86 ON READER-SERVICE CARD FOR MORE INFORMATION

One-Piece Cases

For Electronic Instruments

These Bakelite cases are molded in one piece, have threaded brass corner inserts, and are provided with accurately fitted 1/8" blank Bakelite panels.



They are designed for electronic instruments requiring high insulation protection. No. 8201 measures 6-1/4" x 3-3/4" x 2" high, and No. 8202 measures 6-3/4" x 5-1/4" x 2-3/8" high. Insuline Corp. of America, Dept. ED, 3602 35th Ave., Long Island City 1, N. Y.

CIRCLE ED-87 ON READER-SERVICE CARD FOR MORE INFORMATION

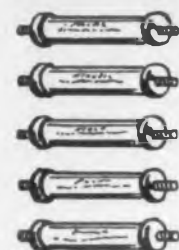


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Plastic Film Dielectric CAPACITORS

with all of the advantages:



Glass container design
Smaller volume
Easier to mount
Hermetically sealed
Lighter weight

By selecting the proper plastic film dielectric, electrical characteristics are
Highest voltage per size
Lowest dielectric absorption
Lowest power factor
Highest resistance
Highest stability with life
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Plastic Capacitors, Inc.

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CIRCLE ED-83 ON READER-SERVICE CARD FOR MORE INFORMATION



is this your timing problem?

Sorry! A. W. Haydon Company Can't Help Your Timing Here.

Only a "pro" and practice can straighten you out!

But . . .

We are the "pro's" for precision timing. Come to us with these timing problems. You'll find that we have solved more complex A.C. and D.C. timing problems than just about anybody else. Maybe we have already solved yours. It costs you nothing to find out. Write for catalog.



CIRCLE ED-88 ON READER-SERVICE CARD FOR MORE INFORMATION

RESINITE

Provides you the HIGHEST RESISTIVITY of any RESINATED PRODUCT

Resinite Coil Forms are laboratory tested and field proven. Their operating characteristics—volume resistivity . . . power factor . . . thermal properties . . . low moisture absorption . . . and resistance to voltage breakdown—represent a new achievement in basic components for electronic application.

Resinite Coil Forms are available with inside or outside threads, slotted, punched or embossed. Axial pressure in excess of 25 lbs. is accomplished through a special three row threaded design. Torque can be controlled to + or -1 in. oz.

RESINITE 8104: for coil forms requiring very high dielectric properties under extreme humidity.

RESINITE "AC": for applications requiring very high dielectric strength. Electrolytic corrosion is impossible.

RESINITE 104: for stapling, severe forming, fabricating. Send today for full details and technical information.

RESINITE CORPORATION
DIVISION OF PRECISION PAPER TUBE

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79 Chapel St., Hartford, Conn.

CIRCLE ED-89 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC DESIGN • November 1953

Microwave Wattmeter Self-Balancing Bridge Type



The Model 309 Microwave Watermeter is a universal, direct-reading, self-balancing bridge type of Microwave Power Meter that can be used with all popular barretter or thermistor bolometers.

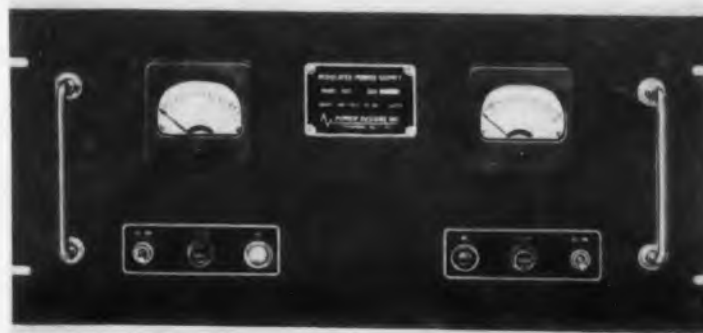
Its basic ranges of 0-1mw, 0-3mw, and 0-10mw may be extended by preceding the bolometer and its mount with an attenuator or directional coupler. Frequency range is limited only by the bolometer mount characteristics.

In addition to general purpose power measurements, the instrument can be used for calibrating r-f voltmeters and generators. It also serves as a versatile microwave detector. Power supply is 105-125v a-c, 60w. Accuracy is 3% exclusive of mount and attenuators. Brunswick Instruments, Dept. ED, P. O. Box 813, New Brunswick, N. J.

CIRCLE ED-90 ON READER-SERVICE CARD FOR MORE INFORMATION

Power Supply

Provides Stabilized D-C



The Model 351 is a stabilized power supply designed to furnish d-c power to equipment where close performance tolerances, rapid recovery time, and freedom from transient responses are required. Rated for 100% duty cycle, regulation is held to $\pm 0.1\%$ for line variations from 150-125v, and load variations from zero to maximum output current ratings.

Ripple and noise level is less than 1mv. Internal impedance is less than 0.4 ohms. Recovery time for instantaneous application of full load from a no-load condition is less than 8 millisecc. Stability is guaranteed to within 0.5% per day.

The supply has an operating range of 150-350v d-c with a load of 0-15ma max. It has a standard 19" rack panel, 8-3/4" high, with a maximum depth behind the panel of 9-1/4". Power Designs, Inc., Dept. ED, 119-22 Atlantic Ave., Richmond Hill 19, N. Y.

CIRCLE ED-91 ON READER-SERVICE CARD FOR MORE INFORMATION

Top-liner for Top Designers

PUSH BUTTON CASTELL LOCKTITE HOLDER AND CASTELL IMPORTED LEAD

- One-hand clutch operation avoids touching lead, smearing fingers or drawing.
- Exclusive collet holds lead in bulldog grip, prevents it slipping back into holder.
- Clean, balanced, efficient for every type of drawing, sketching, rendering, coloring.

CASTELL Imported Lead

18 degrees, 7B to 9H—gives more prints—cleaner and sharper prints—than any other drawing lead. Lasts 25% to 33 1/2% longer. Black or colored. Your Drawing and Art Supply Dealer has them.

CASTELL
the drawing pencil with the Master Degrees

AW FABER CASTELL U.S.A. 2H
REFILL IMPORTED FROM AMERICAN ZONE * 1 DOZEN 9030 2H

AW FABER-CASTELL
PENCIL COMPANY, INC. NEWARK, N. J.

CIRCLE ED-92 ON READER-SERVICE CARD FOR MORE INFORMATION

MAKE THE RIGHT CONNECTIONS WITH SUPERIOR 5-WAY BINDING POSTS

AVAILABLE IN BLACK and RED

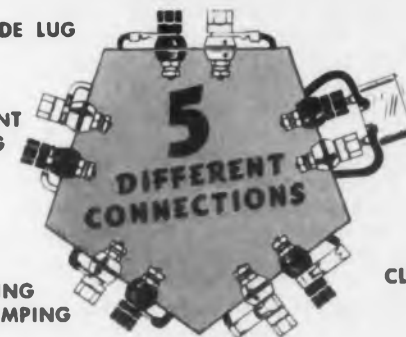


ACTUAL SIZE

bringing you greater

CONVENIENCE, VERSATILITY, DEPENDABILITY

SPADE LUG
PERMANENT CLAMPING



BANANA PLUG

LOOPING AND CLAMPING

CLIP-LEAD

Made of only the finest materials—tough phenolic and brass—5-WAY Binding Posts are better electrically and more rugged mechanically. They are easily mounted in any panel from 1/16" to 1/4" by a single keyed or unkeyed hole and provide complete insulation from the panel.

Current capacity is 30 amperes with a working voltage of 1,000 volts. Available in RED or BLACK to provide easy circuit or polarity identification.

FOR DESCRIPTIVE LITERATURE and A FREE SAMPLE, WRITE ON YOUR COMPANY LETTERHEAD TO 1711 MAE AVENUE, BRISTOL, CONN.

THE SUPERIOR ELECTRIC CO.
BRISTOL, CONNECTICUT



CIRCLE ED-93 ON READER-SERVICE CARD FOR MORE INFORMATION



ELECTRO-MECHANICAL ASSEMBLIES

to your specs

DESIGN • DEVELOPMENT • PRODUCTION

Top project engineers seeking a contract designer and manufacturer for electro-mechanical assemblies have been turning to PM Industries for the past twelve years. Our accomplishments include slip ring assemblies ranging from heavy duty to instrument grade, operator control grips, potentiometer linkages, high speed rotary switches, aircraft winches, square wave generators, and many others. We are organized to design or re-design as necessary, develop, and manufacture.

Your request for full information will get prompt attention. Write PM Industries, Inc., Stamford, Connecticut.

PMI Industries Inc., Stamford, Conn.

CIRCLE ED-94 ON READER-SERVICE CARD FOR MORE INFORMATION

Plastics Fabricating SPECIALISTS

The selection of plastics component parts should start at the design engineer's desk. When his product depends on prompt delivery of fabricated plastics, he looks to reputation for results.

