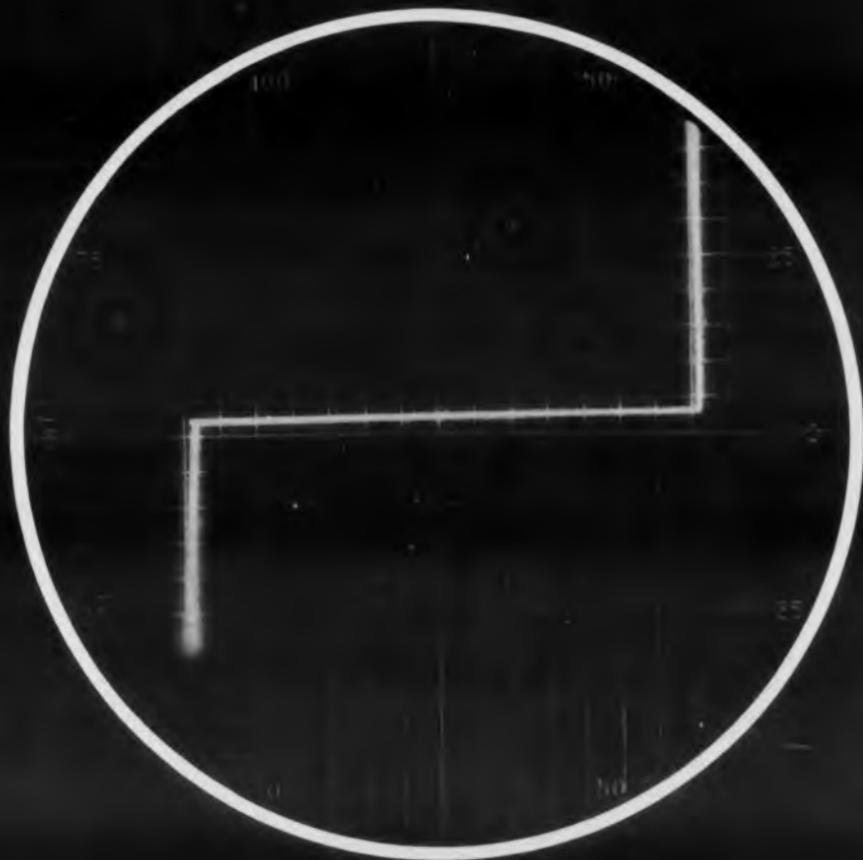


# ELECTRONIC

design

ELECTRONIC



U.S. GOVERNMENT DEPOSIT  
MAR 3 - 1954

Volt-ampere characteristics of two new Silicon Junction Diodes under actual test.

Employing a p-n grown silicon crystal structure, these diodes have definite Zener voltage values and can operate at high temperatures. One of the units is shown below.

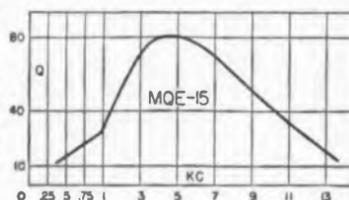
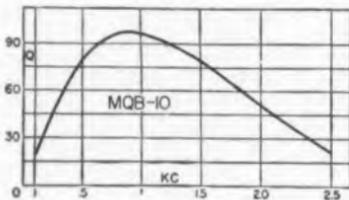
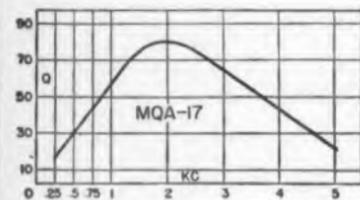
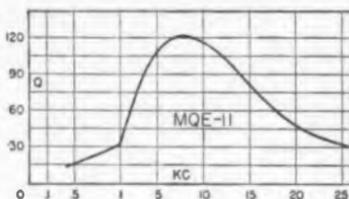
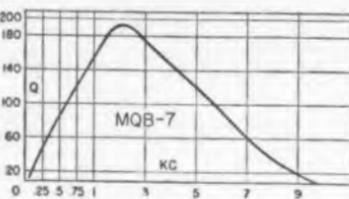
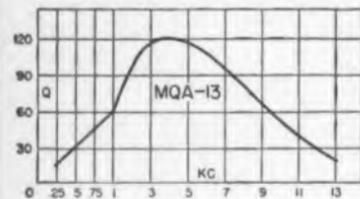
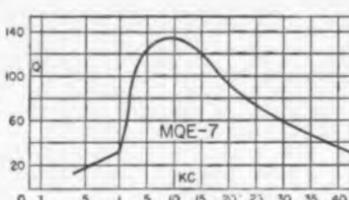
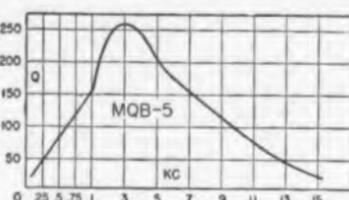
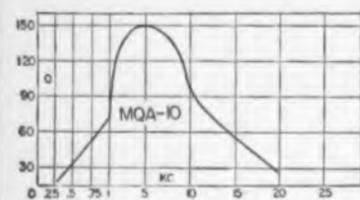
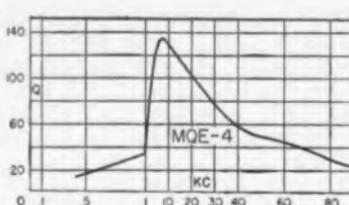
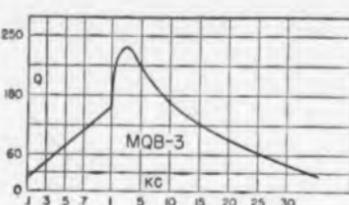
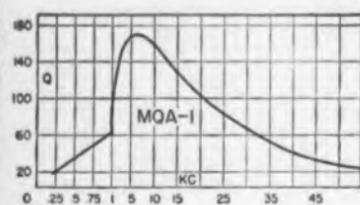


**February 1954**



# NEW "M" TYPE TOROIDS Maximum Q Minimum Size

## TYPICAL Q CURVES



### MQA TYPES

Type No.	Inductance	*DC Max.
MQA-1	7 mhy.	250
MQA-2	12 mhy.	200
MQA-3	20 mhy.	150
MQA-4	30 mhy.	125
MQA-5	50 mhy.	100
MQA-6	70 mhy.	80
MQA-7	120 mhy.	60
MQA-8	.2 hy.	50
MQA-9	.3 hy.	40
MQA-10	.5 hy.	30
MQA-11	.7 hy.	25
MQA-12	1 hy.	20
MQA-13	1.5 hy.	17
MQA-14	2.5 hy.	13
MQA-15	4 hy.	10
MQA-16	6 hy.	9
MQA-17	10 hy.	7
MQA-18	15 hy.	5
MQA-19	22 hy.	4

### MQB TYPES

Type No.	Inductance	*DC Max.
MQB-1	10 mhy.	400
MQB-2	30 mhy.	250
MQB-3	70 mhy.	170
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MQB-5	.5 hy.	60
MQB-6	1 hy.	40
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MQB-8	3.5 hy.	22
MQB-9	7.5 hy.	16
MQB-10	12 hy.	11
MQB-11	18 hy.	9
MQB-12	25 hy.	8

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MQE-5	50 mhy.	50
MQE-6	70 mhy.	40
MQE-7	100 mhy.	35
MQE-8	150 mhy.	30
MQE-9	.25 hy.	22
MQE-10	.4 hy.	17
MQE-11	.6 hy.	14
MQE-12	.9 hy.	12
MQE-13	1.5 hy.	9
MQE-14	2 hy.	8
MQE-15	2.8 hy.	7.2



MQE CASE

Length .....  $1\frac{1}{16}$ "  
Width .....  $\frac{1}{2}$ "  
Height .....  $1\frac{7}{32}$ "  
Unit Weight ..... 1.5 oz.



MQA CASE

Length .....  $1\frac{9}{32}$ "  
Width .....  $\frac{11}{16}$ "  
Height .....  $1\frac{23}{32}$ "  
Unit Weight ..... 4 oz.



MQB CASE

Length .....  $2\frac{9}{16}$ "  
Width .....  $1\frac{13}{16}$ "  
Height .....  $2\frac{13}{16}$ "  
Unit Weight ..... 14 oz.

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

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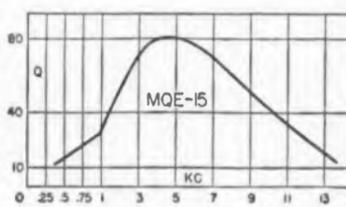
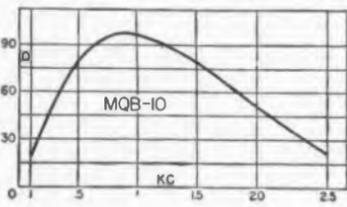
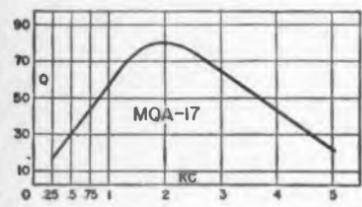
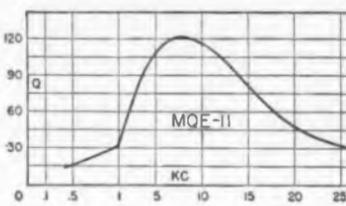
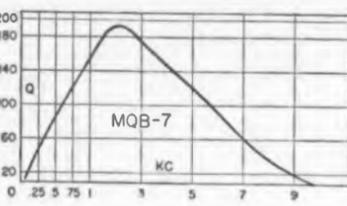
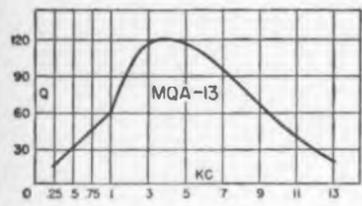
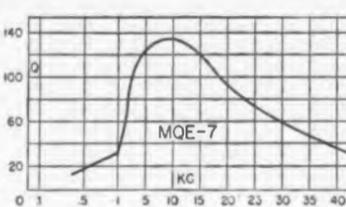
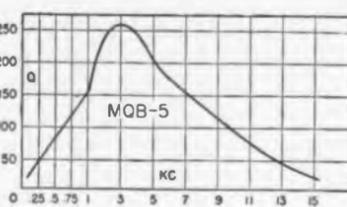
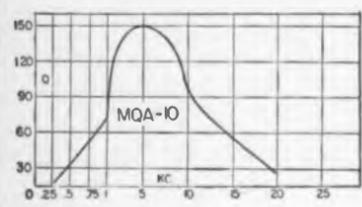
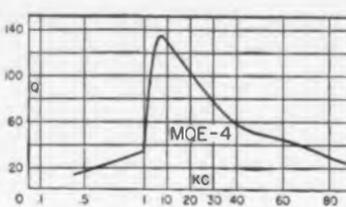
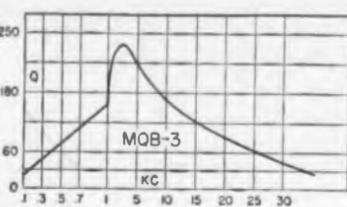
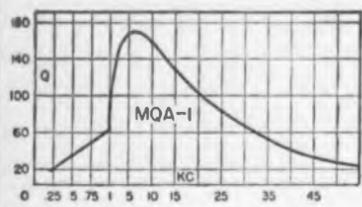
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MQE CASE

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 Width ..... 1/2"  
 Height ..... 17/32"  
 Unit Weight ..... 1.5 oz.



MQA CASE

Length ..... 1 9/32"  
 Width ..... 11/16"  
 Height ..... 123/32"  
 Unit Weight ..... 4 oz.



MQB CASE

Length ..... 2 9/16"  
 Width ..... 1 13/16"  
 Height ..... 2 13/16"  
 Unit Weight ..... 14 oz.

\*This value of D.C. (MA) will drop the coil inductance 5%. Values of D.C. below this will show proportionately (linear) less inductance drop. For example, MQE-1 will drop 1/2% in L with 13.5 MA.

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# ELECTRONIC *design*

Vol. 2

No. 2

February 1954

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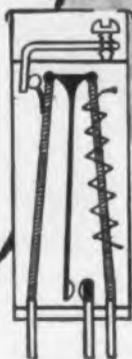
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ELECTRONIC DESIGN is published monthly by Hayden Publishing Company, Inc. at 127 E. 55th Street, New York 22, N. Y., T. Richard Gascoigne, President; James S. Mulholland, Jr., Vice-President & Treasurer; and Ralph E. Marson, Secretary. Printed at Publishers Printing Company, New York, N. Y., ELECTRONIC DESIGN is circulated monthly without charge to men in the electronic industries who are responsible for the design and specification of manufactured devices, including development and design men of consulting laboratories and government agencies. Acceptance under section 34.64 P. L. & R. authorized. Copyright 1954 Hayden Publishing Company, Inc. 24,000 copies this issue.

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*feature  
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Low Resistance  
Contacts*

**T**hese new high amperage capacitors represent the best design achievement for heavy power requirements.

Large periphery terminals and contacts (2" diameter) result in extremely low temperature coefficient and provide for low-resistance connection to circuitry. Thermal conduction and temperature dissipation are increased over 800% as compared with conventional mounting methods. Oxygen free, high conductivity copper is used for all internal active areas as well as for external terminals.

These are available in 5 different type numbers, each rated for 35KV breakdown; 100 amperes RMS. New smaller overall physical dimensions are 5¼" length and 2¾" diameter.





Comparison of contact areas between old (left) and new type (right) capacitors is illustrated by the two vertical bars, showing better than 12 to 1 gain. Moreover, 100% overall contact, despite temperature changes, is assured by new constant-pressure clamp rings supplied with capacitors.

## Editorial . . .

### Competition is Normal

Looking at the newspapers these days, one reads all kinds of predictions as to future business conditions. These prognostications undoubtedly cause some people to wonder about the future of the electronic industries. On that score we have no doubts.

We feel that our industries are truly "infant" industries. There is every reason to believe that they will grow, especially when one considers the many phases of the electronic art where we have only scratched the surface as far as future development is concerned. To keep our industries growing it's going to take (here we resort to what may be considered hackneyed phrases in some quarters), courage, faith in the future, vision, . . . and good design.

It is said that we are entering a "buyers' market", and that competition is going to be tough. Well, this is nothing new for the design engineer. For him competition is always tough and it's always a "buyers' market". Keeping up with new developments in materials, components, test gear and techniques, and making full use of these to improve his company's products is his perennial task. He is also expected to use his imagination to create new markets by creating new products.

Even in the "lush days" the design engineer had to face technical performance competition, size and weight competition, as well as cost competition. His product had to look as good or better than his competitor's so that the sales department would have fewer selling problems. Under today's business conditions these factors have not changed. Performance, cost, and appearance are still basic considerations for the electronic design engineer.

We feel certain that he will do his part to promote the growth of the electronic industries, and we will do our best to help him in this task.

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# Engineering Review . . .

**Ultrasonic Testing Technique . . .** An ultrasonic technique for the non-destructive testing of certain non-metallic solids has recently been developed by Reed Research, Inc., 1048 Potomac St., N. W., Washington, D. C. The work was sponsored by the Navy Bureau of Ordnance.

Prototype test equipment which incorporates ultrasonic absorption techniques and automatic scanning has also been built. It will produce high contrast records of simulated flaws or mechanical defects heretofore imperceptible in X-ray photographs.

In the new system, called the "Acoustigraph", a pair of barium titanate transducers are arranged to transmit and receive acoustic energy at 383kc along radii of the cylindrical test sample, which is revolved about its longitudinal axis at 100rpm. The transducers simultaneously travel the length of the cylinder at a rate of approximately 0.1" per revolution of the cylinder, producing a helical scan the full length of the sample. The entire assembly is submerged in water for good acoustic coupling. The scanning mechanism is coupled through gears to a cylindrical recording drum which has the same angular velocity as the test sample.

The combination of basic principles are applicable to a wide variety of inspection problems—for example, cylindrical samples of wood, bakelite, rubber, graphite and concrete have already been fabricated and tested with the equipment. Other simple geometries such as rectangular blocks, flat plates and thin sheets can be handled by a scanning mechanism using motions of translation rather than rotation.

Where details of the flaw are secondary to the actual presence of a flaw, the system can be extended to accommodate far more complex shapes by comparing patterns in the test record with those in a standard record representing a flawless piece.

The new system, therefore, combines the major advantages of X-ray and ultrasonic testing methods by the distinctive features of: (1) Immediate availability of test results in an easily interpreted form; (2) Inherently high sensitivity to internal mechanical flaws; (3) Easily controlled contrast and differential sensitivity in the final record; (4) Freedom from high voltage and radiation hazards; and (5) Low initial and operating costs. While in the present

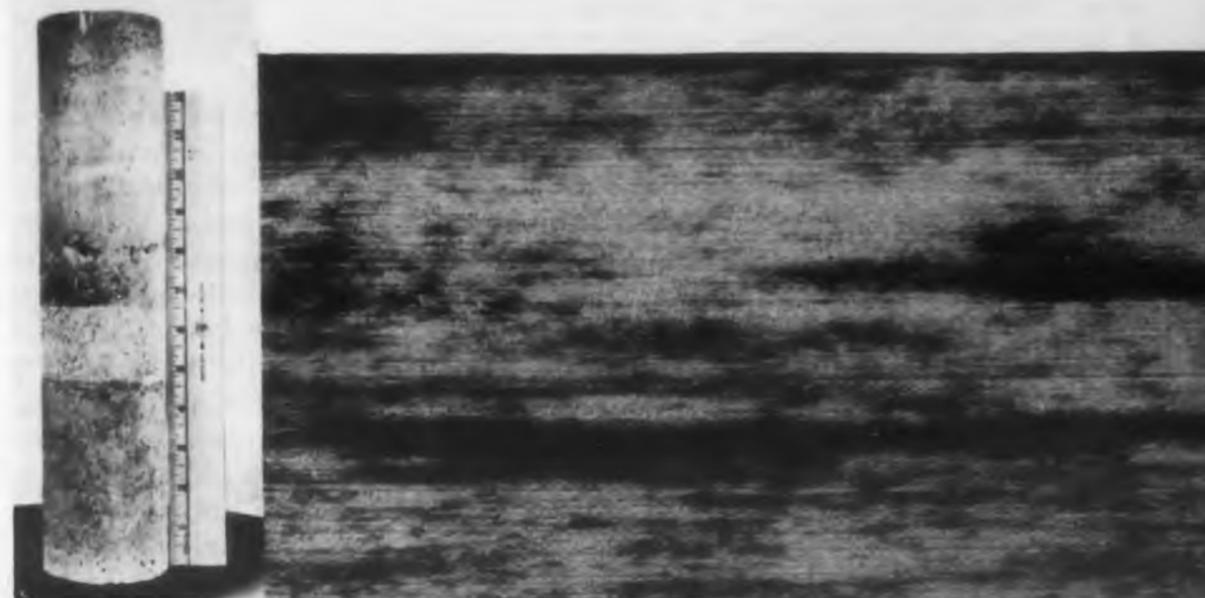
equipment a sample 14" long is represented on the record by 3", and a full revolution by 9", the Acoustigraph will be available in any convenient scale.

The output from the receiver transducer is fed through electronic circuitry to a tungsten stylus held in contact with electrosensitive paper mounted on the recording drum. The stylus traces the length of the rotating drum, leaving dots whose intensity corresponds to the level at the receiver.

An "Acoustigraph" of an extruded graphite cylinder shows extensive variations in the structure of the material. These are indicated by the shaded areas.



This "Acoustigraph" is one of a cast concrete cylinder. The dark narrow horizontal bands are caused by sand and wood chips introduced during casting.



**Color TV Service Education . . .** A program of comprehensive training and education in color television was made available to the entire TV service industry early in February. Developed by the RCA Service Company, Camden, N. J., it will provide complete information on the theory and practice of installation and service for color TV receiving equipment even before the first commercial sets reach the public.

The comprehensive educational program is divided into four major elements: (1) A series of 2-day technical clinics for service dealers and servicemen to be held in 65 key cities across the country; (2) A comprehensive textbook, "Practical Color Television for the Service Industry", which compiles five years of research, development and field testing of color TV receiving and broadcasting equipment; (3) A special home study course in color TV to be offered to technicians throughout the service industry by RCA Institutes, New York, N. Y.; and (4) A new type of test equipment for use with color TV sets called the RCA Color Signal Simulator for the proper phasing and alignment of color TV sets.

### The Sanguinometer

A quick electronic count of human blood cells or other small particles can be made with the "Sanguinometer" system shown at the right. Developed by researchers at RCA's Princeton, N. J. Research Center working with the Sloan-Kettering Institute, the system uses a small TV industrial camera which peers into the microscope, and a simple computer which analyzes and counts the TV pulses and gives the number of cells on a meter dial. The TV monitor is used to check on the microscope's focus and the illumination on the slide.



**TV Tube Depreciation Anticipated . . .** One in every seven TV sets in use today will require a new picture tube in 1954, according to a recent prediction by the General Electric Tube Department, Syracuse, N. Y. Of more than 27,000,000 sets now in use, market research figures show an expected need for over 4,000,000 replacement tubes. This figure, while higher than that of any year so far, represents a normal development with so many sets growing older.

Despite the advent of color TV, the industry expects to produce about 5,200,000 additional tubes for new black-and-white sets. The need for initial equipment monochrome tubes should come mainly from the opening up of new market areas and from continuing consumer demand for the larger picture sizes and lower prices on black-and-white receivers.

This year the electronic tube industry, as a whole, is expected to increase its business over the record year of 1953 by about 5%, or reach a total of \$700,000,000 by the end of 1954.



**New Video Source for Testing . . .** A "Colorvision Slide Scanner" to aid the development of color TV by providing broadcasters and manufacturers with a video source for test purposes has been developed by Allen B. Du Mont Laboratories, Inc., 750 Bloomfield Avenue, Clifton, N. J. The new scanner will furnish manufacturers with exceptionally clear, reliable color tone signals with which to test television receivers now being designed for commercial color TV.

The Colorvision Slide Scanner is composed of two basic units: the Scanner, and the Color Optics and Video Amplifiers. The core of the device is the new TA188-A scanner unit which contains the cathode-ray tube, scanning generator and high voltage supply,

## Engineering Review . . .

**Electronic Dictation Machine . . .** The first dictation machine to employ an endless magnetic belt as the recording medium has been developed by Pierce Dictation Systems, Inc., 5900 North Northwest Highway, Chicago 31, Ill. The result of three years of research by Pierce and the Armour Research Foundation of Chicago, the new machine is completely electronic.

Basic feature of the machine is the magnetic recording of dictation on an endless belt which reproduces every word and inflection of the dictator's voice. The belt, manufactured by Minnesota Mining & Manufacturing Co., can be mailed or filed, and can be used and reused an unlimited number of times. The belt has a 15 minute limit, the time cycle found most practical for office use. Since there is no stylus used in the recording, there is no wear on the magnetic belt and surface and operating noises are entirely eliminated.

The magnetic dictation machine also features "error-free" dictation—a system which permits the dictator to change his mind with ease, eliminating the need for marking a correction slip. By backing up the belt to the point where the correction is to begin, he redictates over the original transcription which is automatically deleted. The method excludes the possibility of the transcriber not catching the correction, and is operated by simple fingertip control.

### Magnesium Casting For Military Electronic Equipment

The magnesium casting shown at the right is to be used as a base for military electronic equipment being manufactured by Western Electric. Weighing about 1630 lb, it is 114" x 93" x 33", and was cast by Rolle Mfg. Co., Lansdale, Pa.

The ultrasensitive microphone has built-in sound level which transmits to the recording medium both loud and soft dictators with great clarity; in addition, it serves as the playback medium.

The transcribing unit features an automatic back-spacer, which lets the transcribing secretary know where she left off. When the operating foot is depressed, the unit back spaces approximately two words, allowing the secretary to hear the last part she has typed. In this manner, the girl is provided with complete continuity when transcribing the material that has been dictated.

The transcribing unit has built-in volume and tone controls, and is lightweight, portable, and compact.

and an optically precise front surface mirror for reflecting light from the tube to the slide unit.

The cathode-ray tube is a new type which operates at 45kv and produces an extremely bright light source. This increase in light output over previous designs retains high resolution and provides an output voltage with high signal-to-noise characteristics. The tube has a high-quality, neutral density faceplate having 66% transmission. The gray faceplate greatly improves small area contrast and increases crispness of the picture by reducing halation. The flying spot scanning tube is positioned vertically and the mirror which directs the light is above the tube face.

The extremely small flying spot traces an unmodulated raster of high light intensity on the face of the cathode-ray tube. Light from this raster is directed to the front surface mirror and reflected to the slide changer section where it is focussed through a lens system onto a 2" x 2" color transparency. The light is then modulated by transmission through the transparency and analyzed into its three component colors by dichroic or color selective mirrors. Additional filtering is obtained by photographic filters.

The light transmitted through this selective mirror system, after passing through the color filters, falls on specially developed 2" individual multiplier phototubes—one for each channel (red, green, and blue).

The signals generated by the three multiplier phototubes are then passed through these phosphor persistence and gamma correction amplifiers—one for each color. Because the amplifiers also add blanking, three simultaneous signals are obtained and may then be encoded according to NTSC transmission specifications by the auxiliary equipment used by the manufacturer or broadcaster.

**Electronics in the Home . . .** 1953 was the first year in which electronic devices entered the American home in significant numbers as robot servants.

A survey, made by Minneapolis-Honeywell Regulator Company, Minneapolis, Minn., shows that one of the major developments in the automatic control field during the past year was the mass-scale adoption of electronic controls to control home temperatures. During 1953 production of such a systems increased more than 700%. By the end of 1954, over 50,000 American homes are expected to have advanced electronic systems which automatically vary indoor temperatures according to outside weather conditions. The new concept, developed out of research into heating systems for jet aircraft, obsoletes the idea that indoor temperatures be kept constant.

The role of electronics in the home, until now, has been limited to the field of entertainment and communication. Now it includes the utmost in livability and comfort. Despite the widespread use of window air conditioners, the company predicted that the ultimate trend in air conditioning will be toward year round systems, and that in 10 years, these will be as commonplace as central heating is today.

ELECTRONIC DESIGN • February 1954



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## Engineering Review . . .

**Valley Community TV Systems . . .** A paper presented at the Winter General Meeting of the AIEE investigated one of the major problems of Community TV System design and the choice of suitable amplifiers for relaying signals along the main trunk line. In the paper, entitled "Line Amplifiers for Community Television Systems", by K. A. Simons, D. Kirk, and H. J. Arbeiter of the Jerrold Electronics Corp. (Philadelphia, Pa.), the growth of community TV systems together with resulting techniques and developments was discussed. Although some of the art is entirely new, the basic technique of moving television frequency signals efficiently from one place to another is closely allied with long-distance telephony.

The possibility of a Community Television System exists where there is a large group of people who cannot receive satisfactory signals directly, located within a few miles of a site where satisfactory reception is possible. The most obvious case is a valley town shadowed by a mountain. The system operator installs high-gain antennas and sensitive receiving equipment on top of the mountain where the signals are relatively strong and distributes them, via coaxial cable, to the homes in the town. Since these signals must be delivered to the customers on the standard television channels between 54 and 216 mc, present practice is to select channels most suitable for the system, and convert the frequencies of the received signals where necessary to fit this pattern. Although adjacent channel operation is possible, it has not been widely used because of the difficulties of preventing interference between channels, and it will not be considered. The paper considers three important possibilities: (1) Separating channels frequency-wise at each repeater point and amplifying each with a separate single-channel cascade amplifier; (2) Separating channels into two groups and amplifying those between 2 and 6 with one broad-band cascade amplifier, and those between 7 and 13 with another; and (3) Using a single distributed amplifier for all channels.

**Digital Computers Aid Design . . .** The digital computer can be used as a powerful tool in the design of electrical machines according to a technical paper ("Digital Computers as an Aid in Electrical Machine Design", by R. M. Sanders, University of California, Berkeley, Calif.; AIEE Paper No. 54-168), presented at the recent AIEE Winter General Meeting in New York City. Referring specifically to punched card or more rapid machines, the author pointed



# DESIGNERS'

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ELECTRONIC DESIGN • February 1954

## TIMELY HIGHLIGHTS ON G-E COMPONENTS



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Now a form of the G-E hermetically sealed relay withstands vibration forces of 10g from 10 to 500 cycles per second. All forms offer extra protection against permanent breakdown due to voltage surges. Coil ratings go up to 10,000 ohms. Contact configurations available include 4-pole double-throw and 6-pole single-throw. See Bulletin GEA-5729.



### Controls 20 circuits

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### Quickly locates shorts

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### G-E analog plotter helps solve complex field problems — fast

Now you can simplify and speed up those complex field studies by using General Electric's analog field plotter. By means of electric current flow patterns set up in a sheet of thin conducting paper, over-all operation of plotting in two dimensional fields is greatly simplified. Problems in electrostatics, electromagnetics, and many other fields are rapidly solved with this sensitive, versatile plotting board and the complete package of components necessary for making field studies. It needs only low-voltage d-c supply, which eliminates shock hazard, and is not affected by line-voltage variations. Explanation and instructions are covered in a 50-page manual accompanying the plotter. For full details, see Bulletin GEC-851.

out that in designing most electrical machines, the most useful function performed by computers is that of repeated analysis.

The author sets up a typical procedure for solving problems which consists of seven basic steps: (1) Ascertain the factors to be varied and the limits over which they are to be varied; (2) Establish relationships connecting the factors together; (3) Decide upon figures of merit; (4) Make a table of operations and run through a sample calculation by hand; (5) Code the solution for the machine; (6) Run the cards and print results; (7) Interpret results.

One of the problems the author cites as an example of the application of the technique is that of determining an optimum design for a synchro. The optimum design was being searched for in terms of fixed large volume production. This was a large scale problem during which the complete design was set up for punched card analysis and 37,500 possible designs were considered through the use of the digital computer.

**Electron Beam Extractor . . .** A newly developed vacuum tube for use in a betatron for extracting electronic beams that may offer therapeutic applications, was described at the AIEE Winter General Meeting, by T. H. Rogers of the Machlett Laboratories, Inc., Springdale, Conn., and D. T. Seag, Allis-Chalmers Manufacturing Company, Milwaukee, Wisconsin in a paper entitled "A Sealed Off Betatron Donut for Electron Beam Extraction".

A betatron is a device based on the principle of the transformer and accelerates electrons to high energy by using a magnetic field varying with time. Enough data has been reported regarding physical properties and possible therapeutic applications of high-energy electron beams obtained from experimentally operated, pump-connected betatron units, to confirm the value to be derived from the availability of a sealed-off vacuum donut for electron beam extraction. Such a vacuum tube is used in the Allis-Chalmers betatron interchangeably with the standard x-ray producing donut without requiring vacuum pumps or any adjustable elements for electron extraction. A rugged beryllium window provides a relatively unimpeded exit portal for the electrons.

A well collimated beam having energies up to 22 MEV is readily obtained with an intensity in the order of 2000 rep per minute at 1 meter, with the same ease and convenience as in the case of normal operation for x-ray production. Energy level is readily adjustable throughout the range from 5 to 22 MEV. Dosage rate and distribution measurements have been made for applications to cancer therapy and various potentialities are indicated.



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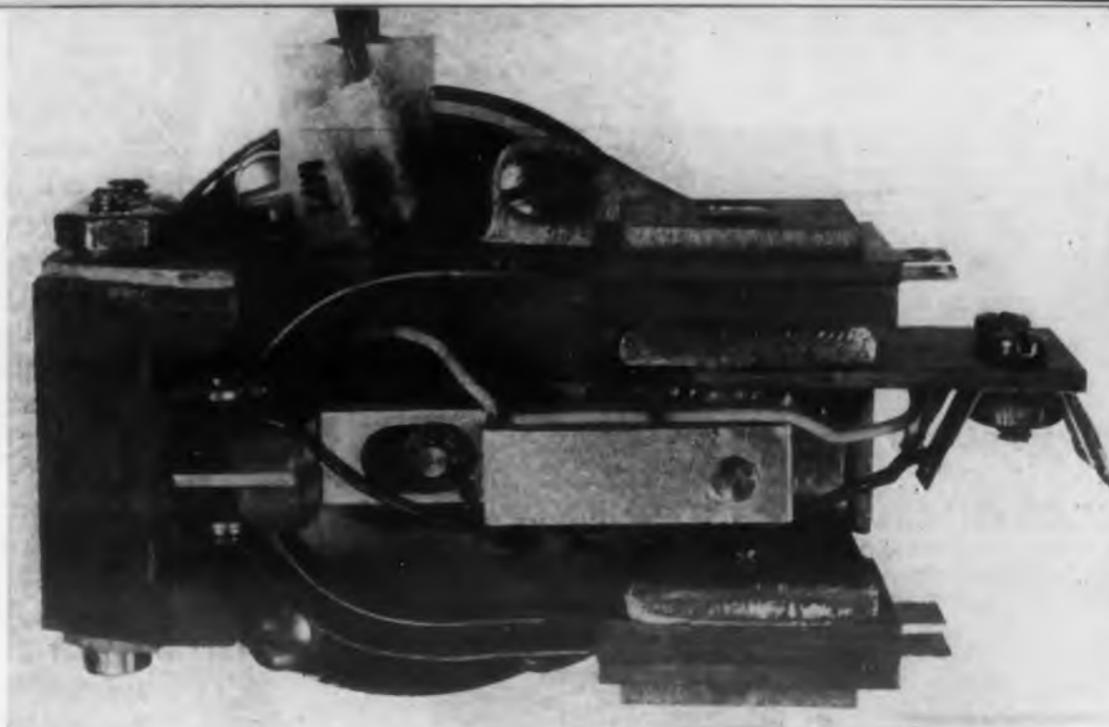
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### Bearings for Relays

Using a miniature bearing to translate rotary to linear motion, provides increased sensitivity and dependability in a new naval fire control relay shown at the right. Besides cutting wear, the bearing withstands severe shock loads. It is made by Miniature Precision Bearings, Inc., 101 Carpenter St., Keene, N. H., and is mounted on an eccentric rotor shaft. Its outer race rides in an elliptical opening in the contactor as shown at the left.



## Engineering Review . . .

### Twenty-five Billion Electron Volt Accelerator . . .

The U. S. Atomic Energy Commission has approved the design and construction at Brookhaven National Laboratory, Upton, L. I., N. Y., of an ultrahigh energy particle accelerator for nuclear research. The new machine, an alternating gradient synchrotron, will be designed to produce beams of protons of energies ranging up to 25 billion electron volts.

The alternating gradient synchrotron will use a series of alternate strongly converging and diverging magnetic fields to confine a proton beam in a tube of relatively small cross-section. This focusing effect allows the production of high energy beams with smaller electromagnets and related equipment than

was possible with previous focusing techniques.

The cost of design and construction of the new accelerator is estimated at \$20 million. Design work will start at Brookhaven in the near future and is expected to be completed within 5 or 6 years. Once in operation, it will be available to scientists wishing to collaborate in Brookhaven research programs or to carry out independent programs.

The most powerful accelerator now in operation is the Brookhaven Cosmotron, which has accelerated protons to energies of 2.3 billion electron volts. The Bevatron, now under construction at the University of California Radiation Laboratory at Berkeley, is expected to accelerate particles into the 5 to 7 billion electron volt range. By providing particles with energies as high as 25 billion electron volts, the Brook-

haven alternating gradient synchrotron is expected to contribute important new knowledge of the fundamental nature of matter.

**Trouble Shooter for TV Receivers . . .** A new system which enables a TV set owner to identify reception troubles of a color television or black-and-white set to a repairman has recently been developed for general home use. The system, initiated by Raytheon Manufacturing Co., Waltham, Mass., is called the Raytheon "Service Saver" plan, and promises to eliminate many of the difficulties expected in servicing the complicated color TV receivers to reach the market this spring. It is also highly effective in reducing time delays and costs of repairing conventional sets.

The purchaser of any TV set receives a "Service Saver" booklet containing 40 numbered pictures illustrating every conceivable trouble that might show up on a television screen. Should an owner have trouble with his set, he identifies the actual disturbance on the screen with the corresponding picture in the booklet, calls the repairman, and gives him the number of the representative picture. The serviceman, equipped with a technical version of the same booklet, may then identify the tube or circuit causing the trouble and leave his shop prepared for the repair. This effects a saving for the customer and the repairman normally required for making tests.

The Service Saver booklet is expected to simplify service repair problems anticipated in highly complex color TV receivers.

### Stratospheric Electricity Potential Prober . . .

A super-sensitive electronic device which enables scientists to probe the phenomena of electrical currents that exist between earth and upper stratosphere is now undergoing tests for completion sometime before the end of 1954.

The research project, announced jointly by the



### Transistorized Radios

These experimental miniature radios developed at RCA's Princeton, N. J. laboratories employ junction transistors. The smaller unit weighs only a pound and has the same output as conventional small portable radios. The larger set, which has a 4" x 6" speaker, is comparable to a table radio in fidelity, and will run 500 hr on its six small batteries.

Minneapolis-Honeywell Regulator Co., Minneapolis, Minn., and the Air Research and Development Command, was described as one that may possibly affect interplanetary flight and will be highly important in long-range communications.

Air Force scientists stated that an electric potential of more than 100,000v exists from earth to at least the height of the ionosphere. Until now, scientists have been able to collect data on this atmospheric electricity only by means of instruments carried by planes up to altitudes of 35,000ft. The new aerial electrometer, in contrast, will be carried aloft by balloons up to 100,000ft. The project is part of a continuing study of the terrestrial electrical field existing between earth and the ionosphere which begins from 60 to 80 miles above the earth.

The sensitive device, designed and developed in the Nuclear Engineering Laboratory of Honeywell's Industrial Division in Philadelphia, weighs only 6-1/2 lb and is about the size of a portable radio. It is battery operated and contains many subminiaturized electronic components. The instrument is housed in an aluminum case with special insulation to minimize the problem of solar radiation and the low temperatures of high altitudes. At stratospheric altitudes, although air temperatures may be as low as 80° below zero, the sun's rays could generate enough heat inside the instrument to melt the parts.

The instrument is so sensitive that it will measure flows of electric current as low as 0.1 $\mu$ amp or one million ions per sec. (It would take about one million billion ions to momentarily light a flashlight).

Carried aloft by large plastic free-flying balloons, the instrument instantaneously radios back to a ground recording station the electrical conductivity, air pressure, and air temperature. By interpreting the readings, scientists will be able to determine accurately the altitude of the instrument and thereby obtain a record of the variation of the electrical conductivity with the altitude. Upon reaching maximum height, the balloon is mechanically broken and the apparatus parachuted to the ground. Data is also recorded during the descent.

When sufficient data has been collected, scientists of the Geophysics Research Directorate of the Air Force Cambridge (Mass.) Research Center will correlate and analyze the information. The analyses are expected to be invaluable in understanding the current of 1800amp constantly flowing toward the earth, the source of which has been a scientific enigma for over 50 years.

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*See Page 12*

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**Engineering Review . . .**



A new photographic technique has determined that the strains in commercial grade fused quartz do not prevent its use as an ultrasonic delay line. These strains are shown in the upper photo. The lower photo, made by this technique reveals no distortion if a 30 Mc/sec sound wave due to the strains.

**Diffraction Technique Checks Quartz . . .** When Schlieren photographic techniques are used to check commercial grade fused quartz intended for delay lines, they reveal extensive networks of strains within the material.

Many of the past difficulties which have arisen in the manufacture of ultrasonic delay lines have been attributed to these strains. As a consequence, this comparatively inexpensive type of quartz has often been considered unsatisfactory in this field of re-

search. It has been felt that the strains, although strongly evident under polarized light or when examined by other optical means, actually have no significant effect on the passage of an ultrasonic beam through the quartz.

To support this theory, Andersen Laboratories, Inc., West Hartford, Conn., have developed a special photographic technique. The results of this accomplishment can be seen in the lower photograph.

The new technique is a diffraction photograph of a 30 megacycle per sec compressional sound wave in the same blank as shown in the top picture. While the major strains may be identified readily in the upper photograph, it is apparent that no bending or distortion of the sound beam takes place at these points.

The new photographic technique permits visual examination of the effects of various assembly methods and designs, and has made possible a much more thorough understanding and precise analysis of many other problems which have arisen in the development and design of ultrasonic delay lines.

▲ Andersen Laboratories' graphic demonstration of ultrasonic compressional sound waves in fused quartz will be on display in Booth 422 at the Radio Engineering Show.

**Dual Vision Television Receiver . . .** A new television receiver which shows two programs on one screen, permitting two audiences to see different programs simultaneously, was introduced recently by Allen B. Du Mont Laboratories, Inc., 760 Bloomfield Avenue, Clifton, N. J.

The receiver, called the "Duoscopic", can tune in any two TV programs from any stations within range. These can be watched simultaneously by two or more people through the use of polaroid glasses or polaroid panels placed in front of the screen. By reversing the glasses or panels the viewer can see the alternate of the two chosen programs.

The set actually incorporates two TV receiver chassis with separate picture tubes housed in one cabinet. The picture tubes, mounted perpendicularly to each other, have oppositely polarized filters over their faces. A dichroic mirror mounted at a 45 degree angle to each face displays the superimposed pictures. The polaroid panels or glasses separate the pictures. The set costs twice as much as an ordinary TV receiver. The method has three dimensional television possibilities.

The audio portion of the set has two individual ear pieces to separate the sound portions of the programs; a remote control unit permits the viewer to listen to either one of the programs by a simple adjustment of the toggle switches.

Aside from the obvious advantages of the new DuMont receiver for the large family and the sports fan, hospitals are expected to find many valuable uses for it with special attention to the individual hearing aspects of the set. The DuMont Duoscopic functions also as a conventional receiver.

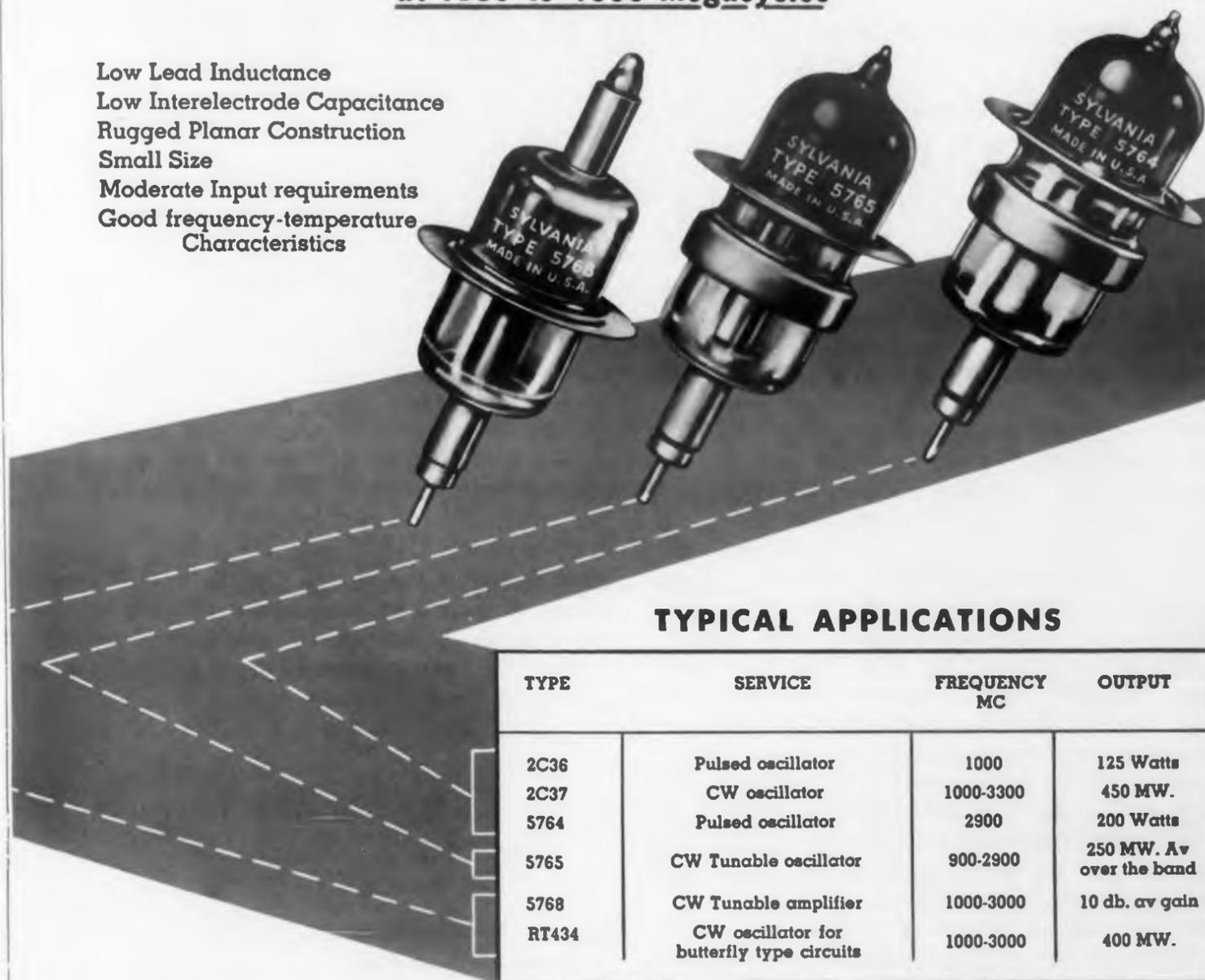
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RT434	CW oscillator for butterfly type circuits	1000-3000	400 MW.

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## Engineering Review . . .

