

ELECTRONIC

DESIGN

ELECTRONIC



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ELIMINATING the bobbin in this precision, wire-wound resistor results in a compact, low-cost design. Special winding techniques minimize strain on the wire, and also permit closer tolerances at lower cost. The windings are sealed in a rugged ceramic tube shown in the lower illustration and the end seals are then permanently bonded to the ceramic housing.

August 1954

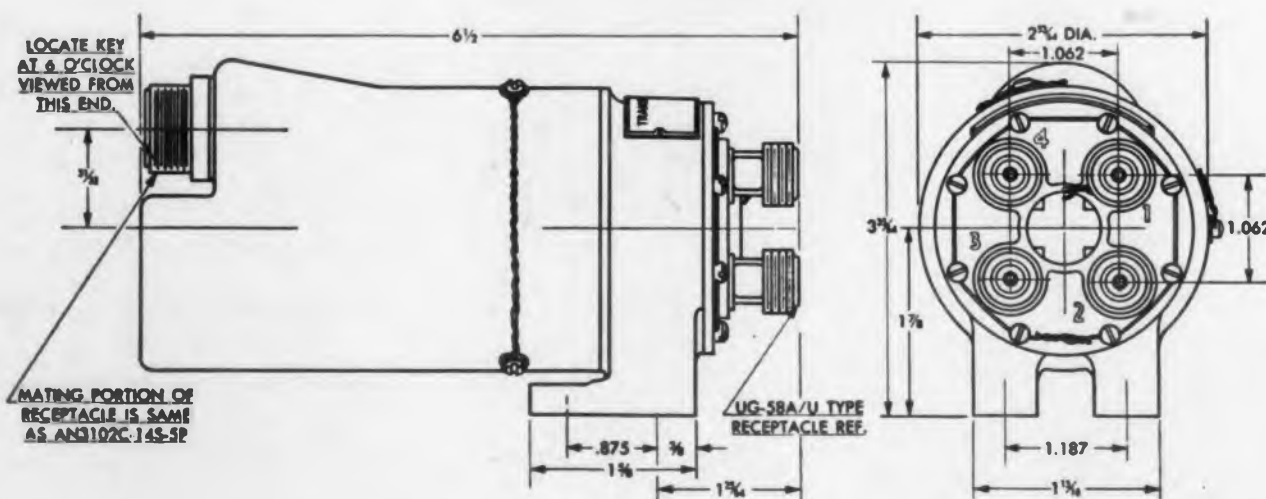
TRANSCO PRODUCTS, INC.

CX D.P.T. 1954

COAXIAL SWITCH

Double Pole—Transfer

No. 1460-30



CHARACTERISTICS:

1. AMBIENT OPERATING TEMPERATURE RANGE: +85° C. (+185° F.) TO -59° C. (-75° F.)
2. OPERATING TIME FROM ONE POSITION TO ANOTHER: APPROXIMATELY 0.15 SECONDS.
3. MOUNTING: FOUR #10-32 TAPPED HOLES—SELF-LOCKING THREADS—FULL THREAD $\frac{3}{16}$ DEEP ON $1\frac{1}{16} \times \frac{3}{8}$ CENTERS.
4. WEIGHT: APPROXIMATELY 2.3 LBS.
5. ACTUATOR POWER RATING: 18-30 VOLTS D.C. AT 2.3 AMPS. PEAK.
6. LIFE DURATION: 30,000 CYCLES OR 60,000 OPERATIONS MINIMUM.
7. R. F. POWER RATING OF COAXIAL SWITCH EQUAL TO THAT OF IMPROVED TYPE "N" CONNECTORS.
8. INSERTION LOSS: 0.5 DB MAXIMUM 30 - 11,000 MEGACYCLES.
9. ATTENUATION BETWEEN CONNECTORS 60 DB MINIMUM.
10. VOLTAGE STANDING WAVE RATIO: 1.3 TO 1 MAXIMUM WITH MATCHED CONNECTORS—RANGE 30 - 11,000 MEGACYCLES.

TO: Purchasing- MEMORANDUM

This is one of a full line of coaxial switches ranging from single pole - two throw to single pole - six throws double pole - double throw. All are available with 26 V.D.C., 115 V.A.C. 60 & 400 cycle actuators. Looks like this answers our Coaxial Switch problems. - Please check price & availability.

Ed Smith

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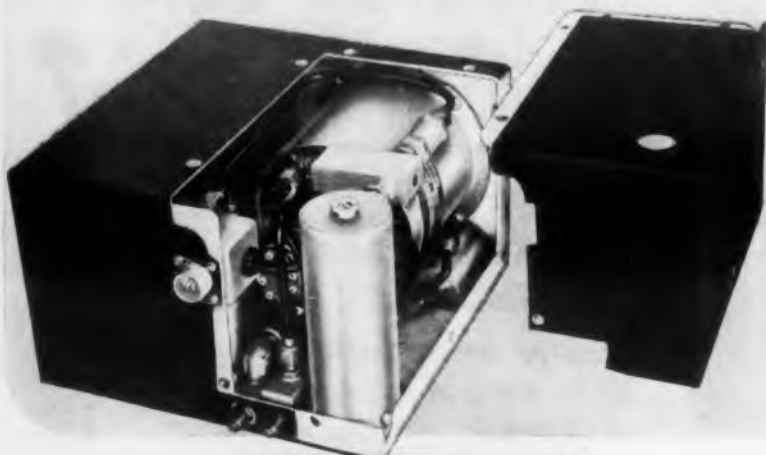
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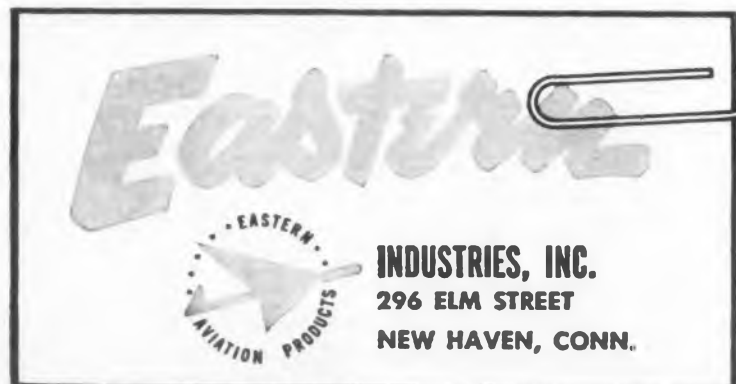


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Editorial . . .

Intelligent Compromise

At every technical gathering papers describing new devices, materials, and components are presented. News of these developments is welcomed with elation by the designers in the audience. Here, in the form of a "super" component or material, are solutions to some of their most vexing design problems . . . now, apparently, their worries are over.

The only difficulty is that nearly all of the items described are either laboratory samples or prototype models; the final commercial product is usually months away. To make matters worse, if the development has important military uses, the commercial equipment designer may not have a chance to incorporate it in his device until the time when military needs are satisfied.

This certainly presents a problem to the designer. One man may decide to ignore the new development completely until the component is commercially available. This is the strictly conservative approach which may have some merit, although it does seem a bit shortsighted.

Another designer may go overboard the other way, deciding to design his equipment around the new component and wait until it becomes available. This, on the other hand, is a bit too farsighted, for when the component finally is available, it may be quite different from the development originally reported in a technical paper months before.

It seems to us that the proper approach for the design engineer is to proceed with his present plans, but to do so with a complete awareness of the impending availability of the new component. If possible, he may arrange his design so that if and when the component is available, it can be readily incorporated into his equipment. He might also inform the manufacturer of his interest and his tentative plans to use the new component, thereby spurring him into greater effort to get the product into the field more quickly.

There are undoubtedly many other approaches to this problem, which is an occupational hazard of the designer, but it is certain that they all point to one thing: the designer must keep informed. He, above all other engineers, should read trade publications carefully, attend technical meetings, subscribe to technical society lecture series, etc. By doing this, he can prepare himself to perform his most important function—that of making an intelligent compromise. This is the essence of design.

Engineering Review . . .

Tiny Pulse Amplifier . . . A tiny, stable pulse amplifier that works at extremely low signal levels, has been developed by the General Electric Company, Schenectady 5, N. Y. Preliminary tests indicate that drift is less than 10^{-16} w over a temperature range of -70°C to 140°C . The circuit diagram for the unit is shown below with a photograph of the amplifier.

The amplifier is essentially a magnetic amplifier that uses a very small high-permeability core and requires no rectifiers. The two greatest sources of drift in conventional magnetic amplifiers—variation in rectifier and magnetic core characteristics—have been eliminated in the pulse amplifier.

Drift problems in the conventional magnetic amplifiers are largely attributed to forward rectifier drop reverse rectifier leakage, and variations in the magnetic characteristics between cores. By eliminating the rectifiers, reducing the number of operational cores to one per amplifying stage, and by operating this core in push-pull, the pulse amplifier has considerably less opportunity for drift. The circuitry is so devised that variation in saturation flux density and hysteresis loop width have negligible effect. Changes in the hysteresis loop affect the gain only, not the level of drift.

In operation, the magnetic core of the amplifier is driven into saturation by the power pulses. Between pulses, the core magnetization settles back to a level dictated by the control signal. The output power is

determined by the amount of pulse remaining after saturation. Push-pull operation is achieved, using a single magnetic core, by comparing the alternate positive and negative pulses. Approximately the same gain and speed of response are realized in the pulse amplifier as in the conventional magnetic amplifier.

Basically a low-level device, the pulse amplifier can be used to amplify a signal to the microwatt level. Here conventional amplifiers can be used to boost the power to higher output levels without further effect upon the drift. The concept of the pulse amplifier suggests a wide variety of new functions that may be performed by magnetic amplifiers. These cover the fields of optical pyrometry, precision calorimetry, spectroscopy, geophysics, meteorology, differential thermometry, etc. Wherever extreme sensitivity is desired, the pulse amplifier has an application.

Materials used to make the cores of the pulse amplifier are the same as those used in conventional magnetic amplifiers—silicon steel, nickel-iron alloy, Permalloy, Mumetal, etc.

Automatic Ultrasonic Inspection . . . Ultrasonic inspection of forgings is automatically controlled in a newly developed apparatus known as "SIMAC"—sonic inspection measurement and control. A combination of punched tape, a digital computer, and servo motors controls the movement of the scanning head with respect to the specimen undergoing non-

destructive, ultrasonic inspection so that a thorough survey is made and the results recorded.

The circular forging is mounted on a rotating turntable completely immersed in a tank of water. The water serves to conduct the ultrasonic scanning pulses. The scanning head is mounted on a vertically moving carriage that is in turn mounted on a larger, horizontally moving carriage in the same tank.

By a combination of continuously rotating the turntable and moving the carriages, the forging is completely scanned and the results are recorded on a circular chart by a fast-acting, pen-recording system. The programming tape controls these movements, but the scanning can also be controlled by an operator from the control console. The operator can watch the results of the inspection on an oscilloscope.

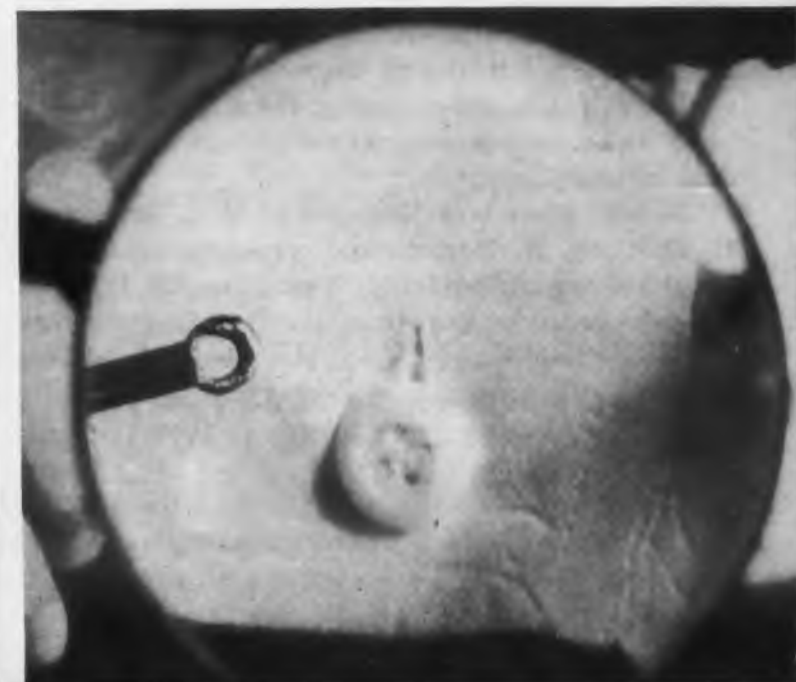
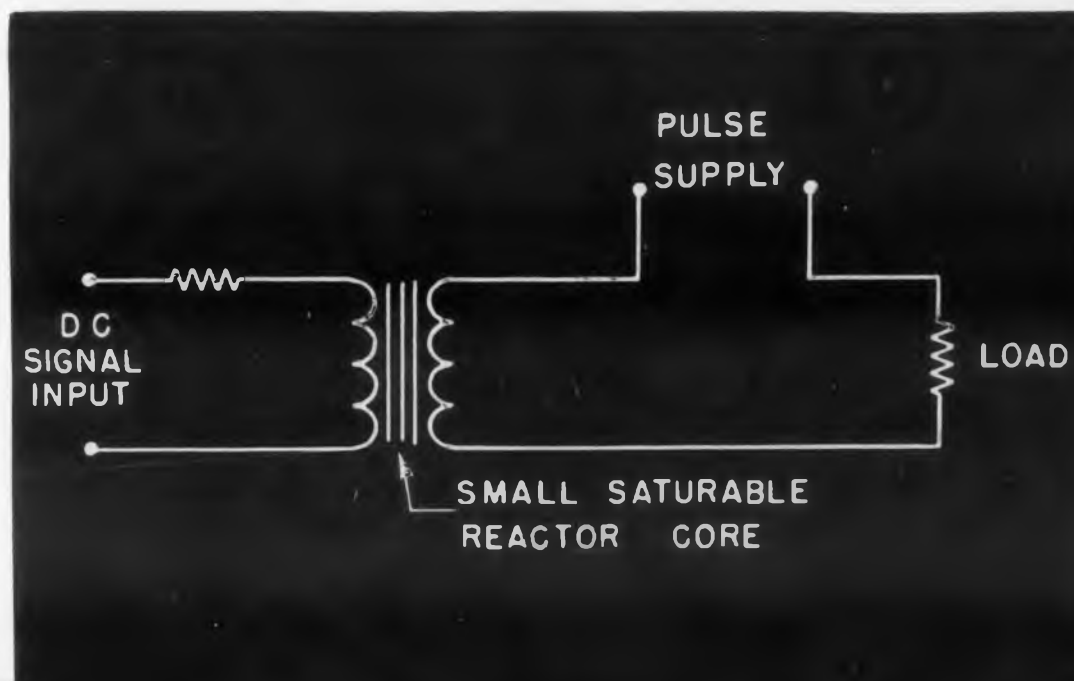
The scanning unit is a quartz crystal transducer that transmits short, 5Mc, ultrasonic pulses. A specially designed "pulse-stretching" circuit was required to amplify the echoes from these pulses in order to accurately drive the recording instrument.

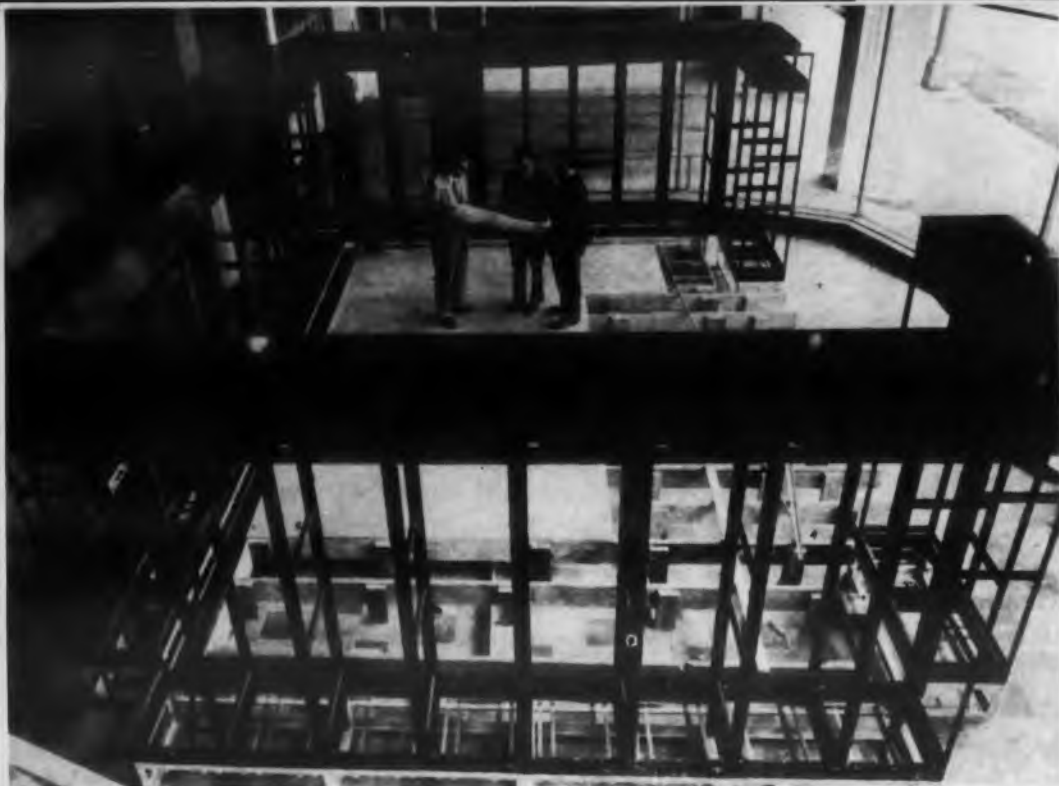
The SIMAC was developed by Sperry Products, Inc., Danbury, Conn., for the Allison Division of the General Motors Corp. Drop forgings for jet engines are tested by the apparatus in 15 minutes, but, if required, two hours continuous and automatic control of the machine could be programmed by the tape.

Color Picture Tube . . . Featuring a screen area of 250 sq in, a newly developed 21" color TV picture tube has a lighter-weight metal envelope. The tube is of the shadow-mask type, and has a frosted face plate to eliminate glare caused by reflected light from room illumination.

The tube, developed by the Radio Corporation of America, 30 Rockefeller Plaza, New York 20, N. Y., affords improved color and black-and-white pictures. A new electron gun is employed which makes possible a shorter neck for the tube. The company has also developed a new color TV receiver chassis with greatly simplified circuitry and fewer tubes.

The simple circuit diagram for the tiny pulse amplifier shown under the magnifying glass in the photograph at the right. The amplifier features very low drift over a wide range of temperatures.





Computer shell

This frame will support the 650 chassis comprising UDEX II, a laboratory computer being constructed by Burroughs Corporation at 1209 Vine St., Philadelphia, Pa. The computer utilizes all but a few of the chassis that were installed in an older Burroughs computer that is being disassembled. The new unit has six times greater memory capacity than the older one, in addition to being faster.

Engineering Review . . .

Diode Application Contest . . . The International Rectifier Corporation is sponsoring a nationwide contest for new applications for selenium diodes. A new Ford sedan will be awarded to the contestant submitting the most useful and practical new application. In addition, 50 secondary prizes totaling \$1500 will be distributed. There are no special requirements for participation. The deadline for entries is Jan. 1, 1955.

Dr. Lee deForrest will be a consultant to final selection of the winning entry. Write to Selenium Diode Contest, International Rectifier Corp., 1521 E. Grand Ave., El Segundo, Calif., for complete contest details and entry blanks.

Pencil Marks Read Electronically . . . A recently developed device known as "FOSDIC" reads marks on microfilmed copies of documents that have been marked with an ordinary pencil or pen, and then processes the information for direct input to a computer. Designed to reduce the vast amount of paper work involved in census taking, the device can be applied to processing other types of information handled in large quantities.

The instrument was developed by M. L. Greenough, H. D. Cook, M. Martens and associates of the National Bureau of Standards, Washington 25, D. C., at the request of the Bureau of the Census. It complements the development of the large-scale, high-speed computer. It surpasses present types of partially automatic processing systems since it doesn't require typewriters or special marking devices like punches or conductive pencils. In addition, FOSDIC does not require especially stiff paper and can handle wrinkled or slightly mutilated documents.

FOSDIC detects specific blacked-in areas or ovals in a large field of possible answers. A "yes-no" answer is given two ovals, while a numerical answer is supplied with a vertical column of 10 ovals for each decade. The scanning process is carried out on a frame-by-frame basis. Each frame is a microfilmed picture of one side of a sheet, which may be as large as 14" x 16". The film is placed in an optical assembly between a cathode-ray tube with a moving spot that scans the image and a photocell that produces a varying electrical signal from the light beam that has passed through the film. The current maximum capacity is about 2800 marks per sheet, considerably greater than the capacity of punched cards.

The chief problem in the design of mark-sensing equipment is to work out a method of locating the individual ovals precisely. Instead of using the edge of a stiff piece of paper as the register, FOSDIC uses a printed index mark below each column. When located by the scanning process, the index mark is an exact guide to the column position. Column height, or distance from top to bottom oval, is not critical, as in mechanical systems, since each answer is searched for over an area several times the size of the oval. The answers are converted into coded-pulse form for recording on 8-channel magnetic tape. The tape is then fed to a computer.

Contact Failure Investigation . . . The failure of contacts to conduct electricity between certain metal surfaces is being investigated by a novel means. A tiny loop of fine platinum wire is used to probe surface films without damaging them.

Measurement of pressure exerted with a micrometer suggests the type of film present. Other data are gathered by measuring the voltage that must be applied through the probe to break down the film and

also by observing the probing action through microscopes. Developed by the General Electric Company Research Laboratories, Schenectady 5, N. Y., the probe has been used to replace difficult chemical methods for analyzing surface films.

Spectrum Analysis . . . A newly developed instrument completes the analysis of a nonrepetitive signal within the duration of the transient. The device, manufactured by Raytheon Manufacturing Company, Waltham 54, Mass., is valuable for the study of speech, vibration, tube microphonics, and for radar development.

The spectrum to be analyzed is applied simultaneously to many narrow-bandpass filters, which cross over at the half-power points to cover the entire spectrum. The energy in each filter is sampled in sequence by a high-speed commutator. The signal-to-noise ratio of a signal in the spectrum under consideration is increased at the output of the filter by the ratio of the width of the spectrum to the width of the filter. The assembly of filters is shown below.



The output of each rod filter is fed to a segment on the stator of a capacity commutator. The rotor of the commutator picks up the signal from each segment in turn and also picks up an indexing signal with each rotation. The resulting spectrum can be shown on a cathode-ray oscilloscope of which the horizontal sweep is synchronized with the indexing signal.

Maximum sensitivity is obtained by the use of high-Q magnetostriction-rod filters. These are selected to cover the given spectrum, but since the rod filters resonate at frequencies higher than the usual spectrum to be sampled, this spectrum is normally translated to a higher frequency range and then applied to an amplifier that drives the rods.

For more information on developments described in "Engineering Review", send inquiries directly to the address given in the individual item.

Silicone Springs . . . Compressibility, a previously unused property of the silicones, is the basis for a new application of the material. Silicone mixed with other liquids makes a fluid of high compressibility for use in hydraulic springs.

The new liquid is used in Hydra Springs, manufactured by the Wales-Strippit Corporation of North Tonawanda, N. Y., and compresses 12% at 20,000 psi compared to 6.2% at 20,000 psi for the previously used material. In addition, the silicone doesn't gall or seize. The new liquid was developed by the General Electric Company. The hydraulic springs are used in machine tools, aircraft and ordnance, and also may be applied to servo systems as well as vehicle suspension.

F-M Car Radio . . . A newly developed f-m tuner for automobiles can either be attached to presently installed a-m car radios or furnished with a separate audio amplifier. Offering steady reception through overpasses, under transmission lines, and in other locations where a-m radios fade or do not receive any signal at all, the tuner is only 6-1/2" x 4" x 7-1/2" deep. It is mounted under the dashboard.

The non-directional antenna for the unit is mounted on the inside of the windshield. The tuner covers the f-m broadcast band from 87 to 109Mc. It has an Armstrong circuit, a crystal limiter, and automatic frequency control. The r-f stage is independently tuned.

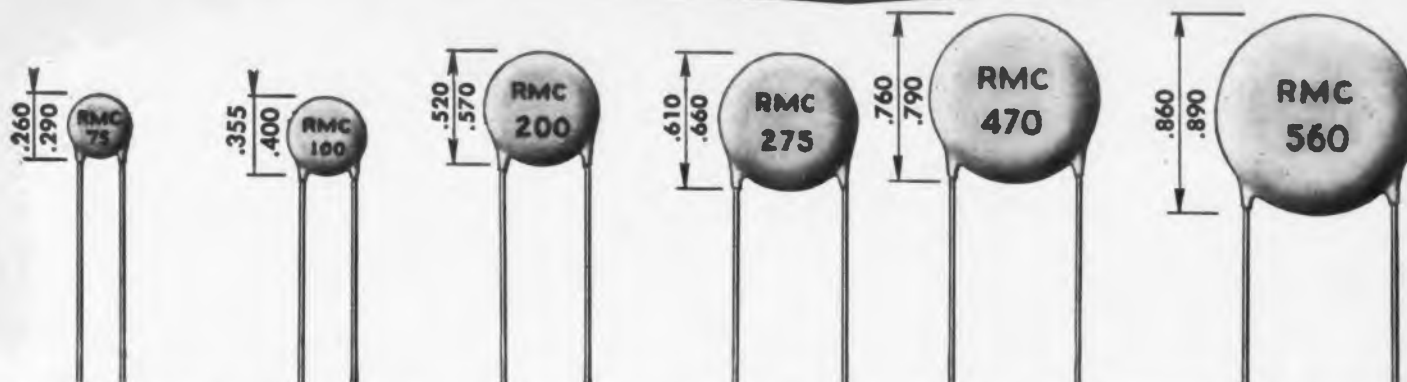
The audio amplifier delivers up to 8w from a push-pull output stage. It has a flat frequency response within 1-1/2db from 20 to 20,000cy and less than 2% distortion at full output. The amplifier above may be used with an a-m car radio to improve its fidelity.

Both the tuner and amplifier are available for operation on either 6v or 12v electrical systems. They are manufactured by Hastings Products, Inc., 171 Newbury St., Boston 16, Mass. In order to receive the full benefits of f-m reception, suppression of interference with the audio stages from the automobile's ignition system may be required in some installations.

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P-100	1- 3 MMF	4- 9 MMF	10- 20 MMF	—	—	—
NPO	2- 12	13- 27	28- 47	48- 62 MMF	63-100 MMF	101-150 MMF
N- 33	2- 12	13- 27	28- 47	48- 62	63-100	101-150
N- 75	2- 15	16- 27	28- 56	57- 68	69-110	111-150
N- 150	2- 15	16- 30	31- 60	61- 75	76-140	141-150
N- 220	3- 15	16- 30	31- 75	76- 90	91-130	131-190
N- 330	3- 15	16- 30	31- 75	76-100	101-150	151-190
N- 470	3- 20	21- 40	41- 80	81-120	121-200	201-240
N- 750	5- 25	26- 56	57-150	151-180	181-300	301-350
N-1500	15- 50	51-100	101-200	201-250	251-330	331-560
N-2200	47- 75	76-120	121-200	201-275	276-470	471-560

Temperature coefficients up to N-5200 available on special order.

SPECIFICATIONS

POWER FACTOR: Over 10 MMF less than .1% at 1 megacycle. Under 10 MMF less than .2% at 1 megacycle.

WORKING VOLTAGE: 1000 V.D.C.

TEST VOLTAGE (FLASH): 1750 V.D.C.

CODING: Capacity, tolerance and TC stamped on disc

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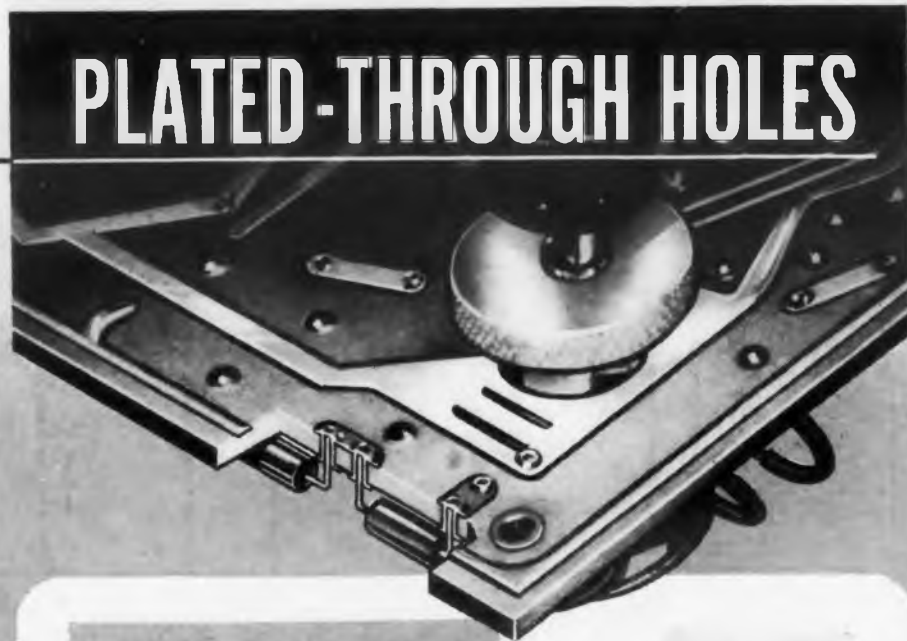
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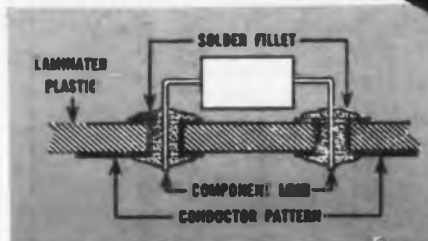
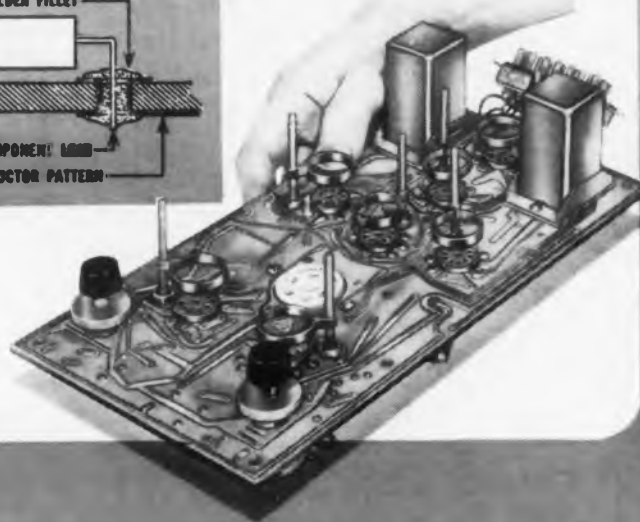


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Engineering Review

Ultrasonics in Medicine . . . Electronically generated ultrasonic vibrations have been used to treat cancer in mice and mental disorders in humans in recent tests at the University of Connecticut at Storrs and the Veterans Administration Hospital at Pittsburgh, Pa., respectively.

Although half the mice were killed by the treatment because of injury to vital organs caused by the high-intensity vibrations, those who survived treatment had a complete regression of the tumor. Ultrasonics have been used successfully in place of possibly dangerous surgical lobotomies in the treatment of mental patients.

Commercial Eliminator . . . By discriminating between the characteristics of music and speech, a device known as the "Vocatrol" blanks out all speech and allows only music to be heard from a radio or TV receiver.

Designed to eliminate commercials, the 5-tube unit can also cut out all announcements. A special control permits the unit to be adjusted so that music plus speech, as in operatic selections, will not be cut off.

The device, manufactured by Vocatrol Corporation, Box 108, Cambridge, Mass., is readily connected to a radio or TV receiver without removing the chassis. The proper tube is removed from its socket, an adapter is inserted in the socket, and the tube is reinserted in the adapter. The adapter is connected to the "Vocatrol" by cable.

Mechanical Translation . . . A new magazine called "MT" and devoted ". . . to the translation of languages with the aid of machines . . ." has been published by the Massachusetts Institute of Technology. The first number is a bibliography.

The magazine will be issued at irregular intervals. Requests for information on subscriptions and the submission of material should be addressed to W. N. Locke, Room 14N-307, M.I.T., 77 Massachusetts Ave., Cambridge 39, Mass.

◀ CIRCLE ED-5 ON READER-SERVICE CARD

Hotel TV Station . . . A small TV station broadcasting by closed circuit to the 1600 TV receivers installed in all rooms was recently demonstrated at a New York Hotel. Telecasts included a telephone message service for participants in a convention with headquarters at the hotel. The names of persons wanted on the phone were listed on a call board placed in front of a TV camera.

In addition, interviews with prominent visitors to the convention and film shorts were broadcast. The studio was in a room only 14' x 10' in size. The equipment was operated by Ampli-Vision, Division of International Telemeter Corp., Los Angeles, Calif.

The closed-circuit TV network is envisioned as a means of additional revenue for hotels. Other types of programs that could possibly be transmitted are shopping and tourist information, lists of motion picture theatres and other places of entertainment, and shows feed directly from the hotel's ballroom or nightclub. Local sponsors would be enlisted to support the programs.

Atomic Information Library . . .

Stanford Research Institute, Menlo Park, Calif., has been selected as an Atomic Energy Industrial Information Depository to serve the West Coast area according to an announcement by the Atomic Energy Commission, Washington 25, D. C. This is the third such depository named by the AEC. Others are the Atomic Industrial Forum, 260 Madison Ave., New York, N. Y., and the John Crerar Library, Chicago, Ill.

Each of the libraries designated receives as an initial complement of material some 700 reports of industrial interest selected from 9500 reports, drawings of the "Swimming Pool" reactor, Nuclear Science Abstracts, and bibliographies of selected AEC reports of interest to industry.

New AEC unclassified reports of special interest to industry and additional engineering drawings are supplied as they become available. In return, the depositories allow general access to the collection and provide photocopies or other suitable single copies at standard prices.

CIRCLE ED-10 ON READER-SERVICE CARD >



G.E. designs 400-cycle alternator to meet demanding guided-missile requirements

Another example of G-E motors for aircraft

NEWLY DEVELOPED to withstand the tremendous range of shock, temperature and atmospheric conditions encountered in guided-missile applications, this explosion-resistant 400-cycle alternator meets rigid environmental and military specifications (MIL-E-5272, procedure 1). Rated up to 1500 volt-amperes, 12,000 rpm, for output of 115 volts, this unit is designed to be driven by a wide variety of d-c, a-c, turbine, and jet-air drives.

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nator—and all G-E aircraft and armament motors—meet specifications regarding altitude, shock, temperature, vibration, humidity, sand and dust, and centrifugal force.

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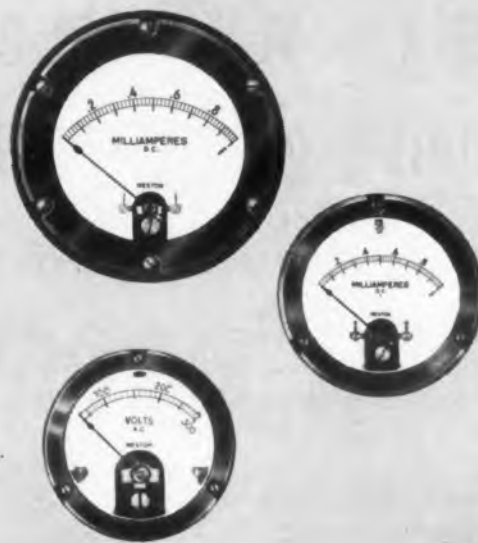
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CIRCLE ED-6 ON READER-SERVICE CARD FOR MORE INFORMATION

Engineering Review . . .

Operations Research . . . The Plastics Department, General Electric Company, Pittsfield, Mass., has inaugurated an Operations Research section within its management group. This method will be applied to all phases of the department's operations.

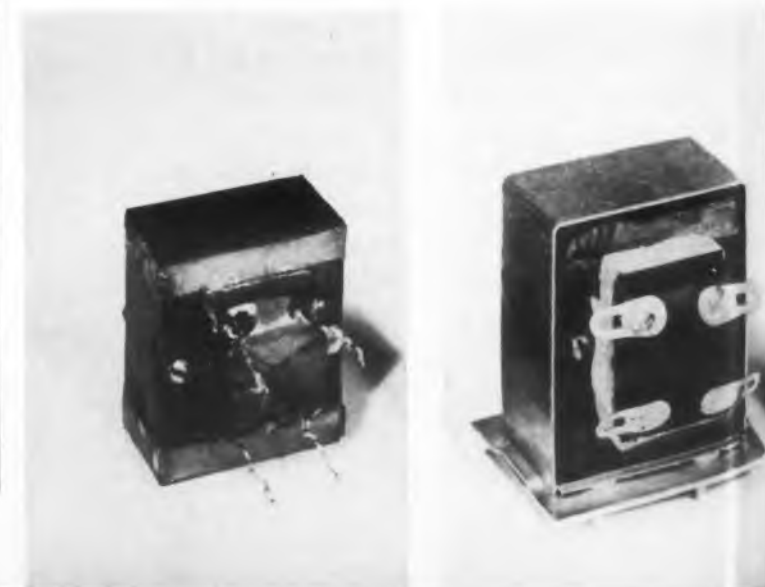
Techniques employed by the new section will include analysis, projection and prediction. Alternate solutions to business problems will be evaluated by this scientific method.

Dynamometers . . . A giant 10,000hp eddy-current absorbing dynamometer has an electronic control that supplies 36kw, d-c, to accurately control torque and speed. The 42-ton unit spins at from 600 to 5800rpm and was made by Dynamatic Division, Eaton Manufacturing Co., Kenosha, Wis.

Neoprene Encapsulated Transformer . . . A newly developed process for encapsulating transformers in humidity resisting neoprene eliminates the need for a metal can and means weight-and-space savings up to 40%. Neoprene-coated units exhibit an insulation resistance of over 1000 megohms after 100 humidity test cycles. Three stages in the encapsulation process are shown in the photographs below.

The first step in the process is to wrap the transformer with neoprene tape in the places where the mounting fixture will hold it. Next, pressure seals are applied to any metal components, like lead wires and mounting hardware, that must pass through the coating. Then the mounting fixture is put on and the unit is dipped twice in a viscous neoprene compound. Each coat is oven-cured to vulcanize the neoprene, and to vulcanize the coating to the neoprene tape applied previously. The encapsulation process does not depend on a neoprene-to-metal bond. Adhesion is required only between neoprene and neoprene, which has the ability to vulcanize to itself. The coating does not become brittle at low temperatures.

Transformers encapsulated by this process are





Atomic-Electronic Guard

The radioactive leather wristbands worn by this power-press operator prevent accidents by activating an electronically operated machine lock driven by a Geiger tube whenever he places his hands near a cutting edge. Knicknamed "Bikini Bracelets", the wristbands are not dangerous to the wearer. For complete safety, the Geiger tubes (painted white on the press illustrated) are sensitive enough to detect when the operator has removed the band and prevent the press from operating. This protective system, already widely used, is manufactured by Hazatrol Corporation, San Francisco, Calif.

available from Aircraft Transformer Corp., West and Willow Streets, Long Branch, N. J., using neoprene manufactured by E. I. du Pont de Nemours & Co., Wilmington 98, Del. The process has already been applied experimentally to selenium rectifiers.



Three stages in the neoprene encapsulation of transformers are shown at the left. Up to 40% reductions in space and weight can be achieved by this process in comparison to hermetic sealing in metal cans.

**CUT
PRODUCT
SIZE**



**WITH
TEXAS
INSTRUMENTS
SUBMINIATURE
TRANSFORMERS**

All transformers shown ACTUAL SIZE

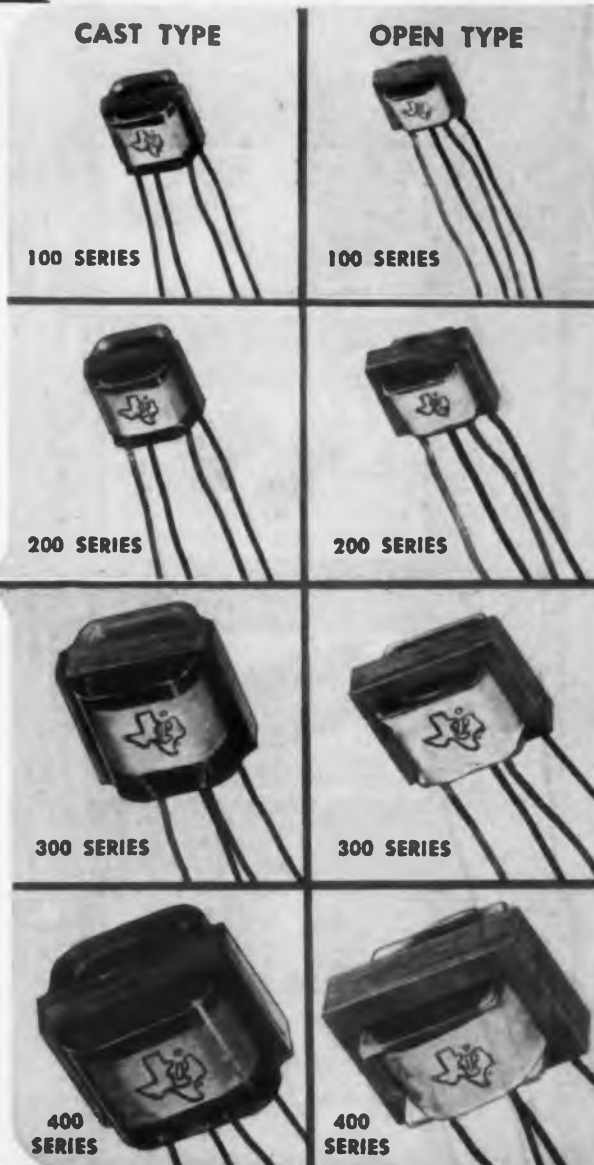
T/I announces 32 new subminiature transformers...

... for transistor and other miniaturization applications. Texas Instruments — also a leading transistor manufacturer — has applied its precise instrument standards in producing both transformers and transistors to bring you this first complete line of subminiature transformers. Behind every TI product are years of experience in meeting the exacting requirements of geophysical and military electronic equipment and components. This experience gives you added assurance of the reliable performance of these new transformers.

Input, interstage, choke, and output types are available in four size series ranging from less than $\frac{3}{8}$ inch cubed (one milliwatt output) to slightly less than one inch cubed (over 100 milliwatts). Each series is manufactured in both open and cast construction, making a total of 16 basic types... 32 models. Designed for use in the audio and ultrasonic frequencies, these subminiatures will operate over a temperature range of -25° C to 100° C, with the cast units being particularly resistant to moisture and other environmental contamination. For your special applications, our engineers will design models to your detailed specifications.

Write for literature! Let our sales and design engineers help you with your specific transformer, magnetic amplifier or pulse network problems.

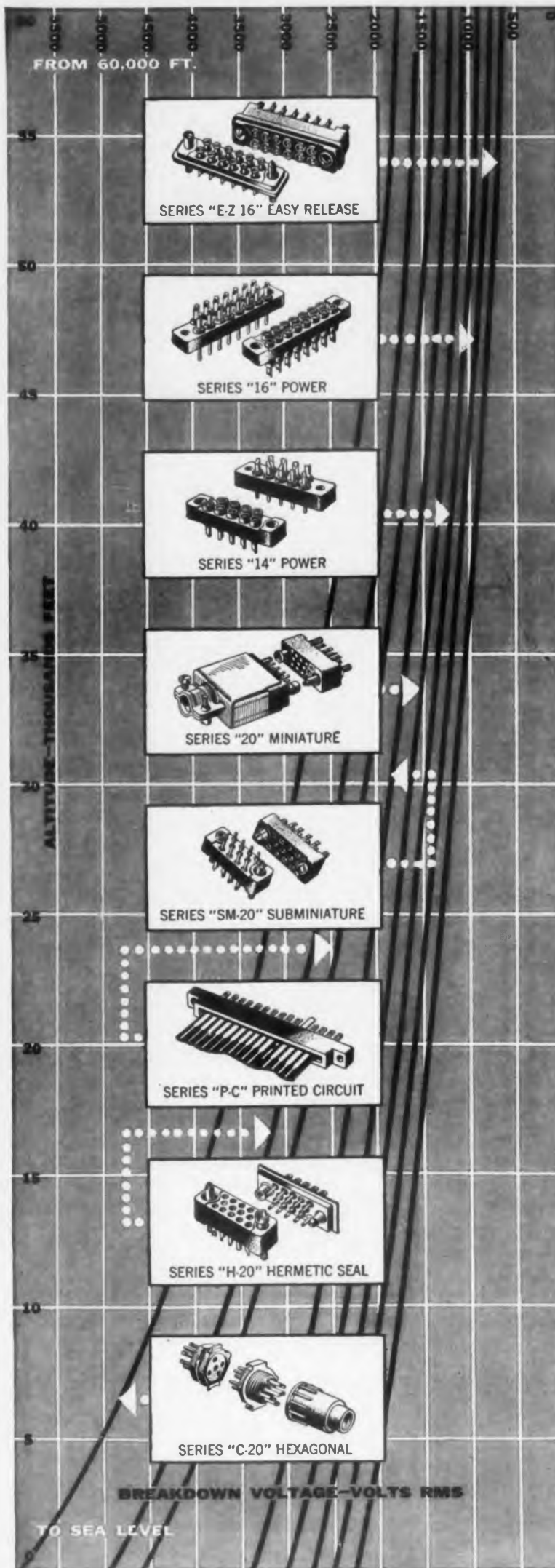
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Write for Engineering Literature, Series P-C, to Department EDPC8, DeJUR-Amsco Corp., 45-01 Northern Blvd., Long Island City 1, N. Y.