For twenty-five years Insulating Fabricators, Inc. has been successfully producing plastics parts with the precision demanded by the exacting requirements of electronic industries. Machining plastics to close tolerances is our specialty.

Large inventories of all types of plastics material are constantly maintained. Complete equipment for every kind of machining operation makes prompt, efficient service on prototypes and production parts our criterion.

Let us work with you on your plastics fabricating problems.

FABRICATORS and DISTRIBUTORS

Kel-F	Milling	Nylon
Teflon	Drilling	Rexolite
Laminates	Screw Machines	Plexiglas
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Vulc. Fiber	Flycutting	Polyethylene
	Punching	

Complete price catalogue on request

INSULATING FABRICATORS, INC.

151 Union Avenue
East Rutherford, N. J.

70 Grove St.
Watertown, Mass.

CIRCLE ED-95 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Magnetic Binary Counter

Counts at Rates up to 50kc



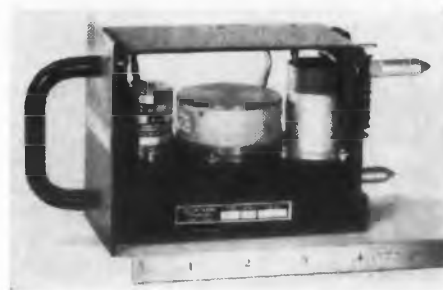
The LFE Model 1001 Magnetic 9-Stage Binary Counter is a plug-in package that counts at rates up to 50kc. It measures only 8" x 2" x 2" and has the additional advantages of low power requirements, wide tolerance on power supply variations, and minimum number of tubes. Major applications are those relating to pulse rate sealing and digital control systems. It can be applied to perform such functions as integration, addition, multiplication and division when used with other plug-in packages made by this firm.

Also available is another new device, the LFE Model 1002 Gating Unit Plug-In Package which is used in combination with the Model 1001 to permit pulse multiplication and division, scale factoring and other functions. Laboratory for Electronics, Inc., Dept. ED, 75-4 Pitts St., Boston 14, Mass.

CIRCLE ED-96 ON READER-SERVICE CARD FOR MORE INFORMATION

Servo Sub-Assemblies

Wide Variety Available



These sub-assemblies are available in unlimited combinations, with newly designed motors, motor generators, gear trains and synchros. They combine precision servo system components into convenient, practical assemblies.

Typical of the complete line is the compact plug-in unit illustrated. It contains a Type 11M motor driving potentiometer, and a Type 11C synchro. Rotation of the potentiometer is limited by internal stops to 300°. The gear ratio between synchro and potentiometer is 2.5:1. The gears are protected by a slip clutch. Transicoil Corp., Dept. ED, 107 Grand St., New York 13, N. Y.

CIRCLE ED-97 ON READER-SERVICE CARD FOR MORE INFORMATION

MINIATURE FANS

ROTRON MODEL DF FANS are a fine example of the thorough engineering and specialized experience built into all ROTRON components.

Purposefully designed for use in compact electronic assemblies, these fans are SELF-CONTAINED including bellmouth and mounting spider.

MODEL DF
FANS
ARE AVAILABLE
IN

48

DIFFERENT
TYPES

1φ, 3φ, DC
50-60-400 CPS
VAR. FREQUENCY



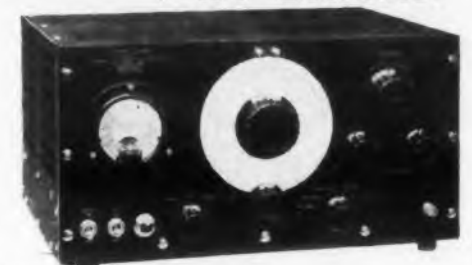
Special HI-ALTITUDE FANS are made with shaft speeds varying with altitude compensating for loss of air density and resulting in constant cooling efficiency.

ROTRON
MANUFACTURING COMPANY
7 SCHOONMAKER LANE WOODSTOCK, N. Y.

CIRCLE ED-98 ON READER-SERVICE CARD FOR MORE INFORMATION

Test
Inspect
Compare } the superiority
of **TE**
R-F Oscillator

Type 410-A



- Features high stability
- Low output impedance
- High output level
- Modulated output available

Another quality instrument in the line offered by Technology Instrument Corporation, the R-F Power Oscillator Type 410-A is used as a signal source for radio frequency bridges and general laboratory measurements.

SPECIFICATIONS

Frequency range:
100 Kc to 10 Mc in six bands
Frequency calibration:
Accurate to ± 0.5% or better
Output voltage range:
Approximately 12 volts to NORMAL position. In HIGH position, approximately 30 volts up to 4.65 Mc., decreasing slightly thereafter. Voltages are for open-circuit condition.
Output impedance:
Approximately 50 ohms
Output level switch:
Selects normal output for minimum distortion or high output where some distortion is permissible
Modulation:
1000 cps modulation available in MOD position for signal identification purposes.

Write for name of nearest representative

TECHNOLOGY INSTRUMENT CORP.

555 Main Street • Acton, Mass. • ACton 3-7711

CIRCLE ED-99 ON READER-SERVICE CARD FOR MORE INFORMATION

Miniature Insulated Wire

Stays Flexible at -70°C

Permanent flexibility at extremely low temperatures is a feature of this miniature insulated wire which is especially useful for electronic instruments and other miniature assemblies. At -70°C the wire can be pinched into a right angle bend without cracking the insulation. It is available in sizes from No. 32 through No. 20, stranded or braided, and in a variety of colors.

Other characteristics include a temperature range of -70°C to $+105^{\circ}\text{C}$; fungus proofing; resistance to acids, alkalis, and petroleum products; a water absorption of 0.74% after 24 hr; and a dielectric strength of 1000v/mil (spark test). Also available are other insulated wires including braided shielded wire, u-h-f and v-h-f, and TV transmission lines. Pitbar-Garrison Co., Inc., Dept. ED, 3 Columbus Ave., Kenilworth, N. J.

CIRCLE ED-100 ON READER-SERVICE CARD

Aluminum Coating Process

High Dielectric Coating

This firm is devoting its entire facilities to the Alcoa MHC (Martin Hard-Coating) Process for the hard-coating of aluminum. The hardened surface, generally 0.002" thick, approximates case-hardened steel or chromium plating, has a very high resistance to abrasion and corrosion, a low coefficient of friction, and a high dielectric strength which makes the process useful for many electronic applications.

The MHC Process is a special anodic treatment that creates an amorphous coat of aluminum oxide. The coating grows equally above and below the original surface, so that an 0.002" coating increases thickness 0.001" on the surface. Most aluminum alloys are suitable for the process. The coating can be applied selectively or to the entire surface. Its color, determined by the alloy, ranges between amber and black. Anodic, Inc., Dept. ED, Salt St., Bridgeport 5, Conn.

CIRCLE ED-101 ON READER-SERVICE CARD

CIRCLE ED-102 ON READER-SERVICE CARD



NEW 38-PAGE ILLUSTRATED CATALOG—

Describes Electrical and Mechanical characteristics. Special Features and Constructions of a complete line of variable resistors for military and civilian use. Includes dimensional drawings of each resistor. Write today for your copy.

TYPE 45, (JAN-R-94, Type RVZ)
1/4 watt, 15/16" diameter variable composition resistor. Also available with other special military features not covered by JAN-R-94 including concentric shaft tandem construction. Attached switch can be supplied.



TYPE 35, (JAN-R-94, Type RVZ)
1/2 watt, 1 1/8" diameter variable composition resistor. Also available with other special military features not covered by JAN-R-94 including concentric shaft tandem construction. Attached switch can be supplied.



TYPE 132, (JAN-R-19, Type RA20)
2 watt, 1 7/8" diameter variable wirewound resistor. Also available with other special military features not covered by JAN-R-19 including concentric shaft tandem construction. Attached switch can be supplied.



TYPE 25, (JAN-R-19, Type RA20)
(May also be used as Type RA20)
4 watt, 1 7/8" diameter variable wirewound resistor. Also available with other special military features not covered by JAN-R-19 including concentric shaft tandem construction. Attached switch can be supplied.



TYPE 46, (Military)
1/2 watt 70°C , 3/4" diameter wirewound variable composition resistor.



TYPE 46
1 watt 70°C , 15/16" diameter variable composition resistor. Attached switch can be supplied. Also available in concentric shaft tandem construction.



TYPE 46, (JAN-R-94, Type RVZ)
2 watt 70°C , 1 1/8" diameter variable composition resistor. Also available with other special military features not covered by JAN-R-94 including concentric shaft tandem construction. Attached switch can be supplied.

COMPLETE MILITARY LINE

Immediate delivery from stock on 189 types including JAN-R-94 and JAN-R-19 types of variable resistors.