**New Radar Device to Pierce Iron Curtain . . .**  
Military secrecy has been lifted from "COZI", a new radar device developed by Raytheon Manufacturing Co., Waltham, Mass., in cooperation with the U. S. Air Force. COZI (Communications Zone Indicator) makes it possible to tell whether broadcasts from international shortwave or any other long-range transmitters are successfully reaching their destinations. It further indicates approximately how strong the broadcast signals are when they arrive, and may show whether the enemy is deliberately jamming that particular frequency with static and interference to prevent good reception.

The Air Force plans to make extensive use of COZI to increase the efficiency and reliability of its international communications system.

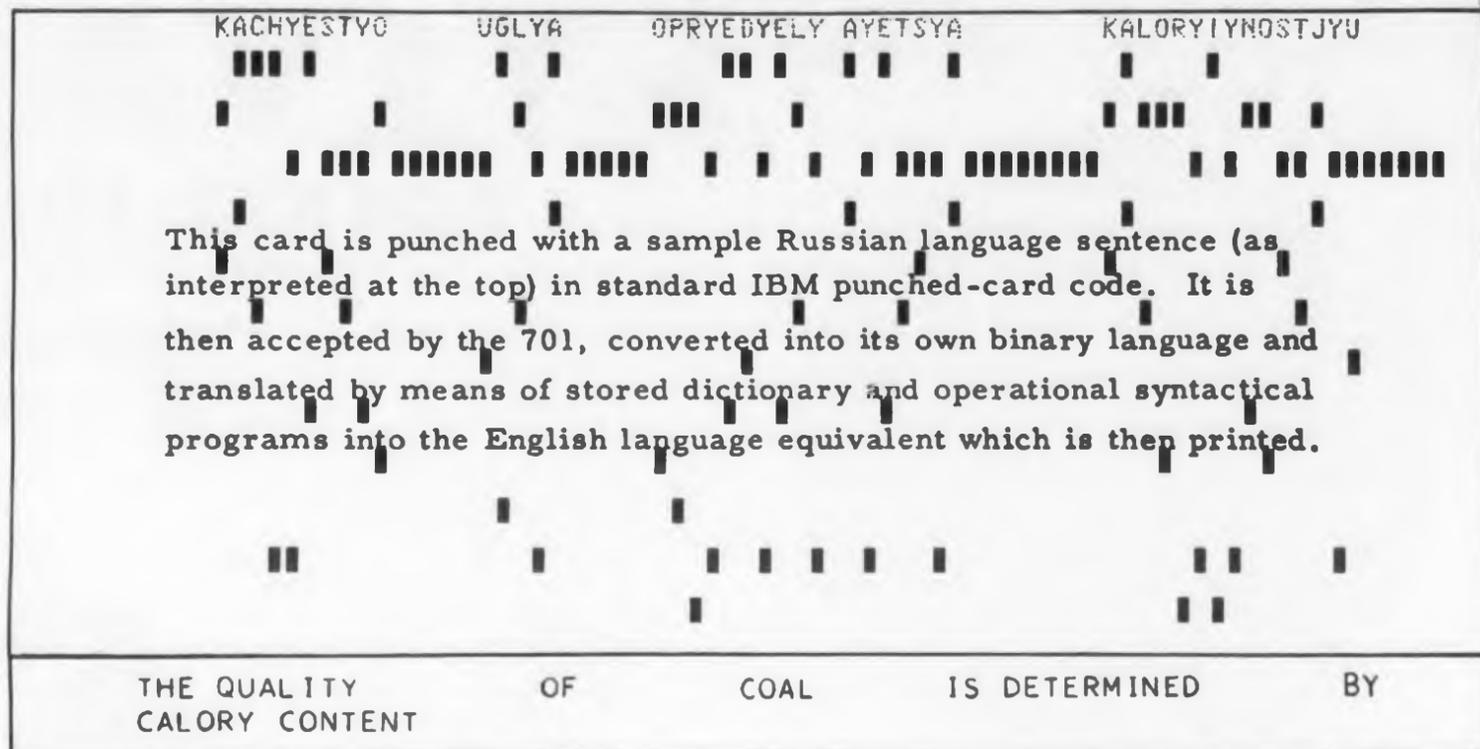
To test a radio signal, COZI sends out a radar beam from the station's own antenna which follows the same path taken by the radio waves. The COZI beam, however, returns and tells where it has been and whether it has run into any interference at its destination.

COZI's radio beams literally skip along by bouncing from earth to sky and back to earth. The peculiar ionized layers of atmosphere lying far above the stratosphere reflect radio beams back to earth. The beam leaves the transmitter and travels straight outward until it reaches the reflecting layer. There it is deflected downward returning to earth a great distance away. The distance from the transmitter to the area where it again comes down to earth is known as the 'skip distance'. By bouncing two, three, or more times from earth to sky, a radio beam may travel around the earth if it is transmitted with sufficient power. For each skip distance, which varies with the transmitter frequency being used, there is an area of silence, where the radio signal cannot be received.

The skip distance, therefore must be adjusted by proper choice of transmitting frequency to make sure that the broadcast will come down out of the sky into the area where the listeners are located.

The skip distance is determined by several factors: the frequency on which the transmitter works, and the condition of the reflecting sky layers. The latter is a variable which offers the greatest difficulty, for it changes during certain seasons of the year and also changes during the time of day, making a great change above the area where day is turning into evening. These regular changes can be predicted with fair accuracy but there are other unpredictable changes caused by sun spots and other atmospheric disturbances. The use of COZI now makes it possible to know instantly and accurately whether a given frequency is being reflected at the proper skip distance to reach its destination.

COZI is made in two units, each about as big as a steamer trunk. One is the transmitter, the other is the receiver. To test a radio station, it is necessary



to interrupt the broadcast momentarily while the radar beam is sent out. A reading is obtained instantly, and broadcasting is resumed without any appreciable break or loss of time.

COZI is being made commercially available to civilian radio stations, but its most provoking possibilities for the present lie in its application to American broadcasts to eastern European nations. The use of the system makes it possible for portable and fixed transmitters, including the "Radio Free Europe" system, to operate with far greater efficiency because its operators can determine, quickly and reliably, whether the broadcasts can be heard by the listeners behind the Iron Curtain.

### Electronic Translation

The possibility of rapid translation by electronics in a few years was shown in a demonstration of Russian to English translation on IBM's 701 computer recently. By employing an elementary grammar made up of six tag-rules developed at the Georgetown Univ. Institute of Languages, the computer places the translated words in correct syntax. A separate tag is attached to each meaning of the 250 Russian words stored in the computer. The Russian to be translated is written in phonetic Latin character equivalents on the IBM card, as shown above.

### Electron Gun For 6-MEV Linear Accelerator

Testing the electron gun for a 6-MEV linear accelerator being developed at Stanford Univ. High frequency waves produced by a klystron accelerate electrons to nearly the speed of light in a six-foot copper tube attached to this gun. Eventually this unit may be produced commercially by General Electric for cancer treatment.



**Atomic Battery . . .** A new method which makes it possible to convert atomic energy directly into usable quantities sufficient to operate a transistor was announced recently by the Radio Corporation of America, 30 Rockefeller Plaza, New York 20, N. Y.

The conversion of nuclear energy into electricity was achieved by an experimental RCA Atomic Battery, powered by a minute quantity of a long-life strontium-90 radioactive isotope obtained as a by-product of atomic reactor operation. The electric current derived from this unique atomic battery exceeds all previous results attained in attempts to generate usable electricity directly from radioactive material by many times.

The new type of battery consists of a radioactive source to which is coupled a wafer of semi-conducting crystal—germanium or silicon. An impurity material has been alloyed into the crystal to form a junction. The junction is similar electrically to those used in a junction transistor, but considerably larger, with an area of 1/20 sq inch.

Strontium-90, one of the most abundant of the materials resulting from the fission of uranium in a reactor, is a highly active source of beta particles and one of the long-lived beta-emitting substances. Its half-life is roughly 20 years, i.e., every twenty years half of its radioactivity is dissipated.

In the battery, 1/300th of a cubic centimeter (a quantity that would fill a cube 1/16th of an inch on a side) of radioactive strontium is spread in a thin layer against the junction wafer. The layer of strontium bombards the semi-conducting crystal wafer with several billion electrons per second. As the electrons penetrate the wafer they release many more electrons, an average of 200,000 for each bombarding electron. In the present experimental atomic battery, each high-speed electron releases in the crystal on the average of 200,000 low-speed electrons. These released electrons flow across the wafer's junction producing a voltage which can be applied to an electronic circuit and cause a current to flow. The electron action within the crystal wafer is known as the electron-voltaic effect, a phenomenon of solid-state physics which heretofore has not been put to any practical use.

When connected to the transistor oscillator circuit, the battery's 1/5 volt potential provides a current of 5 microamperes, an output of approximately one millionth of a watt. The best efficiency of energy conversion so far obtained exceeds 1%, i.e., the ratio of useful electrical power developed by the battery is at least 1/100th the energy of the beta particles as they leave the radioactive source. The greater part of the original energy is lost as heat in the crystal wafer. As present techniques are refined, an efficiency of 10% appears to be a reasonable goal for such devices. Greater power can be achieved by increasing the present 50 millicurie quantity of strontium-90 or by placing a number of units in a single container.

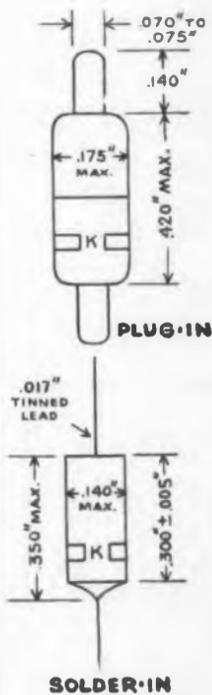
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TYPE	TYPICAL APPLICATION	MAX. DC INVERSE VOLTAGE	MAX. PEAK ANODE CURR. ma.	MAX. AVG DC ANODE CURR. ma.	MIN. FORWARD CURRENT AT +1V ma.	MAXIMUM INVERSE CURRENT				MIN. INVERSE VOLTAGE	AVG INVERSE CURRENT -50V
						AT -5V ma.	AT -10V ma.	AT -50V ma.	AT -100V ma.		
IN67 IN67-P	50V DC Restorer	80	100	35	4.0	0.005		0.05		100	0.1
CK705 CK705-P	Gen. Purpose Diode	60	150	50	5.0		0.05	0.8		70	0.43
CK705A CK705A-P	Gen. Purpose Diode	60	150	50	5.0		0.01	0.8		70	0.43
CK707 CK707-P	50V DC Restorer	80	100	35	3.5	0.010		0.10		100	0.1
CK708 CK708-P	100V DC Restorer	100	100	35	3.0				0.625	120	0.15
CK713 CK713-P	Computer Diode	65	150	50	21 at +2V			0.25 at -40V	(DC characteristics at 50°C)		

P Indicates plug-in type

DC Characteristics measured at 25°C

These types are available in production quantities through Newton, Chicago and Los Angeles sales offices. They are also stocked by over 500 Raytheon Special Tube Distributors.

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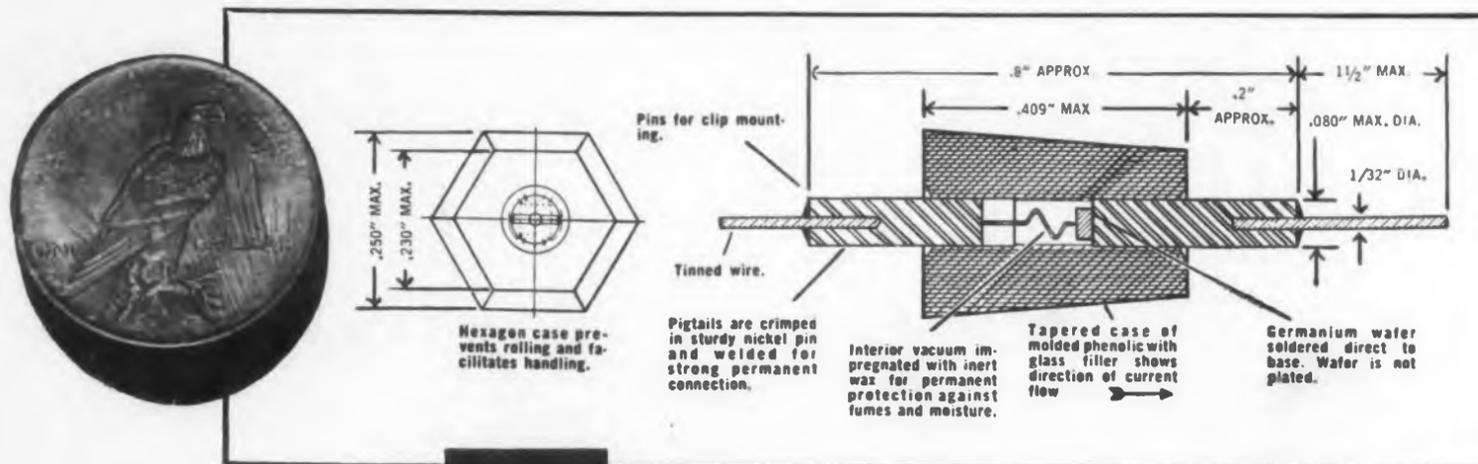
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## Engineering Review . . .

### Meetings

February 18-19: IRE-AIEE Conference on Transistor Circuits. Museum of the University of Pennsylvania, State College, Pa. The program will reflect the present state of research and development in the transistor circuit field and will be geared to engineers already familiar with transistor operation. Reservations should be made through L. H. Good, RCA Victor Division, Bldg. 10-5, Camden, N. J. Publication of the papers presented is being planned.

March 22-25: IRE Radio Engineering Show, Kingsbridge Armory, New York, N. Y. Information may be obtained through B. R. Lester, Technical Chairman, c/o IRE, 1 East 79 Street, New York, N. Y.

April 5-6: The Society of The Plastics Industry, Inc., 12th Annual Conference. Mount Royal Hotel, Montreal, Ont., Canada. Contact William T. Cruse, Registrations Chairman, 67 West 44 Street, New York 36, N. Y.

April 8-9: Operations Research in Business and Industry, sponsored by the Midwest Research Institute, Kansas City, Mo. Participating speakers will include over 400 authorities in industry and business contributing to a program which is to be one of the most comprehensive ever offered in the field. Advance registration may be obtained through Martin Goland, Midwest Research Institute, 4049 Pennsylvania, Kansas City, Mo.

April 12-14: 1954 International Symposium on Information Networks. Engineering Societies Building, 33 West 39 Street, New York, N. Y. The symposium will deal with network theory and synthesis, especially as it is influenced by newer concepts developed in information and general communication theory. American and European authorities who have made original contributions to the field will participate. For reservation information, address Polytechnic Institute of Brooklyn, Microwave Research Institute, 55 Johnson Street, Brooklyn 1, N. Y. Copies of the proceedings will be available in published form by October 1954.

April 19-20: Symposium on the Automatic Production of Electronic Equipment sponsored by Stanford Research Institute and the U. S. Air Force. Fairmont Hotel, San Francisco, Calif. Contact L. K. Lee, head of Advanced Techniques Group, Stanford Research Institute, Palo Alto, Calif.

April 22-23: AIEE Conference on Feedback Control. Claridge Hotel, Atlantic City, N. J. General Chairman, A. G. Kegel, Westinghouse Electric Corp., Friendship International Airport, Baltimore, Md.

April 24: Eighth Annual Spring Technical Conference of the Cincinnati Section of the IRE. For information contact LaVern Winkle, Crosley Division, Avco Engineering, Inc., Cincinnati 25, Ohio.

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solved, another condition must be considered. Suppose it is necessary to null an in-phase component in the presence of a quadrature component of 100mv, a change of 10mv in-phase appears on the meter as  $\sqrt{(100)^2 + (10)^2} = 100.5\text{mv}$ . The actual change is then  $100.5 - 100 = 0.5\text{mv}$ .

This means that an actual change of 10mv produces a change of only 0.5mv on the meter scale. This reduction in sensitivity seriously hampers a proper null setting and thus effectively increases the error of the overall measurement.

The use of an oscilloscope as a null detector also proves difficult especially if the null contains a large harmonic component. Some of the errors previously mentioned may also appear when an oscilloscope is used as a null detector.

An instrument which has proven most satisfactory in difficult nulling problems is the Phazor Null Meter Model 100A shown in Fig. 1. This instrument eliminates the effect of noise and harmonics and is capable of being made sensitive to either in-phase or quadrature component of the null signal.

The principle of operation of this null meter is based upon a multiplying device. The multiplier output is proportional to the instantaneous product of an input signal and a reference signal. A zero centered meter accepts the output of the multiplier and produces a deflection proportional to the time average of the instantaneous product of the input signal and the reference signal. Mathematically, the meter deflection is given in the following equation:

$$D_m = \frac{k}{T} \int_0^T V_s \cdot V_r dt \quad (1)$$

where

$D_m$  = meter deflection  
 $V_s$  = input signal  
 $V_r$  = reference signal  
 $k$  = a constant

Now if the input and reference signals are out of phase so that

$$V_s = A \sin(\omega t + \theta)$$

$$V_r = B \sin \omega t$$

then the meter deflection will be

$$D_m = k \frac{\omega}{2\pi} \int_0^{2\pi/\omega} A \sin(\omega t + \theta) \cdot B \sin \omega t dt \quad (2)$$

and

$$D_m = k' AB \cos \theta \quad (\text{in-phase component}) \quad (3)$$

where

$k'$  = new constant

Employing the built-in phase shifter, the input signal may be shifted 90 degrees or

$$D'_m = k' AB \cos(\theta - 90) \quad (4)$$

$$= k' AB \sin \theta \quad (\text{quadrature component})$$

Equations (3) and (4) show that this instrument can be made sensitive either to the in-phase or quadrature components.

Fig. 2 (right). Illustrating resultant of the fundamental reference signal and its third harmonic when both signals are positive at the origin.

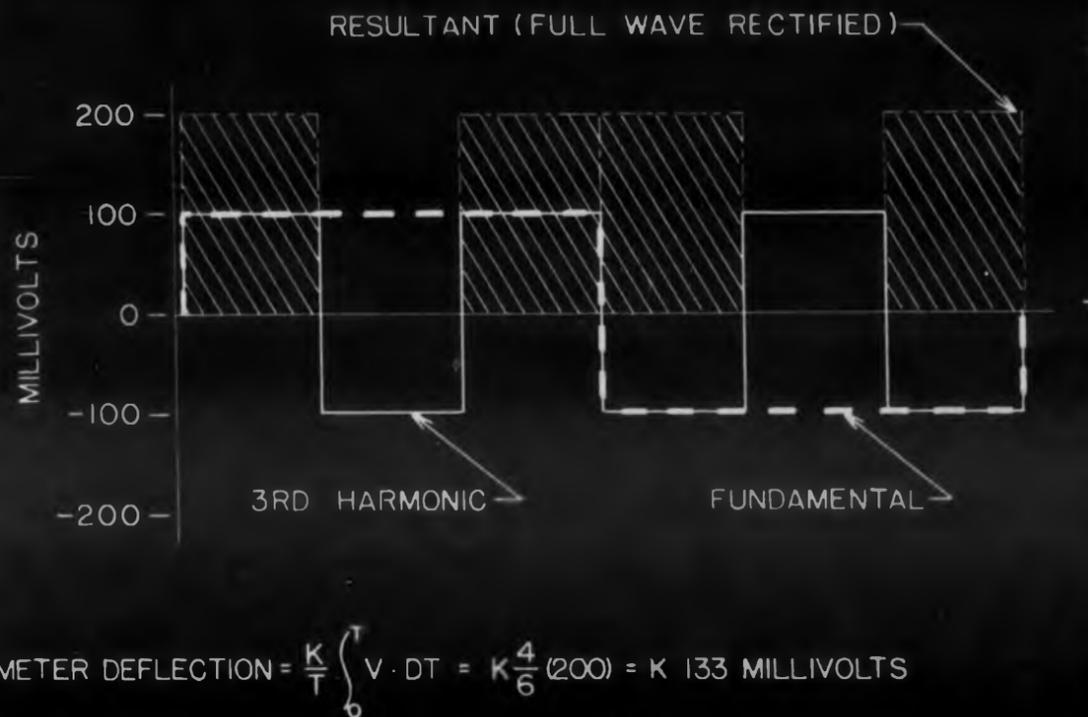
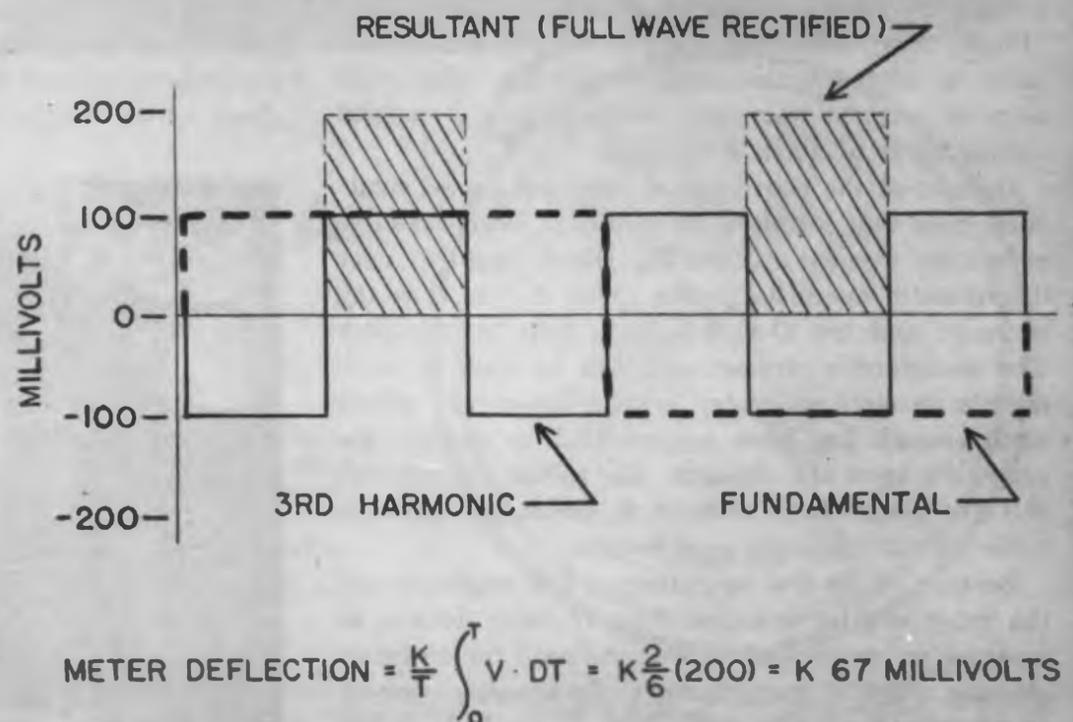


Fig. 3. When the harmonic is shifted 180°, the resultant rectified output is shown right.



Referring to equation (1), there will be no meter deflection if  $V_s$  and  $V_r$  are not of the same frequency. This is the kind of relationship that holds true for a wattmeter. For example, if the current coil of a wattmeter is excited with one frequency and the potential coil excited with a different frequency there is no resultant power or no meter deflection. Because the Phazor Null Meter responds to the product of two voltages, it inherently eliminates errors due to

noise or harmonics if the voltage applied to the reference channel is a low distortion sine wave.

From the above discussion it is apparent that a vacuum tube voltmeter or an oscilloscope can possibly produce erroneous results when used for certain null applications. On the other hand, the Phazor Null Meter Model 100A overcomes the limitations of these instruments and is eminently suited for most null applications, especially where accuracy is needed.



Fig. 1. The "Capaswitch" at the left is a sensitive nonmagnetic relay which operates by means of an electrostatic capacitive element. It requires very little power and responds to very short pulses.

## A Sensitive Nonmagnetic Relay

**A**BOUT 1/100th the power usually required to keep a conventional magnetic-coil relay closed is needed to hold the contacts closed on the Model A-150 "Capaswitch" shown in Fig. 1. This device is basically an ultrasensitive nonmagnetic d-c relay with unusual current carrying capacity and a normal closing delay of about 10 millisecc.

Instead of the conventional electromagnetic structure, this unit employs an unusual electrostrictive capacitive element (0.05mfd), which requires only 0.5mw-sec of operating power (150v d-c) to close the contacts, and less than 0.1mw to hold them closed. The electrostatic element also can be used to store minute amounts of energy from a low-energy source until enough has been accumulated to operate the relay. To open the contacts, the voltage is removed and the electrostatic element is discharged through other circuit elements or a resistor.

Because of its low operating power requirements, the relay can be operated directly from devices as sensitive as phototubes without the need for an intermediate stage of amplification. Its standby current requirements are also very low. A product of the Mullenbach Electrical Manufacturing Co., 2300 East 27th Street, Los Angeles 58, Calif., the unit has a wide range of interesting applications, and is intended primarily for devices of an ON-OFF nature where a relatively large voltage swing is available.

In design work, the "Capaswitch" can be treated as

an 0.05mfd, 300v capacitor, with a leakage resistance of over 100 megohms. Contact pull-in occurs about 10 milliseconds after the capacitor is charged to 125 +20v, and drops out when the voltage across the capacitor is reduced to 75 +20v. Pull-in and drop-out times can be delayed very readily by simply inserting

an external resistance in the input circuit.

Housed in a block phenolic case 3-1/2" x 1" x 3/4", the unit weighs less than 2 oz and can operate at temperatures from -20°F to +150°F. The spdt contacts are conservatively rated at 1amp, 125v, a-c, noninductive load.

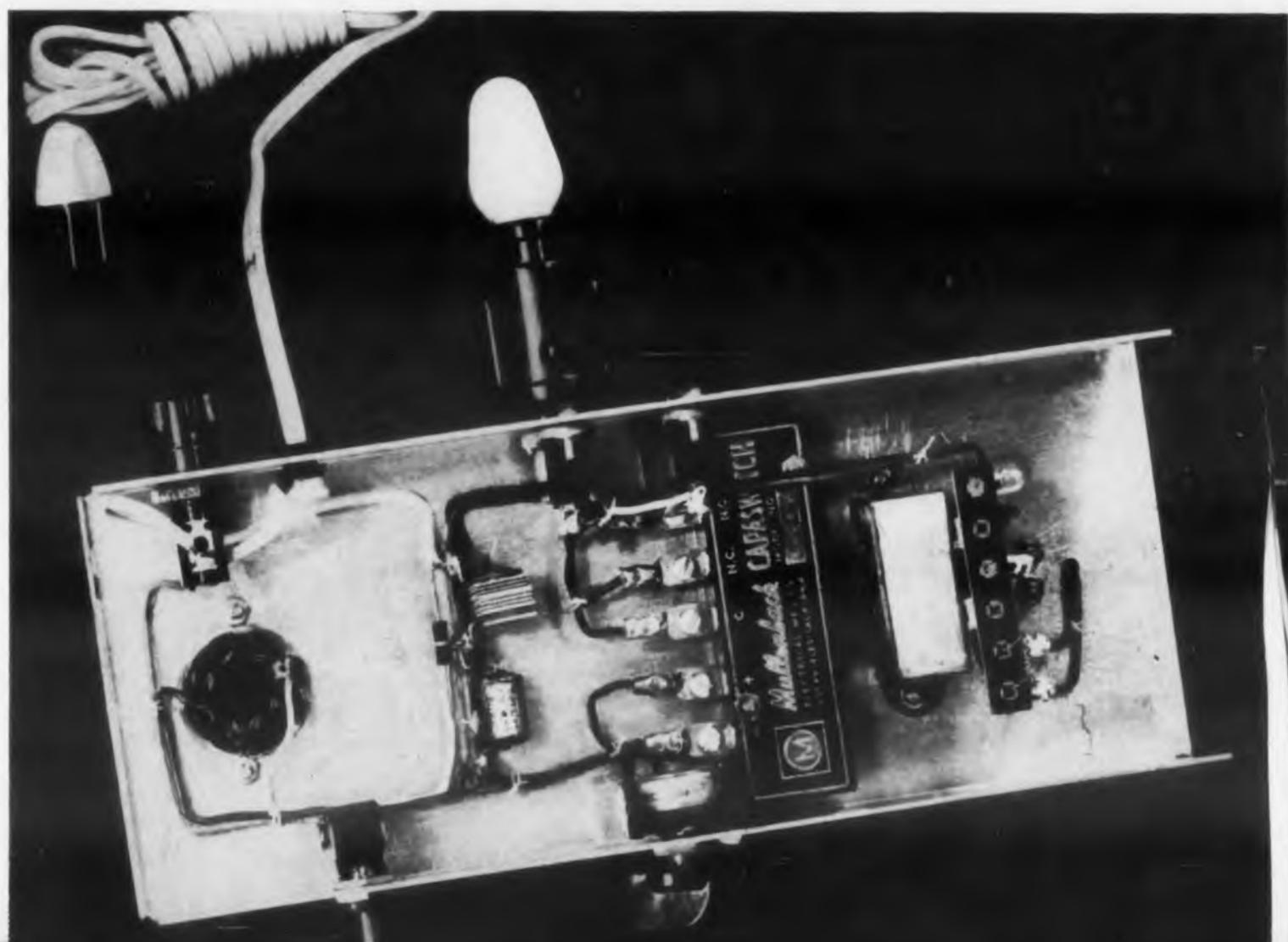


Fig. 2. Bottom view of a typical "Capaswitch" application, which can be used to count small objects passing through a light beam. The new relay operates directly from a phototube without the need for intermediate amplification.

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The most common circuit application for the Capaswitch is one where a d-c voltage source charges the unit through a control element, generally some form of variable resistance whose value is a function of the physical phenomenon to be indicated or controlled. Fig. 2 shows a typical application and Fig. 3 shows a basic control circuit.

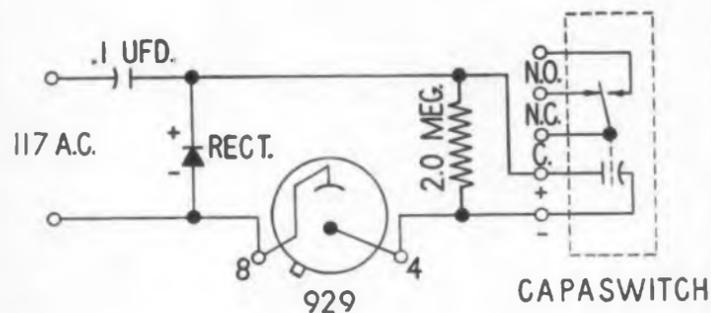
In this instance a Type 929 vacuum phototube, whose resistance is a function of the light falling on the cathode, is the control element. An interesting feature of this circuit is that the phototube is used both as a control element and a diode rectifier in the half-wave voltage doubling power supply. This results in increased sensitivity at no increase in cost.

The selenium rectifier operates on half an input cycle to charge the 0.1mfd capacitor, and on the other half cycle the capacitor discharges in series with the line voltage through the phototube when it is illuminated. This provides double the line voltage to the 2-megohm load resistor and the Capaswitch.

When the phototube is illuminated, the voltage across the Capaswitch operating element rises exponentially to twice the peak line voltage; when the phototube is dark, the voltage across the Capaswitch drops exponentially to zero. The time constant of the charging circuit is a function of the degree of illumination of the phototube. The time constant of the discharge circuit is the product of the load resistance and the capacitance of the Capaswitch.

This makes the pull-in and drop-out delay periods nonuniform, and they vary as functions of the intensity and duration of the phototube illuminations. This characteristic is not objectionable in such appli-

Fig. 3. Basic "Capaswitch" control circuit, using a phototube as a control element and as a diode rectifier in the voltage doubler supply.



cations as night-light controls, slow-rate counters, in photoelectric announcers, and door openers.

When used with a "B" battery voltage supply, the unit assures excellent battery life because of its low standby current requirements. It can also be used as a time delay relay, and its high input resistance and low power requirements make it an ideal plate circuit relay. The ability to operate on pulses of  $10\mu\text{sec}$  or less also make it especially useful in computers and many types of electrically operated business machines.

# Introducing SILICON JUNCTION DIODES

## 1N138A and 1N137A

The SILICON DIODES presented here are a new development in the field of semiconductor devices. They employ a p-n junction structure developed by the Bell Telephone Laboratories and announced in the November, 1952 IRE Proceedings. They should not be confused with point contact polycrystalline silicon diodes currently used in VHF and microwave applications.

These SILICON JUNCTION DIODES represent a significant technological advance in the semiconductor art and open up many new applications which cannot now be served by germanium devices or any currently known non-linear devices.

The SILICON JUNCTION DIODE is characterized by excellent stability, extremely low reverse current, moderate to heavy forward conductance and a sharply defined low impedance breakdown region in the reverse direction which occurs at a particular applied voltage termed the Zener (breakdown) voltage.

These SILICON JUNCTION DIODES are rugged in internal design. They contain no whiskers or point contacts. Internal contacting is a shock proof positive weld that will withstand military as well as commercial usage. They are hermetically sealed in an inert gas atmosphere after prior encapsulation.

It is with considerable pride and satisfaction in the quality and function of this new device that we announce the SILICON JUNCTION DIODE available for commercial application in production quantities.

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MINIMUM BACK RESISTANCE	1000 MEGOHMS @ -10 VOLTS	667 MEGOHMS @ -20 VOLTS
Zener voltage, EZ @ -0.2 mA	20 - 40 V	40 - 70 V
Forward voltage drop, +Eb	<1.0 V @ +5 mA	<1.0 V @ +3 mA
Reverse current, Lib	<10-8A @ -10 V dc	<3-10-8A @ -20 V dc
Reverse voltage, -Eb (working)	18 V max.	36 V max.
Forward current:		
steady state dc, Ib	50 mA max.	30 mA max.
instantaneous peak, ib	250 ma max.	150 ma max.
Zener current:		
steady state dc, IZ	3 mA max.	1.5 mA max.
instantaneous peak, iZ	10 ma max.	5 ma max.
Power dissipation, P	125 mW max.	125 mW max.
Ambient temperature range	-50°C to +100°C	-50°C to +100°C
Mounting position	Any	Any

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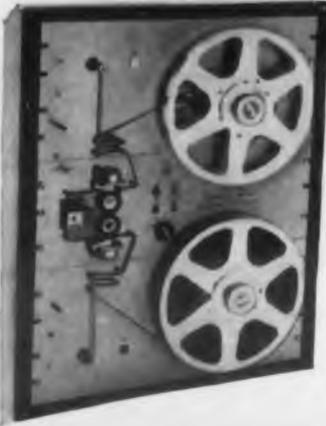
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# Relay and Switch Contact Protector

**M**AINTENANCE costs and service interruptions, due to contact erosion caused by arcing at switch and relay contact points, can be greatly reduced through the use of the Contact Protector shown above. This device is a special application of selenium rectifiers cells that has negligible effect upon circuit operation, and is used in a-c or d-c circuits.

A product of Federal Telephone and Radio Company, 100 Kingsland Road, Clifton, N. J., the unit is small in size and low in cost. It will accommodate all signal and telephone type relays which operate up to 40 times per second and draw up to 600ma current at 150v a-c or d-c.

The curves in Fig. 1 illustrate what happens in circuits without and with protection for the switch contacts. The upper curve shows what happens when contacts are not protected. At time zero the switch is closed, and at time *A* the contacts open with a resultant rise in voltage. Since  $E = -L di/dt$ , (where  $di/dt$  is the time rate of change of current and  $L$  is the inductance of the relay coil), the voltage continues to rise until the arcing across the open contacts begins at about 300v. Arcing continues from *A* to *B* as the contacts separate, and continues until the separation is too great to sustain the arc, which ceases at time *B*. During the interval

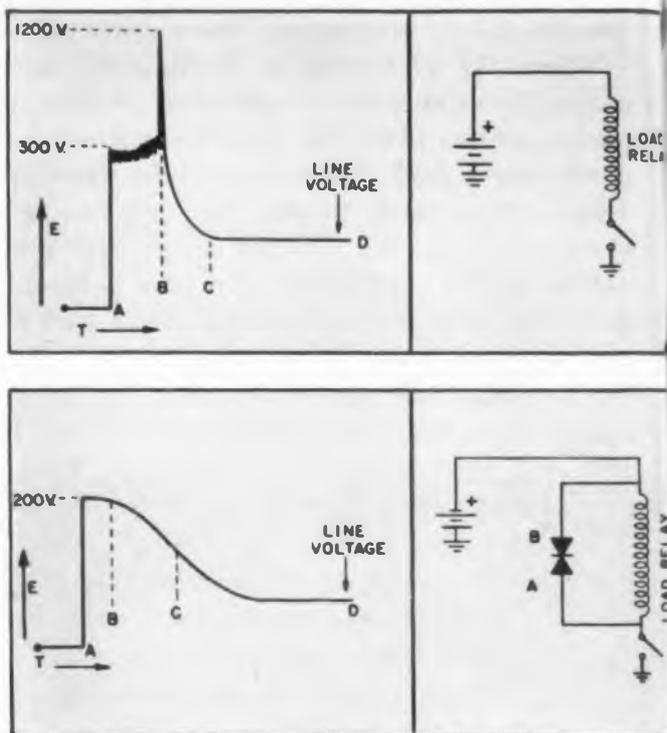


Fig. 1 (above). Line voltage changes at switch closing without and with protection.

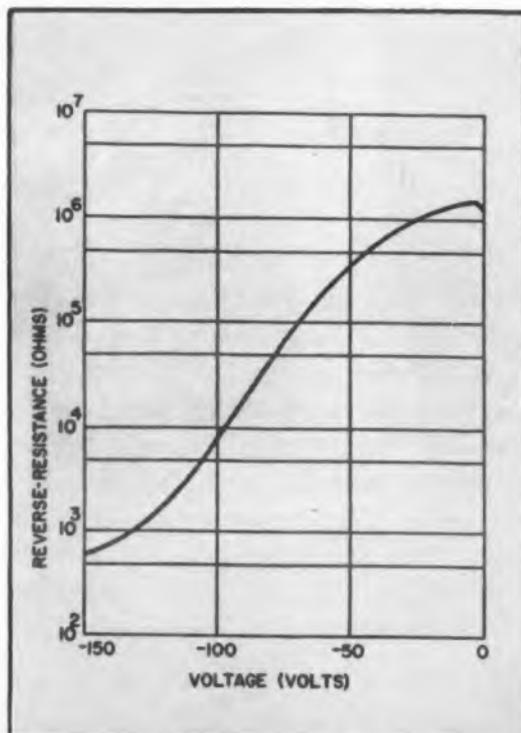


Fig. 2 (right). Reverse resistance of the Protector vs reverse voltage.

from *B* to *C* the voltage decays exponentially, and eventually reaches the line voltage value at time *D*.

When a Contact Protector is connected across the load relay coil as shown in the lower right hand figure, the curve at the lower left shows the resulting voltage action. At time zero the contacts are closed, and at time *A* they open. Again the voltage begins to build up, but this time to a value not high enough to cause arcing. The voltage decays during the interval from *B* to *C*, and eventually reaches line voltage at time *D*.

The Contact Protector consists of selenium rectifier cells assembled in back-to-back arrangement and combined into a compact tubular unit. In the reverse direction the selenium rectifier cells operate as a nonlinear impedance as shown in Fig. 2. This is a plot of reverse impedance vs reverse voltage, and was obtained by using an 8 millisecond pulse.

Referring again to the protected circuit in Fig. 1, when the contact opens, the voltage polarity reverses and rises to a value much greater than the line voltage. The *A* cells, which acted as blockers when the contact was closed, now become a short circuit and the full voltage is supplied across the backward-connected *B* cells in the diagram. The total effect is that the voltage does not rise to the arcing potential because the rectifier presents a low impedance to high voltages.

This combination of rectifier cells compares very favorably with other methods of contact protection with respect to peak voltages and timing characteristics. The physical size of the unit is small and it can be readily connected in a circuit just like a capacitor or resistor.

For direct current applications, units are available with ratings ranging from 15v-22v at 100ma to 133v-154v at 600ma coil current. Their size ranges from 25/64" diam x 5/8" to 1/2" diam x 15/16" long. For alternating current applications units can be furnished ranging from 15v-26v, 100ma, 25/64" diam x 5/8" to 105v-130v, 1/2" diam x 15/16".

For higher currents, standard stack construction can be used. Hermetically sealed units also can be furnished.



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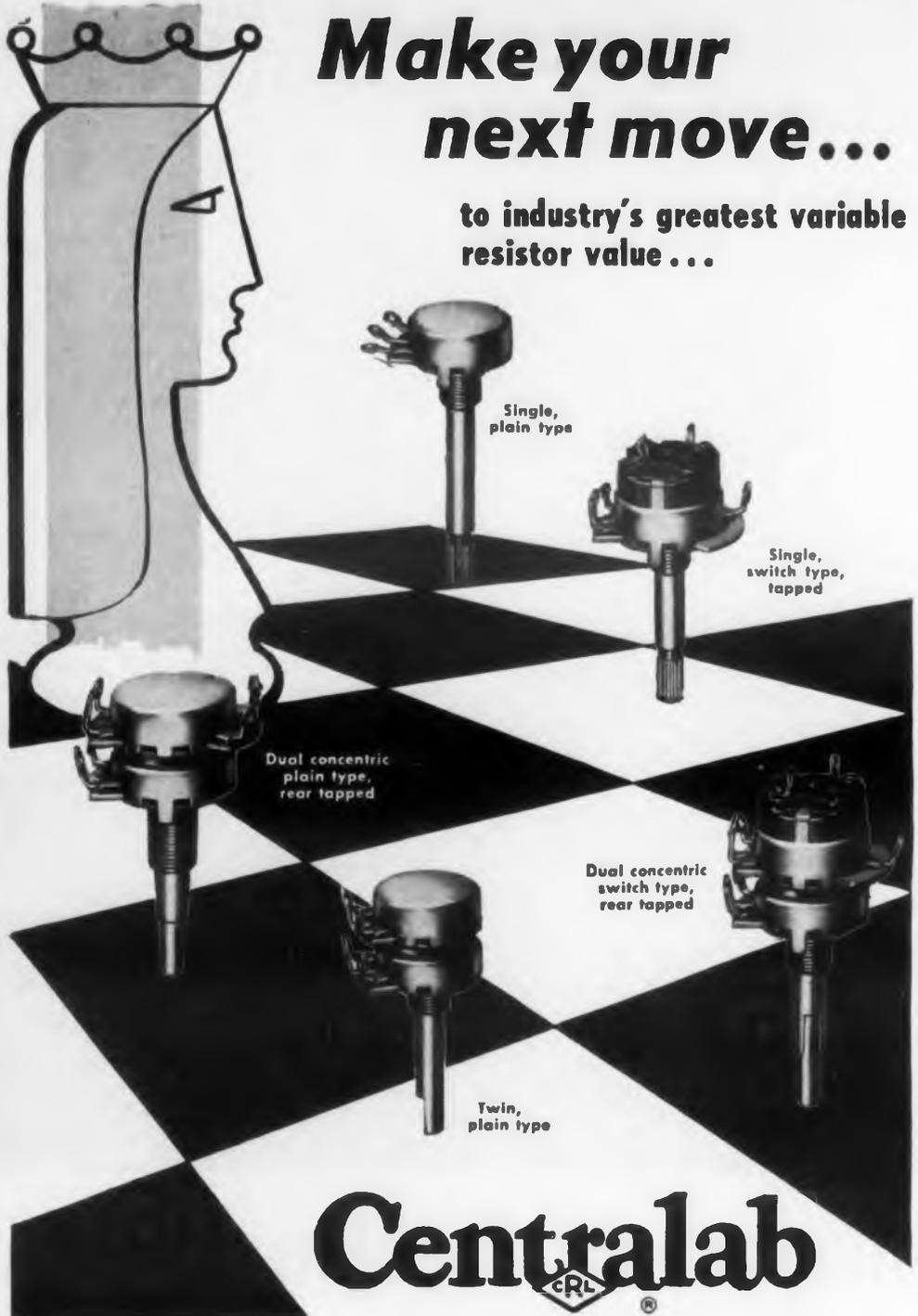
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# Universal Measuring Test Set

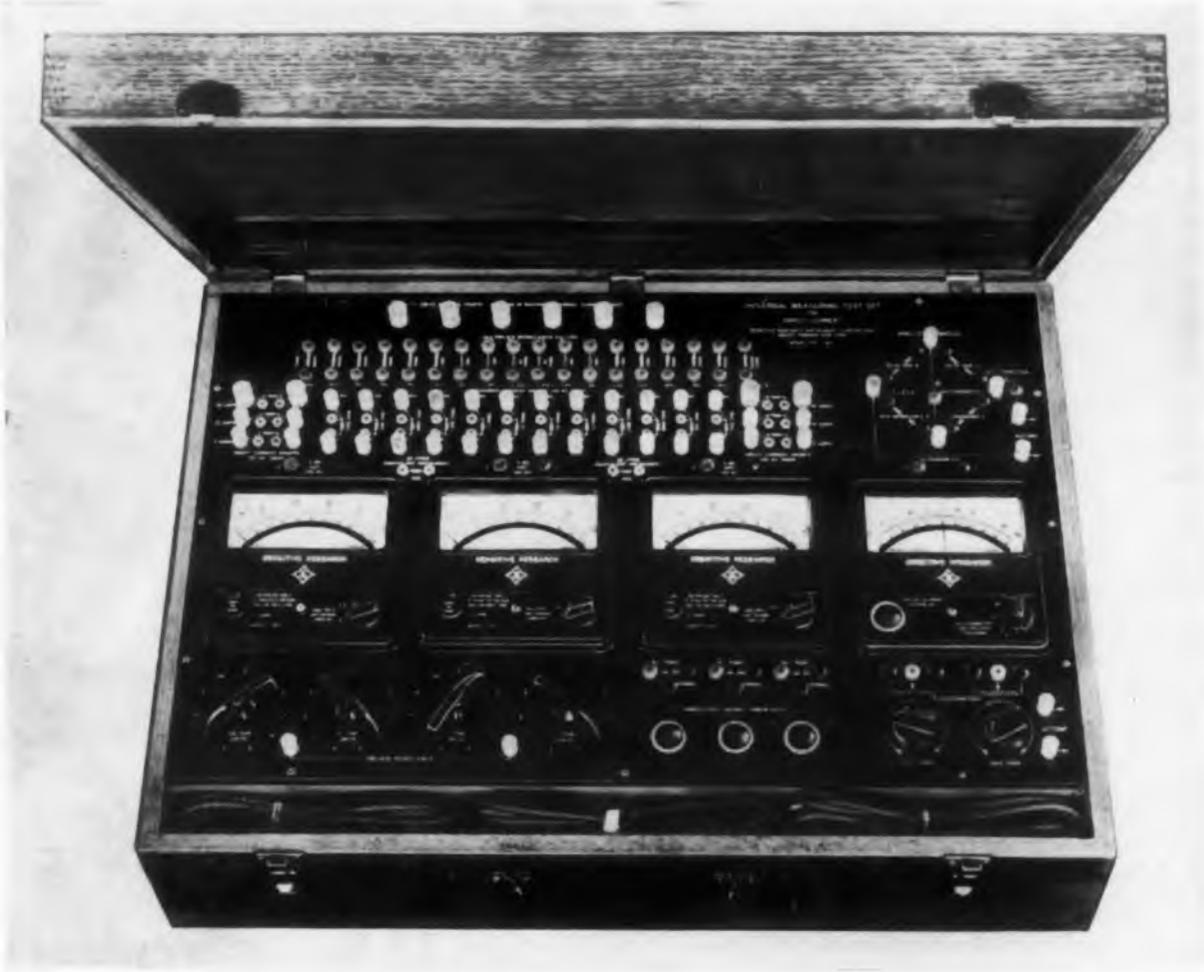


Fig. 1 (above). The Universal Measuring Test Set showing the various connections engraved in the panel. It provides over 200 separate measurement ranges.