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Meetings

August 25-27: 1954 Western Electronic Show and Convention, Pan-Pacific Auditorium and Ambassador Hotel, Los Angeles. For information, write to WESCON, 344 North La Brea Ave., Los Angeles 36, Calif.

September, 1954: International Scientific Radio Union. Amsterdam, The Netherlands.

September 1-16: Golden Jubilee Meeting of the International Electrotechnical Commission, University of Pennsylvania. For information, write to IEC Golden Jubilee Committee, Houston Hall, Univ. of Pennsylvania, 3417 Spruce St., Philadelphia 4, Pa.

September 8-11: Symposium on Radio Propagation and Standards, Boulder (Colorado) Laboratories, National Bureau of Standards. For information, write to T. N. Gautier at the Laboratories.

September 13-24: First International Instrument Congress and Exposition, Commercial Museum and Convention Hall, Philadelphia, Pa. For information, write to A. H. Peterson, Mellon Institute, Pittsburgh 13, Pa.

September 15-17: Symposium on Information Theory, Massachusetts Institute of Technology, Cambridge 39, Mass. Sponsored by the Professional Group on Information Theory, IRE, and others. For information, write to Dr. R. M. Fano, Research Laboratory of Electronics, M.I.T.

September 16-18: Joint Electron Tube Engineering Council, General Conference, Chalfonte-Haddon Hall, Atlantic City, N. J.

September 29-30: Symposium on Industrial Electronics, Mellon Institute, Pittsburgh, Pa. For information, write to Dr. J. B. Woodford, Jr., Electrical Engineering Dept., Carnegie Institute of Technology, Pittsburgh 13, Pa.

October 4-6: Tenth Annual National Electronics Conference, Hotel Sherman, Chicago, Ill. For information, write to R. E. Honacek, Illinois Bell Telephone Co., 208 W. Washington St., Chicago 6, Ill.

October 11-15: AIEE Fall General Meeting, Morrison Hotel, Chicago, Ill. For information, write to AIEE, 33 West 39th Street, New York 18, N. Y.

October 12: Ferromagnetism Conference: Naval Ordnance Laboratory, Silver Springs, Md. For information, write to L. R. Maxwell, U.S.N. Ordnance Laboratory, Silver Spring, Md.

October 13-17: 1954 Annual Convention, Audio Engineering Society, Hotel New Yorker, New York, N. Y. For information, write to C. J. LeBel, P. O. Box 12, New York 11, N. Y.

CIRCLE ED-8 ON READER-SERVICE CARD FOR MORE INFORMATION

October 18-20: *Radio Fall Meeting*, Hotel Syracuse, Syracuse, N. Y.

October 26-28: *National Conference on Tube Techniques*. Western Union Auditorium, 60 Hudson St., New York 13, N.Y. Sponsored by Working Group on Tube Techniques, Dept. of Defense. Papers should be submitted to Dr. Harold Jacobs, Thermionics Branch, Evans Signal Laboratory, Belmar, N.J. For information, write to Harold J. Sullivan, Advisory Group on Electron Tubes, 346 B'way, N. Y. 13, N.Y.

November 4-5: *East Coast Conference on Airborne and Navigational Electronics*. Sheraton-Belvedere Hotel, Baltimore, Md. For information, write to IRE, 1 East 79th Street, New York, N.Y.

November 10-11: *Conference on Electronic Instrumentation and Nucleonics in Medicine*. Morrison Hotel, Chicago, Ill. For information, write to AIEE, 33 West 39th Street, New York 19, N. Y.

November 15-17: *ASA Fifth National Conference on Standards*. Hotel Roosevelt, N.Y.C. For information, write to Public Relations Director, ASA, 70 E. 45th St., New York, N. Y.

November 29-December 3: *First International Automation Exposition*, 242nd Coast Artillery Armory, New York, N. Y. For information, write to First International Automation Exposition, 845 Ridge Ave., Pittsburgh 12, Pa.

December 8-10: *Eastern Computer Conference*, Bellevue-Stratford Hotel, Philadelphia, Pa. The theme of the Conference is, "Design and Application of Small Digital Computers". For information, write to Eastern Joint Computer Conference, P. O. Box 7825, Phila. 1, Pa.

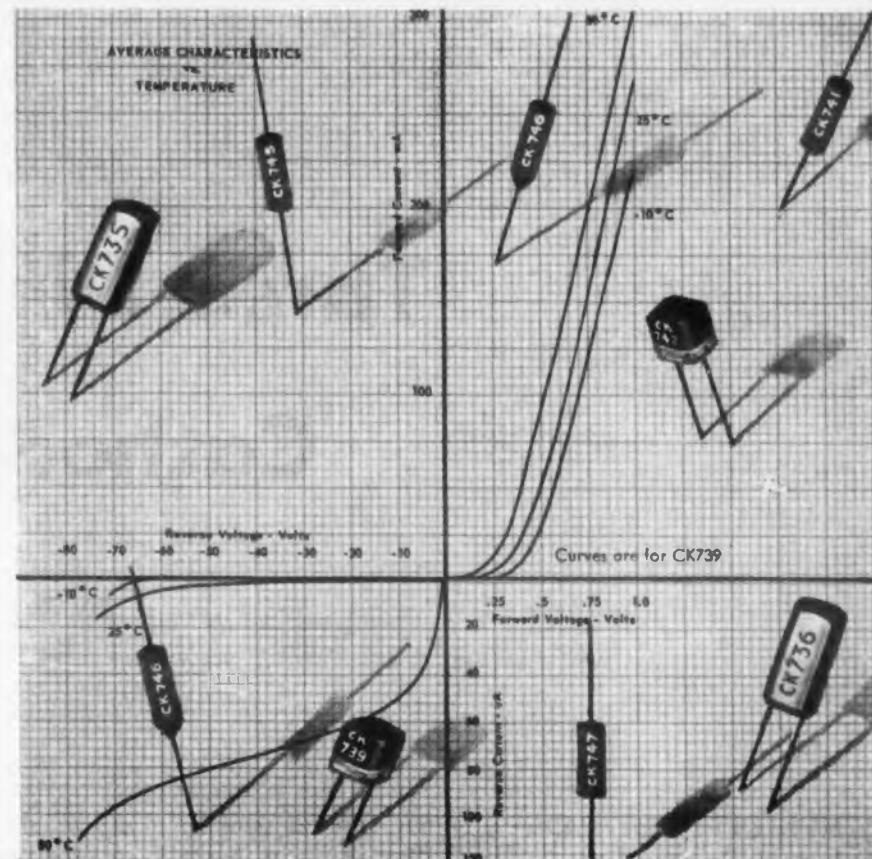
January 17-19: *High Frequency Measurements Conference*, Hotel Statler, Washington, D. C. Sponsored by AIEE and IRE. One-hundred-word abstracts of papers to be submitted should be sent to the chairman of the appropriate session listed as follows: Frequency and Time Measurements, Dr. B. M. Oliver, Hewlett-Packard Co., 395 Page Mill Road, Palo Alto, Calif.; Power and Attenuation Measurements, E. W. Houghton, Bell Telephone Laboratories, Murray Hill, N. J.; Impedance Measurements, Dr. D. D. King, Johns Hopkins Univ., Baltimore, Md.; and Measurements in Transmission and Reception, B. Parzen, Olympic Television and Radio Co., 34-01 38th Ave., Long Island City 1, N. Y. For information, write to AIEE, 33 West 39th St., New York 19, N. Y.

January 31-February 4, 1955: *AIEE Winter General Meeting*, Hotel Statler, New York, N. Y. For information, write to AIEE, 33 West 39th St., New York 19, N. Y.



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Type	Minimum Forward Current at +1 Volt (ma.)	Maximum Reverse Current			Maximum Avg. Rectified Current (ma.)	Maximum Peak Rectified Current (ma.)	Peak Inverse Voltage (volts)	Max. Avg. Power Dissipation (mw.)
		at -10 Volts (μa.)	at Voltage Shown	μa. volts				
CK735	5	0.01	—	—	30	150	15	125
CK736	3	0.1	.5	-50	20	150	70	100
CK738	1	0.1	1.0	-100	20	150	125	100
CK746	2**	2.0	50	-50	15	125	60	100

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		at -10 Volts (μa.)	at Voltage Shown	μa. volts				
CK739	100*	2	20	-50	125	300	60	125
CK740	100*	2	—	—	150	300	15	150
CK741	300	—	500	-8	100	350	8	50
CK742	100	5	20	-100	50	300	125	50
CK745	15	20 at -20 volts	100	-100	40	100	125	40
CK747	100	—	100	-20	100	300	40	100

*Measured at 0.8 volt maximum. **Measured at 1.5 volts maximum. All of the above ratings are at 25°C



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CIRCLE ED-9 ON READER-SERVICE CARD FOR MORE INFORMATION

Three-Dimensional Displays On Cathode Ray Oscilloscopes

by S. Meyers, C. Laskin, and D. Schachet,
Ketay Manufacturing Co., New York, N. Y.

SIMPLICITY and adaptability to compact packaging are outstanding features of a recently developed method of presenting three-dimensional displays of data on a cathode ray oscilloscope. This type of display is useful in radar, sonar, and remote control applications as well as in human engineering and medical research investigations. It can also be valuable as a design tool in presenting vacuum tube or transistor characteristics in a three-dimensional display. Great clarity of detail in the analysis of the input data can be achieved, and the variation in any one of three parameters can be readily observed.

Essentially the system consists of an analogue computer employing four resolver synchros, a control box, and an oscilloscope. The resolvers multiply three variables by direction cosines in such a way that the coordinates of a point in a three-dimensional space are rotated. The following explanation presents the basic idea mathematically.

Consider a point in Cartesian coordinate system, the coordinates being E_x, E_y, E_z . The object being (1) to view the data represented by the coordinates from a direction defined by an azimuth angle ϕ and an elevation angle θ , and (2) to see the data presented

as a projection on a normal plane so oriented that the picture is still level, i.e., so that the new X axis in the projection plane still lies in the old XZ plane. See Fig. 2.

To rotate a set of coordinate axes, the new coordinates $E_x', E_y',$ and E_z' may be represented as follows:

$$\begin{aligned} E_x' &= L_1 E_x + M_1 E_y + N_1 E_z \\ E_y' &= L_2 E_x + M_2 E_y + N_2 E_z \\ E_z' &= L_3 E_x + M_3 E_y + N_3 E_z \end{aligned}$$

Where L_1, M_1 and N_1 are the cosines of the angles the X' axis makes with the old $X, Y,$ and Z axis, respectively. Similarly, this relation applies to Y' (l_2, m_2 and n_2) and Z' (l_3, m_3 and n_3). Electrically this means taking some fraction of l_1 of E_x , and adding a fraction m_1 of E_y and n_1 of E_z . Apply this result to the cathode ray tube as the X deflection voltage. Similarly, use corresponding fractions $l_2, m_2,$ and n_2 of the original voltages for the Y deflection voltage, and the tube will automatically plot the projection of the data on a new arbitrarily rotated $X'Y'$ plane.

The required objects, as stated above, may be simply achieved by using resolvers upon which the angle is set and the output is the required sine or cosine product.

Consider first the rotation about the Y axis (the azimuth angle ϕ) thus:

$$\begin{aligned} E_x' &= E_x \cos \phi + E_z \cos 90^\circ - E_z \cos (90^\circ - \phi) \\ E_y' &= E_y \\ E_z' &= E_x \sin \phi + E_z \cos 90^\circ + E_z \cos \phi \end{aligned}$$

or:

$$\begin{aligned} E_x' &= E_x \cos \phi - E_z \sin \phi \\ E_y' &= E_y \\ E_z' &= E_x \sin \phi + E_z \cos \phi \end{aligned}$$

Fig. 1. The complete equipment required for a three-dimensional display includes an oscilloscope (left), a power supply for the resolvers, and the four-resolver assembly. A display is shown on the oscilloscope screen.



This double an ele view is Thus:

$$\begin{aligned} E_x'' \\ E_y'' \\ E_z'' \end{aligned}$$

or:

$$\begin{aligned} E_x'' \\ E_y'' \\ E_z'' \end{aligned}$$

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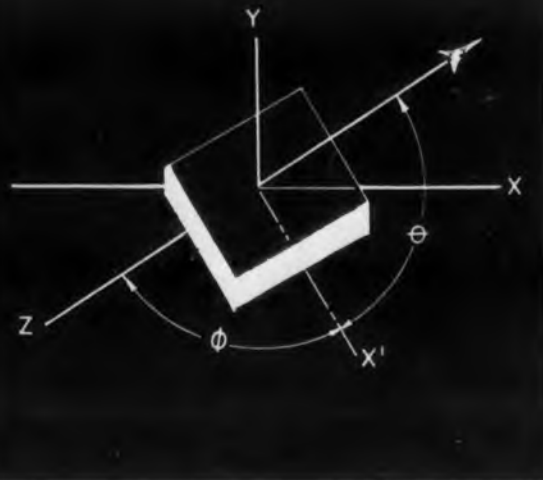
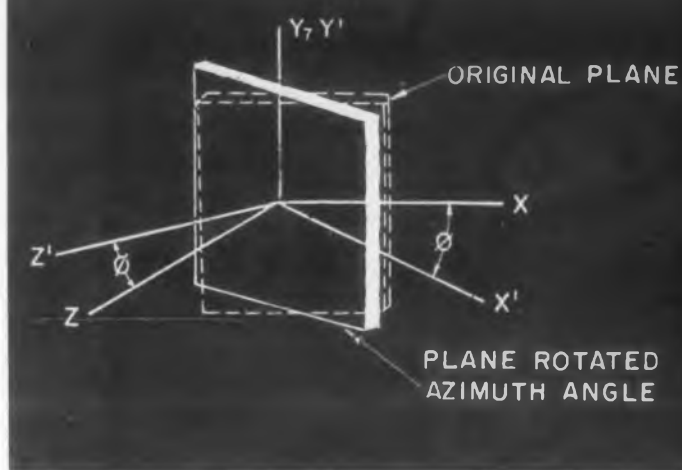


Fig. 2. Two-dimensional data can be made to appear three-dimensional by rotating the plane through the azimuth angle ϕ .

This new coordinate system is now rotated to a new double primed system where the Z' axis is rotated by an elevation angle θ about X' . The desired line of view is along the original Z axis.

Thus:

$$\begin{aligned} E_x'' &= E_x' \\ E_y'' &= E_y' \cos \theta + E_z' \sin \theta \\ E_z'' &= E_y' \sin \theta + E_z' \cos \theta \end{aligned}$$

or:

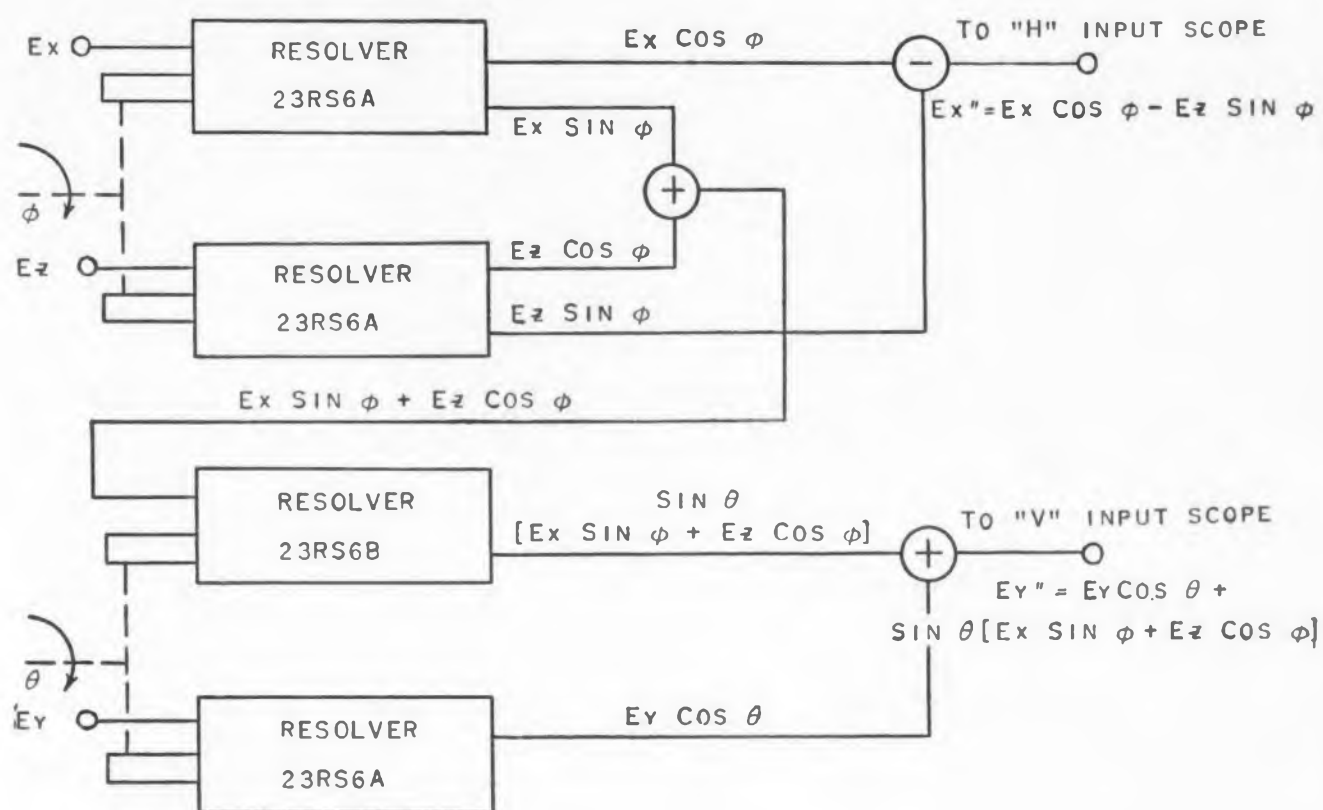
$$\begin{aligned} E_x'' &= E_x \cos \phi - E_z \sin \phi \\ E_y'' &= E_y \cos \theta (E_x \sin \phi + E_z \cos \phi) \\ E_z'' &= -E_y \sin \theta + \cos \theta (E_x \sin \phi + E_z \cos \phi) \end{aligned}$$

Since it is desired to show the projections on the $X''Y''$ plane, we put the E_x'' and E_y'' voltages on the oscilloscope deflection plates, and therefore do not need the E_z'' voltage. The E_x voltage may be used for intensity modulation to simulate depth perception.

Fig. 1 shows the equipment. Flange-mounted resolvers are arranged so that they can be rotated to the necessary angles θ and ϕ ; or they can be driven directly if necessary. The control box in the center contains input and output terminals, "summers" and a "difference taker". These units add or subtract the outputs of the resolvers as shown in the block diagram. They can be transformers, amplifiers, or resistance boxes.

Using resolvers to produce three-dimensional displays offers the designer a number of advantages. The units have a very long life and afford infinite resolution. Their input and output impedance characteristics make them especially suitable for use with amplifiers. Finally, by using miniaturized resolvers, the three-dimensional display system, exclusive of the cathode ray oscilloscope, can be packaged to fit in about 20 cu in of space.

Block diagram of the system showing the various functions generated by each resolver and where the results are applied to the oscilloscope.



OBJECT: TO PRESENT 3D INFORMATION ON A C.R.O.

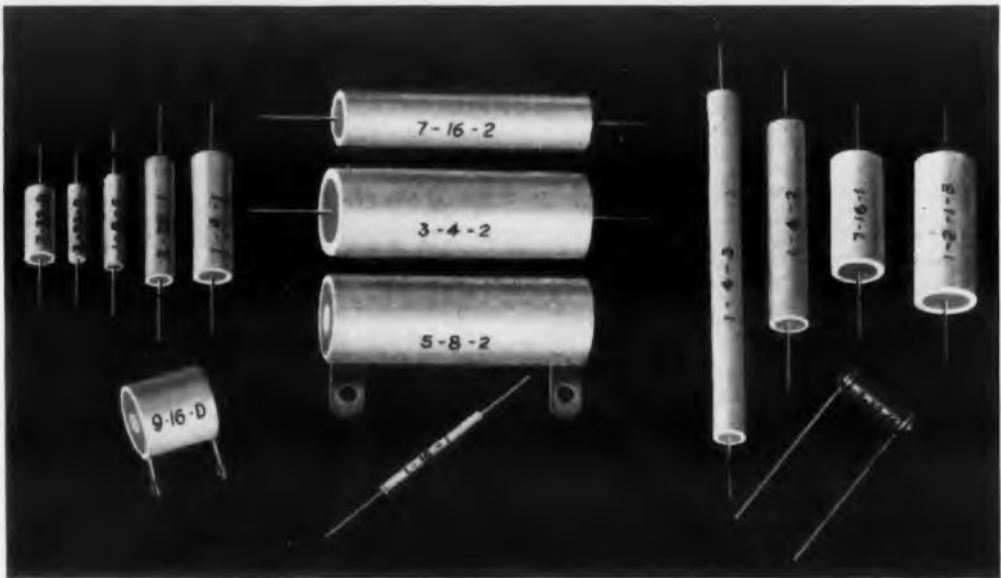
THEORY: 3D VIEW IS OBTAINED BY VIEWING INFORMATION ALONG Z AXIS AND ROTATING COORDINATE SYSTEM BY AN AZIMUTH ϕ , AND AN ELEVATION θ . TRANSFORMING THE ORIGINAL COORDINATES E_x , E_y & E_z YIELD:

$$E_x'' = E_x \cos \phi - E_z \sin \phi$$

$$E_y'' = E_y \cos \theta + \sin \theta [E_x \sin \phi + E_z \cos \phi]$$

METHOD: E_x'' IS APPLIED TO "H" INPUT, & E_y'' IS APPLIED TO "V" INPUT OF C.R.O. E_x'' & E_y'' ARE OBTAINED BY ILLUSTRATED RESOLVER COMPUTING CIRCUIT.

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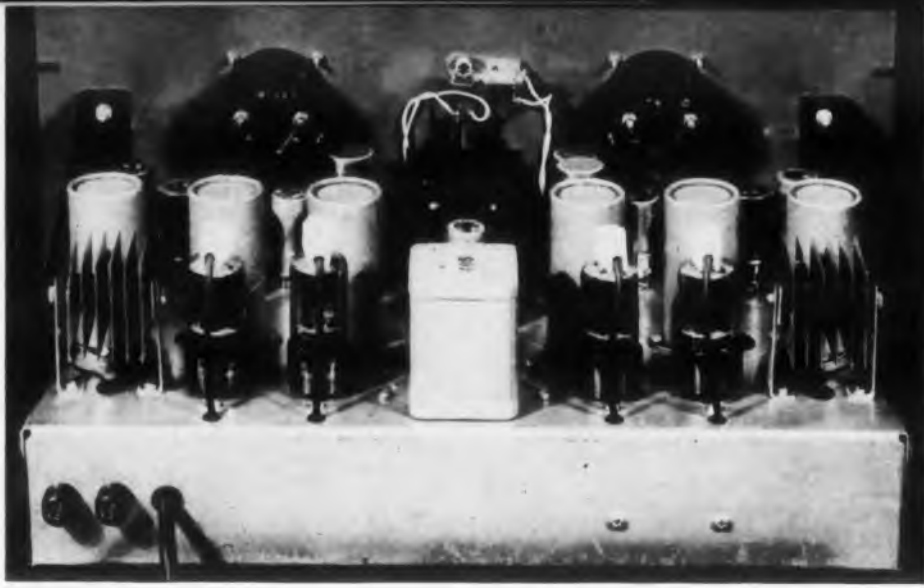
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CIRCLE ED-11 ON READER-SERVICE CARD FOR MORE INFORMATION



A low-voltage, high-current power supply constructed according to the design described.

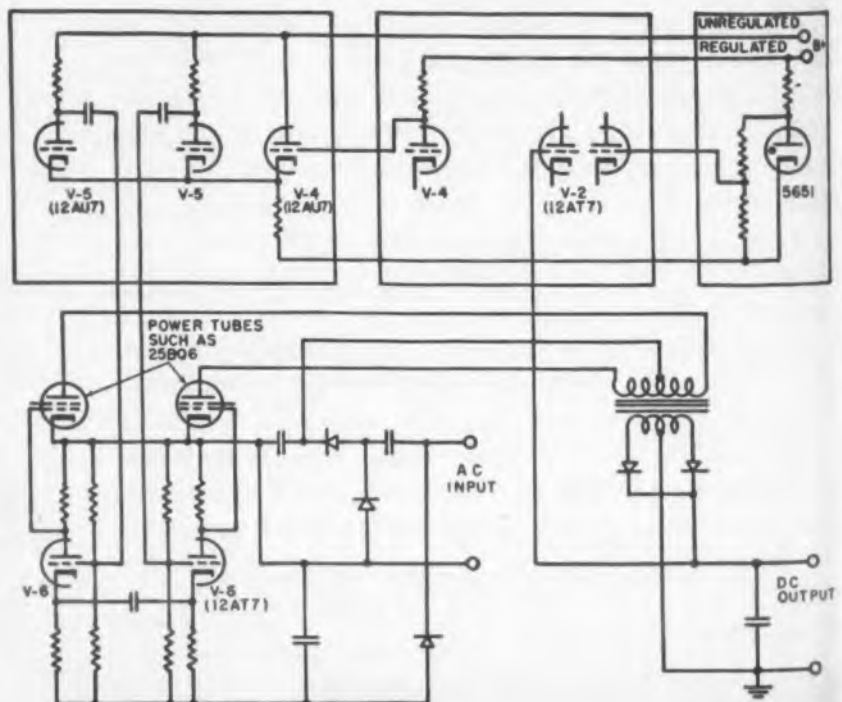
A New Power Supply Design

by Charles H. Richards and William A. Geohegan
Hanover Developments, New York, N. Y.

THE DESIGN of regulated d-c power-supplies for low-voltage, high-current output demands entirely different techniques from those employed for equivalent power at high voltage and low current. An output of 30w at 150ma and 200v, for example, with a high degree of regulation and low ripple content, can be obtained from a conventional regulator with a feedback amplifier and a 6AS7G as the series

tube. But for the same power output at 6v, 5amp, such an arrangement would require 20 6AS7G's in parallel, with heater power of 315w, plate dissipation of 200w, and a d-c plate supply of about 50v at 5amp.

In the technique described here, the power is generated at high frequency, high voltage, and low current, and coupled to the output through a transformer and rectifier. The feedback amplifier compares the



Circuit diagram for the power supply shown in the photograph.

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output with a d-c reference voltage and regulates the high frequency output of the power tubes. Thus, in effect, they also perform the functions of the usual series regulator tube, regulating the d-c output voltage and effectively removing 60cy ripple.

Because the output of the power tubes is a constant voltage high frequency, small components suffice for both the output transformer and filter. A further advantage of the high frequency in reducing size and weight is that it permits the use of a transformerless power supply for the output tubes without grounding restrictions.

The simplified wiring diagram illustrates the principal features. A multivibrator running at about 20kc supplies square wave signals 180° out of phase to the grids of V-5. The upper d-c level of these signals is fixed, so that very small differences between the output voltage and the d-c reference, acting through the differential amplifier on the cathode of V-4, can vary the signals on the plates of V-5 from zero to full value. When the output is grounded, there may be superimposed between these plates and the grids of V-6 an unwanted common 60cy signal of full line voltage. This unwanted signal is attenuated by using small coupling capacitors, which are still large enough to pass the high frequency without loss, and by the differential amplifier V-6. This amplifier has a very low gain for common signals of low frequency, but a substantial gain for differential signals of high frequency, so that the effect on output ripple is negligible.

A small transformer and rectifier supply plate power for V-4 and V-5 and, through a small series type regulator, the multivibrator and differential amplifier. The 5651 acts as the reference for this regulator and, since it is supplied from the regulated side, it provides a highly stable reference source for comparison with the output. The heaters of V-2 are run from the regulated 6v output to minimize drift due to heater voltage changes.

A typical unit, employing these techniques, supplies 6v, 5amp, weighs only 13 lb, and occupies a space only 10" x 12" x 9" high. It can also be constructed for mounting on a relay rack. The output varies less than 0.05% for line voltage changes from 105 to 125v, and the total ripple is less than 2mv. The design is highly flexible and lends itself to almost any combination of voltage and current, or to multiple outputs isolated from each other and from ground.

Write for Bulletin MP 10



MICROSYN POSITION INDICATORS linearly transform an angular displacement into an electrical signal for application in fire control systems and gyro instrumentation.

Resolution to less than 1/100 of 1 degree

Write for Bulletin CFG 10



CAGEABLE FREE GYROS are designed expressly for guided missile applications. They are available with either Synchro or Potentiometer type pickoffs.

Drift is less than $\frac{1}{4}$ degree/minute

Write for Bulletin SM 10



SERVO MOTORS two-phase, 115 volt, 400 cps fulfill the requirements of MIL-S-17087 (BuOrd). Available in sizes from 1.062 inches O.D. to 1.750 inches O.D.

Acceleration 33,800 radians/second²

Write for
Bulletin
VF 10



VFDD POWER SUPPLY - DEMODULATOR serves as a link between sensing instruments and recording equipment. With the DOEL-CAM Type K Rate Gyros it comprises a complete system for flight evaluation of military aircraft.

Voltage-regulated to 1%
Frequency stabilized to 0.2%
Demodulators linear to 1%

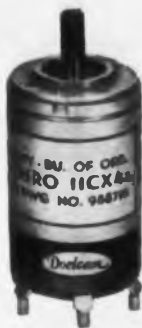
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TYPE K RATE GYROS measure absolute angular rates about any one axis for flight test evaluation or control of aircraft. They are also proven components for use in control and homing systems in guided missiles.

Accurate to 1/4 of 1% of full scale

Write for
Bulletin S 10



SYNCHROS size 11 (1.062" O.D.) 115 volt, 400 cps Control Transmitters and Transformers are approved standard military components (MIL-S-16892). Other sizes and types are also available.

Average electrical error — 5 minutes of arc

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IN EVIDENCE of the exceptional performance of DOELCAM *Master-precision* components, a measure of accuracy is presented with each unit illustrated. Tested and perfected for military use, DOELCAM electromechanical instruments for measurement and control are now standard components in automatic pilots, guided missiles, airborne instrumentation and fire control computers. DOELCAM's expanded manufacturing facilities now make it possible to offer these *Master-precision* components in production quantities for military applications. An outstanding engineering staff with broad experience in the field of instrumentation is available for assistance on your specific problem. For more detailed information — *write for bulletins.*

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SOLDIERS FIELD ROAD, BOSTON 35, MASS.

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Instruments for Measurement and Control

Synchros • Gyros • Servos • Microsyns • Servo Motors

More Reliability in less space without external DC Power Supply



This compact plug-in Type SAI18H Amplifier is primarily designed for analog computer servo loops. Its excellent reliability is the result of a circuit design which allows operation directly from the output of a tapped transformer—no external DC supply is required. A single input-power winding will supply multiple amplifiers. Output, when used with Servomechanisms, Inc. Type 17ID motor (below), is 100 Volts at 400 cps (max.). Voltage gain, with an input of 0.01 V ac (rms) at 400 cps, is 7300 ± 25 percent. Damped natural frequency approximates 10 cps in a typical servo loop.

Hermetic sealing and silicone fluid filling allow for rapid heat dissipation and cushion against shocks and vibration.

This remarkably small and light amplifier—Type SAI18H—is a culmination of our years of leadership in the design of amplifiers.



Servomechanisms, Inc. Type 17ID, for use with the amplifier, is a damped-control motor whose control winding is the output load for the amplifier.



For additional information

Write to:

Westbury Division, Post and Stewart Avenues, Westbury, N. Y.

West Coast Division, 316 Washington Street, El Segundo, California

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

"Printed" Amplifier Subassembly

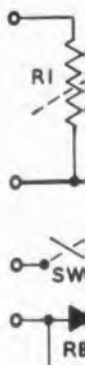
ECONOMIES in the design and production of radios, phonographs, TV receivers, and inter-communication systems can be achieved through the use of the low-cost, compact printed-wired audio amplifier subassembly shown in Fig. 1. Only 2-1/2" wide x 4-1/8" long x 1-3/4" deep, exclusive of control shafts, this two-stage unit produces up to 2w output, sufficient for many audio applications. It can be used as an amplifier by itself, or incorporated into equipment as a subassembly.

The circuit diagram of the amplifier is shown in Fig. 2. Its frequency response is flat to 8000cy. Maximum input voltage is 0.2v and power requirements of the unit at 115v, a-c or d-c, are 24w. The tube complement consists of a 12AT6 as a voltage amplifier and a 50C5 in the output stage. Addi-

Fig. 1. Bottom and top views of the printed-wired amplifier.



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G.E. CONTINUES INDUSTRY LEAD WITH NEW GOLD BONDED GERMANIUM DIODES

- High Forward Current Characteristics
- High Peak Inverse Voltage
- High Back To Forward Resistance Ratio
- High Frequency Response

EXACTING military specifications provided the impetus for G-E's design of these new gold bonded germanium diodes. But, their application is certainly not limited to government use. Each superior characteristic points up a potentially broad market in commercial equipment.

Here, then, you have an indication of General Electric's planned program to supply *high quality germanium products for every conceivable user requirement.* It will benefit you to examine not only these new units but to become familiar with all of the many diodes, rectifiers and transistors G.E. manufactures. Call us or mail the coupon below for detailed information.

 **Germanium Products**
TRANSISTORS • DIODES • RECTIFIERS

G-E Type Number	1N139	1N140	1N141	1N142	1N143
Forward Cur. (a) +1v (MA)	20	40	20	5	40
Maximum Reverse Cur. (a) -50v (μ a)	1500	300	50	—	—
(a) -100v (μ a)	—	—	—	100	100
Peak Inverse Voltage (Volts)	50	85	85	125	125
Cont. Reverse Voltage (Volts)	40	70	70	100	100
Cont. DC Forward Current (ma)	70	85	70	60	85
Peak Oper. Cur. (ma)	250	350	250	200	350
Surge Cur. for 1 Second (ma)	500	750	500	400	750
Ambient Temperature Range	-50°C to +80°C				
Derating above 25°C	10mw/10°C				
Average Shunt Capacitance	0.9 μ fd				
Average 100mc Rect. Eff.	46%				

tional tubes may be included in the series filament circuit, in which case a corrected value of filament resistor (R9) is required. If desired, a phono jack can be provided in the output. The connections are usually soldered. The manufacturer will make other modifications of the basic design to suit individual needs. A selenium rectifier is employed.

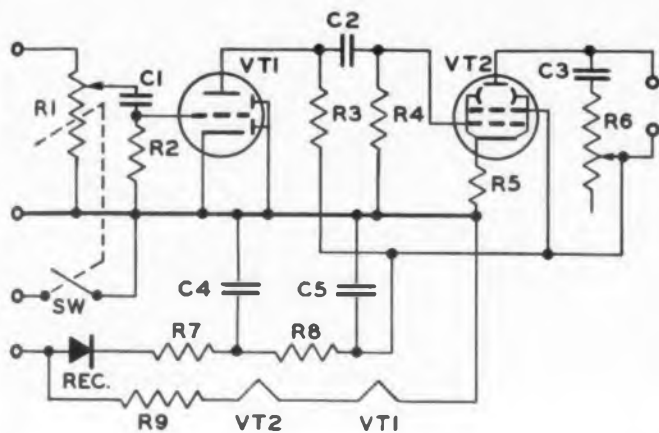


Fig. 2. Basic circuit of the amplifier. It can be modified to suit individual needs.

A volume control and a switch tone control are incorporated in the amplifier. The manufacturer, Photocircuits Corporation, Glen Cove, L. I., N. Y., has under development a second unit of the same dimensions as the amplifier composed of a phase inverter and an additional power stage. When this unit and the audio amplifier are used together, push-pull output is obtained.

Use of printed wiring techniques, dip soldering, and components especially suited for printed wiring makes it possible to produce the amplifier at relatively low cost. Being compact and completely self-contained with its own power supply, the amplifier should find wide application. For more information on these cost-cutting subassemblies, turn to the Reader-Service Card and circle **ED-322**.



GOLD WHISKER

DIMENSIONS:

CASE: Diameter .220 \pm .005 by 1/2 inch maximum length.

LEADS: 1 inch minimum with .020 diameter.

PINS: 1/8 inch length with .079 \pm .001 diameter.

General Electric Company, Section X7484
Electronics Park, Syracuse, New York
Please send me complete specifications on the new G-E Gold Bonded Diodes.

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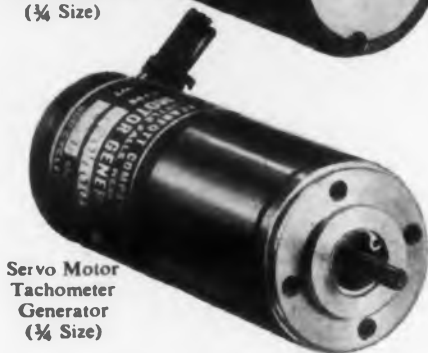
**Where
in Hades
can I use
them!**



Synchro Control
Transformer
($\frac{1}{4}$ Size)



Geared
Servo Motor
($\frac{1}{4}$ Size)



Servo Motor
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Visit the Kearfott display at the Western Electronic Show and Convention, August 25-27 at the Pan-Pacific Auditorium, Los Angeles, Calif., and the first International Instrument Congress & Exposition, September 13-24, Philadelphia, Pa.

Kearfott now offers Servo Motors, Synchros, and Servo-Motor Generators able to operate continuously in temperatures up to 185 degrees C. They are the same size and weight, and have the same characteristics as standard Kearfott Motors, and may be operated with them interchangeably. Besides the use of a new high-temperature insulating material, the stainless steel bearings, laminations and housings enable them to resist corrosion accelerated by high temperature operation.

Complete technical information on these and other Kearfott Components is available in bulletin form. Write today.



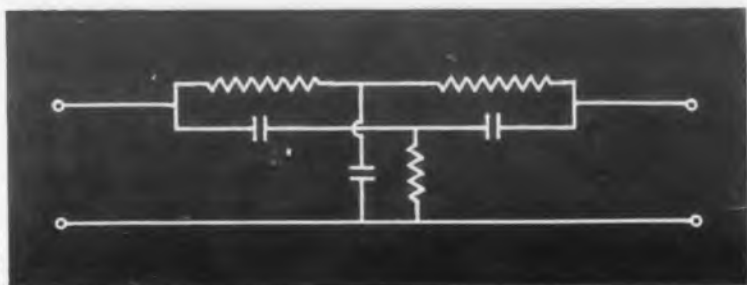
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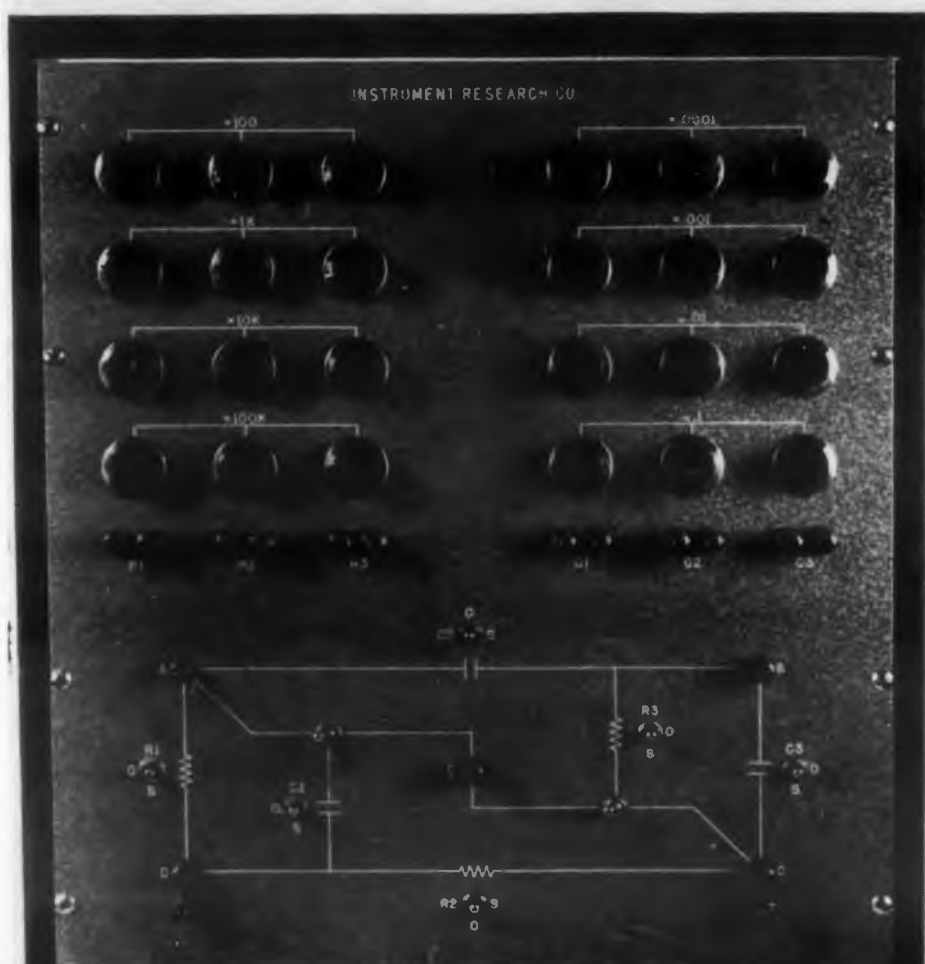
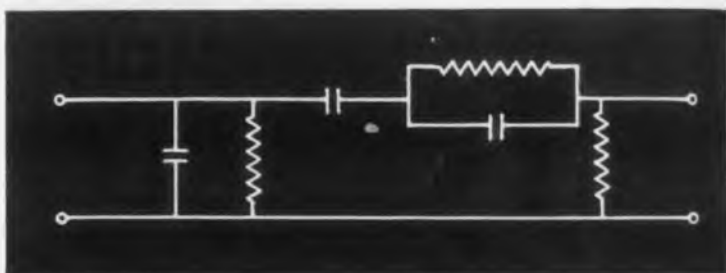
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CIRCLE ED-15 ON READER-SERVICE CARD FOR MORE INFORMATION

Network Design Board



Sample circuits that can be set up and evaluated with the design board.



The Model P100 Network Board in a standard relay rack mounting.

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RAPID evaluation of R-C circuits is made possible with the Model P100 Network Board illustrated in the photograph. Incorporating three resistance and three capacitance decade units, the instrument will facilitate the design of equalizer, feedback, coupling, tuning, comparison, phase-shift, and by-pass as well as many other circuits.

Each resistance unit covers the range from 0 to 1,111,000 ohms in 100-ohm steps. Each capacitance unit offers 0 to 1.111mfd capacity in 0.0001mfd steps. The panel switching circuit, which displays the possible series and parallel decade connections, permits the rapid connection of numerous R-C circuits incorporating 2, 3, 4, 5, or all 6 decade units. Binding posts can be used for the insertion of other components such as rectifiers, audio oscil-



New Instruments and Components to Aid in Design and Reduce Costs

by

TECHNITROL

Unique Variable Pulser is Valuable Laboratory Aid

The Technitrol Variable Pulser is a reliable, versatile instrument which converts the output of a laboratory oscillator into a series of pulses.

One use has been as a low pulse rate device to study the response of components and networks to isolated pulses. Another use has been as a variable pulse rate source to study P.R.F. sensitivity. Still another use has been as a constant high frequency source for a temporary clock pulse generator.

Characteristics

- Wide range of frequencies from 2 cps. to over 2.0 mcs.
- Pulse characteristics optimized with rise and fall times approximately 0.04 μ s. and 0.06 μ s. respectively.
- Duration of pulse variable from 0.2 μ s. to 5.0 μ s. in steps of 0.1 μ s.
- Accurate, stable pulse duration controlled by electric delay lines.
- Amplitude continuously variable without distortion from 0 to 45 volts.
- Trigger pulse precedes output pulse to synchronize oscilloscopes, etc.

Tiny Encapsulated Pulse Transformers Wound to Your Requirements

Technitrol Pulse Transformers are wound on ferrite cores and cast in resin to form a $\frac{3}{4}$ " sealed unit.

Type TE has 2-inch pigtail leads of No. 20 wire. Type TP has 7-pin plug-in for miniature tube sockets. Lends itself admirably to printed circuits where holes can be drilled in the circuit board, the transformer plugged into these and the pins soldered to the circuit leads on the side opposite the body of the transformer.

Very Compact Delay Lines Designed to Fit Your Need

A Technitrol Delay Line—with not more than $\frac{1}{4}$ " diameter and $6\frac{1}{4}$ " length, or in a package—will be designed for your particular circuit application. A variety of mountings offers you a wide choice.

- Delay: 0.01 to 1.6 μ s.
 - Characteristic Impedance: 400 to 2500 ohms.
 - Wide Frequency Response: 0.5 μ s. at 1200 ohms.
3 db down at 5 mcs
6 db down at 8 mcs
10 db down at 10 mcs
- Continuing intensive research and development is expected to make available even greater band-widths.
- Linear Phase: to 9 mcs and beyond

MORE INFORMATION ON REQUEST

TECHNITROL ENGINEERING COMPANY

2751 N. 4th St., Philadelphia 33, Pa.

Write Dept. D-7

Send Bulletin

- 186 Variable Pulser
 166 Pulse Transformers
 174 Delay Lines

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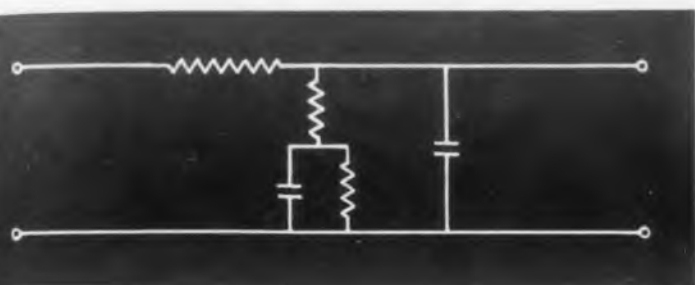
COMPANY _____

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CITY _____

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



lators, external switches, etc., at any point in the circuit under consideration. Decade units not in the circuit can be utilized for other subsidiary circuits. Voltages can be monitored at any point in the circuit through standard jack terminals.