REPRESENTATIVE	IN CANADA
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UNPRECEDENTED PERFORMANCE CHARACTERISTICS

Specialty designed for military use with unusual temperature stability and immunity ranges. -55°C to $+125^{\circ}\text{C}$ —ability to withstand

CTS

CHICAGO TELEPHONE SUPPLY
Corporation

Specialists in Precision Mass Production of Variable Resistors

New Literature . . .

Pyrometer Supplies

103

This 48-page catalog, "Buyers' Guide 100-5" describes, illustrates, and lists prices and sizes of all general-purpose thermocouple assemblies produced by this firm, and covers many special-purpose assemblies as well. Numerous pages are included on such thermocouple components as protecting tubes, thermocouple and extension wires, wells, heads, terminal blocks, and a variety of other functional items. A section of the guide is devoted to thermocouple theory and practice, selection data, and characteristics. Industrial Division, Minneapolis-Honeywell Regulator Co., Wayne and Windrim Aves., Philadelphia 44, Pa.

Cathode-Ray Oscillograph

104

A 4-page, 2-color bulletin on the new Type 322-A Cathode-ray Oscillograph contains complete technical specifications, description, and photo-recordings made with the instrument. A dual-beam unit which permits two signals to be observed together on the screen, it features built-in independent voltage calibration for both beams. Allen B. Du Mont Laboratories, Inc., 760 Bloomfield Ave., Clifton, N. J.

Testing Instruments

105

This 16-page bulletin (GEA-5469B) is a buyer's guide on electric testing instruments. It provides application data, features prices, and other information on hook-on voltmeters, wattmeters, and power-factor meters; portable recorders; voltmeters and ammeters; phase sequence indicators; hand pyrometers; surface roughness scales; insulation-resistance meters; and other equipment. General Electric Co., Schenectady 5, N. Y.

Tantalum Capacitors

106

Bulletin 6.100-1 describes, in 4-pages a new series of tantalum capacitors of the porous tantalum electrode type. Three physical sizes of capacitors are listed in a variety of capacity and working voltage ratings, ranging from 325mfd at 6v, d-c, to 25mfd at 125v, d-c. Curves show typical temperature characteristics. Fansteel Metallurgical Corp., North Chicago, Ill.

Pulse Height Analyzer

107

This 4-page bulletin illustrates and describes both the Model 115 Single Channel Pulse Height Analyzer for studies of the amplitude distribution of electrical pulses between 0 and 100v; and the Model 418 Oak Ridge A-1 Linear Amplifier, which amplifies small pulses to a level where they can be seen on an oscilloscope and counted with a scaler. Specifications and characteristics of both of these instruments are provided. Radiation Instrument Development Laboratory, 2337 W. 67th St., Chicago 36, Ill.

Terminal Blocks

108

The "Lok-A-Blok", which enables users to build their own terminal blocks in various lengths and combinations up to 25 poles without waste, is covered in this 4-page, 3-color bulletin. A graphic description of how a typical block can be assembled easily and without tools from the three simple components is included. Ilco Copper Tube & Products Co., Inc., Cincinnati 27, Ohio.

Electronic Products

109

The 1954 edition of this firm's catalog (135) contains 264 pages of listings, descriptions, illustrations, and prices of thousands of pieces of radio, TV, and industrial electronics equipment. A few of the sections cover adapters, amplifiers, books, cable, chokes, connectors, filters, hardware, inverters, jacks, mobile equipment, oscillators, photoelectric equipment, receivers, tape recorders, timers, transformers, tubes, variable capacitors, wire, and speakers. Allied Radio 100 N. Western Ave., Chicago 80, Ill.

Fibre and Plastic Products

110

A 12-page catalog (GF-54) is designed to serve as a handbook of the many products of this firm. It describes the products, uses, and lists detailed technical data in tabular form. Included are sheet grades of vulcanized fibre; "Dilecto" laminated plastic sheets, rods, and tubes; spiral tubing; "Teflon" sheets, tapes and specialties; "Celeron" molded industrial plastics; "Micabond" tapes, plate, tubing, segments, and V-rings; and silicone tapes. Continental-Diamond Fibre Co., Newark, Del.

Process Control Analysis

111

The "Techlopedia" is a new monthly bulletin compiled and authored by this firm's engineers. Intended as "an encyclopedia of technical information", each edition will contain at least two articles on the mathematical aspects of process work and related fields and applications to specific equipment or techniques. Ordinarily, one article will deal with an essentially chemical or process problem, and the other with some mechanical phase of design associated with process work. The first edition contains a monograph on "Continuous Reactors" and "An Analysis of Shafting Design." Techniflex Corp., Port Jervis, N. Y.

Silicone Products

112

The 4-page 1953-54 "Reference Guide" to this firm's silicone products includes 15 new products, ranging from adhesives to molding compounds. It is divided into sections on silicone fluids, adhesives, release agents, compounds, greases, water repellents, protective coating resins, bonding resins, electrical insulating varnishes, molding compounds, expansible silicone resins, defoamers, and "Silastic" silicone rubber. Dow Corning Corp., Midland, Mich.

Vibration Isolator

113

Bulletin 532 (4-page, 2-color) presents complete technical and performance data on the company's Type 915 vibration isolator. The unit was designed to isolate vibration and structure-borne noise from high-speed machinery such as motor generator sets, compressors, grinders, fans, and blowers. Information includes typical application practice, load range data, physical dimensions, isolation efficiency at various frequencies, and variation of natural frequency over the range of rated loads. Barry Corp., 875 Pleasant St., Watertown 72, Mass.

Coaxial Attenuators

114

A complete line of coaxial attenuators from 0.1db to 60db is covered in a 4-page bulletin. The attenuators may be procured singly or in a turret selector containing any six values of attenuation. The various types are described and illustrated, and specifications are provided. Stoddart Aircraft Radio Co., Inc., 6644 Santa Monica Blvd., Hollywood 38, Calif.

Ignitron

115

A 2-page technical data sheet describes and illustrates the Type NL-5551 ignitron tube, a metal, water-cooled, mercury pool tube with a rating approximately equivalent to a 300amp magnetic contactor. Data on dimensions, general characteristics, a-c control applications, rectifier applications, and other information are included. National Electronics, Inc., Geneva, Ill.

SWEEPS BETWEEN 4 AND 220 MC IN 4 BANDS



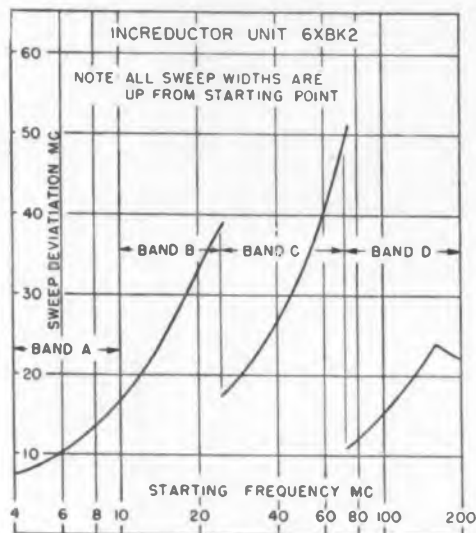
The heart of a sweep generator is the device used to vary the oscillator frequency. The Type 6XBK2 INCREDUCTOR controllable inductor contains four current-controlled signal windings and provides for electronic sweep between 4 and 220 mc on four bands, all on fundamentals.

SPECIFICATIONS

Band	Frequency Ratio	Nominal Inductance
1	2.5:1	25 μ h
2	2.0:1	2.5 μ h
3	1.5:1	.50 μ h
4	1.1:1	.07 μ h

Over-all dimensions: 3/4" x 2 1/2" x 2 3/4"
Approximate weight: 12 oz.

A Colpitts oscillator circuit utilizing a 12AT7 is recommended. Starting frequency within each band may be set with a 75 μ mf dual capacitor. The graph below shows the obtainable sweep at any starting frequency between 4 and 200 mc.



* Trademark

PRICE: \$19.50

CGS Laboratories, Inc.



391 LUDLOW STREET
STAMFORD, CONNECTICUT

CIRCLE ED-116 ON READER-SERVICE CARD

ELECTRONIC DESIGN • November 1953

Capacitors 117

Steatite-cased paper tubular capacitors are covered in detail in this 4-page bulletin. Featuring high humidity resistant characteristics and a variety of available ratings, the capacitors are illustrated and described with test data and graphs of temperature characteristics. Industrial Division, Cornell-Dubilier Electric Corporation, 333 Hamilton Blvd., South Plainfield, N. J.