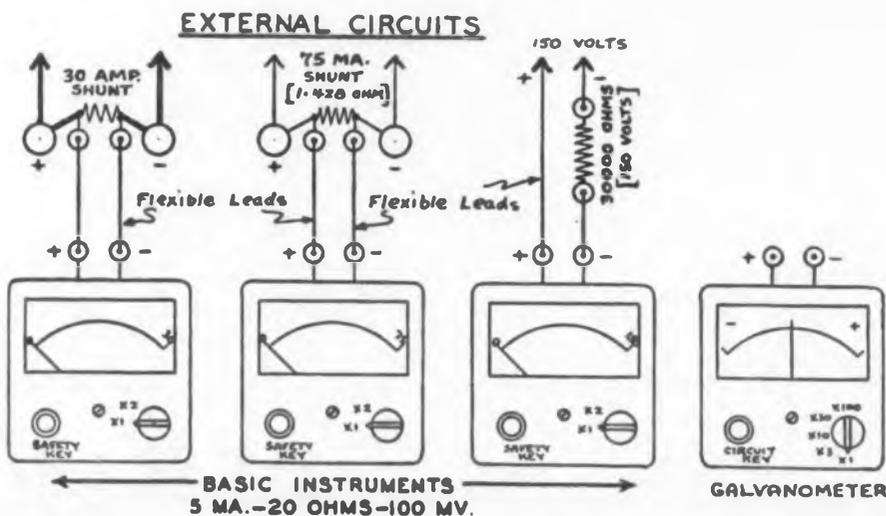


Fig. 2 (left). Connections of the basic instruments for a test requiring a 30amp, a 75ma, and a 150v meter.

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OVER 200 separate instrument ranges are available in the Universal Measuring Test Set which has been designed for a wide variety of d-c measurements, and is shown in Fig. 1. It can be quickly connected for use as a Wheatstone bridge, a potentiometer millivoltmeter and voltmeter, a zero resistance microammeter or milliammeter, a high resistance voltmeter, a r-f voltmeter, an r-f milliammeter or ammeter, and for many other types of measurements.

Basically the unit consists of four separate instruments in one case complete with internal resistances and shunts. It also includes a basic Wheatstone bridge circuit, a 4-dial decade box, fine and coarse potentiometers, galvanometer and volt closing keys, binding posts, plugs, and lead connections.

Three of the instruments are identical, each having a basic full scale sensitivity of 5ma, 20 ohms, 100mv; a 4" mirror scale; and an accuracy of 0.5%. These units provide a total of 96 ranges from 5ma full scale (lowest reading 50 $\mu$ amp) to 60amp, and 100mv full scale (lowest reading 1mv) to 600v. They have a manually operated "key protection" which helps to guard the meters against overloads.

The fourth instrument is a 5-range galvanometer with a basic sensitivity of 50-0-50 $\mu$ amp, and multiplying factors of 1, 3, 10, 30, and 100 to cover a wide range of galvanometer and microammeter ranges.

The test set, which is a product of Sensitive Research Instrument Corp., 9-11 Elm Avenue, Mount Vernon, N. Y., is very simple to operate. For example, Fig. 2 shows how the connections are made for a test requiring a 30amp, a 75ma, and a 150v instrument. In this instance the galvanometer is not used.

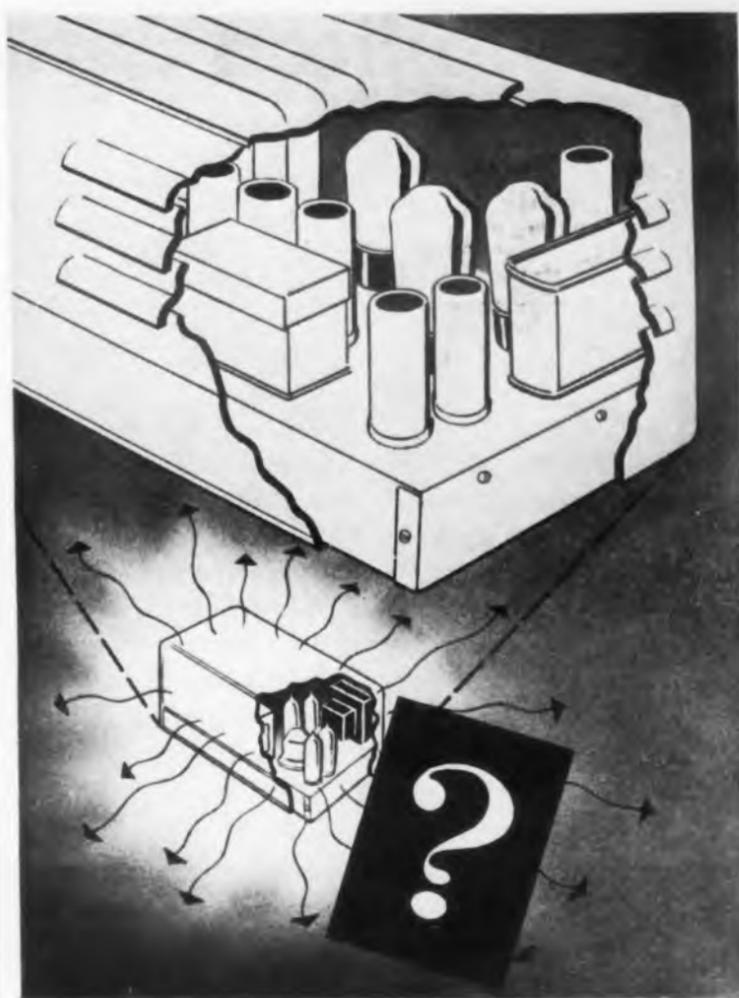
By using the basic bridge and four copper oxide or crystal diode rectifiers, a wide range of a-c measurements can be made. For current and voltage checks in the r-f range, a vacuum thermocouple is employed in conjunction with the galvanometer. In a similar manner the instruments can be connected to make many other types of measurements including d-c power checks.

Each of the basic instruments is readily replaceable if damaged, and the replacement units will operate satisfactorily because the four instruments employed in the test set have been standardized to work in any Universal Test Set without recalibration. The shunt and series connections for current and voltage are engraved on the panel to simplify their use. Replacement resistances and shunts supplied by the manufacturer are easily installed by soldering.

A virtual test laboratory in one case, the Universal Test Set is furnished in a substantial oak case which has a removable cover and compartments for leads, etc. Because of its great versatility and wide measuring ranges, the unit should find wide use in electronic research, development, and design laboratories. **▲This instrument will be on display in Booth 386 at the Radio Engineering Show.**

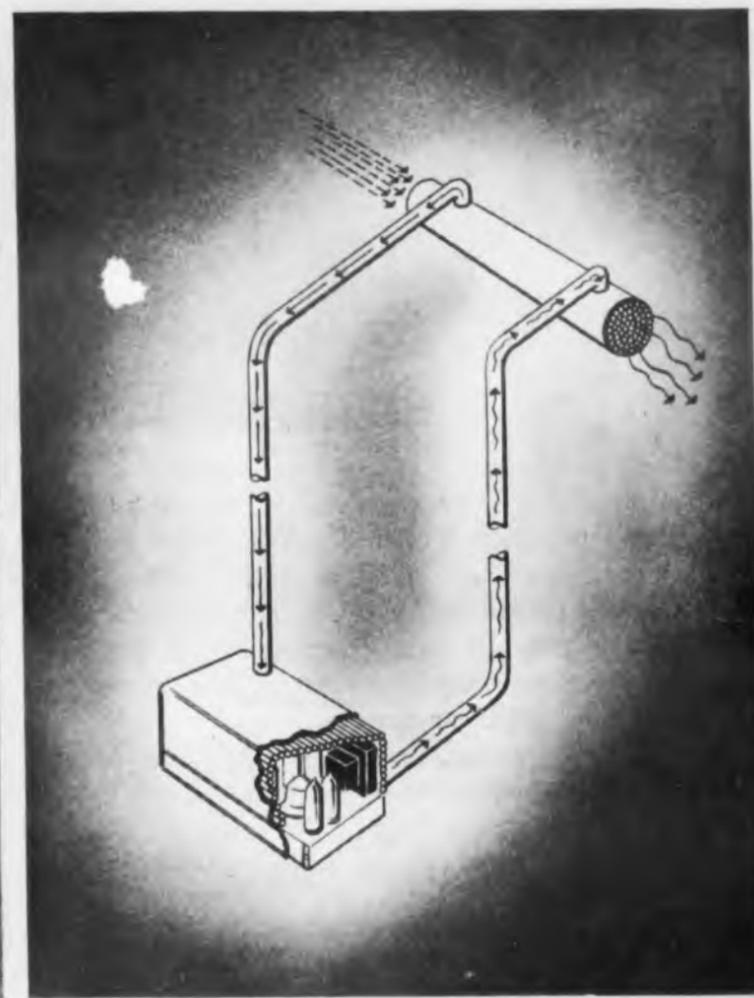
ELECTRONIC DESIGN • February 1954

# IDEAS that started in a HEAT EXCHANGER



## THE PROBLEM

New high-efficiency electronic units (lower unit in above panel) occupy as little as one-twentieth the space of older, air-cooled types (upper unit) — but they generate just as much heat. And since their hermetic sealing prevents direct cooling by air flow, temperatures would rise far beyond safe limits unless the heat were removed and dissipated elsewhere. At the same time, cooling equipment must be kept light and compact enough for aircraft use.



## THE SOLUTION

Working with a leading manufacturer of electronic equipment, Clifford engineers designed the case of this aircraft electronic unit as a liquid heat exchanger. Heat is extracted by connecting with a second exchanger of the air-flow type, as shown. In jet-engined planes, however, heat is preferably dissipated by a liquid-to-liquid cooler — thereby reducing drag on the plane. Made entirely of aluminum, these Clifford heat exchange units combine thorough cooling with minimum size and weight.

## You may have a cooling problem

Your own manufacture may or may not include aircraft applications. But now or later you may be looking for the best way of dissipating heat generated by high wattage elements in small spaces.

Then it will pay you to talk things over with Clifford engineers. These experts in a highly specialized field have developed successful liquid coolers for every type of aircraft — which includes some of the severest and most unusual working conditions any cooler is ever required to meet.

Clifford Feather Weights, for example, are the only all-brazed type of oil cooler. Their superior weight-strength ratio is the result of a patented brazing method and pre-testing in Clifford's wind tunnel laboratory — largest and most modern in its field.

Take advantage of Clifford's long

record of finding the most efficient and economical answers to the toughest cooling problems. Write to Clifford Manufacturing Company, 134 Grove Street, Waltham 54, Massachusetts. Division of Standard-Thomson Corporation. Sales offices in New York; Detroit; Chicago; Los Angeles; Waltham, Massachusetts.



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## Silicon Junction Diodes

**S**UPERIOR stability and higher operating temperatures than those of ordinary germanium devices, as well as definite Zener voltage values are outstanding features of the Type 1N138A and Type 1N137A Silicon Junction Diodes. The availability of these units opens up many new application possibilities which cannot now be served by germanium devices or other nonlinear devices.

Originally developed by the Bell Telephone Laboratories, they employ a p-n structure made with grown

silicon crystals, and are available in production quantities from National Semiconductor Products, Div. of National Fabricated Products, Inc., 930 Pitter Avenue, Evanston, Ill. They have extremely low reverse current, moderate to heavy forward conduction, and a sharply defined low impedance breakdown region in the reverse direction which occurs at a particular applied voltage (Zener voltage).

One of the unique features of these new silicon diodes is the absence of any "knee" in their charac-

teristic curve. This can be seen in the oscilloscope traces shown on the front cover which indicate volt-ampere characteristics under actual test. More detail, which the linear scale reproduction of the oscilloscope cannot provide, is shown in the curves in Figs. 1, 2 and 3 which are semi-logarithmic representatives of the same characteristics.

Maximum ratings for the Type 1N138A include 18v reverse voltage, 50ma forward steady state current, 250ma instantaneous peak current, and Zener

Fig. 1. Characteristic curves for both types; forward current vs forward voltage.

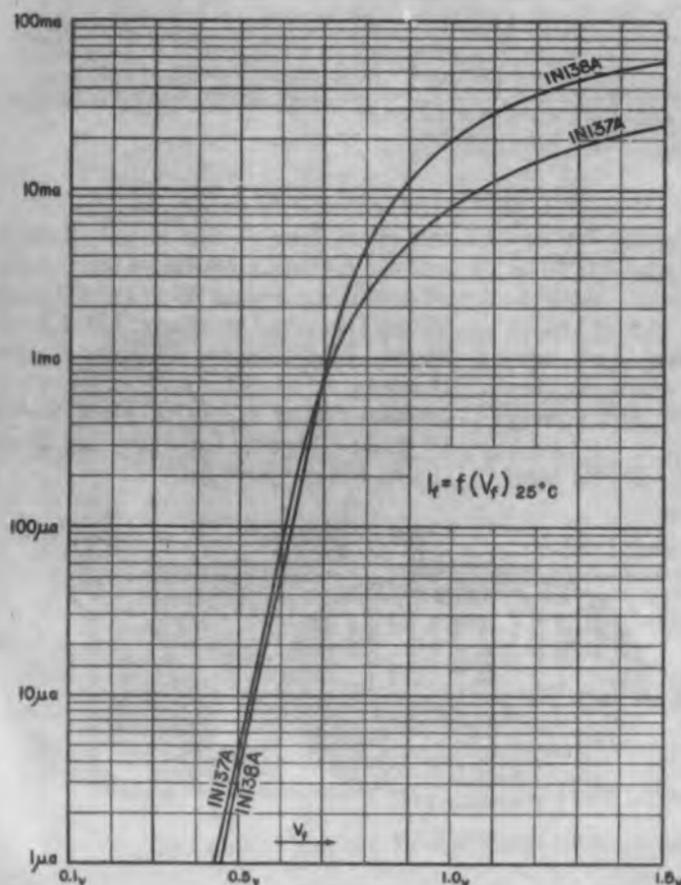


Fig. 2. Characteristic curves for Type 1N138A, reverse current vs Zener voltage.

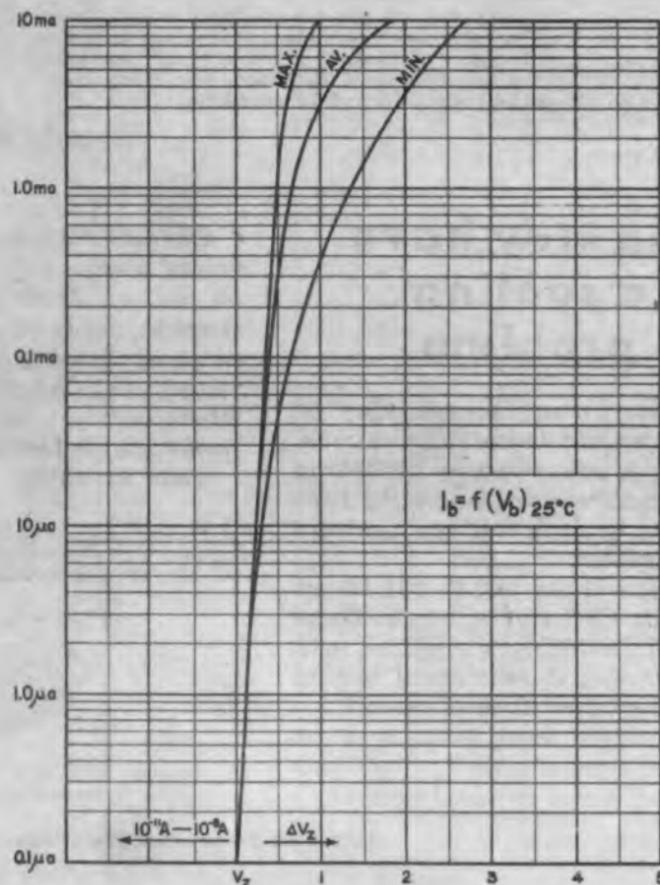
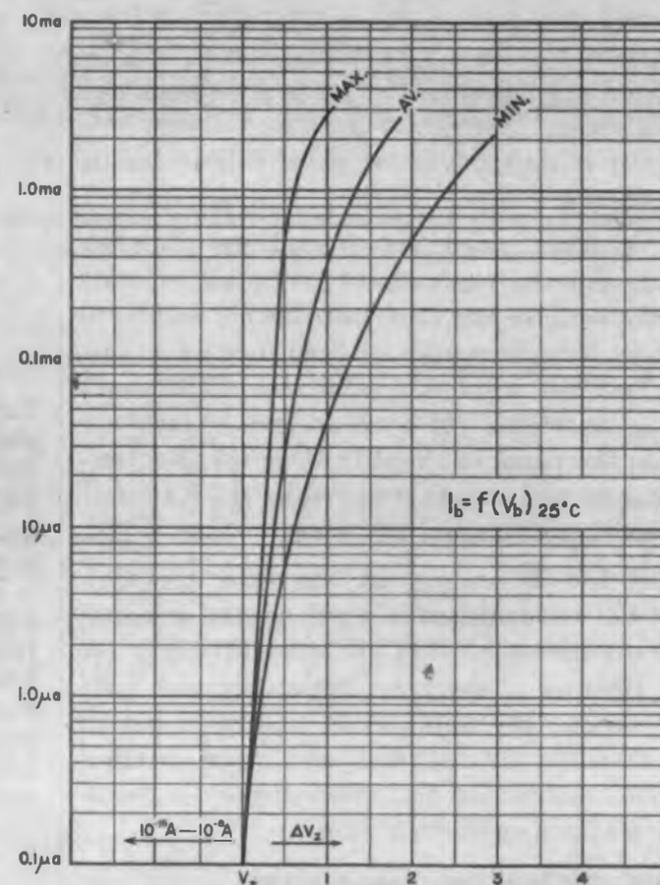


Fig. 3. Characteristic curves for Type 1N137A, reverse current vs Zener voltage.



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currents of 3ma steady state and 10ma instantaneous peak. Zener voltage for the unit is 20-40v at  $-0.2\text{ma}$ ; and reverse current at  $-10\text{v dc}$  is less than  $10^{-8}\text{amp}$ .

For the type 1N137A the maximum ratings are 36v reverse voltage, 30ma steady state and 150ma instantaneous peak forward currents and Zener currents of 1.5ma steady state and 5ma instantaneous peak. Zener voltage is 40-70v at  $-0.2\text{ma}$ , and reverse current at  $-20\text{v dc}$  is less than  $3 \times 10^{-8}\text{amp}$ .

Maximum power dissipation rating for both types is 125mw and they can operate over an ambient temperature range of  $-50^{\circ}$  to  $+100^{\circ}\text{C}$ . The units are rugged in design and contain no whiskers or point contacts. Internal contacting is a shock proof positive weld that withstands military or commercial usage. Their temperature characteristics make them valuable for all uses at elevated temperatures, especially in the  $+90^{\circ}\text{C}$  to  $+100^{\circ}\text{C}$  range. They can be selected in sets of matched fours to make matched "quads" that will stay in balance over wide temperature ranges. Because of the exceptionally high back resistance, silicon junction quads make excellent converters to "chop" d-c ahead of a-c amplifiers. In many f-m applications, these quads afford a high degree of carrier suppression.

Matched pairs can be used in f-m discrimination circuits at 10.25Mc. Their performance is not appreciably impaired in this application when operating at  $100^{\circ}\text{C}$  and higher. The combination of high back resistance with a steep forward characteristic also makes silicon junction diodes very useful in function generating networks.

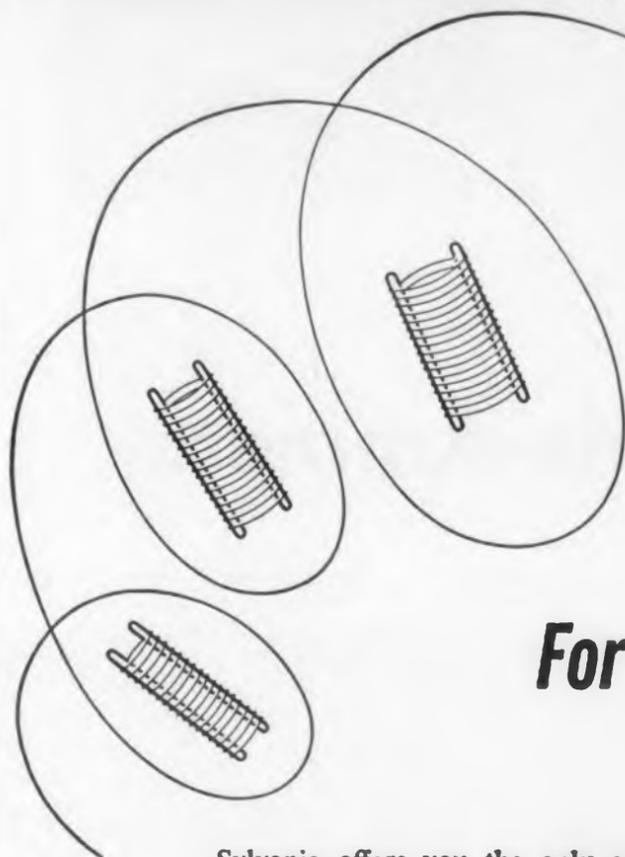
The low dynamic resistance of silicon junction diodes in their reverse breakdown region makes them useful as constant voltage sources. Design center currents much less than are normally used with gas voltage reference tubes like the Type 5651 are optimum for silicon junction diodes. Excellent voltage regulation is possible over very large ranges of current in the breakdown region, with the additional advantage that diodes can be furnished with voltage drops of any desired value.

The reverse breakdown characteristic of silicon junction diodes adapts them for surge protection applications. Their "starting" and operating voltages are nearly identical, and this voltage can be located anywhere from 5v to hundreds of volts. They can be used to protect transistor collectors and emitters very effectively.

Using the units, clipping can be effected at the reverse breakdown voltage without a clipping bias supply being required. If a clipping bias supply is used, the steep forward characteristic of silicon junction diodes results in very sharp corners.

The Type 1N138A and Type 1N137A are the first two silicon junction diodes being announced as available in production quantities by the company. Additional types with extended Zener voltage ranges and higher power and frequency ratings are to follow.

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Fig. 1. Front panel of the Hermach-Englehard Transfer Volt-Ammeter is shown at the left, and a typical measuring setup appears at the right. The instrument is accurate to 0.05% over a 20cy to 20kc frequency range.

## A Precision A-C Volt-Ammeter

**B**ETTER than laboratory standard accuracy, an extremely wide frequency range, and many measuring ranges to cover most laboratory requirements are features of the Hermach-Englehard Transfer Volt-Ammeter shown in Fig. 1. It is a precision a-c multirange instrument that can measure voltages from 5v to 300v and currents from 0.1amp to 5amp with an accuracy of 0.05% over a frequency range from 20 to 20,000cy. Because of these and other features, it can take the place of several laboratory instruments whose accuracy may be limited to a narrow frequency range.

The instrument operates on the transfer principle of matching the heating effect of an unknown alternating current against the heating effect of a known direct current. It makes use of a special thermal converter shown in Fig. 3. The unknown a-c current

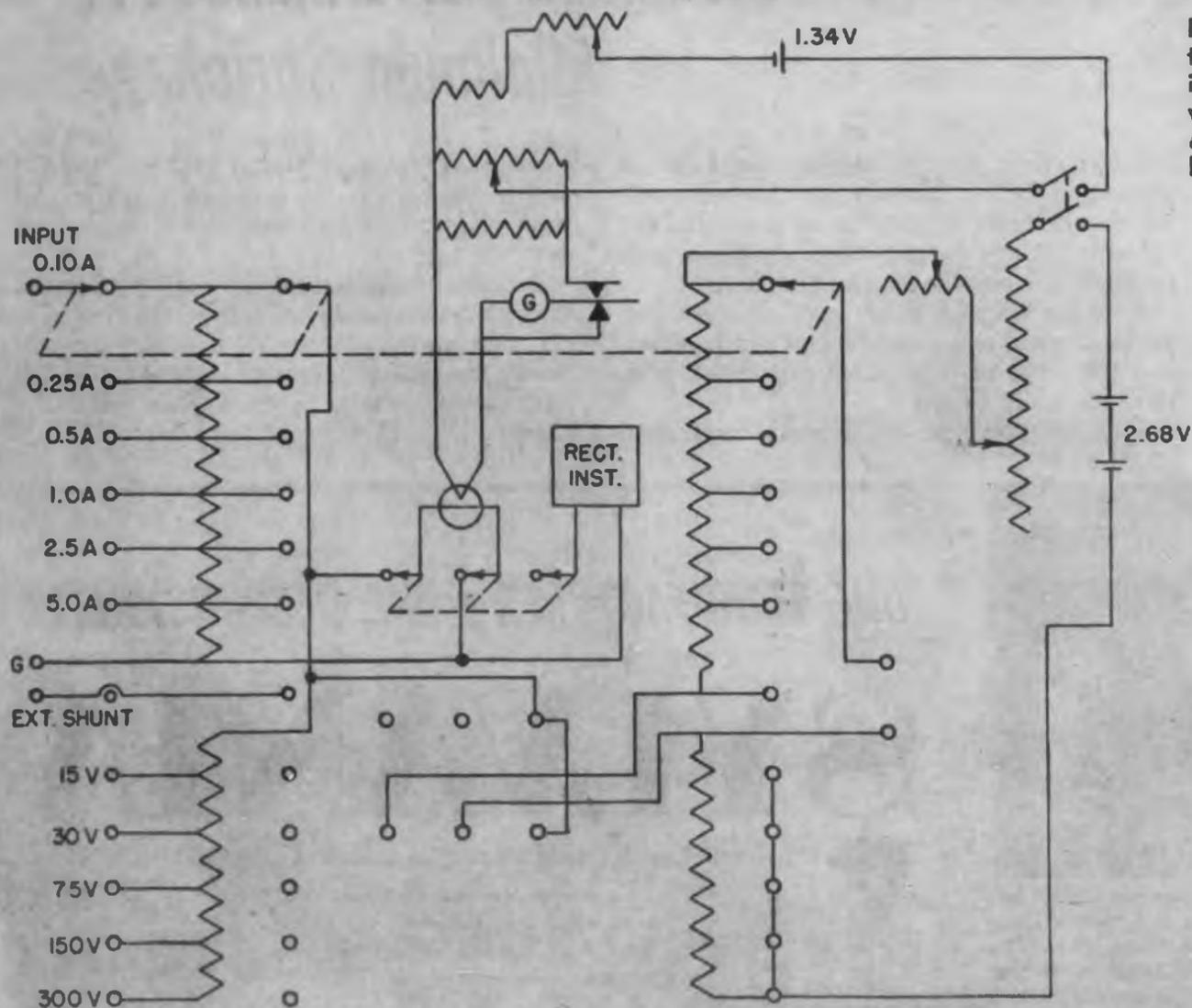


Fig. 2 (left). Circuit diagram of the instrument. The rectifier meter indicates approximate values of voltage and current, and serves as a range checker to prevent burnout of the thermoelement.

Fig. 3 (right). Schematic diagram of the thermal converter. Current through the heater (horizontal wire) generates a voltage in the thermocouple (inverted V-shaped wire) fastened to the heater by an insulating bead.

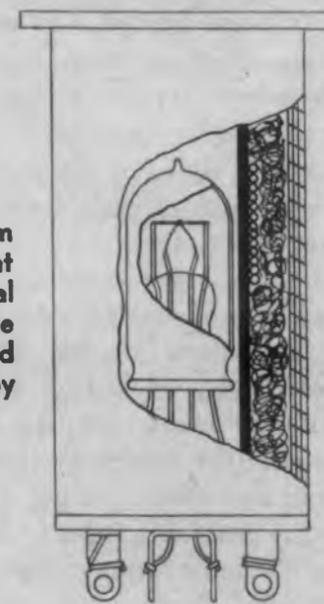
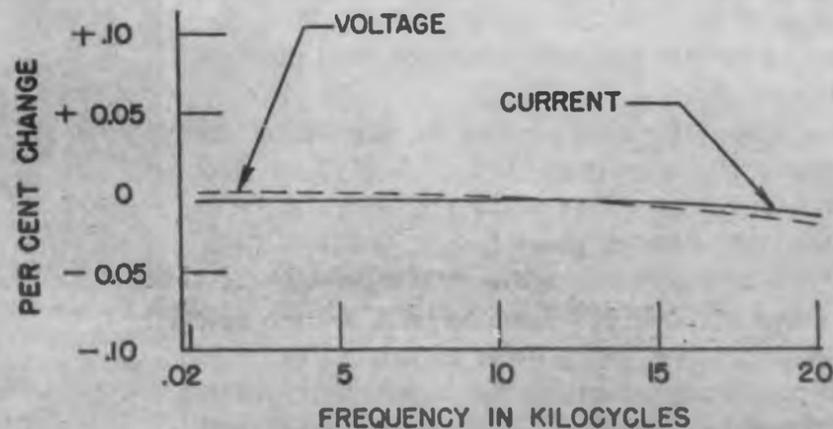


Fig. 4 (below). These curves indicate the excellent frequency characteristics of the instrument. It can be used above 20kc, but with reduced accuracy.



passes through the heater wire to which is attached an insulating bead containing a thermocouple.

The resulting emf developed in the thermocouple is balanced against an adjustable internal d-c "bucking" circuit, as indicated by a null reading on a built-in galvanometer. The heater is then switched to an internal d-c circuit, which is adjusted to give the same output emf, and the voltage drop across a portion of this circuit is measured with an external potentiometer.

The measured potentiometer voltage is multiplied by a simple factor to obtain the unknown alternating current or voltage. The measured a-c voltage depends only on the product of the potentiometer reading and a ratio of resistance. It does not depend upon the characteristics of the converter. A typical measuring setup is shown in Fig. 1, and a schematic diagram of the instrument's circuit is shown in Fig. 2.

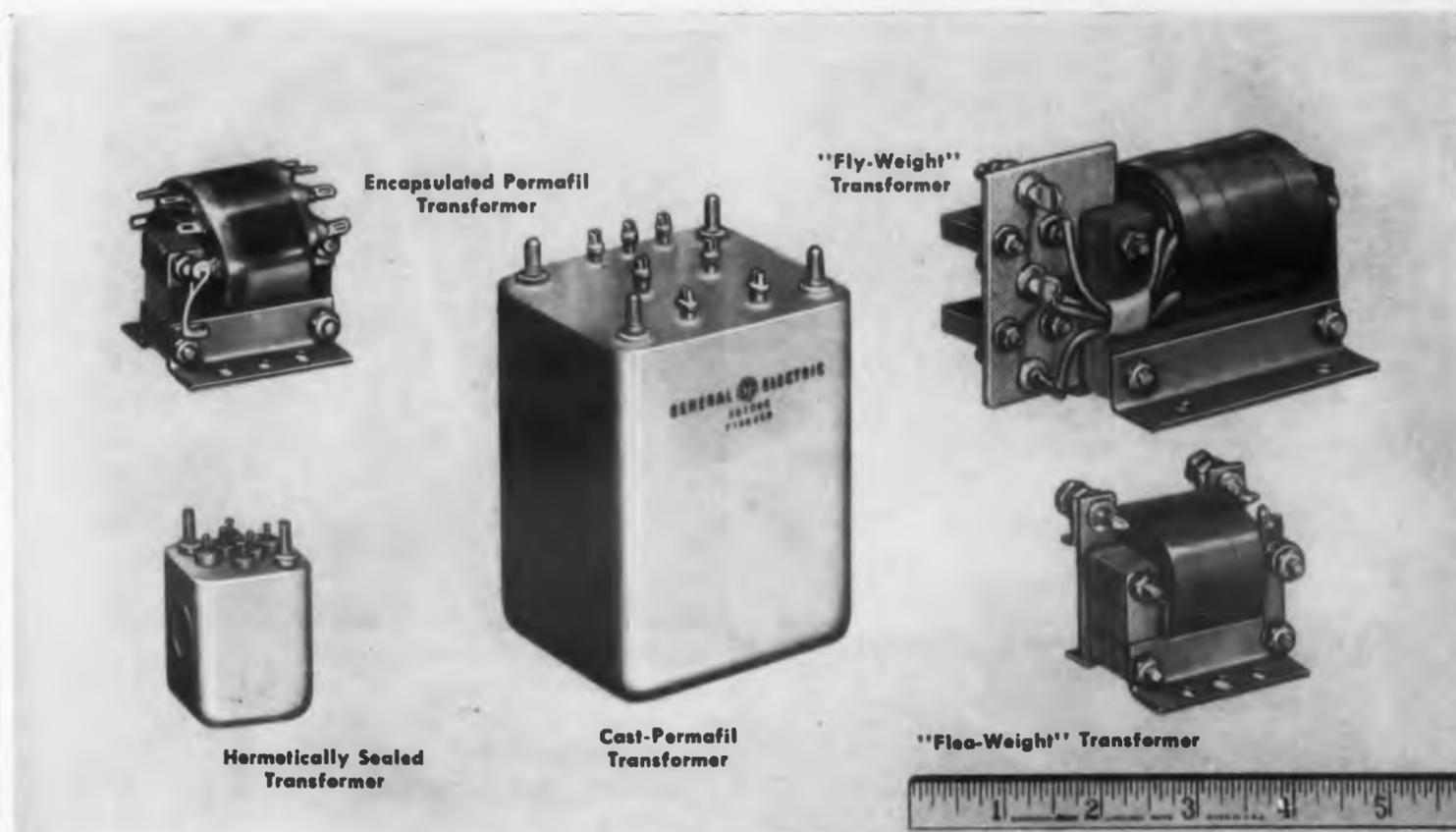
One of the outstanding features of the instrument is that the thermal converter element can be easily replaced without changing the calibration of the instrument in any way. Differences in the conversion efficiency of the unit do not affect the accuracy of the meter. The converter and the internal mercury cell batteries are readily changed through a removable plate on the face of the instrument.

A 5%, direct reading, rectifier type meter is provided to indicate approximate values of current and voltage, and as a check for effects of circuit changes. It indicates the potentiometer setting to 5% and also serves as a range checker to prevent burnout of the thermoelement.

Current ranges of the Volt-Ammeter are 100, 250, and 500ma; and 1, 2.5, and 5amp. The voltage ranges include 15, 30, 75, 150, and 300v. The instrument is a product of Charles Engelhard Inc., East Newark, N. J., who will also furnish external shunts and multipliers to extend the range of the meter. Frequency characteristics of the instrument are shown in Fig. 4. Measurements can be made at frequencies higher than 20,000cy, but with reduced accuracy.

The instrument is light in weight, compact, and portable. It requires the ordinary care given any laboratory instrument, and can be operated by semi-skilled laboratory personnel with a minimum of instruction. No compensation for atmospheric temperatures or leveling is needed.

Because of its wide frequency and measuring ranges, and its stability and ruggedness compared to the usual laboratory precision instrument, the transfer volt-ammeter should find use in many electronic design, development, and research laboratories.



**ENCAPSULATED PERMAFIL** transformer has low center of gravity, strong vibration-resistant mounting, high moisture resistance.  
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## 4 ways G.E. builds dependability into electronic and aircraft transformers

From laboratory samples, made to your specifications, to the last production model delivered, *dependability* is built into General Electric electronic and aircraft transformers *four* ways. Here's how:

**1. INTEGRATED FACILITIES:** All G-E labs, testing facilities, materials sources are integrated to meet the constantly changing requirements of the electronic and aircraft industries. This co-ordination means you get the transformers you want—when you want them.

**2. MECHANIZATION:** The G-E plant is mechanized and staffed to handle large-quantity production, while maintaining laboratory sample quality. Mechanization provides consistent premium quality.

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**4. EXPERIENCE:** Key G-E personnel have had unusual experience and practical training working closely with, and in the factories

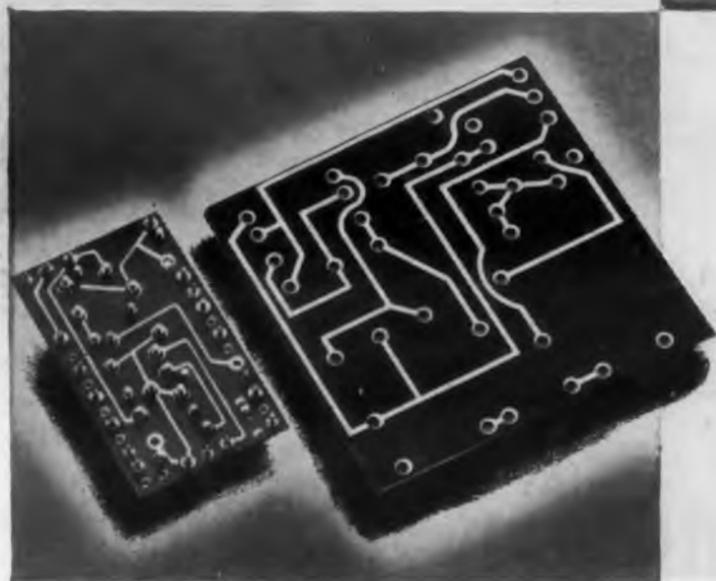
and labs of electronics equipment manufacturers. This means that they keep *your* problems in mind as they produce transformers for your particular, specialized applications.

Application engineering assistance is available from your nearest G-E Apparatus Sales Office. For product literature on G-E aircraft and electronic transformers write to General Electric Company, Section 412-113, Schenectady 5, N. Y.

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**GENERAL  ELECTRIC**

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Because of their excellent electrical properties, high moisture resistance, and mechanical strength, Epon resins are solving many problems in modern electronic "packaging."

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## A Metallic Film Potentiometer

INFINITE resolution, high temperature operation, high wattage dissipation, and a very wide resistance range in a small size unit are characteristics of the Type 771 "FilmPot" shown in Fig. 2. It is a new metallic film potentiometer designed for semi-precision applications such as in servo feedback control systems, electronic computers, guided missiles, jet engine controls, radar, electronic panel controls, trimmers, motor-driven devices, and in telemetering transducer elements.

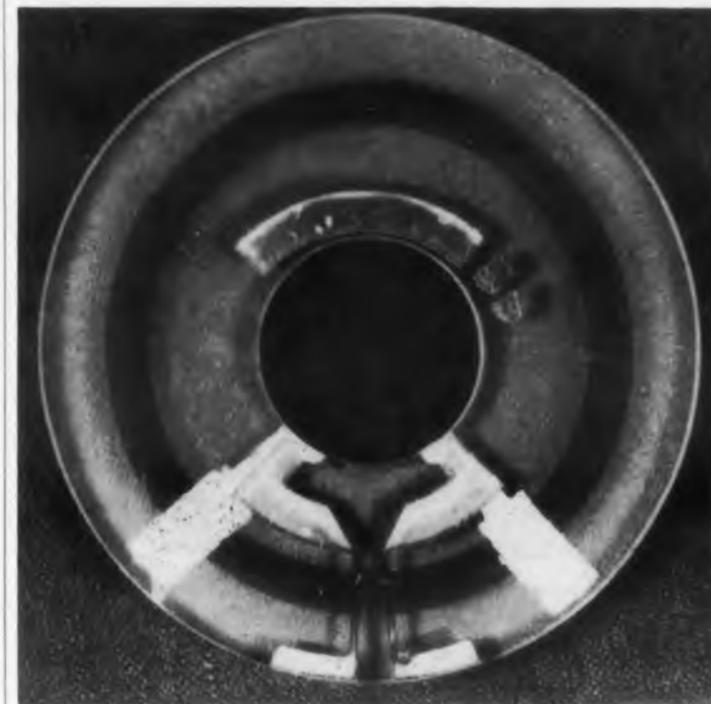


Fig. 1. An enlarged view of the resistance element of the "FilmPot". It consists of a precious metal deposited on an inorganic substrate which is electrically stable at temperature as high as 225°C.

Only 3/4" diam x 1/2" long, the "FilmPot" has a resistance element of precious metal deposited on an inorganic substrate (Fig. 1), electrically stable at temperatures up to 225°C. This resistance element assures a low temperature coefficient of resistance over a range of 100 to 200,000 ohms in the 3/4" case size. Low noise, good service life, and low torque also

are characteristic of the potentiometer which is a product of Fairchild Camera and Instrument Corp., 225 Park Avenue, Hicksville, N. Y.

Linearity of the unit is 1.0% or better, depending upon the resistance range and its wattage rating, at +100°C ambient, is 3w derated linearly to +225°C. Operating ambient temperature range is -55°C to +225°C, and noise is generally 400mv or less. Resistance range is 100 ohms  $\pm 10\%$  min to 200,000 ohms  $\pm 10\%$  max.

Standard electrical function angle for the unit is  $340^\circ \pm 1^\circ$  ( $345^\circ$  max), and the standard contact angle is  $345^\circ \pm 1^\circ$  ( $350^\circ$  max). Two taps per cup can be



Fig. 2. The metallic film potentiometer which features small size, infinite resolution, satisfactory operation at temperatures from -55°C to +225°C, and high wattage dissipation. It can be used for military as well as industrial applications.

furnished, about  $3^\circ$  wide, whose location is accurate within  $\pm 1^\circ$ .

Service life of the "FilmPot" is 250,000 cycles, depending upon resistance value and operating temperature. It is available for continuous or noncontinuous rotation applications. The unit can be furnished with torque ratings of 0.1 to 0.5 oz-in or greater as required.

The "FilmPot" is available with either servo-flange or threaded bushing mountings. The infinite resolution of the metallic film resistance element limits hunting and oscillating of the mechanisms in servo applications, usually encountered with wire wound potentiometers. This feature is especially valuable in many industrial control applications where such hunting might cause serious damage to expensive machinery. The unit also meets JAN-R-19 specifications for salt spray, vibration, temperature cycling, and low temperature requirements, making it suitable for military applications. **▲ This unit will be on display in Booth 405 at the Radio Engineering Show.**

## 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 defective diodes. Each HUGHES DIODE is humidity-cycled, temperature-cycled, JAN shock-tested, and electrically tested under vibration. This testing procedure insures operation of HUGHES DIODES under adverse conditions of moisture, temperature, vibration and severe shock.

Reliability of HUGHES DIODES has been proved in advanced airborne military radar and fire control systems, and for 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.

HUGHES DIODES are also supplied 100% factory-tested to a wide range of customer-specified characteristics, including high-temperature requirements.



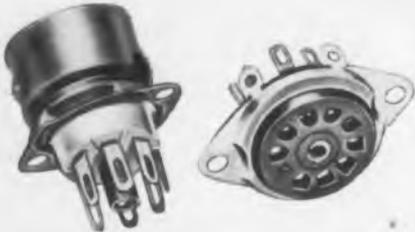
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for electrical  
stability

Hughes

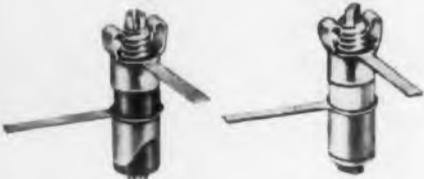


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● United States Gasket Company's Fluorocarbon Products Division offers a broad line of components, parts, and special assemblies for the electronics and electrical industries—incorporating duPont TEFLON and Kellogg's KEL-F, the most outstanding insulating materials known. As pioneer fabricators of these materials, U.S.G. offers techniques in quality control and materials application worthy of your attention.



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Feed-Thru Insulators. Patented Teflon-metal, hermetic solder seal type and gasket type. Catalog Nos. CF-400 and CF-414.



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Feed-Thru Insulators. Miniature and sub-miniature. Threaded metal body or compression mounted. Catalog Nos. CF-405 and CF-408.



Special Assemblies employing original techniques such as molding Teflon around metallic structures, applying metal inserts in Teflon, etc., permitting it to replace conventional insulating materials.