A 3-position lever switch is provided for each decade unit that can open the circuit, short the circuit, or insert the associated decade at the point in question. With the switch either on open (O) or short (S), the associated decade is isolated from the panel circuit, and is available at the decade binding posts for substitution elsewhere. In addition to the six 3-position switches, two function switches are provided that allow a number of series and/or series-parallel connections. The panel itself may be grounded or left floating as required. Three samples of the type of circuits available from this instrument are shown on these pages.

The decades employ low-noise, metal-film resistors of 1% tolerance and precision capacitors rated at 600v d-c working voltage. These capacitors are selected and matched to better than 2% tolerance. Each decade unit has four dials to cover its range of values. Panel dimensions are 19" x 21" for standard relay rack or cabinet mounting. The design board is manufactured by the Instrument Research Company, 371 Harvard Street, Cambridge 38, Mass. For more data on this board, turn to the Reader-Service Card and circle **ED-325**.



**THIS
RELAY
IS FOR
THE
"birds"**



In spite of the fact that we've often wished we had more things non-military to crow about, we've just found another adaptation of our (admittedly military)* Series 73 relay which may have a future in guided missiles that can't be ignored. Quite prosaic—merely as "another" midget SPDT relay. The point is that several others now available about the same size seem to leave something to be desired in vibration resistance and sensitivity.

In this adaptation, coded 73Y, omission of the three-position null-seeking features of the 73X gives a biased polar relay with outstanding abilities at straight switching. It withstands 30 g's at frequencies up to 500 cps, which do not interfere with operation at adjusted sensitivities of 40 milliwatts (e. g. 2.5 ma. in 6400 ohm coil). It operates in less than 1 millisecond without bounce in most circuits, although, having bearings, it is not suitable for extended keying service. Mechanical life is 10,000,000 operations conservatively.

Our occasional pleas for *non-military* uses of sensitive relays should not be construed as a lack of interest on our part in *military* business. So if you think you can use a 73Y in your "bird", get the word on it.

*See "Null-Seeking Shark . . .", January advertisement.

SIGMA

SIGMA INSTRUMENTS, INC.

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

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

Extended-Range Oscillator



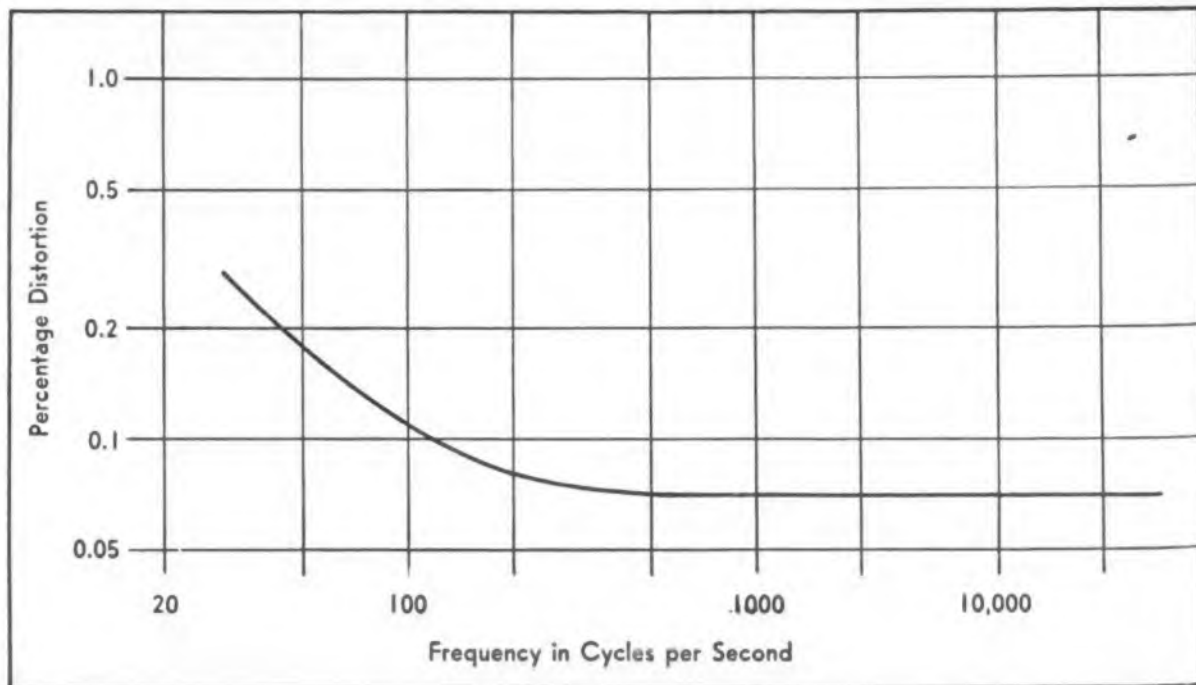
Fig. 1. A cathode-ray-oscilloscope photo of the 1cy output waveform.

LOW-FREQUENCY measurements in the servo-mechanism and computer fields as well as studies of sharply tuned circuits and filters at radio frequencies can all be made by using the compact Model 512 extended-range oscillator. Shown in Fig. 3, this low-distortion oscillator covers the frequency range from 0.9cy to 510ke in five decade ranges plus a bandsread high-frequency range.

Total harmonic distortion is rated at less than 0.1%, rising at low frequencies to 0.3% at 30cy. A curve of distortion vs frequency is shown in Fig. 2. A cathode-ray-oscilloscope photo of the waveform at 1cy output is illustrated in Fig. 1.

Despite its extreme frequency range, the unit provides a maximum output of 2w into 600 ohms,

Fig. 2. Plot of percentage distortion vs frequency in the audio range for the oscillator.



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Fig. 3. The portable Model 512 Oscillator. The concentric frequency scale is 14" long.

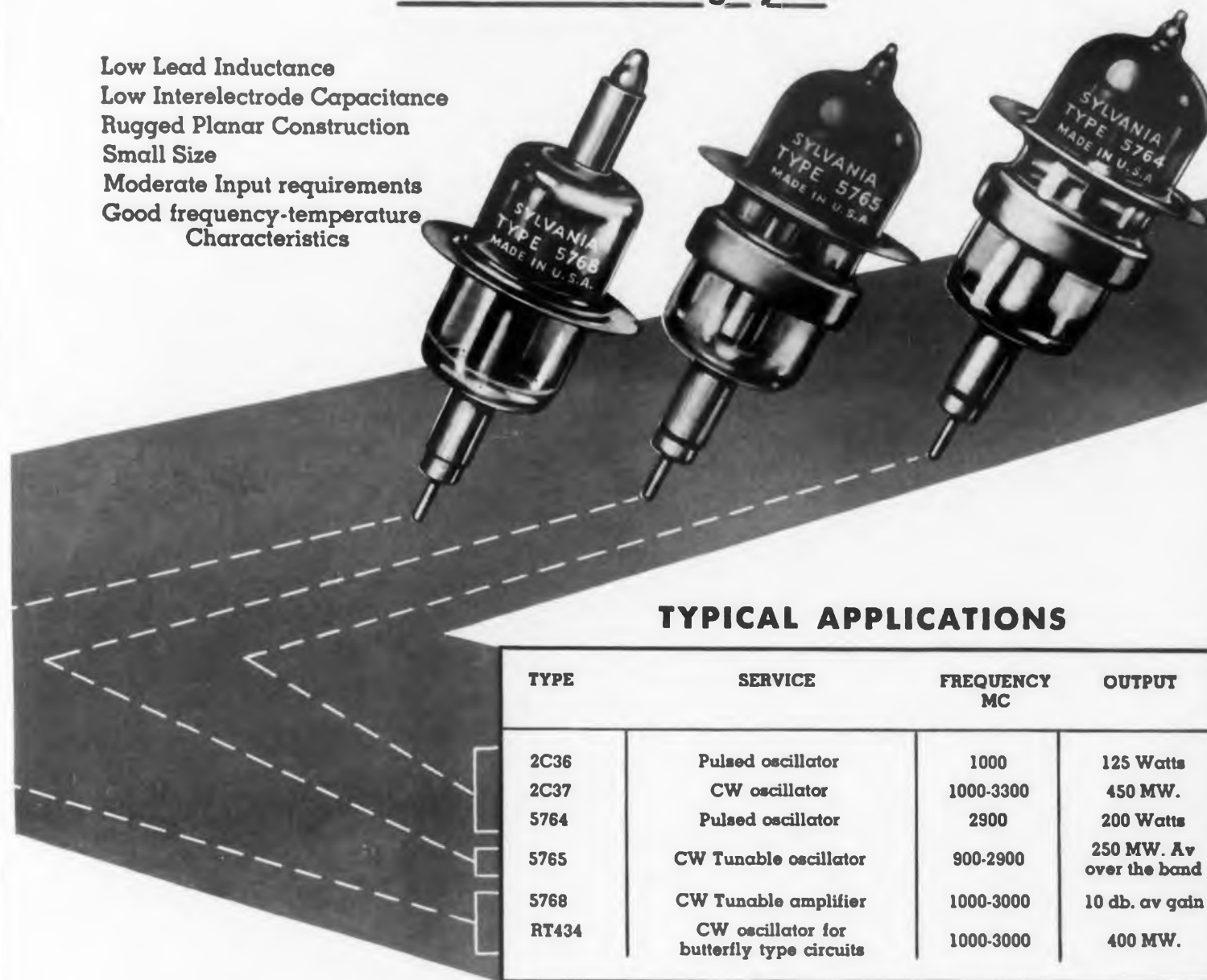
SYLVANIA

ROCKET TUBES

(PLANAR TRIODES)

*The Answer to Efficient Power
at 1000 to 4000 Megacycles*

Low Lead Inductance
Low Interelectrode Capacitance
Rugged Planar Construction
Small Size
Moderate Input requirements
Good frequency-temperature
Characteristics



TYPICAL APPLICATIONS

TYPE	SERVICE	FREQUENCY MC	OUTPUT
2C36	Pulsed oscillator	1000	125 Watts
2C37	CW oscillator	1000-3300	450 MW.
5764	Pulsed oscillator	2900	200 Watts
5765	CW Tunable oscillator	900-2900	250 MW. Av over the band
5768	CW Tunable amplifier	1000-3000	10 db. av gain
RT434	CW oscillator for butterfly type circuits	1000-3000	400 MW.

Still more reasons why it pays to SPECIFY SYLVANIA

For complete information concerning Sylvania Rocket Tubes or other electronic tubes write to Sylvania, Dept. 4E-1403.

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

and 50v into loads of 1200 ohms or more. In addition, a four-step decade attenuator and an output control calibrated approximately in volts provide not only convenient control of amplitude down to extremely low levels (5mv), but also a measure of the output voltage. Source impedance of this instrument is 50 ohms or less, and the hum and noise level is 70db down for each of the attenuator positions. Hum-and-noise content is even lower at higher output levels.

The concentric vernier frequency control makes frequency selection simple. Scale length is 14" for each range. Calibration accuracy of the oscillator is rated $\pm 2\%$, with units having an accuracy of $\pm 1\%$ available on special order. An automatic amplitude control system maintains the output constant within $\pm 1/2$ db throughout the tuning range. Frequency stability for normal variations of line voltage and temperature changes from -20°C to $+50^{\circ}\text{C}$ is better than $\pm 0.5\%$.

Manufactured by Waveforms, Inc., 333 Sixth Ave., New York 14, N. Y., the oscillator measures 8" high x 6-1/2" wide x 8" deep. Provided with a carrying handle and weighing only 12 lb, the unit is conveniently portable. Its tube complement is: three 12B4's, and one each of the 6SJ7, 6AK6, 12AU7, 6BH6, 5Z4, and OA2 tube types. Power requirements are 80w at 117v, 50-400cy line voltage. However, the oscillator will operate satisfactory at line voltages from 105 to 130v.

Other uses of this general-purpose instrument are in the study of low-frequency performance and stability of feedback amplifiers, low-frequency vibration problems, and in the cutoff characteristics of amplifiers at various frequencies. It is also useful for bandwidth determination and magnetic amplifier development. For more information, turn to the Reader-Service Card and circle **ED-316**.

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glass-bonded mica
insulation penetrates
the design barrier
of

temperature endurance!

ALSO OFFERS THESE
IMPORTANT ADVANTAGES—

- VERY LOW THERMAL CONDUCTIVITY
- LOW COEFFICIENT OF EXPANSION
- DIMENSIONAL ACCURACY
- ZERO MOISTURE ABSORPTION
- PERMANENT DIMENSIONAL STABILITY

2000° F
FLAME TEST
FOR 20
MINUTES!



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.



MYCALEX CORPORATION OF AMERICA

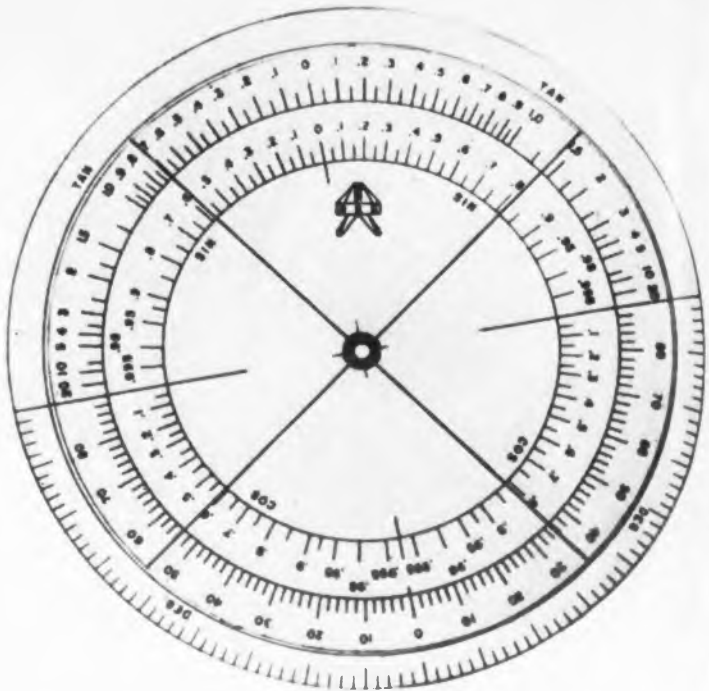
World's Largest Manufacturer of Glass-Bonded Mica Products

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Fig. 1. The Transistor Curve Analyser can also be used for other useful design calculations.

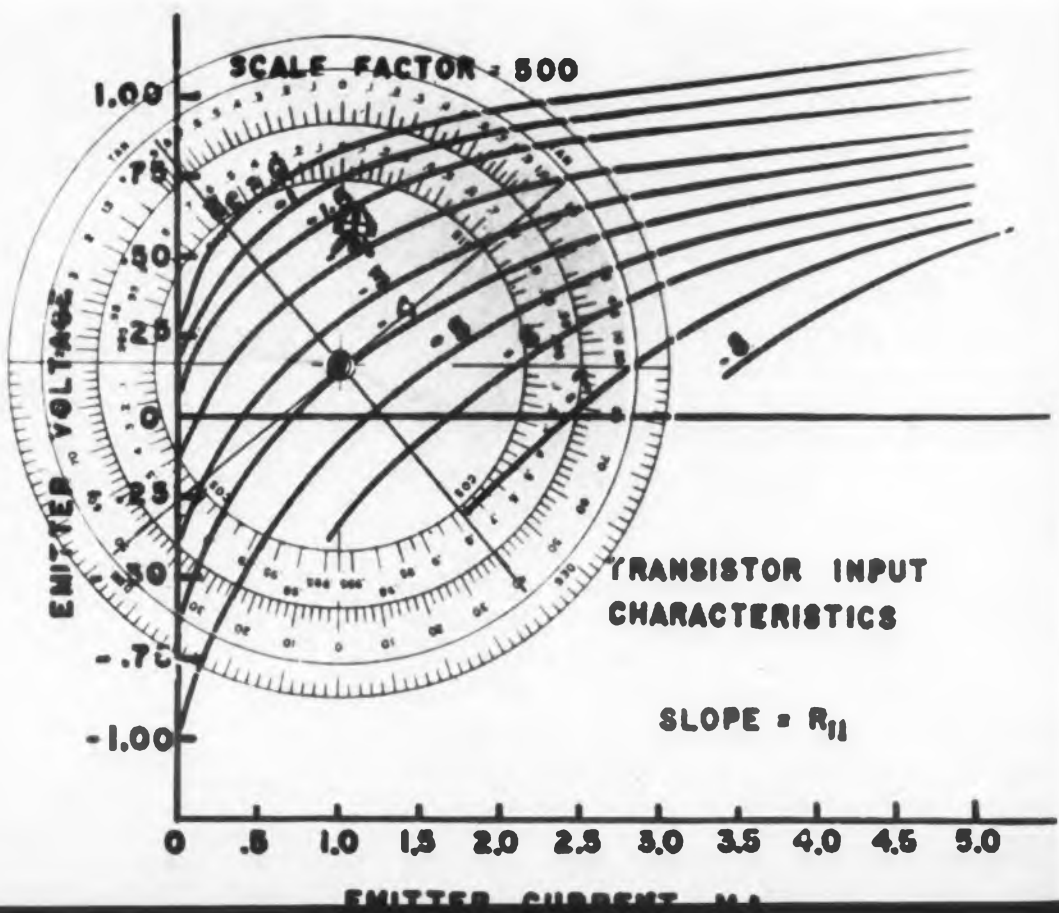


Transistor Curve Analyser

SUBSTANTIAL savings in design time can be realized through use of the Curve Analyser shown in Fig. 1. The device can be used to quickly determine from characteristic curves the equivalent circuit parameters of a transistor, the plate resistance of a triode at the chosen operating point, and the forward and reverse resistances of semiconductor diodes. This information is obtained without drawing pencil lines.

The Curve Analyser, which is made by DKS Electronic Engineering Company, Box 244, Whittier, Calif., consists of two circular, transparent, plastic discs. One disc is slightly larger than the other. These discs can rotate with respect to each other on a common axis. The larger disc contains four trigonometric scales arranged in two circles.

Fig. 2. Using the analyser to determine transistor equivalent circuit values.



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Fig. 3

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The smaller disc has two diameters drawn on it at right angles to each other.

The tangent scale is most useful for obtaining the transistor equivalent circuit parameters. As shown in Fig. 2, the axis of the Curve Analyser is placed on the curve over the operating point chosen by the designer. (This operating point is usually dictated by circuit requirements.) The larger disc is on the bottom, with the tangent scale at the top.

The larger disc is rotated around the operating point so that the longest lines on this disc are parallel to any one of the horizontal cross-hatched lines. The operator holds the large disc from moving and rotates the smaller disc so that one of the lines on this disc is tangent to the curve at the operating point. The slope is read on the tangent scale under the diameter that was not used to set the tangent to the curve. Multiplying the tangent as read above by the curve scale factor gives the input resistance directly in ohms. (The scale factor is simply a vertical voltage division divided by the

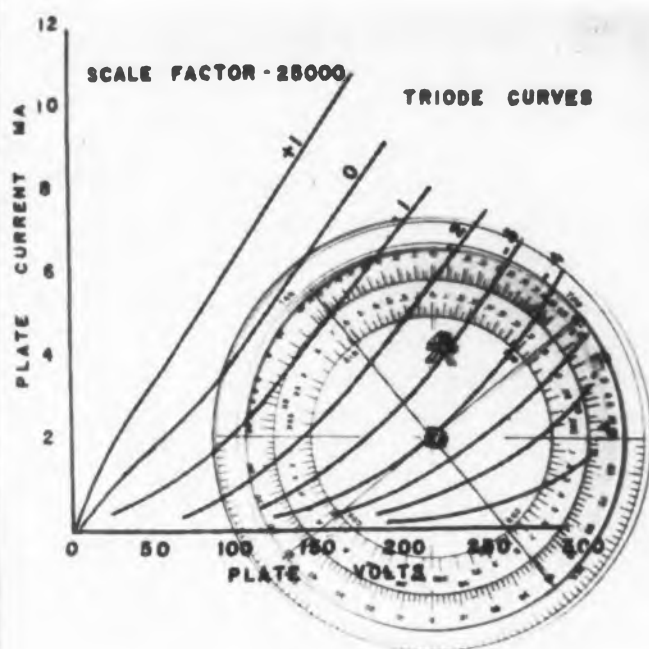
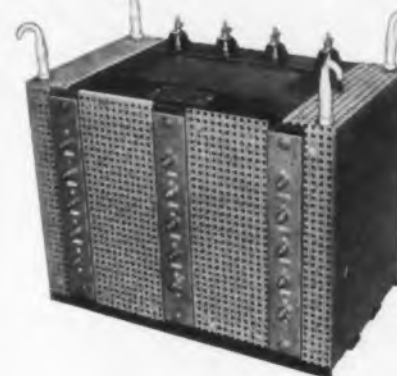


Fig. 3. Determining a triode's plate resistance.

horizontal current division. In Fig. 2, the scale factor is 500. It should be noted at the top of the curve sheet so that it need not be recalculated.)

The same procedure is followed to obtain the other transistor equivalent circuit resistors by using the applicable characteristic curves. After these resistor values have been obtained, the equivalent circuit can be drawn and the expected performance of the transistor can be calculated.

To find the plate resistance of a triode at the chosen operating point as shown in Fig. 3, the procedure is similar to that used to determine transistor equivalent parameters. The Curve Analyser can also be used to find various trigonometric values. For more information on this analyser, turn to the Reader-Service Card and circle ED-323.



SPECIALTY TYPE transformers are now available to industry for applications which require the quality and superior performance characteristics of Moloney Transformers. Engineered to your specifications, tested to your specifications, *performance* to your specifications. Produced in any quantity . . . send your inquiry to us now for prompt attention.

Physical Characteristics: Per MIL-T-27 • Hermetically Sealed • Air Cooled; Class A, B and H • Solder-sealed Bushings • Askarel Filled • Oil Filled.

Write for Bulletin SR-205 describing HiperCore Electronic Cores and Bulletin ST-3505 describing Specialty Transformers.

ME54-B



Moloney HiperCore Electronic Cores are available to manufacturers in any quantity in more than 1000 stock sizes or to your own special specifications.

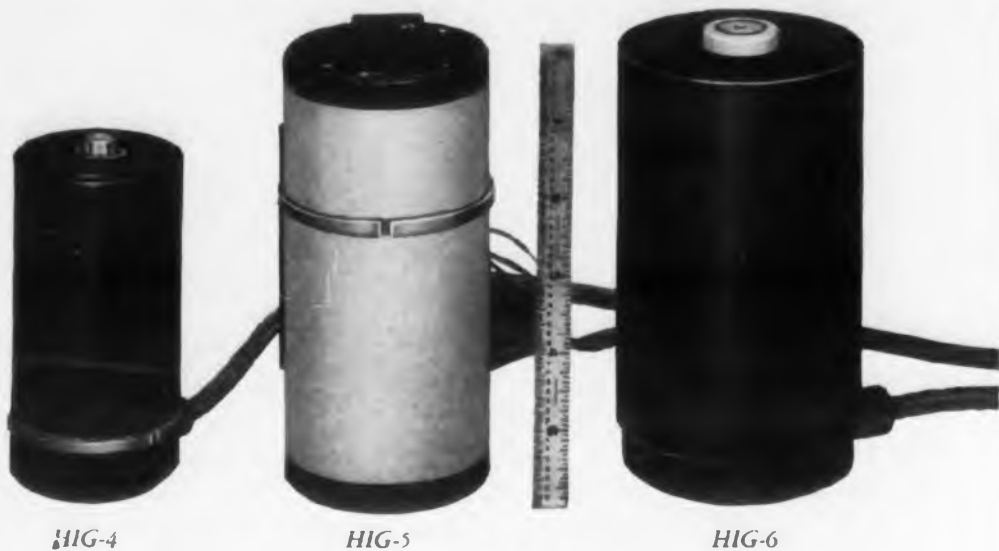
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For full details on the HIG "family" and on our full gyro line, write Honeywell Aero Division, Dept. ED-8-163, Minneapolis 13, Minnesota.

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	<u>HIG-4</u>	<u>HIG-5</u>	<u>HIG-6</u>
Angular Momentum	10^4	10^5	10^6
Threshold	1° per hr	$.2^\circ$ per hr	$.01^\circ$ per hr
Trimmed Drift Rate	5° per hr	1° per hr	$.05^\circ$ per hr
Maximum Precession Rate	5 radians/sec	1 radian/sec	.1 radian/sec
Characteristic Time Constant	3.5 millisec	2.8 millisec	3.1 millisec
Damping Ratio —			
Output Axis/Input Axis	1 to 1	1 to 1	2.1 to 1
Torque Generator Scale Factor	1 or 10 dyne-cm/ma ²	2.5 or 35 dyne-cm/ma ²	.025 or 1 dyne-cm/ma ²
Signal Generator Scale Factor	25 volts/radian at 100ma 400 cps	34 volts/radian at 100ma 400 cps	25 volts/radian at 50ma 400 cps
Spin Motor Excitation	10 volts, 2 phase	10 volts, 3 phase	115 volts, 3 phase
Weight	1.5 lbs.	2.75 lbs.	4.5 lbs.

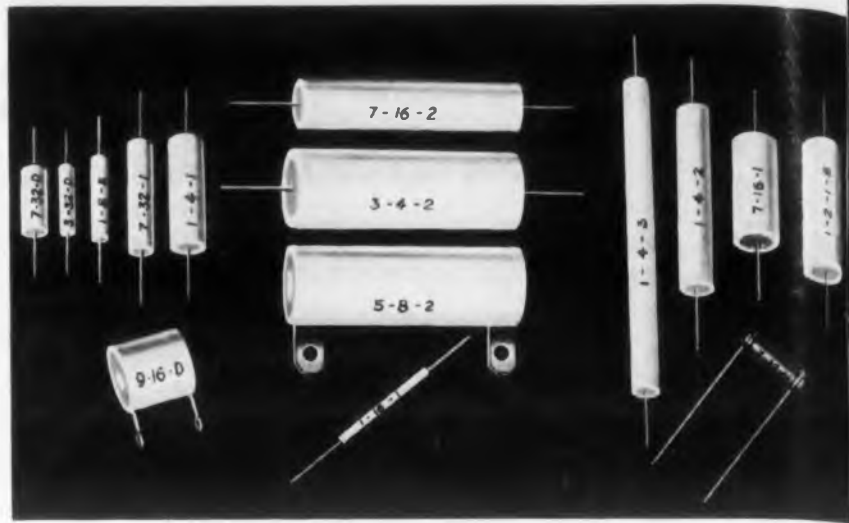
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112 OFFICES ACROSS THE NATION



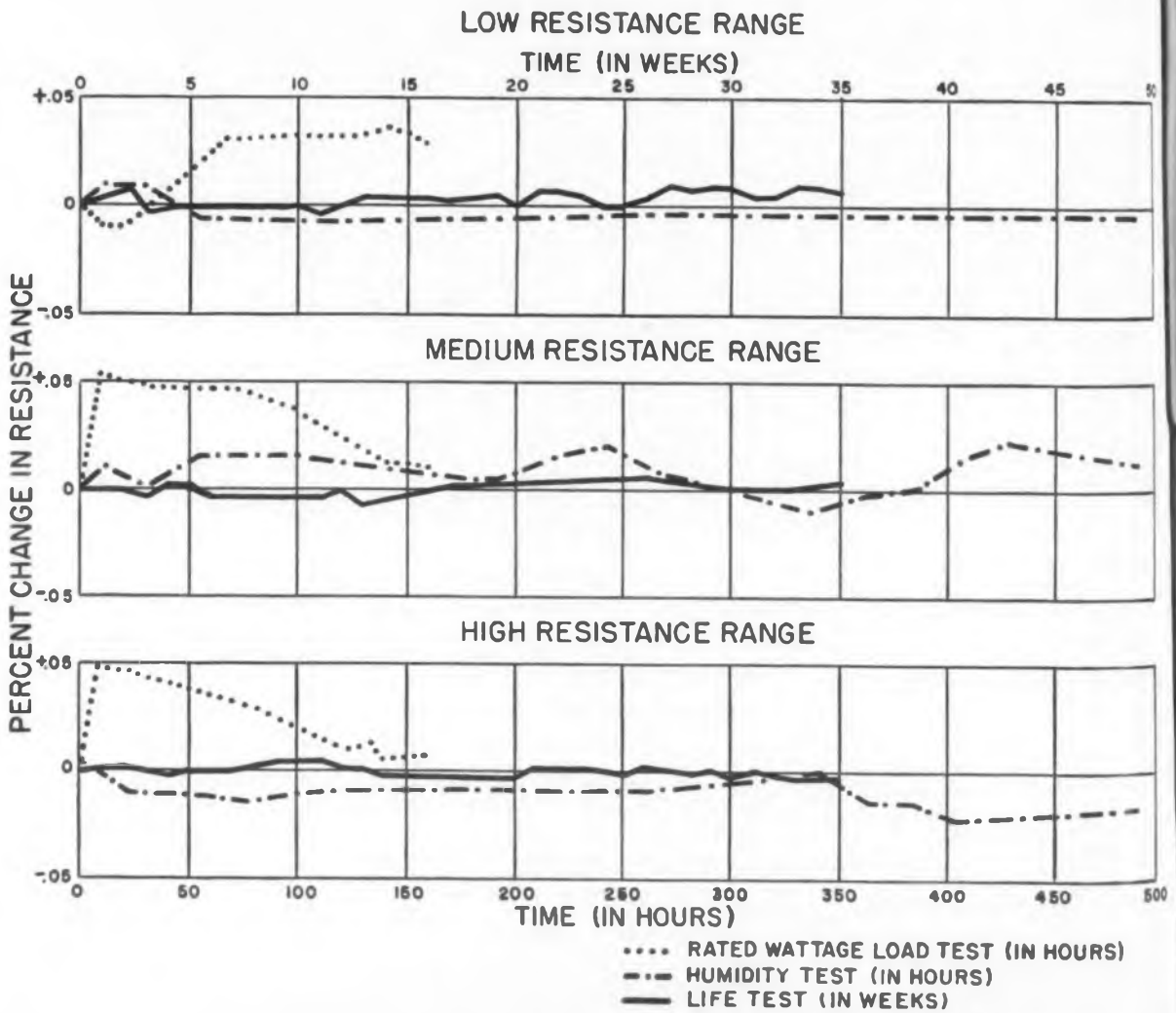
CIRCLE ED-21 ON READER-SERVICE CARD FOR MORE INFORMATION

Some of the "Bobbinless" resistors showing the various shapes and mounting types available.



"Bobbinless" Precision Resistors

The resistance stability of the units is illustrated by these graphs of resistance vs time measured under different conditions.



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MORE COMPACT, less expensive, precision, wire-wound, noninductive, resistors are produced by a new winding technique which eliminates the usual bobbin in the center of the winding. Winding strains in the units are also eliminated by the new process, permitting closer tolerance controls. Some of the units are shown on the front cover and in the photograph at the left.

Equipment such as computers and meters which require accuracy and stability, can profitably incorporate these resistors, made in a wide variety of sizes, shapes, and resistance values, in their design. The resistors also feature low inductance and capacitance effects.

Due to their smaller size and weight for given resistance and wattage ratings, the resistors may be wired directly into most circuits without the support of center-hole mountings. Further production economies are thereby gained. "Bobbinless" units are also made with center-hole mountings. Flexible and feed-through types are available for printed-circuit and other special applications.

By sealing the resistors in rugged ceramic tubes, full protection against humidity and salt spray as well as soldering irons and other assembly tools is gained. The end seal is permanently bonded to the ceramic housing and the lead wires and protected from the effects of humidity by a tough waterproof coating. For added protection, the windings are impregnated with silicones or other humidity resisting materials. To meet specification MIL-R-98, these resistors can be hermetically sealed in heavy walled ceramic. The units have been tested at a relative humidity of 95% for 500 hours with an average change in value of less than 0.1%.

The smallest "Bobbinless" resistor, Type MM-1-16-E, has an outside diameter of only 1/16", a length of 3/4", and a power dissipation rating of 0.1w. It is made in a resistance range from 10 to 1000 ohms. Other units can be furnished with resistances up to 1.5 megohms and a dissipation rating of 1w. The largest sizes have diameters of 3/4".

Standard resistance tolerances of 1/10%, 1/4%, 1/2%, and 1% are available. Where required, 1/50% tolerance can be specified. The units are made by Monson Manufacturing Corporation, 6059 W. Belmont Ave., Chicago, Ill.

By eliminating the bobbin, the problem of different expansion rates with changes in temperature between the bobbin and the winding is avoided. No artificial aging is required. The stability of the units is demonstrated by the graphs at the left.

For all high-value precision resistors, special alloy wire with a temperature coefficient of resistance of 0.002% per degree centigrade is used. The 1 1/2" terminal lead wires are made of soft-drawn No. 20 or No. 22 tinned copper wire, which is firmly soldered or welded to the resistance elements. For more information on these resistors, turn to the Reader-Service Card and circle **ED-318**.

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Rate-measuring gyroscope, type K, courtesy Doelcam Corporation

Torsional vibration damper, courtesy Houdaille-Hershey Corporation

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"Unitized" Audio Amplifiers

Fig. 1. The Brociner Mark 12 Amplifier.



Fig. 3. The Scott 99-A Amplifier, which has the greatest number of controls.



THREE solutions to a problem in audio equipment design are shown on these pages. The problem was raised by the growing interest in high-quality audio reproduction on the part of people who know nothing of circuitry, technical terminology, soldering, etc. They want reasonably priced, good-quality amplifiers that are attractively packaged, compact in size, and simple to operate. Furthermore, if the unit can be readily installed in a wall or bookcase, or placed on an end table beside an easy chair, so much the better. The medium-power "Unitized" amplifiers illustrated, all priced under \$100, meet these requirements with-

Fig. 2. The National Horizon 10 unit.



out sacrificing reproduction qualities. They represent a significant trend in audio equipment design.

All three units feature self-contained power supplies and pre-amplification stages and are housed in "flat" enclosures (averaging 4" high). Because of the flat enclosures, the tubes in all the amplifiers are mounted horizontally. The few required connections to the units are made in the rear panel. Each amplifier can be fed from a variety of sources, such as a record player, f-m tuner, TV receiver, tape recorder, etc. A variety of output impedances to match different speaker systems are provided. All three units can be panel mounted if desired.

The "Mark 12" Amplifier, manufactured by Brociner Electronics Laboratory, 344 East 32nd St., New York 16, N. Y., features the use of "etched wiring" techniques. The etched chassis prior to dip soldering is shown in Fig. 4. The six vacuum tubes are exposed in the rear of the cabinet for cooling purposes and ease of servicing.

This amplifier has a circuit with four feedback loops to provide superior performance. The etched wiring assures correct placement of leads in production to minimize the effects of stray pickup and hum.

With separate turnover and roll-off controls for record compensation, the unit features 24 compensation curves. Power output is 12w at less than 1% distortion. Frequency response is 20cy to 20,000cy within 1db. The tube complement includes three 12AX7's, two 6AQ5's, and one 6X4. Dimensions are 4-1/4" high x 10-7/8" long x 8" deep. Outputs for 4-, 8-, and 16-ohm speakers are provided.

The "Horizon 10" Amplifier, produced by the National Company, Inc., 61 Sherman St., Malden, Mass., features a single-tube pre-amplifier sub-chassis, designated the "Horizon 5", which is also a plug-in component of this firm's "Criterion" a-m f-m tuner and its larger audio amplifier. Instead of the more common push-pull output stage, the Horizon 10 has a "unity coupling" output stage with two 6V6's in series. With this arrangement, the output transformer no longer serves as a coupling between output tubes

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Fig. 4. Etched-wiring chassis of the Mark 12 before the components are added.



Fig. 5. The tubes in the Mark 12 are easily removed at the rear panel.



Fig. 6. Notice the separate pre-amplifier sub-chassis in the Horizon 10.

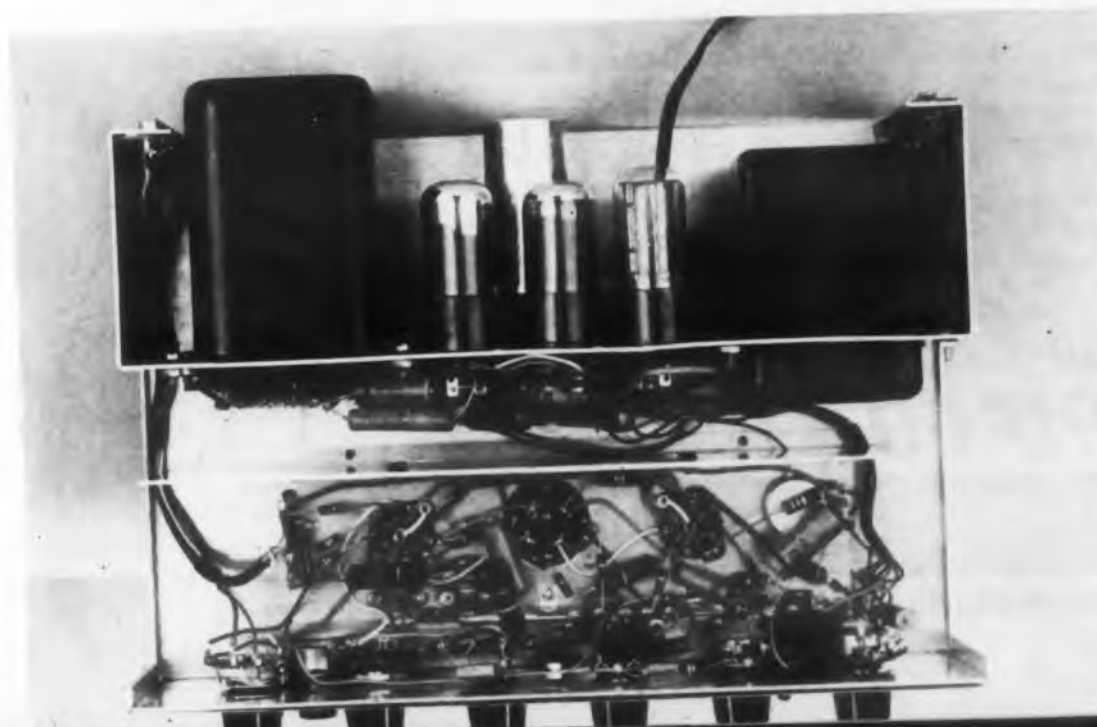


Fig. 7. To keep dust out, only the compartment into which the tubes extend (top) is louvered in the 99-A.

for distortion cancellation, but functions only to match the load to the tubes. The manufacturer claims that this circuit eliminates transformer-caused impulse distortion.

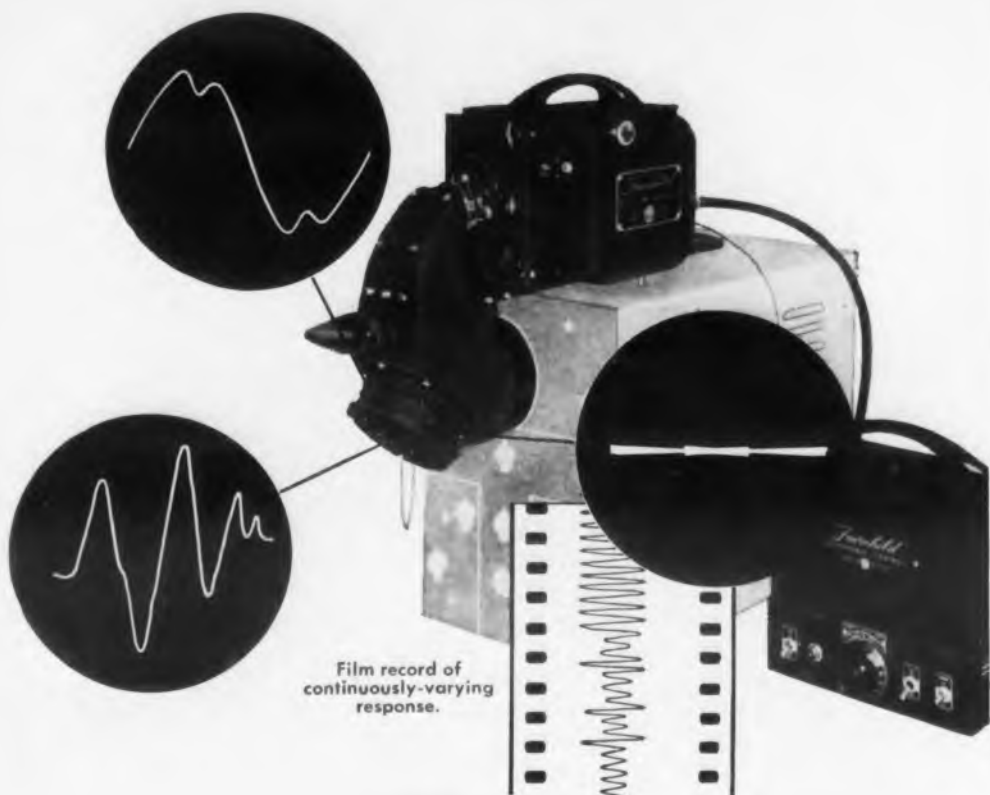
Harmonic distortion is less than 0.5% at 10w output. Frequency response is ± 1 db from 20cy to 20,000cy. The unit has a five-position input selector-record equalizer switch. The tube complement includes two 12AX7's, two 6V6GT's, and one 5Y3GT rectifier. Output impedances of 8 and 16 ohms are available. The unit measures 4" high x 14-1/2" wide x 12-1/4" deep.

The "Type 99A" Amplifier, made by Hermon Hosmer Scott, Inc., 385 Putnam Ave., Cambridge, Mass., has an enclosed chassis to eliminate dust. Only the compartment into which the tubes extend is louvered, as shown in Fig. 7. Although rated at 10w, the unit will deliver much higher peaks with low distortion. Any clipping of high peaks is symmetrical. The chassis is all aluminum to minimize circulating and ground currents in order to reduce hum.

For record equalization, separate three-position bass-turnover and treble-roll-off controls are provided. A total of nine record compensation curves are available. Speaker output terminals of 4, 8, 16 and 500 ohms are provided. A separate a-c outlet is provided in the rear panel for accessory components such as a turntable or an f-m tuner.

Frequency response of the 99-A is flat from 20cy to 30,000cy. Harmonic distortion is less than 0.8% at 10w output. The tube complement is: two 12AX7's; one 12 AU7; two 6V6GT's; and one 5Y3. The cabinet's dimensions are 3-3/4" high x 13-1/4" wide x 9-3/4" deep.

Since all the elements of an audio amplification system plus associated controls are concentrated in one box, these amplifiers are sure to appeal to the general audio market. Because the designers of these units have also made the enclosures attractive in appearance and compact in size, as well as simple to operate and install, they have created highly merchandisable products.



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For more information on Fairchild oscilloscope cameras and how they can assist you in engineering and research analysis, write *Fairchild Camera and Instrument Corporation, Robbins Lane, Syosset, L. I., N. Y., Department 120-22G.*

FAIRCHILD

OSCILLOSCOPE RECORDING CAMERAS

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

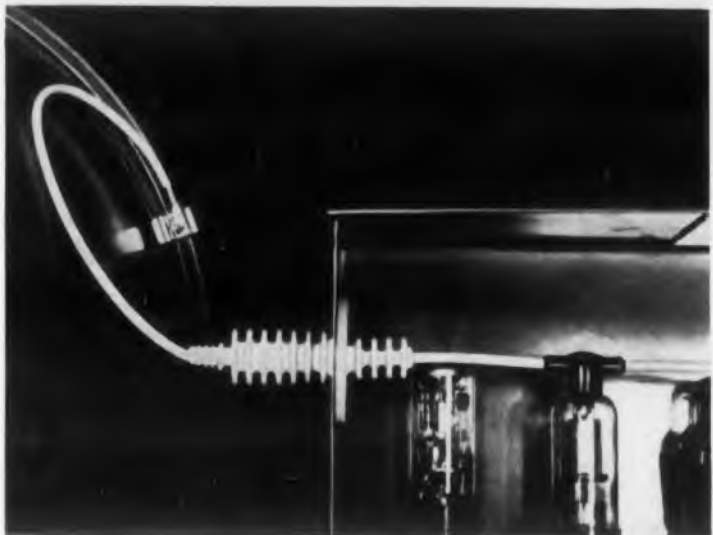


Fig. 1. From left to right, this cable assembly is made up of an anode disconnect clip, a chassis-mounting disconnect, and an in-line tube cap.

Connector Cables for High Potentials

Fig. 2. An in-line disconnect rated to 15,000v.

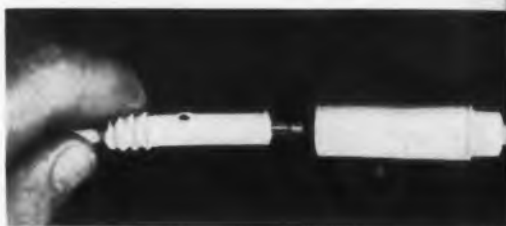


Fig. 3. This chassis-mounting disconnect is rated to 20,000v.

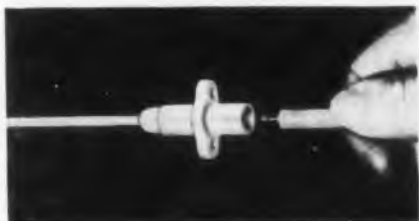


Fig. 5. This in-line tube cap is made of nylon.

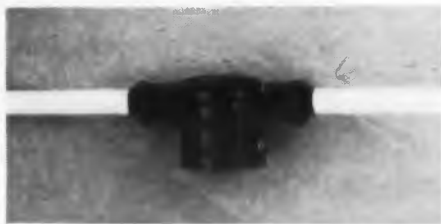


Fig. 4. A high-tension chassis-mounting disconnect.