Relays 118

A 12-page color bulletin illustrates and provides descriptions, dimension drawings, and detailed specifications on four relay types: the Series 100 d-c Computer Relay, the Series 300 d-c Miniature Relay, the Series 400 a-c or d-c Coaxial Relay, and the Series 500 d-c Communication Relay. Joseph Pollak Corp., 81 Freeport St., Boston 22, Mass.

Transformers and Coils 119

This 4-page, 2-color brochure describes the facilities of this firm's Transformer and Coil Manufacturing Division, as well as its design and development services. Many illustrations of different departments and equipments are given, and a variety of typical coils and transformers are listed. Transvision, Inc., New Rochelle, N. Y.

Insulators for Tubes 120

Bulletin 537, "Internal Insulators for Electronic Tubes," gives mechanical and electrical properties required in vacuum tube insulators. Lava and synthetic ceramics are then described in relation to these requirements. This 4-page, 3-color bulletin also contains many data on the properties of these materials. American Lava Corp., Chattanooga 5, Tenn.

Plastic Components 121

A 4-page, 2-color brochure describes various of the company's types of plastic components, including teflon, "Kel-f", nylon, laminated phenolics, "Formica", "Rexolite", polyethylene, and polystyrene. Each of these types is illustrated, and specification data are provided. Tolerances of 0.001" are held on production runs of these components. Tri-Point Mfg. & Developing Co., 401 Grand St., Brooklyn 11, N. Y.

Plate-Circuit Relay 122

A data sheet (Form C-1-753) describes a new relay having sharp single-impulse opening and closing. Especially suitable for plate-circuit applications, the relay incorporates a snap-acting switch with contacts suitable for highly inductive loads. Detailed specifications are provided. Thermo Instruments Co., 1306 Old Country Rd., Belmont, Calif.



BEAM POWER AMPLIFIER

for the ultimate in reliability where the 6L6 is called for . . .

Absolute reliability!

There, in two words, is the net result of all the engineering which TUNG-SOL has put into the 5881. This completely new tube is designed to operate in circuits for which the 6L6 is specified and is completely interchangeable wherever the 6L6 is now in use. Full utilization of the design and production techniques which have proved themselves over the past 15 years, has created this exceptionally reliable tube.

The 5881 is manufactured under laboratory conditions accompanied by the most severe tests. It is rugged both mechanically and electrically, with tremendous overload capacity. The 5881 maintains high efficiency throughout its life and provides low cost operation through reduced maintenance.

Where reliable service is essential in audio circuits, the TUNG-SOL 5881 is a "must." Order it from your regular TUNG-SOL supplier.

The TUNG-SOL engineering which has produced the 5881 is constantly at work on a multitude of special electron tube developments for industry. Many exceptionally efficient general and special purpose tubes have resulted. Information about this and other types are available on request to TUNG-SOL Commercial Engineering Department.



Tung-Sol Electric Inc., Newark 4, N. J.

Sales Offices: Atlanta, Chicago, Columbus, Culver City (Los Angeles), Dallas, Denver, Detroit, Newark, Seattle.

TUNG-SOL makes All-Glass Sealed Beam Lamps, Miniature Lamps, Signal Flashers, Picture Tubes, Radio, TV and Special Purpose Electron Tubes and Semiconductor Products.

TUNG-SOL ELECTRON TUBES

CIRCLE ED-123 ON READER-SERVICE CARD FOR MORE INFORMATION

MEASURING
FREQUENCY?

do it faster
more accurately
with unskilled operators

WITH

BERKELEY

DIRECT READING FREQUENCY METERS



Model 554



Model 555B



ON THE PRODUCTION LINE...

BERKELEY frequency meters give rapid and precise direct-reading digital display of the unknown frequency. Ideal for production-line checks with unskilled operators on crystals, filters, oscillators, transmitter assemblies—any application where precise frequency determination plays a part.

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Versatile, direct-reading BERKELEY frequency meters save time, reduce error in frequency measurements of all types. May also be used for measurement of flow, pressure, r.p.m., viscosity, velocity, etc. Printed readout available to record data on standard adding machine tape.

AT THE TRANSMITTER...

High accuracy, simplicity of operation, and direct-reading digital display of information make BERKELEY frequency meters favorites for transmitter monitoring!

SPECIFICATIONS

	Model 554	Model 555B	Model 5570
RANGE	20-100,000 cps	0-1,000,000 cps	0 cycle-42 mc
ACCURACY	± 1 cycle, ± crystal stability (see below)		
TIME BASE	Fixed, 1 second	Decade Multiples .0001 to 1 sec.	Decade Multiples .002 to 2 sec.
SHORT TERM STABILITY	Std. crystal: 1 part in 10 ⁷ Oven crystal: 1 part in 10 ⁸	(Oven Crystal) 1 part in 10 ⁸	(Oven Crystal) 1 part in 10 ⁷
INPUT (any wave form)	0.2-50 v. rms	0.2-25 v. rms	0.1 v. rms
DISPLAY	Direct reading digital—variable 1 to 5 seconds		
PANEL (Standard Rack)	19" x 8¾"	2 each 19" x 8¾"	2 ea. 19" x 8¾" 1 ea. 12¼" x 19"
DIMENSIONS	20¾" x 10½" x 15"	20¾" x 19" x 15"	32" x 21" x 16"
PRICE (f.o.b. factory)	\$775	\$995	\$1,990

For complete data, please write for Bulletin D11

Berkeley

Berkeley
ELECTRONIC LABORATORIES, INC.
100 UNIVERSITY AVENUE
BERKELEY, CALIF. 94720

New Literature . . .

Normal Probability Functions

"Tables of Normal Probability Functions," National Bureau of Standards Applied Mathematics Series 25, a 344-page, buckram-bound publication, is designed to meet the continuing demand for tables of statistical functions. It is a reprinting of the highly accurate tables in MT14, now out of print. Price of the publication is \$2.75. Write direct to Government Printing Office, Washington 25, D. C.

Hydraulic Servo Systems 126

This 4-page bulletin contains an article titled "Pressure-Control Versus Flow-Control in the Design of High Performance Hydraulic Servo Systems." It was written to illustrate the advantages of "pressure-control" in such systems, and it should be of interest and value to engineers in the automatic control field. Standard Controls, Inc., 1230 Poplar Pl., Seattle 44, Wash.

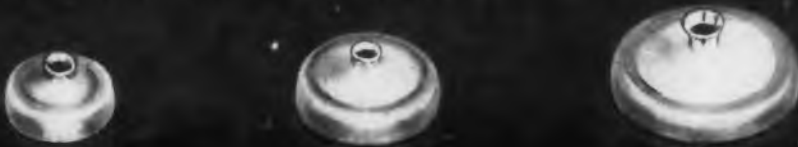
Transformers, Reactors 127

This 24-page catalog (530) presents a complete line of transformers for broadcast, laboratory, and other applications. Descriptions, illustrations, characteristics, and many curves are included. The catalog also provides a price list covering all items described. United Transformer Co., 150 Varick St., New York 13, N. Y.

Electrodeposition Research

A National Bureau of Standards Circular (No. 529), "Electrodeposition Research" is a 129-page publication which contains the papers given at a symposium sponsored by NBS to encourage further research in this field, to present current research results, and to facilitate the exchange of information. Papers cover a wide variety of subjects, ranging from research in a variety of countries to current and metal distribution in electrodeposition. Price of the publication is \$1.50. Write direct to Government Printing Office, Washington 25, D. C.

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THE HERMASEAL CO, Inc. Elkhart 45, Indiana

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Potting Compounds

130

A 10-page technical bulletin provides detailed data on Hysol 6000 Series potting, casting and encapsulating compounds. Sections are devoted to methods of modification, molds and mold release agents, instructions for use, and properties. Information on a new series of pigmented and filled modifications of Hysol 6020, a liquid epoxide resin which will cure at room temperatures through the addition of selected catalysts, is included. Houghton Laboratories, Inc., Olean, N.Y.

Point-Contact Transistors

131

A 4-page bulletin (No. DL-S 312) covers two types of hermetically sealed point-contact transistors. Mechanical specifications and complete electrical data are given. A 2-page section is included on the theory and applications of point-contact transistors, complete with formulas, equivalent circuits, and characteristic curves. Texas Instruments, Inc., 6000 Lemmon Ave., Dallas 9, Tex.

Synthetic Rubbers

132

Typical properties, uses, and compounding of "Thiokol" synthetic rubbers are described in this 4-page, 2-color bulletin. The information is designed to aid manufacturers in the selection of special-purpose elastomers to withstand oils and solvents, the effects of aging, and extremely low temperatures. Thiokol Chemical Corp., 780 N. Clinton Ave., Trenton 7, N. J.