*TEFLON and KEL-F stock and Molded and Machined Parts, precision fabricated to customer specifications.*



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**FLUOROCARBON  
PRODUCTS, INC., DIVISION  
CAMDEN 1 • NEW JERSEY**

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Cities Throughout the World



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



Fig. 1 (above). A disassembled preamplifier unit showing its high gain transistor amplifier. It affords improved reception, yet saves weight.

# Transistorized Microphone Preamplifier

Fig. 2 (below). The microphone disassembled to show the preamplifier unit.



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**G**REATLY improved speech intelligibility and reduced noise in radio, aircraft, and other mobile installations as well as in public address systems has been achieved in the Remler Transistor-Magnetic Microphone shown in Fig. 2. These features are the result of combining a tiny transistorized preamplifier and a high quality magnetic microphone to produce a high performance unit.

The transistors are built into the microphone unit in both straight microphone and handset applications. It is not necessary to revise installations to use the new unit. It derives its power supply from the same sources as the carbon microphones now used and can be plugged directly into existing equipment. The microphone is a rugged magnetic type variable reluctance unit, and it is combined with an efficient, high gain transistor preamplifier as shown in Fig. 1. It is a product of Remler Company Ltd., 2101 Bryant St., San Francisco 10, Calif.

Output of the Transistor-Magnetic Microphone is 0.778v rms at 100 dynes/sq cm, with a nominal supply voltage of 27.5v, d-c. Output is down 2db at 15v, 4db at 10v, and 11db at 5v. Frequency response is  $\pm 6$ db from 500 to 6000cy with a 6db per octave fall off from 500cy. The unit has been operated satisfactorily at temperatures from  $-60^{\circ}\text{F}$  to  $+125^{\circ}\text{F}$ ; at 95% to 100% humidity; and in simulated altitudes up to 50,000ft. It has also been service tested for about 1000hr in regular service on a major airline.

Extraneous noises are suppressed in the new microphone, and the range includes voice frequencies from the lower part of the sixth to the ninth octave. This eliminates confusion in understanding difficult letters such as "B" and "V", an important feature for aircraft and other emergency uses. The frying and hissing sounds created by temperature changes or even just handling some carbon microphones are absent in the new unit. Its performance is stable, and it is not appreciably affected by rough usage common to mobile units. **▲ This device will be on display in Booth 346 at the Radio Engineering Show.**



...curious about  
**TRANSISTORS?**

**We're long past the "Cat's Whisker stage" with Transistors.  
Contact Hydro-Aire for consultation NOW!**

The day has come when the Electronics Industry must examine all vacuum tube applications for the possibility of substituting Transistors. Of course, it will not be a matter of simple replacement; each application must be designed around the Transistor. But the advantages of the Transistor are overwhelming. You get small size and light weight, long life and low cost. In addition, there is an endless potential of entirely new applications still unexplored.

Hydro-Aire is ready to co-operate with you in exploring this fascinating new field. The specialized know-how of our experienced Transistor Development and Application Division is yours for the asking. Our research engineers are waiting to consult with you.\*

\* Please address your inquiries:

CHIEF CONSULTING ENGINEER

Transistor Development and Application Division

**HYDRO-AIRE**

Inc.

3000 WINONA AVENUE, BURBANK, CALIF.

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CONSULTANTS ON TRANSISTOR APPLICATIONS

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



ELCO SCREWS ARE GOOD SCREWS

WOOD SCREWS	PIPE PLUGS
MACHINE SCREWS	STOVE BOLTS
MACHINE SCREW NUTS	CAP SCREWS
TAPPING SCREWS	LAG SCREWS
THREAD-CUTTING SCREWS	DRIVE SCREWS
PHILLIPS AND SEMS SCREWS	SPECIAL SCREWS
	COLD HEADED PRODUCTS



ELCO TOOL AND SCREW CORPORATION  
1948 BROADWAY • ROCKFORD, ILLINOIS

CIRCLE ED-23 ON READER-SERVICE CARD FOR MORE INFORMATION

## New Products . . .

### ▲ A Capacity Decade Box Pocket Sized, 1% Accurate



The Model 478 Capacity Decade Box provides four decades from 100mmfd to 1.1111-mfd, in 100mmfd steps. A pocket-size unit, it measures only 3-3/4" x 6-1/4" x 2" and is low in cost.

All capacitors are well within 1%. They are silver mica and rated at 600v, except for the highest values which are special, low-drift, oil impregnated, and rated at 400v. Binding posts accept the use of plug pins, alligator clips, spade lugs or wires. Precise Development Corp., Dept. ED, Oceanside, N. Y. ▲ *This product will be on display in Booth 282-284 at the Radio Engineering Show.*

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

### Tape Resistors For Printed Circuit



Stable tape resistors for a wide range of printed circuit applications are available either as cured, ready-to-use resistors only 1/2" long x 1/8" wide x 1/100" thick, or as uncut,

uncured tape rolls. Both types have a resistance range of 100 ohms to 10meg, and meet all JAN-R-11 specs.

The resistors are suitable for semi-automatic applications in which a single operation, requiring less than 1sec, fastens them permanently to the chassis and connects them into the circuit, without soldering, bending of leads, or punching holes in the chassis.

The "ready-to-use" resistors have characteristics including power rating, 1/4w at 150°C; resistance tolerance, ±10%; operating temperature range, -55° to +200°C; humidity, 95% at 40°C for 250hr; load life 500hr minimum. Sanders Associates, Inc., Dept. ED, 137 Canal St., Nashua, N. H.

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

### Coreless Power Resistor Up to 50% Lighter in Weight



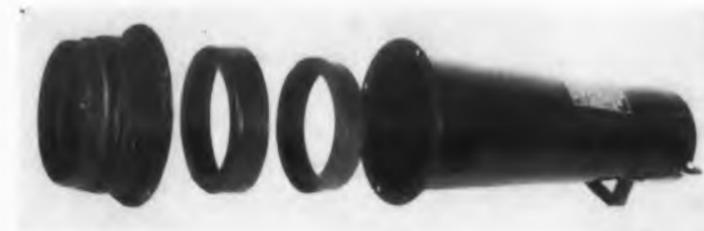
These "Kor-les Cool Blue Power Resistors" are available in standard resistance values within MIL types RW 29, 30, 31, 32, 33, 34, and 35. They are designed to meet

characteristic "V" of the MIL R26B specification. The illustration shows how one conventional 55w power resistor outweighs three coreless resistors rated at 55w, 17w, and 11w.

The resistors are constructed of a ceramic refractory material completely enclosing the wire windings. The construction permits the use of finer wires when necessary for special applications requiring higher than standard ohmic values and closer resistance tolerances. The coating is a non-organic vitreous enamel which will not deteriorate with age and readily withstands the higher operating temperature called for in characteristic "V". Thinner walls permit more rapid heat dissipation and result in cooler operation. General Electric Co., Dept. ED, Electronics Park, Syracuse, N. Y.

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

### Magnetic Shields For Cathode-Ray Tubes



These standard magnetic cathode ray tube shields are being produced for the popular 2", 3", and 5" cathode ray tube sizes. Made of Mu Metal and "Nicoloi", they can be furnished with light hoods, retainers, and "Plexiglass" windows. Electronics Division, Multi-Metal Wire Cloth Co., Inc., Dept. ED, 1350 Garrison Ave., New York 59, N. Y.

CIRCLE ED-27 ON READER-SERVICE CARD FOR MORE INFORMATION

## Multiplier Phototubes

### Sensitive, High Speed Units



The RCA-6328 Multiplier Phototube, a 9-stage type with S-4 response for headlight-control service, and the RCA-6342 Multiplier Phototube, a 10-stage, head-on type with S-4 response for scintillation counters, have been added to this firm's line.

The RCA-6328 is illustrated. It has instantaneous response to meet the critical timing requirements of headlight control service, and is capable of providing stable performance over long periods. Its high luminous sensitivity allows use of an amplifier with relatively low impedance input and fewer stages than required by a less sensitive tube. Overall dimensions are 3-1/8" x 1-5/16" diam.

The RCA-6342 is designed to be used in scintillation counters for the detection and measurement of nuclear radiation, and in other applications involving the measurement of low-level, large-area light sources. Its relative freedom from after-pulses and its small spread in electron-transit time make it particularly useful for fast coincidence scintillation counting. Overall dimensions are approximately 5-5/8" x 2-1/4" diam. RCA Victor Div., Dept. ED, Harrison, N. J.

CIRCLE ED-28 ON READER-SERVICE CARD FOR MORE INFORMATION

## Synchronous Contactor

### Cam-Operated, Adjustable Switch



The "Rototimer" provides a simple, accurate means for angular position of a rotating shaft and the opening or closing of an electric circuit. It comprises a cam-operated spst switch that can be externally adjusted

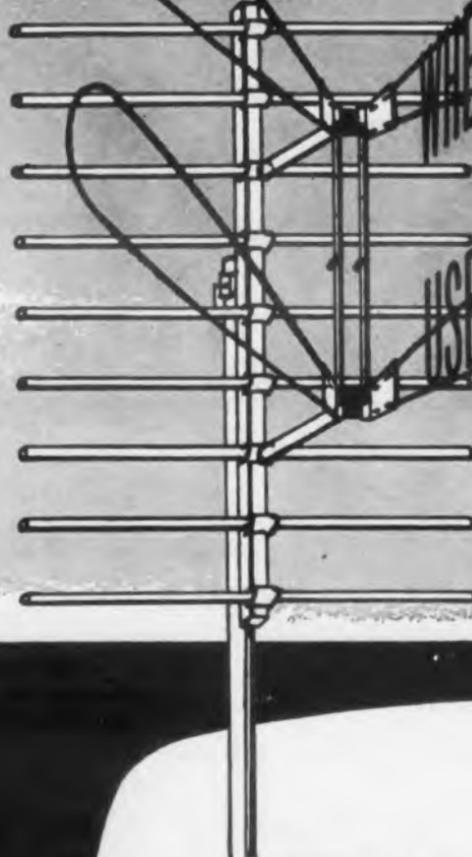
through 360° in either direction from any starting position so that the switch operates at any point in the rotation of the shaft to which the drive shaft is connected. Cams are available for either normally open or normally closed circuits. The user can adjust the duration of open or closed circuit time by turning a screw.

The electrical system is designed to handle 1 amp at 125v a-c. Overall dimensions are 6-3/32" long x 5-1/2" wide x 5-1/16" high. Farmer Electric Co., Dept. ED, 21 Mossfield Rd., Waban, Mass.

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

ELECTRONIC DESIGN • February 1954

# For VHF and UHF...



WHEN YOU TEST  
USE THE BEST

# PRD

## PRECISION TEST EQUIPMENT



PRD Radio Frequency Test Equipment is the most complete line available. It covers the entire frequency range from .01 to 40 kilomegacycles per second. All units are engineered and manufactured to the highest standards of the industry. PRD equipment excels in quality, accuracy and dependability... proven by its adoption in leading laboratories world-wide. For complete engineering assistance on standard or custom PRD equipment, contact our staff of experienced engineers, today. There is no obligation.

**MODEL 907 BROAD-BAND SWEEP FREQUENCY GENERATOR** — A fundamental oscillator which can be swept over a band not less than 8 Mc/s for center frequency of 40 Mc/s. Sweep width not less than 40 Mc/s over the UHF band. Output continually variable over voltage range of 10  $\mu$ v to 1/2 volt.

**MODEL 904 NOISE GENERATOR** — A direct reading noise source permitting measurements of noise factors up to 20 db. for r-f amplifiers and receivers operating from 10 to 1000 Mc/s. The TT-1 coaxial diode has nominal input impedance of 50 ohms. VSWR Approx. 1.25.



# Polytechnic RESEARCH & DEVELOPMENT COMPANY, Inc

55 JOHNSON STREET, BROOKLYN 1, NEW YORK

WESTERN SALES OFFICE: 741 1/2 NO. SEWARD ST., HOLLYWOOD 38, CALIFORNIA

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

## New Products . . .

### Vacuum Tube Voltmeter

Has 500mv to 500v RMS Range



The Model 1520 Vacuum Tube Voltmeter covers, in six steps, a voltage range from 500mv to 500v rms over a frequency range from 15cy to 250kc. The meter calibrated both in a-c voltage (from 0.5v to 5.0v) and decibels (from -5db to +17db based on zero db equaling 1mw in 600 ohms.

The instrument is housed in a cabinet measuring 5-3/4" x 11-1/2" x 5-7/8" deep. Power requirements are 117v  $\pm$ 10%, 50/400cy. Power consumption is approximately 35w. Accuracy is  $\pm$ 2%, and stability is  $\pm$ 1% with line voltage variation from 105v to 125v. Communication Measurements Laboratory, Inc., Dept. ED, 350 Leland Ave., Plainfield, N. J.

CIRCLE ED-31 ON READER-SERVICE CARD

### Adhesive-Clad Copper

For Printed Circuit Applications

"Plymaster" adhesive pre-coated on Anaconda electrolytic sheet copper, is now available for printed circuit applications. The adhesive-clad copper offers bond strengths up to 35psi. It cuts the steps in the production of the base copper-clad laminate for printed circuits from eight to two operations.

There are two types of "Plymaster" adhesives: Type N for adhering copper sheet to a phenolic resin base to pass the 200°C "solder dip test"; and the Type E to pass the 235°C "solder dip test" and also for use with epon or silicone base laminates. Both types of formulations may be obtained pre-coated on either 1 oz. or 2 oz. electrolytic copper sheet. Rubber & Asbestos Corp., Dept. P, 225 Bellville Ave., Bloomfield, N. J.

CIRCLE ED-32 ON READER-SERVICE CARD

### Correction

Two of the specifications on the Model 55A Subminiature Stabilized D-C Amplifier (manufactured by Electro-Mechanical Research, Inc., P. O. Box 307, Ridgefield, Conn.) described in the January 1954 issue, ED-112, p. 44, were incorrectly listed.

Noise and drift performance is 25 microvolts and 100 microvolts respectively, instead of 25mv and 100mv as stated in the description.

# A NEW TERMINATION TECHNIQUE FOR . . .

- BUSINESS MACHINES
- COMPUTERS
- CONNECTOR PLUGS

- MULTI-CIRCUIT COMPONENTS
- SIGNAL APPARATUS
- PRINTED CIRCUITS

## AMP

## ROUND\* TAPER



Here at last is a connector which combines miniature size and self-locking action! To make electrical connections, simply press AMP Taper Pins into mating receptacles. The pins are almost as small as the wire itself, yet when securely inserted will maintain their connection even up to the point of wire failure. Salt spray and vibration tests show initial contact resistances of only 0.5 to 1.0 milliohms increasing to a maximum of 2.63 milliohms after 160 hours of cycling.

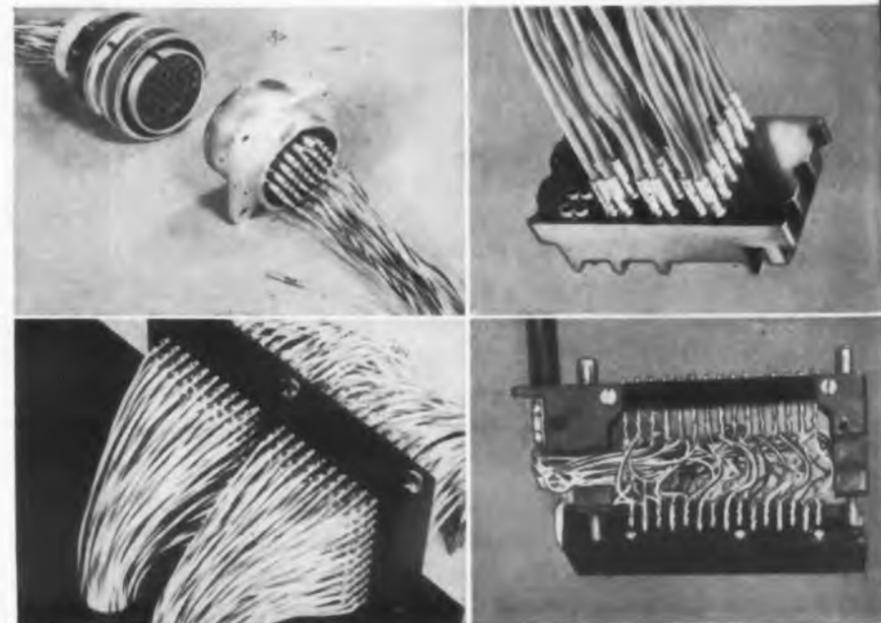
New applications are being found every day for these versatile connectors—over a billion pins are in the field in computers and associated business machines alone!

Uses include termination of printed circuits, speaker disconnects, UHF antennae filters and tuners, Germanium diodes and TV high voltage fuses etc. Extraordinary security under vibration makes them excellent for attaching wires to crowded multiple contact "AN" connectors in aircraft. Write for "TAPER TECHNIQUE" Folder.

*\*For relays, switches, multi-circuit components, and other applications where a flat tab is more adaptable, see AMP Taper Tab Receptacles.*

AMP Taper pins, rolled from strip stock to very close tolerances, are wound on reels ready for use in AMP Automatic Wire Terminators. Pins can be applied as fast as operator can insert wire with speeds reported as high as 4,000 per hour! Spring type installation tool will seat pins firmly in mating receptacles.

Pins shown in illustration at right are 50% larger than actual size.



CIRCLE ED-35 ON READER-SERVICE CARD FOR MORE INFORMATION

R PINS

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**AMP**

AMP Trade Mark Reg. U.S. Pat. Off.

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**AIRCRAFT-MARINE PRODUCTS, INC.**

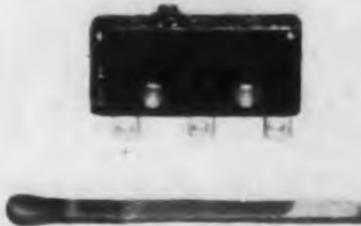
ELECTRONICS DIVISION  
2100 Paxton Street, Harrisburg, Pa.

**Aircraft-Marine Products of Canada, Ltd.**

1764 Avenue Rd., Toronto 12, Ontario, Canada

CIRCLE ED-35 ON READER-SERVICE CARD FOR MORE INFORMATION

### Basic Snap Action Switch In Subminiature Design



The case of this subminiature snap action switch is made of durable plastic material and measures  $27/32'' \times 23/64'' \times$

0.260'' thick. Its small size and long life make it adaptable for use on electronic equipment, guided missiles, rocket launchers, and many other military applications. It is also useful in commercial equipment, such as business machines, sensitive diaphragms, and other "feather touch" devices.

Sturdy terminals that extend from the bottom of the case permit easy soldering without increasing switch size. Three standard actuators are available: toggle, push-button, and leaf spring.

Switches are available normally closed, spst; normally open, spst or spdt. They are rated 2.5 amps or 5 amps, 125/250v a-c; 30v d-c, 2.5 amps inductive; or 30v d-c, 4.0 amps resistive. Electro-Snap Switch & Mfg. Co., 4218-30 W. Lake St., Chicago 24, Ill.

CIRCLE ED-36 ON READER-SERVICE CARD

### Line-Bridging Transformer Converts Voltmeters to Balanced Input



The Model 122 line bridging transformer converts most makes of voltmeters from single-ended to balanced input.

It plugs into voltmeter input terminals, and it is compensated so that readings are corrected for the transformer's small insertion loss.

The Model 122 is supplied for bridging measurements on systems of the following impedances: Model 122A, 135 ohms; Model 122B, 500 ohms, and Model 122C, 600 ohms. Each comprises a broadband ferrite core unit operating flat within 0.5db from 15kc to 500kc. All models are identical in size, measuring  $2'' \times 3'' \times 4''$ , and are housed in a lightweight aluminum case with plug-type input binding posts and banana-plug output terminals. Both sets of terminals are on standard  $3/4''$  centers. Sierra Electronic Corp., Dept. ED, 1050 Brittan Ave., San Carlos 2, Calif.

CIRCLE ED-37 ON READER-SERVICE CARD

# NOW I-T-E quality I.F. and R.F. transformers and coils

*Custom built to  
your specifications*

Long noted for top-quality wire-wound components—precision resistors, power resistors, deflection yokes, and focus coils—I-T-E now adds I.F. and R.F. transformers and coils to its line.

Coils or complete transformers—the simplest to the most complex—are precisely fabricated to your specifications. Versatile coil-winding machinery plus latest-type testing equipment assure close electrical and mechanical tolerances. Components are sturdy—built to “take it”. They’re stable over time, temperature variation, and in humid atmospheres.

Take advantage of I-T-E engineering skill, coil-winding experience, and modern facilities. We will build to your particular specifications . . . and, at a competitive price!

all types of I.F. and R.F. coils • R.F. output transformers • antenna transformers • any stage tuners • buffers • doublers • mixers • R.F. chokes • linearity coils • peaking coils

Get your copy of Catalog R-200 D. It gives complete information about I-T-E wire-wound products.

Write to Resistor Division, Advt. Dept., I-T-E Circuit Breaker Co., 1924 Hamilton St., Phila. 30, Pa.



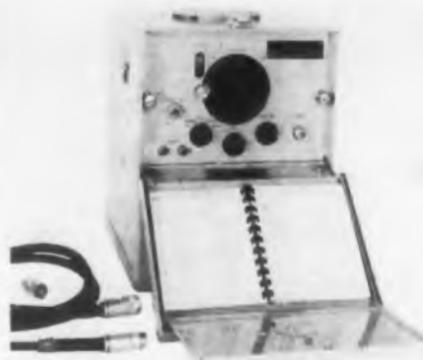
## WIRE-WOUND PRODUCTS

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

## New Products . . .

### ▲ Frequency Meter

For Use in 85-1000Mc Range



A portable frequency setting and determining instrument, the TS-175 A/U frequency meter is for general use in the 85-1000Mc range. It includes a calibration book located in the front panel,

which is hinged to permit easy reference to the book.

Front panel controls include: a tuning control; a selector switch with “off,” “standby,” “crystal,” “operate”, and “check” positions; a corrector for setting the local oscillator frequency to the crystal check frequency at check points; a modulation switch for modulating the r-f output; and an audio gain control.

A number of accessories, such as adapters and an antenna, are included. The unit weighs 18-1/2 lbs, without batteries, and is contained in a 9-1/2" x 10-1/4" x 12-1/2" case. Colortone Electronics, Inc., Dept. ED, 238 William St., New York 38, N. Y. ▲ This product will be on display in Booth 623 at the Radio Engineering Show.

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

### Compact Controls

For Printed Circuits



Two Variable Composition Resistors for use in printed circuit applications have been added to the company's line.

The design provides protection against bending during handling by recessing each blade-type terminal in a notch in the Bakelite base of the control. Valuable mounting space is conserved on the printed circuit panel by placing terminals close into the mounting bushing. Adequate clearance for circuit paths is provided by ample spacing between terminals.

The compact controls are available in 3/4" diam (Type U70) and 15/16" diam (Type U45). The latter is also available with spst and dpst 3amp, 125v switches (Types GC-U45 and WF-U45). Chicago Telephone Supply Corp., Dept. ED, Elkhart, Ind.

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

## INCREMENTAL INDUCTANCE

*quickly  
simply  
accurately*

The new Type 1002-A Incremental Inductance Bridge combines outstanding features of compactness, ease of operation, accuracy, and wide range of measurement. A visual balance indicator allows measurements to be made in a few seconds even in noisy locations. Maximum sensitivity at the balance point greatly improves the accuracy of balance. Only a single balance control is used, with crt indication.



Inductance range is from one to 200 henries. Direct current through the reactor under test is accurately controllable from one to 500 milliamperes, limited only by the resistance of the coil windings. The effect of a change of dc on the inductance value is immediately measurable, by simple re-balancing. The inductance is measured at a constant frequency of 120 cps.

For design and test work on iron-core inductors, transformers, filter chokes, and plate reactors, this compact self-contained instrument is unsurpassed.



Write today for technical details and price information.

**WATERS MANUFACTURING, inc.**

Waltham 51, Massachusetts

APPLICATION ENGINEERING OFFICES IN PRINCIPAL CITIES

CIRCLE ED-41 ON READER-SERVICE CARD

# MINIATURE *wire-wound* POTENTIOMETERS

*that don't NEED  
incoming check*

## Problem:

To find a potentiometer that will —

- ... Dissipate 3 watts continuously at 80 degrees C, through 50,000 ohms total resistance.
- ... Occupy no more space than absolutely necessary.
- ... Weigh as little as possible.
- ... Maintain accurate resistance setting, over a wide range of temperatures.
- ... Not require YOU to do production-control checking for the manufacturer.



## Solution:

Waters Series RT-7/8 and RTS-7/8 —

- Precision wire-wound construction.
- Three watts continuous, to 80 degrees C.
- Resistances from 10 ohms to 50,000 ohms.
- Diameter 7/8", depth 3/8".
- Weight, approximately 1/2 ounce per section — multiple ganging easily provided.
- Temperature coefficient of resistance 0.002% per degree C.
- Manufactured to rigid military specifications.
- Individually checked through a production quality control system that guarantees you full performance from EVERY unit in your order.



Write today for full technical information and prices.

**WATERS MANUFACTURING, inc.**

*Waltham 54, Massachusetts*

APPLICATION ENGINEERING OFFICES IN PRINCIPAL CITIES

CIRCLE ED-42 ON READER-SERVICE CARD

## Microwave Spectrum Analyzer

With Interchangeable R-F Heads



Twelve interchangeable r-f heads are available for operation in the SA25 Microwave Spectrum Analyzer. They cover the active portions of the spectrum from 300Mc to 40kMc and can be purchased separately if portions of the band are not to be used.

The analyzer has a double range sweep, covering 2-20eps (or 6-60eps) in two overlapping ranges, for improved operation with long or short pulses at low or high pulse repetition rates. Improved horizontal and vertical amplifier low frequency response is incorporated. Useable dispersion has been increased 2:1 on the X-band and 5:1 or more on the S-band, with comparable increases in other areas of the spectrum, by introduction of a d-c filament supply for the Klystron.

A cathode ray tube with Pw phosphor is standard on all analyzers. Also included is a visual viewing filter to match tube phosphor for maximum display brilliance in high ambient light. For photo recording, a flat face cathode ray tube and a special illuminated scale are available. Vectron, Inc., Dept. ED, 380 Main St., Waltham 54, Mass.

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

## Audio Oscillator

Range From 20cy to 1 meg



This Extended Range Audio Oscillator, the Model 411, makes measurements requiring a sine wave signal over the range from 20cy to 1Mc. A resistance-capacity tuned type oscillator and a cathode follower in the output system are employed to provide uniform response. Frequency accuracy is main-

tained by the use of deposited carbon resistors in the frequency determining network.

Low level measurements are facilitated by a panel switch which reduces output voltage, distortion, and hum. Other features are good case ventilation, a well spread dial calibration for ease in reading, and compact size with light weight. The Clough-Brengle Co., Dept. EX, Chicago 40, Ill.

CIRCLE ED-44 ON READER-SERVICE CARD FOR MORE INFORMATION

# 2 NEW ACHIEVEMENTS

in precise *wire-wound* trimmer potentiometers

## *Aerohm* Micro-miniature Series AP 1/2



Series AP 1/2

- Two watts continuous at 80 degrees C.
- Resistances from 10 ohms to 20,000 ohms.
- Diameter 1/2 inch, depth 1/2 inch.
- Temperature coefficient 0.00002 part per degree C.
- Weight 1/4 ounce.
- Sealed well enough to permit potting.

## *Aerohm* Series AP 1 1/8



Series AP 1 1/8

- Four watts continuous at 80 degrees C.
- Resistances from 10 ohms to 100,000 ohms.
- Diameter 1 1/8 inch, depth 1/2 inch.
- Temperature coefficient 0.00002 part per degree C.
- Weight less than 3/4 ounce.

Available also as  
ganged units.



Series AP 1/2-2



Series AP 1 1/8-2

These new potentiometers embody many features that are usually found only in much more costly units. They are precision machined throughout, with bodies of anodized aluminum, line-reamed phosphor bronze bushings, centerless-ground stainless steel shafts, and gold-plated fork-type terminals. All electrical connections are soldered, except for precious metal sliders and slip rings. All units are fully sealed, and treated with Service-approved moisture-proofing and fungicidal materials.

In addition, all *Aerohm* potentiometers are individually checked through a quality-control system that guarantees you full performance from every unit in your order.

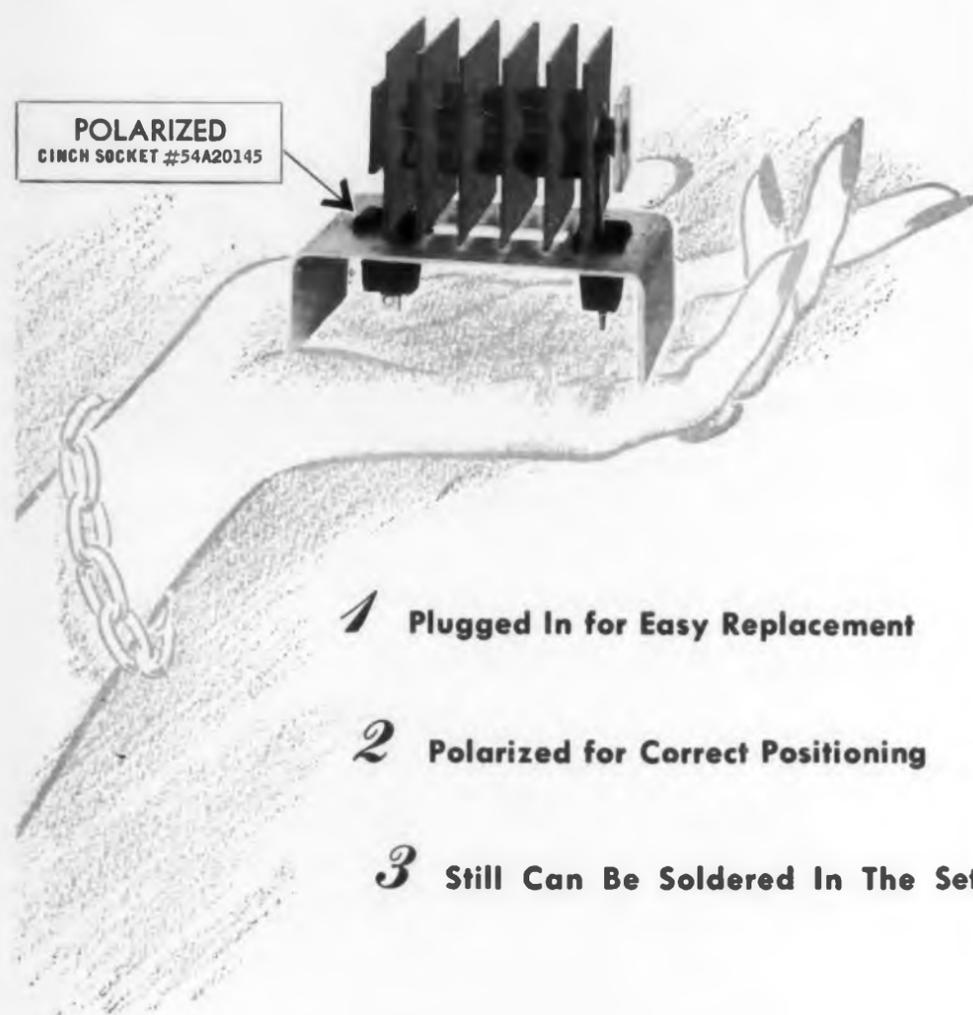
Write for full technical  
information and prices.

# *Aerohm* CORPORATION

282 MOODY STREET, WALTHAM, MASSACHUSETTS

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

# Now It's Plug-In Selenium Rectifiers



- 1 Plugged In for Easy Replacement
- 2 Polarized for Correct Positioning
- 3 Still Can Be Soldered In The Set

Available In All Sizes. Write for Further Information.

Rectifier **Sarkes Tarzian** Division

415 N. College Ave., Dept. C-2, Bloomington, Indiana  
In Canada - 50 St. Clair Ave., N. W., Toronto

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

## New Products . . .

### Pulse Generator

Produces Low Rise Time Pulses



The Type 163 Pulse Generator is designed to supply rectangular pulses of less than  $0.2\mu\text{sec}$  rise time when triggered by either a positive pulse or a negative-going sawtooth from an external source. A positive pulse of calibrated continuously variable amplitude from 0 to 25v peak-to-peak, and a positive gate of 25v fixed amplitude, are supplied. The pulse and gate are identical in other characteristics.

Duration is calibrated and is continuously variable from  $1\mu\text{sec}$  to  $10,000\mu\text{sec}$ . When triggered by a sawtooth voltage, the output may be delayed a calibrated interval from 0 to 100% of the duration of the sawtooth. Decay time is  $0.2\mu\text{sec}$ , and overshoot can be adjusted to zero. Tektronix, Inc., Dept. ED, P. O. Box 831, Portland 7, Ore.

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

### Unit Oscillator

Has 0.5-50Mc Frequency Range



The Type 1211-A Unit Oscillator has a frequency span of 0.5Mc to 50Mc which is covered in two 10-to-1 logarithmic ranges. Frequency is read directly from a 6" dial, with a slow-motion-drive dial

which indicates frequency-increments of 0.2% per division. Output power is over 1w above the 0.5-5Mc range, and at least 0.2w over the 5-50Mc range.

The effective shielding of the oscillator permits it to be used as a power source in bridge measurements. The Type 874 coaxial output connector permits extension of the shield system to the bridge. The Type 1203-A Unit Power Supply is available for a-c operation. Batteries can be used for field applications. Direct amplitude modulation over the audio-frequency range is possible with an external audio oscillator. General Radio Co., Dept. ED, 275 Massachusetts Ave., Cambridge 39, Mass.

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

## HERE IS THE SOLUTION

to many metering and positioning problems requiring extreme sensitivity and extreme durability.

Texas Instruments originally developed this sensitive, smooth, linear and long-lived magnetic fluid clutch meter/positioner to solve a 30° bi-directional recording problem in some airborne military gear. Simply and durably built, it far outlasts anything similar we've ever seen (over 3000 hours continuous duty at rated load).

In essence, it consists of two TI-developed magnetic fluid clutches (weighing .46 lb each) working in opposition. Input current of 100 microamps causes a 6° output shaft deflection with from 10 to 500 microamps being measurable. General data is appended.

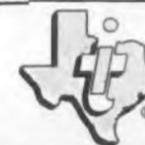
If you are being perplexed by a metering/positioning problem demanding a rugged—yet sensitive and accurate—movement, just drop us a line and we'll be glad to answer your questions in detail.

**T** magnetic  
fluid clutch  
meter/positioner



### SPECIFICATIONS

Meter/Positioner Movement  
Sensitivity . . . . . 6° per 100 microamps  
Accuracy . . . . . ±5%  
Life . . . . . 3000 hr @ rated load  
Frequency Response  
Flat to 5 cps, as applied  
Deflection . . . . . 30° either side of zero  
Min. Input Signal . . . . . 10 microamps  
Max. Input Signal . . . . . 500 microamps  
Ambient Temp. Range . . . . . -40 to +75° C  
Coil Impedance . . . . . 15,000  $\Omega$ , 450 henries  
following data taken w/o springs  
Output Torque  
0.125 oz-in./100 microamps  
Maximum Output Torque  
5.25 oz-in. at 4 milliamps



TEXAS INSTRUMENTS  
INCORPORATED  
6000 LEMMON AVE. DALLAS 9, TEXAS

CIRCLE ED-49 ON READER-SERVICE CARD



**precision resolvers**

SIZES 11, 15, 23



**400~ servo motors**



**brushless induction potentiometers**

**RELIABLE  
AND STABLE  
PERFORMANCE**

**servo components,  
instruments,  
synchros**



Let us quote on your detailed requirements.

**American Electronic Mfg., Inc.**

9503 W. JEFFERSON BLVD., CULVER CITY, CALIF.  
TELEPHONE: TE 226 0-5471

## D-C Power Supply

Regulation is less than  $\pm 0.05\%$



Measuring only 8" x 5" x 5-1/2", the Model 302 Power Supply furnishes precise regulation with low ripple and minimum magnetic radiation. Two d-c outputs are available. The first is 150-350v at 0-80-

ma, with either positive or negative grounded to chassis. Regulation is less than  $\pm 0.05\%$  against line and load variations within specifications.

The other d-c output is 0-150v at 0-5ma, with positive internally connected to the negative of output No. 1. Regulation is better than  $\pm 1.0\%$  against line variations only.

Ripple is less than 3mv, and ambient temperature range is 0-40°C. Operating voltage required is 105-125v rms, 50/60cy, 150w maximum. For increased capacity, several units may be paralalled and operated from a single control. A 2-1/2" voltmeter is standard equipment.

For a-c work, output is 6.3v at 5amps, unregulated. Allied Engineering Division, Allied International, Inc., Dept. ED, Connecticut & Richards Aves., South Norwalk, Conn.

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

## Galvanometer and Display Box

Extremely Sensitive Unit



The Model 60A ruggedized galvanometer (right) and Model 61A display box (left) are designed for both field and laboratory use. The galvanometer suspension is totally immersed in liquid having a specific gravity equal to the mean density of the suspension. The resultant assembly is consequently impervious to linear acceleration and shock during operation.

Sensitivity as great as  $10^{-8}$  amp for 1mm at 1 meter is available. Maximum full-scale sensitivity is  $0.2\mu$ amp. Electro-Mechanical Research, Inc., Dept. ED, P. O. Box 307, Ridgefield, Conn.

Circle ED-52 on Reader-Service Card for more information

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



## HOW TO AVOID ELECTRONICS



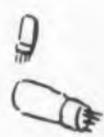
Remote control of radio broadcast transmitters, recently approved by the F.C.C., means that broadcasters can make more money because they don't need to have people wasting their time watching the transmitters — which incidentally can be located where real estate is dirt cheap. All checking, monitoring and adjusting are done at the studio.



As a result, everybody and his brother has jumped into the business of knocking together so-called remote control systems. Following recognized electronic design principles, they start with a couple of black boxes and jam into them as many tubes, wires, resistors and such, as Newton's law will allow (or is it Euclid's fifth axiom?).



We're proud that one of our commercial customers followed a more practical route. He believed that the fewer the components, the more foolproof would be the result. We subscribe to this theory as long as it sells our relays.



So, our friend, The Rust Industrial Company, Manchester, N. H., designed a job that has zero (0) tubes either at transmitter or studio as compared to another system which has thirty-seven (37) in the control and metering circuits, twenty-four (24) of which are at the transmitter. The Rust system has but one control adjustment whereas the competitor has 23. Although nowhere near as electronic, the Rust system works.



Incidentally, Rust has 15 relays (as compared to 16 for the competitor) and the four sensitive ones that Rust calls the heart of the whole system are Sigma (types 5 and 7). The Sigma relays receive the signal over the remote control line and decide which function to initiate at the transmitter. Rust likes these Sigma relays so much that they are replacing other types used in some early Rust models for free. Such is the power of propaganda.

# SIGMA

SIGMA INSTRUMENTS, INC.

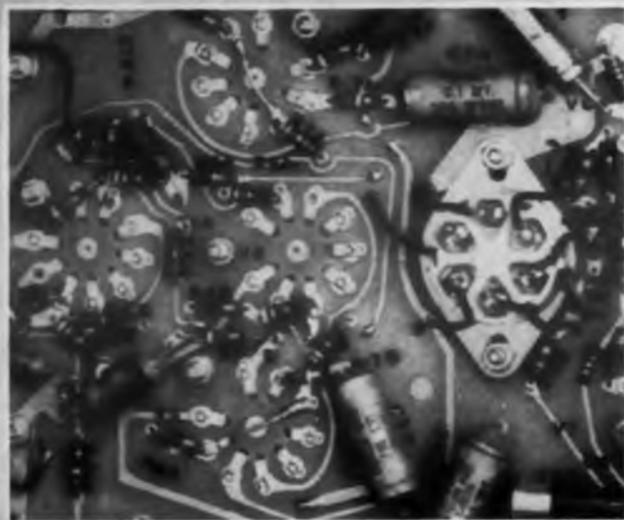
91 PEARL ST., SO. BRAintree, BOSTON 85, MASS.

- speed production
- eliminate hardware with



## Carry-Through Printed Circuits

proved enormously successful as shown by this sub-assembly



I.C.I. carries the pattern of the printed circuit through the holes to the other side to maintain efficient continuity.

NO hardware... with resulting excellent economies plus speeded-up production and more useable space. In a one square foot area of a printed circuit board .125" thick, 150 holes .020" in diameter can be successfully plated through.

I.C.I.'s unparalleled experience and engineering staff are at your disposal. WRITE, detailing your requirements for specific help and a copy of our thorough, new technical brochure which explains our research, design and conversion services.

I.C.I. also handles complete sub-assemblies as shown.

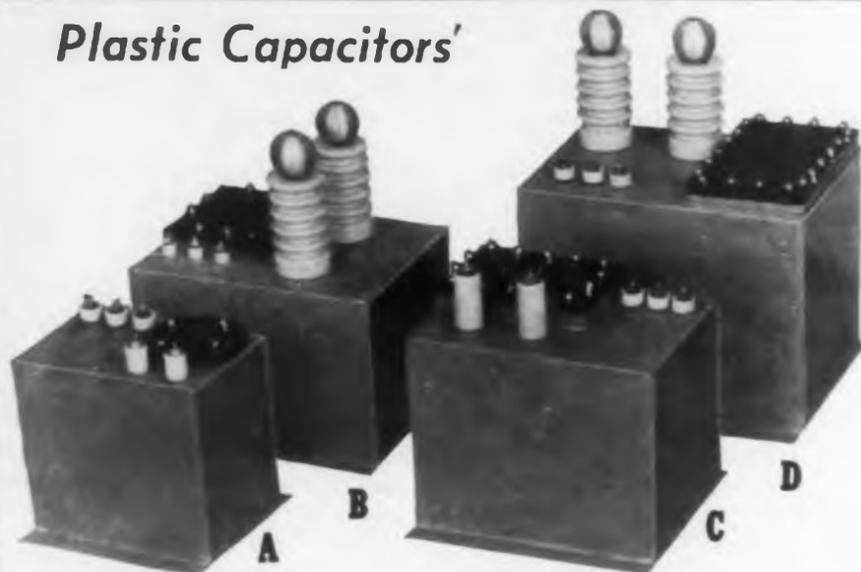
117 Roosevelt Avenue, Belleville, New Jersey



*Insulated Circuits*  
INCORPORATED

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

## Plastic Capacitors'



(A) 5 KV, 5 ma  
(B) 30 KV, 1 ma

(C) 15 KV, 5 ma  
(D) 30 KV, 5 ma

These units are representative of our complete standard power pack line, 14 different units ranging from 2,000 to 75,000 Volts.

We invite your inquiries.

Ask for our complete catalog on your company letterhead.

- Plastic Film Capacitors
- High Voltage Power Packs
- Pulse Forming Networks



*Plastic Capacitors, Inc.*

2511 W. MOFFAT STREET, CHICAGO 47, ILLINOIS

## HIGH VOLTAGE "POWER PACKS"

### Features:

- hermetically sealed
- tubes can be replaced in the field

### Small size

Standard power packs are available from stock to meet the requirements of most manufacturers.

Special power packs can be designed to conform to unusual electrical and mechanical specifications.

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

## New Products . . .

### Connectors

#### Provide Spring Loading



The 980 series connectors are for use on rack and panel type equipment in communications and power circuits. They feature spring loading on guide contacts, which reduces the separating force in dis-

engagement of connectors, while also providing additional contact stability. Double wiping, external and internal, contacts assure positive contact under all conditions.

The connectors utilize a high compression molding of asbestos-filled melamine in accordance with MIL-P-14D type MME, providing high arc resistance and mechanical strength. The guide pins are polarized, sturdy (3/16" diam), and assure proper connector alignment before engagement of small contacts. The pins also serve as heavy current contacts for ground leads. U. S. Components, Inc., Dept. ED, 454-462 E. 148th St., New York, N. Y.

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

### Push-Button Switches

#### For MIL-S-6743 Uses



The Series W100 moistureproof, momentary-contact, push-button switches may be ordered with a variety of adapters to meet practically all front-of-panel, back-of-panel, edge-lit panel,

blind hole, or force-fit mounting requirements. These small, precision, snap-action switches are designed to meet MIL-S-6743 specifications and are ideally suited for aviation and critical industrial electronic applications where long life and positive action are essential.

Available types include most commonly used spst, 3-terminal, or spdt circuit arrangements. Current ratings are 1amp resistive, 5amp inductive, and 3amp lamp. Weight is approximately 1/4 oz. Length is only 1-5/16"; when used with an adapter, the switches mount in a 5/8" diam panel hole. Hetherington, Inc., Dept. ED, Sharon Hill, Pa.

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

## TWO EXCLUSIVE FEATURES IN NEW VITROHM RING RHEOSTATS GIVE POSITIVE CURRENT CONTROL



**M**YCALEX insulating hub of Ward Leonard's new Ring Rheostats is *molded* to one end of the drive shaft to give more positive control and eliminate backlash.

Double ended, balanced spring steel contact arm, interlocked to the insulating hub, assures uniform contact pressure. Stock types: 25R and 50R. 25 and 50 watts. 1 to 10,000 ohms.

Write Ward Leonard Electric Company, 77 South St., Mount Vernon, N.Y.