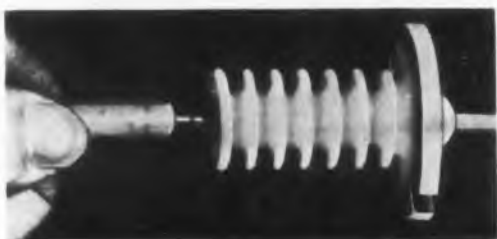


Fig. 6. An anode disconnect clip.



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CONNECTORS and other cable connector components are molded directly onto the wire insulation in a newly developed cabling technique valuable for high-voltage applications. These integrally molded cables not only save space, but the problems of strain relief, wire insulation pull back, wire fatigue under vibration, and high voltage arc-over at wire holes are eliminated.

Developed for color TV, these custom-made cables are useful for high-voltage power supplies and high-voltage rectifier circuits in such equipment as radar, transmitters, X-ray gear, etc. The cabling technique was developed by Alden Products Company, 117 North Main Street, Brockton 64, Mass., who will prepare tailor-made cable assemblies from a whole series of high-voltage disconnects, tube caps and tube socket connectors,



Fig. 7. Resistors can be molded into this nylon tube cap connector.

some of which are illustrated on these pages. One example of such an assembly is shown in Fig. 1. The components are available as individual units.

Very compact designs are possible because there is no need for long leakage paths at the wire joints. The high voltage potential sources are sealed into the insulating jacket, greatly reducing the problems of corona suppression and shielding. Only the female contacts are exposed to the air, and only at the point of mating where there is a natural damping of corona.

These connector components can be made of various materials such as rulon and nylon to meet the required electrical or environmental conditions. Resistors can be molded into the tube cap connectors shown in Fig. 7. For more information, turn to the Reader-Service Card and circle **ED-324**.



Fig. 8. Cut-away view of socket for a color picture tube. Socket is molded about the tube pin connections, which are integral with the cable insulation.

As a high
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and hermetic
seal



SILASTIC Stays Elastic

By using a Silastic* diaphragm, Haydon Switch, Inc., of Waterbury, Conn., has produced a hermetically sealed snap-action switch that weighs only about half an ounce and gives maximum life and reliability. It also operates with less than half the effort required by standard "aircraft quality" switches.

The Silastic diaphragm remains so flexible that the operating force on the actuator need not exceed 32 ounces even at -90 F. Fatigue problems and subsequent unreliability associated with metal diaphragms are also eliminated. Operational life in the range of a million cycles is far in excess of the best metal diaphragms or bellows.

Accelerated permeability tests indicate that an effective hermetic seal is maintained for more than 10 years. Internal pressures up to 100 psi have failed to produce leakage or rupture, and no change in the diaphragms has been observed even after 72 hours' immersion in

salt, fresh, or soda water, or in automotive or AN-0-6 aircraft oil.

Originally designed for aircraft, fire control and guided missile service, the new miniature switch is being applied to domestic and commercial washing machines, machine tools and other equipment exposed to liquids or moisture.

That's the kind of performance that has established Silastic as an ideal diaphragm material where pressures must be maintained despite temperature extremes, weathering and oxidation, or in contact with a variety of oils and chemicals. Silastic is also unique among resilient dielectric materials because it combines high thermal conductivity with excellent resistance to moisture, corona, and to fatigue.

That's why, if you need a rubberlike material that retains its dielectric properties and its resilience at temperatures from -100 to 500 F. it pays to consider Silastic first.

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



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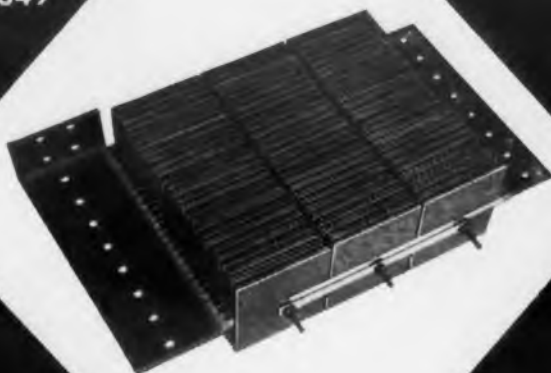
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CIRCLE ED-25 ON READER-SERVICE CARD FOR MORE INFORMATION

Standard Etched-Wiring Circuit Boards

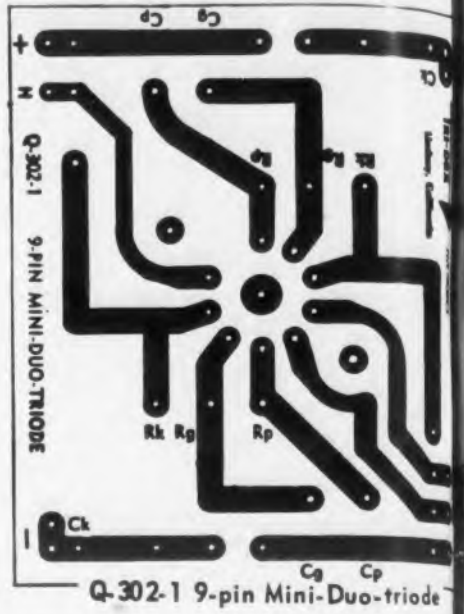


Fig. 1. Two types of standard etched-wiring boards. The right one is designed for power filter circuits.

Fig. 2. Five of the boards are mounted on this main chassis in a "modular" design. Three are shielded.

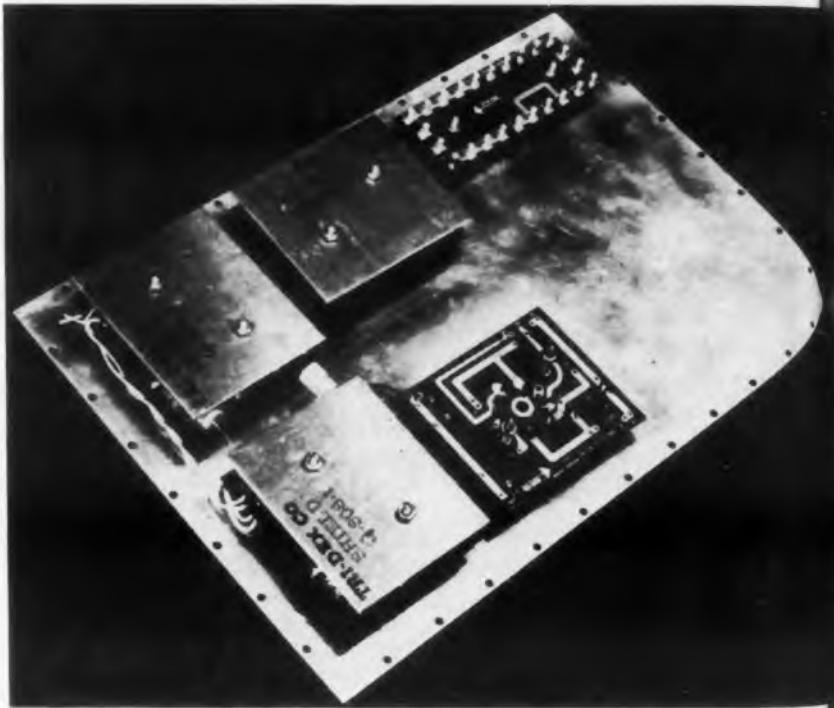
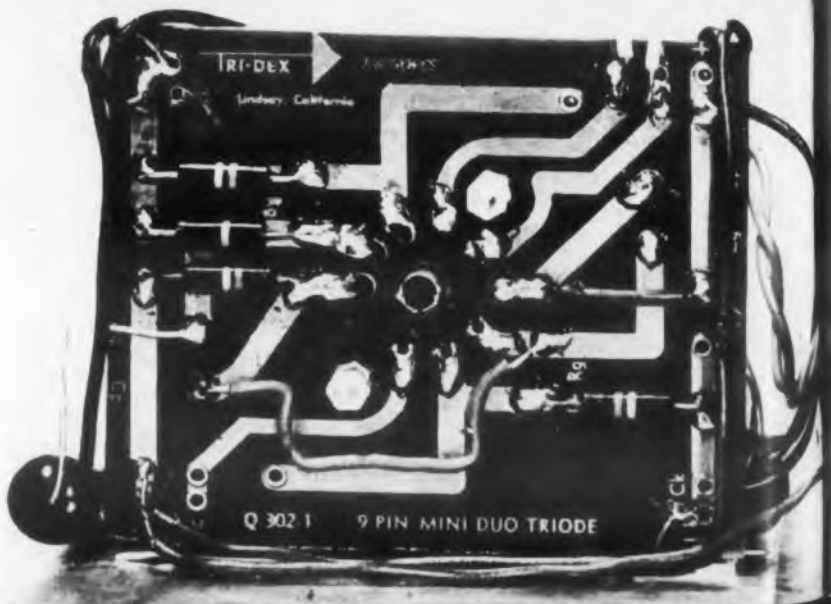


Fig. 3. The board shown in Fig. 1 (above) after the components have been soldered in place.



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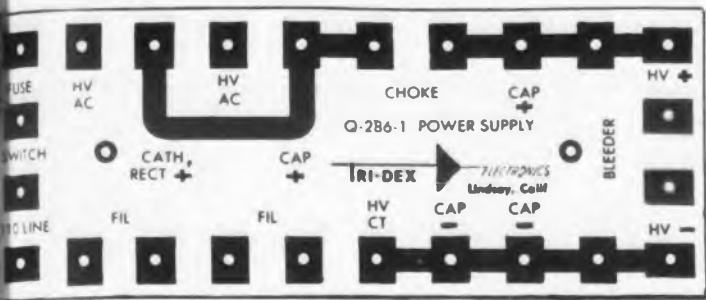
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ETCHED WIRING can be economically utilized in equipment of limited production runs or in development models by using standard etched-wiring circuit boards such as those shown in Fig. 1. Of the seven circuit boards available, six accommodate various types of sockets and provide wiring for more than 72 common tube types. The seventh board is for power supply filter circuits. These standard circuit boards allow "modular" or



"subassembly" design techniques to be readily applied as shown in Fig. 2.

It is comparatively easy to use the circuits. Each board is marked for the tube types it can accommodate; each eyelet where components are connected and each terminal is also clearly marked. Changes in wiring, if desired, can be easily made by cutting the etched copper conductors and stripping them off the base with a razor blade. Circuit tracing is a simple matter, and the marking of the circuit boards and eyelets also makes for ease of servicing and maintenance.

Each board is supplied with instructions, mounting hardware, and an aluminum shielding plate. All resistor eyelets are on 3/4" centers, while all by-pass capacitor eyelets are on 2" centers. The boards are coated with a protective fluxing varnish that prevents oxidation and aids soldering. This varnish can be removed if necessary with alcohol. The six boards that accommodate tubes are all 2 1/2" x 3" in size, while the filter circuit board is 1 1/2" x 3 3/4" in size. The boards can stand 1200v peak at room temperature and have a maximum operating temperature of 240°F.

The standard circuit boards are manufactured by Tri-Dex Electronics Co., P. O. Box 1207, Lindsay, Calif. They are mounted on their respective tube sockets, which are in turn mounted on the chassis by special hardware. All soldering of eyelets and the few wired connections is performed after the board is mounted as shown in Fig. 3. The shield, a flat metal plate, is then added. The completed mounting makes a sturdy, compact unit rigidly attached to the chassis. Other mounting arrangements are possible. For more information, turn to the Reader-Service Card and circle **ED-320**.

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6-3-422, P246 Times
MACHINIST, Turret Lathe
class, 20 yrs exp, O-2 Times

Busy transistor looking for additional employment

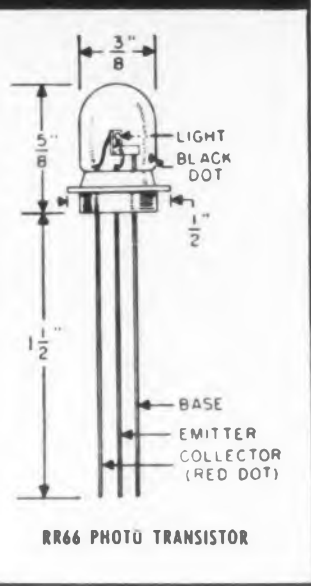
PHOTO TRANSISTOR—really reliable with finest family background, desires employment in electronic circuit. Past work record testifies to highly sensitive, dependable and useful performance. Qualified for industrial controls, punch cards and perforated tape readings, street light control, sound-on-film, burglar alarms, automatic door openers, counters, foul line indicators, etc. Highly stable and rugged; not afraid of hard work and long hours under diversified conditions. Available now. For further details write Semiconductor Division, Radio Receptor Co., Inc., 251 West 19th St., New York 11.



Really



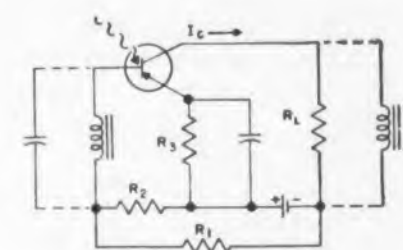
Reliable



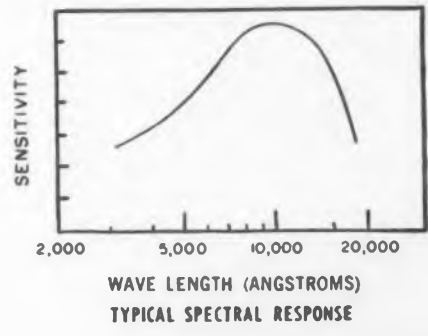
RR66 Photo Transistors are headed for a long and important career in electronic circuits. Perhaps we can discuss this new device with you now!

RR66 PHOTO TRANSISTORS

- Hermetically sealed in glass.
- Miniature size; low cost.
- High optical sensitivity.
- Available base connection permits thermal stabilization.
- Spectral response includes visible range with greatest sensitivity in infra-red region making it useful for invisible light applications.
- Response embraces practically the complete spectrum of a tungsten filament lamp.
- Operates at low voltage and low impedance levels.



RECOMMENDED PHOTO-TRANSISTOR CIRCUIT FOR MODULATED LIGHT
TYPICAL OPERATION
R_L = 10K; R₁ = 20K; R₂ = 1K; R₃ = 1K
Collector Supply Voltage 12 volts
Collector Current 0.5 Ma.
Sensitivity 0.16 volts/ft. candle



Semi-Conductor Division

RADIO RECEPTOR COMPANY, INC.

In Radio and Electronics Since 1922

SALES OFFICES: 251 WEST 19TH STREET, NEW YORK 11, N. Y.
TELEPHONE: WATKINS 4-3633 • FACTORIES IN BROOKLYN, N. Y.

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



Digital Computer Techniques

Applied to
the design,
development
and
application
of

Electronic Business Systems
Military Radar Fire
Control Systems
Aircraft Control and
Navigation Systems

The successful application of Hughes airborne digital computers to high speed aircraft fire control problems has opened up an entire new area for these digital computer techniques. Similar equipment is now under development in the Advanced Electronics Laboratory to apply such digital computer systems to modern business information handling.

Areas include

LOGICAL DESIGN
COMPONENT DEVELOPMENT
PROGRAMMING
MAGNETIC RECORDING
CIRCUIT DESIGN
INPUT & OUTPUT DEVICES
SYSTEMS ANALYSIS

Hughes developments in these fields are creating new positions in the Advanced Electronics Laboratory. Exceptional men in the following spheres of endeavor are invited to apply:

Engineers and Physicists

Computer activities embrace systems planning and analysis, design and development, system engineering and component development. Experience in these areas, as well as in application of electronic digital computers, is desirable but not essential. Analytically inclined men with backgrounds in systems work are required for this phase.

Hughes

Scientific
and
Engineering
Staff

RESEARCH AND DEVELOPMENT LABORATORIES
Culver City, Los Angeles County, California

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

New Products . . .

Color Picture Tube

Has 205 Sq In Screen Area



A larger version of this firm's Type HD-187 (*ED, March, 1954, pp. 24 and 25*), the Type 205 "Colortron", a tri-color TV picture tube, features a useful screen area of 205 sq. in. The Type HD-187 has a screen area of 104

sq. in. The Type 205 employs the phosphor-screen-and shadow-mask type of construction. It can also be used for monochrome reception. The 19" aluminized, glass-envelope tube has an overall length of 26-7/16" contrasted with 26-1/2" for the 15" Type HD-187. This negligible increase in length means that cabinets designed for the smaller tube need not be increased in depth to utilize the larger tube. The Type 205 weighs 31 lb.

The "Colortron" employs an electromagnetic convergence system that does not require extremely high voltages. Typical operating conditions call for an anode voltage of 25,000v, a focusing voltage of 6500 to 8000v, and a maximum peak grid-No. 3 current of 225 μ amp. The approximate deflection angle is 62°.

The tube has a small-shell, diheptal 12-pin base (JETEC B12-105). Optimum performance of the Colortron requires proper shielding against the effects of the earth's magnetic field and stray fields around the picture tube. A magnetic shield of "MuMetal" or equivalent material should be placed over the bulb portion. Placement of magnetic components of the receiver so that the effect of their fields on the picture tube is minimized will result in improved tube performance.

Permanent damage may be done to the screen-and-mask assembly if scanning should cease during tube operation. For this reason an electronic switch activated by the horizontal and vertical deflection voltages should be provided. CBS-Hytron, Dept. ED, A division of the Columbia Broadcasting System, 100 Endicott St., Danvers, Mass.

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

Voltmeter

For Ultra-low Frequencies

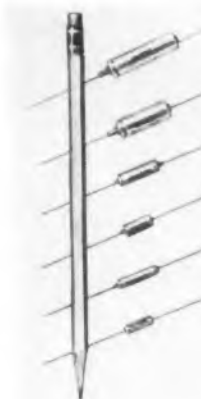


The Model 316 Voltmeter was developed primarily for the measurement and monitoring of small potentials in ultra-low frequency systems, such as servomechanisms and geophysical equipment. A range of 20mv to 200v peak-to-peak is directly read in four decade steps with an accuracy of 3% throughout the spectrum of 0.05cy to 30ke. Measurements are also possible between 0.01cy and 0.05cy when corrections are applied. Point flutter is negligible down to 0.05cy while discharge of the storage circuits for a rapid sequence of readings may be effected by a reset device. The voltmeter features high input impedance, freedom from line disturbances, logarithmic voltage scale, and excellent long-term stability. Ballantine Laboratories, Inc., Dept. ED, 102 Fanny Rd., Boonton, N.J.

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

Electrolytic Capacitors

Miniature, Subminiature Units



Types MT and SMT miniature and subminiature electrolytic capacitors are low-cost, low-current drain units especially designed for use with transistors, printed circuits, and other applications where small size, lightweight units are required. Features include all-aluminum construction, with connecting leads of tinned brass for extra strength.

The capacitors are hermetically sealed. Operating temperature range is -20° to +65°C. They are made in a capacity range of 1/2mfd to 100mfd, and with voltage ratings of 3v to 75v d-c. Case diameters range from 1/8" to 3/8", and lengths from 1/2" to 1-1/4". Illinois Condenser Co., Dept. ED, 1616 N. Throop St., Chicago 22, Ill.

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

ELECTRONIC DESIGN • August 1954

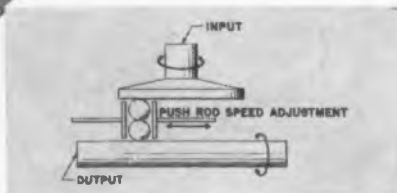
NEW

BALL & DISK SPEED CHANGER



*High Precision
Variable Speed
Device*

- Reversible
- Stepless
- Precise
- Compact



Moving parts are of hardened alloy steel. Light in weight, long life, great accuracy and reasonable cost. A comparatively low torque speed changer for generating reversible speeds in a smooth and stepless fashion from forward to zero to full reverse.

Size: Width 2-1/8" Length 2-3/4"
Height 3-11/16" Weight 17 oz.
\$90.00 F.O.B. Stamford.
Quantity Discounts.

Used as INTEGRATORS for analog computers, servo mechanisms and similar devices requiring smooth and high precision speed control.

TRC THE REFLECTONE CORPORATION
639 W. Main Street
Stamford, Connecticut

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

ELECTRO SNAP

SUB-MINIATURE Basic Switch

... a tiny switch for a man-size job



Sub-miniature E4

This Electro-Snap Sub-Miniature Basic Switch handles 5 amps at 125/250 v. AC, yet has a plastic case no thicker than a lead pencil, less than 27/32" long, 23/64" high. Low operating force and small movement differential make it ideal for "feather touch" devices such as diaphragms, bimetal elements and other precision control applications. Since snap action is independent of speed of actuation, switch performs equally well when actuated by slow or fast moving cams, etc. The patented snap-action "S"pring compression member equalizes the stress on the switch springs which eliminates early fatigue commonly caused by concentrated stress on only one part of the spring. Sturdy terminals at bottom permit wiring without increasing length dimension. Available in normally open or closed single-pole, and single-pole, double-throw models. Toggle, push button and leaf spring actuators available. Custom-made rotary actuated multiple mountings and hermetically sealed housings also available on special order. Write for Data Sheet ES-8.

see our catalog to
PRODUCT
DESIGN
FILE
or write for copy

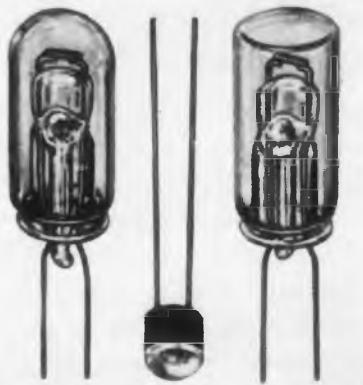
ELECTRO-SNAP SWITCH AND MFG. CO.
4224 West Lake Street, Chicago 24, Illinois

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

ELECTRONIC DESIGN • August 1954

Cadmium Sulphide Photocells

Deliver Up to 5ma



These practical, inexpensive and extremely small cadmium sulphide crystal photocells are capable of operating inexpensive sensitive relays directly without an amplifier. They can effect great cost reductions on a wide variety of photo-electric assemblies.

Units as small as 1/4" diam x 1/4" exclusive of leads deliver from 2 to 5ma when exposed to light of from 50 to 100 foot-candles intensity with about 100v applied across cell and load. These photocells show useable resistance change with light intensities as low as 1/1000 foot-candle. Speed of response is in the order of 1/10,000sec at 50 foot-candles.

CdS photocells respond to visible light, ultra violet, X-rays, and nuclear radiations. They can be applied in X-ray detectors, densitometers, and other measuring equipment. Dark resistance is about 10,000 megohms. Maximum resistance variation with temperature is 2 to 1 between -50°C and +75°C. Standard Piezo Company, Dept. ED, 265 E. Pomfret St., P. O. Box 278, Carlisle, Pa.

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

Ceramic Capacitor

Simplifies Circuit Design



Called "Flat Pan Ceramic Capacitors", these capacitors simplify the design of v-h-f bypass circuits, particularly in mili-

tary equipment. The units consist of one to four sections in a shallow metal pan filled with a phenolic resin for moisture protection. They mount flat against a chassis by a screw or rivet through the hole in the handle.

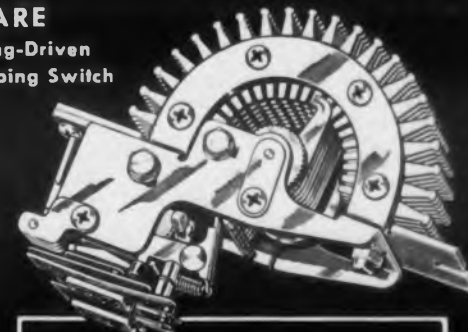
The lead length between the capacitor sections and ground is effectively zero, thus resulting in a high self-resonant frequency. When mounted adjacent to a miniature tube socket, the unit offers fixed lengths of lead to the socket terminal, thereby avoiding lead dress problems and providing a cleaner chassis. The secure mount avoids vibration problems.

The units are available in voltage ratings ranging from 100 to 500v, d-c, and in various capacitances depending upon the ceramic body. Sprague Electric Co., 347 Marshall St., North Adams, Mass.

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

CLARE Stepping Switches meet wide range of circuit selection and control problems

CLARE
Spring-Driven
Stepping Switch



TYPE	CAPACITY
20	1 to 8 levels, 20-point
26	1 to 10 levels, 26-point
40	1 to 4 levels, 40-point
52	1 to 5 levels, 52-point

A versatile, high-speed switch for—Selecting desired point of a series • Sequence control • Counting and totalizing • Monitoring.

OPERATION SPEED: Remote Control—30 steps per second (max.). Automatic Operation—up to 60 steps per second on 48 volts dc or 115 volts ac (with rectifier).



CLARE
Direct-Drive
Stepping Switch

Designed for such control functions as—Selecting one circuit path out of ten • Consecutively performing operations in separate individual circuits.

OPERATION SPEED: 35 steps per second (max.) under ideal pulsing conditions.

RELEASE TIME: 0.030 to 0.070 second depending on voltage and position from which wipers are released.

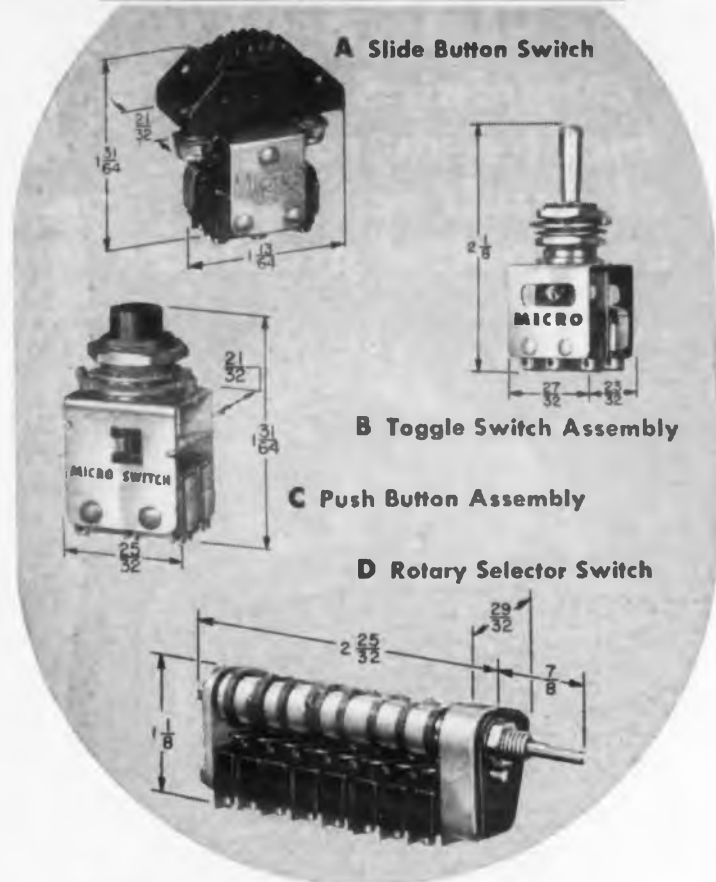
Send for Engineering Bulletin No. 103 for a discussion of stepping switch operation and applications. For full technical data ask for Engineering Bulletin No. 101. Address C. P. Clare & Co., 3101 West Pratt Blvd., Chicago 45, Illinois. In Canada: Canadian Line Materials, Ltd. Toronto 13. Cable Address: CLARELAY.

CLARE RELAYS FIRST IN THE INDUSTRIAL FIELD

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

MICRO SWITCH Precision Switches

A PRINCIPLE OF GOOD DESIGN



Why Electronic designers turn to MICRO SWITCH

for manually operated switch components

Wide variety Small size Light weight Utmost reliability

MICRO SWITCH precision switches shown here are typical of hundreds of switches developed to meet the specific requirements of the electronics industry. Whatever your requirement, consultation with MICRO SWITCH engineers can save you time and money.

A Slide Button Switch. Designed for two-circuit control. Two subminiature switches mounted in a three-position, maintained contact, slide-button assembly.

B Toggle Switch Assembly. For panel mounting and providing control of as many as 4 circuits. One of two single-pole, double-throw subminiature switches is actuated in each extreme toggle position.

C Push Button Assembly. Composed of two single-pole, double-throw subminiature switches. Switch provides an improved "feel" and simultaneous make and break of the two circuits.

D Rotary Selector Switch. Uses from 2 to 8 single-pole, double-throw subminiature switches to control multiple circuits. It permits 2 to 8 switching positions with spring or manual return to neutral position.

For complete information—call your nearest MICRO SWITCH branch office.

MICRO SWITCH

A DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR COMPANY
FREEPORT, ILLINOIS



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

New Products . . .

Junction Transistors Feature Low Noise Figure



Hermetically sealed, the Types 2N47, 2N49, and 2N62 alloy junction transistors feature a maximum collector dissipation at 25°C of 50mw. All three units have low noise figures. The first two types are intended for hearing aid applications, while the last unit is designed for medium power needs.

Maximum collector voltage for common base connection is -35v, while maximum collector current is -20ma. The leads are sealed in glass. Philco Corporation, Government and Industrial Division, Dept. ED, 4700 Wissahickon Ave., Philadelphia 44, Pa.

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

Power Supply Provides Constant Current or Voltage



The Model PS-110 Power Supply is a wide range precision instrument primarily intended for use with semi-conductors. It also affords maximum protection against excessive currents for meter calibration and measurements of non-linear devices.

Current and voltage may be varied from plus to minus continuously through zero without the necessity for polarity switching. The unit is capable of controlling very small currents in the order of considerably less than 1μamp. It has seven current ranges, full scale, from ±50μamp to ±50ma, at a maximum load voltage of ±100v. It has three voltage ranges, full scale, from ±200v to ±10v, at a maximum current of ±50ma.

Regulation with load changes is 0.25% or less. Regulation of line voltage is 1% or less. Provision for sweep inputs and current sampling, as well as external current control, are incorporated. Either bench or rack mounted models are available. Teletronics Laboratory, Inc., Dept. ED, 54 Kinkel St., Westbury, L. I., N. Y.

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

SKL MODEL 610 HIGH-SPEED SWEEP GENERATOR

SWEEP
SPEEDS
FROM .05
TO 500 CM.
PER μSEC



The Model 610 is designed to supply extremely high-speed sweeps for the display of very fast phenomena of a transient or repetitive nature when used in conjunction with the SKL Model 600 Cathode Ray Indicator.

The Model 610 provides continuously adjustable sweep speeds of from .05 to 500 centimeters per microsecond. The Model 610 can be triggered for single or repetitive sweeps of up to 10,000 p.p.s. Brightening pulse and gate outputs are also provided.

SKL SPENCER-KENNEDY LABORATORIES, INC.
186 MASSACHUSETTS AVE., CAMBRIDGE 39, MASS.

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



GUIDE TO VOLTAGE SPEED CURRENT SERVO CONTROL

ON REQUEST

This new 12-page illustrated bulletin describes the wide variety of control situations to which the REGOHM electro-mechanical controller is adaptable.

Learn how REGOHM will provide sensitivity, speed of response and system stabilization under severe operating conditions in your control system.

Circuit diagrams illustrating the many applications of this versatile, automatic controller, are given. Text and illustrations describe the functions, design advantages, operation and control characteristics of this small size, lightweight, plug-in device.

Write for Bulletin 505.00. Address Dept. G, Electric Regulator Corporation, Norwalk, Conn.

REGOHM



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

on the design table
...and in the
production line

ACE NYLON BALLS

KEEP THINGS MOVING SMOOTHLY IN
HUNDREDS OF INDUSTRIAL APPLICATIONS!

MASS-PRODUCED OF DuPONT NYLON FM No. 10001
TO CLOSE TOLERANCES OF $\pm .001$. Sizes $\frac{1}{8}$ " to $\frac{3}{4}$ "

Ace Nylon Balls have brought new design flexibility
and production economy to many of America's
largest manufacturers. Uniform, precision-fabri-
cated, light-weight Ace Nylon Balls are tough at
low temperatures, stable at high temperatures,
and resistant to chemicals and abrasion. Ace
Nylon Balls may add greater efficiency and
economy to your products, too.

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OUR ENGINEERS
ADVISE YOU?

Complete facilities
for fabricating
plastic parts for all
industries. Estimates
submitted promptly
on receipt of blue-
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Write for samples, bulletin,
price list today.

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Precision Plastic Fabricators and Extruders

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

Miniature ELASTIC STOP[®] nuts *



Here is the world's smallest self-locking nut, developed espe-
cially for your miniaturization program. Sizes as small as .109
across flats. The famous red nylon locking collar damps out
severe shock and vibration—grips the bolt thread—holds adjust-
ment indefinitely. One-piece fasteners—no extra parts can drop
into delicate equipment and short out circuits. Weight, installa-
tion space and assembly time are cut to a bare minimum. Nylon
collar makes miniature ELASTIC STOP nuts reusable many
times. And the installed cost is considerably less than set screws
or other double-operation fastening methods.



For information on all electronic fastener problems
write ESNA—address Dept. N56-857.

**ELASTIC STOP NUT CORPORATION
OF AMERICA**

2330 Vauxhall Road, Union, N. J.

DESIGN HEADQUARTERS FOR SELF-LOCKING FASTENERS

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

ELECTRONIC DESIGN • August 1954

Pressure Transducer

For Ranges of ± 1 to ± 1000 psi



The Series P100
Pressure Trans-
ducer can be sup-
plied in differ-
ential or gage types
for measuring
pressure in non-
corrosive liquids
and gases. Ranges
from ± 1 psi to
 ± 1000 psi are avail-

able. Mechanical displacement of a pressure sensing
diaphragm produces an inductance variation in a
closely spaced coil structure. The variable inductance
electrical output can be employed in an inductance
controlled oscillator of the Hartley, Colpitts, or any
two-terminal type.

The transducers were designed for r-f telemetering
applications but are readily useable with carrier-
driven Wheatstone bridge recording systems. The
out-put-versus frequency pressure curve is linear to
 $\pm 3\%$ with RDB standard oscillator deviation. Zero-
drift and sensitivity-change is less than $\pm 1.5\%$ over
 $\pm 50^\circ\text{F}$ variation about ambient temperature, and less
than $\pm 3\%$ from -40° to $+165^\circ\text{F}$.

The natural resonant frequency varies approxi-
mately as the square root of the sensitivity, and is
approximately 2000 cy in the ± 10 psi sensitivity
range. Acceleration sensitivity is between 0.005% to
0.05% in the worst direction, depending on pressure
sensitivity. Datran Engineering Corp., Dept. ED,
6312 W. 92nd St., Los Angeles 45, Calif.

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

D-C to A-C Choppers

60cy Types



Available in 22 models, these d-c
to a-c Choppers can be used in anal-
og-computer amplifiers, regulated
power supplies, automatic-balancing
strain-gage bridge circuits, self-bal-
ancing potentiometers, sampling cir-
cuits and microvolts meters. Designed
for 60cy operation, they can be speci-
fied for 25cy or 120cy operation.

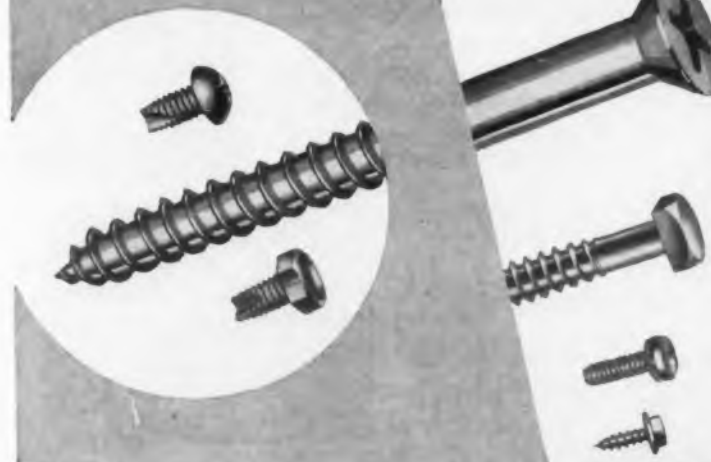
Contacts are either spdt or dpdt.
The gold alloy contacts are rated
1ma, 0 to 1-1/2v d-c. The platinum-
rhodium contact can carry 5ma, 1-50v
d-c. Two connection types are available. One has all
connections through the 8-pin octal socket. The other
has the 8-pin octal socket with a top connection for
the a-c coil leads. Noise level is less than $1\mu\text{v}$ when
measured into a 100,000 ohm load. Stevens-Arnold,
Inc., Dept. ED, 22 Elkins St., South Boston 27, Mass.

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

**ELCO
SCREWS**

ELCO SCREWS ARE GOOD SCREWS

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



ELCO TOOL AND SCREW CORPORATION
1948 BROADWAY • ROCKFORD, ILLINOIS

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

MINIATURIZING YOUR EQUIPMENT?

Specify SIMPLEST, MOST COMPACT

AMPERITE

THERMOSTATIC DELAY RELAYS

MOST ECONOMICAL, HERMETICALLY SEALED



STANDARD



MINIATURE

Provide delays ranging from 2 to 120 seconds.

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

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

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

PROBLEM? Send for Bulletin No. TR-81

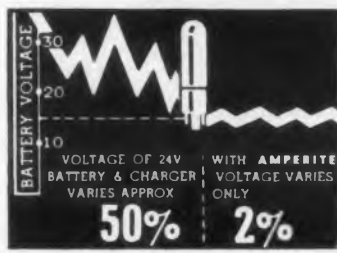
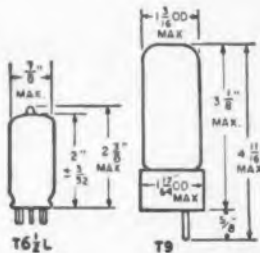
BALLAST-REGULATORS

- Amperite Regulators are designed to keep the current in a circuit **automatically regulated** at a definite value (for example, 0.5 amp).
- For currents of 60 ma. to 5 amps. Operates on A.C., D.C., or Pulsating Current.
- Hermetically sealed, light, compact, and most inexpensive.

Maximum Wattage Dissipation:
T6½L—5W. T9—10W.



T9 BULB



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

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

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

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

New Products . . .

TV Receiving Tubes For Series String Operation

The first 17 tubes in a group designated the "600 Series" designed especially for series string operation in TV receivers is available. The tubes have a uniform heater warm-up time of 10.5sec. This helps solve the problem of tube failures in series string circuits resulting from excessive filament voltages occurring across some of the tubes during the warm-up period.

All the tubes utilize 600ma filaments. The use of larger heater wire with fewer turns allows better heater-cathode insulation. Except for heater ratings, each "600 Series" tube is identical in electrical characteristics with its equivalent type. The new "600 Series" tubes with their equivalent types in parenthesis are: 3AL5 (6AL5, 12AL5), 3AU6 (6AU6, 12AU6), 3BC5 (6BC5), 3BE6 (6BE6, 12BE6), 3BN6 (6BN6), 3BY6 (6BY6), 3CB6 (6CB6), 5AQ5 (6AQ5, 12AQ5), 5BK7-A (6BK7-A), 5J6 (6J6), 5T8 (6T8), 5U8 (6U8), 5V6-GT (6V6-GT, 12V6-GT), 12BK5 (6BK5, 25BK5), 12BQ6-GA (6BQ6-GA, 25BQ6-GA), 12L6-GT (25L6-GT), 12W6-GT (6W6-GT, 25W6-GT). General Electric Company, Tube Dept., Dept. ED, Schenectady 5, N. Y.

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

Phase Standard Provides Accuracy of 0.1°



The Type 706-A Ultra-Sonic Phase Standard is of use in design and measurements on precision phase shifters, phase detector circuits, goniometers,

resolvers, threshold circuitry in timing, pulse position and similar determinations. The unit provides two sinusoidal voltage output signals whose phase relationships can be continuously controlled from 0° to 360° with an accuracy of $\pm 0.1^{\circ}$.

Units can be furnished to supply any single specified output frequency between 20kc and 200kc, although the standard frequency is 82kc, one cycle of which corresponds to 2000 yards in radar-ranging circuits. An indicator-check-read switch permits establishment of Lissajous patterns on the built-in 3" scope with either phase-shifted or unshifted voltage, so that basic accuracy is essentially independent of dial calibrations. Output voltage is about 10v across 5000 ohms or higher. Phase stability is $\pm 0.2^{\circ}$ per hour at 25°C after one hour warm-up. Technology Instrument Corp., Dept. ED, Acton, Mass.

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

technical paper 339

a Helipot Technical Information Service

Accuracy of Potentiometer Linearity Measurements

BY ROBERT McDONALD & IRVING HOGAN
Research and Development Division
Helipot Corporation

Reprinted from August, 1953
TELE-TECH & ELECTRONIC INDUSTRIES

Write today
for your free
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Technical Paper.
Ask for Data
File 807

first in precision potentiometers

Helipot Corporation / South Pasadena, California
a division of BECKMAN INSTRUMENTS, INC.

B
BECKMAN

348

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

Precision PAPER TUBES

2000 SIZES
in any shape
ID or OD

Whatever your specific needs, depend on PRECISION PAPER TUBES to meet all requirements. Spirally wound under pressure, PRECISION PAPER TUBES are subjected to rigid tolerance control to insure strict adherence to specifications and provide maximum winding space. PRECISION PAPER TUBES possess 15 to 20% greater strength, yet are light in weight.

Made from the finest dielectric kraft or fish paper, phenol impregnated, acetate or combinations, PRECISION PAPER TUBES afford high insulation, heat dissipation and moisture resistance. Available in any size, shape, I.D., or O.D.—any quantity.

Write today for Arbor List of over 2000 sizes . . . Send specifications for free sample.

PRECISION PAPER TUBE CO.

2055 West Charleston Street • Chicago 47, Illinois
Plant No. 2: 79 Chapel St., Hartford, Conn.
Also Mfrs. of PRECISION Coil Bobbins

CIRCLE ED-53 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-54 ON READER-SERVICE CARD FOR MORE INFORMATION

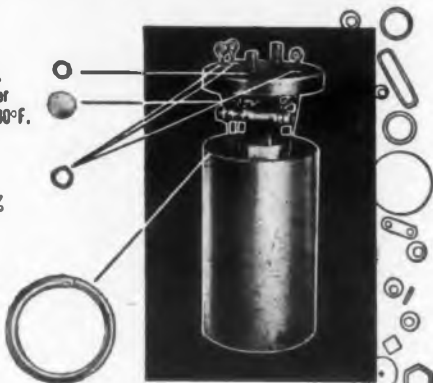
3 Soldering Operations in 1
Easy as ABC

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.

WRITE TODAY for free "Solderform" samples and literature.

KESTER
SOLDER COMPANY

4200 Wrightwood Avenue • Chicago 39, Illinois
Newark 5, New Jersey • Brantford, Canada

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

Delay Line

Variable from 0 to 0.7 μ sec

The Model RDVL 650-0.7 delay line provides continuously variable time delay of 0 to 0.7- μ sec, with a rise time of 0.1 μ sec at full delay. With an attenuation of 10%, band width at full delay is 4Mc.



Highly miniaturized, the unit is commonly front-panel mounted for easy access and calibration. It is especially valuable for use in laboratory, radar systems, loran systems, for establishing confidence sweep and input signal in high speed oscilloscopes, and for measuring time intervals with an accuracy better than 2millimicrosec.

It is designed to meet military environmental requirements and withstand normal shock and vibration without affecting the delay setting calibration. Nominal characteristic impedance is 650 ohms. PCA Electronics, Inc., Dept. ED, 2180 Colorado Ave., Santa Monica, Calif.

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

Inductors

Miniature, High Q Design



Type SL1 miniature inductors are especially suited for use as inductor elements in tuned circuits and filter networks in receiving, telemetering, and navigation systems, computers, and laboratory measuring equipment. In general, they are for use in any application where a compact, stable, and durable inductor having high

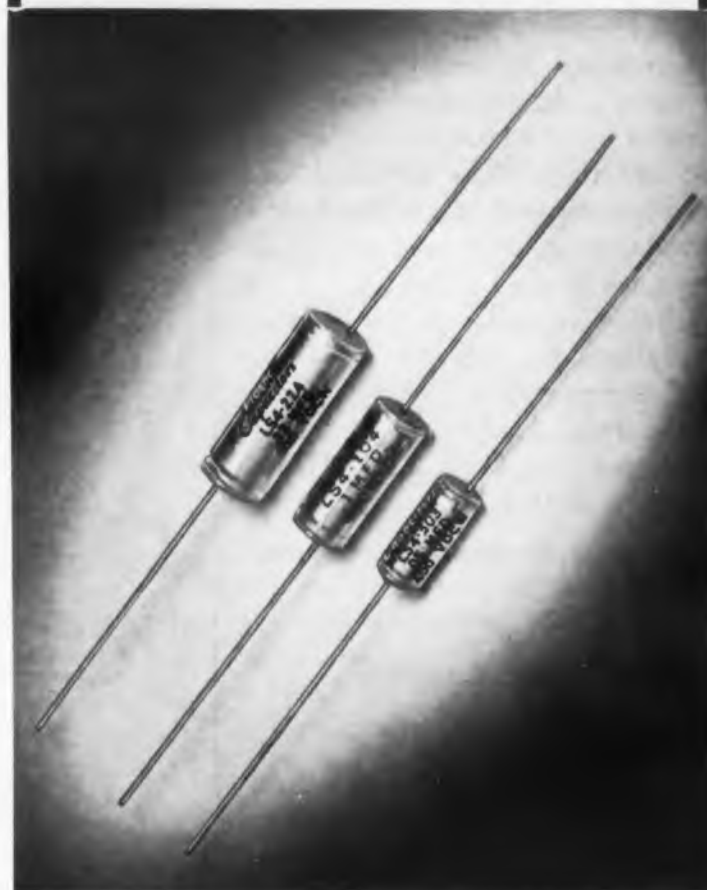
Q is required to operate in the frequency range of 5-500kc.

Coils are random wound on plastic bobbins using coated wire. They are checked for inductance and Q and adjusted to specific values. The coil assembly is installed in a molded phenolic case and sealed with resin. A stud, threaded 8-32, is provided for single hole mounting. A pin furnishes an anti-rotation feature.