Glass Seals

133

This 36-page catalog (No. 453) on Kovar metal-to-glass seals is divided into sections on: multi-terminal headers, diode and transistor bases-cases-covers, standard single terminals, crystal holders, tubular button type seals, stand-off terminals, strain relief terminals, dual lead terminals, high-voltage terminals, graded seals, bulb-type terminals, special seals, and Kovar Glass Windows. Also included is a section on designing special seals to meet specific applications. Stupakoff Ceramic & Mfg. Co., Latrobe, Pa.

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WEIRD DEVELOPMENTS



The other day we got a request for quotation from the Foul Fiends of the Air Procurement Agency, material required in conformance with a horrible list of spook specs. Sales didn't think we had a ghost of a chance, but the boys in the back room brushed the dead crows aside and went to work.

It seems that this year the Ghouls are trying out a new apparition apparatus which computes the spirit resistance of the victim during the ephemeral expedition so as to energize the ectoplasm at the optimum rate and range. Rate-correction is derived from the victim's tooth-chatter rep-rate up to within a few microseconds of the awful climax.



The required relay pulses electroplasm to the Cold cathode of the Spiritron whose emanations produce greenish light and jangle the chains through a phantom link. (The throat-clutch is engaged manually.) The normally closed contact puts a damping diode on the atmosphere control and prevents accidental dematerialization.



Fortunately, operating temperatures are never higher than cold blood, and even though humidity and corrosion requirements are — well — unspeakable, the boys have developed a very neat relay with controlled contact shudder, unaffected by screams of 60 db max. up to 2 kc and as sensitive as a will-of-the-wisp.



The job was done so promptly and brilliantly that we hope to cash in on this year's Hallowe'en business. The boys who did it are still out on a bat so we haven't anybody for the coffin-nail jobs right now, but brass-tack requests for relay developments will get a spirited† response.

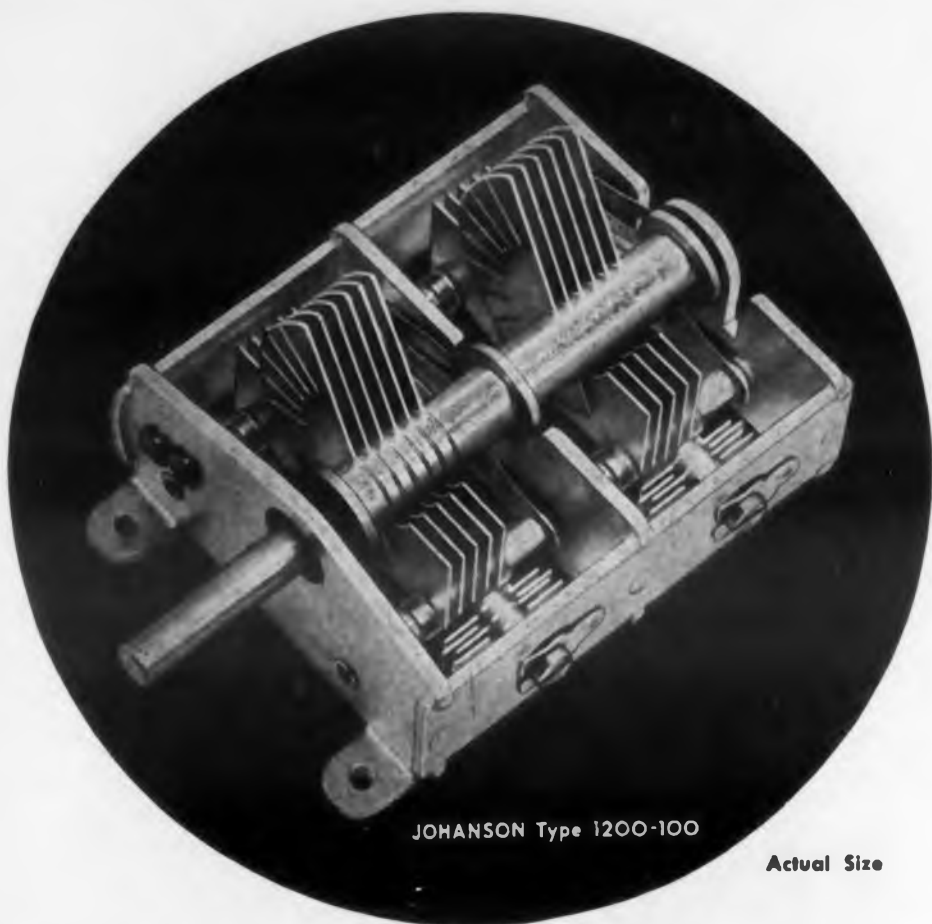


For example, this little prototype for switching 1000 watts was developed in about a month.

SIGMA

SIGMA INSTRUMENTS, INC.

91 PEARL ST., SO. BRAintree, BOSTON 85, MASS.



JOHANSON Type 1200-100

Actual Size

ANNOUNCING A NEW LINE OF VARIABLE AIR CAPACITORS

- Small size, of instrument quality
- Hardened stainless steel ball bearings
- Compression-loaded ceramic rod stator suspension
- Stable—High Q—Low minimum

Shown above is the new Johanson Type 1200-100 variable air capacitor. Of instrument quality, it is typical of the entire Johanson line. Notable among its many features is its simplicity of design for all U.H.F. and R.F. applications.

Its compact, lightweight frame is swaged and soldered. It has a three point mounting. Like all Johanson capacitors, this unit is provided with hardened stainless steel ball bearings. All rotors and stators are soldered to further insure its permanency. Wipers of hardened, silver-plated, beryllium copper avoid any electrical noise. The unit is constructed of silver-plated brass (or invar) for low surface resistance.

The compression-loaded ceramic rod stator suspension of each new Johanson variable air capacitor gives it an exceptionally long dielectric path and mechanical reliability. A variable air trimmer with a capacity of 6 mmfd. is an integral part of each section. All of the Johanson capacitors have high Q and low minimum capacities.

SPECIFICATIONS, TYPE 1200-100

2 Gang * Maximum capacity, 100 mmfd. * Minimum capacity, 6 mmfd.
 ΔC of trimmer, 5 mmfd. * Invar rotor and stator construction

Optional Features:

Insulated rotors can be supplied. Either CW or CCW rotation.
 Single section to 4-gang are standard units.

Write for complete information

Johanson

MANUFACTURING CORPORATION

16 Rockaway Valley Road Boonton, N. J.

CIRCLE ED-136 ON READER-SERVICE CARD FOR MORE INFORMATION

Patents . . . By John Montstream

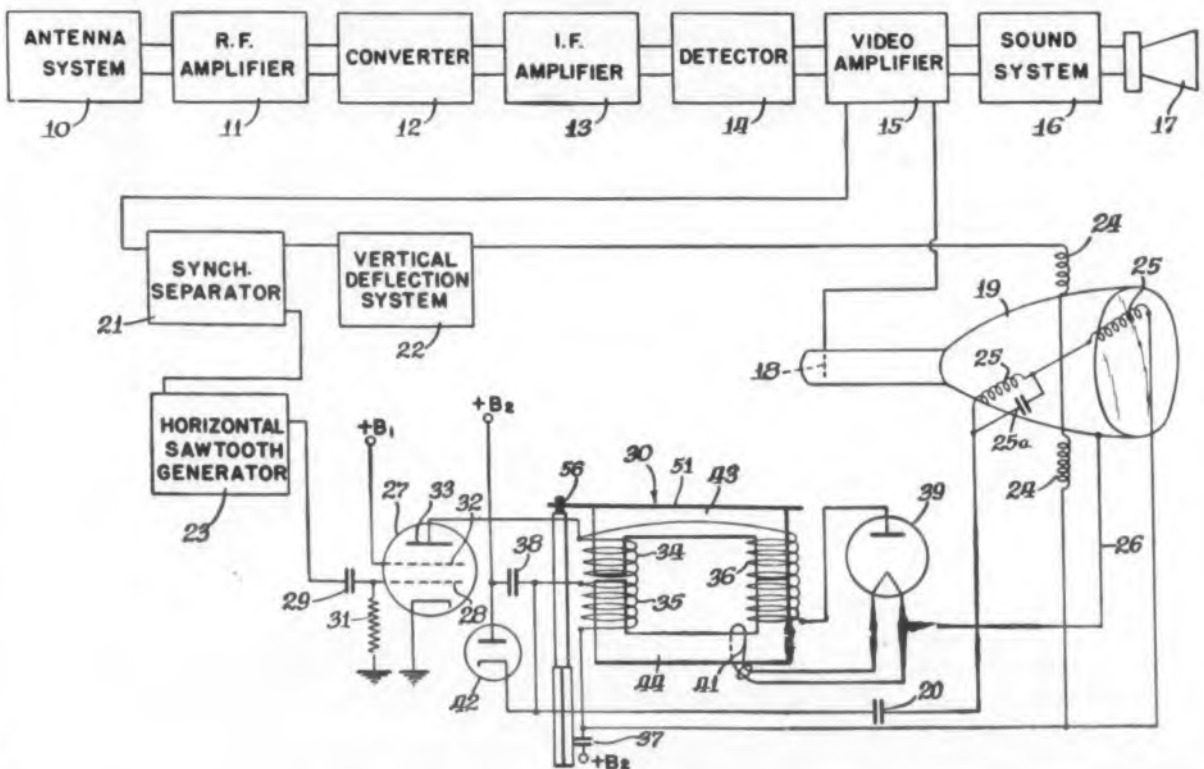
Television Circuit . . . Patent No. 2,644,104. George W. Fyler and Lawrence J. Mattingly, Lombard, Illinois. (Assigned to Motorola, Inc.).