**WARD LEONARD ELECTRIC CO.**

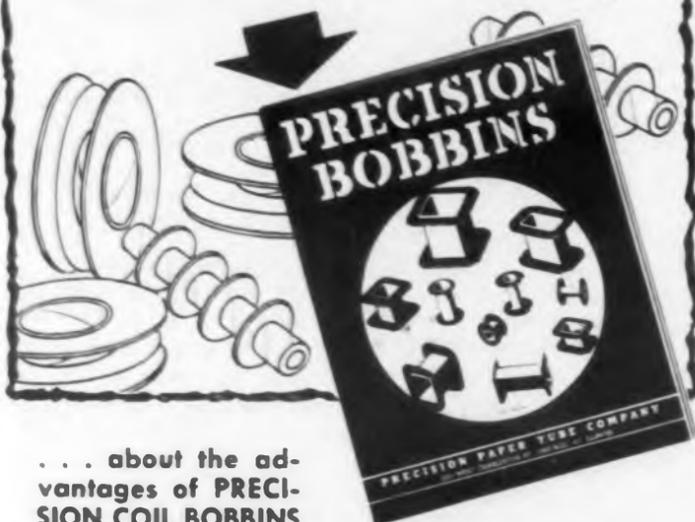
*Result—Engineered Controls Since 1892*

RESISTORS • RELAYS • MOTOR CONTROLS • CHROMASTER



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

## Get the facts...



... about the advantages of **PRECISION COIL BOBBINS**

... about what goes into them to make them better—the research, the materials, the precision workmanship. Learn these facts to improve your coils.

Send for your copy of this informative **PRECISION BOBBIN** bulletin . . . write today!

**PRECISION PAPER TUBE CO.**

2055 West Charleston Street, Chicago 47, Illinois  
Plant No. 2: 79 Chapel St., Hartford, Conn.  
Also Mfrs. of Precision Paper Tubes

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

ELECTRONIC DESIGN • February 1954

## Coaxial Crystal Mixers

For 225-5600Mc Range



Model CM-107 Fixed Tuned, Coaxial Crystal Mixers are offered in eight ranges, from 225-400Mc to 4000-5600Mc, covering the entire 225-5600Mc frequency range. The input VSWR is better than 2:1, without adjustments, for all frequencies within the nominal frequency range.

Local oscillator power requirement is 10mw. The oscillator injector is adjustable to accommodate large variation on oscillator power. The local oscillator VSWR is better than 2:1 regardless of injector adjustment. Local oscillator rejection at i-f output is better than 30db. Two types of input connectors are available: Type "N" or UG-48/U. Empire Devices Prod. Corp., Dept. ED, 38-15 Bell Blvd., Bayside 61, N. Y.

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

## Transistor Test Set

Aids in Circuit Design



The Type 210 Transistor Test Set is a completely self-contained, moderate cost instrument designed to be of maximum value in the design and development of transistor circuits. It measures the equivalent parameters of both junction and point-contact units over a wide range of d-c conditions.

No accessory equipment is necessary and operation is simple. Owen Laboratories, Dept. ED, 412 Woodward Ave., Pasadena 10, Calif.

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

is **YOUR**  
relay requirement  
different?

These

## CLARE RELAYS

have successfully met  
thousands of problems



**FAST OPERATE—  
FAST RELEASE**

The Clare Type C Relay will operate in from 0.005 to 0.04 second, depending on voltage

applied, coil resistance, and contact assembly. Release time is from 0.006 to 0.020 second.

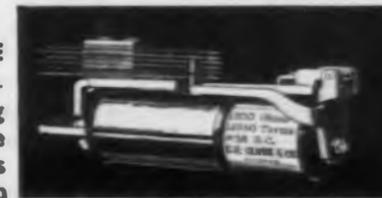
**SLOW OPERATE**

The Clare Type D Relay makes use of a low resistance copper collar, or slug, on the armature end of the coil, to delay its operation. Operate time can be varied, from 0.01 to 0.1 second, by proper selection of coil. Release time can be held low by heavy spring pressures and large residual settings.



**SLOW RELEASE**

The Clare Type E Relay uses a copper slug on the heel end of the coil to hold circuits operated from 0.05 to 0.3 second after the coil circuit has been broken. Operate time is from 0.01 to 0.04 second.



**SNAP-ACTION** The Clare Type CMS Relay has enclosed snap-action switch contacts, rated at 10 amperes, 125 volts a-c.



● Write for Engineering Data Book. Address C. P. Clare & Co., 4719 West Sunnyside Ave., Chicago 30, Illinois. In Canada: Canadian Line Materials Ltd., Toronto 13. Cable Address: CLARELAY

## CLARE RELAYS

FIRST IN THE INDUSTRIAL FIELD

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

## Koiled Kords\* permit EASY SERVICING of In-a-Door or Sliding Units . . .



A six inch section of KOILED KORDS retractile cord will extend to more than two feet when pulled and when released will retract immediately to its original neat, compact, spring-like shape. KOILED KORDS solve the problem of carrying current to movable units without having a long trailing cord to foul in the mechanism. They make it possible to retain electrical contact between units when they are pulled out for servicing, facilitating trouble location and correction.

KOILED KORDS extend as needed without looping, dangling or tangling.

KOILED KORDS are compact, neat, attractive, built to withstand continued flexing.

KOILED KORDS are available on special order to your specifications in multi-conductor types up to 37 conductors. Stocked types include 2, 3, 4 and 5 conductor #23 AWG communications cords and 2, 3 and 4 conductor Underwriters' Laboratories approved SO, SJO and SV-neoprene jacketed power cords. KOILED KORDS can be supplied in 48 inch mandrel lengths or prepared into cord sets for attachment to equipment.

WRITE FOR KOILED KORDS APPLICATION BULLETIN  
SHOWING MANY USES.

**Koiled Kords**  
Incorporated

Box K, New Haven 14, Conn.

\*KOILED KORDS is the trademark of Koiled Kords, Inc.

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

## New Products . . .

### ▲ Sensitive DPDT Relay Withstand Rugged Environments

This miniature, hermetically sealed, dpdt relay, the PR9100 series, weighs only 3 oz. Due to counter-balanced features, it will withstand high acceleration, vibration, shock, and tumbling. It meets the shock requirements of MIL-E-5400 and will withstand continuous acceleration of 50G's without malfunctioning.

Certain contact combinations can be furnished with a required coil power as low as 20mw, and any relay in this series can be obtained with a coil resistance as high as 15,000 ohms. A typical relay tested in the firm's laboratories completed operations in excess of 1-3/4 million carrying a 3amp resistive load at 28v d-c, and still continued to function. Phastron Co., Dept. ED, 151 Pasadena Ave., South Pasadena, Calif. ▲ *This product will be on display in Booth 479 at the Radio Engineering Show.*

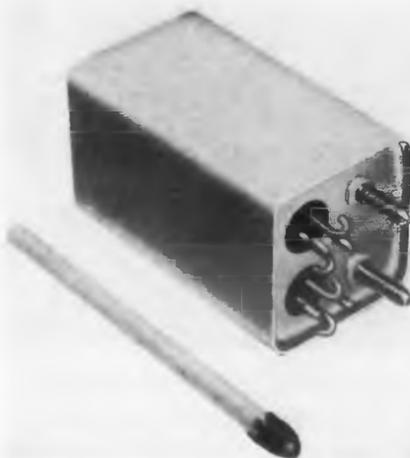
CIRCLE ED-63 ON READER-SERVICE CARD FOR MORE INFORMATION

### R-F Amplifier

#### For 2000Mc to 4000Mc Range

The Model 24 Broad Band Amplifier utilizes a traveling-wave tube to provide high gain over the 2000-4000Mc frequency range. Small signal gain averages 35db, and saturation output power averages 30mw. Maximum noise figure for the amplifier is 20db or less.

Completely self-contained, the amplifier includes regulated power supplies and a traveling-wave tube-focusing structure. Case dimensions are 4-7/8" x 7-5/8" x 19-9/16" deep (JAN aircraft equipment dimensions). The amplifier is directly usable as a laboratory tool or as a system component. Supply requirements are 108-122v at lamp, 50-800cy. Westlabs, Inc., Dept ED, P. O. Box 1111, Palo Alto, Calif.



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

## NEW SCREEN BOOTH FILTERS block radio interference 0.14 TO 15,000 MEGACYCLES



More than 100 db attenuation from 1000 megacycles down to 100 kilocycles is provided by the new series of Tobe screen room filters. Our exclusive UHF/SHF filter, used in conjunction with these new filters, extends the 100 db attenuation range through 15,000 megacycles. The line filters are available in current ratings from 15 to 250 amperes and voltage ratings from 28 volts d-c to 500 volts a-c or 1000 volts d-c. Each unit is contained in a sturdy metal case with convenient shielded output terminal. Write for data sheet giving dimension and performance specifications.

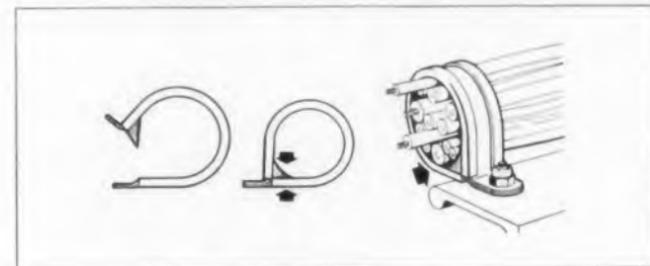
**DO YOU KNOW THAT . . .** in 1929, Tobe was selling effective power line filters for screen rooms? Ask Tobe for the answers to all radio interference questions; our 25 years' experience can solve your problems.



**TOBE DEUTSCHMANN**  
CORPORATION  
NORWOOD, MASSACHUSETTS

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

## "TA" WIRE HARNESS CLAMPS



As clamp is closed, wedge seals cushion and forms escape-proof grommet for complete protection of wires. Patent Pending. Experts report up to 40% of electrical problems are caused by pinched wires.

New MS21919WDG now incorporates improved TA-708 and TA-710 wedge-lock clamps. Special V-shaped wedge is vulcanized or molded to cushion. Protects wires and saves hours of assembly and maintenance time by eliminating tedious, costly taping. Permits easy removal or replacement of single strands. Especially recommended for installations where extra margin of safety against short-circuits is desired, such as proximity to fuel, gas, inflammable materials, explosives, etc. Available in aluminum, steel, stainless steel, also in .020 lightweight series. Choice of cushioning materials, AMS 3209, TA-74 High Temp. Cushion and silicate rubber cushion. Write today for Bulletin. Thomas Associates, 4613 Alger St., Los Angeles 39, Calif.

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

ELECTRONIC DESIGN • February 1954

"Helineers"

## Electrical Noise in Wire-Wound Potentiometers

by Irving J. Hogan

Reprints of a talk presented at the 1952 West Coast I. R. E. Convention are now available. A copy is yours for the asking.



ASK FOR DATA FILE No. 224

**Helipot** corporation

a division of BECKMAN INSTRUMENTS, INC.  
SOUTH PASADENA, CALIFORNIA

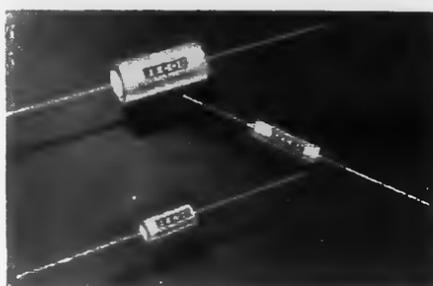
... first in precision potentiometers

235

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

## Plastic Film Capacitors

In 0.01mfd to 1.0mfd Value



Type "MH" capacitors utilize moisture-proof DuPont "Mylar" polyester film, which provides high insulation resistance together with low dielectric absorption.

They are hermetically sealed in metal tubular cases with glas-to-metal seal terminals at each end.

These miniature, high quality units are available with tolerances of  $\pm 5\%$ ,  $\pm 2\%$ , and  $\pm 1\%$  in values from 0.01mfd to 1.0mfd, with voltage ratings of 200v, 400v, and 600v d-c, in standard case sizes. Larger values and special size cases can be supplied upon request or to specification. The capacitors are conservatively rated for operation over the temperature range of  $-60^\circ$  to  $+125^\circ\text{C}$  without derating. Electronic Fabricators, Inc., Dept. A, 682 Broadway, New York 12, N. Y.

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

## Data Handling System

Digitizes, Samples, Records

Illustrated is a new multi-channel Data Handling System for use in aircraft and missile testing. It is designed to digitize, sample, and record information obtained from Doppler - frequency effects or pulse code modulation from each of three independent channels, and to provide, through a fourth channel, recorded time marker signals as a data reference.



Special decades are used to allow addition or subtraction of counts and to provide an indication of algebraic sign of the total counts. An important element in the data reduction process is a new Digital Magnetic-Tape Handler which is used as the basic recording medium. It permits recording data from all four channels at high rates and playback at the lower speeds required to put data on tabulating cards or insert it into electronic computers. Potter Instrument Co., Inc., Dept. ED, 115 Cutter Mill Road, Great Neck, N. Y.

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

## MICRO Precision Switches



## Why 64 MICRO Subminiature Switches are used in Collins airborne navigation system

Engineers of Collins Radio Company chose MICRO subminiature switches for this sensational new navigation development because they combined small size with the utmost precision and reliability required in such delicately adjusted equipment.

These small, precision subminiature switches are mounted on the inside panel of the card reader of Collins Navigation System (Type NC 101).

The switches are actuated by the business machine-like punched holes in the navigation card, transferring information from the punched cards to the computer. This tunes the VHF receivers and gives the pilot a continuous fix measured in miles along his course line which tells him how far he is from and how to get to his destination.

Electronic engineers in every field of industry are finding MICRO switches peculiarly suitable for use in devices where small size must go hand in hand with precise action and reliable performance. MICRO field engineers are located in 16 branch offices. Consultation with them on difficult switch problems can save you time and money.

# MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY

FREEPORT, ILLINOIS



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

## Electro PRESSUREGRAPH

**UNEQUALLED PRESSURE MEASUREMENTS**  
of air, gases, water, viscous liquids



### HERE'S WHY

- measures dynamic pressures
- drift, temperature stabilized
- linear output for unit pressure change
- one pick-up for all pressures
- balanced output for driving DC recorders
- no need for pre-amplifiers
- simple operation
- records 50 microsecond pressure transients
- can be water-cooled for temperatures exceeding 1000° F.
- auxiliary Synchro-Marker adds 2 channels
- uses 200 feet of pick-up cable
- time-proven by internationally known industrial concerns
- reasonably priced

FREE BULLETIN gives uses and details.

### ELECTRO PRODUCTS LABORATORIES

4501-EDp Ravenswood Ave., Chicago 40, Ill.  
Canada: Atlas Radio Corp., Ltd., Toronto, Ont.

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

ELECTRONIC DESIGN • February 1954

## ENGINEERS:

DOES YOUR  
PRESENT JOB  
GIVE YOU

ALL THESE

**RCA**

CAREER

ADVANTAGES?

POSITIONS NOW OPEN FOR  
SENIOR DEVELOPMENT  
AND DESIGN ENGINEERS:

- ✓ ELECTRONIC . . .
- ✓ COMMUNICATIONS . . .
- ✓ MECHANICAL . . .
- ✓ COMPUTER . . .
- ✓ ELECTRON TUBE . . .

PERSONAL INTERVIEWS ARRANGED  
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, Dept. 3178  
Radio Corporation of America  
30 Rockefeller Plaza  
New York 20, N.Y.

### CHECK SHEET

- Yes No
- PROFESSIONAL RECOGNITION AND PRESTIGE?
  - ADVANCEMENT IN STATUS?
  - SECURITY AND STABILITY?
  - CHALLENGE AND OPPORTUNITY?
  - HIGH SALARY SCALE AND OPPORTUNITIES FOR PROMOTION?
  - EXCELLENT SUBURBAN HOUSING AT REASONABLE COST?
  - FACILITIES FOR PROFESSIONAL ADVANCEMENT?
  - UNEXCELLED TECHNICAL AND LABORATORY FACILITIES?
  - ASSOCIATION WITH TOP SCIENTISTS?
  - TUITION REFUND PLAN FOR ADVANCED STUDY?
  - MILITARY OR COMMERCIAL OPPORTUNITY?
  - MODERATE COST OF LIVING?
  - MODERN RETIREMENT PLAN?
  - COMPANY-PAID LIFE INSURANCE?
  - COMPANY-PAID LIBERAL HOSPITAL, SURGICAL AND DISABILITY PLAN (FAMILY BENEFITS)?
  - LIBERAL VACATION PLAN?
  - LIBERAL HOLIDAY SCHEDULE?
  - PROFESSIONAL STATUS AND UTILIZATION OF YOUR EDUCATION AND EXPERIENCE?

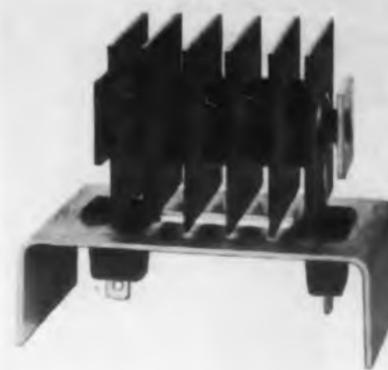


RADIO CORPORATION of AMERICA

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

## New Products . . .

### Selenium Rectifier Has Plug-In Design



This firm's entire line of "Centre-Kooled" selenium rectifiers is being converted to the "Plug-In" type with only slight dimensional changes and at no increase in price. The sockets, which are made by

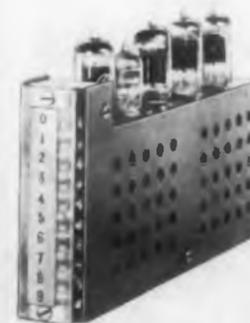
Cinch Manufacturing Company, are designed with a 90° twist on the plus lug for polarization.

Socket placement determines the rectifier size, and it is possible to mount the plug-in rectifier in a conventional manner and solder to the lugs. Sarkes Tarzian, Inc., Rectifier Division, Dept. ED, 415 N. College Ave., Bloomington, Ind.

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

### Electronic Counter

Counts at 75,000 Pulses/Sec Rate



The SC-41 "Plug-In Decaseale" is a direct-reading counter capable of operating at speeds up to 75,000 counts per second and resolving individual pulses separated by as little as 5 $\mu$ sec. It has a five-tube decade scaling unit with a self-contained 10-light neon indicator. It contains

four conventional scales-of-two with additional circuit connections which cause the system to deliver an output pulse and to reset after 10 input counts have been received. The output pulse may be applied to the input of a following "Decaseale", thus permitting any desired count capacity, or to other devices.

Input pulse range is from 75v to 100v negative, with a rise time of 1 $\mu$ sec or less. Output pulses are 100v negative at count of 10, with 100v positive pulses available at counts of 2, 4, 6, and 10 for special uses. Power required is 250-400v d-c, with 300v at 14ma nominal, and 6.3v a-c at 1.5amp. Overall dimensions are 8-3/4" x 1/2" x 5-1/2", with tubes. The unit has many applications where high speed, accurate registration is required. Tracerlab, Inc., Dept. ED, 130 High St., Boston 10, Mass.

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

ELECTRONIC DESIGN • February 1954

what is

available from **Pyramid**

The security of experience.

Pyramid has more experienced personnel (in years of actual designing and manufacturing of capacitors) than any other manufacturer.

The control of specially designed facilities. Pyramid is the only manufacturer of capacitors whose plants were planned and built specifically for the entire manufacturing process of capacitors from drawing board conception through reception of raw materials, fabrication, packaging and shipment.

The guarantee of one standard. All Pyramid capacitors are one quality, made of the same quality materials demanded by rigid military specifications. Pyramid capacitors have a low leakage factor due to the non-hygroscopic insulating material used on all production. Pyramid delivers the best at no premium.

A complete line of capacitors—full ranges in all ratings and types.

**▲ PYRAMID ELECTRIC COMPANY**  
1448 HUDSON BOULEVARD • NORTH BERGEN, N. J., U. S. A.  
CIRCLE ED-74 ON READER-SERVICE CARD FOR MORE INFORMATION

### Regulated D-C Supply

Tubeless, Magnetic Amplifier Type



The "Nobatron" Model MA-2850 delivers 50amp at 28v (adjustable between 23v and 32v). Regulation accuracy is  $\pm 1\%$  against line and load combined.

This tubeless supply uses magnetic amplifier principles. Designed for testing inverters, radar installations, and fire control systems, it has a dependability, high capacity, and accuracy that indicate many uses in and out of the aircraft electronics field. Sorensen & Co., Inc., Dept. ED, 375 Fairchild Ave., Stamford, Conn.

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

### ▲ Vibration Exciter

Tests Tubes at High Frequencies



The Model C-7 High Frequency Vibration Exciter with its accessory equipment, Model P-70 Amplifier and F-34 Field Supply, is especially designed for testing sub-miniature electron tubes. It incorporates a means of rigidly clamping the tubes in the armature, and includes a flat top table to facilitate its use in the calibration of small vibration pickups and accelerometers.

The exciter and power supply are designed to provide constant table acceleration for constant amplifier input voltage within the usable frequency range. There is no load matching power factor or gain adjustment required from 200cps to 10,000cps. This feature makes the system especially useful for small pickup calibration or for reproducing complete wave forms without introducing distortion. The ratio of table acceleration to amplifier input voltage is flat within  $\pm 15\%$  from 200cps to 10,000cps with a dead mass table load of 3gr. Operation below 200cps is possible at reduced acceleration levels.

The exciter was especially designed to shake a 3.2gr T-3 electron tube. With this tube attached to the moving element, the exciter will deliver 10G's acceleration. The resonant axial mode with a T-3 tube is above 25,000cps. The MB Manufacturing Co., Inc., Dept. ED, 1060 State St., New Haven 11, Conn. ▲ This product will be on display in Booth 120-122 at the Radio Engineering Show.

CIRCLE ED-77 ON READER-SERVICE CARD FOR MORE INFORMATION

# NEED A TRANSDUCER SIMULATOR?



## SIE

### MB-1 BATTERY POWERED Oscillator

WITH THE **SIE**  
GEOPHYSICAL  
MICROVOLTER

USE IT TO SIMULATE:  
geophones, vibration pickups,  
phonograph pickups, pressure  
pickups, accelerometers, strain  
gages, and similar transducers  
for field tests or laboratory de-  
sign of amplifiers and recording  
equipment.

The oscillator, which may be used separately, is stable, splash proof, hum proof, and produces up to 5 volts with very low distortion. With the attenuator, it will provide 1 microvolt to .1 volt AC (2 to 20,000 cps) or DC at an output impedance of 10 to 500 ohms. Price, f.o.b. Houston, complete with batteries and cover: \$295.00. Oscillator only, complete with batteries and cover: \$215.00. Attenuator only, in separate case: \$95.00.

Write today for free literature.

### SOUTHWESTERN INDUSTRIAL ELECTRONICS COMPANY

2831 POST OAK ROAD  
HOUSTON 19, TEXAS

CIRCLE ED-78 ON READER-SERVICE CARD

Another

# CHATHAM

Exclusive Design!



## Type VC-1258 MINIATURE HYDROGEN THYRATRON

*with 10KW  
peak rating!*

MANY OTHER TYPES  
AVAILABLE—

This tube is one of many CHATHAM thyratrons ranging in size to 40 megawatts, all of which represent an advantageous departure from conventional designs and are the result of several years of concentrated development work. Full information on request.

MAX PEAK ANODE VOLTS	1000
MAX PEAK ANODE AMPS	20
MAX AVER ANODE AMPS	0.05
NOMINAL FILAMENT WATTS	12.6

Specifically designed for pulse generating applications, this tube handles peak pulse power up to 10 KW. Repetition rates in excess of 10,000 pps are possible at lower power. Type VC-1258 operates at zero bias, fits a standard ceramic miniature socket, and is designed to withstand all shock and vibration tests of a ruggedized electronic tube.

### CHATHAM ELECTRONICS CORP.

Executive and General Offices: LIVINGSTON, NEW JERSEY  
Plants and Laboratories: NEWARK and LIVINGSTON, NEW JERSEY



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

# Doelcam

**NEW**

**POSITION INDICATOR Microsyns**



**simplify  
measurement  
and control**

DOELCAM Microsyn Position Indicators are small electro-mechanical signal generators which transform angular displacement into an electrical signal. Their high accuracy and dependability offer a new level of instrument performance to designers of indicating and control equipment in the chemical, refinery and process industries. Write for Bulletin MP 10.

Type 1C-020	MODEL	A	B	C	D	E	F
Frequency	cps	60	400	400	400	1000	5000
Excitation	volts	6.3	10	26	55	10	10
Excitation	ma	26	45	37	23	44	38
Sensitivity 100k load	v/degree	0.27	2.01	2.88	3.00	3.81	3.07

- Linearity  $\pm 1/2\%$  to 7 degrees,  $\pm 1\%$  to 10 degrees.
- Residual Null Will not exceed signal equivalent to 0.01 degree rotation.
- Static Friction Standard Model 0.03 oz.-in.  
Low Friction Model 0.002 oz.-in.
- Reaction Torque Less than bearing friction level.
- Rotor Moment of Inertia 0.04 ounce-inches sq.
- Unit Weight 7.3 ounces.

**Doelcam CORPORATION**  
SOLDIERS FIELD ROAD, BOSTON 35, MASS.  
West Coast Office: 304 Tejon Pl., Palos Verdes, Calif.  
**Instruments for Measurement and Control**  
Gyroscopic Instrumentation • Servomechanisms  
Synchros • Microsyns • Servo Motors

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

## New Products . . .

### Miniature Connectors Easily assembled, Long Life Units

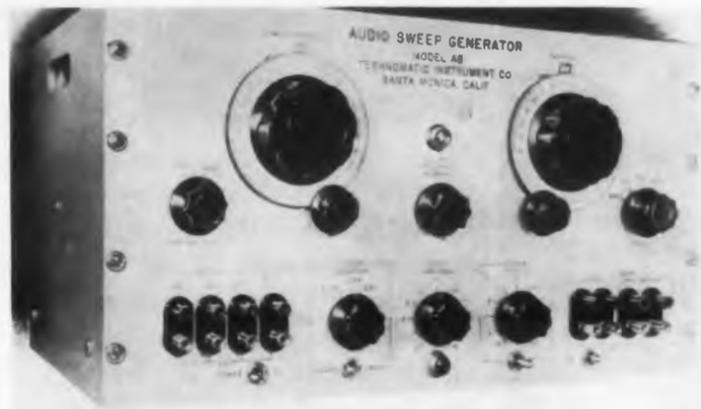
The "VT" Series of miniature rectangular connectors is available with 7, 8, 14, 18, 20, 21, 34, and 41 contacts. There is also a 25-contact unit with one high-voltage contact. Polarizing guides are optional, and hoods are also available.



Except for the 8-contact unit, all connectors are interchangeable with similar equipment. Socket contacts are spring types which snap in and out easily without special tools. They require no "C" rings, and no undercutting is needed to seat a "C" ring on the solder-pot side. It is possible to insert insulating sleeving into insulator on the solder-pot side of both socket and pin contacts. Viking Electric, Dept. E1, 1061 Ingraham St., Los Angeles 17, Calif.

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

### Audiosweep Generator Permits Automatic Plotting



Essentially a beat frequency oscillator, this instrument eliminates the need for point-by-point plotting of frequency response curves. It presents curves at a glance by automatic visual plotting as a display on a cathode ray tube, accurately analyzing the audio and supersonic spectrum.

The frequency sweep is achieved by a continuous variation of the sinusoidal output frequency between any two frequency limits in the range 20cy to 200,000cy. Other models cover ranges from 2cy to 20,000cy, and 0.2cy to 2000cy. The frequency swing of the Audiosweep Generator is accomplished by electronic means. A variable marker makes possible accurate frequency readings at any point along the curve. A selection of sweep types and sweep rates is available. Technomatic Instrument Co., Dept. ED, 2316 Pico Blvd., Santa Monica, Calif.

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

for the best in **TEFLON**  
depend on



*engineering  
leadership  
and  
facilities*

\*DuPont trade-mark for tetrafluoroethylene resin

When you use John Crane Teflon products you get *all* the advantages of this remarkable material—because you get the finest in fabrication "know-how" and quality.

"John Crane" fabricates Teflon for countless applications, including rods, tubing, tape, sheets, gaskets, bellows, washers, insulators, electrical parts, valve discs, "C-V" Rings, braided packings, coverings for dough sheeting rolls and heat sealing jaws, and a wide variety of other forms. Our engineers are ready to work with and assist you in your particular needs or problems.

Let us know your requirements. Send for our 12-page illustrated catalog. Crane Packing Co., 1841 Belle Plaine Ave., Chicago 13, Illinois.

**JOHN CRANE CRANE PACKING COMPANY**

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

Dimensions: 2" dia.  
X 5/8" deep.



**HIGH-VOLTAGE  
Controls**

★ Ideal for high-voltage low-current applications. Voltage traps in mechanical design make this control. Series 51, ideal. Molded phenolic housing. Terminals at rear. Compact.  
★ Write for Bulletin 119. Let us quote.

Composition - element, 5000 ohms to 1 megohm. Tapers available. 1 watt max.

Tolerance plus/minus 20% to 1 meg; above, plus/minus 30%.

Rotation. 270° mechanical and electrical; effective, 250°. 1 to 3 oz.-in. torque.

Insulation, 10,000 V.D.C. breakdown test from terminals to mounting bushing.



CLAROSTAT MFG. CO., INC. DOVER, N.H.

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

**New Fenwal  
Miniature  
THERMOSWITCH®  
Control  
Saves Space**



**Free bulletin gives details**

If your product or project calls for temperature control that is exact and reliable but space saving is an important consideration, you will want to know more about the new Fenwal Miniature THERMOSWITCH unit. It incorporates in a small temperature control many characteristics previously found only in much larger controls.

This dependable little device can be adjusted anywhere within the range of 0°F to 200°F. It is extremely sensitive to temperature variations and positive in action . . . maintains normal control characteristics under vibrations of up to 5 G's . . . is as rugged as it is tiny. It lends itself perfectly to electrical, electronic, radio, radar and other protective uses where space is at a premium.

For complete information on the new Fenwal unit, send for your FREE copy of the Miniature THERMOSWITCH control bulletin. Write Fenwal Incorporated, 92 Pleasant St., Ashland, Mass.



**THERMOSWITCH®**

Electric Temperature Control and Detection Devices  
**SENSITIVE...but only to heat**

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

**Data Plotter  
High Speed, Accurate Unit**



The "Electroplotter" plots from a variety of input data, such as analog or digital computers, punched card machines, or a manual keyboard. In the latter case, a high-speed 10-key keyboard with a numerical verifier provides for plotting rates of about 35 points per minute. Pen traversing speed is 18" min. Accuracy is  $\pm 0.1\%$ . The unit plots on any type paper up to 11" x 17"; larger sizes are available.

Features include automatic symbol printing, independent zero and scale controls for each axis, selectable incremental advance when required, and a vacuum table for holding paper. Benson-Lehner Corp., Dept. ED, 2340 E. Sawtelle Blvd., West Los Angeles 64, Calif.

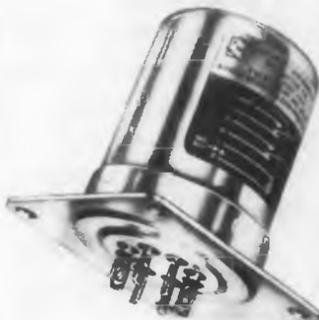
CIRCLE ED-86 ON READER-SERVICE CARD FOR MORE INFORMATION

**This will be your last issue of ELECTRONIC DESIGN unless you return your subscription renewal and qualification form.**

*See Page 12*

**Miniature Relay**

**Operates at 50mw to 2w**

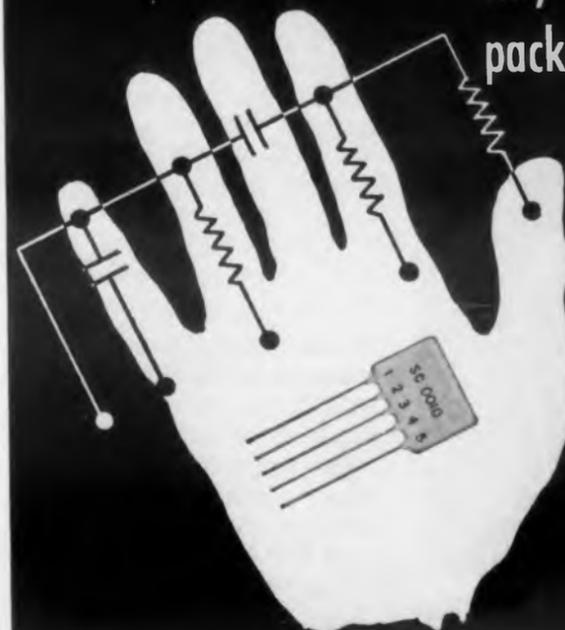


The Model 2021 dpdt relay is designed for quality, dependability, and vibration immunity which exceeds military specifications. Made for adaptability, it has coil resistances up to 80,000 ohms and operates over the range of 50mw to 2w. The mounting plate is drawn and formed of 1/16" steel. Other enclosures are available to any user specification. Dimensions of the relay are 1.625" diam x 2.187". Electro-Mechanical Specialties Co., Inc., 6819 Melrose Ave., Los Angeles 38, Calif.

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

a handful of components

in one  
tiny  
package



**Stupakoff  
Printed Circuits**

Space is saved, assembly time reduced and errors eliminated when sturdy, compact Stupakoff Printed Circuits are used. In one tiny package—half the size of a book of matches—few or many accurately rated components—resistors and capacitors—are permanently assembled according to specifications. The only connections to be made are the external leads.

Stupakoff excels in the development and manufacture of Printed Circuits, and today is equipped with modern facilities for the mass-production of dependable units made to your specifications. Write for Bulletin 1151-A.

**STUPAKOFF CERAMIC  
& MANUFACTURING COMPANY  
LATROBE, PENNSYLVANIA**

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



**Kalotron**  
*Temperature Limited*

**DIODES**

Kalotron diodes have pure tungsten cathodes, which means that the specified ratings are maintained throughout the normal life of the tube. Some types incorporate a safety feature by which an external high impedance circuit is closed in event of filament failure. All Kalotron diodes are backed by careful production and processing methods which guarantee stable characteristics held to close tolerances.

*Write for literature giving full descriptions, including electrical and mechanical specifications.*

**Thermosen, Inc.**

361 WEST MAIN ST. STAMFORD, CONN.

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

FASTER, MORE ACCURATE INSPECTION WITH  
**FLASH-O-LENS**  
**Illuminated Magnifiers**



In industrial inspection departments, on production lines, in foundries and laboratories, wherever close visual inspection is important, FLASH-O-LENS gets the job done better, faster. FLASH-O-LENS spots minute defects by spotlighting the area it magnifies.

Battery models, powered by standard flashlight cells, and AC-DC plug-in models are available with 5, 7, 20 or 40 power precision lenses to meet a wide range of inspection needs. Prices start from \$10.65.



WRITE TODAY  
 for literature showing  
 applications, types, prices.

**E. W. PIKE & COMPANY, Inc.**  
 492 NORTH AVENUE ELIZABETH 3, N. J.

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

LET **PERKIN**  
 BUILD YOUR

**AIRBORNE HI-VOLTAGE  
 POWER SUPPLIES**



**TYPICAL MODEL  
 No. M1139D**

6000v. @ 100μamps.  
 115v., 400cps., 1 phase input  
 Built to MIL specs.  
 Potted with specially  
 developed epoxy resin

Units up to 50kv. can be built to your specs.

**MAGNETIC AMPLIFIER REGULATED  
 POWER SUPPLIES**

**1% REGULATION AND RIPPLE**

Model	Volts	Amps	Model	Volts	Amps
MR532-15	5-32	15	M293	10-32	50
M426A	10-40	30	M93B	24-32	200

Write or phone factory for literature or quotations. Samples of M1139D can be loaned for your testing purposes!

Phone: ORegon 8-7215

**PERKIN ENGINEERING CORP.**  
 345 Kansas Street • El Segundo, Calif.

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

**New Products . . .**

**Low Frequency Noise Generator  
 For Simulation Studies, Testing**



The Model RUG-1-10 makes available a random voltage source of controlled frequency spectrum and probability distribution. Examples of uses include: study of random air-load effects in airframe design, noise problems in missile guidance, study of the statistical properties of ground electromagnetic reflection, low frequency phenomena including chemical and thermal processes, and certain bioelectrical effects.

The basic noise source is a gas tube, which provides signals to three controlled distribution channels generating Gaussian, Rayleigh, and uniform distributions—all accurate to 2%. The frequency coverage is from 0-10cy in three steps: 0-2cps, 0-5cps, and 0-10cps for all three distributions. Wider bandwidths are available upon request.

The generator will deliver approximately 5v rms at the wide bandwidth and 1v at the narrow setting; it is continuously variable to 0.1v accuracy. Statistical Instrument Co., Dept. ED, P. O. Box 552, Church St. Station, New York 8, N. Y.

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

**Expanded Scale Voltmeter  
 Measures Transformation Ratios**



This special, expanded scale voltmeter is designed especially for measuring transformation ratios of transformers, synchros, and resolvers. It is equipped with separate inputs for primary and secondary voltages of 57.3v, 78v, 90v, 105v, and 115v. Primary or secondary

voltages are selected by a switch.

Accuracy is  $\pm 1\%$  of input voltage, with the input impedance to 10,000 ohms/v. Arga Division, Beckman Instruments, Inc., Dept. ED, 220 Pasadena Ave., South Pasadena, Calif.

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



100 amps at 6 volts, 75 amps at 12 volts, 50 amps at 28 volts.

**TUBELESS  
 MAGNETIC  
 AMPLIFIER  
 DC SUPPLIES**

Sorensen Nobatrons Model MA6/15 and Model MA2850 are tubeless — using magnetic amplifier principles. They have plenty of current capacity — 100 amps at 6 volts or 75 amps at 12 volts in the MA6/15 and 50 amps at 28 volts in the MA2850. Regulation is  $\pm 1.0\%$  against line and load.

MA6/15 is designed primarily as an automotive production test instrument for use in checking window motors, heaters, clocks, radios, headlight dimmers, ignition systems, cigarette lighters. The MA2850 can be used for testing aircraft heaters, pitch changers, inverters, radar, fire control systems, etc. Built around tubeless circuits, both models are carefully engineered and built to give years of trouble-free dependable service. Write for information now!

**SORENSEN**  
 375 FAIRFIELD AVENUE, STAMFORD, CONN.

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



Look Sharp—  
 Are Sharp—

on the New

**Handy-Hannah\***  
 ELECTRIC KNIFE SHARPENER

Built to deliver super sharp, daily performance for a long, long life time, Phalo-Cord cord sets at the same time give this handsome Handy Hannah Electric Knife Sharpener, a smart finishing touch.

Look around you . . . you'll find more and more quality electrical and electronic products depending on Phalo-Cord cord sets to carry the current load.

Join the growing trend to Phalo-Cord cord sets . . . Tailor-Made or standard . . . no finer cord-sets available!

\*Handy Hannah Electric Knife Sharpener is a product of Standard Products Corporation, Whitman, Mass.

IVORY SPT-2

**PHALO PLASTICS CORPORATION**  
 25-1 FOSTER ST., WORCESTER, MASS.  
 Insulated Wire and Cables—Cord Set Assemblies

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

## Dynamotor

Operates 6v Radios on 12v



The "Change-A-Volt" Dynamotor makes it possible to operate 6v, 2-way radio equipment from 12v systems without any rewiring or modifications. It is supplied complete with starting relay

and switch, 12v fuse block, and wiring to directly convert a 12v battery to a 6v radio supply.

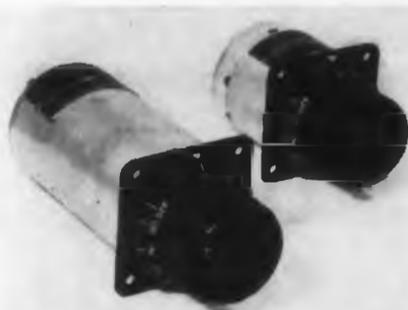
These Dynamotors are also available for transmitters up to 30w output. The model B615V delivers 15amp continuously for receive, and 45amp for transmit. Efficiency is 65%.

Other units are offered in 24v, 28v, 32v, 48v, and 64v inputs to change directly to 6v or 12v. Carter Motor Co., Dept. 27, 2664 N. Maplewood Ave., Chicago 47, Ill.

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

## Intervalometers; Count Limiter

Permit Variety of Pulse Programs



At left in the illustration is an Intervalometer, and at right is an auxiliary instrument, the Count Limiter, both recent additions to the company's line.

Two Intervalometers are available, the B-9A and B-10A, designed to furnish a 28v d-c, 3amp pulse of 0.250sec duration at regular time intervals. Repeat accuracy of the pulse interval is within  $\pm 10$  milliseconds over a supply voltage range of 24-29v d-c. Provision is made to start and stop the Intervalometer from a remote position. Each model is provided with two interchangeable time interval scales providing, in all, four ranges to 12, 24, 60, and 120sec in 0.1, 0.2, 0.5, and 1sec increments respectively.

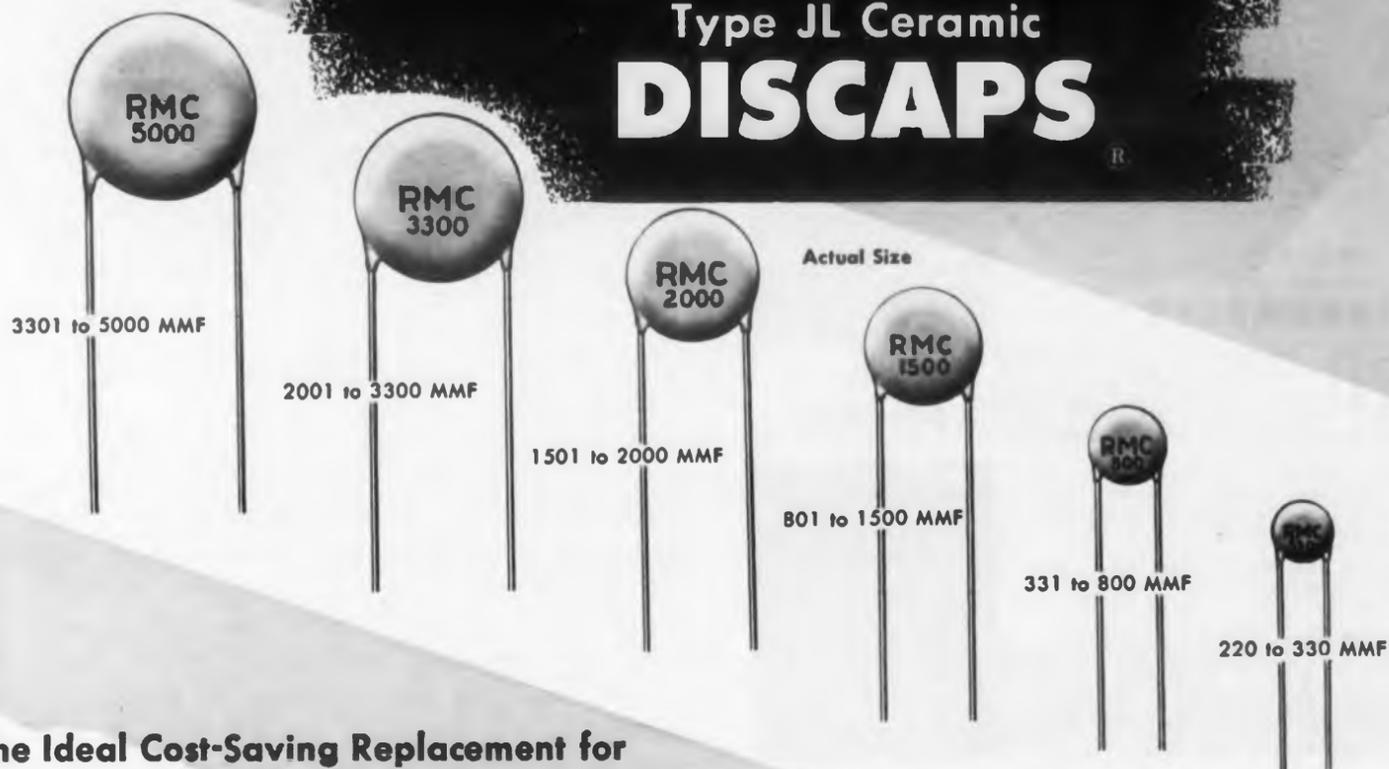
The Count Limiter, CN-1A1, may be used with an Intervalometer as a pulse counter and limiter for stopping the Intervalometer at the desired number of pulses from 1 to 120, as set on the dial. Two Count Limiters can be connected together to provide up to 14,400 pulses. Any number of Intervalometers and Limiters may be interconnected to provide an infinite variety of preset pulse programs. The units are built to Air Force specifications. Abrams Instrument Corp., Dept. S4, 606 E. Shiawassee St., Lansing 1, Mich.

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

ELECTRONIC DESIGN • February 1954

# Another RMC First

## Type JL Ceramic DISCAPS



## The Ideal Cost-Saving Replacement for Paper or General Purpose Mica Capacitors

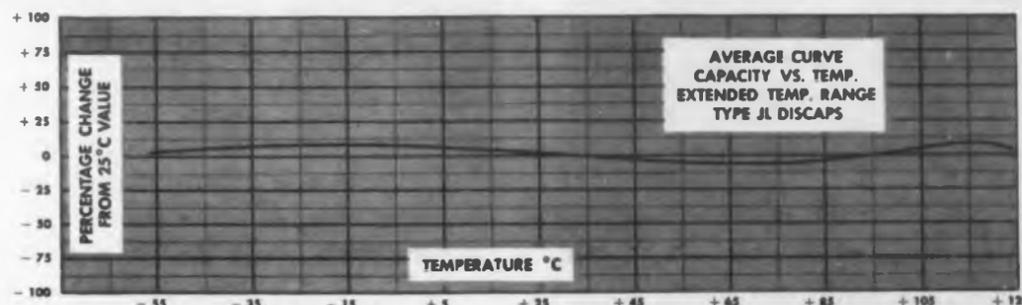
Type JL DISCAPS, the result of extensive research in the RMC Technical Ceramic Laboratories, afford exceptional stability throughout an extended temperature range. The maximum capacity change between  $-60^{\circ}\text{C}$  and  $+125^{\circ}\text{C}$  is only  $\pm 7.5\%$  of capacity at  $25^{\circ}\text{C}$ . Type JL DISCAPS are available in tolerances of  $\pm 10\%$  or  $\pm 20\%$ . Standard working voltage is 1000 V.D.C.