The units are self-shielding and highly compact, with a weight of only 3/4 oz. Inductance values range from 2.2mh to 220mh. Nominal tolerance is $\pm 10\%$ \pm one turn. Mico Instrument Co., Dept. ED, 80 Trowbridge St., Cambridge 38, Mass.

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

NEW LOWCOST Miniature Capacitors



- Plastic film dielectric
- Very High resistance
- Low dielectric absorption
- Very Low cost
- Temperature range — 70°C to 140°C
- Smaller than the smallest
- Extremely long life
- Voltage 100 to 1000 volts
- Capacitance .001 to 1 mfd.
- Will withstand severest environmental tests.

We invite your inquiries. Ask for our complete catalogue on your company letterhead.

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



Plastic Capacitors, Inc.
2511 W. MOFFAT STREET, CHICAGO 47, ILLINOIS

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

New Products . . .

Slide Rule

For Thermostatic Calculations

A slide rule computer designed to fit into project work books is available without charge to design engineers engaged in thermostatic work. It incorporates all nine standard scales including C1 reciprocals. It is 10" long x 4" wide and is furnished in a protecting cover.

In addition to standard scales, the rule contains trigonometric formulae for right triangles, sines and limits of value by quadrant as well as natural functions. Also included is a four-place logarithmic table, decimal equivalents to 32nds, and a long list of commonly used formulas.

Suitable formulae for calculating applications for this firm's "Mighty Mite" thermostats are also contained on the rule. Mechanical Industries Production Co., Dept. ED, 217 Ash St., Akron 2, Ohio.

CIRCLE ED-61 ON READER-SERVICE CARD

Silicone Coating

For Covering Fabrics

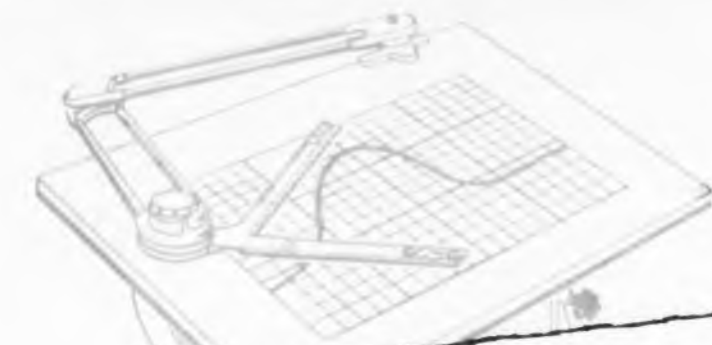
Silastic 132, an improved silicone rubber coating for glass cloth or synthetic fabrics used in cable wrapping, features greatly increased crease resistance and excellent retention of dielectric strength. Sample 10mil coatings on ECC 116 heat-cleaned glass cloth keep their original average strength, lengthwise, of 140 lb per inch unchanged after four creases. Similarly coated samples, measured with 1/4" electrodes, exhibit a dielectric strength of 1100v per mil both "as received" and after 21 days at 250°C.

Less sensitive to processing temperatures, the coating cures equally well over a wide range of tower temperatures. It is available in the form of 100% solids or as a 35% dispersion in xylene. Dow Corning Corporation, Dept. ED, Midland, Mich.

CIRCLE ED-62 ON READER-SERVICE CARD

CIRCLE ED-63 ON READER-SERVICE CARD >

DESIGN IS OUR BUSINESS



TYPE X-80 SHUNT DIODE & RECTIFIER

Featuring—
1. Bonded thorium tungsten core filament for ruggedness and high electron emissivity.
2. Graphite anode for maximum dissipation.
3. Isolated getter traps for hard vacuum.

MAX. DIMENSIONS:
Ht. 9.75"
Diam. 3.36"

RATINGS:
Ef 11.5 volts
If 15.5 amps

shunt diode
epx 40 kv
ib 80 amps
Ib 75 mAdc

rectifier
epx 40 kv
ib 2.5 amps
Ib 800 mAdc



TYPE 576 SHUNT DIODE AND RECTIFIER

Designed for radar applications, radio and TV transmitter high voltage supply.

MAX. DIMENSIONS:
Ht. 7.75"
Diam. 2.312"

RATINGS:

shunt diode
Ef 5.4 volts
If 15 amps
epx 25 kv
ib 12 amps
Ib 30 mAdc

rectifier
Ef 5 volts
If 14 amps
epx 25 kv
ib 2.5 amps
Ib 500 mAdc



TYPE 583 CLIPPER DIODE RECTIFIER

A powered-up and ruggedized recast of World War II JAN type 3826.

MAX. DIMENSIONS:
Ht. 5.12"
Diam. 1.445"

RATINGS:
Ef 2.5 volts
If 4.9 amps

clipper diode
epx 15 kv
ib 8 amps
Ib 20 mAdc

rectifier
epx 17 kv
ib .250 amps
Ib 65 mAdc
Altitude rating—35,000 ft.
Shock rating—375 G



TYPE 577 HALF-WAVE RECTIFIER

High altitude version JAN type 578, designed for use in other instruments where compact size is important.

MAX. DIMENSIONS:
Ht. 7.5"
Diam. 2.06"

RATINGS:
Ef 5 volts
If 10.3 amps
epx 25 kv
ib 1.5 amp
Ib 300 mAdc



TYPE 596 HALF-WAVE RECTIFIER

High altitude version JAN 1641.

MAX. DIMENSIONS:
Ht. 5.75"
Diam. 2.25"

RATINGS:
Ef 5 volts
If 3 amps

cond. input
epx 23 kv
ib 8 amps
Ib 2 mAdc
i-surge—2

epx 4
ib 3
Ib 3
Eo
choke inp
epx
ib
Ib
Altitude
condition

Design is the vital industrial element from which all progress stems. It is that *something* which makes an electronic component move smoothly through its own production processes, and perform faithfully in its service environment.

We at UNITED ELECTRONICS are singularly devoted to design. Our facilities are designed to serve efficiently a modest but important segment of a great market. Our tubes are designed for outstandingly reliable use in special purpose devices.

Indeed, DESIGN IS OUR BUSINESS.

Since World War II we have specialized in electron power tubes of improved and modernized design. This program has been channelled toward two general objectives:

(a) The re-design of existing types to make them smaller, more rugged and more reliable without diminution of original power ratings.

(b) The creation of new tubes—many of which have been officially adopted by the government as military types.

The very largest manufacturers of electronic equipment absorb a major portion of our production. We work in close liaison with them as to new performance objectives and new tube needs for commercial as well as military applications.

All tubes illustrated above are high vacuum types developed by UNITED ELECTRONICS for exacting duties which no previous tubes of comparable size could handle.

We shall be glad to have your inquiries.

OUR BUSINESS



TYPE 578 HALF-WAVE RECTIFIER & SURGE LIMITING DIODE

Reduced size version of JAN 8020 designed for airborne and other installations where compactness is important.

MAX. DIMENSIONS:
Ht. 6.5"
Diam. 2.07"

RATINGS:

rectifier
Ei 5 volts
If 6 amps
epx 40 kv
ib 750 ma
Ib 100 mAdc
surge limiting diode
Ei 5.8 volts
If 6 amps
epy 12.5 kv



TYPE 582 HALF-WAVE RECTIFIER

High vacuum tube for use in lieu of gas tubes in airborne equipment.

MAX. DIMENSIONS:
Ht. 5.75"
Diam. 1.57"

RATINGS:

Ei 2.5 volts
If 5 amps
at 60,000 ft. alt.
epx 7 kv
ib 1 amp
Ib 250 mAdc
Ik 40 (min.) sec.
i surge 5 amps
at 55,000 ft. alt.
epx 9 kv
Ib 210 mAdc
Full ratings apply for supply frequencies up to 500 cps.



TYPE 3B24WA HALF-WAVE RECTIFIER

Ruggedized version of JAN 3B24W.

MAX. DIMENSIONS:
Ht. 4.8125"
Diam. 1.5625"

RATINGS:

Ei 5 volts
If 3 amps
epx 20 kv
ib 300 ma
Ib 60 mAdc
with 1/2 filament
Ei 2.5 volts
If 3 amps
epx 20 kv
ib 150 ma
Ib 30 mAdc
Shock Rating 450 G



TYPE 591 CLIPPER DIODE RECTIFIER

Designed for oil immersed operation in airborne radar.

MAX. DIMENSIONS:
Ht. 2.875"
Diam. 2.0625"

RATINGS:

Ei 6.3 volts
If 4 amps
clipper diode
epx 16 kv
ib 12 amps
Ib 60 mAdc
rectifier
epx 18 kv
ib 470 amp
Ib 150 mAdc

TYPE 577 HALF-WAVE RECTIFIER

Reduced size version of JAN 8020 designed for airborne and other installations where compactness is important.

DIMENSIONS:
Ht. 7.5"
Diam. 2.06"

RATINGS:

Ei 5 volts
If 10.3 amps
epx 25 kv
Ib 1.5 amps
Ib 300 mAdc

TYPE 596 FULL WAVE RECTIFIER

High altitude version of JAN 1641.

MAX. DIMENSIONS:
Ht. 5.75"
Diam. 2.250"

RATINGS:

Ei 5 volts
If 3 amps
cond. input
epx 2300 volts
ib 825 ma
Ib 275 mAdc
i-surge— 2.75 amps

epx 4500 volts
ib 165 ma
Ib 55 mAdc
Eo 2000 Vdc

choke input
epx 2750 volts
ib 360 ma
Ib 275 mAdc

Altitude rating under above conditions—60,000 ft.



Since 1934

UNITED ELECTRONICS

UNITED ELECTRONICS COMPANY, 42 Spring Street, Newark 4, New Jersey

Molded Knobs

Made in Variety of Colors

A line of plastic knobs and handles designed to meet a wide range of applications is available from stock. Modifications can be made from the stock molds to meet special requirements.

Special markings, graduations and other designs can be branded as desired on the plastic knob much faster and with less expense than engraving. Synthetic Products Co., Dept. ED, 1405 16th St., Racine, Wis.

CIRCLE ED-64 ON READER-SERVICE CARD

Thermostat Metal

In 0.001" Thicknesses

Thermostat metal strips in coils or cut lengths in thicknesses of 0.001", in widths ranging from 1/16" to 5", with thickness tolerances held as close as ± 0.00015 " are available from this rolling mill. They are also equipped to manufacture accurately fabricated parts such as spiral and helical coils, flat blades, U-shapes, etc.

Excellent metallurgical bond between the high-expansive and low-expansive lamina is achieved without the use of a liquid-phase bonding procedure. American Silver Company, Inc., Dept. ED, 36-07 Prince Street, Flushing 54, N.Y.

CIRCLE ED-65 ON READER-SERVICE CARD

Self-Stick Labels

Have No Backing Paper

These self-stick labels withstand heat, cold and extreme humidity or dryness. They are made in a handy roll form. There is no backing paper to pull off.

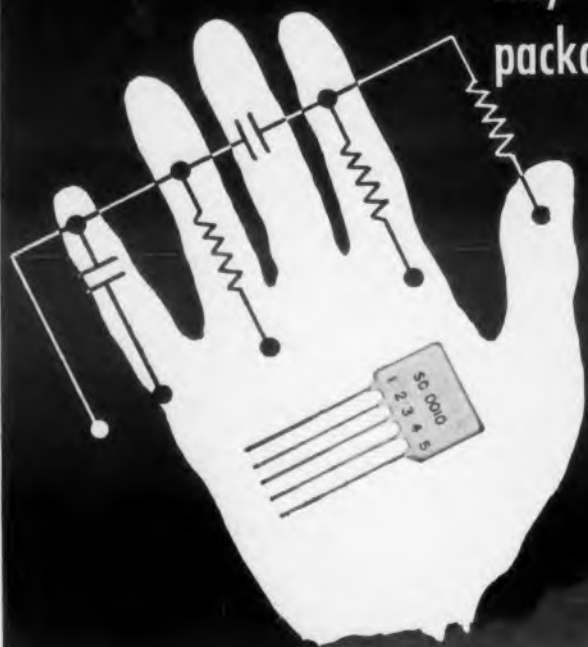
The labels will also withstand oil and grease. They can take pen, pencil or type, or can be printed to order. Two forms are available: "Time Tape" is a white continuous tape from 3/4" to 2" wide; "Time Labels" are white labels with a red border from 3/4" x 1" to 2" x 3" in roll form. Professional Tape Co., Dept. ED, Box 41, Riverside, Ill.

CIRCLE ED-66 ON READER-SERVICE CARD

CIRCLE ED-63 ON READER-SERVICE CARD

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 & MFG. CO.
LATROBE, PENNSYLVANIA
DIVISION OF THE CARBORUNDUM COMPANY

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

New Products . . .

Servo Motor

Has High Torque-to-Inertia Ratio



The M-100 Servo Motor has a new lamination design and is built to yield high motor performance at reduced manufacturing cost. Made in the 1.750" OD size, it features a hermetically sealed stator providing high operating stability and a high torque-to-inertia ratio for rapid acceleration and deceleration service encountered in servo mechanism and computing applications. The unit is designed to be inoperative under single-phase conditions. A sloping speed-torque characteristic provides viscous damping in control applications.

Motor characteristics include: voltage, 115v (fixed phase), 115/57.5 (control phase); frequency, 400cy; two-phase, four-pole; no-load speed, 10,000rpm; stalled torque, 2.7 oz-in; weight, 12.2 oz. Infra Electronic Corp., Dept. ED, 553 Eagle Rock Ave., Roseland, N. J.

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

Impedance Bridge

Checks Network Pulse Characteristics



The Model PIB-1 Pulse Impedance Bridge is a compact self-contained unit capable of measuring impedance and evaluating pulse characteristics of networks and components. It is especially valuable for measurement and analysis of pulse-forming networks, delay lines, pulse transformers, transmission lines, and similar equipment.

The unit consists essentially of a signal generator, a compensated Wheatstone bridge, and a comparator which alternately applies the signal voltages appearing across the arms of the bridge to a common output connector. Output signals may be applied to the vertical deflection system of a driven-sweep oscilloscope.

With an accuracy better than 1%, the unit is direct reading from 0 to 1100 ohms; it is usable to much higher values by simple computation. Internal pulse-forming networks are 0.25 μ sec, 1 μ sec, 5 μ sec, and 12 μ sec. External pulse-forming networks are usable for impedances from 2 ohms to 2000 ohms, 0.05 μ sec to 1000 μ sec. Maximum voltage across the unknown is 100v peak. Clegg Laboratories, Inc., Dept. ED, 142 S. Livingston Ave., Livingston, N. J.

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



Metron

MINIATURE
SPEED CHANGERS

COMPLETE
COMPACT
ADAPTABLE

- Over 400 different Standard ratios! 10:9 to 531,441:1
- SMALL! 1.050" Diameter. Overall lengths: Class A, 3-1/8" Class B, 3-15/16" Class C, 4-3/16"
- Transmit power either way to 100:1 ratios!
- Concentric ball-bearing input and output shafts.
- Hardened steel spur gears.
- Permanent lubrication.
- Prompt deliveries on production or experimental quantities.

BULLETIN No. 100

Gives complete details—Write for it today to METRON INSTRUMENT COMPANY, 450 Lincoln Street, Denver 3, Colorado

BUILT
BY

Metron

MAKERS OF INSTRUMENTS
FOR PRECISION MEASUREMENTS

CIRCLE ED-72 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-73 ON READER-SERVICE CARD FOR MORE INFORMATION

LET *Ametron* RECORDERS
SOLVE **YOUR** COUNTING PROBLEMS

PULSE COUNT
TIME INTERVAL
REVOLUTION COUNT



for **ANY** counting or
timing job!

Ametron Recording Counter

Consists of two basic electrical circuits, both normally open. Momentary closure of the counting circuit advances indexing device one step. Momentary closure of print circuit causes unit to print accumulated count. Automatic reset to zero available if desired. A wide variety of timing mechanism available as standard equipment.

This unit may also be furnished to record elapsed time in these increments: 1/10 minute, 1/100 minute, 1 second and 1/10 second. Counting unit may also be equipped for direct drive from a rotating shaft to count revolutions in units of one tenth.

• THE
STANDARD
OF
ACCURACY
SINCE
1888
•

Write for circular RC 38.

STREETER-AMET COMPANY
4101 N. RAVENSWOOD AVENUE • CHICAGO 13, ILLINOIS

CIRCLE ED-74 ON READER-SERVICE CARD FOR MORE INFORMATION



NEVER BEFORE! A SWITCH SO SMALL
SO LIGHT (6½ oz.) • SO LOW PRICED
AS LINEMASTER **COMPACT**
FOOT SWITCH

Write for
folder and
prices NOW.

Let us quote
on your
special switch
requirements.

Our brand new Linemaster "COMPACT" combines unbelievable low price with the finest, most efficient design now available. It's small and light for maximum adaptability. The absolutely fool-proof actuating mechanism has amazing sensitivity which permits versatile operation by foot, finger, knee or elbow. Ruggedly constructed of long lasting heavy gauge steel, featuring a handsome black crackle finish and non-skid base, "COMPACT" switch has thousands of potential profit-making industrial applications.

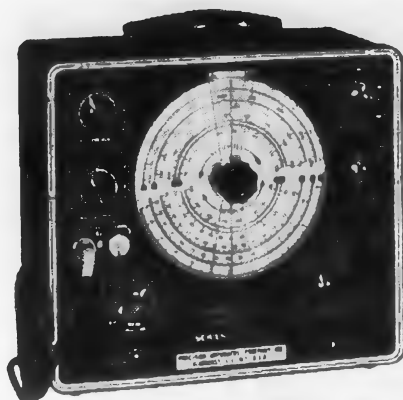
LINEMASTER SWITCH CORP.

130 Putnam Road • Woodstock, Connecticut

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

ELECTRONIC DESIGN • August 1954

Signal Generator
Covers 88kc to 240Mc Range



The Model E-200C is a signal generator intended for alignment work. With high quality sweep signal generators, it can serve as a variable frequency marker generator.

The unit affords direct-reading frequency coverage from 88kc to 240Mc, fundamentals to 60Mc. It has nine bands, and no charts are required. Accuracy is 1% on all bands. It has a 0-1000 point vernier scale. Dual r-f attenuators assure smooth stepless control of r-f signals.

The unit is available in a black, ripple finished, portable steel case. It measures 10-1/2" x 12" x 6". Precision Apparatus Co., Inc., Dept. ED, 92-27 Horace Harding Blvd., Elmhurst, L. I., N. Y.

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

Automatic Sweep
Simplifies Oscilloscope Work



The "Auto-Sweep" eliminates the need for many of the adjustments usually made in oscilloscope work. It locks onto any signal in its normal frequency and voltage range, synchronizes automatically, and generates a sawtooth sweep voltage of constant amplitude at one-half of the input frequency. This voltage may be fed to the X-axis amplifier of any oscilloscope to provide a sweep showing two cycles of the input signal. Both positive and negative sweep polarities are available. No adjustments are necessary.

It is intended that the output of this unit be fed to the X-axis amplifier (preferably d-c), while its input should be fed by the oscillator used in the test. With a weight of 20 lbs, the "Auto-Sweep" measures 7" x 17" x 10". Input frequency range is 20cy to 30kc; input voltage is 0.1-50v; output voltage is over 2v, peak-to-peak; input impedance is over 1 megohm; output impedance is under 1000 ohms; load impedance is over 100,000 ohms; and sweep frequency is half of signal frequency (to show two cycles on the screen). Audio Instrument Co., Inc., Dept. ED, 133 W. 14th St., New York 11, N.Y.

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

an important move



that

means -

INCREASED
PRODUCTION

GREATER
EFFICIENCY

BETTER
SERVICE

for **EAD** customers

Until recently, EAD's expansion was the acquisition of more and more small plants clustered about our main building in Brooklyn. Sooner or later something permanently suitable to our growing needs had to be found...and our new plant, in Dover, New Hampshire, is it. Now, under one tremendous roof—with more than 130,000 square feet of working space occupied, and additional space available for future needs—EAD has the elbow room to offer you better service than ever on all your motor and blower requirements. In looking forward to still greater expansion, we recognize the source of our progress—you, our customers and friends—and we shall strive to keep your friendship through constant development of newer and better rotating electrical equipment.

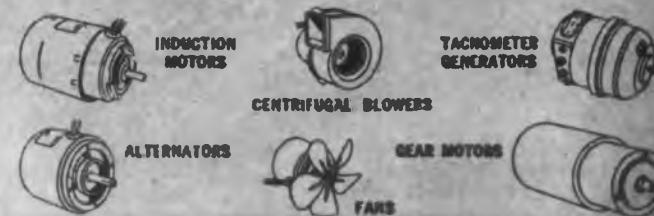
Solving Special Problems Is Routine at EAD

If your problem involves small rotating electrical equipment, bring it to EAD. Our completely staffed organization will modify one of our standard units or design and produce a special unit to meet your most exacting requirements.



EASTERN AIR DEVICES, INC.

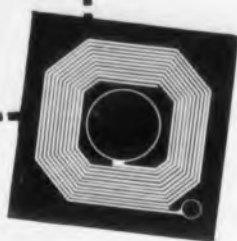
SOLVING SPECIAL PROBLEMS IS ROUTINE AT EAD



391 CENTRAL AVENUE—DOVER, NEW HAMPSHIRE

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

PRINTED CIRCUITS



USECO announces expanded production facilities in a separate new plant devoted exclusively to production of

- Printed Circuits • Etched Circuits
- Terminal Boards (Standard and Custom Built)

Our additional facilities permit MASS PRODUCTION techniques without forfeiting the QUALITY or FAST DELIVERY for which USECO is noted.

Printed and etched circuits in sizes to 18" x 18". Samples on request. We meet all Mil Specs. Complete line of Standardized Electronic Hardware. 24-hour service on quotations. Write today for further information.



U. S. ENGINEERING CO.

521 Commercial St., Glendale 3, Calif.

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

Standard Inductors from 100 μ h to 10h in 16 values

- ★ Calibrated at 100 c against similar inductor as standard, latter certified by NBS
- ★ Individual calibration certificate - corrections at 200 c, 500 c and 1 kc supplied
- ★ Limits of measured certified value of inductance are between $\pm 0.10\%$ and $\pm 0.03\%$
- ★ Very low and known temperature coefficient - approximately 30 parts in 10^6 per deg. C.
- ★ Inductance independent of voltage
- ★ Toroids on ceramic core - negligible magnetic field and pick-up
- ★ Hermetically sealed - thermally aged to relieve all winding strains.



Type 1482
Standard Inductors
priced from \$60 to \$185

GENERAL RADIO Company 275 Massachusetts Ave.,
Cambridge 39, Mass.

90 West St. NEW YORK 6 8055 13th St., Silver Spring, Md. WASHINGTON, D.C.
920 South Michigan Ave. CHICAGO 5 1000 North Seward St. LOS ANGELES 38

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

New Products . . .

Color TV Tester Checks Electron Beam Alignment



This "Color TV Dot Generator" introduces on the color screen a large number of rectangles of light which are large enough to show exactly the degree to which the electron beams of a tube are out of proper convergence. By observation of these rectangles while the tube is being adjusted externally, the user is able to determine when the beams converge at the aperture.

The device should have wide application in color TV laboratories. Sylvania Electric Products, Inc., Dept. ED, 1740 Broadway, New York 19, N. Y.

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

Tension Gage

Operated by One Hand



Spring tensions or the resistive force of any device that opposes motion can be checked accurately and with complete ease in the range from 4 to 2500gm by means of the GEC Tension Gage. Only one hand is needed in applying the gage. The instrument is preset to the required tension by means of a knurled micrometer screw. The end of the gage operating strip is then applied to the point at which the opposing force is to be checked, such as the tip of a spring. Deflection of the operating strip, at the same time that the resisting element moves, indicates that the opposing force is equal to the gage setting.

The gages are precision calibrated, with adjustable zero correction. Six models are available to cover the following ranges in grams: 4-24, 10-80, 50-250, 100-500, 200-1600, 500-2500. Made by the General Electric Company, Ltd. of England. Available from Imtra Corp., Dept. ED, 58 Charles St., Cambridge, Mass.

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

NEW

Type USM



ACTUAL SIZE

SUB-MINIATURE UNIMAX® SWITCH

for easy wiring
in miniaturized apparatus.

- Sturdy, standard flat terminals are widely spaced for rapid wiring and easy soldering.
- Case size 25/32" x 23/64" x 1/4".
- Long life.
- In plain or leaf-actuator styles.
- Rated 5 amps. at 125/250 volts a-c, or 2 amps. at 30 volts d-c; SPDT.

Write for data sheet.

UNIMAX

DIVISION OF THE W. L. MAXSON CORPORATION
460 WEST 34th ST. NEW YORK 1, N. Y.

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

RHODIUM PLATING

Improves Contact Performance

With These Unbeatable Qualities:

- hard, corrosion-resistant, electrical contact surface
- assures low and stable contact resistance
- allows higher pressures to be used in sliding contacts
- not affected by atmospheric changes
- oxide-free contacts eliminate partial rectification and unwanted signals
- provides low noise level for moving contacts
- extremely long-wearing

These exceptional properties of RHODIUM plate assure greater efficiency; as a result, it is widely adaptable for electrical and electronic applications. RHODIUM plated contact surfaces are resistant to surface corrosion under all atmospheric conditions, proving extremely efficient in the field of high and ultra-high frequency.

Write for Free, detailed booklet on RHODIUM PLATING.

BAKER
& COMPANY, INC. **PRECIOUS
METALS**

113 ASTOR STREET, NEWARK 5, NEW JERSEY
NEW YORK • SAN FRANCISCO • CHICAGO • LOS ANGELES

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

ELECTRONIC DESIGN • August 1954

NEW DATA AVAILABLE ON PRECISION SERVO MOTORS

An informative new catalog about Servo Motors is now available from G-M Laboratories Inc. Known as Servo Motor Catalog Number 4, it gives dimensions and characteristics on standard types of G-M precision Servo Motors which can be sampled or produced in quantity within the shortest time possible. By using this catalog as a guide, it is easy to pick out a standard unit to meet dimension and performance specifications. Engineering drawings and characteristics charts are in easy-to-read form. A description of the quality and variety of materials that go into these precision motors is included; also a simplified outline to be followed when ordering standard motors.



G-M LABORATORIES INC.
4284 N. Knox Ave., Chicago 41, Ill.

CIRCLE ED-86 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.

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

ELECTRONIC DESIGN • August 1954

Wire-Wound Resistors Encapsulated Miniature Types



Type EM resistors, of the encapsulated miniature type, are manufactured in accordance with MIL-R-93. They range in size from 7/16" x 1/8" to 1-1/4" x 1/4" and are available in capacities from 10 ohms to 30,000 ohms. Higher resistances are available on special order.

Tolerances range from 1% to 0.01%, full wattage to 350°F. Other features include a low-temperature coefficient of 0.00002/°C, and low thermal emf. The units are recommended for transistor use, digital computers, and similar equipments. Electronic Div., Eastman Pacific Co., Dept. ED, 2320 E. 8th St., Los Angeles 21, Calif.

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

Midget Thermostats Vibration-Resistant Units



The "Thermoswitch" series of precision miniature thermostats features a size of 1/4" diam x approximately 2-3/8" long. Weight is little more than a 25-cent piece.

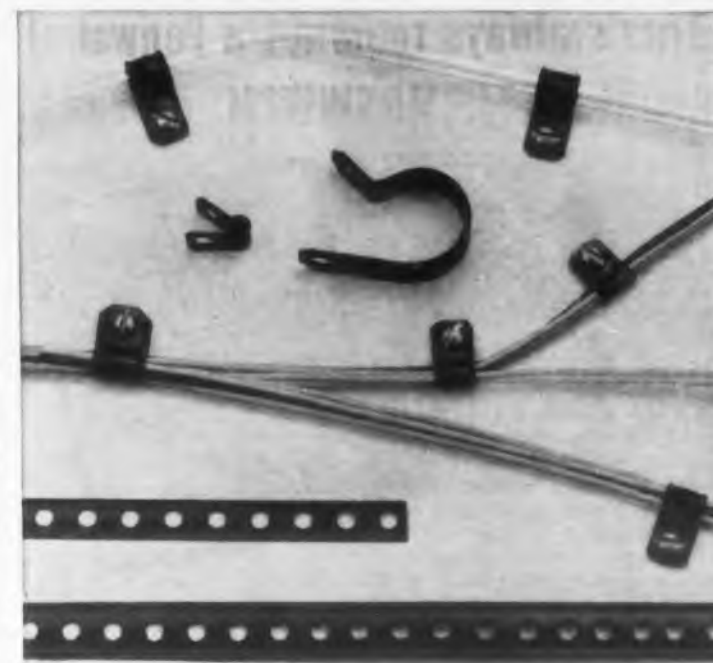
Because of its small size and double-lead design, this unit can be used as a precision temperature controller in any heated device, especially where installation space is closely limited. It may also be used as an overheat detector wherever overheating might endanger a process or mechanism.

Operating characteristics include built-in temperature anticipation, fast reaction time, short heat transfer path, wide operating range, and uniform sensitivity. The design is unusually stable under shock and continuous vibration; under 10g continuous vibration along each of three mutually perpendicular planes. It will hold preset temperature actuation of $\pm 5^\circ\text{F}$.

The thermostat is factory-set to actuate at any selected temperature in the range -65° to $+450^\circ\text{F}$. Depending on the set point, it will have an accuracy of 1° to 5°F . It is designed for lamp service at 115v a-c or 32v d-c.

Three different models permit a variety of mounting arrangements. One has a triangular mounting flange; the second has a threaded hexagonal head for mounting in a tapped hole; the third model has a stud locator to facilitate mounting in a slotted hole. Fenwal, Inc., Dept. ED, Pleasant Street, Ashland, Mass.

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



HOLD—wiring—fragile glass tubing—mercury switches—components—etc. with these **NyGrip*** (all Nylon) plastic cable clips and perforated strapping—light weight—tough—flexible—strong—chemically resistant—use from -60 to 250°F —send for free samples and literature. TM

WECKESSER CO.

5253 N. Avondale Ave.

Chicago 30, Ill.

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

Kanthal DR resistance wire
SAVES YOU UP TO 50% because...

... it is lighter in weight (more feet per pound), and the per pound price is low. Total savings approximately 50%.

... Kanthal DR improves the performance of resistors and precision equipment. Its electrical resistivity is high—812 ohms per circular mil foot—its temperature coefficient is low ($\pm 0.00002^\circ\text{C}$ between -50° and $+150^\circ\text{C}$), and it has a low thermal EMF to copper.

Available in fine gages and all types of insulation.

WRITE FOR FURTHER INFORMATION AND PRICES TODAY

KANTHAL THE KANTHAL CORPORATION
8 AMELIA PLACE, STAMFORD, CONN.

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

There's always room for a Fenwal Miniature THERMOSWITCH® control



SEND FOR BULLETIN

Designed for:
CRYSTAL OVENS
GUIDED MISSILES
WAVE GUIDES
RADAR · COMPUTERS
ANTENNAS

and many others where temperature control is vital and space is at a premium, the new Fenwal Miniature THERMOSWITCH units are real problem solvers.

Bringing you advantages never before found in so small a control, these rugged little devices are extremely sensitive to temperature variations and positive in action. Adjustable anywhere within the range of 0°F to 200°F, they maintain normal control characteristics under vibrations ranging up to 5 G's.

For details on how you can get maximum dependability of temperature control in minimum space, send for your copy of the Miniature THERMOSWITCH Control bulletin.

Write Fenwal Incorporated, 98 Pleasant St., Ashland, Mass.



THERMOSWITCH®

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

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

the NEW miniature ALL-METL



for all-temperature vibration protection
of airborne equipment

These new isolators are the latest addition to the famous Barry ALL-METL line. They are specifically designed to help you meet miniaturization demands under toughest environmental conditions.

- Perfect operation from -60° C to +200° C.
- Weight only 1/2 ounce per unit isolator.
- Free height only 1 1/4" — bottomed height 25/32"
- Load ratings from 0.1 to 3.0 lb. per unit.
- Meet all relevant requirements of JAN-C-172A.
- Ruggedized models for equipment to meet shock tests under AN-E-19, MIL-E-5272, MIL-T-5422.
- Available for 2 or 4-hole mounting.



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

For complete information, ask for your free copy of the new Barry Product Bulletin 542, containing full installation and performance data. And for greatest benefits with these new isolators, let our Field Engineering Service help in the early stages of your equipment design. Write directly to The Barry Corporation, 775 Pleasant Street, Watertown, Massachusetts, or get in touch with your nearby Barry representative.



New Products . . .

Sweep Generator

Covers Complete Range in Single Sweep

This Sweep Generator has the feature of covering its complete frequency range in a single sweep without tuning. Designed primarily as a laboratory test unit, it generates a sweep frequency signal with which bandpass and frequency response, standing wave ratio, and attenuation can be measured in conjunction with a detector and an oscilloscope.



A portable, wide range unit, the generator has applications in all areas of high frequency work, including TV, antenna testing, telemetering, air navigation and traffic control, and mobile communications. It comes in three ranges, with each range covered in a single sweep. Type 2144-01 has a range of 225-420Mc; Type 2144-02 from 470-890Mc, and Type 2144-03 from 850-1275Mc. A self-contained passive marker furnishes stable, accurate frequency indication. Marker calibration is in 5Mc steps, and frequency accuracy is better than ±1Mc in the low range unit, and ±2Mc in the high range unit.

In operation, the sweep generator furnishes a horizontal sweep signal which gives linear frequency display on an oscilloscope. A reference base line is obtained by retrace blanking. The unit has a 50 ohm output impedance with a source vswr of 1.25:1 or less. Kollsman Instrument Corp., Dept. ED, 80-08 45th Ave., Elmhurst, N. Y.

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

Bonding Resin Quick Curing

Low pressure silicone-glass laminates with initial strength and stiffness values approaching those of the organics are being made with a new bonding resin, No. 2106. High temperature strength is obtained after relatively short cures. Optimum strength is attained after only 80 hours at 480°F, or less than half the curing time formerly required.

Flex strength of 10,000psi at 500°F is reached in only 6 hr, indicating that in many applications these laminates may be cured in service. While most samples to date have been laminated at 30psi or less, these laminates may also be produced by high-pressure equipment. Dow Corning Corp., Dept. ED, Midland, Mich.

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

NEY'S SMALL PARTS

PLAY A BIG PART IN
PRECISION INSTRUMENTS



"Like many complicated electronic instruments, the Minshall Organ requires the utmost in precision and quality in all of its components. That's why we take our bias off to your company and its very fine product."

With ideal physical and electrical properties, resistance to tarnish and most corrosive atmospheres, Ney Precious Metals, fabricated into slip rings, brushes, wipers, and contacts, have again demonstrated their superiority for use in precision electrical and electronic apparatus. Improve the accuracy and prolong the life of your instrument by using Ney Precious Metal Alloys. Write today to . . . Engineering Department.

THE J. M. NEY COMPANY

Specialists in Precious Metal Metallurgy Since 1812

373 ELM STREET, HARTFORD 1, CONNECTICUT

13NY54A

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

MINIATURE RELAYS



A NEW STANDARD IN RELAYS



2PDT

model 2001

Contacts to 12 amps Resis. Vibration 15 G's thru 500 CPS without chatter. Coil resistance to 80,000 OHMS. Life —500,000 at 10 amp, 2,000,000 with 5 amp load.



3PDT

model 2007

Contact rating to 20 amps. Shock and Vibration exceeds MIL-R-5757B. —55°C to +100°C. Operation life 50,000 MIN at 15 amps. W/60 amp. surge for 10 millisecond @ 115V, 400 CPS.



4PDT

model 2010

Contacts to 10 amps Resis. Shock and Vibration exceeds MIL-R-5757B and MIL-R-6106. —55° to +125° C 20 G's Vibration without chatter thru 370 CPS.

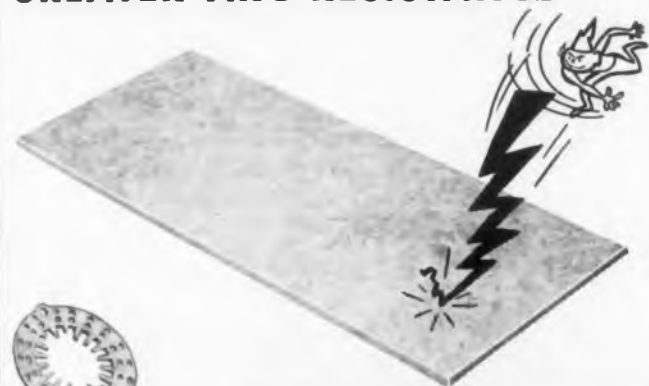


ELECTRO-MECHANICAL SPECIALTIES CO., INC.

6819 MELROSE AVE. • LOS ANGELES 38, CALIFORNIA
WESCON SHOW—BOOTH No. 165

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

GREATER ARC RESISTANCE



A New Polyester Glass Fibre Laminate
... INSUROK[®] XT-200

Combines excellent electrical properties with structural strength which is maintained at elevated temperatures. Low moisture absorption. Punches cold. Write for Data Sheet XT-200.

The RICHARDSON COMPANY

FOUNDED 1858

2682-Q Lake St., Melrose Park, Illinois (Chicago District)

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

Direct-Writing Recorder For Voltage and Current Records



Available in both a-c and d-c models, this lightweight, direct-writing recorder is for voltage and current records. Weighing only 7-1/2 lb, and including the "Cor-mag" self-shielded instrument mechanism, its uses include checking re-

ports of low voltage, overloads or unbalanced conditions; monitoring radio detectors when used with electronic amplifiers; recording current and duration in electroplating and refining; recording speed; and many others.

Model 6401, for d-c measurement, is available in ranges from 1ma to 5amp, and in voltages from 100mv to 300v, self-contained. Higher ranges can be obtained through the use of accessory shunts or multipliers. Rectifier type Model 6402, for a-c measurement, is available in ranges up to 5amp, and up to 300v, self-contained. Higher voltage ranges can be obtained through the use of external multipliers, and higher current ranges with a Model 604 Type 1 current transformer.

Both models measure 6-3/4" x 6-1/4" x 7" deep (approx) and use 4" diam charts. Furnished as portable instruments, they can be provided with brackets for wall mounting, and, when specified, furnished with flange cases for flush panel mounting. Weston Electrical Instrument Corp., Dept. ED, 614 Frelinghuysen Ave., Newark, N.J.

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

Machine Screw Nuts

Low-Cost, Self-Locking Design



The design of "Self-Locking Machine Screw Nuts" eliminates lock washers and their cost of assembly. In addition, the nuts are double-chamfered and countersunk and may be assembled either side up. They are made in

one piece, all metal, and are immune to the effects of oil or water.

They will maintain locking action after repeated use, and will lock in any position on the thread. The nuts are cold-formed for uniformity and strength. They are available in steel, brass, and aluminum, and in all machine screw sizes. Jacobson Mfg. Co., Inc., Dept. ED, Kenilworth 9, N. J.

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

NEW

MICROMAG

Static Magnetic Low Level DC Converter

All Magnetic
Drift Free
High Sensitivity
No Bias Required



MODEL MH-1

Actual Size

A new line of MICROMAG magnetic DC converters... that produce phase reversing AC output (sinusoidal) voltage in response to a polarity reversing DC input voltage. Fully magnetic design eliminates use of vacuum tubes and all moving parts. It is an extremely rugged, reliable and highly stable component of compact configuration. Exhibits very constant conversion gain over a wide ambient temperature range.

APPLICATIONS: Converters for strain gauges, photocells, thermocouples, summing amplifiers, null detectors, control and measurement instruments. Numerous applications in place of mechanical choppers.



Stabilvolt Type C



Micromag MM-421

For telemetering instrumentation

FOR COMPLETE TECHNICAL DETAILS...WRITE SALES DEPT.



MAGNETIC RESEARCH CORP.
318 KANSAS STREET • EL SEGUNDO, CALIFORNIA

VISIT BOOTH #645 • WESCON SHOW • PAN PACIFIC • LOS ANGELES •

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



Get This Informative Free Booklet on New Uses for Straits Tin

New, 20-page booklet tells important story of Straits Tin and its many new uses today. Fully illustrated. Includes sections on new tin alloys, new tin solders, new tin chemicals. Covers tin resources and supply, Malayan mining. Booklet is factual, informative—could well prove profitable to you. Mail coupon now.

THE MALAYAN TIN BUREAU

Dept. C, 1028 Connecticut Ave., Washington 6, D.C.

Please send me a copy of your free booklet on new uses for Straits Tin.

Name _____

Firm Name _____

Street _____

City _____ Zone _____ State _____

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

ANOTHER NEW FAIRCHILD POTENTIOMETER



**TYPE 753
SINE-COSINE**

The Type 753 produces a continuous, full sine-cosine function without mechanical cams and linkages. Each quadrant has 20,000 ohms resistance; linearity is $\pm 0.5\%$ peak to peak. The Type 753 is 3" in diameter and 1 1/4" long from the front of the servo flange to the rear of the cup. Up to six cups can be ganged. All terminals are gold plated for lower contact resistance, less corrosion and faster soldering. Also available as straight sine function.

SAMPLES AVAILABLE ON ORDER

The Type 753 is another reason why Fairchild can help you solve all your precision potentiometer problems. For more information write Fairchild Camera & Instrument Corp., Potentiometer Division, 225 Park Avenue, Hicksville, L. I., N. Y., Department 140-50N.



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

MARKEM[®] MACHINES

Solve "IN-PLANT" Printing Problems
— FASTER — NEATER — AT LOWER COST

Markem machines meet many marking requirements: on flat, curved or irregular shaped objects of plastics, paper, glass and metal. Mark items at production rates — or a few at a time — only as you need them. Easily changed type for variable data produces neat, clear imprints in fast drying inks. Machine operation is simple.

Markem can supply the right machine, type and ink for your needs. Write for information, enclosing item you want to mark.

PRODUCTS
PACKAGES
PARTS
LABELS



MARKEM
MACHINE CO.
KEENE 19
NEW HAMPSHIRE

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

New Products . . .

Decade Amplifier

For D-C to 100kc



The Model 103 D-c Decade Amplifier is valuable for servo system design, computer design, strain gage applications, as a recorder or oscilloscope preamplifier, and as a general purpose laboratory

amplifier. It provides step-wise gains of 0, 20, 40, and 60db from 0 to 100kc. (The bandwidth at 60db amplification is 0 to 5kc.)

Chopper stabilized amplifier circuitry produces drift-free operation. Adequate feed-back and frequency-corrective networks provide flat response. Input impedance is 100,000 ohms. Output voltage range is $\pm 100v$, and output current is 10ma, max. The dimensions of the unit are 17-1/8" x 8-15/16" x 12-3/4". Kalbfell Laboratories, Inc., Dept. ED, P. O. Box 1578, 1090 Morena Blvd., San Diego 10, Calif.

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

Actuator Motor

Compact Unit for Intermittent Use



A compact motor for intermittent duty, the Type SR43 is useful for such applications as low or high-speed, linear or rotary-actuator mechanisms. The unit incorporates an automatic clutch brake which applies 2 oz-in or brake torque to the load, and disengages the armature automatically when power is removed. Totally enclosed, the unit turns up to 20,000 rpm at 1-3/4oz-in torque with 3.8amp of 28v d-c power.

Rotation is reversible, and various shaft arrangements including plain shafts, splines, keyways, and gears to specification can be provided. Electrical connections are by integral shielded leads which can be of various lengths as specified. Dalmotor Co., Dept. ED, 1326 Clay St., Santa Clara, Calif.

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

CONTINUOUS TUNING

FROM 50 TO 200 Mc



Just Hatched!
New VHF
Receiver



No time lost in switching from one frequency range to another. Has 72-inch direct reading dial, masked so as to show only the frequency region of interest.

This highly-sensitive, selective AM-FM receiver delivers full professional quality performance in airways, police and other general communication applications . . . in direction finding . . . and in laboratory work. Speaker and all features normally needed are included as integral parts of the receiver. In addition, special outputs are provided for the operation of an external speaker and auxiliary units to facilitate use of the receiver as a component in complete communication, telemetering and direction finding systems.

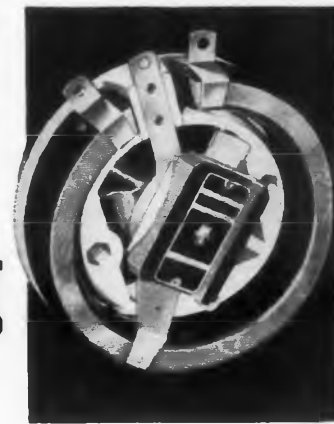
It's compact—8 3/4" high by 19" wide. For detailed specifications, write Dept. ED-8.

**SERVO CORPORATION
OF AMERICA**

New Hyde Park, New York

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

New 300-watt Vitrohm ring rheostat with exclusive "twin-shoes"



Ward Leonard's exclusive sintered self-lubricating twin-shoe construction insures uniform contact pressure, plus unusually smooth and trouble-free operation.

Other features of the new 6" Vitrohm ring rheostat eliminate backlash, insure contact pressure, prevent arm over-travel or radial motion. It takes less back-of-panel space, too.

Write for Bulletin 1116, Ward Leonard Electric Company, 77 South St., Mount Vernon, N.Y. 413

WARD LEONARD ELECTRIC CO.

Result-Engineered Controls Since 1892

RESISTORS • RELAYS • MOTOR CONTROLS • CHROMASTER



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

ELECTRONIC DESIGN • August 1954

Plastic Laminate

Easily Worked

A paper-base, electrical-grade plastic, bonded with a polyester-modified melamine resin has been developed to eliminate difficult machining properties. This high-pressure laminate possesses excellent dielectric strength, low dissipation factor and good moisture resistance.

The melamine-polyester can be punched in thicknesses up to 1/8". In addition, sections up to 3/8" can be shaped by shaving dies. It can be drilled, sawed, turned, and milled using standard tools rather than carbonyl-tipped tools. It is available in 39" x 47" sheets in thicknesses of 1/32" to 1" inclusive. The color is ivory and the finish is dull semi-gloss. National Vulcanized Fibre Co., Dept. ED, Wilmington, Del.