It is usual practice to provide television circuits with horizontal size control for the picture, but the known circuits are either relatively expensive or are not wholly satisfactory in operation. The circuit of the patent secures horizontal size control by adjustment of the coupling choke unit of the sweep circuit and does not require any additional parts. The choke unit may be constructed so that adjustment of the acceleration voltage is secured as well, and one control may be adjusted independently of the other.

The coupling choke unit 30 by which the adjustment of horizontal picture size

and accelerating voltages is secured includes the series connected windings 34, 35 and 36 forming an autotransformer. Windings 34 and 35 form the primary section, winding 35 is the sweep secondary section, and all three windings form a high voltage secondary section connected through a rectifier (39) and connection 26 with the acceleration anode of cathode ray tube 19. The core is made up of two U-shaped sections (43 and 44) with provision made for adjusting the gap between the two sections. Fig. 1 shows an adjusting screw (56) for varying the gap in the core at windings 34 and 35 which controls the horizontal size of the picture. A similar control for the gap in the core for winding 36 controls the accelerating voltage. Each control may be adjusted independently of the other.

Fig. 1. Schematic diagram of a TV circuit which secures horizontal size control by means of a coupling choke in the sweep circuit.



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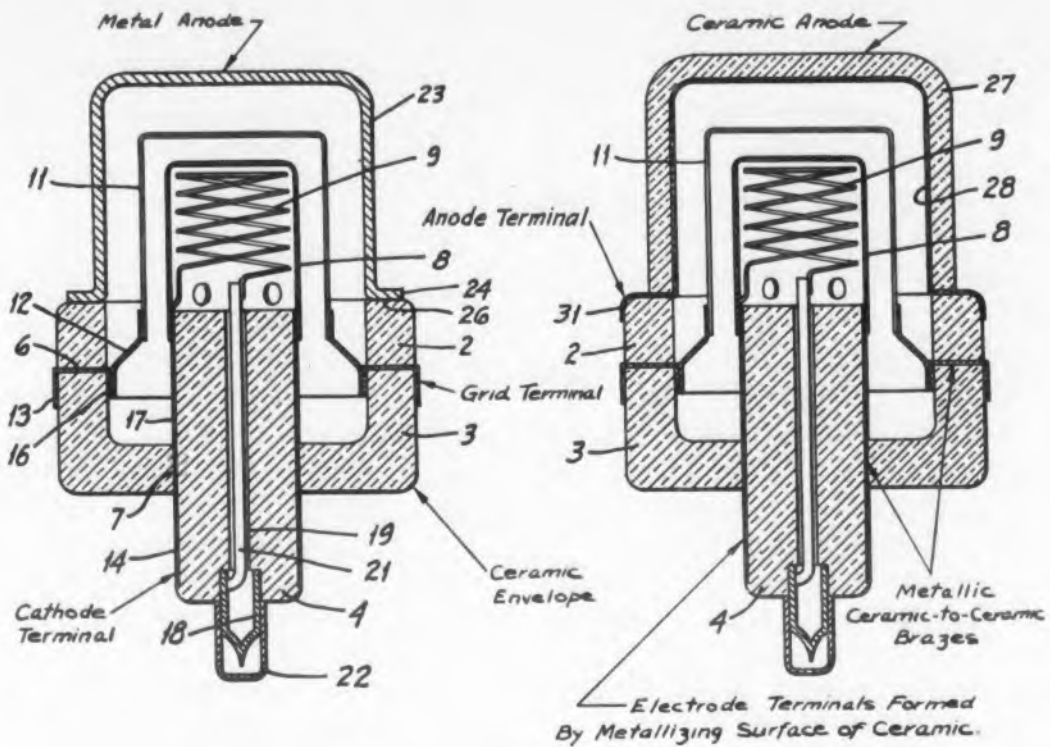


Fig. 2. Two forms of a ceramic electron tube which has improved electrical, thermal, and mechanical properties.

Ceramic Electron Tube . . . Patent No. 2,647,218. Harold E. Sorg et al, Redwood City, California. (Assigned to Eitel-McCullough, Inc.).

This ceramic tube provides improved electrical, thermal and mechanical properties. The tube is built up of ceramic sections metallurgically bonded together, with the bond serving as electrical connections to the electrodes within the tube. Metallized surfaces on the ceramic may also serve as terminals.

Two forms of tubes are illustrated in Fig. 2, and tubes include ceramic sections 2 and 3 bonded together by metal bond 6. A central tubular stem (4) has a metallized surface over most of its length which is bonded with section 3 and also forms a terminal and lead-in connection for cathode 8 and heater 9. The metallized bond 6 is connected with and forms a terminal and lead-in connection for grid 11. At the left in Fig. 2 the tube has a metal cap (23) which forms the anode, whereas the one at the right uses a ceramic cap (27) with an internal metallized surface (28) to form the anode which anode is connected with the metallized bond (31) between the cap (27) and section 2 to form a terminal and lead-in connection for the anode. A metal exhaust tubulation is provided for the central hole through the stem (4) which with the cap (22) forms

the other terminal for the heater (9).

The metallic bonds (6) and (7) may be sintered molybdenum powder or a mixture of metallic powders on the joining ceramic surfaces. These metallic surfaces are then brazed together. Titanium or zirconium hydride powders may also be used to form the metallized surfaces.

Selective Signalling System . . . Patent No. 2,626,384. Marion R. Winkler, Phoenix, Ariz. (Assigned to Motorola, Inc.).

A selective control system is described in the patent which is capable of communicating with a single receiver to convey a message to the one receiver, or communicating with several of receivers at the same time. The circuit accomplishes this by means of a transmitting station which generates a plurality of individual tones, the number of tones depending upon the number of receivers forming the system.

In order to call a single receiver, the transmitter transmits a pair of tones simultaneously for a short duration and then a second pair of tones for the same time. The receiver, responsive to these two pairs of tones, is connected with the transmitter. In order to call a group of receivers, a single tone of each pair is transmitted for a relatively long duration. The circuit is rugged and particularly designed for mobile units.

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IN INDUSTRIAL AND MILITARY applications, this small electromechanical signal generator transforms angular displacement into an electrical signal. It provides a linear output and a resolution to less than 0.01°. Tested and perfected as a standard military component for use in gyro instruments and computers, the DOELCAM Microsyn Position Indicator is now finding wide

application in the industrial fields of process control, data transmission, measurement of mechanical variables and analog computation.

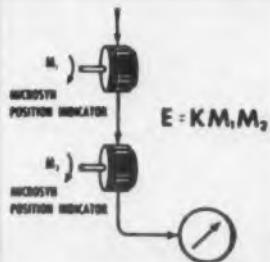
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West Coast Office: 304 Tejon Pl., Palos Verdes, Calif.
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Data Transmission



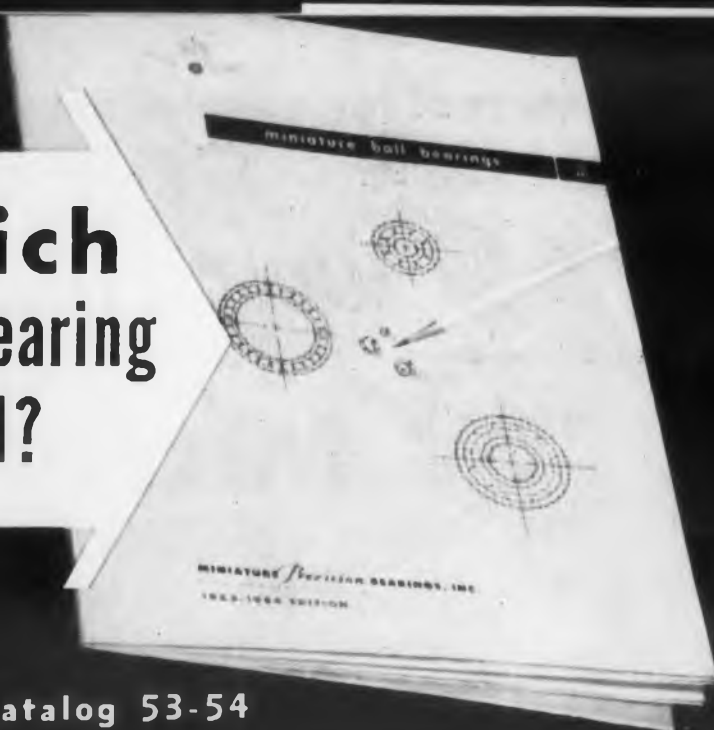
Process Control



Computation

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- Lubrication — what and how — including government specifications and commercial sources
- Recommended shaft and housing fits and shaft and shoulder data
- Radial and axial clearance graphs
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For the designer of precision mechanisms this new 20 page **MPB** catalog offers practical solutions of problems involving miniaturization. As suggested by the partial list of contents above, **MPB**, originator and pioneer manufacturer of miniature ball bearings, has compiled for you the most complete and detailed information ever offered on this subject.