Manufactured in a wide range of capacities, Type JL DISCAPS offer the advantages of longer life, dependability, and lower initial cost. Their smaller size and greater mechanical strength provide additional economies in assembly line operations.

It will pay you to investigate the advantages of using Type JL DISCAPS as replacements for paper or general purpose mica capacitors. Your inquiry is invited.

### SPECIFICATIONS

POWER FACTOR: 1% max. @ 1 K C (initial)  
 POWER FACTOR: 2.5% max. @ 1 K C, after humidity  
 WORKING VOLTAGE: 1000 V.D.C.  
 TEST VOLTAGE (FLASH): 2000 V.D.C.  
 LEADS: No. 22 tinned copper (.026 dia.)  
 INSULATION: Durez phenolic—vacuum waxed  
 INITIAL LEAKAGE RESISTANCE: Guaranteed higher than 7500 megohms  
 AFTER HUMIDITY LEAKAGE RESISTANCE: Guaranteed higher than 1000 megohms  
 CAPACITY TOLERANCE:  $\pm 10\%$   $\pm 20\%$  at  $25^{\circ}\text{C}$



SEND FOR SAMPLES AND TECHNICAL DATA

DISCAP  
CERAMIC  
CONDENSERS



RADIO MATERIALS CORPORATION

GENERAL OFFICE: 3325 N. California Ave., Chicago 18, Ill.

FACTORIES AT CHICAGO, ILL. AND ATTICA, IND.

DISTRIBUTORS: Contact Jobbers Sales Co., 146 Broadway, Paterson 1, N. J.

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

## STREAMLINED AND RUGGED



**BRAND  
NEW**

Cast Iron  
Housing

Black Wrinkle  
Finish

Sponge Rubber  
Skid Pad

## LINEMASTER CLIPPER FOOT SWITCH

The streamlined Clipper Switch matches your unit's most modern features! Complete with all the rugged features of a heavy industrial switch. It is easily operated from sitting or standing position giving the worker a free hand for greater efficiency. Nearly 100% dust-proof and yet accessible to wiring—just two screws to remove to reach interior mechanism.

Size 4½" X 3½" X 1½"—Wght. 2 lbs.

**LINEMASTER SWITCH CORP.**

130 Putnam Road • Woodstock, Conn.

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

WRITE FOR  
BULLETIN  
AND PRICES

Let us quote on  
your switch  
requirements

## Z32.3-1946



### NO. 175 ELECTROMASTER

ALL ELECTRICAL SYMBOLS SHOWN IN THE AMERICAN STANDARDS ASSOCIATION MANUAL Z32.3-1946, AS WELL AS OTHER ACCEPTED SYMBOLS IN THE UTILITY, POWER AND LIGHT FIELDS CAN BE MADE WITH THIS TEMPLATE. MADE OF MATHEMATICAL QUALITY PLASTIC SHEETS LAMINATED TO .080 THICKNESS. INNER CONTOURS BEVELED. PRINTING IS BETWEEN THE LAMINATED SHEETS. ONE OF THE MORE THAN 30 RAPIDESIGN TIME-SAVER TEMPLATES—ALL OF WHICH ARE BETTER MADE, MORE USEFUL AND LESSER PRICED.

\$4.00 AT YOUR LOCAL DEALER  
CATALOGUE NO. 49 AVAILABLE UPON REQUEST

**RAPIDESIGN** INC.  
P. O. BOX 592 • GLENDALE, CALIF.

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

52

## New Products . . .

### Printed Circuit Connectors Permit Direct "Plug" Connections



This series of Printed Circuit "Continental" Connectors permits direct connection to a printed circuit "plug" or "plug" mounted subassembly. For space economy, both sides of the

printed circuit card can be used for wiring to the external circuit with the connectors' double row contact construction. This feature provides up to 30 (PC-15), 36 (PC-18), and 44 (PC-22) contacts. The connectors are also available in single row construction. Additional designs may be obtained on request.

Multi-conductor two-sided pressure contacts of spring temper phosphor bronze are gold-plated over silver for low contact resistance. Terminal ends can be hot tinned for easy soldering at assembly. The contacts have a maximum voltage drop of 20mv at rated currents. Positive polarization is provided with a polarizing stud which can be located at any contact. Three insulating materials are available: Mineral-filled Melamine, Plaskon reinforced (glass) Alkyd type 440-A, and Diallyl Phthalate (blue). Electronic Sales Division, DeJur-Amsco Corp., Dept. ED, 45-01 Northern Blvd., Long Island City, N. Y.

CIRCLE ED-100 ON READER-SERVICE CARD FOR MORE INFORMATION

### Boot for Switches Made of Silicone Rubber



Part No. 2030 is a high pressure hermetic seal for 3-hole mounting toggle switches and circuit breakers. A single unit covering all exposed parts of the switch, it is hermetically sealed by three gasket ribs, integral parts of the boot, which seat firmly against the back of the panel to keep out moisture, dust, or combustible vapors.

The boot is made of silicone rubber and is impervious to salt water, acids, and ozone. It surpasses the requirements of MIL Spec B-5423. The temperature range is from  $-80^{\circ}$  to  $+500^{\circ}$ F, and the boot has met all vibration and weather requirements of MIL Spec E-5272A. The standard color is gray, but other colors can be supplied on special order. Automatic & Precision Mfg. Co., Dept. ED, 252 Hawthorne Ave., Yonkers 5, N. Y.

CIRCLE ED-101 ON READER-SERVICE CARD FOR MORE INFORMATION

## FLUSHING FANS

Since their introduction 6 years ago ROTRON'S Model BFV and CFV cabinet flushing fans have become a standard of quality and reliability in the broadcast, TV and communications industry for cooling instrument cabinets and transmitter cubicles.



115 or 230 VOLT  
50-60 CPS, 1 PHASE  
200-500 CFM

PUSH OR PULL OPERATION  
DOUBLE SHIELDED BALL BEARINGS  
HIGH AMBIENT TEMPERATURES  
RESILIENT MOUNTING (any position)

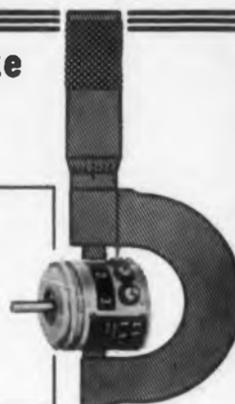
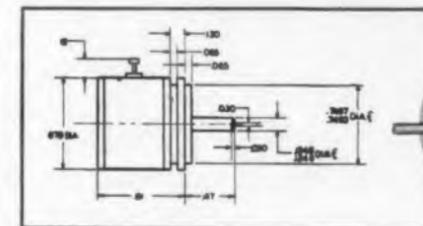


**ROTRON**  
MANUFACTURING CO., INC.  
7 SCHOONMAKER LANE  
WOODSTOCK, N. Y.

CIRCLE ED-102 ON READER-SERVICE CARD FOR MORE INFORMATION

(T)  
POT  
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### SUBminiature size with SUPERprecision



This new TYPE 9 (less than .9" dia.)  
Ultra-Low-Torque

### POTENTIOMETER by ELECTRO-MEC

offers designers and manufacturers of electronic equipment an opportunity to achieve greater miniaturization without sacrificing precision.

**SPECIFICATIONS:** Length: single cup assembly .810"  
each additional cup .500"  
Diameter: .875"  
Shaft (ball bearing mounted): dia. .125"  
Linearity: .5% (or less)  
Ganged assemblies available.

For detailed information communicate with our Engineering Dept. or telephone STillwell 6-3402.  
Available in Canada through Aeromotive Engineering Products, Montreal and Toronto.

Sales Representatives needed in several territories.

**ELECTRO-MEC LABORATORY, INC.**  
21-09 - 43 Avenue Long Island City 1, N. Y.

CIRCLE ED-103 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC DESIGN • February 1954

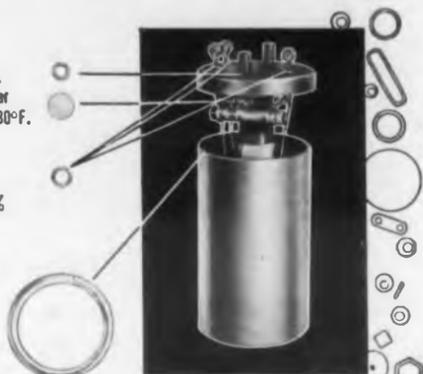
## 3 Soldering Operations in 1 Easy as ABC

### with KESTER "SOLDERFORMS"

**A** Solder screws and stud to can cover.  
Solderform™ Disc & Rings 5% Silver  
—95% Lead Alloy. Melting Point 680°F.

**B** Solder glass terminals to cover.  
Solderform™ Rings 63% Tin—37%  
Lead Alloy. Melting Point 361°F.

**C** Hermetically seal cover on can.  
Solderform™ Ring 28.5%  
Bismuth—28.5% Tin—43%  
Lead Alloy. Softening Point 250°F.



Here's a typical example of a tough resistance soldering job involving progressively lower melting temperatures. Kester "Solderforms" made sure this high precision oscillator coil came through every test successfully.

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# KESTER

SOLDER COMPANY

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CIRCLE ED-104 ON READER-SERVICE CARD FOR MORE INFORMATION

## Power Meter

Has Range of D-C Through X-Band



This power meter measures rms power over the frequency range of d-c through X-band without the use of frequency limited bolometer mounts. Completely self-contained, it uses a single power probe for all frequencies.

The instrument uses a power sensitive element that does not employ a hot wire barretter or other delicate elements. It can withstand 150% overload without burnout or other ill effects. The probe is permanently connected to the meter, while the other side may be fastened directly to the equipment under test, avoiding errors involved in r-f connecting cables.

Two power scales are available; 0-20mw and 0-100mw. The power range may be extended by the use of directional couplers, fixed pads, or variable attenuators. Polarad Electronics Corp., Dept. ED, 100 Metropolitan Ave., Brooklyn 11, N. Y.

CIRCLE ED-106 ON READER-SERVICE CARD FOR MORE INFORMATION

## Try Them Free!

# KEPS

TESTING SAMPLES

See how this amazing new Shake-proof fastening saves assembly time and assures vibration protection. A SHAKEPROOF® Lock Washer of the right size and type is pre-assembled on each nut... only one unit to handle... the lock washer can't drop off... every nut is certain to be locked tight.

**SEND FOR YOUR FREE KIT OF KEPS TESTING SAMPLES TODAY!**

## SHAKEPROOF

"Fastening Headquarters"

Division of Illinois Tool Works  
St. Charles Road, Elgin, Illinois

CIRCLE ED-105 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC DESIGN • February 1954

Jennings  
RADIO



FOR

## HIGH VOLTAGE MEASUREMENTS

### JENNINGS' CAPACITIVE TYPE VACUUM VOLTAGE DIVIDER

These newly designed JENNINGS' VOLTAGE DIVIDERS can be used to measure continuous or pulsed voltages up to 60 KV peak at practically any desired voltage division ratio. They can be used at high frequencies because the low voltage probe is shielded and because the input loading capacitance can be as low as 1.5 mmfd. They can also be used at frequencies down to 60 cycles. RF transmission line voltages and push-pull output voltages up to 120 KV peak-to-peak can be measured by using these dividers in a balanced-to-ground arrangement.

Applications include:

- Measuring RF tank and transmission line voltages
- Viewing output of high voltage pulse generators
- Viewing output wave shape of high voltage aircraft magnetos.

Literature mailed on request

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

CIRCLE ED-107 ON READER-SERVICE CARD FOR MORE INFORMATION

for  
**Machine Tool  
Designers**

**New Data Booklet  
on G-E Wires and Cords**

Here's a new 12-page booklet describing the properties of General Electric wires and cords for the machine tool industry. It contains tables of specifications to help you select and apply Flamenol\* machine tool wires, Geoprene portable cords, and Geoprene control cables. These G-E wires and cords have been designed to meet the demands of complex multi-motor machine tool wiring, and the severe operating conditions imposed by the modern machine tool.

For your free copy of the booklet "Wires and Cords for the Machine Tool Industry," write Section W102-166, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

\*Registered Trade-mark General Electric Company

*You can put your confidence in—*

# GENERAL ELECTRIC

CIRCLE ED-108 ON READER-SERVICE CARD FOR MORE INFORMATION

## NEW non-linear resistors



New IRC VARISTORS are voltage sensitive and provide sharp variation of resistance with applied voltage. Designed to meet most needs for non-linear resistors, they are available in 5 convenient cell sizes, and a complete choice of enclosures including hermetic seals.

◀ SEND FOR TECHNICAL DATA BULLETIN

INTERNATIONAL RESISTANCE CO.

Dept. D, 401 N. Broad St., Philadelphia 8, Pa.  
In Canada: International Resistance Co., Ltd.,  
Toronto, Licensee



Please send me Technical Bulletin SR-3

Name \_\_\_\_\_ Title \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_ State \_\_\_\_\_

*Whenever the Circuit Says ~~~*

CIRCLE ED-109 ON READER-SERVICE CARD FOR MORE INFORMATION

Defeat your "Arc Enemy"  
with **CONTACT  
PROTECTORS**

A unique application of  
**SELENIUM RECTIFIERS**  
developed by

**Federal**

TO PUT AN END TO  
ARCING CONTACTS

Contact Protectors by Federal are a sure way to economy and longer life for relay contacts . . . to eliminate circuit failure and interference caused by arcing.

Now you can throw away your slide rule! . . . Select the Contact Protector for your application from Federal's extensive list.

Designed for use in AC or DC circuits . . . small in size . . . with pigtail leads for easy mounting. For full information, write to Federal, Dept. F-135.



**Federal Telephone and Radio Company**

SELENIUM-INTELIN DEPARTMENT

100 Kingsland Road

Clifton, N. J.

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Pick 'DIAMOND H' RELAYS



FOR HIGHER

**VIBRATION  
RESISTANCE**

Vibration resistance range of "Diamond H" Series R Relays has been more than doubled, extending now from 0 to well over 1,000 cycles per second at 15 "G's." Hermetically sealed, miniature aircraft relays, they are basically 4PDT but are also available in DPDT and 4PDT with two independent coils, either or both of which will operate the unit. They meet all requirements of USAF Spec. MIL-R-5757B . . . and far surpass many.

Operating shock resistance exceeds 50 "G's"; temperature range is from -65° to +200°C. They operate consistently over 400,000 cycles without failure at 5 A. and go 3,500 or more under 30 A. at 30 V., D. C. resistive. Voltages up to 300 D. C. at 4/10 A. are carried for more than 400,000 cycles. Coil resistances up to 50,000 ohms available. Operating time is 10 ms. or less; drop out time 3 ms. or less. Sensitivity approaches 100 mw. at 30 "G's" operational shock resistance. Inter-electrode capacitance is less than 5 mmf. contacts to case; less than 2½ mmf. between contacts. All standard mounting arrangements.

Bulletin R-150, giving basic performance data under varying conditions, is yours on request. Our engineers are prepared to work with you to develop variations to meet your specific requirements. Tell us your needs.

**THE HART MANUFACTURING COMPANY**  
210 Bartholomew Ave., Hartford, Conn.

CIRCLE ED-111 ON READER-SERVICE CARD FOR MORE INFORMATION

**New Products . . .**

**Cathode Ray Indicator**  
For High Speed Writing



The Model 600 Cathode Ray Indicator is designed to utilize the high-writing-speed capabilities of the type 5XP cathode ray tube in applications too ad-

vanced or special for standard oscilloscopes. Especially designed for use with the SKL Model 610 High Speed Sweep Generator, it permits writing speeds in excess of 500cm per  $\mu$ sec.

The indicator has positioning, intensity, focus, and astigmatism controls on the front panel. The internal power supply provides 4000v overall accelerating potential. Predeflection and positioning potentials are regulated to prevent interference from line voltage changes. Provision has been made for connection of an additional external accelerating supply of up to 25,000v. Spencer-Kennedy Laboratories, Inc., Dept. ED, 186 Massachusetts Ave., Cambridge 39, Mass.

The indicator has positioning, intensity, focus and astigmatism controls on the front panel. The internal power supply provides 4000v overall accelerating potential. Predeflection and positioning potentials are regulated to prevent interference from line voltage changes. Provision has been made for connection of an additional external accelerating supply of up to 25,000v. Spencer-Kennedy Laboratories, Inc., Dept. ED, 186 Massachusetts Ave., Cambridge 39, Mass.

CIRCLE ED-113 ON READER-SERVICE CARD FOR MORE INFORMATION

**Power Supply—Demodulator**  
Links Transducers to Recorders



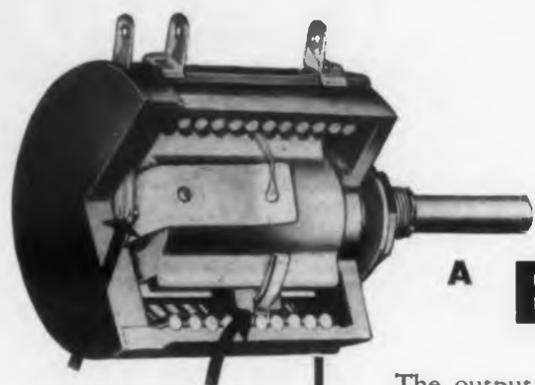
The Type VF-DD Test Instrument consists of a power supply and a three-channel demodulator unit. The power supply section is especially suited for exciting many types of transducers, such as gyros,

accelerometers, position indicators, or synchros. The demodulator section comprises three demodulator channels to transform 400cy signals to d-c for use with recording galvanometers.

Voltage is regulated within 1% under all operating conditions. Drift will not exceed 0.2%. Demodulation is linear within 1% of full scale. Doelcam Corp., Dept. ED, Soldiers Field Rd., Boston 35, Mass.

CIRCLE ED-114 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC DESIGN • February 1954



NEY PRECIOUS  
METAL ALLOY  
CONTACTS

NEY'S SMALL PARTS PLAY  
A **BIG** PART IN PRECISION INSTRUMENTS

The output of any potentiometer is dependent upon the contacts. Illustrated above is a Helipot 10-turn Potentiometer (Model A) using Ney Precious Metal Contacts between the slider and the resistance winding and for the slip ring pick-off, assuring the utmost in linearity and electrical transmission.

The J. M. Ney Company has developed a number of precious Metal Alloys and fabricates these into contacts, wipers, brushes, slip rings, commutator segments and similar components for use in electrical instruments. Ney Precious Metal Alloys have just about ideal physical and electrical properties, high resistance to tarnish, and are unaffected by corrosive atmospheres. Consult the Ney Engineering Department for assistance in selecting the right Ney Precious Metal Alloy which will improve the electrical characteristics, prolong the life and accuracy of your instrument.

**THE J. M. NEY COMPANY • 373 ELM STREET, HARTFORD 1, CONN.**  
Specialists in Precious Metal Metallurgy Since 1812

CIRCLE ED-112 ON READER-SERVICE CARD FOR MORE INFORMATION



# BRUSHES CONTACTS

## SLIP RINGS

...AND SLIP RING ASSEMBLIES



BRUSHES — CONTACTS — ASSEMBLIES

... Use **SILVER GRAPHALLOY** for applications requiring low electrical noise; low and constant contact drop; high current density and minimum wear.

EXTENSIVELY USED IN:

**SELSYNS • GUN FIRE CONTROLS  
ROTATING THERMOCOUPLE and  
STRAIN GAGE CIRCUITS  
ROTATING JOINTS • DYNAMOTORS**

Wide range of grades available for standard and special applications.

### Other Graphalloy Products



Oil-free, self-lubricating Bushings and Bearings (applicable -100° to +300° F.); with expansion coefficient half that of steel will not seize shaft at low temperature; oil-free Piston Rings, Seal Rings, Thrust and Friction Washers, Pump Vanes.

#### GRAPHITE METALLIZING CORPORATION

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- Please send data on Graphalloy BRUSHES and CONTACTS.
- Send data on BUSHINGS.

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 COMPANY \_\_\_\_\_  
 STREET \_\_\_\_\_  
 CITY \_\_\_\_\_ ZONE \_\_\_\_\_ STATE \_\_\_\_\_

CIRCLE ED-115 ON READER-SERVICE CARD

## ▲ Line Insulator

Prevents Standing Waves



The "Pal" line insulator has an all-polyethylene head. It prevents standing waves by keeping the metal

away from the voltage conducting twin-lead or coaxial cable.

Mechanically, the insulator's hinge mechanism permits quick installation. Rather than detach the grommet from the stand-off frame, the user simply swings the grommet open, slips in the wires, and slips the grommet closed. The design eliminates loose parts and threading of the lead-in through the grommet.

The insulator is designed for all u-h-f and v-h-f transmission lines. JFD Manufacturing Co., Inc., Dept. ED, 6101 16th Ave., Brooklyn 4, N. Y. ▲ *This product will be on display in Booth 123 at the Radio Engineering Show.*

CIRCLE ED-116 ON READER-SERVICE CARD FOR MORE INFORMATION

## Random Noise Generator

Provides Three Ranges



Entirely random noise with good normal or Gaussian amplitude distribution is provided by the Type 811-A Random Noise Generator. The unit is valuable for tests

in design and production of sound apparatus; for installing or checking sound systems and acoustic treatment; for making acoustic or psycho-acoustic measurements; and for studying effects of noise on circuits and equipment.

The random noise is generated by a gaseous discharge in a 6D4 gas tube. Oscillation at high frequencies is eliminated by a magnetic field. Three noise ranges are provided. In the a-f and r-f ranges, the noise is "white", with a uniform frequency spectrum having equal power in equal bands. In the ASA range, a noise is generated meeting ASA standard Z24.3-1944 for "noise of general character". Maximum open circuit output voltage is 2v rms in all ranges.

The instrument is entirely self-contained and operates 105-125v at 50-60cy. A low flux density power transformer allows operation without adverse effects on nearby equipment operating at low signal levels. Hermon Hosmer Scott, Inc., Dept. ED, 385 Putnam Ave., Cambridge 39, Mass.

CIRCLE ED-117 ON READER-SERVICE CARD FOR MORE INFORMATION

# MEPCO



*Announcing* a complete line of  
**Deposited Carbon Resistors**  
**HERMETICALLY SEALED**  
.25 watt to 2 watt ratings

Mepco presents a complete line of **Hermetically Sealed** deposited carbon resistors with ratings from .25 watts to 2 watts.

These are not the usual varnish coated types. Instead, they are completely sealed in steatite housing, which assures positive moisture protection.

Also available are resin coated types manufactured to MIL-R-10509A, glass enclosed and helium filled high stability types, and high frequency rod and disc units.

Write for complete information. Fill-in and mail the coupon today.

**MEPCO, INC.**

Morristown,  
New Jersey

- Please send me information on Mepco deposited carbon resistors.
- Please send me information on Mepco wire wound resistors.

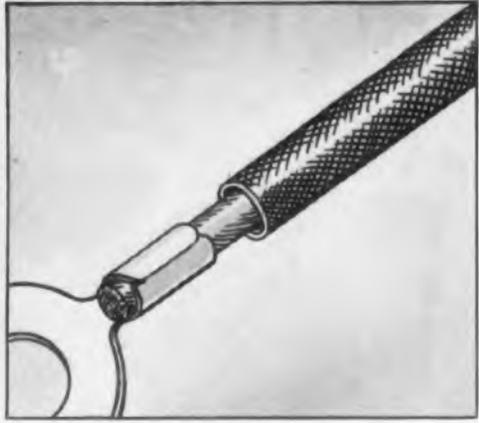
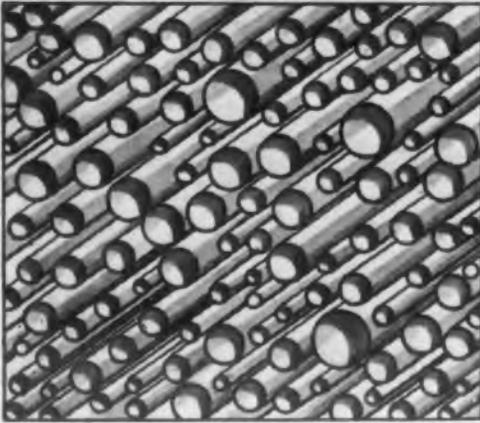
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COMPANY \_\_\_\_\_

STREET \_\_\_\_\_

CITY \_\_\_\_\_ STATE \_\_\_\_\_

# Why All This? for Just This?



Insulating a lead or wire is just a matter of slipping on a piece of tubing or sleeving. Then why are there thousands of standard and special Dieflex treated tubing and sleeving products?

One reason is that the leads on some electrical or electronic units have to be protected with tubings or sleeveings against temperatures that may go up to 392F. Other equipment may need tubings that have exceptional flexibility and push-back ability for easy handling, high abrasion resistance, resilience, or chemical resistance to withstand physical and chemical abuse. That is why there are five different types of Dieflex tubings and sleeveings, each excelling in one or more important features. Made with a flexible braided glass or cotton sleeving base, the different types are silicone rubber and varnish treated glass, "Vinylglas" vinyl coated glass, and oleoresinous varnished glass and cotton.

Insulation on wires must withstand different voltages, also. That means different grades of tubings and sleeveings, each with a different dielectric strength. Every type of Dieflex product is made in four or five NEMA grades.

What's more, if leads are to be identified by color, each type and grade of tubing or sleeving must be available in different standard or special colors or tracer combinations—ten or more in the case of some Dieflex products.

Then, to assure snug fits, figure on 25 or 30 different standard sizes for each type, grade, and color of Dieflex tubing or sleeving.

These are the reasons there are thousands of different Dieflex tubings or sleeveings. These are the reasons why you're sure to get the tubing or sleeving that exactly meets the requirements of your job—IMC can give unbiased recommendations.

PHONE OR WRITE TODAY FOR LITERATURE AND SAMPLE CARD "SELECTOR" ON

**DIEFLEX**® TUBINGS AND SLEEVINGS

**INSULATION**

**MANUFACTURERS CORPORATION**



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Phone Superior 1-2310

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Phone Michigan 1391

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Phone Geneva 5353

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101 Mainz Court  
Phone 2-7786

\*LOCAL STOCKS AVAILABLE AT THESE LOCATIONS

CIRCLE ED-119 ON READER-SERVICE CARD FOR MORE INFORMATION

# New Products . . .

## Power Oscillator

Range from 200Mc to 2500Mc

The U-H-F Wide Band Power Oscillator is designed for the testing and measurement of antenna radiation, antenna field strength, wave filters, noise, and interference. It is adaptable as a general purpose, low-power, portable transmitter.



It is adaptable as a general purpose, low-power, portable transmitter.

Features include a 200Mc to 2500Mc frequency range with one simple band changeover by minor adjustment of feedback assemblies and parts. The varying power output depends on the frequency: 50w at 200-400Mc, 25w at 400-1000Mc, and 10w at 1000-2500Mc. It provides for external modulation at video and audio frequencies. It has 200w power consumption at 115v, 60cy. Size is 24" x 12" x 16" deep.

The instrument employs a grid-separation, dial cavity, coaxial line oscillator, a 2C39A discseal triode, and an integral rectifier power supply. A single tuning control sets plate and grid circuit line lengths, with maximum output provided by individual tuning of the grid-cathode line. The W. L. Maxon Corp., Dept. ED, 460 W. 34th St., New York 1, N. Y.

CIRCLE ED-120 ON READER-SERVICE CARD FOR MORE INFORMATION

## ▲ Code Typing Device

Simplifies Sending of Morse Code



The Model EBC2 "Codetypes" permits the user to send the International Morse Code without any training. The leads of this unit are clipped directly across the hand key or directly to the transmitter.

Messages are formed with machine accuracy at any speed from 10wpm to 75wpm. Smaller and lighter than a typewriter, the unit contains only 12 miniature tubes and is suitable for a-c or d-c operation. Continuously variable speed control is provided. Codetyper Laboratories, Dept. ED, 550 5th Ave., New York 19, N. Y. ▲ This product will be on display in Booth 810 at the Radio Engineering Show.

CIRCLE ED-121 ON READER-SERVICE CARD FOR MORE INFORMATION



**THERMADOR**

*Transformers for Television  
... Radar... Aircraft...  
Geophysics... Radio*

You will find Thermador ready, willing and fully qualified to handle your transformer requirements. Engineering experience and manufacturing know-how, developed over a period of 35 years, form the hard core that makes Thermador today's largest West Coast manufacturer of electrical appliances and transformers. We would like to work with you on your next project involving the design and production of transformers for specific requirements...including joint Army-Navy specifications.

### transformers:

Audio Auto	Geophysical
Driver Filament	High-Fidelity Audio
Input-Output	Midget Plug-In
Plate Power	Television
Tube to Line	

...also Chokes and Reactors



**THERMADOR ELECTRICAL  
MANUFACTURING CO.**

"Seven Leagues Ahead" 3-320

ELECTRONICS DIVISION

2000 So. Camfield Ave., Los Angeles 22, Calif.

CIRCLE ED-122 ON READER-SERVICE CARD

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When you need a special-purpose gadget or component of electrical or electro-mechanical nature, THINK OF RAM.

**Designing  
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Founded 1936

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DETROIT 20, MICHIGAN

CIRCLE ED-123 ON READER-SERVICE CARD

## Miniature Receiving Tube For Remote-Cutoff Cascode Use



The Type GL-6386 is a medium-mu twin triode in which each section exhibits a remote-cutoff characteristic. An addition to the line of "Five Star" high reliability tubes, it is designed primarily

for use in remote-cutoff cascode applications. It can minimize cross modulation which can occur in the first stage of a receiver when a strong signal is close to the frequency of the desired signal. In cascode applications, the tube is characterized by high gain, low noise figure, and low third order harmonic distortions.

The tube is designed as a cascode r-f amplifier, i-f amplifier, or mixer in circuits to which it is desired to apply automatic gain control. Characteristics and operating conditions of the tube as a cascode amplifier are: plate supply voltage, 200v; grid supply voltage, -2v; cascode transconductance, 4000- $\mu$ ohms; cascode plate current, 10.5ma. Tube Department, General Electric Co., Dept. ED, Electronics Park, Syracuse, N. Y.

CIRCLE ED-124 ON READER-SERVICE CARD FOR MORE INFORMATION

## Instrument Bearing Improved R2 Type Unit



The "Micro R2" features a ribbon-type, balanced, cone-controlled retainer which cannot wind up, hang up, or fall out. The result is a low and repetitive starting torque in one bearing and from one bearing to another. Maximum break-away is 140 dyne-cm without special testing, and a maximum of 100 dyne-cm

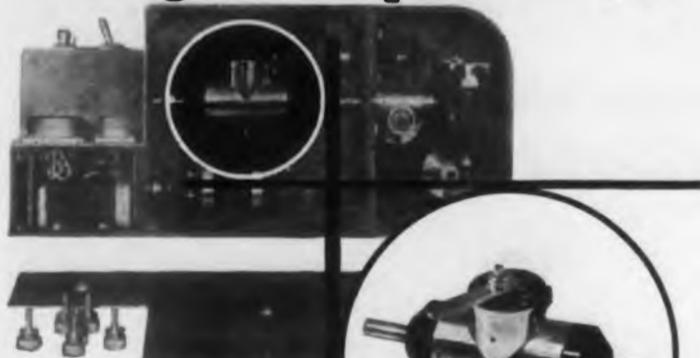
with testing, based on a 75gm thrust load.

The retainer of this new bearing is stronger than the old crown version and with higher speed limits; the bearing has been tested at 90,000rpm. Also, the bearing is available in the flange-type, and with a straight O.D. In addition it can be furnished in stainless steel, and in angular contact construction with phenolic retainer. Tolerances are ABEC5 to ABEC7 and beyond. New Hampshire Ball Bearings, Inc., Dept. ED, Peterborough, N. H.

CIRCLE ED-125 ON READER-SERVICE CARD FOR MORE INFORMATION



## Design Simplified...



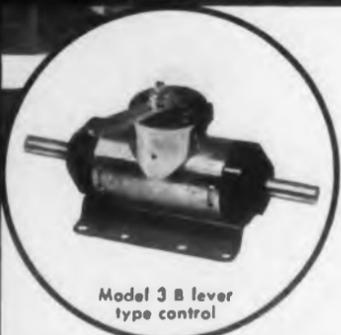
### with the **Metron** VARIABLE SPEED DRIVE

- Permanently lubricated
- Your choice of 6 controls
- Speeds up to 10,000 RPM
- Nominal output .025 HP

For further information about how Metron units can simplify your costly speed changing problems, write for Bulletin 99.



**Metron**



Model 3 B lever type control

Design engineers at Century Geophysical Corporation make use of the Metron Variable Speed Changer to give them continuously adjustable chart speeds in their miniature oscillograph. Century engineers find that it is simpler and more economical to use Metron Miniature units as components than to design and build their own. Metron Variable Speed Changers are designed into countless products that call for changes in speed. The units are small—only 4 3/16" long—to fit minimum space. They are smooth and accurate in operation and cover infinitely variable output speeds from 5:1 step down thru 1:1 to 1:5 step up.

**INSTRUMENT COMPANY**  
450 LINCOLN ST., DENVER 9, COLO.

CIRCLE ED-127 ON READER-SERVICE CARD FOR MORE INFORMATION

## Rapid Production Testing

of RESISTORS: 2 Ohms to 20 Megohms

INDUCTORS: 200 Microhenrys to 1500 Henrys

CAPACITORS: 50 Micromicrofarads  
to 100 Microfarads

This Comparison Bridge is self-contained. It compares the unknown in terms of a standard; it permits very rapid measurements of all types of impedances.



Type 1604-B Comparison Bridge: \$390

- Test Frequencies: 400 c, 1 and 5 kc
- CRO Visual Indicator; approach to balance instantly indicated
- Basic Accuracy: 1/10 of 1%



**GENERAL RADIO Company** 275 Massachusetts Ave., Cambridge 39, Mass.  
100 West St. NEW YORK 6 920 South Michigan Ave. CHICAGO 5  
1000 North Seward St. LOS ANGELES 38

CIRCLE ED-128 ON READER-SERVICE CARD FOR MORE INFORMATION

## New Products...

### Variable Inductance Kit For Color TV Circuits



This set of eight variable inductance coils covers a range from 1  $\mu$ h to 590  $\mu$ h and is suitable for use in color TV circuits as shown in the NTSC published schematics. Design features include "Q-Max" impregnation, an extra terminal for tiepoint convenience, and spring clip mounting designed for 5/16" chassis holes.

Individual calibration charts permit adjustment to requirements of inductance value without test equipment. The inductances are designed for both laboratory and prototype use. They are supplied individually packaged in plastic containers. Crest Laboratories, Inc., Dept. ED, 84-11 Rockaway Beach Blvd., Rockaway Beach, N. Y.

CIRCLE ED-129 ON READER-SERVICE CARD FOR MORE INFORMATION

### Germanium Diodes Hermetically Sealed



The 1N67-1N67-P is a hermetically sealed germanium diode designed for use as a 5v to 50v d-c restorer rectifier in those applications where small size, low shunt capacity, and absence of heater voltage are important. Rated for operation from -50°

to +100°C, it can be heated as high as 125°C with no irreversible change in characteristics. It has an unusually low temperature coefficient in the forward direction and is sealed to withstand severe atmospheric conditions.

Absolute maximum ratings (at 25°C) include: 80v inverse voltage; 35ma average rectified current; 100ma peak rectified current; and 500ma surge current (for 1sec). Characteristics (at 25°C) include a maximum inverse current of 0.005ma at -5v, and 0.05ma at -50v; a maximum forward current of 4.0ma at +1v; and a shunt capacitance of 1.0mmfd. Raytheon Manufacturing Co., Receiving Tube Div., Dept. ED, 55 Chapel St., Newton 58, Mass.

CIRCLE ED-130 ON READER-SERVICE CARD FOR MORE INFORMATION

### Multi-Purpose



### LABORATORY POLI-SCALER

Versatile  
Compact  
Precise  
Low-Cost

The Detectron DS-606 Poli-Scaler is a complete laboratory scaler of exceptional versatility. Adaptable to GM and scintillation counting and frequency checks. Power supply may be used for either GM input or to operate accessory equipment.

PULSE HEIGHT DISCRIMINATOR INPUT - 2 to 100 V  
POSITIVE or NEGATIVE PULSES - 2-100V Pos-2-50V Neg.  
RESOLUTION TIME - 5 Microseconds per pulse pair or less  
HIGH VOLTAGE POWER - Variable in 1-step from 0 to 2.5 kv.  
COUNTING RATE - 1,000 per sec. max.  
ACCESSORY SOCKETS - for count rate meter and speaker  
DIRECT READING - to 99,999,999

Write for FREE folder  
Dept. 76

THE **Detectron** CORPORATION  
5420 VINELAND AVE., NO. HOLLYWOOD, CALIF.

CIRCLE ED-131 ON READER-SERVICE CARD FOR MORE INFORMATION

## CHANGEABLE CHASSIS



### Speed-Chassis

The Speed-Chassis is a flexible breadboard assembly with interchangeable socket arrangements which can be mounted on a relay rack. A shield can and panel are available to make successful breadboard assemblies both permanent and neat.

Two insulated tie-point strips and one grounded tie-point strip are provided, each 14" long. Individual plates are available, with holes already punched, to fit most all needs. In addition, three sizes of blank plates are cataloged.

IMMEDIATE DELIVERY

SPECIFIC PRODUCTS

14515 DICKENS STREET  
SHERMAN OAKS 1, CALIF.

CIRCLE ED-132 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC DESIGN • February 1954

## Impedance Matching Device

Facilitates U-H-F TV Measurements



The U-1, U-2 Transformer - Balun Combination transforms the output impedance of an unbalanced source of voltage,

such as a signal generator or sweeper, to a balanced 300 ohm output. Covering the 400-900Mc portion of the spectrum, these units are specifically designed to facilitate measurements in the u-h-f—TV band.

The Model U-1 Transformer transforms a 50 ohm unbalanced source to 75 ohms unbalanced over the 300-900Mc range with an swr of less than 1.15. The U-2 Balun (illustrated) transforms a 75 ohm unbalanced source to a 300 ohm balanced impedance over the 400-900Mc range with an swr of less than 1.2. Overall swr of the combination from 400-900Mc is less than 1.2. Terminations are available for calibrating the transformer or transformer-balun combination. Linear Equipment Laboratories, Dept. ED, Brightwater Pl., Massapequa, L. I., N. Y.

CIRCLE ED-133 ON READER-SERVICE CARD FOR MORE INFORMATION

## Delay Line

Variable in 0.2 $\mu$ sec Increments



For electronic circuit work such as color TV, instrumentation, pulse-forming networks, and computer circuits, this "Type A" laboratory type delay line is variable in additive increments of

0.2 $\mu$ sec each. It is of the lumped constant type with a total maximum delay of 1.0 $\mu$ sec measured at 1/2 amplitude, with a rise time of 0.05 $\mu$ sec (measured at 10% and 90% amplitude). The characteristic impedance is 50 ohms, 70 ohms, or 100 ohms, and maximum peak voltage is 500v.

The delay line is constructed so that the individual switches each control a step of 20 coils and 20 matched capacitors. Low attenuation is also a feature. Overall dimensions are 2-1/2" x 3" x 4-1/2".

Also available, with the same chassis, are "Type B" delay lines with steps, in microseconds, of 0.05, 0.1, 0.15, 0.3, and 0.5, to total 1.0 $\mu$ sec, making it possible to switch in any delay from 0 to 1.0 $\mu$ sec in increments of 0.05 $\mu$ sec. May Engineering Co., Dept. ED, 6055 Lankershim Blvd., North Hollywood, Calif.

CIRCLE ED-134 ON READER-SERVICE CARD FOR MORE INFORMATION

# New CBS-Colortron

NOW IN MASS PRODUCTION



Unique photographic process, like photoengraving, uses aperture masks as negatives to print consecutively the red, green, and blue phosphor dots (250,000 of each) on CBS-Colortron screens.

After tri-color screens are printed, aperture masks are temporarily removed and face plates move on to critical inspection for screen imperfections.

**COLOR TV IS COMING . . .** faster than you think. The revolutionary new CBS-Colortron . . . a practical color picture tube . . . hastens the day. Already it is in lower-cost, mass production . . . made possible by its simplified, advanced design.

As in black-and-white tubes, the CBS-Colortron's screen is deposited directly onto the inside of its face plate. A unique photographic technique makes this possible. Because each aperture mask serves as a negative to print its tri-color screen, perfect register of mask and screen is automatically achieved

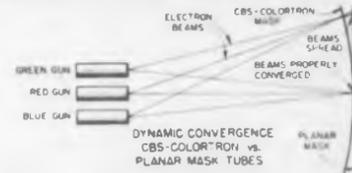
and maintained. The rugged, simple, light-weight mask sharply reduces assembly and exhaust problems. And the spherical design of mask and screen simplifies convergence circuitry and adjustment.

The CBS-Colortron is now a 15-inch, round tube. But, as soon as tooling is completed, it will be made in larger sizes. Watch for the new CBS-Colortrons. You'll see plenty of them soon. And you'll be sold on sight by their logical simplicity . . . their superior performance . . . their many advantages.

## CBS-Colortron OFFERS MANY ADVANTAGES



Cross-section (face plate, aperture mask, funnel, tri-color electron gun) shows simplicity of CBS-Colortron and its adaptability to low-cost, mass production.



Spherical screen and aperture mask of CBS-Colortron simplify convergence and focus. Electron beams remain in focus over entire surface of screen.



Light-weight (6 oz.), rugged, simple aperture mask of CBS-Colortron minimizes problems of exhaust, handling, and assembly.

## COMPLETE CBS-Colortron DATA FREE!

Take a look into the future. Write today for complete information on CBS-Colortron 15HP22: Construction . . . operation . . . application . . . installation and adjustment . . . electrical and mechanical data. Four packed pages . . . free!



CBS-HYTRON, Main Office: Danvers, Massachusetts

Manufacturers of Receiving Tubes Since 1921

A Division of Columbia Broadcasting System, Inc.

A member of the CBS family: CBS Radio • CBS Television • Columbia Records, Inc. • CBS Laboratories • CBS-Columbia • and CBS-Hytron  
RECEIVING • TRANSMITTING • SPECIAL-PURPOSE • TV PICTURE TUBES • GERMANIUM DIODES AND TRANSISTORS

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# ACE PRECISION NYLON BALLS

**LIGHTER**  
**TOUGHER**  
**MORE STABLE**

fabricated of DUPONT NYLON FM No. 10001 to close tolerances  
SIZES 1/8" to 3/4" TOLERANCES  $\pm .001$

Mass-produced to close tolerances giving you toughness at low temperatures, form stability at high temperatures, light weight, chemical and abrasion resistance. Ace Nylon Balls offer greater design possibilities for hundreds of industrial applications.

**NOW AT LOWER PRICES!**  
Because of mass production Ace is now producing the same quality at lower costs . . . the savings are yours!

Write for Samples, Bulletin, Price List Today

**ACE PLASTIC COMPANY**  
Precision Plastic Fabricators and Extruders

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All Special Purpose Tubes

Refer to your ALLIED Catalog for all electronic supplies. Write today for a FREE copy of the complete 268-page 1954 ALLIED Electronic Supply Guide.

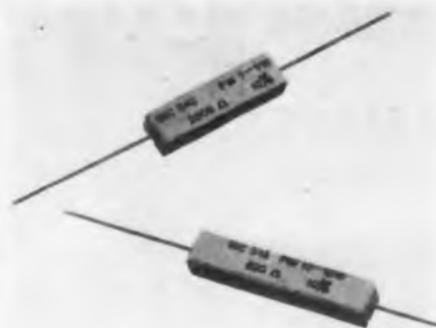
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100 N. Western Ave.  
Dept. 69-B-4, Chicago 80, Ill.

Everything in Electronics from One Dependable Source

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## New Products . . .

### Power Resistors In 7w and 10w Ratings



The Types PW-7 and PW-10 High Temperature Resistors are available in resistances from 0.51 to 5100 ohms and 1.0 to 8200 ohms respectively, both in  $\pm 5\%$  and  $\pm 10\%$  tolerances. Wire

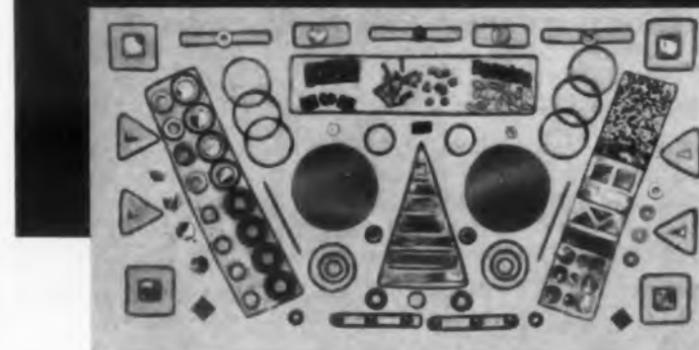
elements are uniformly and tightly wound on glass fibre cores with axial leads 1-1/2" long, 0.036" diam. Body dimensions of the PW-7 are 1-25/64" long x 3/8" wide x 11/32" high; of the PW-10 are 1-7/8" long x 3/8" wide x 11/32" high.