CIRCLE ED-120 ON READER-SERVICE CARD

Color Coded Wire

Made with "Kel-F"

Unlimited color coding by means of striping in 10 standard colors on "Kel-F" insulated wire is available. Coding is further extended by varying the number and width of stripes. Over 2000 combinations are possible. Kel-F may be used from -125°C to 150°C. The Rex Corporation, Dept. ED, West Acton, Mass.

CIRCLE ED-121 ON READER-SERVICE CARD

Chart Paper and Ink

Produces Clean, Accurate Records

A line of chart paper and recording ink has been designed to meet needs for greater accuracy, faster recording speeds, and broader applications of recording. The new paper has been specially sized so that the new inks will produce a clean, accurate record and will not "feather" (a fuzzy line produced by overabsorption of ink). The ink is available in a number of colors. Minneapolis-Honeywell Regulator Co., Industrial Division, Dept. ED, Wayne and Windrim Aves., Philadelphia 44, Pa.

CIRCLE ED-122 ON READER-SERVICE CARD

CIRCLE ED-123 ON READER-SERVICE CARD ➤

New General Electric "fleaweight" aircraft transformers 50% lighter

New insulation and coil winding process make possible smaller, lower-priced transformers, rated 50 to 500 va

With space and weight so much a premium in today's aircraft, you'll want to take advantage of the savings offered by the new G-E "fleaweight" transformers. Here's a line of transformers that are up to 60% smaller and 50% lighter . . . save you mounting space and materials . . . cost you less than existing units.

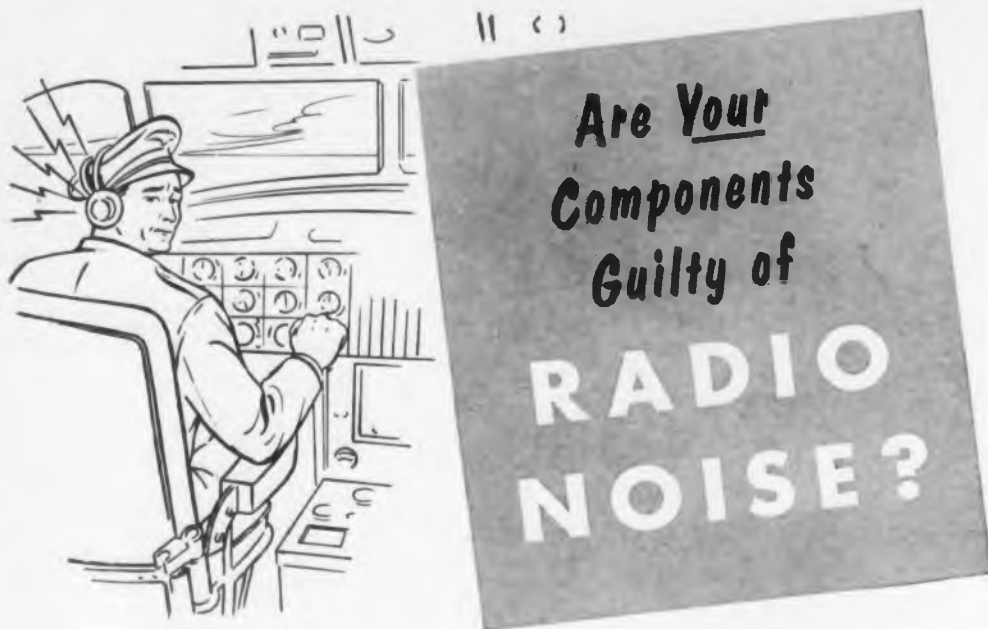
Combining silicone insulation and a new method of coil winding, the new "fleaweights" are especially suitable for operation in the higher ambient temperatures of today's high-speed aircraft. Use them for a wide range of 400-cycle aircraft applica-

tions including landing lights, navigation lights, and instruments. The "fleaweights," featuring a low center of gravity and strong vibration-resistant mounting, give you power reliability.

Like other units in the G-E line of electronic and aircraft transformers, the "fleaweights" are tailored to your particular, specialized requirements. If you need application engineering assistance, contact your nearest G-E Apparatus Sales Office. For literature on G-E transformers, write General Electric Company, Section 412-114, Schenectady 5, New York.

Progress is our most important product

GENERAL  ELECTRIC



POTTER can tell you "why"
POTTER can tell you "how"
 and **POTTER** can make
 the **FILTER** that will
 confirm that "how"

Once it's stated completely and correctly,
 a problem is half solved.

Potter can put the facts and figures of
 your problem on paper . . . can
 chart its limits in laboratory tests . . . can
 engineer the solution. And Potter
 can embody that solution in
 subsequent design and production.

Call Potter to engineer, design and
 produce the filter to solve your
 radio interference problem.
 Write for Bulletin 41C.



THE
potter
 COMPANY

1950 SHERIDAN ROAD
 NORTH CHICAGO, ILL.

SPECIALISTS IN
 FIXED PAPER
 CAPACITORS
 SINCE 1925

CIRCLE ED-115 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Teflon-Silicone

Available in Various Hardnesses

Called "Tufsil", this elastomer is a Teflon-Silicone combination with a tear strength up to 210 lb per inch. It is available in various hardnesses and retains the thermal properties of silicones, with much greater tear strength and oil resistance. It maintains its flexibility over a temperature range of -120°F to 600°F . Pacific Moulded Products Co., Dept. ED, 905 East 59th Street, Los Angeles, Calif.

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

Choppers

For Mobile, Military, and Aircraft Use



These precision, electro-mechanical vibrator, d-c to a-c choppers convert d-c into a modified square wave output with a fundamental frequency equal to that applied to the coil.

With a 0-500cy frequency range, they are available in four standard coils for 6v, 12v, 18v, or 26v rms. The tolerance on operating voltage is $+30\%$ -20% .

Gold contacts are used to assure superior performance in the critical 0 to 1-1/2v d-c range. The contacts are spdt, rated 0 to 1-1/2v d-c, 1ma max. The choppers meet all applicable military specifications and have liberal safety factors. Operating characteristics are examined over the full -65° to $+85^{\circ}\text{C}$ range. The case is high permeability steel. The units are available as Type CH-364 plug-in and Type CH-365 non-plug-in. Seated height of the plug-in style is 2-5/16", with a 1.01" diam. Stevens-Arnold, Inc., Dept. ED, 22 Elkins St., South Boston 27, Mass.

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

Plastic Metal

For Prototype Fabrication

Designated "Devcon", a new putty-like material consisting of fine steel powders and an extremely strong plastic can be used to make models and prototypes. It can also be used on the production line in forming dies and drill jigs, etc.

It is as easy to use as modeling clay. No heat and pressure is required, just a hardening agent. The plastic sets in about two hours. It can be sawed, tapped, threaded, and ground with conventional metal-working equipment. It can also be plated or metallized. Chemical Development Corp., Dept. ED, Danvers, Mass.

CIRCLE ED-118 ON READER-SERVICE CARD FOR MORE INFORMATION

**YOU CAN'T
 SHAKE 'EM LOOSE!
 BUT YOU CAN COOL 'EM OFF.**



With **BIRTCHER**

KOOL KLAMPS

BIRTCHER KOOL KLAMPS will help keep your subminiature tubes **COOL** . . . and hold them firm and secure, regardless of how they are shaken, or vibrated.

KOOL KLAMPS are made of a specially developed heat treatable alloy 99 1/2% pure silver of high thermal conductivity.

KOOL KLAMPS under certain conditions are able to reduce bulb temperatures as much as 40°C . **KOOL KLAMPS** have proved of particular value in miniaturized electronic equipment.

Where heat conditions are less critical, beryllium copper **KOOL KLAMPS** are available.

The BIRTCHER CORPORATION

4371 Valley Blvd.
 Los Angeles 32, California

Dept. ED-8-4

Please send Bulletin which describes and illustrates Kool Klamps in detail.

Company
 Attention of
 City State

CIRCLE ED-119 ON READER-SERVICE CARD

Viking miniature connectors

DESIGNED FOR
LONG, RELIABLE
SERVICE LIFE



VIKING circular types. Positive polarization and shielding. Simple locking device mates units against vibration. One to four contacts on small units—5 to 9 on large units.



VIKING printed circuit receptacle. Increases your circuits—unit shown has 20 contacts, and is interchangeable with 18-contact types. Extremely strong contacts, pierced or unpierced.

Hermetic sealing is available on the circular and rectangular series. Write for literature on these or the complete line of VIKING connectors.

VIKING

ELECTRIC

1061 INGRAHAM STREET
LOS ANGELES 27, CALIF.

See our complete line at the
WESCON SHOW • BOOTH #257

CIRCLE ED-132 ON READER-SERVICE CARD



Output Relay

For Two Way Control and Servos

Designed for two way control systems and servos, this 3-position relay has either a single or double pole switch of 2amp rating. With current balanced in two windings, or zero in a single winding arrangement, all switch circuits are

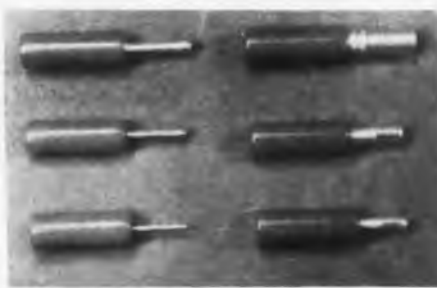
open. One polarity of coil current, or unbalanced current, closes one throw of the switch; opposite polarity closes the other.

Rated double pole sensitivity is 12mw. The relay measures 2-5/8" high above octal or magnal socket by 1-5/8" square. Sigma Instruments Inc., Dept. ED, 170 Pearl St., South Braintree, Boston 85, Mass.

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

Test Adapter Kit

For AN-Type Connectors



The test adapters supplied in the Type 580 Kit provide a safe means of testing wire harnesses and electronic equipment utilizing AN-type connectors.

They accommodate the three most popular socket and pin contact sizes, Nos. 16, 12, and 8, and mate with standard banana plug terminated test leads.

Pin and socket contact dimensions conform to AN specifications; this eliminates socket contact spreading on the connector under test and also provides a convenient means for determining relative contact engaging and separation forces. Air-O-Tronics, Dept. ED, P. O. Box 31, Lancaster, Pa.

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

Laminate

For Printed Circuitry

Designated FF-91, this epoxy type, copper-clad laminated plastic can be used in printed circuitry. The average value of insulation resistance is 100,000 megohms.

Flexural, tensile, and impact strengths are high. dielectric constant at 60cy is 4.62. When dipped in solder at 500°F, the laminate shows no blistering up to 60sec. The Formica Co., Dept. ED, 4616 Spring Grove Ave., Cincinnati 32, Ohio.

CIRCLE ED-135 ON READER-SERVICE CARD FOR MORE INFORMATION

Slug Tuned Coils Precision Wound to Specifications by C.T.C.



Whatever your requirements — military or commercial — you can depend on CTC to give you *guaranteed* accuracy in every detail. All CTC materials, methods, and finishes meet applicable government specifications — and are under the most minute quality control.

CTC coil forms are made of quality paper base phenolic or grade L-5 silicone impregnated ceramic with slugs and mounting hardware furnished. A table of frequencies and permeabilities for slugs used in coil forms appears in CTC Catalog 400, available on request.

Of further interest to design engineers is CTC's new CST-50 capacitor which surpasses the range of capacitors many times larger in size.

For full details on these and other CTC products — custom or standard, the guaranteed components — write Cambridge Thermionic Corporation, 457 Concord Ave., Cambridge 38, Mass.

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



Miniature, Hermetically Sealed, Aircraft Type Relays

Have a New, Wider Range of Performance Characteristics

If you need a small, light 4 PTD or DPDT relay to operate consistently under extremely critical or downright adverse conditions, chances are your requirements can be readily met by one of the multitude of variations possible with the basic "Diamond H" Series R relay. Originally designed to meet all requirements of USAF Spec. MIL-R-5757B, they far surpass many. For example: Various brackets of vibration resistance from 10 to 2,000 cps, plus temperature ranges from -55° to $+200^{\circ}$ C., coil resistances from 1 to 50,000 ohms, contact capacities from 350 V., D.C., 400 MA, to 10 A. at 30 V., D.C. (20 A. for reduced life). Also reliable in signal circuits. Operating time (24 V. models) 10 ms. or less; dropout less than 3 ms. Dielectric strength 450 to 1,250 V., RMS. Insulation resistance 1,000 megohms at room temperature (100 at 200° C.). Operational shock resistance 30, 40 or over 50 "G". Mechanical shock resistance to 1,000 "G". Single or two independent coils, either or both of which will operate unit. All standard mounting arrangements.

Call on "Diamond H" engineers to work with you in developing a variation to meet your specific needs.

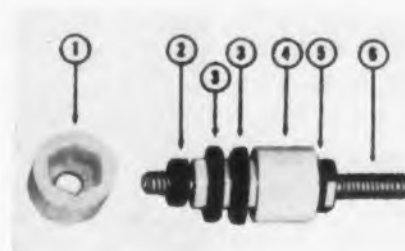
THE HART MANUFACTURING COMPANY
210 Bartholomew Ave., Hartford, Conn.

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

New Products . . .

Bushing

Meets MIL-T-27 Specifications



The HLI-500 non-turning, hermetic seal bushing meets MIL-T-27 Specifications and conforms to the MIL-T-27 twist test. It consists of a stud with a hexagon shoulder (6) which cushions on a neoprene gland (5) and seats into a hexagon counterbore in the top steatite (4).

The top steatite has a hexagon-shaped shaft, fitting through a neoprene washer (3) (which seats on the panel), through the panel opening, and through another neoprene washer (3), into a hexagon counterbore in the bottom steatite (1). The shaft is cushioned against a neoprene gland (2). This forms a non-turning hermetic seal with excellent mechanical and electrical characteristics. The insertion of steatite into the counterbore (1) gives additional electrical insulation. Heldor Manufacturing Corp., Dept. ED, 238 Lewis St., Paterson, N. J.

CIRCLE ED-126 ON READER-SERVICE CARD FOR MORE INFORMATION

Oscillator

Source of Pulses or Square Waves



The Model G-1 Pulse and Square Wave Oscillator features accurate, continuously variable, repetition rates. Three outputs are available. Positive and negative pulses of 0.2- μ sec width and 30v amplitude are simultaneously available, together with a square wave of 75v amplitude. The pulse rates are variable from 1 pulse/sec to 100,000 pulses/sec in five decade ranges. These repetition rates may be controlled by the main dial or by an external control voltage to an accuracy of 1%.

The unit can be used as a variable frequency master timing oscillator in laboratory experiments; for the determination of operating rate limits of equipment under test; and as a frequency modulated oscillator in data transmission systems. Overall dimensions are 7-1/2" x 7-1/2" x 13"; weight is 15 lb. Rutherford Electronics Co., Dept. ED, 3707 S. Robertson Blvd., Culver City, Calif.

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

MISSILES? RADAR?

From one tired ol' engineer to another—PERKIN engineers love to work at solving your most perplexing **DC POWER SUPPLY** problems . . . and keep way ahead of future **DC POWER REQUIREMENTS** in your field—

We've just completed final engineering and production on some unique new types of tubeless! magnetic amplifier regulated **DC POWER SUPPLIES** for ground or airborne **MISSILE** and **RADAR** applications!

Send PERKIN your required power supply specifications for prompt analysis and quotations!

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345 KANSAS ST.
EL SEGUNDO, CALIF. • OR 8-7215

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

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-130 ON READER-SERVICE CARD FOR MORE INFORMATION



for Machine Tool Designers

Data Booklet on G-E Wires and Cords

Here's a 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 W102-820, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

*Registered Trade-mark General Electric Company

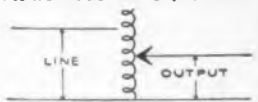
Progress Is Our Most Important Product

GENERAL ELECTRIC

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

FOR DESIGNS THAT REQUIRE ADJUSTABLE A-C VOLTAGE

You can choose from a complete standard line of Powerstat variable transformers. Units are offered in manually-operated and motor-driven assemblies for 120, 240 and 480 volt duty in capacities from 150 VA to 100 KVA.



POWERSTAT TYPE 136



In many applications where you might usually use a rheostat, investigate Powerstat variable transformer to do a better job — and you can get a Powerstat for as little as \$8.50.

You'll find Powerstats are superior. Their dimensional and physical characteristics make them easier to "design into" a product. Their conservative ratings, smooth operation and long life make them a "plus" feature of value.

For the best in continuously-adjustable voltage control use variable transformers. For the best in variable transformers always specify POWERSTATS.

Be sure to see Superior Electric's Mobile Display when it visits your area.

The SUPERIOR ELECTRIC Company
1708 Clarke Avenue, Bristol, Conn.

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

ELECTRONIC DESIGN • August 1954

Flap Attenuator Operates over X-Band Spectrum



This flap attenuator provides a simple and convenient method of adjusting power levels and isolating oscillators from the pulling effects of variable loads.

With a fully inserted flap, it may be employed as a load. It operates over the X-band spectrum from 8200-12,400Mc. For attenuation values less than 20db, maximum vswr is less than 1.15.

A simple screw mechanism positively varies the attenuation continuously from 0 to over 30db. An auxiliary locking device, when used, offers assurance against variation in attenuation due to vibration, shock, and "knob-turners". Guideline Associates, Dept. ED, 57 State St., Newark, N. J.

CIRCLE ED-110 ON READER-SERVICE CARD FOR MORE INFORMATION

Precision Resistor With Elements Suspended in Silastic



The "Rhom-Ized" Precision Wire Wound Resistor is a highly stabilized unit completely impervious to salt water and humidity under all climatic conditions. This feature is achieved by a process in which the wire resistance elements are completely suspended in "Silastic" and then encapsulated in a non-hygroscopic resin.

"Silastic", the silicone rubber used, will withstand temperatures up to 500°F. It has a very high dielectric strength and is weather-proof, water-proof, freeze-proof, and has a high thermo-conductivity value, resulting in lower temperature hot spot rises.

The resistors can be supplied to tolerances of 1%, 0.5%, 0.25%, and 0.1%. Leads are either axial, lug, or radial types. Rho Engineering Co., Dept. ED, 4205 Sepulveda Blvd., Culver City, Calif.

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

Metal Powder For Fabricating Small Parts

A new type of stainless steel metal powder called "Stain-Alloy" is available for making gears, self-lubricating bearings, small precision electronic and electrical parts, bushings, as well as conventional sintered parts. The powder is 18-8 low-carbon moldable stainless steel. Alloy Metal Powders, Inc., Dept. ED, 238 Eagle St., Brooklyn 22, N. Y.

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



For "unit-plug-in" applications... rack, panel, chassis.
Strong aluminum shell. Corner-keying prevents mismatching.
Chamfered lead edges permit blind piloting.
Gold-plated contacts, 5 amp. and coaxial.
Hi-dielectric insulation. Junction shells available.
Write for PR-DPI folder. Write TODAY!

CANNON PLUGS

Please refer to Dept. 143
CANNON ELECTRIC COMPANY 3209 Humboldt St., Los Angeles 31, Calif.
Factories in Los Angeles; East Haven; Toronto, Canada; London, England.
Representatives and distributors in all principal cities.

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



lower costs...
improve design...
save time...
with

**GRC die cast
GEARS & PINIONS**

COMBINATIONS
die cast in
ONE
piece!

Cast in one piece, at one time — and one low unit cost! Produced precisely to your specifications, permitting a flexibility of design heretofore impractical. One-piece assemblies can be cast with shafts or center holes, or in combination with cams, hubs, spacers, flanges and other mechanical elements. Maximum size: 1 1/8" outside diameter x 1/8" face width; wider faces for smaller diameters.

MANY COMBINATIONS AVAILABLE FOR LESS PRECISE APPLICATIONS FROM STOCK DIES AT NO TOOLING CHARGE.

Write Today For
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Send specifications for prompt quotation 100,000 to millions.



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World's Foremost Producer of Small Die Castings
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CIRCLE ED-114 ON READER-SERVICE CARD FOR MORE INFORMATION

IT'S **CHICAGO** FOR
High Fidelity

**BROADCAST
MILITARY
MINIATURE
COMMERCIAL
HOME**



Where fine audio quality is essential, for private, commercial or military equipment, you can depend on CHICAGO high fidelity transformers for distortionless sound reproduction.

CHICAGO
**ULTRA-LINEAR
HIGH FIDELITY**
Output Transformer
BO-13

This "super-range" transformer, specifically designed for ultra-linear Williamson amplifier circuits, is typical of the many high fidelity transformers available from CHICAGO.

Amplifier frequency response, with the BO-13, is flat from 20 to 60,000 cycles at 20 watts output. At a 1 watt listening level, the BO-13 is flat from less than 10 cycles to beyond 200,000 cycles.

Intermodulation distortion, measured at 60 and 7000 cycles, 4:1 ratio, is less than 3% at 21 watts. Total harmonic distortion is below 0.1%, measured at 1000 cycles, up to 21 watts.

The BO-13 is housed in a compact, seamless steel case measuring $3\frac{3}{16}$ " x $3\frac{11}{16}$ " x $4\frac{11}{16}$ " high. CHICAGO's famous "sealed-in-steel" construction provides maximum shielding and full humidity protection.

CHICAGO Bulletin 33 lists performance curves and other useful information on the BO-13. Write for your FREE copy, or get it from your CHICAGO distributor.



CHICAGO CATALOG CT-554, listing complete electrical and physical specifications on over 500 CHICAGO transformers. Available from your CHICAGO distributor or from Chicago Standard Transformer Corporation.

CHICAGO STANDARD TRANSFORMER CORP.

3501 ADDISON STREET

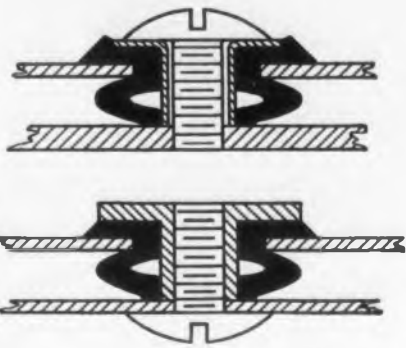
CHICAGO 18, ILLINOIS

EXPORT SALES:
Roburn Agencies, Inc.
431 Greenwich Street
New York 13, N. Y.

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

New Products . . .

Vibration Absorber For Grommet-Type Applications



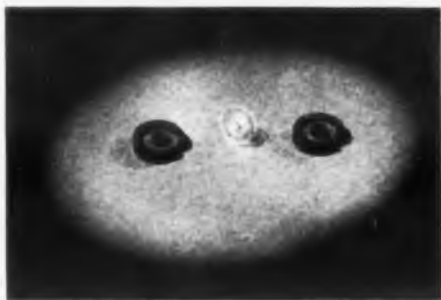
Low cost, ease of installation, and effective isolation of noise and high-frequency vibration are features of the T-Nut Isolator. These units are typically used to isolate sensitive assemblies in air-

craft and guided missiles, to quiet small motors, to protect panel-mounted instruments, and to reduce transformer hum.

With a natural frequency of 35 to 40cy, they provide excellent isolation of disturbing vibrations at 100cy and above. The T-Nuts will fit through plates up to 3/16" thick in four available core lengths. Only 1/16" to 1/8" clearance is needed between the isolated assembly or unit and the mounted panel. The core is either clearance-drilled or tapped for any of several common machine-screw threads. The resilient material can be made of rubber, neoprene, etc. The Barry Corporation, Dept. ED, 875 Pleasant St., Watertown 72, Mass.

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

Ferrite Pot Core Miniature Size



A miniature pot core, designated Part No. 7F160, made of "Ferroxube Type 3C" ferrite material permits construction of very small coil assemblies having

moderate inductance values with a relatively high Q. It can be applied to blocking oscillator transformers, pulse transformers, filters, delay lines, oscillator inductances, etc.

Entirely surrounded by high permeability material, shielding of the units is excellent and stray fields are minimized. Assemblies of this pot core may be placed close together and even stacked in some applications with negligible coupling between adjacent coils.

A nylon bobbin, part No. A508-72, is also available for use in assemblies of the new pot core. The bobbin may be seen in the center of the photograph between two halves of the pot core structure. Ferroxcube Corporation of America, Dept. ED, Saugerties, N. Y.

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

Miniature Altitude Switch



with

IMPORTANT DUTIES

Weighing only 2.335 ounces these minute devices tell the Jet Pilot when to apply oxygen, pressurize the cockpit and level off at service ceiling. It also functions as an automatic radio gain control, protects aerial photography film, and monitors the emergency fuel control system. To undertake these and other important duties faithfully, this snap action aneroid must be manufactured to the most exacting specifications. When calibrated to 40,000 feet pressure altitude, it responds within ± 1500 feet upon being subjected to extreme physical and environmental conditions. Manufactured by the Diaphlex Division.

We invite your inquiry.

Cook Electric Company

Established 1897

2700 Southport, Chicago 14, Illinois

Diaphlex—Aircraft Components and Accessories
• **Wirecom**—Wire Communications, Protection & Distribution Apparatus • **Magnilastic**—Expansion Joints, Heavy Industry Equipment, and Airframe Structures • **Cook Research Laboratories**—8100 Monticello Avenue, Skokie, Illinois • **Inland Testing Laboratories**—1457 Diversey Parkway, Chicago 14, Illinois • **Electronic Systems Division**—2533 N. Ashland Avenue, Chicago 14, Illinois • **Subsidiary: Canadian Diaphlex Limited**—Aircraft Components and Accessories, Toronto, Ontario, Canada • **Plymold Division**—3415 Belmont Avenue, Chicago 18, Illinois.

CIRCLE ED-141 ON READER-SERVICE CARD

teflon

... and We Can Deliver!



EXTRUDED & MOLDED ROD and TUBE Small Machined Parts! Sheets!

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

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

*DuPont trade-mark
for tetrafluoro-
ethylene resin



SEND US YOUR "SPECS" LET US QUOTE!

FLEXROCK COMPANY

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

We are enclosing sample, specs, and quantity for our TEFLON requirements. Please furnish quotation.

Please send us your TEFLON Bulletin including stock list.

Name

Company

Address

City Zone State

CIRCLE ED-60 ON READER-SERVICE CARD

New Products . . .

Low-Resistance Switch Self-Cleaning

This precision self-cleaning switch is designed for special laboratory test or production equipment. It has 12 positions. Internal resistance is extremely low, permitting its use in the most precise equipment.

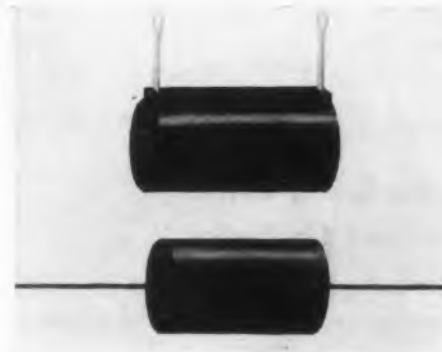


The switch features continuous rotation and detent-action with phosphor-bronze wiper contacts.

It is manufactured to provide a long service life under rugged conditions. Industrial Instruments, Inc., Dept. ED, 89 Commerce Rd., Cedar Grove, N. J.

CIRCLE ED-142 ON READER-SERVICE CARD FOR MORE INFORMATION

Wire Wound Resistors Encapsulated



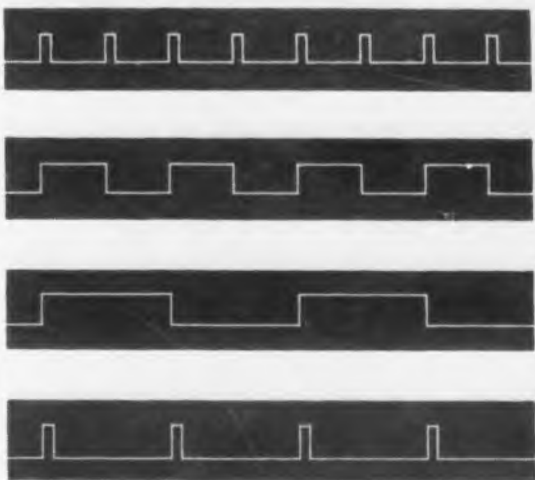
The "Dalohm" Types WWL and WWA lightweight, non-inductive, wire-wound precision resistors are now encapsulated for hermetic sealing. The inert encapsulating material makes them com-

pletely impervious to salt ions, humidity, moisture, and corrosive gases and vapors. The material has a very high dielectric strength. Its coefficient of expansion matches that of the wire itself, eliminating the possibility of distorted windings and shorted turns.

The resistors surpass the requirements of MIL-R-93A and other applicable MIL and JAN specifications. They are Pi-wound on cores molded from the same material as the encapsulating resin to assure the same temperature and humidity cycling characteristics for core and encapsulating material. They are available in resistance ranges of 0.1 ohm to 3 megohms and in tolerances of 0.1% to 1%.

Type WWL resistors have tinned brass lugs and a mounting hole for a #6 screw. Type WWA resistors have axial tinned copper leads directly welded to terminals. Dale Products, Inc., Dept. ED, 1318 28th Ave., Columbus, Nebr.

CIRCLE ED-143 ON READER-SERVICE CARD FOR MORE INFORMATION



Burroughs **PULSE** equipment lets you assemble your own system— **IN MINUTES**

Just by connecting standard cables between Burroughs Pulse Control units, you can assemble virtually any pulse system you want.

Suppose you need a complex pulse sequence for testing. The basic units required to make up the system can be ordered from Burroughs—and delivered from stock. Connect them together, and there's your system. You've saved time-consuming "breadboard" engineering, equipment cost, and delay on your primary project. What's more, your Burroughs Pulse Equipment can be used over and over again on different, future projects.

To meet the growing need for

versatile pulse control systems, Burroughs offers a whole family of matched pulse handling units: pulse generators, coincidence detectors, flip-flops, gating circuits, etc. During the past four years, this equipment has been in use by such prominent organizations as MIT, Consolidated Engineering Corp., Wayne University, Stanford Research Institute, and many others.

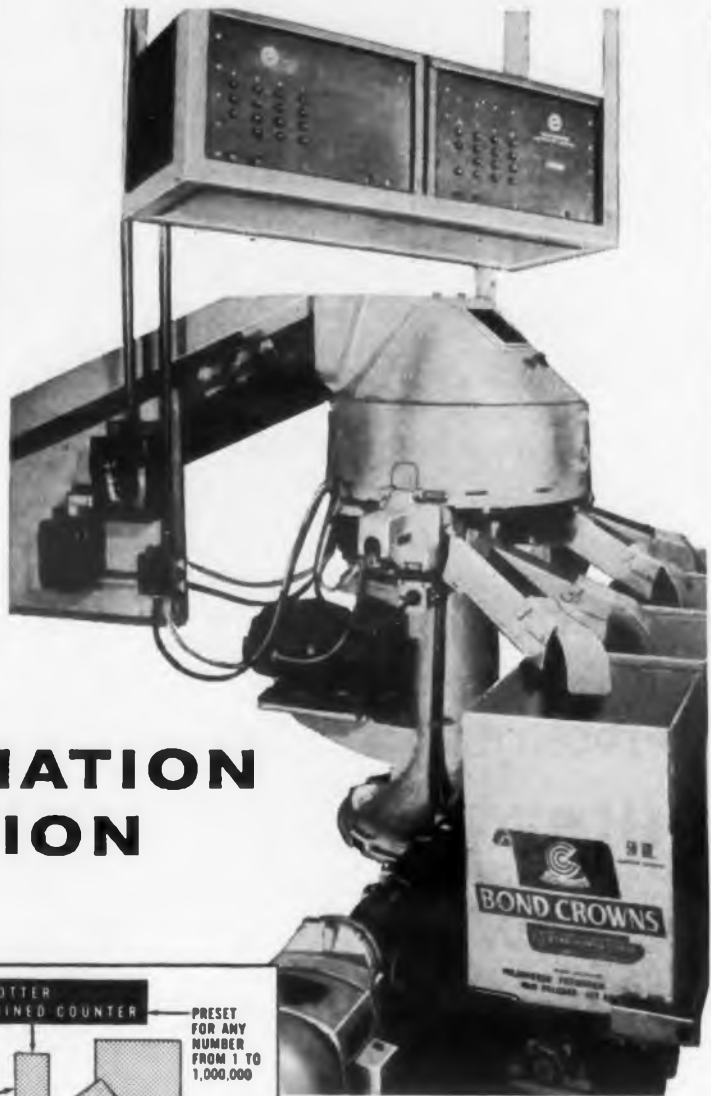
Let us help you get started quicker on pending engineering work. Write us a letter outlining briefly your pulse system requirements. Dept. 4-H, Electronic Instruments Division, Burroughs Corp., 1209 Vine St., Philadelphia 7, Pa.

B *ELECTRONIC INSTRUMENTS DIVISION*
Burroughs

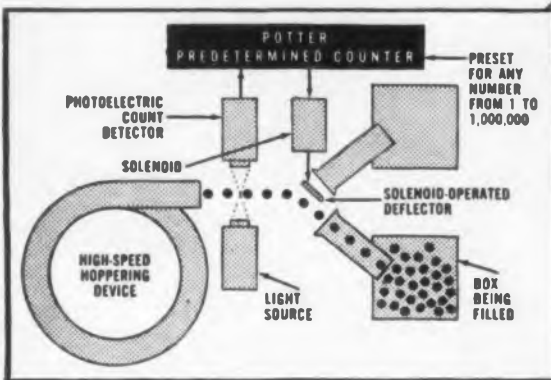
FIRST IN PULSE HANDLING EQUIPMENT

CIRCLE ED-144 ON READER-SERVICE CARD FOR MORE INFORMATION

**HOW
POTTER
ELECTRONIC
COUNTERS
SAVED
MONEY
FOR
CONTINENTAL
CAN**



AUTOMATION IN ACTION



▲ The Crown & Cork Division of the Continental Can Company employs Potter Predetermined Electronic Counters to package exactly 7,200 bottle caps in each carton — automatically. Results: reduced labor costs, greater packaging accuracy, less material waste.

▲ The sketch shows how an economical Potter counter can automatize your packaging or batching process. Counters are available for batches from 1 to 1 million, and rates of 60,000 per minute and higher may be accommodated.

Exact packaging by direct count has the following advantages over approximate methods, such as weighing and volume measurements:

- Eliminates customer complaints due to short counts.
- Eliminates costly overcounts.
- Frees operators for more productive work.
- Packaging becomes automatic and limited in speed only by capabilities of production machinery.
- Completely electronic—no moving parts to wear.

Automation need not be complicated and expensive. Many users have installed Potter systems without interrupting production. Exclusive circuits assure long-lasting trouble-free operation. Also available is a complete line of photoelectric, electromagnetic and impact count detectors.

Send full details of your packaging or control problem today. Our applications engineers will be pleased to submit a detailed proposal. No obligation, of course.

Potter POTTER INSTRUMENT COMPANY, INC.

115 Cutter Mill Road, Great Neck, N. Y.

CIRCLE ED-146 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Signal-Gain Generator For U-H-F Testing



The Model SU-200 Signal-Gain Generator has a frequency range from 440 to 910Mc to an accuracy of $\pm 2\%$. Compact, light in weight and fully portable, this instrument features continuous and precise tuning over the entire u-h-f range;

calibration in both frequency and channel designations; balanced detector meter circuit and gain control; and coaxial tuning elements. It has a single direct-reading scale.

The instrument measures gain, tracking, calibration, accuracy and range of u-h-f tuners, converters, antennas, strips, boosters, and receivers. It can act as a signal power source for various types of measuring equipment, such as v-h-f bridges and slotted lines. Granco Products, Inc., Dept. ED, 36-17 20th Ave., Long Island City 5, N. Y.

CIRCLE ED-147 ON READER-SERVICE CARD FOR MORE INFORMATION

Teflon-Insulated Wiring Spiral Striped for Coding

Spirally striped "Tensolon" high-temperature "Teflon" insulated hook-up wires conform to commercial (GEN-104) and military (MIL-W-76A) specifications for color coding. Up to 819 different striped combinations are possible using black, brown, red, orange, yellow, green, blue, purple, and grey inks.

The colored stripes are made with high-temperature tetrafluoroethylene inks fused into the surface of the insulation. A broad, colored, helical stripe is used on natural or white Teflon insulation to represent the base color. One or more narrower stripes can be applied to represent conventional tracer colors. Width and spacing of the stripes makes the sequence of colors easily distinguishable.

Finished wire is supplied in conductor sizes from No. 26 to No. 10 AWG. The insulation has a nominal wall thickness of 0.010" to meet specification MIL-W-16878A for type E wire rated at 600v and up to 250°C continuous temperature. A nominal wall thickness of 0.007" is also available. Tensolite Insulated Wire Co., Inc., Dept. ED, 196 Main St., Tarrytown, N. Y.

CIRCLE ED-148 ON READER-SERVICE CARD FOR MORE INFORMATION

New! Mag-Seal

MINIATURE SEALED CONTACT RELAY . . .

High operating speeds (up to 0.8 milliseconds), high sensitivity, low contact resistance and capacitance. Long life contacts hermetically sealed in glass with either vacuum, inert or reducing gases; unusual space-saving construction; single and multiple pole types.

Models available to operate under conditions of high vibration and acceleration. Single or double coil construction for biased or differential operation. Variety of contact ratings available. Write for Information.



Giannini

G. M. GIANNINI & CO. INC.

Electro-Mechanical Division

EAST ORANGE, NEW JERSEY

CIRCLE ED-149 ON READER-SERVICE CARD

ELECTRONIC DESIGN • August 1954



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.

8503 W. JEFFERSON BLVD., CULVER CITY, CALIF.
TELEPHONE: TEXAS 0-5581 • VERMONT 0-6402

Printed Circuit Kit

Includes Complete Instructions

These inexpensive kits provide all the components required for the formation and evaluation of a printed circuit in the laboratory. The materials permit the formation of printed wiring, printed coils, and printed capacitors.

The process requires an initial inking of the copper laminate followed by an etching bath and a neutralizing bath. The instructions include calculations to determine the inductance of a printed coil. Electronic Products Co., Dept. ED, 1315 Jericho Turnpike, New Hyde Park, L. I., N. Y.

CIRCLE ED-150 ON READER-SERVICE CARD FOR MORE INFORMATION

Decade Scaler

Fast, Accurate, 10Mc Unit



The HLI-5000 "Fast Decade Scaler" is designed to allow fast and convenient high speed counting of pulses encountered in nuclear work, computer and

pulse control problems, high frequency measurements (to 10Mc), and small time interval measurements (to 0.1μsec accuracy). The scale factor of 100 and the output pulse characteristics have been chosen so that almost all slow, conventional commercial scalars (approximately 10⁵ counts per sec) and frequency counting equipment can be operated from the output pulse with ease. Maximum continuous uniform rate of this unit is 10Mc or 10⁷ counts per sec.

The decade system does not use feedback. Decade action is accomplished by the direction of pulse flow through a four-stage binary scaler by diode gates. The gates are controlled by the normal binary progression of counts through the scaler. This makes possible a decade with a bias range as wide as a binary, and with an inherent reliability approaching that of a binary. The gate switching method minimizes the usual delays in decades. A four-neon 1-2-4-8 indication system is used for each of the two decades. Each lamp has independent on-off characteristics of a binary and thus provides the same reliability of indication.

Size of the unit is only 10-1/2" x 19" x 13" deep (rack mounting). It takes 105-125v, 50-60cy, 175w (approx). Pre-amplifiers, and a pulse-height discriminator can be provided. The scaler can also be provided equipped with any number of additional slower decade scales. Mechanical registers and other accessories can be included. Relay outputs can be provided for direct binary-decimal coding of computers. Electrical and Physical Instrument Corp., Dept. ED, 27 W. 43rd St., New York 36, N. Y.

CIRCLE ED-151 ON READER-SERVICE CARD FOR MORE INFORMATION

How **Berkeley** equipment helped solve a problem

for Litton Industries

San Carlos, California



PROBLEM: Detection and counting of pulse failures in production testing of magnetrons. High accuracy, reliability, speed and simplicity of operation required.

SOLUTION: Litton engineers devised a system providing reference pulses corresponding to magnetron input and output pulses. These reference pulses are then compared in a coincidence circuit. When the magnetron fails to "fire," an output pulse is produced by the coincidence circuit. This "triggers" a BERKELEY Model 410 electronic counter. Number of pulse failures during test interval is accurately recorded in direct-reading digital form.

RESULTS: BERKELEY equipment made possible positive detection of mis-fires and assisted in identification of the cause. Resulting design improvements produced a magnetron of exceptional reliability at lower cost. The simplified test procedure made efficient production rates possible; relatively unskilled operators are used, releasing higher technical skills for research and development work.

MAY WE HELP SOLVE YOUR PROBLEM? If it involves a faster, more accurate, easier and simpler way to measure frequency, flow, pressure, velocity, rpm., time intervals, viscosity — or high speed counting and counting plus preset control—chances are that BERKELEY can help you solve it. Complete data sheets covering many applications in these fields are yours for the asking — check coupon and mail it now!

M-31

Berkeley

division

BECKMAN INSTRUMENTS INC.
2200 WRIGHT AVE., RICHMOND, CALIF.

Dept. D-8, 2200 Wright Ave., Richmond, Calif.

Please send me application data sheets checked

Name _____

Title _____

Address _____

City _____ State _____

MEASUREMENT OF:

- Pressure Velocity Flow
 Viscosity Operating Time RPM
 Frequency of _____

**COUNTING OR
PREDETERMINED COUNTING OF:**

- CONTROL OF:** Cutting Stock to Length
 Packaging and Batching

CIRCLE ED-152 ON READER-SERVICE CARD FOR MORE INFORMATION

flower of the Engineered Plastics

TEFLON and KEL-F

Electrically—The finest insulating materials known for VHF, UHF and microwave circuits operating in wide range of ambient temperatures and pressure altitudes to 80,000 feet.

Chemically—The only materials that are inert to all chemicals except molten alkali metals, fluorine under pressure and chlorine trifluoride.

Physically—The most anti-heave material known, as well as tough, resilient, wear resistant.

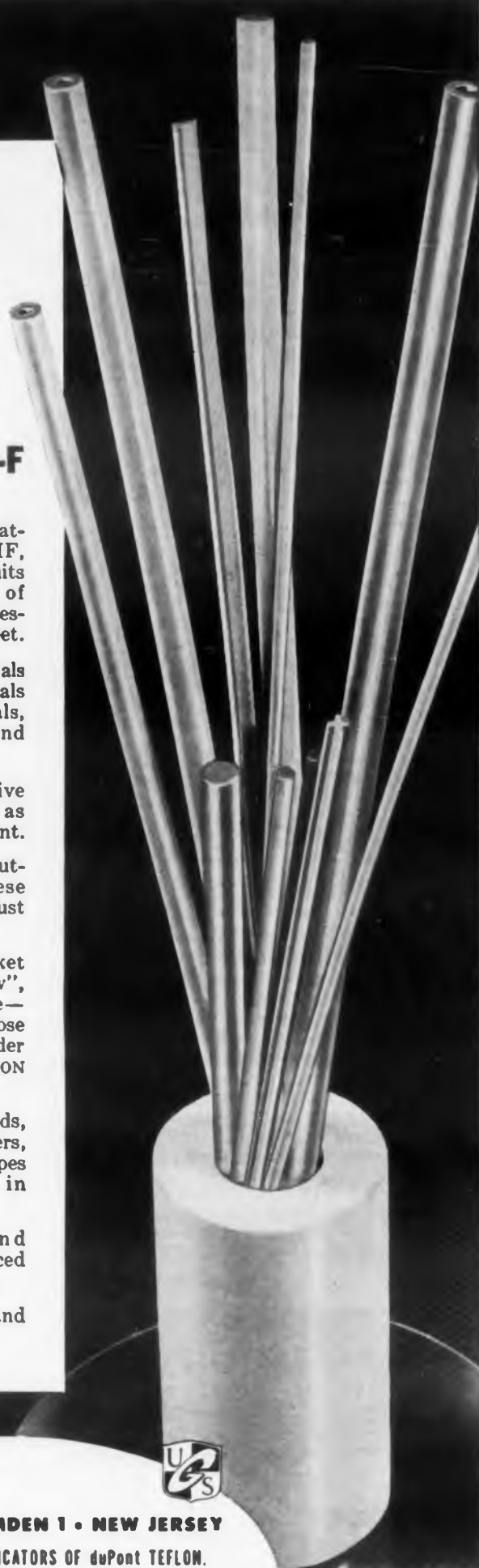
But to gain all their outstanding advantages, these materials must be handled "just right" in their fabrication.

The United States Gasket Company offers "Knowhow", based on long experience—specialized facilities—and close Quality Control "from powder to part" to assure you TEFLON and KEL-F at their best.

Stock includes sheets, rods, tubing, tape, bars, cylinders, beading, and extruded shapes (the most complete line in the country).

Precision molded and machined parts are produced to customers' specifications.

Ask for Bulletins No. 300 and No. 500.



**UNITED
STATES
GASKET
COMPANY**

CAMDEN 1 • NEW JERSEY
FABRICATORS OF duPont TEFLON.
Kellogg KEL-F AND OTHER PLASTICS

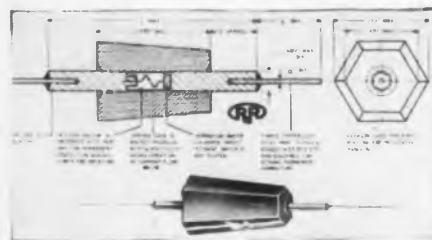
Representatives in Principal
Cities Throughout the World

CIRCLE ED-155 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Germanium Diodes

For Computer Applications



Types 1N111, 1N112, 1N113, 1N114, and 1N115 Germanium Diodes are recommended for applications requiring stability, long life and operation at 55°C, specifications usually encountered in such devices as computers.

Another unit is Type 1N60 Video Detector Diode suitable for use in TV receivers. Selectron & Germanium Division, Radio Receptor Co., Inc., Dept. ED, 251 West 19th St., New York 11, N. Y.