Request the new **MPB** catalog 53-54 on your letterhead . . . it may help develop a new product idea for you. Also request data sheet ED 11.

**HOW DO THEY MAKE
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If you've ever wondered about it — you'll find the answer in "MIGHTY MINIATURES" — 15 minute, full-color, sound film. "MM" is the story of Miniature Precision Bearings — with the accent on manufacturing processes and uses of MPB bearings. It's available to qualified groups. Write Engineering Dept., MPB, Inc., Keene, N. H.



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AT . . .

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Keene, New Hampshire

MPB

Patents . . .

High Frequency Loop Antenna System

. . . Patent No. 2,650,303. Kurt Schlesinger, Maywood, Ill. (Assigned to Motorola, Inc.).

Television antennas or any high frequency antenna as presently used for transmission and reception require tuning for the channel to be received or transmitted and oriented as to its direction. The antenna described in this patent may be used without particular tuning or orienting for individual frequencies within the frequency range, and it can be built into a television receiver cabinet. A diagram of the antenna is shown in Fig. 3.

The antenna is of the loop type having two conducting sections (10 and 11) which may be formed by depositing conducting material on an insulating sheet. The antenna sections are V shaped, and arranged to form a square with their adjacent edges separated. Each side of the

antenna sections has a length substantially equal to 1/4 of the wave length of the highest frequency for a frequency of 216Mc is about 15". This gives a high response throughout the high frequency range.

Conductors 13, 14, 15 and 16 of standard balanced 300 ohm sections, about 10" long, form a transmission line connecting the antenna sections in parallel and the line is transposed so that each end of one antenna section is connected with the opposite end of the other antenna section. A tuning stub (21) forming a balanced 300 ohm line is connected at 30 between the sections of the transmission line. A capacitor (24) is connected across the tuning stub at 25 which is about 2" from junction 30 which effectively shorts the transmission line conductors with respect to the high frequency television range. At point 26 across the stub, which is about 5-1/2" from point 25, a tuned circuit 27, 28 is connected. The stub is also shorted at 29 and connected to the antenna section 11. The receiver may be connected at 32 and a small capacitor 31 is connected across the



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JFD PISTON TYPE VARIABLE TRIMMER CAPACITORS

in both civil and military equipment

No. VC 1 G (0.7 to 6.0 mmf.) Glass Dielectric
 No. VC 5 (1.0 to 10.0 mmf.) Quartz Dielectric
 No. VC 11 (1.0 to 10.0 mmf.) Quartz Dielectric
 No. VC 11 G (1.0 to 12.0 mmf.) Glass Dielectric
 No. VC 20 (0.5 to 1.9 mmf.) Glass Dielectric

NO OTHER LIKE IT!

- Approximately ZERO TEMPERATURE COEFFICIENT FOR QUARTZ AND INVAR construction.
- Approximately ± 50 PPM per degree C. for Glass and INVAR construction.
- One-piece SPRING LOADED PISTON and screw prevent backlash.
- SILVER BAND fused to exterior of precision drawn quartz or glass tube serves as optimum stationary electrode.
- "Q" of 1,000 at 1 mc.
- DIELECTRIC STRENGTH equals 1,000 volts DC at sea level pressure and 500 volts at 3.4 inches of mercury.
- 10,000 megohms INSULATION RESISTANCE MINIMUM.
- OPERATING TEMPERATURES, -55 C. to +125 C. with glass dielectric. -55 C. to +200 C. with quartz dielectric.
- Over 100 megohms MOISTURE RESISTANCE after 24 hours exposure to 95% humidity of room temperature.
- PISTON DIMENSIONAL ACCURACY is held to close tolerance maintaining minimum air gap between piston and cylinder wall.

Write for Form No. 199

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◀ CIRCLE ED-138 ON READER-SERVICE CARD

ELECTRONIC DESIGN • November 1953

ELEC

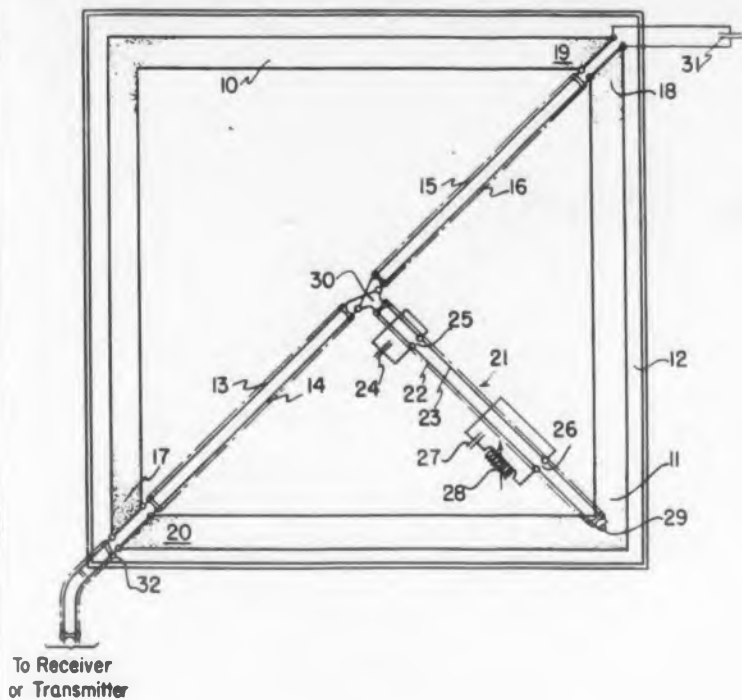


Fig. 3. This high frequency loop antenna can be used without tuning or orienting for individual frequencies, and can be built into a TV receiver cabinet.

opposite ends of the antenna sections.

The capacitor 24 provides the main tuning of the antenna for the low frequency television range which comprises two separate frequency ranges and effectively shorts the stub in the high frequency range.

Proper design of stub 21 and its components will emphasize the two ranges in the low frequency range. The patent gives considerable additional details as to the antenna structure, operation and modifications which may be made therein.

High Vacuum Industrial Rectifier Tubes

75 to 150 PKV Inverse Voltage, 0.75 to 10 Peak Anode Amperes



Machlett Laboratories offers a family of high-voltage, high-vacuum rectifier tubes for industrial and special applications. These tubes include:

	<i>Peak Inverse Voltage</i>	<i>Peak Anode Current</i>
ML-102A . . .	75 PKV	0.75 amp.
ML-5575/100	150 PKV	1.00 amp.
ML-5575/200	150 PKV	2.50 amp.
ML-199	110 PKV	10.00 amp.

Each tube incorporates a unique-design catenary filament which permits extremely close plate-filament spacings, giving low internal voltage drop and high average load current capacity. The catenary filament remains coaxial under electrostatic stress, contributing to long-life, uniform operation.

For industrial particle precipitation, high power test equipment, research, and other high voltage requirements, these tubes are the preferred choice.

Machlett Laboratories, Inc., 1063 Hope Street, Springdale, Conn.

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KELLOGG Magnetic Impulse Counter



- The long life normal to relay equipment!
- Occupies space of only two telephone relays!
- Operates over same wide range of pulse ratio and frequency as a chain of counting relays!

New, simple way to save space and money! Swiftly solves countless electro-mechanical switching problems. Replaces a two-magnet ten-point stepping switch or a chain of 10 to 20 relays, for counting and marking. Write for complete facts!

KELLOGG Midget Condenser Microphone

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Proved by sixteen years of superior service! Meets all requirements for precision sound measurements and high quality recording. Humidity-proof. Ruggedly built to exacting laboratory standards for accurate, stable and reliable performance. Use your letterhead to request full details—today! Dept. 68-K



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KELLOGG

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A Division of International Telephone and Telegraph Corporation

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New Books . . .

Communication Theory . . . Edited by Willis Jackson. 532 pages. Academic Press Inc., 125 East 23rd Street, New York 10, N. Y. \$11.00.