The resistors are particularly recommended for circuits requiring an actual wattage dissipation of 7w to 10w or less, where operation is at a high ambient temperature. With a rectangular shape, they have been designed to allow a high degree of automatic assembly at low cost. International Resistance Co., Dept. ED, 401 N. Broad St., Philadelphia 8, Pa.

CIRCLE ED-138 ON READER-SERVICE CARD FOR MORE INFORMATION

## ANCHOR SOLDER MICROFORMS

speed production, cut costs!



SAVE time, labor and solder with these fast-flowing Microforms. Tailor-made to your individual specifications. Ideal for production soldering by induction heating, hot plate, oven, flame. Available in rings, discs, pellets, drops, segments, foil, powder, washers, balls, rectangles squares—with or without flux—all in alloys from a melting point as low as 135°F. to as high as 1700°F., composed of: tin & lead, tin & silver, lead & silver, lead & antimony, indium, fusible & brazing alloys.

Other Anchor Solders are available in bar, solid wire, "Shurflo" rosin core, acid core, "AF" core—in all alloys and diameters to your specifications.

Anchor Fluxes are: rosin liquid, stainless steel, aluminum, acid, brazing, and "Shurflo" solder paint.

Write for free Pamphlet ED.

**ANCHOR**

METAL COMPANY  
244 Boerum Street, Brooklyn 6, N. Y.  
HEgeman 3-8150

CIRCLE ED-139 ON READER-SERVICE CARD FOR MORE INFORMATION

BOURNS presents the New

# TRIMPOT

Trade Mark

An adjustable . . .  
Sub-miniature potentiometer  
for precise circuit trimming

BOURNS TRIMPOT is a wire-wound potentiometer designed for miniaturized equipment. Adjustments of the 25 turn slotted shaft are made with a screw driver. Accurate electrical settings in increments of 1/4 to 1/2% are easily controlled and are securely retained without the use of lock-nuts. Vibration of 15G at 10-2000 cps or a sustained acceleration of 100G does not interfere with the dependable performance of the TRIMPOT.

TRIMPOTs can be installed individually or in stacked assemblies with two mounting screws through the eyelets in the body.

BOURNS designs and manufactures Linear Motion, Gage Pressure, Differential Pressure, Altitude and Acceleration Potentiometers.

**B** **BOURNS LABORATORIES**  
6135 Magnolia Avenue, Riverside, California  
Technical Bulletin on request, Dept. 232

CIRCLE ED-140 ON READER-SERVICE CARD FOR MORE INFORMATION

## SHOCK, VIBRATION, and NOISE



DO YOU WANT Complete DATA?

CATALOG 523-A. Air-damped Barrymounts for shock and vibration protection of military airborne equipment.

BULLETIN 532. Vibration isolator Type 915, for isolating vibration and noise caused by high-speed motors or motor-driven equipment.

BULLETIN 533. Medium-impact shock machine Type 150-400 VD, for qualification and acceptance shock tests up to 77g.

BULLETIN 534. Series M44 ALL-METL vibration isolators and Series TOMA mounting bases, for military airborne equipment under extreme operating conditions.

BULLETIN 535. Component shock machine Type 20 VI, for qualification and acceptance shock tests up to 210g.

BULLETIN 536. Series M64 ALL-METL vibration isolators and Series AOMA and NOMA mounting bases, for military airborne equipment under extreme operating conditions.

BULLETIN 537. Series 262/-633 vibration isolators, for isolating vibration and noise caused by medium-speed motors or motor-driven machinery.

BULLETIN 538. Series 670/297 shock and vibration isolators, for isolating shock caused by impact-type machines, and vibration and noise caused by heavy rotating or reciprocating machines.

"LOOK — NO LAGGING!" Increasing profits through the use of the new Leveling Barrymount for industrial machinery.

Here are complete engineering data, application information, and pointers to profits in every field of shock and vibration isolation. Write TODAY for your free copies of the ones you need.

The Barry Corporation, 775 Pleasant Street, Watertown 72, Mass.

CIRCLE ED-141 ON READER-SERVICE CARD FOR MORE INFORMATION

## Self-Locking Fasteners for Electronic Applications

When weight reduction, space limitations, and vibrations in electronic equipment are problems, use Elastic Stop nuts, with the famous red insert collar. The nylon collar grips bolt threads—damps out severe shock and vibration—permits accurate bolt loading—maintains adjustment. Elastic Stop nuts are reusable many times. Instrument nuts (top) are for mounting instruments in panel faces; clinch nuts for pre-positioning in thin section metal components. Hex nuts in sizes from .109 across flats.



For information on any electronic fastener problem write: Elastic Stop Nut Corporation of America, 2330 Vauxhall Road, Union, N. J. Address Dept. N59-257.

**ELASTIC STOP NUT CORPORATION OF AMERICA**

DESIGN HEADQUARTERS FOR SELF-LOCKING FASTENERS  
CIRCLE ED-142 ON READER-SERVICE CARD FOR MORE INFORMATION

the standard for its service . . .

### ESCO TYPE-A ROTARY MULTIPOLE SWITCH

#### RATINGS:

##### Continuous

10 amp. 125 volts

##### Interrupting

AC—5 amp. 125 volts (at 0.75 PF)

3 amp. 125 volts (lamp load)

DC—5 amp. 30 volts (non-inductive load)  
1 amp. 125 volts

##### Overload

50 cycles—30 amp. 125 volts (non-inductive load)

A compact, multipole switch for tap, transfer, and selector service at medium current ratings. Up to seven sections controlled from a single knob. Wide selection of switching actions. An exceptionally sturdy detent assures positive positioning at all steps. Write for FREE descriptive bulletin.



**ELECTRO SWITCH CORPORATION**

167 King Avenue, Weymouth 88, Mass.

CIRCLE ED-143 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC DESIGN • February 1954

## Voltmeters and Ammeters Rack-Mounted, Vacuum Tube Type



This line of rack-mounted vacuum tube voltmeters and ammeters correspond to this firm's older, portable type meters and can be equipped with or without terminals for connection of external indicating instruments and recorders. The most important of these new units are the RM-17B D-C Millivoltmeter, lowest range 0.1mv, 6meg input; the RM-18B R-F Meter, lowest range 0-10mv, 1-2500Mc; and the RM-12A A-C Voltmeter, lowest range 0-3mv, 20cy to 250ke. In addition, ammeters and multi-meters are available in rack-mounted form.

Illustrated is the RM-17B Millivoltmeter, corresponding to the MV-17B portable meter. Millivac Instrument Corp., Dept. ED, 444 2nd St., Schenectady 6, N. Y.

CIRCLE ED-144 ON READER-SERVICE CARD FOR MORE INFORMATION

## NEW FREE CATALOG

Brings You GREATEST SELECTION of

## Self-Locking SET SCREWS

Improved "ZIP-GRIP"



"NU-CUP"



"OFF-SET"



\*Pat. Pending



Whatever your application may be, if vibration or close-precision-setting are factors, you are most likely to find the right Self-Locking Set Screw in this most complete range on the market. Write us a brief description of your problem or send blueprint and we will be glad to supply you with free test samples of Zip-Grip\*, Nu-Cup\* or Off-Set, Set Screws, whichever we believe will best suit your particular needs.

Simply write your name and address on margin of this page, tear out and mail today.



Set Screw & Mfg. Co. 265 Main St., Bartlett, Ill. (Chicago Suburb)

We Specialize in Solving Puzzling Set Screw Problems

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# TEFLON

by ETHYLENE

HIGHEST STANDARD OF QUALITY

Ethylene specializes in producing a wide variety of Teflon forms which are stocked in large quantities to assure quick shipment. Engineering experience is available to help solve your problems.

EXTRUDED OR MOLDED RODS, TUBES, AND SPECIAL SHAPES  
• STRESS RELIEVED OR HIGH TENSILE SHEETS AND MOLDINGS  
• PRECISION MACHINED COMPONENTS • FILLED PRODUCTS

Send for new illustrated Catalog 53 with stock and price lists.



Pioneers and Specialists in TEFLON products

**ETHYLENE CHEMICAL CORPORATION**

245 Broad St. • Summit, New Jersey

\*Du Pont Trade-Mark for tetrafluoroethylene resin

CIRCLE ED-146 ON READER-SERVICE CARD FOR MORE INFORMATION



**CASTELL**  
push button  
**LOCKTITE**  
lead holder has  
PERFECT BALANCE

Perfect balance makes Push Button CASTELL LOCKTITE Holder the king of its class.

Exclusive collet holds lead in bull dog grip, preventing slipping or turning.

No graphite dust stains your fingers—because with one-hand push-button action you extend and retract the lead. No need to touch graphite. Comfortable "wood-pencil" feel—not metallic.

Equipped with easily-replaced clutch, giving your LOCKTITE indefinite life.

Imported CASTELL 9030 Lead inserted in your LOCKTITE Holder gives you the combination for brilliant results on your drawing board. Ask your Dealer for both—LOCKTITE Holder and Imported CASTELL 9030 Lead in 19 degrees, 7B to 10H.



**AW. FABER-CASTELL**

PENCIL COMPANY, INC., NEWARK 3, N. J.

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**IRE** presents  
**UHF CRYSTAL CALIBRATOR**  
**MODEL 541**

**A NEW UHF - VHF FREQUENCY STANDARD**

- ACCURACY .003%
- MARKERS EVERY 25 AND 50 MC.
- COVERS 25 MC. TO 3500 MC.
- IDEAL MARKER FOR UHF - TV

LABORATORY FOR ELECTRONIC INSTRUMENTATION  
 P. O. Box 549 New London, Connecticut

CIRCLE ED-148 ON READER-SERVICE CARD FOR MORE INFORMATION

**NOW**  
 better resistor service  
 through IRC distributors

**BT INSULATED COMPOSITION RESISTORS**

**BW LOW WATTAGE WIRE WOUNDS**

**NEW, MBC MOLDED BORON-CARBON PRECISTORS**

**NEW INDUSTRIAL SERVICE PLAN**  
 IRC's Distributor Policies and Prices have been adjusted to include larger quantities; certified quality; and new, insulated, close-tolerance resistors.

**BONDED STOCK PROTECTION**  
 IRC Electronic Parts Distributors now supply quantity requirements of BT, BW and MBC resistors in FACTORY-SEALED BOXES. Sealing tape bears IRC's certification of contents. Specifications are identified.

**LOCAL PROCUREMENT**  
 saves you delivery time and shipping charges. Your nearby IRC Distributor is well qualified to serve you. Call him and he'll prove it.

**IRC**

**INTERNATIONAL RESISTANCE CO.**  
 Dept. D 401 N. Broad St., Philadelphia 8, Pa.  
 In Canada: International Resistance Co., Ltd., Toronto, Licensee.

*Wherever the Circuit Says*

CIRCLE ED-149 ON READER-SERVICE CARD FOR MORE INFORMATION

## New Products . . .

### Frequency Meters

Accurate to 0.001%



Three new frequency meters added to the company's line, are designed for simple, economical operation under both laboratory and field conditions. Model LA-5

(illustrated) provides frequency measurements at 10-100Mc, Model LA-6 at 100-500Mc, and Model LA-61 at 500-2000Mc.

The meters are compact in design, extremely rugged, and are only 2 cu ft in volume. Lavoie Laboratories, Inc., Dept. ED, Morganville, N. J.

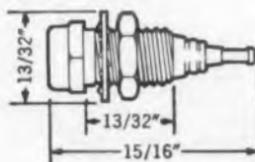
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Have you returned your subscription  
 renewal and qualification form?

See Page 12

## For hard service, dependability ...it's the

### CANNON test point jack



For engineering data, write for Test Point  
 Jack Bulletin TJ-1.

**CANNON ELECTRIC**  
 Since 1915



**CANNON ELECTRIC COMPANY, LOS ANGELES 31, CALIFORNIA**  
 Factories in Los Angeles, Toronto, New Haven. Representatives in principal cities.  
 Address inquiries to Cannon Electric Co., Dept. 143, Los Angeles 31, Calif.

CIRCLE ED-151 ON READER-SERVICE CARD FOR MORE INFORMATION

Cannon 45-E Series Test Point Jacks are high quality, precision-made receptacles designed for general laboratory and electronic equipment as single lead high voltage disconnects, stand-offs, and leads from important junctions in electronic equipment. Only 15/16" in length by 13/32" in diameter across the lock washer, these tiny jacks have a threaded brass barrel giving sturdy support to the Nylon insulation. They mate with standard RTMA phone tips.

The threaded body and locknuts are nickel plated brass. Contacts are heat treated beryllium copper, silver plated, and insulated with Nylon FM10001 in 7 colors for identification. Flashover values 4,000 v average, 60 cycle ac.

**PRINTED CIRCUITS**  
 can simplify your design . . .  
 speed output . . . cut costs

Eliminate wires! With Du Pont Conductive Coatings, you can print circuits for capacitors and couplings; for static shielding to replace foils and cans; for resistors and solder seals. Streamline your designs in television sets and radios, electronic equipment, meters and switchboards.

Coatings are easily applied by spray, brush, dip or stencil on metals or non-conductors. Fit right into high-speed assembly-line operation. Save you money. For up-to-date, descriptive bulletin write to: E. I. du Pont de Nemours & Co. (Inc.), Electrochemicals Department, Wilmington 98, Delaware.

**DU PONT**  
**CONDUCTIVE COATINGS**  
 —Best for printed circuits!

**DU PONT**  
 BETTER THINGS FOR BETTER LIVING  
 ...THROUGH CHEMISTRY

CIRCLE ED-152 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.

See our exhibit, IRE Show, Booth 425

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## FREED Sets a NEW Standard for Performance

### PRECISION TEST INSTRUMENTS



**No. 1010A COMPARISON BRIDGE.** Self contained — A.C. operated. Ideal for laboratory and production testing of resistors, condensers and inductors.



**No. 1020B MEGOHM METER. DIRECT READING.** Self contained—A.C. operated. Electronically regulated supply. 1 megohm to 2 million megohms.



**No. 1060 VACUUM TUBE VOLTMETER.** A 50 megohm input impedance wide frequency range V.M. for use at audio and super-sonic frequencies.

### TRANSFORMERS—MILITARY & COMMERCIAL



**MILITARY PULSE TRANSFORMERS.** Constructed to MIL-T-27 specifications. Designed for optimum pulse performance.



**MINIATURE AUDIO.** Hermetically sealed — constructed in accordance with MIL-T-27 specifications.



**HIGH FIDELITY.** 1/2 DB 20 CPS to 30 KC.

**NEW COMPLETE CATALOG NOW AVAILABLE**  
**FREED TRANSFORMER CO., INC.**  
 1727 Weirfield Street Brooklyn (Ridgewood) 27, N. Y.

CIRCLE ED-154 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
Polyesters	Printed Circuits	Polystyrene
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-155 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC DESIGN • February 1954

## Miniature Ball Bearings

### Variety of Types in R2 Size



Two basic constructions and 10 different types of miniature ball bearings are now available from this firm in the R-2 size: 0.3750" O.D., 0.1250" bore, and 0.1562" width. The typical unit illustrated is the Type RF 864 S-5-14, made to ABEC-5 tolerance, with a one-piece snap-type ball retainer. It is specially suited for low torque, medium speed applications and is also available with a 2-piece ribbon-type ball retainer for high speeds.

Five of the new bearings, the RF 864 series, feature the capillary type "Filloseal" closure which assures lubrication over a wide temperature range. The capillary principle permits the use of oil as a lubricant, rather than grease. The design provides less torque at lower temperatures, retention of lubricant at elevated temperatures, and bearing protection during storage and assembly.

The other five bearings are the R 864 series which have no seals. Both series are available in ABEC 1-3 and 5 tolerances. Landis & Gyr, Inc., Dept. ED, 45 W. 45th St., New York 36, N. Y.

The other five bearings are the R 864 series which have no seals. Both series are available in ABEC 1-3 and 5 tolerances. Landis & Gyr, Inc., Dept. ED, 45 W. 45th St., New York 36, N. Y.

CIRCLE ED-156 ON READER-SERVICE CARD FOR MORE INFORMATION

## Solve Your Corrosion Problems with RHODIUM PLATING

Rhodium plating is finding increased use by electronic design engineers where hard, corrosion resistant electrical contact surfaces are required. Rhodium provides a stable contact resistance and allows use of higher pressures in sliding contacts... Rhodium is not affected by atmospheric changes, provides a low noise level and is particularly adapted to applications in the printed circuit field.

WRITE FOR BOOKLET 17

## BAKER & CO., INC.

113 ASTOR STREET, NEWARK 5, NEW JERSEY  
 NEW YORK • SAN FRANCISCO • LOS ANGELES • CHICAGO



CIRCLE ED-157 ON READER-SERVICE CARD FOR MORE INFORMATION

## HOW JOYAL INFLUENCES DESIGN

*Joyal*

WELDING  
 AND SOLDERING  
 MACHINE 5000 W—  
 MODEL D

Eliminates 5 Production  
 Handling Operations



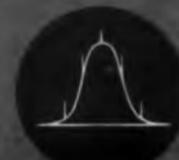
Design with production-wise Joyal equipment in mind to achieve easier production and increased efficiency. **BEFORE:** In making the contact arm shown, it was necessary to thread the wire into the hole, bend the wire, cut the wire, flux, bring part to soldering

iron, solder and then clean. **NOW:** Just bring the 2 parts together; weld. Find out about Joyal's line of standard equipment and how Joyal can engineer special and automatic soldering and welding machines. Write for data detailing your problems.

JOYAL PRODUCTS, INC., 115 Edison Place, Newark 5, N. J.

CIRCLE ED-158 ON READER-SERVICE CARD FOR MORE INFORMATION

## NEED INSTRUMENTS TO SOLVE ELECTRONIC PROBLEMS?...



SADA-SWEEP  
Radar IF Amplifier  
Alignment



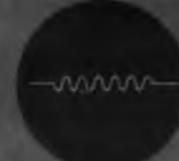
MEGA-MATCH  
Measurement of  
Fidelity Coefficient



MEGA-PULSE  
Transient Timing  
Wave Analyzer



PARCA-SWEEP W-F  
TV Tuner Alignment



SADA-PULSE  
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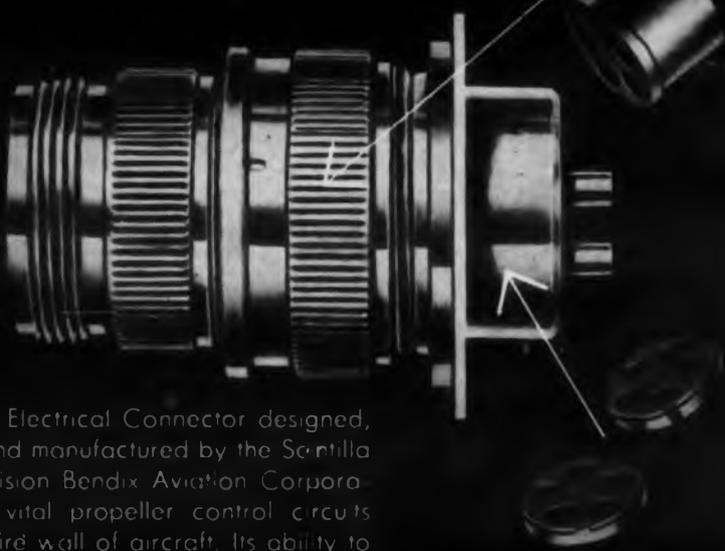
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glass-bonded mica  
insulation penetrates  
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temperature endurance!

2000° F  
FLAME TEST  
FOR 20  
MINUTES!

ALSO OFFERS THESE  
IMPORTANT ADVANTAGES -

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- LOW COEFFICIENT OF EXPANSION
- DIMENSIONAL ACCURACY
- ZERO MOISTURE ABSORPTION
- PERMANENT DIMENSIONAL STABILITY



This fire wall Electrical Connector designed, developed and manufactured by the Scintilla Magneto Division Bendix Aviation Corporation, carries vital propeller control circuits through the fire wall of aircraft. Its ability to resist flame must equal or exceed that of the fire wall itself. Tests prove that this connector which uses MYCALEX 410 and MYCALEX 410X glass-bonded mica inserts is the best solution for this application. MYCALEX insert connectors provide a full 20 minute flame barrier under direct exposure to a 2000° F flame . . . 20 minutes that could spell the difference between total loss and safe landing. For complete information on product improvement with MYCALEX, phone or write J. H. Du Bois, Vice President-Engineering, at address below.



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World's Largest Manufacturer of Glass-Bonded Mica Products

Executive Offices: 30 Rockefeller Plaza, New York 20, N. Y.

ADDRESS INQUIRIES TO -

General Offices and Plant: **123** Clifton Blvd., Clifton, N. J.

**CIRCLE ED-160 ON READER-SERVICE CARD FOR MORE INFORMATION**

# New Literature . . .

## **Drafting Equipment 161**

This 24-page, 2-color catalog (553) on the "Lifetime Steel" line includes filing cabinets, drafting tables, tracing tables, portable tracing boards, taborets, and table easels. Sizes, production and design features, and other valuable information are included. Stacor Equipment Co., 768-778 East New York Ave., Brooklyn 3, N. Y.

## **Relays 162**

A 14-page catalog (1954-C5) gives ratings and prices for hundreds of different relays made by varied manufacturers and stocked by this firm. Included are standard and short telephone relays, midget relays, timers, aircraft contactors; keying, hermetically sealed, differential and polarized, antenna and ceramic, motor and control, mechanical action, ratchet and stepping, and latching and interlocking relays; voltage regulators and cutouts; and other assemblies. Also available is a 4-page supplement giving prices on a complete line of phototubes, rectifiers, and thyratrons. Relay Sales, 4721 W. Madison St., Chicago 44, Ill.

## **Miniature Ball Bearings 163**

A 20-page, 2-color catalog covers this firm's line of miniature ball bearings, offered in more than 140 types and sizes from 1/10" to 5/16" O.D. The fully illustrated catalog covers such types as radial, super-light radial, spring separator, flanged radial, flanged radial retainer, separable, angular contact, pivot, and thrust bearings. Full dimensional data, load ratings, data on lubrication, tolerances, data on shaft and housing fits, and much other information are included. The catalog is available by sending a request on company letterhead directly to Miniature Precision Bearings, Inc., Dept. ED, Keene, N. H.

## **Electroplating with Rhodium 164**

This 24-page handbook provides data and directions for electroplating with rhodium. It fully describes the physical properties of the material, with text and tables. Instructions are provided on preparation of work, electrocleaning, underplating, the plating bath, stripping, and other relevant problems. A number of pertinent graphs are included. Baker & Co., Inc., 113 Astor St., Newark 5, N. Y.

## **TV Picture Tube Chart 165**

This 17" x 22" wall chart is a new version of the "TV Picture Tube Comparison Chart". Over 160 tubes are listed, with face, body, focus, deflection angles, basings, and length included for all tubes. Added features include ion trap listings and base diagrams. Sylvania Electric Products, Inc., 1100 Main St., Buffalo, N. Y.

## **Recording Meters 166**

This 28-page bulletin covers in detail Series 500 recording voltmeters and ammeters for wall, switchboard, flush panel, pole mounting, or portable use. Various sections are devoted to applications, principle of operation, outstanding features, and specifications of the various models. The Bristol Co., Waterbury 20, Conn.

## **Rubber Parts 167**

An 8-page, 3-color brochure describes the molded rubber design, development, short run, and production facilities of this firm, providing numerous illustrations of both products and plant. A unique feature is a rubber specification chart which should aid in the specifying of rubber and synthetic rubber compounds. The Spencer Rubber Products Co., Manchester, Conn.

## **Electroni**

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## **Electronic Parts, Equipment 168**

The 18th edition of "Radio's Master" contains 1370 catalog pages of more than 90% of the electronic industry's parts and equipment manufacturers. Complete descriptions, specifications, and prices are accompanied by better than 8000 product illustrations. This edition is systematically organized into 18 sections. A section index and a thoroughly cross-referenced product index pin-point the more than 85,000 items cataloged. Publisher's price of the book is \$6.50, but most parts distributors sell it for only \$1.95. Circling your ED number will bring you a list of "Radio's Master" distributors. United Catalog Publishers, Inc., 110 Lafayette St., New York 13, N. Y.

## **Electrical Insulations 169**

"Quinterra-Quinorgo" is the title of a 32-page brochure that gives complete information about these electrical insulations made of purified asbestos—why they were developed, what their characteristics are, and where they may be used to advantage. Tables give test data on physical and electrical properties. Picture stories of typical applications are included. Johns-Manville, 22 E. 40th St., New York 16, N. Y.

## **Waveguide Data 170**

This 20-page booklet, "Microwave Nomograms and Charts", provides practical engineering data and curves developed by the staff of this firm in designing and using waveguide components such as mixers, duplexers, flexible and rigid waveguides, directional couplers, and allied accessories. The data should prove useful in the handling of microwave problems. Airttron, Inc., Dept. II, Linden, N. J.

## **Coaxial Cable 171**

This 16-page, 2-color bulletin presents data on characteristics, information on properties, and other valuable data on "Styroflex" semi-flexible, aluminum sheathed, coaxial cable. Included are rating factors for adjusting the cable power ratings for modulation and standing waves, and graphs illustrating power rating in air, attenuation versus frequency, and circuit efficiency versus decibel loss. Phelps Dodge Copper Products Corp., Habirshaw Division, 40 Wall St., New York 5, N. Y.

## **Permanent Magnets 172**

A 4-page technical report (PM-112) contains latest information on the uses, design, properties, and manufacture of Alnico permanent magnets, cast grade 7. In addition to graphs and tables explaining magnetic and physical characteristics, it contains a detailed discussion of design considerations, test information, and a general comparison of this grade with other magnetic materials. Carboloy Dept., General Electric Co., Detroit 32, Mich.

## **Stainless Steel Fastenings 173**

This 20-page catalog (53-B) serves as an in-stock inventory of cap screws, nuts, washers, machine screws, sheet metal screws, wood screws, rivets, screwed fittings, flanged fittings, balls, wire rope, self-locking nuts, cup washers, and many other items. Illustrations and easy-to-read charts make location of items easy. Star Stainless Screw Co., 190-A Union Ave., Paterson 2, N. J.

## **Electronic Apparatus 174**

A 16-page bulletin (B-6093) gives descriptions, applications, and operating ranges for such equipment as surge comparison testers, portable balancers and vibrographs, magnetic amplifiers, transistors, capacitors, relays, and many other types of units for the electronics industry. Also provided are information on such semi-finished material as transformer coils, and magnetic materials and alloys. Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa.

## **Precision Bobbins 175**

Dielectric coil bobbins made entirely of dielectric paper and materials for small motors, relays, solenoids, reactors, photoelectric devices, and other electrically actuated equipment, are illustrated and described in a 4-page bulletin. Round, square, and rectangular bobbins are made in practically every size and length. The bulletin provides information on flanges, bobbin winding vs. layer winding, heat factors, and other data. It includes a number of application photos. Precision Paper Tube Co., Dept. E-15, 2033 W. Charleston St., Chicago 47, Ill.

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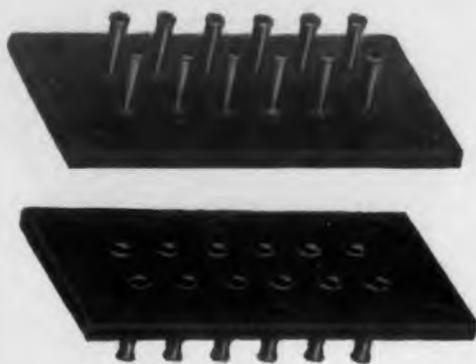
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precision connectors by Continental



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**TERMINAL  
BOARDS**

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Tell us the job you want your terminal board to do. From our wide range of terminal designs and base materials our skilled engineers will design the board to fit your application.

The illustrated special application terminal board is of laminated thermosetting plastic per ASTM D-709 type 1 grade and has hot tin dipped brass turret terminals. Terminal boards are silk-screen coded and wax impregnated.

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For further information write DeJUR-Amsco Corporation, Dept. EDT2, 45-01 Northern Boulevard, Long Island City 1, New York.

# Continental Connectors

ELECTRONIC SALES DIVISION

DeJUR-AMSCO CORPORATION

See the DeJUR line at Booth 200, "Production Road," Radio Engineering Show, Mar. 22-25

CIRCLE ED-177 ON READER-SERVICE CARD FOR MORE INFORMATION

## New Literature . . .

### Plant Layout System 178

A low-cost plant layout system involving the use of photocopy is detailed in a 4-page bulletin. The system involves photocopying of scaled templates, representing machine tools, benches, etc.; making floor plans on white-surfaced aluminum plates with a 1/4" grip; stationing templates on the aluminum plates with double-sided adhesive tape; and producing negative and positive copies of completed plates with a vacuum-bed printer. The system permits a complete file of plant layout prints to be economically made. Peerless Photo Products, Inc., Shoreham, L. I., N. Y.

### Environmental Testing 179

The facilities of this firm for the environmental testing of electronic equipment are covered in a 12-page brochure. "Facilities and Services." Any possible combination of service conditions which could be encountered can be simulated with their equipment. General Testing Laboratories, 227 W. Chestnut Ave., P. O. Box 178, Monrovia, Calif.

### Pneumatic Relays

181

This 4-page, 2-color catalog describes a complete line of solenoid-actuated, pneumatically-controlled, time delay relays. Mounting dimensions, wiring diagrams, typical applications, detailed specifications, and other data are provided. These "Agastat" relays are offered in two basic types: one with the time delay beginning when the coil is energized, and the other when the coil is de-energized. A'G'A Division, Elastic Stop Nut Corporation of America, 1027 Newark Ave., Elizabeth, N. J.

### Selenium Rectifier Handbook

An enlarged, 80-page edition of the "Selenium Rectifier Handbook" treats in detail a representative listing of the selenium rectifiers made by this firm for radio and TV use. It also covers rectifier designs and power supply circuits for such applications as phonographs, audio amplifiers, mobile radios, photocell amplifiers, intercommunication systems, and other d-c power supply requirements. In addition, servicing information is presented in easy-to-follow form. Price is 50¢. Write direct to Federal Telephone and Radio Co., Dept. ED, 100 Kingsland Rd., Clifton, N. J.

### Switch

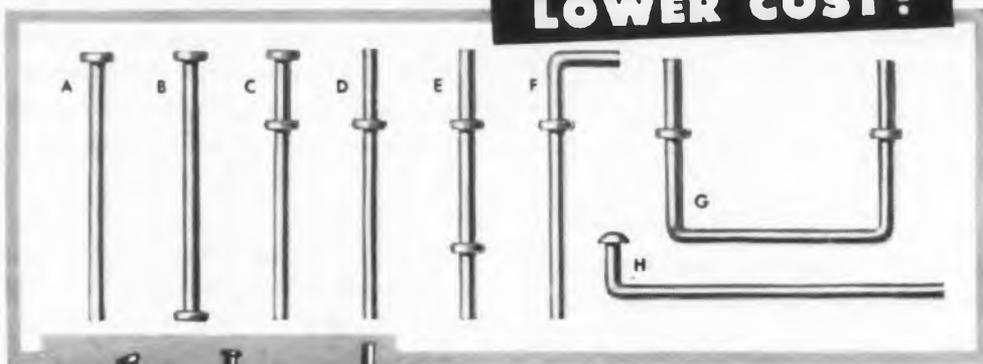
This descriptive bulletin covers a wide variety of mechanical switches. The result is a unique and comprehensive listing of many of the most popular and rugged switches. G. A. Salem A.

### Transi

The following bulletin contains information on the experimental transistor diodes, developed in a detailed bulletin in a few months. The other scientific literature.

## UNIFORM PRECISION...

### LOWER COST!



ACTUAL SIZE

# UPSET PINS

Here's high precision production on automatic equipment that delivers continuous uniformity from the first to the millionth unit! Economical production, minimum scrap add up to low piece prices that will surprise you. Upset Pins of the types shown made from any workable metal or alloy . . . in wire diameters from .010" to .090" Flanges accurately positioned to your specifications. Flanges and heads with rounded edges. Send blueprints or samples for estimate.

ART WIRE & STAMPING CO. 2-N Boyden Pl., Newark, N. J.

CIRCLE ED-180 ON READER-SERVICE CARD FOR MORE INFORMATION

ELECTRONIC DESIGN • February 1954

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## Switches

This 20-page, 2-color catalog contains descriptions, illustrations, highly detailed specifications, and many other data on a wide variety of switches and switching mechanisms. Flat rivet assembly designs result in compact switches which have unique rotor and stator constructions. Many of the products can be assembled into more complex subassemblies. Shaft, lever, and pushbutton actuations are covered. Grigsby-Allison Co., Inc., 407 N. Salem Ave., Arlington Heights, Ill.

## Transistor Periodical

184

The first issue of "Transistor Research Bulletin" is an 8-page publication containing articles on new semiconductors, an experimental dynamic operation condition transistor test set, small area junction diodes, and latest transistor and diode developments in Germany. Included is a detailed semi-conductor bibliography. The bulletin will be published every two months with the intention to keep its readers up to date on transistors, diodes, and other solid state devices. National Scientific Laboratories, 2010 Massachusetts Ave., N.W., Washington 6, D. C.

183

## Small Motors

A 16-page bulletin (No. 153) contains dimensional data and specifications on numerous types of permanent magnet d-c motors, including governed types; permanent magnet d-c gear motors; a-c or d-c motors with centrifugal blower assemblies, 400cy motors with and without gear reduction; motor and fan assemblies; and a motor with axial flow blower assembly. Mission-Western Engineers, Inc., 132 W. Colorado St., Pasadena, Calif.

186

## Polyurethanes

187

A 16-page technical bulletin (No. P-151) is titled "Polyurethanes and Their Use as Adhesives." These products are prepared from a polyfunctional hydroxyl compound with an excess of diisocyanate. As adhesives, they have been found suitable for almost all types of rigid materials, including steel to steel, steel to acrylic resin, magnesium to aluminum, glass to glass, and glass to steel. Data on bond strengths, use of the adhesives, and other applications of polyurethanes (surface coatings and dielectrics) are provided. Monsanto Chemical Co., Phosphate Division, St. Louis 4, Mo.

**PATENTED**  
Socket-Turrets for most tube types will carry a wide variety of circuit elements.

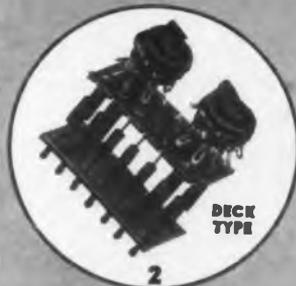


**UNIQUE**

Plug-Ins of many sizes with sockets and plugs as desired provide great flexibility in circuitry.



4-40U  
NUT  
1



DECK  
TYPE  
2



TUBE  
BASE  
PLUGS  
5

Unitize those tricky circuits for quick change or repair, compactness, ease of wiring. New snap-on 4-40 U nuts for socket saddles enable easy mounting (1). New pre-punched, eye-letted strip construction provides many variations (2). New Socket Test Adapters for most tubes enable quick tests on tube side (3). New miniature tube base plugs (5). Write for new catalog.



TEST  
ADAPTER  
3



PLUG-IN  
6

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David H. Ross Company  
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CIRCLE ED-185 ON READER-SERVICE CARD FOR MORE INFORMATION

# You've been hoping for an EFFICIENT, LOW COST DC POWER SUPPLY



*Here  
it is*

THE NEW  
**DRESSEN-  
BARNES**  
MODEL  
**3-150-L**  
ONLY  
**\$95<sup>00</sup>**

INCREASE EFFICIENCY OF ENGINEERS AND TECHNICIANS. Now, it is practical to provide individual low-cost, high-performance DC power supplies. Front scale calibration has eliminated need for meters, thus simplifying operation. Sturdy and compact, Dressen-Barnes Model 3-150-L DC power supplies have a wide range of output ratings and applications:

- **OUTPUT:** 1. Zero to 300 volts DC; continuously variable (without switching) from zero to 150 MA.  
2. 6.3 volts AC, unregulated at 6 amps.
- **INPUT:** 115 volts AC, 1 phase, 60 cycles.
- **REGULATION:** 1. Better than 1%, from 100 to 300 volts, 10% load to full load, plus or minus 10% line voltage variation.  
2. Better than 2%, from 1 to 100 volts, 10% load to full load, plus or minus 10% line voltage variation.
- **STABILITY:** 1. Better than .5%, from 100 to 300 volts.  
2. Better than 1%, from 1 to 100 volts.
- **RIPPLE:** Below .01 volts peak to peak at full load.
- **OUTPUT IMPEDANCE:** Less than 1 ohm at full output. (Two units can be mounted on 8 $\frac{3}{4}$  x 19 panel — specify Model D3-150-L.)

## DRESSEN-BARNES SUB-CHASSIS MOUNTING TYPE



Regulated DC Power Supplies have performance comparable to Model 150 units. Designed to fit into most experimental chassis types, they provide efficient, economical DC power for prototype or production apparatus.



Output ratings range from 150 volts at 20 MA to 500 volts at 6 amps.

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250 N. Vinedo Ave., Pasadena 8, Calif.  
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**PIONEERS IN HIGH VOLTAGE DC POWER SUPPLIES**

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***New!***

**"P" TYPE  
ENCAPSULATED  
RESISTORS**

# Stable... Small... Light-weight...

Shallcross "P" Type Encapsulated Resistors are ideal for installation where stability, dependability, and minimum size and weight are a must. These radically new resistors offer the performance advantages of hermetically-sealed seatite resistors at less cost.

Because of the unique Shallcross method of encapsulating windings, "P" type resistors have greater maximum resistances, longer leakage paths, and higher wattage ratings.

Shallcross "P" type resistors are available in six MIL-R-93A lug-type styles and five axial lead styles with wattage ratings ranging from .500 to 3.5 watts. All styles meet and exceed JAN-R-93A, Characteristic A.

Complete information on sizes, ratings, and test results of Shallcross "P" type precision wirewound resistors is available in Engineering Bulletin L-30. Write for your copy today.

**SHALLCROSS MANUFACTURING CO.**  
526 Pusey Avenue, Collingdale, Pa.

# Shallcross

Our **25th Year** 1929 1954

CIRCLE ED-192 ON READER-SERVICE CARD FOR MORE INFORMATION

## New Literature ...

### Microwave Test Equipment 193

An 8-page catalog covers this firm's line of microwave test equipment for general laboratory use. Descriptions, illustrations, and specifications are included. A price list for all items is attached. Equipment covered includes: attenuators, frequency meters, a crystal-bolometer detector, impedance meters, mixers, waveguide bends, and other types of units. Narda-Nassau Research & Development Associates, Inc., 66 Main St., Mineola, N. Y.

### Vertical Scale Indicator 194

The "ElectroniK" Vertical Scale Indicator is illustrated and described in 8-page, 2-color Bulletin 1541. This 6-1/2" wide instrument is designed for panel mounting where space is at a premium. It provides rapid and precise multiple indication of any variable that can be transformed to millivolts. Specifications, features, typical scales, and other data are included. Industrial Division, Minneapolis-Honeywell Regulator Co., Philadelphia 44, Pa.

### Electrostatic Voltmeters 261

A variety of types of electrostatic voltmeters are described and illustrated in this 8-page bulletin, including low voltage and high voltage peak units, high voltage electrostatic designs, high sensitivity units, "University" models, and multirange units for a-c and d-c. Prices, data on ranges, and other pertinent information are provided, as well as sections on peak voltage measurements, and on the history of electrostatics. Sensitive Research Instrument Corp., 9-11 Elm St., Mt. Vernon, N. Y.

### Radiation Counters 262

This 60-page catalog (No. 15) contains illustrations, descriptions, and specifications of a wide variety of equipment. It is divided into sections on: radiation counters; electronic equipment, including special scalers, health instruments, a variety of amplifiers, and nuclear reactor controls; shields, mounts, planchets, accessories; and products of Wakefield Industries, Inc., including scintillating crystals and liquids, pipets and pipet accessories, glassware, chemicals, gases, and special Mylar films. Radiation Counter Laboratories, Inc., 5122 W. Grove St., Skokie, Ill.

### Electronic Equipment 195

The 196-page "Complete Electronic Reference Book" contains thousands of items for industry, laboratories, high fidelity, radio, and TV. Whole sections are devoted to test equipment; industrial equipment and supplies; high fidelity systems and components; TV chassis, accessories, and antennas; tape and disk recorders; inter-communication systems, books, tools, and other equipment. Newark Electric Co., 223 W. Madison St., Chicago 6, Ill.

### Digital Computer 196

A 14-page bulletin describes the "Circle Computer", a low cost computer designed to handle about 90% of the problems encountered in scientific work. Speed is some 400 times that of a skilled calculator operator. Many data on the features and operation of this 700 tube unit are included. The main unit measures 3' x 4' x 6', operates from a 60cy 110v single phase source, and consumes 3-1/2kv. Inputs and outputs are either typed or tape punched. Circle Computer Division, Nuclear Development Associates, Inc., 80 Grand St., White Plains, N. Y.

### Test Probe 263

A 4-page, 2-color bulletin illustrates and describes a clip-on test probe that has a push-to-operate mechanism which allows it to be clipped to any convenient wire without disturbing adjacent circuitry or introducing any possibility of shorting under high voltage operation. Mic-Con, Inc., 521 Lehigh Ave., Union, N. J.

### Electronic Computers 264

This 18-page bulletin describes two practical electronic computers, one for science and research, and the other for business and industry. The first unit has a magnetic drum which can store 512 "words" and a magnetic tape with a capacity of 100,000 "words", each equivalent to nine decimal digits. Data are inserted on a 10-key printing calculator, and results are delivered on adding machine tape. The other computer has a 1000 "word" drum memory and a 125,000 "word" tape memory. Numbers and instructions are inserted by electric typewriter or punched paper tape. Both computers are compact, easy to install, and easy to operate. Electronic Computer Division, Underwood Corp., 35-10 36th Ave., Long Island City, N. Y.

### Record

A 4-page complete recording as many as 300cps only, with any standard instrument proper operating data are ing Cor

### Power

Catal completions including charts and motors assisting rotation winding voltage N. Map

## Recording Oscillograph

198

A 4-page bulletin (CEC 1533) contains complete data on the Type 5-117, low cost, recording oscillograph. This unit permits as many as six active data channels in the 0-300cps range to be recorded simultaneously, with positive time correlation. The instrument provides an accurate record of any static or dynamic phenomenon convertible to an electric signal through use of proper pickups. Specifications, dimensions, operating information, and many other data are included. Consolidated Engineering Corp., Pasadena 15, Calif.

## Power Supplies

199

Catalog No. 753 provides in 28 pages complete electrical and mechanical specifications on all of this firm's "Dynamotors," including performance and oscillograph charts and dimensional diagrams. Dynamotors are rotary type power supplies consisting of a primary or motor winding for rotation and a secondary or generator winding to provide the specified output voltage. Carter Motor Co., Dept. 27, 2664 N. Maplewood Ave., Chicago 47, Ill.

## Foamed Plastic

200

A 28-page bulletin, illustrated with over 40 charts, graphs, and photos, describes the many uses of "Lockfoam" as a material for electronic devices, packaging, reinforcement of equipment parts, thermal insulation, and vibration dampening. The "foamed-in-place" plastic will fill any cavity, regardless of configuration. It has high strength, insulation, electrical, and adhesive properties. Lockfoam Div., Nopco Chemical Co., Harrison 44, N. J.

## Tubular Paper Capacitors

201

Detailed data on "Glasseal" tubular paper capacitors are provided in a 20-page, 2-color catalog (PG-3). The capacitors are offered in temperature ranges from  $-55^{\circ}$  to  $+125^{\circ}\text{C}$ , capacitance range from 0.001mfd to 1.0mfd, and voltage range from 100v to 600v, d-c. Also provided is a price supplement, and a wall chart showing a graphic representation of minimum insulation requirements for capacitors covered in the catalog. Pyramid Electric Co., 1445 Hudson Blvd., North Bergen, N. J.

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Custom built to your specifications... sample and short run production solicited... designed to meet MIL-T-27, ANE-19 and commercial specifications.

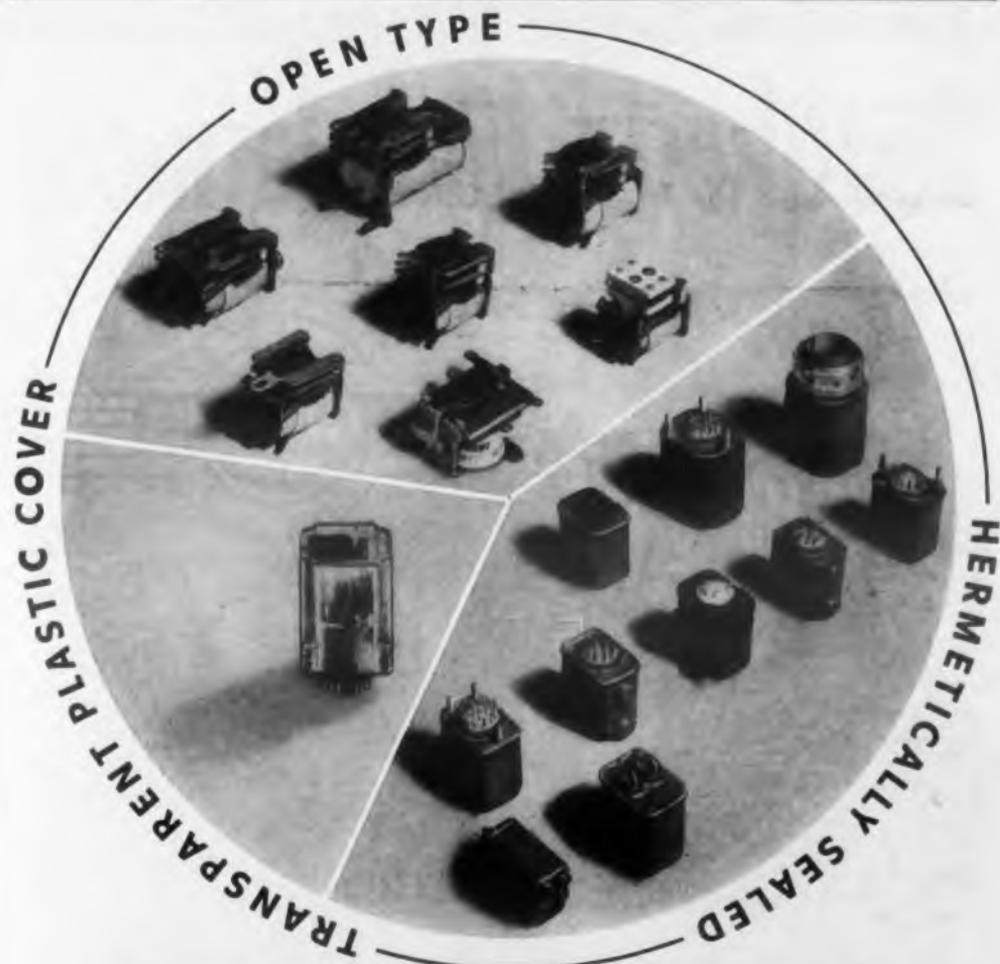
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Write for detailed catalog.