CIRCLE ED-156 ON READER-SERVICE CARD FOR MORE INFORMATION

Analog-Digital Converter

For Data Handling Systems, Computers



This component simplifies and speeds up analog-digital conversion by eliminating ambiguity and intermediate analog steps in the conversion process. The signal travels from shaft position to code disks and then to either a relay system or a diode scanning network followed by a single flip-flop. Time sharing of control circuits is possible for multi-channel systems, using isolation diodes in series with each pick-off brush, allowing the control circuit to be used for scanning many converters.

Ambiguity is eliminated by using two pick-off brushes for each track of the code disk except the first, or least significant. Standard code disks are made for binary operation, but Gray, decimal, or other systems may be ordered. Present models include 7, 13, 17, and 19 digit units, all 2" in diameter and varying from 2-49/64" to 4-13/16" in length. Conversion from digital code to analog shaft rotation may be made with but slight increase in circuitry.

Input torque is under 0.2 oz-in. Current carrying capacity is 2ma per pick-off brush. Digit output frequency may vary from 500cy to 1Mc or higher. The unit operates independent of voltage, temperature, and frequency limitations over a wide range. Life expectancy is 5,000,000 or more cyclings of input shaft at speeds 1-2rps. Weight is 8oz. Librascope, Inc., Dept. ED, 1607 Flower St., Glendale, Calif.

CIRCLE ED-157 ON READER-SERVICE CARD FOR MORE INFORMATION

NEW! UHF GRID DIP METER

300 TO 1000 MEGACYCLES



FEATURES:

- ★ Exceptionally wide frequency range.
- ★ High sensitivity for both capacitive and inductive coupling.
- ★ No wiping contacts.
- ★ May also be used as a sensitive high Q absorption frequency meter.
- ★ Frequency accuracy: $\pm 2\%$ (individually calibrated dial.)
- ★ 18 inches total dial scale readable to $\frac{1}{4}\%$ anywhere on dial.
- ★ High stability RF circuit. Short term stability approximately .01% after initial warm up.
- ★ Provision for internal or external modulation.

PRICE \$275
F.O.B. Boonton, N. J.

**BOONTON
ELECTRONICS CORP.**
BOONTON, NEW JERSEY

BOONTON 8-3603

CIRCLE ED-158 ON READER-SERVICE CARD

Pentode

For Wide-Band Amplifiers



The Type *GL-6265* is the 33rd tube type in this firm's "Five-Star" high-reliability line, making possible the design of aircraft or mobile receivers using the "Five-Star" tubes in every socket. The new type alone can fill up to 45% of existing mobile receiver sockets, and up to 66% of existing aircraft receiver sockets.

The tube is a sharp-cutoff pentode for wide-band, high frequency amplifier applications. Its standard prototype is the *6BH6*.

It is especially designed for dependable life and reliable service under the exacting conditions of mobile and aircraft applications.

The tube incorporates a heater-cathode construction designed to withstand many thousand cycles of intermittent operation. When used in on-off control applications, it will maintain its emission capabilities after long periods of operation under cutoff conditions.

Characteristics and typical operation in Class A-1 amplifier service are: plate voltage, 250v; cathode bias resistor, 100 ohms; plate resistance, approximately 1.0 megohm; transconductance, 4600 micromhos; plate current, 7.4ma. General Electric Tube Dept. Dept. ED, Schenectady 5, N. Y.

CIRCLE ED-159 ON READER-SERVICE CARD FOR MORE INFORMATION

Gear Boxes

For Servomechanisms, Computers



Virtually friction-free and backlash-proof, these precision gear boxes are intended for use in servomechanisms, computers, and other electro-mechanical components. They are available in speed ratios from 20:1

up to 3125:1. They have less than 0.01 in-oz frictional torque at the input shaft.

Backlash at the slow shaft on gear boxes, which operate at speeds of 500:1, has been rated at less than 0.27%. Gears are constructed of aluminum and are lubricated for the life of the assembly. Inertia has been measured at 4.5 gram-cm² on a 500:1 unit. The gear boxes are only 3 1/2" square. Link Aviation, Dept. ED, Binghamton, N. Y.

CIRCLE ED-160 ON READER-SERVICE CARD FOR MORE INFORMATION

bill
of
particulars.



PURCHASE ORDER

KEYSTONE PRODUCTS COMPANY
UNION CITY 2, N. J. UNION 6-2400

TRANSFORMER REPLY SHEET

KEYSTONE has made a specialty of meeting unusually difficult standards and specifications... and that experience can be put to work for you. We will be happy to make recommendations to answer your needs based on the information outlined here.

Company _____
Address _____
City _____

TRANSFORMER REQUIREMENTS

Type	Class	Volts	Grade	Applicable users
Input				
Max. Dimensions			C-1 Duty cycle	Load VA
			Max. weight	

OUTPUT			
voltage			
vol. tolerance			
current			
load PF			
regulation			
vol. breakdown			

Ambient temp. _____
Mounting preferred _____

Max. operating temp. for:
class A 100°C
class B 125°C
class C 175°C

Please include performance diagram and additional remarks on reverse side.

Consumer demands shape manufacturers' requirements... to fail to measure up is to lose the sale... incorrectness in one component often makes the difference... because of this, KEYSTONE custom-engineers each transformer it produces for the individual requirements of each manufacturer... KEYSTONE'S unique system of evaluating data supplied by manufacturers on the new reply sheet, enables KEYSTONE engineers to specify the correct transformer type for all operating conditions... this func-

tional fitting increases consumer acceptance and sales... proving over the years that confidence placed in KEYSTONE is well placed. For free information about how the KEYSTONE transformer reply sheet can help you, write box ...ED-8... today!

keystone 
PRODUCTS COMPANY

804 23RD STREET UNION CITY 2, N. J.

CIRCLE ED-161 ON READER-SERVICE CARD FOR MORE INFORMATION



New Products . . .

Linearity Checker For Testing Instruments



The "Lin-A-Check" is used for determining or checking linearity of all types of indicating instruments, such as voltmeters, d-c milliammeters, vacuum tube voltmeters, galvanometers, and recorders. It can be used on amplifiers and complete instrumentation channels. It provides a sequence of 10 precisely equal increments of a-c or d-c voltages or currents.

Specifications include: 100ohm total impedance; maximum applied voltage of 30v, a-c or d-c; maximum current of 0.3amp; and an accuracy that permits it to determine 10 equal increments of current or voltage with maximum error of less than 0.2%. Overall dimensions are 4-1/4" x 5-1/2" x 4-1/4" deep. Net weight is 2 lb. Micrometrical Development Corp., Dept. ED, 2821 S. State St., Ann Arbor, Mich.

CIRCLE ED-163 ON READER-SERVICE CARD

Variable Transformer Low-Cost Design



The Model PA-3 Variable Auto-Transformer has been added to the "Adjust-A-Volt" line. It is a low-cost unit adaptable

for work-bench or other applications, such as line-voltage control for power supplies and instruments, control of heat, motor speeds, light intensity, and other phenomena.

The unit features a toroidally wound variable transformer with a low-resistance commutator surface and a new type brush assembly.

This control measures only 6-1/2" x 6-1/8" x 6-1/2". It is equipped with a jeweled pilot light, on-off switch, convenient fuse, cord, plug, and receptacle. Input is 115v. Output is 0-135v. Maximum load rating is 0.4kva. Maximum output current is 3.0amp. Standard Electrical Products Co., Dept. ED, 2240 E. 3rd St., Dayton, Ohio.

CIRCLE ED-164 ON READER-SERVICE CARD



DESIGNER'S

Micro-miniature Tantalum capacitors give new design flexibility



Smallest electrolytic capacitors commercially available

Micro-miniature Tantalum capacitors can now be supplied in ratings up to 20 volts, or, up to 8 microfarads in the $\frac{1}{8}$ " long case—higher capacitance in a $\frac{1}{2}$ " case size . . . with -0% to +100% capacitance tolerance. They give you new design flexibility in low-voltage, d-c circuits—particularly transistorized subminiature assemblies where space is at a premium.

Designed especially for nonresonant, noncritical applications such as coupling, by-pass and filtering, G-E micro-miniature Tantalum capacitors outperform aluminum electrolytics in electrical stability, operating and shelf life because of the inert characteristics of tantalum metal. They operate over a -20C to +50C range and may be stored at -65C. With some capacitance derating, Tantalum capacitors perform well below -20C—with some life limitations they will also perform satisfactorily above +50C.

You may obtain samples 2 to 3 weeks after your order is received at the factory. Production lots are supplied 6 to 8 weeks after the order is received. For more information see your G-E Apparatus Sales representative, or write for Bulletin GEA-6065.



G.E. builds dependability into electronic transformers—3 ways

From laboratory samples to the last production model, dependability is built into G-E electronic transformers. Here's how:

- 1. INTEGRATED FACILITIES:** G-E labs, testing facilities, and materials sources are co-ordinated to help get you 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.
- 3. EXPERIENCE:** G-E personnel have worked hand-in-hand with electronics manufacturers for years and consequently keep *your* problems in mind as they produce transformers for your particular, specialized applications. See your G-E Apparatus Sales representative for more information.

GENERAL  ELECTRIC

CIRCLE ED-165 ON READER-SERVICE CARD FOR MORE INFORMATION



New electronic relays have high sensitivity

This new electronic resistance-sensitive relay is able to amplify minute currents carried by very delicate contacts. Even a wet thread will provide enough signal for it to operate.

Sensitivity level is set by adjusting dial, which can be locked in place. The relay may be remotely controlled from as far away as 500 feet. Each can be set for either "normal" (relay "drops-out") or "reverse" (relay "picks-up") operation of the magnetic relay included in the device.

Built for long life, its enclosure is weather-resistant and dust-tight. Terminals are easily accessible; all components of this G-E relay are open for ease in servicing. For further information send for Bulletin GEA-5893.

Fast, accurate circuit analysis

This self-contained, highly stable G-E self-balancing potentiometer rapidly converts small d-c voltages to measurable currents—without loading the measured circuit—for analysis of electronic circuits. It is consistently accurate because simple controls, and automatic, rapid circuit balance minimize operator errors. Easily changed resistor permits selection of input ranges from 100 microvolts to one volt d-c full scale with 5-milliampere d-c output. See Bulletin GEC-367.



Tiny signals amplified

Combining amplifying and rectifying elements in a unit, G-E amplistats (self-saturating magnetic amplifiers) "sense" small signal changes, amplify them greatly, and impart the amplified signal to a system to obtain the desired control. They give you the practical advantages of virtually instantaneous response, low power consumption, long life, and electrical signal isolation. Obtain assistance in applying G-E amplistats at your G-E Apparatus Sales Office. See Bulletin GEA-5950.



Small rectifier has high output

G-E germanium rectifiers offer the highest output in the smallest of rectifiers. For example, the dime-sized, sealed, air-cooled type is available in ratings up to 50 volts, 0.4 amperes d-c. Germanium rectifiers have these advantages: *high efficiency*—operate 98% to 99% efficient; *compactness*—small size and weight per watt output means you can build more compact assemblies; and *long life*—two-year life tests show no detectable aging. Write for Bulletin GEA-5773.



Miniature Pentode Has Long Life

A new 9-pin miniature pentode tube, the 404A, similar to a high-performance 6AK5, is available for use in communications equipment as a voltage amplifier, i-f amplifier or low-noise input tube in the r-f section. Extremely long operating life is achieved by means of a patented "Poliop-tic" manufacturing process that prevents contamination of the tube elements during processing.



In the new process, the chamfered button seal and the tube envelope are optically polished. They form a good seal when the stem and envelope are joined. During the exhaust phase, the stem may be finally sealed to the envelope at a much lower temperature than usual because of this initial seal. As a result, no significant oxidation of the tube elements occurs.

The 404A employs an oxide-coated cathode, and its heater rating is 6.3v, 0.30amp. Maximum anode voltage and dissipation is 180v and 3w, respectively. American Radio Co., Dept. 129, 445 Park Ave., New York 22, N. Y.

CIRCLE ED-166 ON READER-SERVICE CARD

Selenium Rectifier Long-Life Design



With an inverse cell rating of 40v, this selenium rectifier has low leakage (2ma per sq in, average), low inverse loss (with heating as a result of inverse loss at high voltage averaging less than 5°C); and high dielectric quality (with ability to stand surges up to twice rated voltage). It operates in ambient temperatures up to 125°C, with no derating for 50°C.

A new, inherently stable, inorganic barrier adds substantially to the life of the rectifier, with inverse characteristics improving with use. Life tests are now past the 25,000 hr mark. Vickers Electric Division, Vickers, Inc., Dept. ED, 1817 Locust St., St. Louis 3, Mo.

CIRCLE ED-167 ON READER-SERVICE CARD



EQUIPMENT FOR ELECTRONIC MANUFACTURERS

Components	Fractional-hp motors	Development and Production Equipment
Meters, Instruments	Rectifiers	Soldering irons
Dynamotors	Timers	Resistance-welding control
Capacitors	Indicating lights	Current-limited high-potential tester
Transformers	Control switches	Insulation testers
Pulse-forming networks	Generators	Vacuum-tube voltmeter
Delay lines	Selsyns	Photoelectric recorders
Reactors	Relays	Demagnetizers
Motor-generator sets	Amplidynes	
Inductors	Amplistats	
Resistors	Terminal boards	
Voltage stabilizers	Push buttons	
	Photovoltaic cells	
	Glass bushings	

General Electric Company, Apparatus Sales Division
Section F 667-28, Schenectady 5, New York

Please send me the following bulletins:
 for reference only X for planning an immediate project

- GEA-5773 Germanium Rectifiers
- GEA-5893 Electronic Resistance Sensitive Relay
- GEA-5950 Amplistats
- GEA-6065 Micro-miniature Tantalytic Capacitors
- GEC-367 Self-balancing Potentiometer

Name

Company

City State

CIRCLE ED-165 ON READER-SERVICE CARD FOR MORE INFORMATION

"MICRO PROCESSED"
I-S
 BERYLLIUM COPPER SPRINGS



Would a superior coil spring
 solve your design problem?

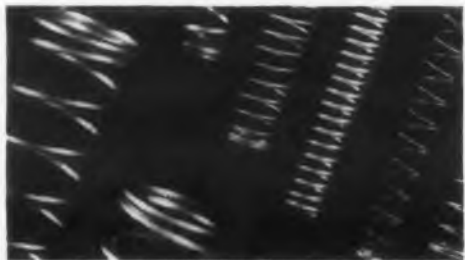
I-S BeCu Springs have an impressive record of superior performance

- ★ High strength
- ★ High Conductivity
- ★ Uniformity
- ★ Reduced set and drift
- ★ Close tolerances
- ★ Long endurance life
- ★ Corrosion resistance
- ★ Stability at extreme temperatures
- ★ Reduced inspection and assembly costs
- ★ Reduced space requirements

It is known that beryllium copper does have certain inherent advantages for some applications. But I-S exclusive heat-treating techniques in spring-forming have magnified and multiplied these advantages. From jet aircraft to refrigerators, billions of I-S BeCu springs have been used for their superior performance—and the resulting economies in cost and labor.

Call it difficult? Then call I-S . . .

From design conference—to prototype—to finished production . . . I-S' exclusive facilities and the specialized ability of our engineering staff are available to help solve your challenging problems.



For more information on BeCu Springs, write today for your free copy of our newest catalog, No. 8. For electronic components, ask for No. 8-A.

Like many other leading manufacturers, you will find that these I-S facilities can make significant improvements in your manufacturing processes, and in your product. And they most likely will save you money. One thing is certain . . . it costs nothing to compare.

But it may cost considerable, not to!



Instrument Specialties Co. Inc.

270-B BERGEN BOULEVARD, LITTLE FALLS, NEW JERSEY
 Telephone Little Falls 4-0280

CIRCLE ED-169 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Wire-Wound Resistors Encapsulated in Air Pocket



"Encapsulated Sealed-Ohm Resistors" have a special construction permitting them to be furnished with temperature coefficients below ± 20

parts per million per degree Centigrade, when required, and with accuracies to $\pm 0.05\%$. The resistance wire in the design is in a slot filled with dry air; no external pressures are applied to it. The air pockets between wire and plastic coating guarantee stability and eliminate shorted turns.

The resistors are completely hermetically sealed, yet are no larger than standard lug-type resistors. The temperature coefficient of expansion of the molding compound is matched with the ceramic bobbin, the resistance wire, and the metal terminals. In addition, the units are made in accordance with MIL-R-93A, and are highly rugged. They withstand the JAN-R-93, characteristic A, salt-water immersion test; and temperature cycling from -65° to $+125^\circ\text{C}$. The molding material will resist pressures equivalent to 75,000' altitude, and will not cold flow at temperatures up to 150°C . The Daven Co., Dept. ED-SW, 179 Central Ave., Newark 4, N. J.

CIRCLE ED-170 ON READER-SERVICE CARD FOR MORE INFORMATION

V-H-F Beam Power Tube For 12v Battery Equipment



The 6417 is a beam power tube of the 9-pin miniature type designed for use in compact, low-power mobile transmitters and in emergency communications equipment operating from 12v storage batteries. Having an ICAS plate-dissipation rating of 13.5w, it can be operated with full input up to 50Mc and with reduced input to 175Mc.

The tube has high transconductance, high permeance, and high power sensitivity, making it valuable as an r-f power amplifier, frequency multiplier, oscillator (VFO or crystal), and driver tube for larger tube types. The high permeance enables it to supply high power output at relatively low supply voltages. Overall dimensions are $7/8$ " diam x $2-5/8$ " high (including pins). Radio Corporation of America, Tube Division, Dept. ED, Harrison, N. J.

CIRCLE ED-171 ON READER-SERVICE CARD FOR MORE INFORMATION

A REAL SPACE SAVER!



the new, highly efficient...
ADVANCE TQ
 MINIATURE RELAY

Only .94 cu. inches in size—yet it carries 3-amp. loads in the 4PDT combination. It's available up to 6PDT, and with class "H" insulation.

It's extra efficient, too, having only one air gap in the magnetic assembly. By spring-holding the armature rigidly in place, and using cross-bar contacts, all alignment problems are eliminated. Insulation is inorganic, hence there is no gassing or bubbling.

The ADVANCE TQ telephone type operates on 90 milliwatts or less. Withstands 10G vibration (10 to 55 CPS). Ambient temperature range: -55°C to $+125^\circ\text{C}$. Life expectancy: 1,000,000 cycles with cross-bar contacts. Open and hermetically sealed types. Write for details.



**ADVANCE ELECTRIC
 AND RELAY CO.**

2435-K NORTH NAOMI STREET
 BURBANK, CALIFORNIA

CIRCLE ED-172 ON READER-SERVICE CARD

Tube Characteristic Sheets

Additions to Line

Pads of 20 sheets of large-size characteristic curves for additional tube types have been added to this firm's line of aids for electronic designers. The 6AQ5-6V6-7C5-6CM6 family are now available on these 8-1/2" x 11" sheets in two types: triode and pentode connection. The military preferred type 6005/6AQ5W is also included.

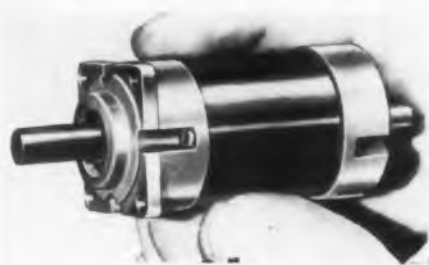
An especially useful feature of the pentode sheet is the inclusion of a set of curves for screen current vs screen voltage and grid voltage in a form permitting the designer to construct load lines exactly as with plate characteristic curves. The curves are for plate characteristics, positive-grid characteristics, μ , g_m , and r_p , plus screen characteristics for pentodes. The reverse side of the sheet gives tabulated electrical and mechanical data and ratings for the tube.

Pads for types 5687, 5751, and 5718 will also be available shortly. Technical Publishing House, Dept. ED, 15 Everett St., Cambridge 38, Mass.

CIRCLE ED-173 ON READER-SERVICE CARD FOR MORE INFORMATION

Gear Reducers

Convert High Speeds to High Torques



A line of miniature precision integral planetary gear reducers is available for converting high speeds into high torque. These packages are

rugged, compact precision gear trains. Continuous output torque ranges up to 1,000 in-oz are furnished.

Basic unit diameter is 1-1/4", with a 3/16" diam input shaft. Length depends on any of the standard speed reduction ratios from 18.78:1, to 21,808:1. The design is consistent with aircraft application requirements and is suitable for operation under environmental extremes. Globe Industries, Inc., Dept. ED, 1784 Stanley Ave., Dayton 4, Ohio.

CIRCLE ED-174 ON READER-SERVICE CARD FOR MORE INFORMATION

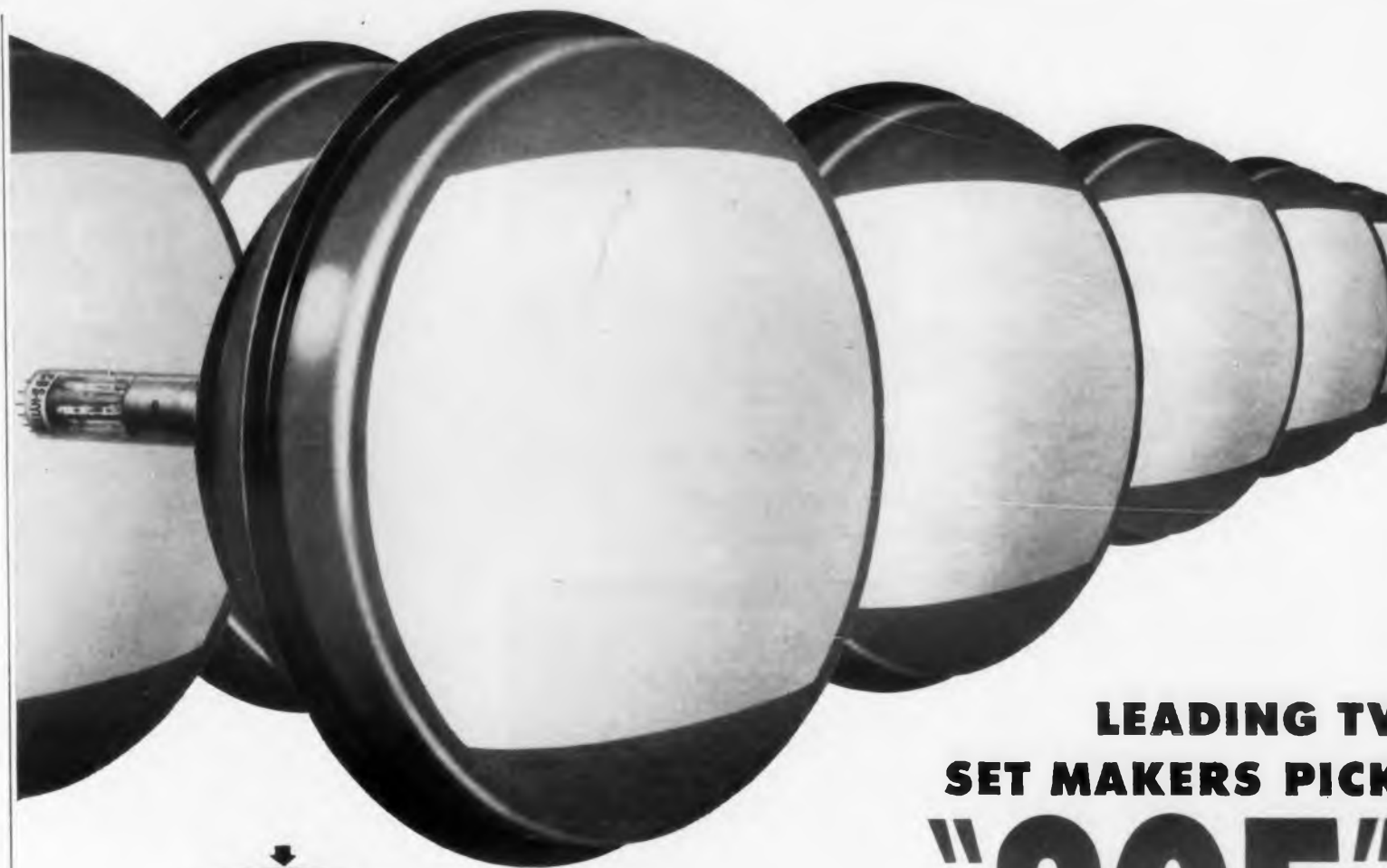
Adhesive

Bonds Mylar to Other Materials

Offering high dielectric strength, "Bondmaster" L272 has been specifically developed for bonding "Mylar" polyester film to a wide range of papers, plastic films, fabrics, etc., for the manufacture of laminations used in slot insulations, phase insulation, core and layer insulation in transformers, and motors.

It retains full bond strength after constant exposure to 320°F for 672hr while at the same time offering excellent electrical properties. Rubber & Asbestos Corp., Dept. ED, 225 Belleville Ave., Bloomfield, N. J.

CIRCLE ED-175 ON READER-SERVICE CARD FOR MORE INFORMATION



**LEADING TV
SET MAKERS PICK**

"205"

LEADING BIG-SCREEN COLOR TUBE

... for Biggest Picture
... for Superior Performance
... for Delivery NOW!

The CBS-Colortron "205" is *today* traveling in freight cars and trucks to the nation's leading TV set manufacturers. It was chosen by them, because of: The "205's" larger 205-square-inch screen. The "205's" over-all superior performance. The "205's" easier circuit adjustments. The "205's" absence of "pincushioning" and other distortion. And the "205's" availability in production quantities now!

BIG-SCREEN COLOR TV IS HERE . . . today . . . at CBS-Hytron. Original . . . simple . . . functional . . . advanced design of the "205" made this possible: 1. With its curved screen-mask construction. 2. With its maximum use of the screen area. 3. With its electromagnetically converged three-beam electron-gun assembly. And CBS-Hytron's huge, new Kalamazoo plant stands ready to step up the "205's" availability when needed. Yes, you can look to CBS-Hytron as the leader . . . and major producer of big-screen color picture tubes.

NEW . . . FREE "205" DATA

Keep abreast of big-screen color TV. Four-page sheet on CBS-Colortron "205," RETMA type 19VP22, contains complete data on: Construction . . . operation . . . application . . . installation . . . adjustment . . . electrical and mechanical characteristics. Write for Bulletin E-227 today!



CBS-HYTRON Main Office: Danvers, Massachusetts

A Division of Columbia Broadcasting System, Inc.
A member of the CBS family: CBS Radio • CBS Television • Columbia Records, Inc. • CBS Laboratories
CBS-Columbia • CBS International • CBS-Hytron



HOW "205" ACHIEVES BIGGEST PICTURE

As its name implies, picture area of "205" is a big 205 square inches. The "205" achieves this maximum utilization of screen area: 1. By photographic printing of tricolor screen directly on inside of curved face. 2. By using a simple, light-weight shadow mask. 3. By positioning the three mask supports above and below the desired screen area . . . where the screen is masked off anyway by the set maker to obtain the desired 4 x 3 aspect ratio. This permits full lateral use of screen.



IT'S CBS-HYTRON FOR NEW COLOR RECEIVING TUBES TOO

TYPE	DESCRIPTION
CBS-Hytron 3A3	Half-wave, high-voltage rectifier
CBS-Hytron 6AM8	Diode, sharp-cutoff pentode
CBS-Hytron 6AN8	Medium- μ triode, sharp-cutoff pentode
CBS-Hytron 6BD4A	Sharp-cutoff beam triode, high-voltage regulator
CBS-Hytron 6BD6	Sharp-cutoff r-f pentode color demodulator
CBS-Hytron 6BJ7	Triple-diode d-c restorer

RECEIVING • TRANSMITTING • SPECIAL-PURPOSE • TV PICTURE TUBES • CRYSTAL DIODES AND TRANSISTORS

CIRCLE ED-176 ON READER-SERVICE CARD FOR MORE INFORMATION

USERS OF ELECTRICAL INSULATION PARTS:

... When you need parts fabricated from any electrical insulating material



... and fabricated with precision accuracy



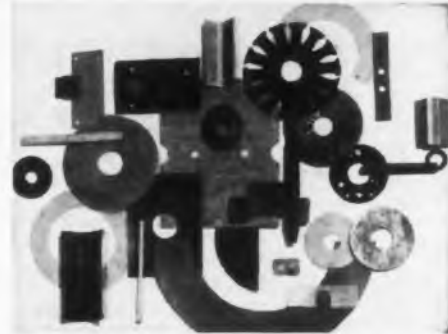
... to your exact specifications



... on moneysaving, high-speed, modern equipment



... that make your insulation parts



... to fit perfectly your electrical product and requirements



Specify **Inmanco**[®]

FABRICATED ELECTRICAL INSULATION PARTS—ASK FOR LITERATURE TODAY

INSULATION		MANUFACTURERS CORPORATION		
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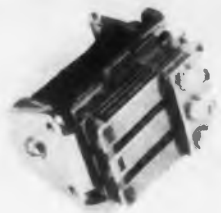
CIRCLE ED-179 ON READER-SERVICE CARD FOR MORE INFORMATION

New Products . . .

Miniature Relay

Meets Spec MIL-R-5757B

The Series M relay is essentially a multi-purpose relay covering the medium sensitivity and medium power fields. Equipped with up to 18 contact springs, this unit will operate for a minimum of 1,000,000cy. Circuit resistance



decreases with life, and a self-wipe action minimizes maintenance.

Contact rating is 115v a-c at 4amp; 115v d-c at 0.5amp; and 28v d-c at 3amp. The unit has medium sensitivity, operating as low as 250mw d-c. Contact resistance is less than 0.03 ohms, and coil resistance can go as high as 20,000 ohms. Operating temperature ranges from -55°C to $+85^{\circ}\text{C}$. Special features such as vacuum impregnation, tropicalization, twin contacts, etc., are available. Kurman Electric Co., Dept. ED, 35-18 37 St., Long Island City 1, N. Y.

CIRCLE ED-180 ON READER-SERVICE CARD FOR MORE INFORMATION

Measuring Instrument

Covers 62 Electronic Ranges



The Model 657 electronic "Do-All" is a measuring unit that covers 62 individual electronic range measurements and combines a capacity meter, a high range ohmmeter, as well as conventional and low ranges, a

VT voltmeter, a peak-to-peak VT voltmeter. It is also an inductance meter with inductance measurements given by chart reference.

Capacity measurements range from 1mmfd to 1,000mfd. The ohmmeter has a 10 ohm center scale on the low range, and its highest range is 10,000 megohms. D-C and a-c (rms) voltages are direct reading to 6,000v and do not require any external multiplier probe. There is also a zero center d-c VT voltmeter permitting discriminator and other voltage measurements showing plus and minus from center scale. The instrument has an 8-1/2" easy-reading meter. Its carrying handle also serves as an inclinable rest to tilt the instrument. Radio City Products Co., Inc., Dept. ED, 1010-14 Centre St., Easton, Pa.

CIRCLE ED-181 ON READER-SERVICE CARD FOR MORE INFORMATION

CASE HISTORY #0237

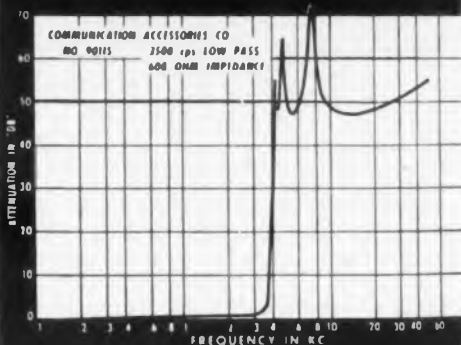
X Company phoned—had a toroid and filter problem. Two CAC engineers visited company via CAC airplane following day. Discussed the problem, suggested engineering approach—returned to CAC plant. Next day engineering started—sample completed rapidly—prototype air-xed. Company X rapidly proved prototypes, completed production drawings and specs. Bid requests circulated. CAC low bidder, as usual. Shipments delivered on schedule. These are the facts. Case closed.

Filter Problems?

SEE A C-A-C MAN



All types of filters—toroidal inductors and special capacitors for maximum stability, sharpness and attenuation—advanced design and printed circuit techniques make possible high degree of miniaturization—hermetically sealed construction.



SEE A CAC MAN

NEW YORK—Harold Gray Assoc.—LA. 4-4258
286 Fifth Ave., New York, N. Y.
PHILADELPHIA—Charles R. Hile Co.—Elgin 6-2266
Hillview Rd., Bx. 144, Paoli, Pa.
BALTIMORE—Charles R. Hile—Boulevard 1202J
(L. G. Korman) 5006 Kenwood, Baltimore 6, Md.
CHICAGO—Gassner & Clark Co.—Rogers Pk. 4-6121
6349 N. Clark, Chicago, Ill.
KANSAS CITY—E. W. McGrade Co.—Delmar 9242
6315 Brookside Plaza, Kansas City, Mo.
LOS ANGELES—Samuel O. Jewett—State 9-1214
13537 Addison St., Sherman Oaks, Calif.
HAMBURG—Cooper-Morgan, Inc.—Emerson 3405
P. O. Bx. 152, Hamburg, N. Y.
SYRACUSE—Naylor Electric Co.—2-3894
State Tower Bldg., Room 317, Syracuse 2, N. Y.
MERIDEN—Henry Lavin Assoc.—7-4555
(Henry Lavin) P. O. Bx. 196, Meriden, Conn.
NEEDHAM—Henry Lavin Assoc.—3-3446
(Robt. V. Curtin) 82 Curve St., Needham, Mass.
CLEVELAND—Ernie Kohler Assoc.—Olympic 1-1242
8905 Lake Ave., Cleveland 8, Ohio
COMMUNICATION ACCESSORIES CO.
Hickman Mills Missouri

CIRCLE ED-182 ON READER-SERVICE CARD

Output Transformer For Ultra-Linear Operation



Designed to convert a regular Williamson high-fidelity audio amplifier circuit into ultra-linear operation, the Ultra-Linear Output Transformer A-8072 is

shown mounted on the left chassis above.

This transformer can be incorporated in circuits producing up to about 25w output. Chicago Standard Transformer Corp., Dept. ED, 3501 West Addison St., Chicago 18, Ill.

CIRCLE ED-183 ON READER-SERVICE CARD FOR MORE INFORMATION

Subminiature Resistors For Transistorized Assemblies



These "Glennite" subminiature resistors are available in resistance values from 50 ohms to 1 megohm. Power rating is 0.1w (up to 0.25w on special request). Especially suitable for transistorized assemblies, they can be used individually, in multiples, in packaged R-C circuits, or incorporated into printed networks.

The resistors are made of a special material deposited on a thin ceramic base. By varying the composition of the material, a wide range of resistance values is covered, with little change in physical size.

Cut to size and resistance after being cured, the individual resistors may be evaluated before being inserted into a packaged or printed circuit.

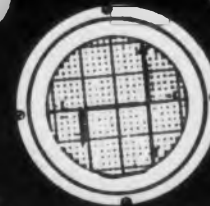
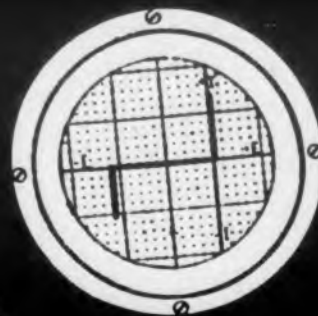
Resistors can be furnished without protective coatings, or with a thin protective coat of high dielectric strength. Where extra strength or security against moisture is necessary, a heavier wax-impregnated phenolic resin is applied. Minimum coating strength is 600v. Dimensions without coating are 0.020" thick x 0.250" long x 0.075" to 0.125" wide.

The resistors can be soldered directly into a circuit or are provided with axial or radial leads, as required. They are self-supporting. Resistance does not change significantly with applied voltage. Maximum temperature coefficient is 0.2%/°C. Glenco Corp., Dept. ED, Metuchen, N. J.

CIRCLE ED-184 ON READER-SERVICE CARD FOR MORE INFORMATION

SILICONDUCTORS*

TRADE-MARK



*SINGLE CRYSTAL SILICON JUNCTION DIODES

BROAD RANGE
IN137A & IN138A

NARROW RANGE
IN200 TO IN215
16 TYPES IN 10%
VOLTAGE RANGES
FROM 5 TO 180 VOLTS

AS

ZENER DIODES
VOLTAGE REGULATORS
HIGH BACK IMPEDANCE RECTIFIERS

IN PRODUCTION QUANTITIES FOR IMMEDIATE DELIVERY

LICENSED BY WESTERN ELECTRIC CO., INC.

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DIVISION OF NATIONAL FABRICATED PRODUCTS, INC.

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CIRCLE ED-185 ON READER-SERVICE CARD FOR MORE INFORMATION



AVAILABLE AS
MATCHED PAIRS & QUADS
CLOSE TOLERANCE ZENER VOLTAGE

*precision-designed
to your specifications*

Now you can order direct! Your call to Thermador's new, completely self-contained Electronics Plant quickly brings you the engineering ingenuity... the precision designing... the dependable, quick delivery that has gained Thermador's world-wide reputation for excellence. 35 years of quality service!

Let a Thermador engineer work with you to develop the

Thermador Transformers

finest transformer for your application, chassis, or performance standards. Thermador's complete environmental testing facilities make certain that each transformer exceeds your specifications and MIL requirements. One or a thousand—certified without delay—delivered quickly. Order direct. Call us today. Request literature from: Electronic Division, Thermador Electrical Manufacturing Company, 2000 South Camfield Avenue, Los Angeles 22, Calif. PARKVIEW 8-2105



THERMADOR
Electronic Division



SEVEN LEAGUES AHEAD
3-918

CIRCLE ED-187 ON READER-SERVICE CARD FOR MORE INFORMATION

New Literature . . .

Miniature Capacitors

188

Miniature, hermetically sealed, paper capacitors of various mounting types and with different kinds of impregnants are listed in this 20-page catalog (No. X-100). The units are available in capacities from 0.0001mfd to 4.0mfd, and in a voltage range from 100 to 1000wvdc. Some of the units have operating temperature ranges from -55°C to 125°C . Various electrical characteristics are plotted on page 5, and a section of engineering data is also included. Gudeman Company, 340 W. Huron St., Chicago 10, Ill.

Servomechanism Components

189

Precision synchros, servo motors, rate and motor generators, gyros and gyro components are listed in this 4-page catalog (Publication No. 544-27). A line of "Pygmy" synchros of 0.937" diameter is included. The gyro components include a roll gyro transmitter and two vertical gyro transmitters. Eclipse-Pioneer Div., Bendix Aviation Corp., Teterboro, N. J.

Nickel Plating

190

The "Kanigen" process, a method of plating nickel by a chemical reaction instead of the usual electrolytic system, is described in this 6-page brochure. The process produces a very hard, uniform coating directly on iron, steel, brass, bronze, and aluminum. The coating is an alloy of nickel (93%) and phosphorous (7%). General American Transportation Corp., 135 S. La Salle St., Chicago 90, Ill.

Disconnect Panels

191

A line of electrical disconnect panels to carry connections through bulkheads in pressurized aircraft is fully described in this 20-page bulletin (No. VH554). The panels are secured to the bulkhead by a gasket or plastic sealant. Panels with from 8 to 100 sockets are available. An illustrated description of the installation procedure with pictures of all tools required is included in the brochure. Burndy Engineering Co., Inc., Norwalk, Conn.

Relays and Components

192

Although designed for use in aircraft, the relays, time delay relays, and other components listed in this loose-leaf catalog can be applied to other fields where their ruggedness is a valuable asset. Each unit is illustrated and completely described in this tab-indexed, imitation-leather bound publication. A line of custom-made bellows is also given. Cook Electric Co., 2700 North Southport Ave., Chicago 14, Ill.

Component Distributors

Listing thousands of sources of electronic parts, *Who's Who In Electronic Distribution* contains alphabetical listings of manufacturers, manufacturer's representatives, and parts distributors. A special feature of this 376-page volume is a listing of electronic parts distributors catering to industrial accounts. Distributors in this section are listed by localities under the names of the manufacturers whose products they stock and sell.

Another feature to aid procurement is a listing of suppliers by more than 300 products stocked. An alphabetical listing of more than 1000 product trade names with the companies using them is also given. Geographic lists of more than 600 representatives and 1300 parts distributors complete the volume. Each listing contains all data essential to procurement work. Cloth bound and thumb indexed, the book is priced at \$7.50. Write direct to *Radio and Electronic Jobber News, Inc.*, 846 Leader Bldg., Cleveland 14, Ohio.

Microwave Gas Tubes

193

The microwave gas tubes described in this bulletin (No. A-20) are used to control microwave propagation. They may be used as a switch, a modulator, an absorption attenuator, a variable reactance, a phase shifter, or a gyrator. They may also be used as detectors, mixers, or noise sources. Specifications for four types of tubes are given. Theoretical descriptions of the tubes when used as absorption attenuators, reactance modulators and switches, and phase shifters are included. Roger White Electron Devices, Route 17 and Erie R. R., Ramsey, N. J.

Snap

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Snap Action Switches

194

This 36-page catalog gives detailed specifications, dimensions and operating characteristics for the company's two lines of switches: "Acro" switches, which operate by the rolling spring principle; and "Mu" switches, which employ the single, pre-stressed blade principle. A comprehensive index enables the user to quickly locate the proper switch for any application by type, size, and rating. Acro Manufacturing Co., Acro-Mu Switch Division, Columbus 16, Ohio.

Regulated Power Equipment

195

Electronic a-c and d-c voltage regulators, "B" supplies, electronic frequency changers, inverters, magnetic-amplifier d-c sources, and related equipment are listed in a 31-page catalog (No. 254). The publication provides general information on the operating principles of the instruments and complete specific data on each instrument, including pictures, general descriptions, electrical and mechanical specifications. Sorensen & Co., Inc., 375 Fairfield Ave., Stamford, Conn.

Directional Couplers

196

Technical Bulletin T-2400 is a 6-page bulletin which provides much of the basic theoretical and design information necessary to the engineer in choosing the proper directional coupler for use with reflectometers, test equipment, power splitters, and in local oscillator coupling and similar radar and microwave applications. The four basic types described in the bulletin include the sidewall coupler, crossguide coupler, broad wall to narrow wall, and broad wall to broad wall couplers. Each is fully described as to construction, theory of operation, electrical characteristics, and typical applications. In addition, other available types of couplers designed for special applications are illustrated in a range to fit waveguide sizes from 6.50 x 3.25" down to 0.280" x 0.140" I.D. with couplings from 400 to 40,000Mc. The designer may conveniently compare relative advantages of different directional coupler designs for mechanical packaging, directivity, and power handling capacity, and so determine the proper design for his particular application. Airtron, Inc., Dept A, Linden, N. J.

Specialty Transformers

197

Filament, power, and plate transformers and filter chokes for 380cy to 1600cy 115v operation are listed in this 2-color, 4-page catalog (Section No. 44-265). All of these units are "Fosterite" impregnated and electrostatically shielded. Ratings at 85°C ambient temperatures are for 2000 hours minimum life, with a 50°C average rise in winding temperature. Westinghouse Electric Corporation, Transformer Division, P. O. Box 231, Greenville, Pa.



BORG MICROPOTS

the
NEW STANDARD
of precision
multi-turn
potentiometers

BORG 900 SERIES 3-TURN AND 10-TURN MICROPOTS

3-TURN MODELS 931-935



9315

9328K

9335K

9355

10-TURN MODELS 901-903



9015K

9025

9035K

9035

Standard models of Borg 900 Series Micropots offer such flexibility that they meet special design needs. Borg has created a new standard for high-precision, multi-turn potentiometers.

Advantages of the Borg 900 Series include greater accuracy, finer resolution, lower torque, longer life, better performance under severe and excessive

vibration, greater adaptability and versatility in application.

Standard models include: 10-turn precision Micropots in 1 to 3 gang models, 3-turn in 1 to 3 gang models, single or double shafts, servo or bushing mounts on either or both ends. Available in design quantities and engineering in any quantity.

SYNCHRONOUS AND INDUCTION BORG-MOTORS

1000 SERIES 2 POLE AND 4 POLE MODELS

With and Without Gear Trains

These Borg-Motors were designed specifically for instrumentation, control and timing devices. They are recommended for all applications where low torque, constant speed and long life are positive requirements.



For Complete Engineering Data



SERVO-CONTROL Borg-Motors

Two phase, 115 volt, 400 cps induction type Borg-Motors for servo control applications. Approximate size 1 1/2" diameter x 2" long with a locked rotor torque of 0.82 ounce-inch.

ATTACH TO YOUR LETTERHEAD

BORG EQUIPMENT DIVISION
THE GEORGE W. BORG CORPORATION
JANESVILLE, WISCONSIN

NAME.....

TITLE.....

Please send complete information and engineering data on items checked.

- Precision Multi-Turn Potentiometers, 900 Series
- Borg Standard Potentiometer, 1100 Series
- Precision Multi-Turn Counting Dials
- Servo Control Motors
- Frequency Standards
- Instrument Motors
- Contract Manufacturing

BORG EQUIPMENT DIVISION

THE GEORGE W. BORG CORPORATION
JANESVILLE, WISCONSIN

"SEE US AT PHILADELPHIA—BOOTHS 260 and 262, INSTRUMENT CONGRESS AND EXPOSITION"

CIRCLE ED-198 ON READER-SERVICE CARD FOR MORE INFORMATION

INTRODUCING - the new

CHATHAM TYPE 6337 LOW-MU POWER TRIODE



..an outstanding
regulator tube
for DC power
supply units

Featuring:

- LOW MU, HIGH PERVEANCE
- PLATE CURRENT HELD WITHIN $\pm 10\%$
- COMPACT PHYSICAL DESIGN
- WITHSTANDS 500 G SHOCK

PLATE SUPPLY—225 volts
BIAS RESISTOR—100 ohms
AMP. FACTOR—2.7
PLATE RESISTANCE—60 ohms
PLATE DISSIPATION—80 watts
TRANSCONDUCTANCE—
45,000 μ mhos
PLATE CURRENT—450 ma
HEATER VOLTS—6.3 (AC or DC)
HEATER AMPS—7.25

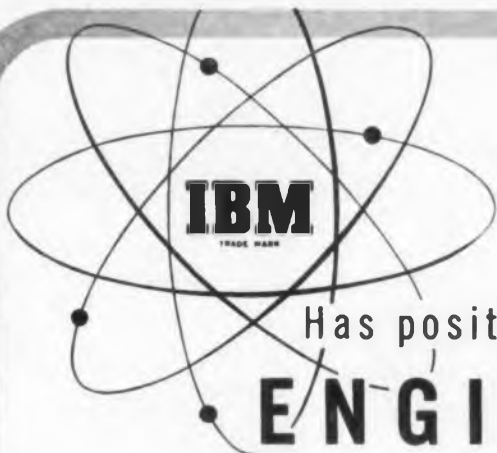
Specifically designed as a regulator tube, Type 6337 features plate current held within $\pm 10\%$, and complete absence of plate current drift. A hard glass envelope and a button stem that strengthens the mount, provide high immunity to extreme shock and vibration. Wide interlead spacing practically eliminates electrolysis. These and many other special features make the Type 6337 a tube of utmost dependability in critical regulating circuits. Write today on company letterhead for data sheets.