The papers read at a symposium on "Applications of Communication Theory" held at the Institution of Electrical Engineers, London, England, September 22-26, 1953, have been compiled in this book.

The application of mathematics to communication processes is a subject of interest to a wide range of scientists concerned with the processes by which living organisms convey information. This interest prompted the organization of a symposium of "Information Theory" which was held in 1950. On that occasion it was decided to have another gathering with the objective of examining the practical value of the theory to the problems of electrical communication. This book consists of the papers presented at the second symposium, together with the resulting discussions.

The book begins with a brief opening address, and then presents a summary of communication theory which serves as a refresher for nonspecialists. These are followed by a group of nine papers on transmission systems and coding, covering such topics as "A Comparison of Transmission Systems", "A Method for the Construction of Minimum-Redundancy Codes", "Efficiency of Noise-Reducing Codes", and "Nonlinear Distortion in Pulse Code Modulation Systems".

The next section deals with transmission in the presence of noise—signal discrimination. Here eight papers are presented on such subjects as "Exhaustion Methods of Selecting Signals from Noisy Backgrounds", "Integration in Pulse Radar Systems", "Video Signal Integration Using a Storage Tube", and "Statistical Methods for the Detection of Pulsed Radar in Noise".

Characteristics of transmission channels are treated in the following section which

includes a paper on "Channel Capacity and Propagation Time". The next section is made up of three papers dealing with the application of communication theory to television. These are "Communication Theory of Transmission of Simple Drawings", "Some possibilities for the Compression of Television Signals by Recoding", and "Note on a Method of Coded Color Television Transmission".

There follows a paper on "A Theory of Hearing", a section on transmission and analysis of speech, one on associated studies, and a concluding discussion.

The "associated studies" group of papers include "Generators of Information", "An Information Theory of the Statistical Structure of Language", "Semantic Information", and "Application to Optics of Certain Results and Methods of Information Theory".

Although a good deal of mathematics is used to convey the authors' ideas and many of the concepts are difficult to grasp, it will pay the practicing engineer to become more acquainted with this field which is growing in importance each year.

Proceedings of the Western Computer Conference . . . Published by the Institute of Radio Engineers, Inc., 1 East 79th Street, New York 21, N. Y. \$3.50.

This booklet contains all the papers and panel discussions presented at the 1953 Western Computer Conference sponsored by IRE, AIEE, and the Association for Computing Machinery, which was held in Los Angeles, Calif., February 4-6, 1953. The technical papers deal with the application of computers to business data handling and aircraft design, and with recent developments in analog and digital computing equipment. The panel session subject is "An Evaluation of Analog and Digital Computers", and the comments of a group of experts are included.

Leafing through the pages of this book-

et, one becomes aware of the great strides being made in the field of computers. It also becomes apparent that the field is becoming more and more specialized. In a keynote address (for which, unfortunately, there is only an abstract), Dr. Simon Ramo of the Hughes Aircraft Company points out the technical difficulty of the field and the need for training engineers and scientists in new specialties to insure progress for the computer art. Eventually, the universities will have to turn out a new kind of doctor whose studies will include the physical sciences with emphasis on electronics, a study of the human brain, methods and procedures in business and industry, and government and labor rules and regulations.

Practical Analysis—Graphical and Numerical Methods . . . By Dr. F. A. Wil-
lers; translated by Robert T. Beyer. 422 pages. Dover Publications, Inc., 1780 Broadway, New York 19, N. Y. Cloth bound, \$6.00; Paper bound, \$1.90.

This is a fairly comprehensive survey of the numerical, graphical, and some of the

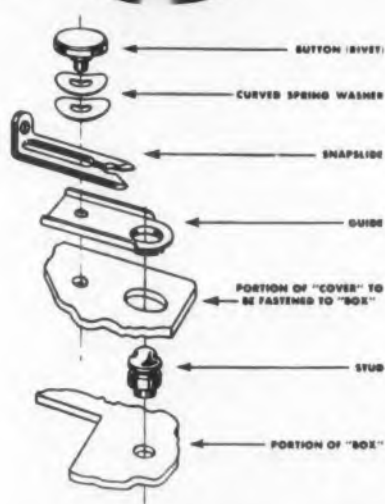
instrumental methods of practical analysis. The author evaluates and compares the various methods and shows how they can be applied to many classes of problems. Numerical methods are treated in great detail because they can produce the most accurate results. Because graphical methods often produce rapid and sufficiently accurate results for many problems, they too are covered thoroughly.

The first chapter deals with numerical calculations and its aids. It covers slide rules, electromechanical calculators, and other aids to computation such as tables, charts, and nomograms. The second chapter contains the standard methods of interpolation: the third, the methods of numerical differentiation and integration; and the fourth chapter covers the practical determination of the roots of single algebraic equations and systems of linear equations. Chapter five, "Analysis of Empirical Function" deals with empirical formulas and curve fitting, and the last chapter discusses graphical and numerical integration of ordinary differential equations.

An excellent reference book, this volume definitely belongs on an electronic designer's book shelf.



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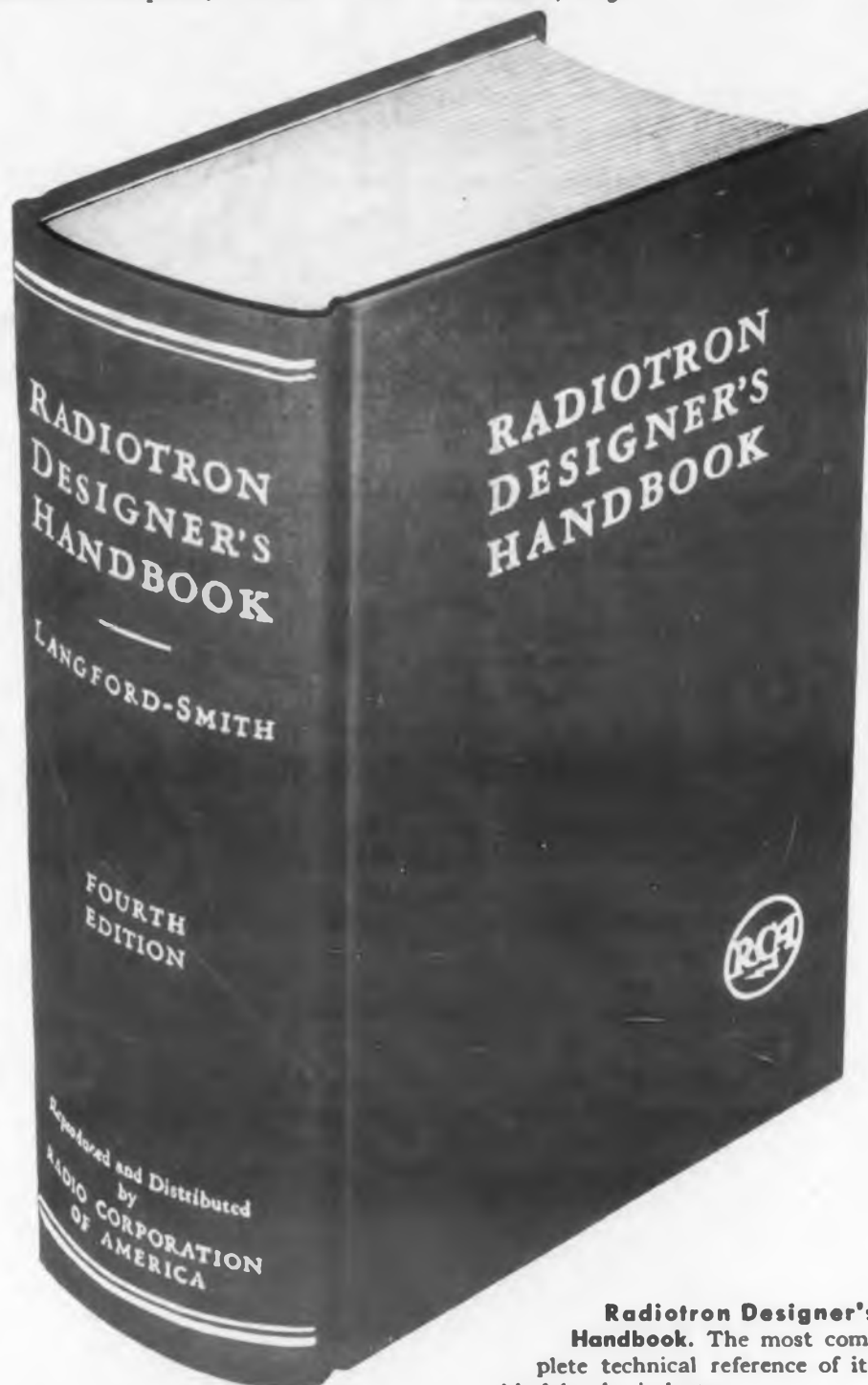
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