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CIRCLE ED-202 ON READER-SERVICE CARD FOR MORE INFORMATION



# R-B-M Relays

**FOR EVERY ELECTRONIC  
APPLICATION**

**Meeting Commercial and Government Requirements**

**OPEN TYPE.** Circuit switching—power and dynamotor loads—plate circuit—low capacitance.

**HERMETICALLY SEALED.** Stud or bushing mounting—solder or plug-in headers—circuit switching—power—low loss applications.

**TRANSPARENT PLASTIC COVER.** Most R-B-M relays now available in low cost transparent plastic cover.

**OTHER PRODUCTS:** Motor starting relays and overload protectors for refrigeration, appliance and general purpose motors. Industrial contactors and across-the-line starters. NEMA size 1 and smaller. Low cost general purpose relays. Low voltage D.C. manual and magnetic devices.

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Write Dept. L-2 for ASR Bulletin.

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**ESSEX WIRE CORPORATION**  
Logansport, Indiana

*Controls for Electronic,  
Refrigeration, In-  
dustrial, Appliance,  
Communication and,  
Automotive Industries*



CIRCLE ED-203 ON READER-SERVICE CARD FOR MORE INFORMATION

where only the best will do, you'll find the world's

# toughest transformers

on the team!



Available in  
3 versatile mountings

*they're*  
**Sealed-in-Steel**  
*they're*  
**True-to-Ratings**



#### FREE CHICAGO CATALOG

You'll want the full details on CHICAGO's complete "Sealed-in-Steel" transformer line. There is a unit available for every circuit application:

Power, Bias, Filament, Filter Reactor, Audio, MIL-T-27,

Stepdown. Write for your FREE copy of Catalog CT-153, or get it from your electronic parts distributor who can supply you with CHICAGO—the world's toughest transformers.

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## New Literature . . .

### Miniature Capacitors 205

This 20-page, 2-color catalog (No. 53) provides detailed data on a variety of glass-to-metal hermetically sealed subminiature capacitors designed to meet the operating requirements of MIL-C-25A. Inserted tab and extended foil constructions with different impregnants, with d-c voltage ratings from 100v to 1000v, a wide range of capacities, and for operation over temperature ranges from  $-55$  to  $+125^{\circ}\text{C}$  are described. Dumont-Airplane & Marine Instruments, Inc., 15 William St., New York 5, N. Y.

### Angle Resolver 206

A 2-page, 2-color bulletin describes the Sine-Cosine Mechanism, a precision angle resolver which accurately converts angular rotational movements into linear sine or cosine movements. Brief specifications, dimensional data, features, and other pertinent information on this computer component are provided. Librascope, Inc., 1607 Flower St., Glendale, Calif.

### Plastic Capacitors 207

A 4-page bulletin presents dimensions, voltage ratings, and data on applications for several hundred different capacitors. Also covered are hermetically sealed "Power Packs" which deliver high voltage d-c from a primary a-c source. They are particularly useful for the operation of display tubes of all types, insulation and breakdown testers, Alpha and Geiger counters, air amplifiers, and general laboratory use. Plastic Capacitors, Inc., 2511 W. Moffat St., Chicago 47, Ill.

### Electronic Components 208

This 18-page General Catalog No. C 12 provides illustrations, descriptions, and prices of a wide variety of components made by varied manufacturers. It includes numerous dynamotors, filters, fuses, fuse holders, lamps, lamp holders, rectifiers, shock mounts, tube sockets, and vibrators. This catalog is the first of three volumes on electronic components to be issued in 1954 by this firm. All items are stocked for immediate delivery. Wells Sales, Inc., 833 W. Chicago Ave., Chicago 22, Ill.

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## Snap-Action Relays 210

This 2-page, 2-color bulletin (No. 20) covers a new line of relays which feature snap-action switching contacts, dynamically balanced armatures, and construction of high-temperature materials throughout. They are designed for use in aircraft, rockets, missiles, submarines, ships, and wherever shock, temperature, or vibration are problems. Specification data, dimensions, and other details are given. Barth Engineering & Mfg. Co., Milldale, Conn.

## Microfinish Comparator 211

The S22 Microfinish Comparator, described in a 4-page, 2-color bulletin, is a flat scale with 22 different established flat-surface roughness specimens used for visual and tactual comparisons ranging from 2-500 microinches, and conforming to ASA standards. Placed beside machined work, the comparator provides a quick and positive comparison by eye or touch for quality and workmanship. It is made of corrosion-resistant nickel. The bulletin describes the available surfaces, applications, and includes other pertinent data. Baptist Machine Co., Ludlow St., Stamford, Conn.

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## Pre-Finished Metals 212

This 8-page, 2-color bulletin describes the variety of base metals, finishes, plating metals, and types of surfaces for pre-finished metals available from this firm in sheets, strips, and coils. Numerous typical products incorporating these pre-finished metals are illustrated, with descriptions of the metals employed. Data on characteristics of the pre-finished metals, and other information of value to the product designer are included. Apollo Metal Works, Dept. E-15, 66th Pl. and S. Oak Park Ave., Chicago 38, Ill.

## Oscillograph 213

This 6-page bulletin describes the Type 301-A miniaturized, wide-band, quantitative, cathode-ray oscillograph. The front cover of the bulletin is an actual size illustration of the front panel of the instrument, while fold-outs illustrate the depth, providing an actual-size, three-dimensional mock-up. Complete electrical and mechanical specifications are included. Allen B. Du Mont Laboratories, Inc., 760 Bloomfield Ave., Clifton, N. J.

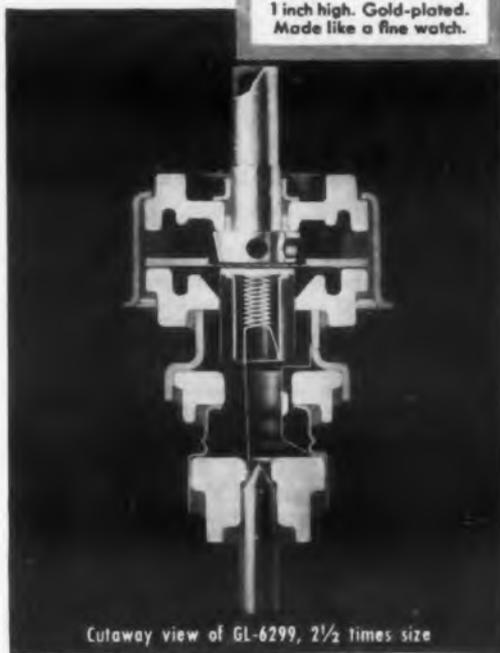
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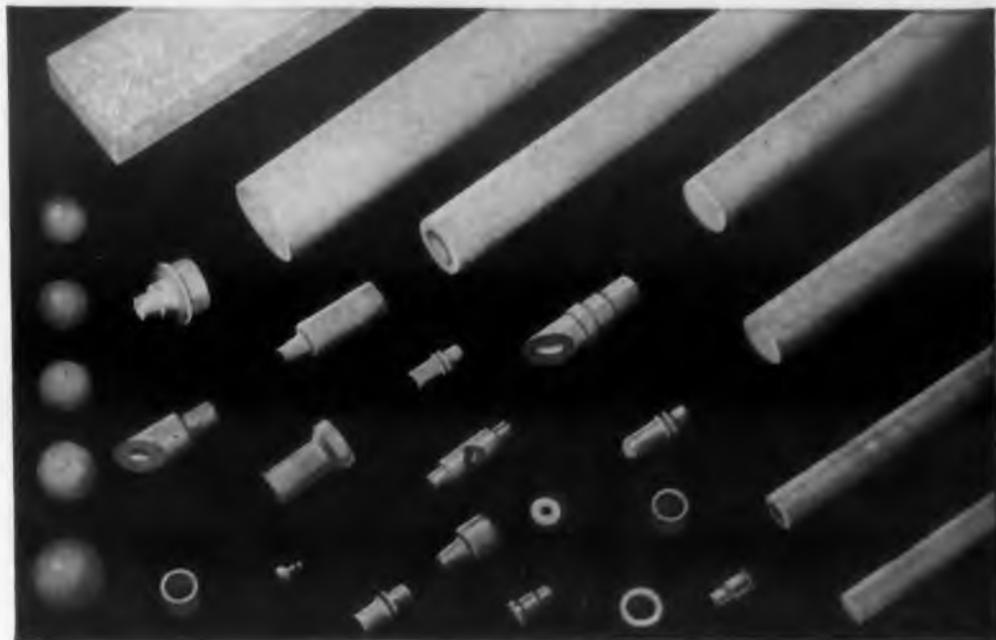
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## New Literature ...

### Focus Coils 217

Two new electromagnetic focus coils are illustrated and described in a 2-page bulletin. Type F10, for 1-1/2" neck diameters, is for laboratory, military, and special purpose applications. Type F30, for 2-1/8" neck diameters, is for projection, laboratory, and special purpose applications. Complete technical information is presented. Syntronic Instruments, Inc., 100 Industrial Rd., Addison, Ill.

### Magnetic Impulse Counter 218

A 4-page bulletin illustrates and describes the "Magnetic Impulse Counter", a selector switch used to solve many switching or control problems where the intelligence to be registered, stored, and released is supplied in the form of electrical pulses. The pulse rate may be as high as 20/sec. Design features, operating characteristics, and other pertinent information are provided. Kellogg Switchboard and Supply Co., 79 W. Monroe St., Chicago, Ill.

### Power Tube Charts 219

Two 3-color, 15" x 16-1/2" selection charts make easy the selection of power tubes, rectifiers, thyratrons, and ignitrons. The first chart shows the rating in power output vs frequency for power tubes in typical operation; tubes that will meet practically any r-f or audio operation can be found. The second chart shows the rating in peak inverse voltage vs maximum average forward current for rectifiers, thyratrons, and ignitrons for practically any condition of service. Both charts provide additional valuable data. Amperex Electronic Corp., Hicksville, L. I., N. Y.

### Electronic Test Equipment 220

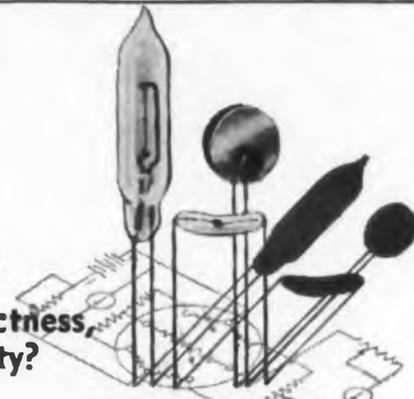
In addition to describing this company and its services, the 12-page bulletin, "Electronic Test Equipment", illustrates and describes various types of test equipment, including a synchronizer test unit, an electronic control amplifier test unit, a computer system test unit, and a signal data converter test unit. Cal-Tronic Corp., 11305 Hindry Ave., Los Angeles 45, Calif.



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## Recording Systems

222

A 16-page, 2-color booklet describes Recording Systems for permanent and accurate recording of a wide variety of electrical and mechanical phenomena. The recording equipment is available in completely assembled systems. Records are made without ink by a heated stylus ribbon which melts the plastic-coated surface of the recording paper, leaving a sharp, permanent tracing. The booklet covers the wide choice of speeds and channels available, code and time markings, galvanometer design, rectangular coordinates, and other features. Industrial Division, Sanborn Co., Cambridge 39, Mass.

## Oscillograph

224

A 12-page bulletin (GEC-449B) describes the PM-10 general-purpose oscillograph, for use in investigation, design, and testing. It permits simultaneous records to be made of voltage, current, time, speed, pressure strain, and sound. Features and operation are explained and prices, information on accessories, and descriptions of other electric instruments for industrial use are provided. General Electric Co., Schenectady 5, N. Y.

## Piston Capacitors

223

A 4-page, 2-color bulletin (220) provides technical data on Piston type variable Trimmer Capacitors for military, industrial, experimental, and radio trade requirements. Thirteen different capacitors are illustrated, and specifications and dimensional data are included. JFD Mfg. Co., Inc., 6101 16th Ave., Brooklyn 4, N. Y.

## Flexible Enclosures

225

The "Emcor System" of flexible enclosures is designed to meet requirements of a wide range of radio, TV, computing, transmission, and other equipment when an enclosure, groups of enclosures, or complete control systems are required. Described in a 4-page, 2-color bulletin, the system is comprised of over 75 component units. Starting with a basic console unit, the system permits an almost unlimited number of combinations, including console-desks. Elgin Metalformers Corp., 903 N. Liberty St., Elgin, Ill.

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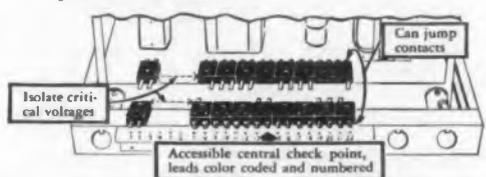
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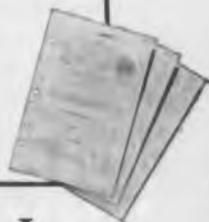
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**Variable vacuum capacitors** come in three models, are lightweight, compact, eliminate the effects of dust and atmospheric conditions and have low inductance. Also available are eight types of fixed vacuum capacitors.

**Air-system sockets**, designed for Eimac tube types 4-400A, 4-1000A, 4X150A, and 4X150D, simplify cooling and assure adequate air-flow to various seals. The 4-400A socket can also be used with the 4-125A and 4-250A

radial-beam power tetrodes if desired.

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# Patents . . . By John Montstream

**Square Wave Generator . . . Patent No. 2,653,242.** John W. Gray, White Plains, N. Y. (Assigned to General Precision Laboratory, Inc.).

A free running multivibrator makes a valuable type of square wave generator, but because it may not start without the introduction of a transient pulse, it has failed to find a use in unattended equipment. The patentee has devised a circuit shown in Fig. 1 which generates initial pulses to automatically start the multivibrator, whereupon the starting pulses cease to be generated.

The tubes 11 and 12 with their circuit elements constitute a well known multivibrator. The starting pulses are generated by neon tube 48 and capacitor 56, which operates as a relaxation oscillator, the starting pulses being applied to the control grid (19) of the multivibrator tube (11). In starting, if both tubes 11 and 12 become conducting so that the multivibrator is not oscillating, the current flow through resistors 21 and 22 bias the control grids

of the limiting tubes 38 and 39 with respect to their cathodes. Under this condition, capacitor 56 charges until the potential on electrode 51 of the neon tube is raised sufficiently above that of electrode 49 to discharge the neon tube. The pulses generated by the discharges is applied to the control grid (19) of the multivibrator tube (11) to unbalance the multivibrator and start it oscillating. The starting pulses continue to be generated until the multivibrator starts operating. When this occurs one of the tubes, e.g. tube 11, is not conducting. This results in control grid 41 going positive so that tube 38 conducts current. Under this condition the current flow through resistor 52 maintains the potential on electrode 51 of the neon tube too low to fire the tube. Similarly when tube 12 becomes non-conducting, tube 39 becomes conducting so that current flow through resistor 52 prevents a firing potential from being developed on the electrode 51 of the neon tube. Starting pulses therefore cease to be generated when the multivibrator is operating.

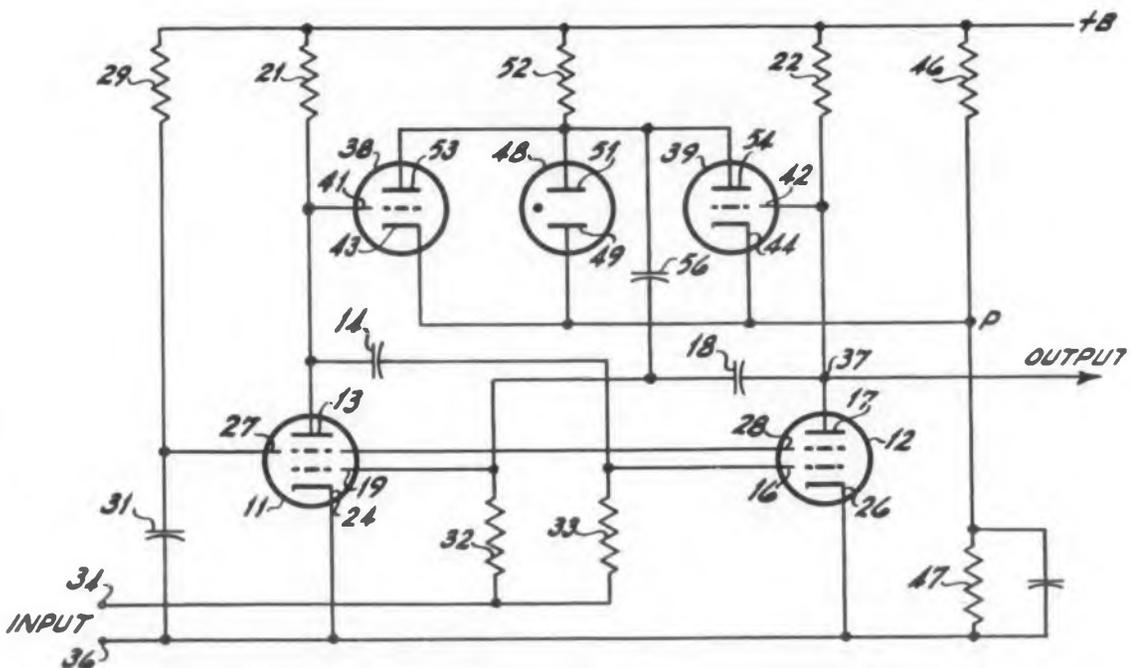


Fig. 1. Automatic firing square wave generator circuit suitable for unattended or remote equipment.

Fig. 2 (right). A simple dipole antenna featuring improved coupling.

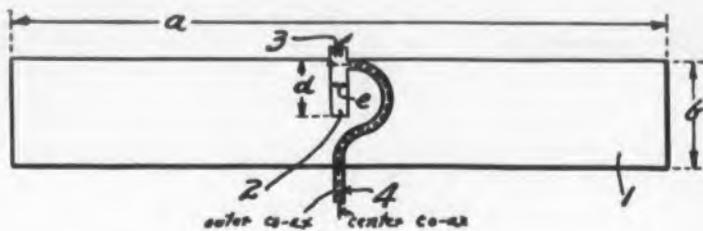
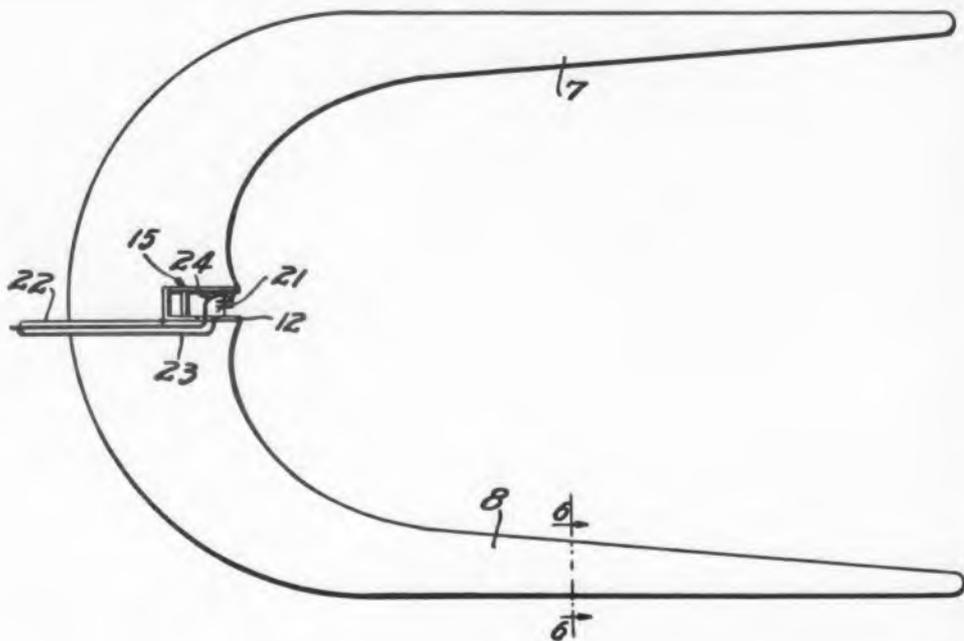


Fig. 3 (right). The same concept in another physical arrangement with lower wind resistance for airborne gear.



Tubes 38 and 39 also serve as limiting tubes for maintaining the peak-to-peak potential of the square wave output constant and the upper peak at the potential of point  $p$  of the voltage divider (46, 47). These tubes also increase the abruptness of the wave. If the potential of anode 13 should rise above the potential of point  $p$ , control grid 13 becomes positive with respect to its cathode and grid current flow occurs through resistor 21, control grid 41 and cathode 43. This grid current increases the current flow through and the potential drop across resistor 21 to restore the potential on plate 13 to the potential of point  $p$ . Triode 39 operates similarly to control the output potential of the multivibrator tube 12.

Because this multivibrator starts automatically, it may be used with remote or unattended equipment. The circuit also has the advantage of maintaining the peak-to-peak potential constant regardless of variations in potential of the filament supply for the tubes.

**Dipole Antenna and Feed Arrangement**  
 . . . Patent No. 2,652,492. John P. Shanklin, Cedar Rapids, Iowa. (Assigned to Collins Radio Company).

A simple and unusual dipole antenna has been devised by the inventor which has all the operational advantages of a folded

half wave dipole and in addition provides a transmission line coupling arrangement having several desirable advantages. As shown in Fig. 2, the antenna may be a plate (1) having a notch (2) in one edge thereof. The plate has a length ( $a$ ) less than half a wave length at resonance and a width ( $b$ ) which can vary widely but usually substantially less than the length.

The notch need not be located centrally along a longitudinal edge; for best results the depth ( $d$ ) should be less than one quarter wave length and the width substantially less. The open end of the notch has an inductive reactance of proper value at the operating frequency which reactance is resonated by a small capacitor (3) bridged across the notch so that in effect an infinite impedance is presented across the notch. A transmission line connected across the notch will feed into whatever impedance is presented by the dipole and notch at the connecting point.

Because it can be made tubular for strength and rigidity and formed in a U shape as shown in Fig. 3 to give it an omni-directional field pattern with low wind resistance, the antenna lends itself to aircraft service. By inserting a bracket (15) in the notch and properly spacing a bridge member from the open end of the notch, impedance correction is effected to increase the frequency coverage of the antenna.

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## Patents . . .

**Lightning Arrestor . . . Patent No. 2,650,325.** Edward J. Ehrbar, Cleveland, Ohio. (Assigned to Cornell-Dubilier Electric Corp.).

Lightning arrestors designed for use with TV antennas generally are of the airgap, resistive, and neon lamp discharge types. Because of their internal capacities, they cause line insertion losses which are raised as the frequency of the received signal is increased. They are also restricted as to their static or stray discharge rate; for example, a neon tube requires 60v of static charge for conduction and an air gap requires 500v before discharge occurs.

The lightning arrestor described in the patent and shown in Fig. 4, overcomes these difficulties, and effectively places the antenna, lead-in, or transmission line at ground potential. The simplicity of the design also makes possible an inexpensive construction. The arrestor provides a cas-

ing (1) having a recess (3) in which an inductance coil (4) is mounted with its ends connected with two terminals (8). One of the antenna lead-in or transmission wires is connected with one terminal, and the other lead-in wire is connected with the other terminal. A wire (13) connects

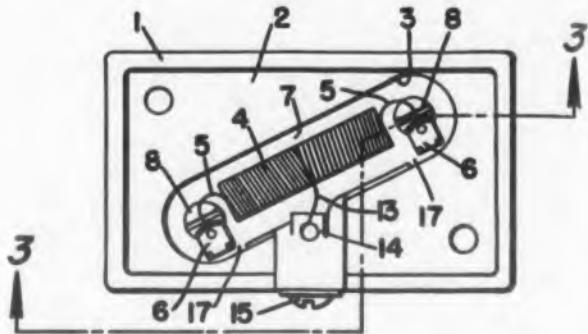


Fig. 4. A TV antenna lightning arrestor that offers no signal attenuation.

the midpoint of the inductance to ground so that the antenna lead-in line is at ground potential, the d-c resistance of the inductance coil being less than one ohm.

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The impedance of the coil is sufficiently high so that it offers no signal attenuation for the frequencies which it is designed to pass. Air gaps (17) are provided between each lead-in wire and the ground wire (13).

**Modulation Circuit . . . Patent No. 2,651,758. H. B. Foster, Ellisburg, and J. R. Parker, Haddon Heights, N. J. (Assigned to Radio Corporation of America).**

The circuit in Figure 5 differs from the prior modulation circuits of this type in that an R-C circuit (20, 21) is connected between the modulation transformer and the suppressor grid in series in the suppressor grid to cathode circuit which automatically prevents overmodulation. The suppressor grid is negatively biased ( $-E_o$ ) to about one half of the potential at which zero power output is obtained. When overmodulation occurs, therefore, the suppressor grid is driven positive so that it draws current which develops a voltage across resistor 20 and increases the bias of the

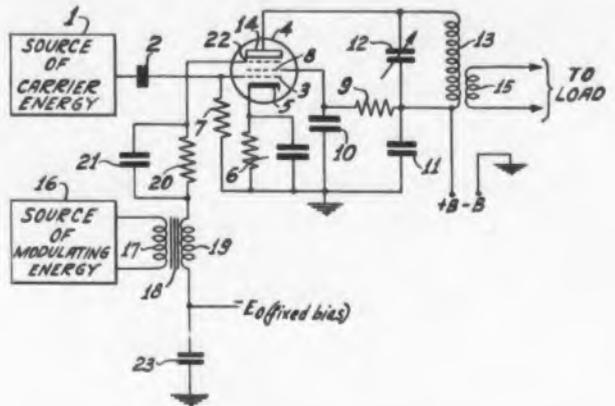


Fig. 5. Overmodulation is automatically prevented in this circuit shown above.

suppressor grid. The increased operating bias automatically prevents overmodulation when the components are properly selected. For example a 2200 ohm resistor (20) an 0.1mfd capacitor (21), and approximately  $-50v$  bias ( $E_o$ ) will function satisfactorily with a Type 2E22 tube.

Some distortion due to clipping occurs when the bias or line of modulation is shifted upon overmodulation but it is less than 15% at 90% modulation, which is low enough for communication work.

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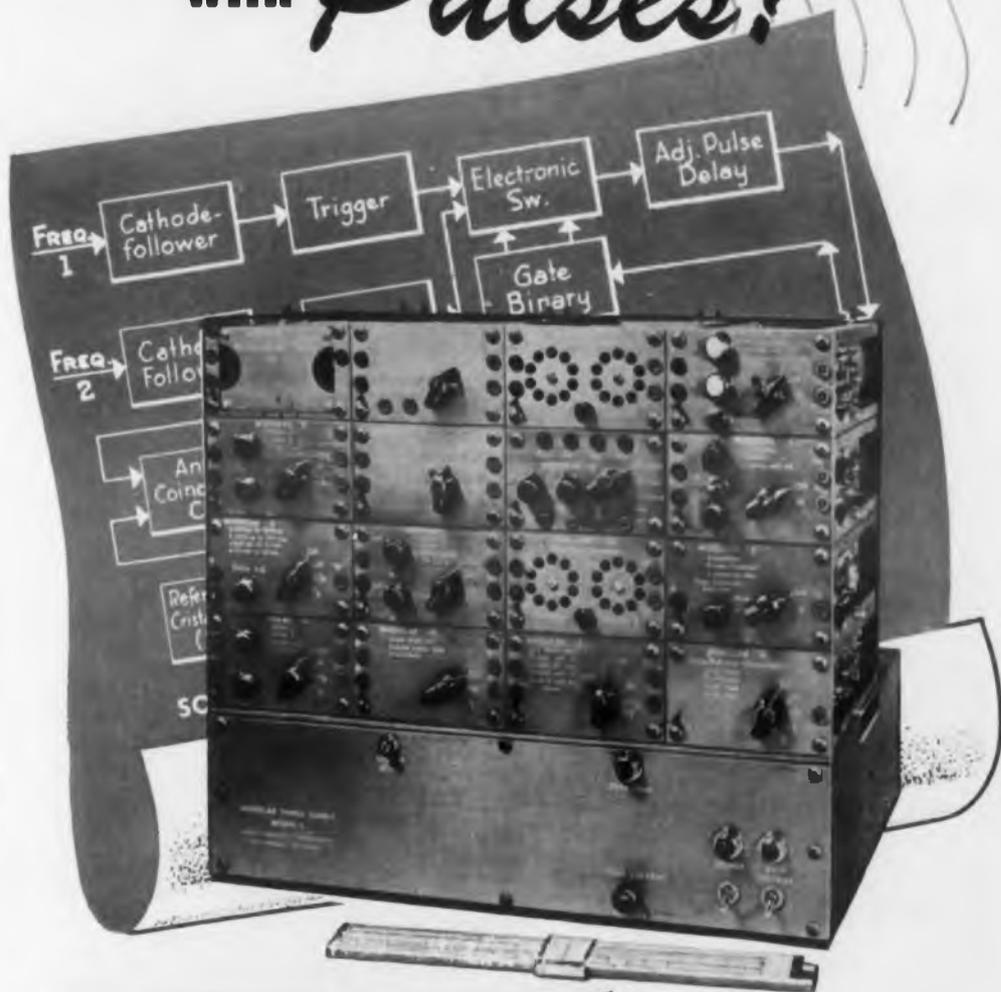
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## Patents . . .

**Brightness Control Circuit for TV Receivers . . . Patent No. 2,651,729. W. H. Chudleigh, Jr., Oreland, Pa. (Assigned to Philco Corp.).**

It is common practice in television receivers to derive the high accelerating potential for the second anode of the picture tube by connecting (see Fig. 6) a rectifying tube (30) across the stepped up primary winding (28) of the transformer (14) which connects the power output tube (10) with the horizontal beam deflecting coils (12) of the picture tube. With a manually adjustable background control as a part of the circuit, any adjustment to increase background illumination has the objectionable effect of increasing the vertical picture dimension. The width of the picture is not similarly affected because of compensating factors.

The patentee has devised a circuit for control of the brightness of the picture

without causing a variation in the picture height. This is secured by adjusting a slider (58) along a potentiometer (52) which is in the grid (44) cathode (48) circuit and includes resistors 53, 55 and 56. Considering the connection of "B" supply voltage through resistor 62, shifting of the slider (58) to the right towards point B lowers the positive potential on the cathode (48) and raises the potential of the grid (44) to increase the brightness of the picture. Movement of the slider towards point A results in a reverse potential effect on grid and cathode to decrease the picture brightness.

Point A of the potentiometer (52) is also connected with the screen grid (32) of the power tube (10) through resistors (66 and 34), and a width control potentiometer (67) is connected between a B+ supply and this circuit. When the slider (58) is moved to vary the picture brightness, the positive potential on the screen grid (32) is also varied to change the output of the power tube. By proper selection of resistance values, the second anode potential is maintained fairly constant re-

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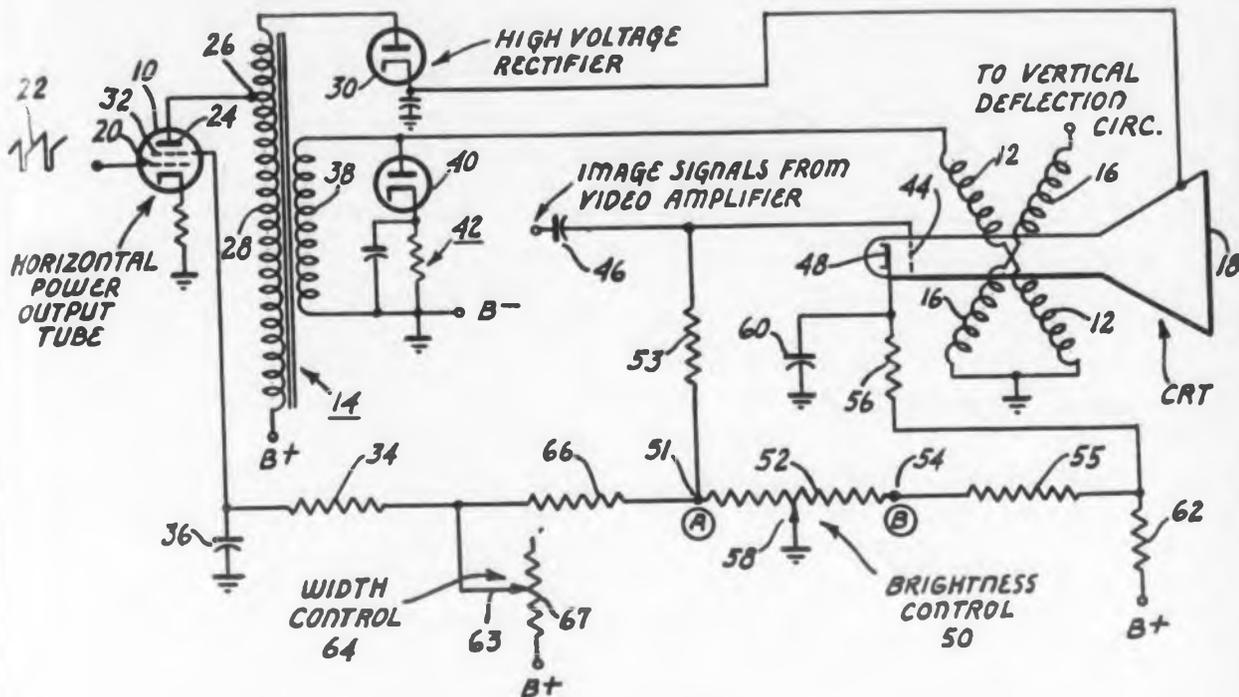


Fig. 6. An improved brightness control circuit for TV receivers.

regardless of variations in the brightness of the picture. Any variation in the width control slider (63) also varies the potential on the screen grid (32) so that a substan-

tially constant potential is maintained on the second anode of the cathode ray tube regardless of adjustment of the width control in the television receiver.

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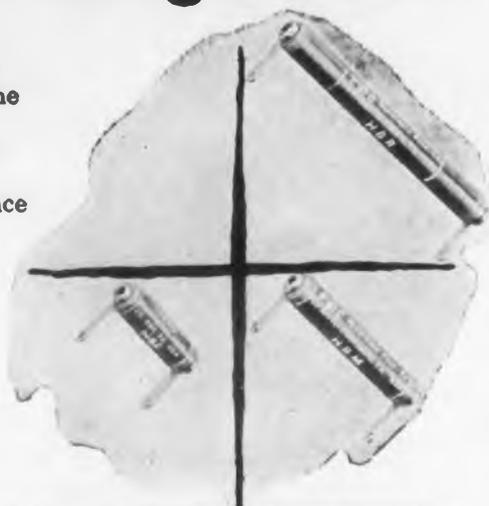
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# Books . . .

**Advances In Electronics Vol. V . . .**  
 Edited by L. Marton, 420 pages. Academic Press Inc., Publishers, 125 East 23 Street, New York 10, N. Y. \$9.50.

A group of eight subjects by different authors covering a wide variety of topics indicating the present status of the electronic art in these fields makes up the contents of the fifth volume of this interesting series. The subjects include "Performance of Detectors for Visible and Infrared Radiation", "Beta-Ray Spectrometers", "Solid-State Luminescence", "Thorium Oxide and Electronics", "A Review of Modern Vacuum Pumps in Electronic Manufacturing", "On the Steady-State Theory of the Magnetron", "A Review of Recent Work in Color Televi-

sion", and "Junction Transistor Applications".

The subjects are treated in a fairly comprehensive and detailed manner. A new feature of this volume is a cumulative author and subject index to articles that have appeared in previous volumes in the series.

**Technical Illustration . . . 88 pages.** Published by the Higgins Ink Co., Inc., 271 Ninth Street, Brooklyn 15, N. Y. \$2.50.

Three dimensional drawing is the basic subject of this interesting book. Because this type of presentation seems to be receiving some degree of acceptance these days, especially in military manuals, it should interest many designers. The book was com-



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plied under the supervision of B. Cholet, sales promotion manager of the Higgins Ink Company.

The book's major chapters deal with axonometric and perspective drawings which can be dimensioned and which are sound from the engineering standpoint. These were assembled by A. D. Pyeatt, a noted authority on visual presentations which are technically correct. These chapters are profusely illustrated with examples and they also cover drawing instruments as well as lettering techniques.

The latter half of the book presents 22 plates executed by B. G. Smith, a noted designer, which vividly illustrate various techniques of presentation. The same subject in the same projection is employed throughout the series to emphasize the results of using different techniques. The electronic designer will find many helpful suggestions in this clearly presented work.

**Television Factbook, No. 18 . . . January 15, 1954 Edition. 374 pages. Published by Radio News Bureau, Wyatt Bldg., Washington 5, D. C. \$3.00.**

The latest edition of this semiannual

reference work which covers all phases of the television industry, includes a 43" x 29" 1954 TV map showing all TV cities, all existing and projected AT&T and private network facilities, all cities pertinent to the TV allocation plan, and all other cities of over 10,000 population.

The factbook itself contains a wealth of data on including complete information on all TV stations and TV networks with data on personnel, rates, etc. It also lists manufacturers of TV receivers, picture and receiving tubes, telecasting and receiving antennas, tuners and converters, as well as electronic research laboratories and financial data on TV and receiving set manufacturers.

The book further includes a number of miscellaneous services such as an FCC personnel directory, publications in TV and related fields, associations in TV and related fields, literature and reference books about TV, miscellaneous consulting services, TV and radio consulting engineers, and market research organizations. A trade statistics and market data section summarizes such data as set and tube production, sales and shipments, and financial data on manufacturers.

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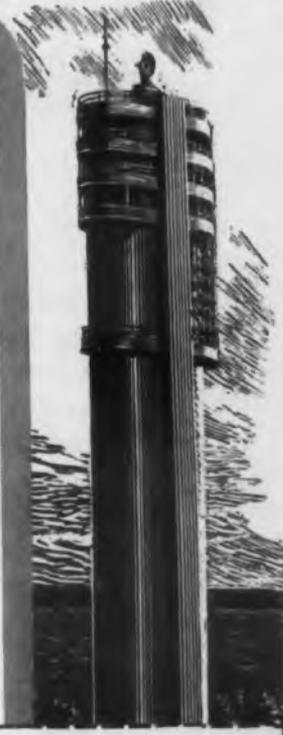
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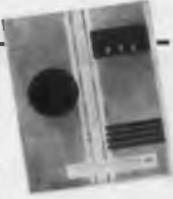
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42	Waters Manufacturing, Inc.	39
237	Western Gold & Platinum Works	79
7	Weston Electrical Instrument Corp.	11



FIG. 1

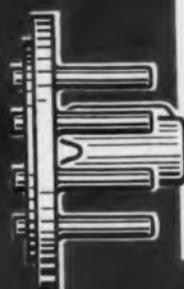
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A7079-2  
A7045-1  
A7045-2  
A7138-1  
A7138-2  
A7108-1  
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A7141-1  
A7141-2

FIG. 1

A7144-1  
A7144-2  
A7038-1  
A7038-2  
A7146-1  
A7146-2  
A7148-1  
A7148-2  
A7150-1  
A7150-2

FIG. 1

A7085-1  
A7085-2  
A7046-1  
A7046-2  
A7153-1  
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A7157-1  
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FIRST

# COMPRESSION SEALS



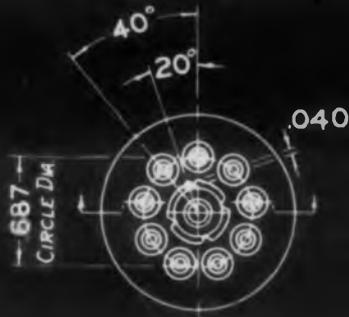
## 8 TERMINAL

PART NO. FIG. 2	FIG. 3	FLANGE DIA.	SHOULDER DIA.	A	B	EXHAUST TUBULATION
A7042-1		1.250	1.175	1/8	040	As Shown
A7042-2		1.250	1.175	1/8	040	None
A7137-1		1.250	998	1/8	080	As Shown
A7137-2		1.250	998	1/8	080	None
A7139-1		1.235	1.062	1/8	045	As Shown
A7139-2		1.235	1.062	1/8	045	None
A7140-1		1.125	998	1/8	080	As Shown
A7140-2		1.125	998	1/8	080	None
A7142-1		1.062	998	1/8	080	As Shown
A7142-2		1.062	998	1/8	080	None
A7041-1		—	1.062	1/8	—	As Shown
A7041-2		—	1.062	1/8	—	None
G7143-1		—	998	1/8	—	As Shown
G7143-2		—	998	1/8	—	None



## 9 TERMINAL

PART NO. FIG. 2	FIG. 3	FLANGE DIA.	SHOULDER DIA.	A	B	EXHAUST TUBULATION
A7058-1		1.250	1.175	1/8	040	As Shown
A7058-2		1.250	1.175	1/8	040	None
A7145-1		1.250	998	1/8	080	As Shown
A7145-2		1.250	998	1/8	080	None
A7147-1		1.235	1.062	1/8	080	As Shown
A7147-2		1.235	1.062	1/8	080	None
A7149-1		1.125	998	1/8	080	As Shown
A7149-2		1.125	998	1/8	080	None
A7151-1		1.062	998	1/8	080	As Shown
A7151-2		1.062	998	1/8	080	None
A7047-1		—	1.062	1/8	—	As Shown
A7047-2		—	1.062	1/8	—	None
G7152-1		—	998	1/8	—	As Shown
G7152-2		—	998	1/8	—	None



## 11 TERMINAL

PART NO. FIG. 2	FIG. 3	FLANGE DIA.	SHOULDER DIA.	A	B	EXHAUST TUBULATION
A7059-1		1.250	1.175	1/8	040	As Shown
A7059-2		1.250	1.175	1/8	040	None
A7084-1		1.250	998	1/8	080	As Shown
A7084-2		1.250	998	1/8	080	None
A7154-1		1.235	1.062	1/8	045	As Shown
A7154-2		1.235	1.062	1/8	045	None
A7156-1		1.125	998	1/8	080	As Shown
A7156-2		1.125	998	1/8	080	None
A7158-1		1.062	998	1/8	080	As Shown
A7158-2		1.062	998	1/8	080	None
A7048-1		—	1.062	1/8	—	As Shown
A7048-2		—	1.062	1/8	—	None

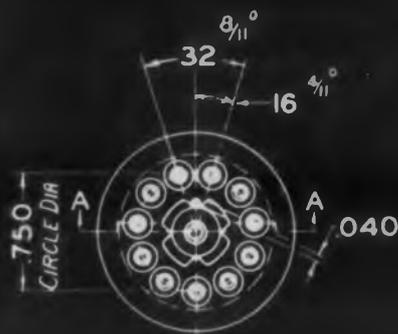


FIG. 1

FIG. 2

FIG. 3

**HERMETIC SEAL PRODUCTS CO.**



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# DESIGNER'S NEWS

—from the RCA Tube Department



## New Multiplier Phototube for Headlight Dimming Service

RCA-6328 is a short, 9-stage multiplier phototube. Instantaneous response of the tube meets the critical timing requirements of headlight control service. RCA-6328 is capable of providing stable performance over long periods. High luminous sensitivity allows this tube to be used with an amplifier having relatively low-impedance input and fewer stages than required for a less-sensitive tube.



(ACTUAL SIZE)

## RCA Germanium-Crystal Diodes are now available

RCA Point-contact Germanium-Crystal Diodes are now available in quantity. Sealed in glass, they include RCA-1N34-A (general-purpose type); 1N38-A, 1N55-A, and 1N58-A (large-signal types); 1N54-A (high-back-resistance type); and the 1N56-A (high-conduction type).



(ACTUAL SIZE)

## UHF "Pencil" Triodes for Mobile and Aircraft Services

These new "Pencil" tubes—with external plate radiators—can be operated with full ratings at frequencies as high as 500 Mc—and at reduced ratings up to 1700 Mc! ICAS plate dissipation is 13 watts. RCA-6263 is intended for rf power amplifier and oscillator service; RCA-6264 is designed for frequency-multiplier service.



(ACTUAL SIZE)



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RCA Tube Department  
Commercial Engineering, Section B18R,  
Harrison, N. J.

Please send me technical data on:  
 Multiplier Phototube RCA-6328  
 RCA Germanium Diodes  
 RCA Transistors

New UHF "Pencil" tubes—  
 RCA-6263  RCA-6264

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