CHATHAM ELECTRONICS CORP.

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

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Many positions are open now in an outstanding engineering organization engaged in electronic computer development. Men with BSEE degrees and some experience in design are required.

Excellent salaries, many educational opportunities, and generous employee benefits. Moving expenses paid to Poughkeepsie, N. Y.

Your inquiry will be treated confidentially. Send resume of education and experience to:

W. M. Hoyt, Dept. 686(9)

INTERNATIONAL BUSINESS MACHINES

590 Madison Ave., N. Y. 22, N. Y.

New Literature . . .

Precision Potentiometers 201

All of "single-turn" construction, the precision potentiometers listed in these three bulletins can be ganged. They are available in standard threaded-sleeve types or servo-mount types. The "100" series have a power rating of 2w. The "200" series have a rating of 2.5w, and the "400" series are rated 5w. All three series have a standard tolerance of $\pm 3\%$, with tolerances as low as $\pm 1/2\%$ on special order. Spectrol Corp., 2661 Myrtle Ave., Monrovia, Calif.

Etched Wiring 202

An etched wiring processor describes the services available from his concern in this 4-page folder (No. MD8 10M). Charts of resistances of etched copper foil and characteristics of various insulating base materials are included. Miller Dial & Name Plate Co., 4400 North Temple City Blvd., El Monte, Calif.

Dynamometer 203

The two "Dyna-Chek" dynamometers described in in this 4-page brochure are designed to measure the power output of electric motors of 2hp and less and 1/10hp and less, respectively. Two types of broad-range speed measuring equipment are available as accessories. Mission-Western Engineers, Inc., 132 W. Colorado, Pasadena 1, Calif.

Frequency Converter 204

A compact 60 to 400cy converter is described in this circular (No. E11). The motor-generator unit does not have brushes. Available in 1/2 to 25kva sizes. Other output frequencies can be specified. Georator Corp., Manassas, Va.

Timers 205

This firm's line of timers for automatic control purposes are listed in an 11-page booklet along with a short discussion of the uses of the units in industry. Eagle Signal Corporation, Moline, Ill.

Power Tube Guide

A complete guide on this company's line of power tubes is covered in a 12-page booklet (No. 86-020). It covers characteristics and ratings of over 150 tube types. All types of rectifiers, phototubes, amplifiers, modulators, oscillators, and other miscellaneous types for use in industry and radio are described. An interchangeability chart lists the firm's type that directly replaces each of approximately 225 tubes of other manufacturers. Price 15 cents. Write directly to Westinghouse Electronic Tube Division, Dept. T-056, Box 284, Elmira, N. Y.

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**semiconductor
devices**
from TI's wide
range

Outstanding research-to-production teamwork makes Texas Instruments your best source of supply for reliable semiconductor devices. The new silicon transistor—produced first by TI in commercial quantities—is the most recent result of this teamwork. All TI semiconductor devices are glass-to-metal hermetically sealed and are tested over 20 times before shipment.



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devices
small signal
transistors
power transistors
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general purpose
p-n-p alloyed
junction transistors
n-p-n grown junction
transistors
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CIRCLE ED-207 ON READER-SERVICE CARD

ELECTRONIC DESIGN • August 1954

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Choppers

209

Catalog No. 370 describes the company's redesigned line of 60cy choppers for low level operation at noise levels under 1 millivolt. Twenty-two different models are listed with specifications. They are available in both single-pole and double-pole for use in computers, business machines, recording potentiometers, servo-mechanisms, regulated power supplies, and microvolt meters. Stevens-Arnold, Inc., 22 Elkins Street, South Boston, Mass.

Instrument Motors

210

Synchronous and induction motors with power ratings of 1/2000, 1/1500, 1/1000, and 1/750hp are listed in this 4-page brochure. The units can be applied to a number of instruments and recording devices. The motors are available with or without gear trains and with ball or sleeve bearings. They are totally enclosed. Borg Equipment Div., The George W. Borg Corp., 120 S. Main St., Janesville, Wis.

Electronic Flash Handbook

211

This 9-page manual lists a line of electronic photo-flash tubes and the batteries and capacitors designed for use with them. Various circuits utilizing the flash tubes are given with suggested components. Illinois Condenser Co., 1616 North Throop Street, Chicago 22, Illinois.

Flexible Shafts and Couplings

212

Light-duty flexible shafts and couplings are illustrated with all dimensions in this 16-page catalog. These shafts can be used to eliminate gearing or allow greater freedom in the placement of components. Kupfrian Manufacturing Co., 395 State St., Binghamton, N. Y.

Insulations, Coatings

213

Potting compounds, laminates, and various other plastic insulations and coatings are listed in this compilation of technical bulletins. Charts of bulk density vs dielectric constant, dissipation, compressive strength, and unicellularity, for "Eccofoam", a plastic foam product, are given. Prices are included. Emerson & Cuming, Inc., 869 Washington St., Canton, Mass.

Recording Accessories

214

Laboratories employing magnetic tape will find the various accessories listed in this folder of interest. Filters, equalizers, amplifiers, a test oscillator, a tape splicer, and a head demagnetizer are listed with prices. Sound recording tape with prices are also listed. Audio & Video Products Corp., 730 Fifth Ave., New York, N.Y.

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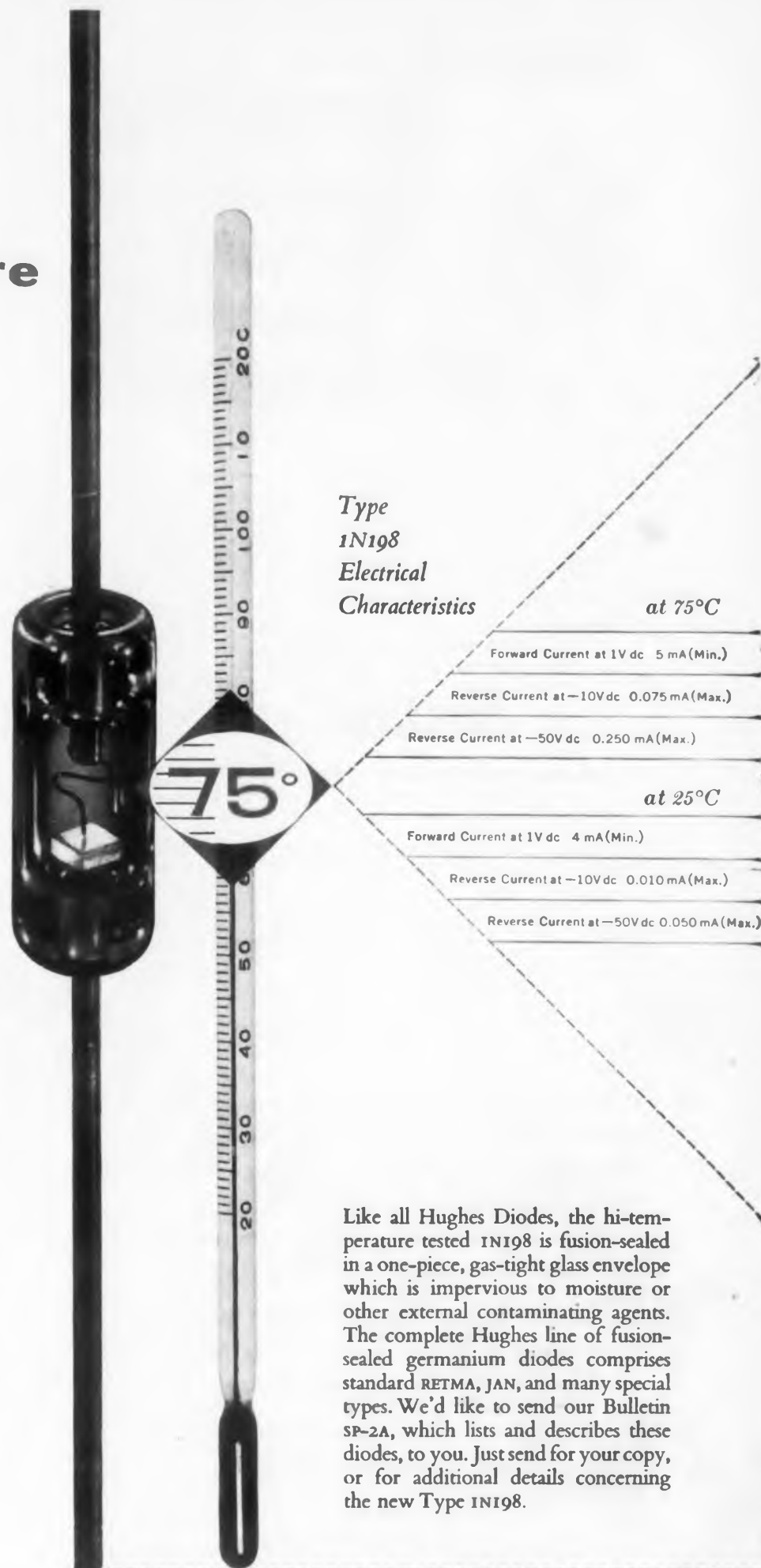
Hi-Temperature Tested Germanium Diode

The new Hughes type 1N198

Temperatures inside operating equipment usually climb well above the equipment ambient temperature. At these elevated temperatures, you need components with *known* characteristics. Most germanium diodes are tested at room temperature and, as operating temperatures rise, their performance deteriorates. But the new Hughes Type 1N198 is a *realistic* germanium point-contact diode.

That's because this diode is tested 100% at 75°C—which is just about as hot as most electronic equipment gets in operation. In addition, samples of the 1N198 are regularly subjected to all standard tests at 25°C. This means that you can use these hi-temperature tested diodes with confidence, can design equipment to take full advantage of the fact that electrical characteristics at the higher temperatures are specified.

ACTUAL DIMENSIONS
DIODE BODY:
0.265 by 0.130 inches (maximum)



Type
1N198
Electrical
Characteristics

at 75°C

Forward Current at 1V dc 5 mA (Min.)

Reverse Current at -10V dc 0.075 mA (Max.)

Reverse Current at -50V dc 0.250 mA (Max.)

at 25°C

Forward Current at 1V dc 4 mA (Min.)

Reverse Current at -10V dc 0.010 mA (Max.)

Reverse Current at -50V dc 0.050 mA (Max.)

Like all Hughes Diodes, the hi-temperature tested 1N198 is fusion-sealed in a one-piece, gas-tight glass envelope which is impervious to moisture or other external contaminating agents. The complete Hughes line of fusion-sealed germanium diodes comprises standard RETMA, JAN, and many special types. We'd like to send our Bulletin SP-2A, which lists and describes these diodes, to you. Just send for your copy, or for additional details concerning the new Type 1N198.

Hughes

SEMICONDUCTOR SALES DEPARTMENT

Aircraft Company, Culver City, Calif.



New York Chicago

CIRCLE ED-216 ON READER-SERVICE CARD FOR MORE INFORMATION

**A Sequential Relay That
Counts, Stores or Remembers**



**KELLOGG
Magnetic
Impulse
Counter**

PROVED IN USE!

- SEQUENTIAL OPERATION**—10 operations in sequence
but one relay pulse coil
- DIGITAL STORAGE**—Once read-in, stored without power
but no latches
- TELEMETERING**—Counting or controlling from a distance
but minimum wiring
- COMPUTERS**—Series read-in parallel read out
- STEPPING**—Replaces 2 magnet 10 point stepping switch at
pulse rates up to 20 per second

WRITE FOR FREE TECHNICAL DATA TODAY, DEPT. 68-H



KELLOGG SWITCHBOARD AND SUPPLY COMPANY
A Division of International Telephone and Telegraph Corporation
SALES OFFICES: 79 West Monroe Street, Chicago 3, Illinois

CIRCLE ED-217 ON READER-SERVICE CARD FOR MORE INFORMATION



1



2



3

- 1 **Glasseal hermetically sealed sub-miniature paper tubulars.** Manufactured to the highest commercial standards and engineered to the exacting performance requirements of Military Specification MIL-C-25-A.
- 2 **Oil paper capacitors of finest possible commercial quality, meeting MIL-C-25A and Jan-C-25 standards of precision.**
- 3 **Electrolytics of superior commercial performance characteristics, meeting Jan-C-62.**

Write for Catalog J-8 for further detailed information.
Or call your local Pyramid Sales Representative or write to:



PYRAMID ELECTRIC COMPANY

Dept. 123, 1445 North Hudson Blvd., North Bergen, New Jersey

CIRCLE ED-218 ON READER-SERVICE CARD FOR MORE INFORMATION

New Literature . . .

Power Tubes 219

Transmitting, industrial and other special-purpose big tubes are listed in this 16-page catalog. A description, general characteristics, and maximum ratings are given for each tube. Power tube accessories are also listed. Machlett Laboratories, Inc., 1063 Hope St., Springdale, Conn.

Microwave Junctions 220

Short slot hybrid junctions for use in high frequency radar and communications equipment are described in this bulletin (No. HJ-1). The units are available in beryllium copper and aluminum castings suitable for torch or dip brazing. Microwave Development Laboratories, Inc., 220 Grove St., Waltham 54, Mass.

Diffraction, Spectography 221

The first issue of the "Norelco Reporter" contains 16 pages of articles and data on X-ray diffraction and spectography. This new publication will be published bi-monthly and will offer application stories, techniques, technical information, apparatus modifications, and other data of interest to diffractionists. North American Phillips Co., Inc., Mount Vernon, N. Y.

Console Units 222

Engineers designing laboratory or production consoles to enclose an array of instruments or controls will find this folder (No. 10-CA10M-154) of interest. This "modular enclosure system" designed around a basic console assembly can be expanded to meet future needs. Accessories for the console assembly are available from stock. Elgin Metalformers Corporation, 903 North Liberty St., Elgin, Ill.

DC Power Supplies 223

A 4-page, illustrated bulletin (No. MA 154) describes this company's line of airborne high-voltage power supplies and magnetic amplifier regulated units. It includes operating characteristics and performance curves of the units and includes a partial listing of other power supply models available. Perkin Engineering Corp., 345 Kansas Street, El Segundo, Cal.

Klystrons 224

Entitled "Klystron Facts", this 16-page brochure is a series of questions and answers based on inquiries to this manufacturer about their klystrons. A number of illustrations are included. Eitel-McCullough, Inc., 198 San Mateo Ave., San Bruno, Calif.

Tubing 225

Properties, applications, and advantages of seamless and "Weldrawn" beryllium copper tubing are presented in Data Memorandum No. 7-2. Beryllium copper, which can be formed cold in the soft annealed or slightly work-hardened condition after heat treatment shows high strength and hardness, wear resistance, and electrical conductivity. Mechanical and physical properties, heat treating procedures, welding and brazing methods, pickling solutions, corrosion resistance tables, standard production limit tables, and tubing tolerances are also included. Superior Tube Co., 1521 Germantown Avenue, Norristown, Pa.

Flush Latches 226

A new 48-page, 2-color, loose-leaf catalog illustrates, describes and gives full details of a complete line of flush latches. Dimensions, assembly, installation, combinations, parts list, etc., are given. Hartwell Company, 9035 Venice Blvd., Los Angeles 34, Calif.

Tube Shields 227

Two booklets entitled "Effect of Tube Shields on Miniature Electron Tubes" and "An Evaluation of Shields for Subminiature Electron Tubes" contain factual test result data, comparison charts on tube shield clamps and their heat-dissipating effects, conductivity and vibration effects as applied to advanced electronic and guided missile development. International Electronic Research Corp., 175 West Magnolia Boulevard, Burbank, Calif.

Co-axial Connectors 228

These Series C connectors feature a minimum vswr in applications up to 10,000Mc. Silicone rubber is employed in them to insure water-proofing. They are designed for use with 50 ohm, middle size r-f cables. Kings Electronics Co., Inc., 40 Marbledale Rd., Tuckahoe, N.Y.

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Laminations**229**

Bulletin MIL 101 entitled "Performance Guaranteed Magnetic Laminations", contains many pages of lamination specification sheets that show the individual laminations to actual scale, properties of square cross-section core stacks, and weights and counts for different materials. Other sections cover laminated-core assemblies, mechanical and magnetic parameters, and lamination tolerances. Magnetics, Inc., Butler, Penna.

Standards Library Data**230**

This pocket-sized 8-page booklet is a description of the library of the American Standards Association. Entitled "The Library of Standards", the booklet tells about the library's contents, which include 8000 German, 4000 French, 2000 British, and 3500 of the most important of Russia's 8000 standards in addition to American standards. ASA, 70 E. 45th St., New York 17, N. Y.

Potentiometers**231**

A line of 10-turn and 3-turn precision potentiometers is described in this 6-page catalog (No. BED-A15). Linearity as great as 0.025% is available. The units may be ganged. Both servo and bushing mounts are available. Borg Equipment Div., The George W. Borg Corp., 120 S. Main St., Janesville, Wis.

Microwave Equipment**232**

Unidirectional transmission lines and amplitude modulators for microwave applications are described in this compilation of technical bulletins. The transmission lines employ ferrite elements. This firm's audio driver for the amplitude modulators is also described. Cascade Research Corp., 53 Victory Lane, Los Gatos, Calif.

Receiving Tubes**233**

Construction features of this firm's line of high-reliability receiving tubes, designated "Five-Star" types, are described in this 18-page brochure (No. ETD-548C). These tubes are made in both miniature and subminiature sizes. Maximum and average ratings for each tube are listed. Tube Department, General Electric Co., Schenectady 5, N.Y.

Single-Sideband Receivers**234**

A 2-page, illustrated discussion of single-sideband reception is included in this 8-page bulletin (No. 254). Two of this firm's receivers, Models 48 and 156 are described with all technical specifications. Crosby Laboratories, Inc., Box 233, Hicksville, N. Y.

Ceramic Insulators**235**

Custom-made insulators of very pure alumina for use in vacuum tubes are described in this 4-page bulletin. The insulators can be made in a variety of shapes. The properties of two types of alumina material are listed. Western Gold & Platinum Works, 589 Bryant St., San Francisco 7, Calif.

Communications Receiver**236**

In a two-color, 4-page bulletin, the designs, specifications, and operating procedure of this firm's latest communications receiver, the HQ-140-X, are covered in detail. The receiver, which is built for both professional and amateur use, covers frequencies from 540kc through 31Mc in six bands. Bandspread dial calibrations are for the 80, 40, 20, 15, and 10 meter bands. The folder also illustrates the layout, construction, and physical design of the receiver. Hammarlund Manufacturing Co., 460 West 34 Street, New York 1, N. Y.

R-F Test Instruments**237**

This 48-page, 2-color catalog contains technical data, photos, and typical circuit diagrams on numerous series of r-f power and vswr instruments, absorption-type r-f wattmeters, r-f load resistors, station guardians, and accessories. Detailed information on uses, specifications, dimension drawings, and other pertinent data are included. M. C. Jones Electronics Co., Inc., Bristol, Conn.

Choppers**238**

A well illustrated 12-page discussion of the theory of the d-c to a-c chopper and many applications compiles the major part of this bulletin (No. 103). A line of choppers is also described and illustrated. A bibliography of chopper literature is included. Airpax Products Co., Middle River, Baltimore 20, Md.

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Patents . . .

Aerial Arrangement . . . Patent No. 2,665,380. William A. McGough and William F. Hickson (Assigned to Circle X Antenna Corp., Perth Amboy, N. J.)

The television antenna shown in Fig. 1 covers the entire television range without adjustment and does not require reflectors to cover a wide angle of reception. Many variations in the basic structure illustrated are also described. The antenna is inexpensive to manufacture and easily installed.

The pairs of radius bars (B) may be 60 to 120° apart without affecting reception. A clamping strap (28) clamps the ends of each of the pair of radius bars to the insulating block (C) and also provides a convenient part to which connections can be made. A circular ring (A) is secured to the outer ends of radius bars B. For best results bars B have a length of 1/2 wavelength of the wave at the middle of the television band and the arc (48) of the circular ring between the radius bars is three-quarters of this wave length. A circular ring about 86" in diameter provides the dimensions stated.

Some of the variations which are contemplated by the inventors are a greater number of radius bars, additional rings as well as a double cone construction. Stub

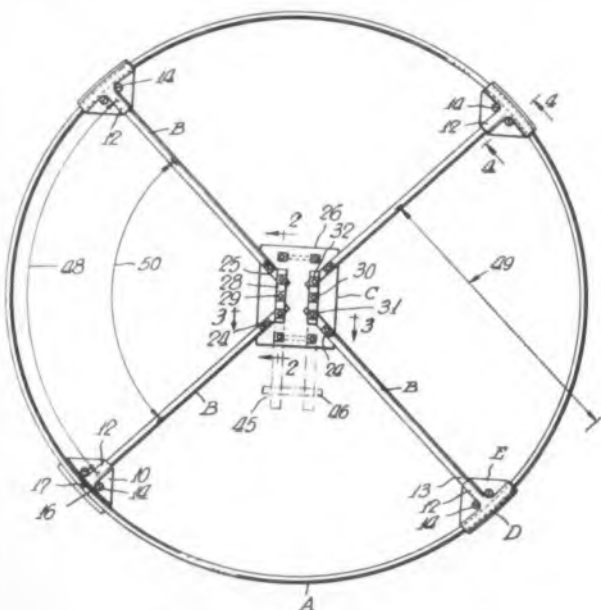


Fig. 1. Multi-channel television antenna.

bars (45) and an adjustable impedance (46) enable the antenna to be matched over a range of from 72 to 300 ohms.

Electron Discharge Device and System . . . Patent No. 2,662,933. Louis Malter, Princeton, N. J. (Assigned to Radio Corporation of America).

Improved discharge tubes have been devised by the inventor that reduce the time within which the grid recovers control of the tube after a discharge has ceased and hence enables the tube to operate at higher frequencies. In prior tubes control was not recovered until the ionizing medium had deionized. In the new tubes control is recovered even though full deionization of the medium has not occurred. Again during the recovery time, grid current flows through the grid resistor which develops a voltage opposite to that of the bias and results in a loss of grid bias which increases as the resistance value is increased. This places a limitation on the maximum value of the grid resistor and for weak signals, it becomes necessary that the grid bias be close to the discharge potential. The tubes of the patent overcome these difficulties as well as an instability occasioned by grid emission.

There are several different forms of the tube that give the improved operation. The one shown in Fig. 2 is essentially similar to an 884 and illustrates the basic principles of the tube construction. The tube may use the usual cathode (16), anode (19) and a suitable ionizable material within the tube. The concentric blocking grid (21) has an aperture (28) on one side and a trigger grid (27) is located in the aperture for initiating the discharge. The trigger grid is small so that it has a low surface area and hence low emission.

A bias from a bias source (30, Fig. 2) is applied to the trigger grid through a resistor R_{TG} of high value, which may be as high as 10 megohms. The blocking grid (21) is connected to the bias source through

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a low value resistor R_{BG} of about 1000 ohms. With proper anode, blocking grid, and cathode voltages, a signal applied to the trigger grid fires the tube which continues to pass current until a cut-off po-

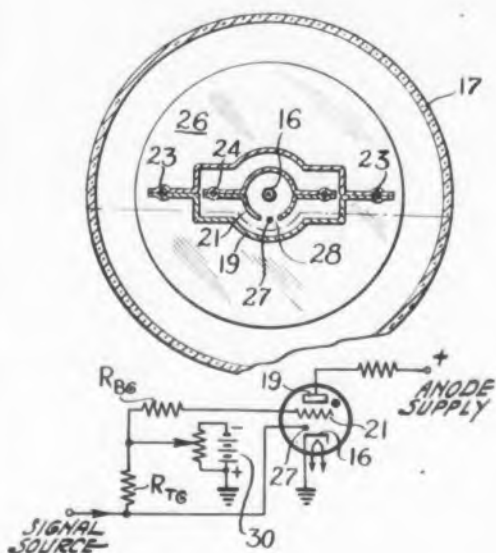


Fig. 2. Cross-section of the discharge tube and its circuit.

tential is applied to the anode and conduction through the tube ceases. The blocking grid then quickly returns to its bias potential because of the low resistive value of R_{BG} and permits rapid restoration of the grid bias. This action restores control of the tube to the blocking grid and operating anode potential may be again applied to the anode for the next input signal.

Frequency Controlled Oscillator System
 . . . Patent No. 2,663,800. G. B. Herzog.
 (Assigned to Radio Corp. of America.)

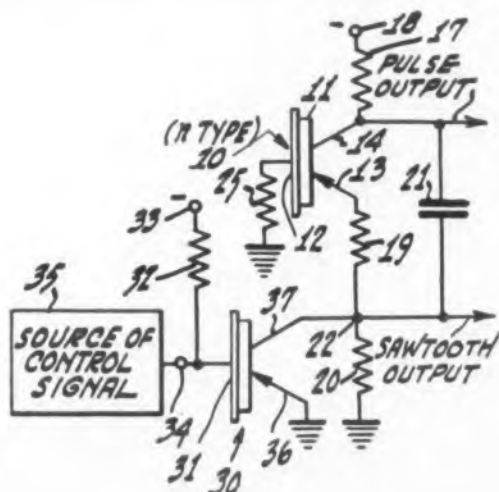
A transistor has two regions of operation, one of low conduction, which is a stable state, and the other of high conduction, which is an unstable state. An oscillator system that makes use of this characteristic has been devised by George C. Sziklai and is used in the circuit illustrations of this patent. The transistor control circuit shown in Fig. 3 controls the frequency of such an oscillator. The oscillator system described has particular applicability for control of the generation of a saw tooth wave for television receivers.

The oscillator circuit includes the capacitor 21, which is charged through resistors 20 and 17 from a current source or battery, the negative terminal being connected at 18 and the positive terminal grounded.

An n type transistor (11) may serve as a discharge circuit. Its collector 14 and emitter 13 with a resistor (19) are connected in parallel with condenser 21. The capacitor begins to charge and the current flow through resistors 20 and 17 establishes a relatively low potential with respect to ground at point 22 and a relatively high potential with respect to the source potential at collector 14 so that the potential across the emitter-collector electrodes is within the low conduction stable state of the transistor. As the charge on the condenser increases, the current flow decreases which raises the potential at point 22 and lowers that at 14 until the potential across electrodes 13 and 14 reaches the value at which the transistor makes a sudden shift to its high conduction unstable state. The condenser then discharges to restore initial conditions, whereupon the cycle repeats.

A p-n-p type of transistor (30) controls the frequency of the oscillations by having its emitter 36 and collector 37 connected in parallel with the resistor 20. The impedance between these two transistor electrodes is controlled by the current supplied from a signal source (35). The required bias for the base electrode (31) is supplied by a resistor (32) and a current source at terminal 33. By changing the current from control signal source 35 the impedance between collector 37 and emitter 36 is changed, which in turn changes the impedance of the parallel circuit including the resistor 20 and the rate of charging of capacitor 21. This action controls the frequency of the oscillator. The control transistor may have its collector-to-base circuit in parallel with the resistor as illustrated in other forms of the circuit. The frequency range of the system is from 20 to 28kc.

Fig. 3. Transistor oscillator circuit.



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Patents . . .

Multiple Electric Capacitor . . . Patent No. 2,665,376. George T. Kodama. (Assigned to Herlec Corporation, Milwaukee, Wis.)

This interesting construction of a multiple capacitor unit avoids undesirable inter-coupling, secures shielding of some of the capacitors forming the unit, and reduces the number of external connections necessary to connect the unit into a circuit. The reduction in the number of external connections is secured by forming one capacitor element or plate as an extension of the coating forming another capacitor element. This can be done only with capacitors which are directly connected in a circuit.

The multiple capacitor unit uses a single ceramic dielectric plate (15, Fig. 4). On one of its sides a coating (16) is deposited. On the other side a corresponding coating (36) is deposited. External connections 23 and 38 extend from the coatings. At the other end of the plate is a similar pair of coatings (17 and 35) forming a second capacitor. Two additional capacitors are provided by an "H" form of deposited coating on one face of the dielectric plate and an "h" form of coating on the other side with the horizontal cross bars 43 and 20 opposite each other. An extension (28) of Coating 17 forms a capacitor with the upper end of vertical leg 41 of the H coating on the other side. Being an extension, it provides its own direct connection between these two elements and therefore, between the two capacitors. The fourth capacitor is formed by cross bar 43 and a coating (29) on the opposite side of dielectric plate 15 from the cross bar. Since cross bar 43 is part of the H, the upper portion of which is one of the coatings for capacitors 41 and 28, these two capacitors are

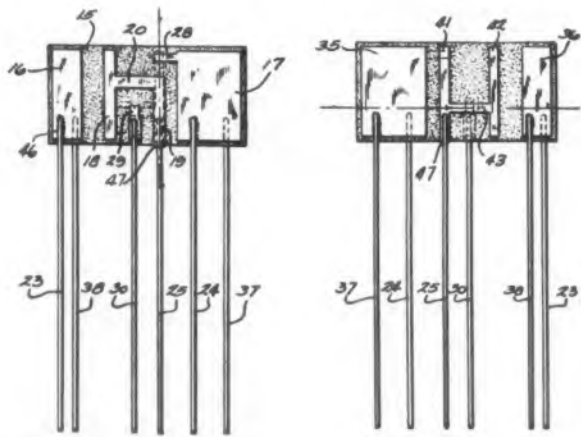


Fig. 4. Front and back views of the capacitor.

directly connected in the unit. External wire connections are used as illustrated.

Shielding between the capacitors is secured by the parts (18, 19 and 20) of the h coating which are grounded by wire 25. Since capacitor elements 41 and 43 are also to be grounded, the lower end of leg 41 may extend around the bottom edge of the dielectric plate (47) to connect with the h-shaped coating on the other side. This multiple capacitor unit supplies four of the capacitors such as are used in an ac-dc radio receiver circuit with a duodiode-triode tube and a pentode in series. Another form of multiple capacitor unit is described for use in a circuit having a duodiode-pentode tube and a pentode tube connected in series.

Automatic Volume Control for Alternating Current . . . Patent No. 2,671,849. Everhard H. B. Bartelink. (Assigned to Automatic Electric Laboratories, Inc., Chicago, Ill.)

A telephone system of the mobile type where calls originate from cars, boats, airplanes and other subscribers, experiences a wide variation in the strength of the input signal received at the central office.

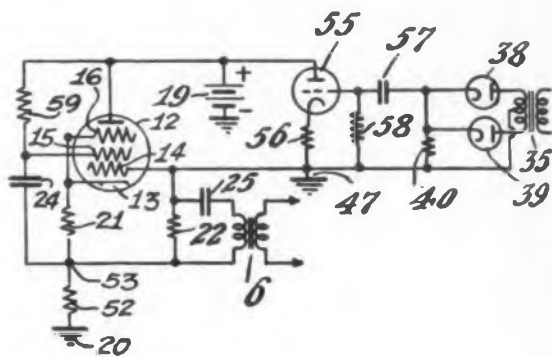


Fig. 5. Automatic volume control circuit.

Automatic volume control circuits to overcome this problem are common. The simple and inexpensive circuit shown in Fig. 5 has been devised by the patentee to control automatically the volume of the received signal by a new method.

The input signal from a mobile subscriber is received at the central office on the primary of transformer 6 and is applied to the control grid of a remote cut-off tube (12) through a grid leak connection formed by condenser 25 and resistor 22. Tube 12 operates at the lower portion of its characteristic curve so that if the input signal is of large amplitude, condenser 25 becomes charged, increasing the grid bias in proportion to the level of the

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input signal and thereby lowering the signal level. Tube 12's plate is coupled with the transmitting station of the central office by a transformer which is not shown.

The biasing charge on condenser 25 received from a high level input signal leaks off slowly through resistor 22, which would be detrimental if the next input signal is of low amplitude. To correct this situation, the receiving station of the central office provides a carrier relay which is energized by an incoming signal and closes a switch in the circuit of the primary winding of transformer 35. The secondary of this

transformer is connected with a full wave rectifier formed by two diodes (38, 39) to apply a positive pulse to triode 55's grid so that it becomes momentarily conducting and immediately discharges biasing condenser 25. The circuit functions equally well if a diode is substituted for the triode. By using a full wave rectifier, a positive pulse is applied to the control grid of tube 55 when the incoming signal is received and also when the incoming signal is cut off, which assures that any biasing charge on the condenser is discharged before the next incoming signal is received.

AEC Patents For Industry

Additional patents owned by the Atomic Energy Commission have been made available for licensing. Licenses will be granted to applicants on a non-exclusive, royalty-free basis. Applicants should apply to the Chief, Patent Branch, Office of the General Counsel, U.S. Atomic Energy Commission, Washington 25, D. C., identifying the subject matter by patent number and title. Of the 22 patents released, the following ones are particularly interesting to electronic design and development engineers.

Relay System (Patent No. 2,668,934); L. G. Nierman, inventor. This patent discloses an electronic relay system for actuating an electrically operated device under desired conditions detected by any suitable condition responsive means. The system incorporates a plurality of mechanical relays and a plurality of electronic relays operatively associated therewith for the purpose of insuring actuation of the associated device under the proper conditions.

Coupling Stage for Distributed Amplifiers Stages (Patent No. 2,670,408); G. G. Kelley, inventor. Relates to an improved amplifier system utilizing distributed amplification wherein the desired overall gain of the system is maintained, even at low frequencies. The system is provided with a novel coupling between the stages of the distributed amplifier whereby the voltage gain per stage is substantially doubled.

Multipactor Tube Oscillator (Patent No. 2,674,694); W. E. Baker, inventor. The patent discloses an improved multipactor tube oscillator. The tube comprises a pair of electrodes, an antenna disposed parallel to the shortest distance between these electrodes, a high-frequency oscillator energizing the antenna in the transverse electric mode, and waveguide means between the antenna and the electrodes whereby a potential

difference from the antenna is impressed upon the electrodes, the potential having the proper magnitude and frequency to produce multipaction between the electrodes.

Phase Meter (Patent No. 2,676,299); M. A. Leavitt and B. H. Smith, inventors. The patent relates to a phase meter for measuring phase difference between electrical signals which is accomplished by the "three meter" method in which total voltages are measured and compared giving an indication of the phase difference.

Electronic Scaling Circuits (Patent No. 2,676,756); M. Q. Gullett, inventor. The patent relates to electronic scaling circuits and more particularly to an improvement for modifying the counter factor of a scaling circuit. The invention is capable of the modification of any suitable conventional scaling circuit to make it count in multiples of 10 or other convenient multiples.

Frequency Measuring Instrument (Patent No. 2,677,104); E. L. Chase, inventor. The patent pertains to an instrument for accurately measuring an unknown frequency. The apparatus comprises a source of standard oscillations, amplifying and recording means for counting the number of standard oscillations emitted in a specified time interval, a second amplifying and recording means for counting the number of cycles of the unknown frequency for said specified time interval, and means for controlling the duration of the specified time interval.

Correction

A notice of patent No. 2,662,183, dealing with a Phase Shift Oscillating System, appearing on page 72 of the July, 1954, issue of *Electronic Design* incorrectly stated that this patent is assigned to Radio Corporation of America. Actually it has been assigned to the Zenith Corporation.

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The I.E.R.C. subminiature shield has no resonances when shaken at 10G from 0 to 2000 cycles. The shield relies upon intimate contact of the soft pure silver with the bulb to conduct heat from the tube to the heat sink, and in all cases holds the tube firm in relation to the heat sink.

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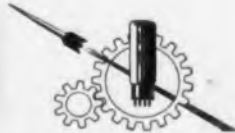
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Books . . .

Investigation of Electron Tube Reliability in Military Applications. General Report No. 1 . . . 97 pages, paper bound. Prepared and published by Aeronautical Radio, Inc., 1520 New Hampshire Ave., N. W., Washington 6, D. C. \$.50.

Since vacuum tubes are still the heart of the electronics industry, all members of the industry will find this report on tube reliability of great interest. The performance of tubes in nearly 500,000 sockets in equipment operated by all the military services was investigated. Each tube failure was studied. The tubes investigated and evaluated are the most common types in use today.

Recommendations for both corrections in applications of tubes and in actual tube design itself are given. This last point is of great concern to tube designers and manufacturers.

Such studies as these have great value for the purchasers of electronic equipment. The present study is based on a similar investigation of tubes in equipment installed in commercial aircraft. As a result of that investigation, the replacement rate of tubes in such equipment has dropped considerably and is much lower than the rejection rate in military gear.

Radio Receiver Design, Part I . . . By K. R. Sturley. 667 pages. John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. \$10.00.

This book is a revision of Part I of a well-known work first published in 1943. It covers radio frequency amplification and detection. Chapter 1, which deals with fundamentals of reception, has been completely revised. The major change in chapter 2 is the addition of a section on tube noise, its calculation and measurement.

New material on crystal-coupled i-f transformers has been added to chapter 7. Numerous illustrations and mathematical derivations are given with each chapter. The volume includes a glossary of symbols and appendices on "j" notation, equivalent π and T sections, lattice network equivalents, Foster's reactance theorem, a tapped transformer and lattice equivalent, and the Fourier series. The author is a former lecturer at the Marconi School of Wireless Communication in Great Britain.

Design Is Your Business . . . 45 pages. Small Business Management Series No. 10. Available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. \$.25.

This pamphlet was prepared by the Small Business Administration to aid the small manufacturer in understanding the problems of designing a product. It



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CIRCLE ED-251 ON READER-SERVICE CARD

is divided into the following chapters: "What Is Design", "Studying the Design of Your Product", "Design for Making", "Design for Selling", "Packaging and Design Coordination", "The Consultant Designer", "Every Businessman His Own Designer?", and "The Essentials of a Design Policy." A useful bibliography is included.

Practical Color Television . . . Paper cover, 77 pages.
RCA Service Company, Inc., Camden, N. J. \$2.00.

Design engineers approaching color TV for the first time will find this profusely illustrated booklet to be an excellent introduction to the field. The 31-page Section I deals with "Fundamentals Relating to Color Television". Section II discusses the circuitry of the RCA color TV receiver. Many of the block diagrams include the actual colors carried by each stage.

Section III, which deals with installation and servicing, contains many color photos showing the effect on the picture of various set faults. This section also has a series of color diagrams showing oscilloscope readings taken at various crucial points in the receiver circuit. A foldout circuit diagram of an RCA color TV receiver, a glossary of color TV terms, and a bibliography of literature in the field is also given.

The Principles of Physical Optics . . . By Ernst Mach, 324 pages. Dover Publications, Inc., 1780 Broadway, New York 19, N. Y. \$3.50, cloth bound; \$1.75, paper bound.

Subtitled "An Historical and Philosophical Treatment," this republication of a classic scientific work makes valuable reading for those interested in the history of science and the development of the scientific method.

The author, himself an outstanding scientist, begins with the earliest considerations on the nature of light, thoroughly discusses the work of the great Renaissance experimenters and continues on up to some of the outstanding scientists of the last century. The appendix includes two articles in French by Malus. The volume includes 279 illustrations.

A Bibliography of Selected AEC Reports of Interest to Industry, Part 4, Electronics and Electrical Engineering . . . 33 pages. Available from the Office of Technical Services, Department of Commerce, Washington 25, D. C. 35¢.

This bibliography lists 180 non-classified Atomic Energy Commission reports, many of value to the electronic design engineer. Sample titles are: "Notes on Amplifier Design"; "Pulse Transformer Design"; "Notes on Stability of Linear Feedback Systems"; and "Some Notes on Wideband Feedback Amplifiers". Many of the reports deal with construction of accurate laboratory measuring devices. This pamphlet is recommended for all industrial and design department libraries.

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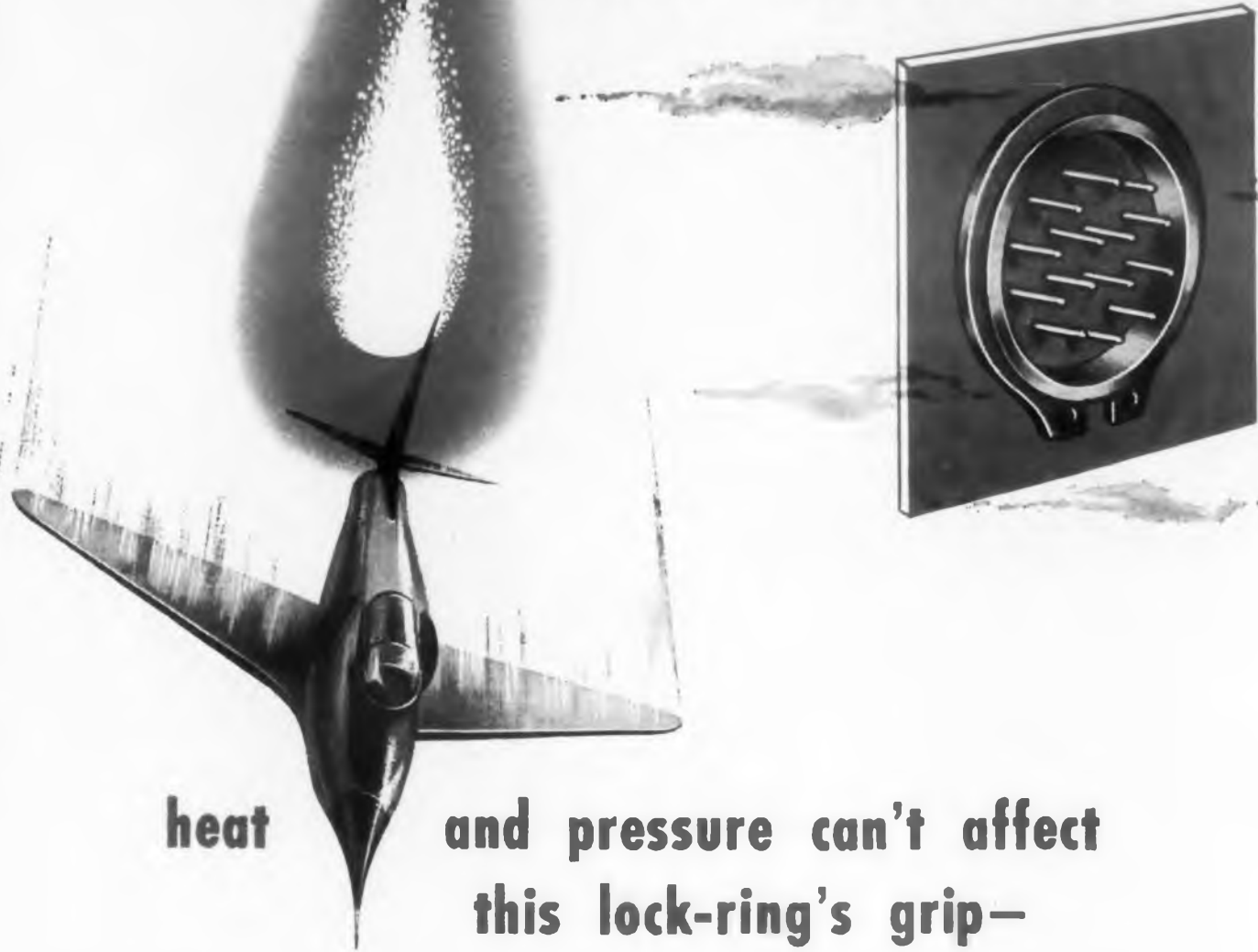


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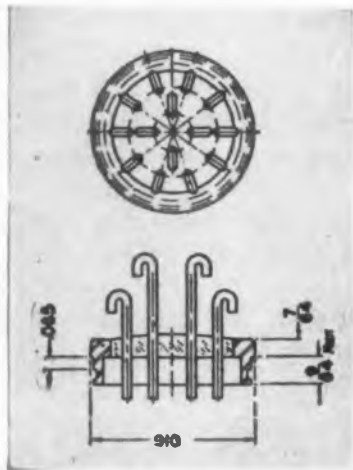
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-hp- 200H	Carrier current, telephone tests	60 cps to 600 kc	10 mw/1v	350.00
-hp- 200I	Interpolation, frequency measurements	6 cps to 6 kc	100 mw/10v	225.00
-hp- 201B	High quality audio tests	20 cps to 20 kc	3w/42.5v	250.00
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-hp- 202B	Low frequency measurements	1/2 cps to 50 kc	100 mw/10v	350.00
-hp- 202D	Low frequency measurements	2 cps to 70 kc	100 mw/10v	275.00
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-hp- 205A	High power audio tests	20 cps to 20 kc	5 watts	390.00
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-hp- 230A	Carrier test oscillator	35 cps to 35 kc	+14 dbm/600 ohms	275.00
-hp- 233A	Carrier test oscillator	50 cps to 500 kc	3w/600 ohms	475.00
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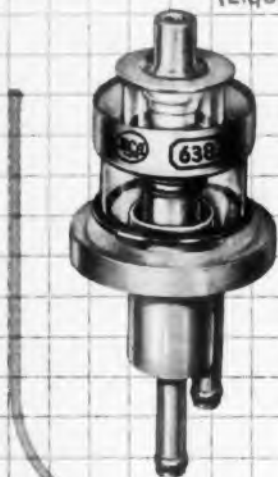
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Frequency 9375 ± 30 Mc

For a 1 μ sec. pulse duration and duty cycle of 0.001

Max. Peak Input 635 Kw
Typical Peak Output 240 Kw

For technical data, write RCA Commercial Engineering, Section H18R, Harrison, N. J.

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